

# Literature Update on Wheat, Barley, and Triticale



CIMMYT



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**CIMMYT**



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Irrigation	3661-3662	Food Contamination and Toxicology	4328-4339
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## PREFACE

To maintain quality in their research and training work, scientists need prompt and reliable access to up-to-date scientific information. However, in developing countries, the information resources are often weak, and the scientists are at a great disadvantage as compared with their colleagues in more developed countries and in international institutions. For lack of foreign currency, their librarians may be unable to buy the more recent scientific books and journals; and, for lack of access to bibliographic data, the scientists themselves cannot easily identify the most useful reprints to request from their colleagues in other countries.

CIMMYT and ICARDA seek to offset these disadvantages: they sponsor workshops at which researchers can exchange knowledge, and they produce publications which are made available free of charge to research institutions in developing countries. For a decade or so (1984-1994), CIMMYT also purchased bulk subscriptions to *Wheat, Barley and Triticale Abstracts* from CAB International, and the individual issues were sent directly to developing-country recipients that CIMMYT had nominated.

Both CIMMYT and ICARDA recognize the high quality of the products from CAB International; however, our budgetary realities require that we look for the least costly means to provide announcements of current information. In 1994, contacts were made with the Institute for Scientific Information (ISI), the private corporation based in Philadelphia, Pennsylvania, which produces *Current Contents: Agriculture, Biology and Environmental Sciences*. This is a weekly CD-ROM service giving abstracts of articles from the current issues of the world's most influential scientific journals. ISI has authorized us to extract the abstracts that deal with wheat, barley and triticale and to distribute these abstracts - in printed form - to collaborators in developing countries.

This authorization is the basis on which CIMMYT and ICARDA are now offering *Literature Update on Wheat, Barley and Triticale*. However, since *Current Contents* covers only the more prominent journals, it lacks coverage of other types of publication - for example, reports and conference proceedings - and it does not report the articles that appear in the less well known journals, many of which are published in the developing countries themselves. Therefore, to give more balance to the product, we are also including references and abstracts from the AGRIS database.

AGRIS, the International Information System for the Agricultural Sciences and Technology, is managed by FAO, and its database is constructed by contributions from some 135 participating centers which represent most of the countries of the world plus many of the regional and international organizations working in the agricultural sector. Relevant AGRIS items are extracted from tapes obtained from FAO and are merged with the items from *Current Contents*. Because CIMMYT and ICARDA are two of the centers contributing to the AGRIS database, we are able to use this material without payment of royalties.

Today's product was designed for greater economy, but we believe recipients will now welcome speed of reporting on the one hand (material from *Current Contents*) and in-depth coverage on the other (material from AGRIS).

CIMMYT and ICARDA back up this product with an offer to provide photocopies of individual articles that readers need and are unable to obtain. Details are explained separately, but this service has to be on a very limited basis, both to respect copyright restrictions and because of our own modest capacity to respond.

We welcome comments and suggestions on how to improve our product; we emphasize that it can be distributed only in developing countries; we thank the Institute for Scientific Information for allowing us to reproduce its material; and we salute our fellow-participants who, with the leadership of FAO, have built AGRIS into one of the world's richest sources of bibliographic information in agriculture.

A handwritten signature in black ink that reads "Timothy Reeves". The signature is written in a cursive style with a long horizontal line extending from the end.

Timothy Reeves  
Director General, CIMMYT

A handwritten signature in black ink that reads "Adel El-Beltagy". The signature is written in a cursive style with a long horizontal line extending from the end.

Adel El-Beltagy  
Director General, ICARDA

## Sample Entries

### a) Sample entry retrieved from ISI-Current Contents (journal article)

- 1 → 172 Reynolds, MP.; Sayre, KD.; Vivar, HE. (1994) INTERCROPPING  
WHEAT AND BARLEY WITH N-FIXING LEGUME SPECIES - A  
METHOD FOR IMPROVING GROUND COVER, N-USE EFFICIENCY  
AND PRODUCTIVITY IN LOW INPUT SYSTEMS. *Journal of Agricultural*  
*Science*. 123(Part 2):175-183. English [CIMMYT WHEAT PROGRAM  
LISBOA 27 APDO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

### b) Sample entry retrieved from AGRIS (journal article)

- 1 → 69 Alizaga, R. (Costa Rica Univ., San Jose (Costa Rica). Centro para  
Investigaciones en Granos y Semillas); Sterling, F.; Herrera, J. (1992)  
[Evaluation of the vigor in maize seeds and its relationship with the  
behaviour in the field]. *Evaluación del vigor en semillas de maíz y su  
relación con el comportamiento en el campo. Agronomía Costarricense (Costa  
Rica) v. 16(2) p. 203-210. 20 ref.; graf. Spanish . (AGRIS 94-116456).*

### c) Sample entry retrieved from AGRIS (article in conference proceedings)

- 1 → 1 Gonzalez Estrada, Adrian (INIFAP. C.E. Valle de Mexico. Ap. Postal  
10, Chapingo, Mex. 56230 (Mexico)) (1992) [Economic aspects of agricultural  
research in relation to the production of wheat in Mexico]. *Aspectos  
economicos de la investigacion agricola en el cultivo del trigo en  
Mexico. Primera conferencia nacional sobre la produccion de trigo en  
Mexico. (Memoria); Cd. Obregon, Sonora (Mexico); 22-25 Mar 1988.  
[National conference on wheat production in Mexico. (1, 1988, Cd.  
Obregon, Son.) (Proceedings)]. Conferencia nacional sobre la produccion  
de trigo en Mexico. (1, 1988, Cd. Obregon, Son.) (Memoria). *Publicacion  
Especial. Centro de Investigacion Regional del Noroeste (Mexico); no. 4 p.539-550.  
Centro de Investigacion Regional del Noroeste. 21 ref. 2o. tomo. Spanish.  
(AGRIS 94-114649).**

- |   |  |   |  |
|---|--|---|--|
| 1 | Entry number   | 6 | Source   |
| 2 | Author(s)  | 7 | Language of text   |
| 3 | Publication year   | 8 | Organization where work was carried out                          |
| 4 | Title in English   | 9 | AGRIS Reference Number; only<br>for entries retrieved from AGRIS |
| 5 | Original title (only in entries<br>retrieved from AGRIS) |   |  |

## Note to Readers

The source of each entry - whether *Current Contents* or AGRIS - can be readily inferred from its appearance: TITLES from *Current Contents* are wholly in uppercase, whereas those from AGRIS are in upper and lower case. For non-English documents, *Current Contents* gives only an English translation of the title, but AGRIS normally gives both the translation and the title in its original language. There are many other minor differences in the presentation and sequencing of data from the two sources. In the case of entries from AGRIS, please note the reference number given in parentheses at the end of the bibliographic description: often, this number may be used as a surrogate for the whole description in communications between libraries seeking loans or photocopies.

Users of the indexes are also cautioned that the same item may appear in two slightly different forms: for example, the author Kim, S.K. may also be listed as Kim, SK and the subject AFLATOXIN may be followed by a separate entry for AFLATOXINS. To harmonize such data from two different systems would require complex programming and operations, and we hope that our readers will not find these minor anomalies too troublesome.

## A50 AGRICULTURAL RESEARCH

3474 AlGhamdi, A.S. (Date Palm Research Centre, King Faisal University, Al Hassa (Saudi Arabia)) (1996) Biotechnology research initiatives in Saudi Arabia. *Science, Technology and Development (United Kingdom)* v. 14(1) p. 151-156. 25 ref. English. (AGRIC 97-057536).

## B50 HISTORY

3475 Hjelmqvist, H. (Goeteborg Univ. (Sweden). Botaniska Museet) (1996) [A contribution to the history of two-rowed barley in Sweden]. Ett bidrag till det tvaaradiga kornets aeldre historia i Sverige. *Svensk Botanisk Tidskrift (Sweden)* v. 90(3) p. 161-171. 35 ref. Swedish. (AGRIC 97-057577).

## D50 LEGISLATION

3476 Bugbee, B.; Koerner, G.; Albrechtsen, R.; Dewey, W.; Clawson, S. (1997) REGISTRATION OF USU-APOGEE WHEAT. *Crop Science*. 37(2):626. English. [UTAH STATE UNIV CROP PHYSIOL LAB LOGAN, UT 84322 USA].

3477 Cox, TS.; Hussien, T.; Sears, RG.; Gill, BS. (1997) REGISTRATION OF KS92WGRC16 WINTER WHEAT GERMPLASM RESISTANT TO LEAF RUST. *Crop Science*. 37(2):634. English. [KANSAS STATE UNIV DEPT AGRON MANHATTAN, KS 66506 USA].

3478 Kuhn, D.; Parow, N.; Sapauschke, W. (1996) [Barley and malt in the European cereal market order. Interpretations of the laws and orders in 1995]. Gerste und Malz in der Europaeischen Getreidemarkordnung. Erlaeterungen zu den Gesetzen und Verordnungen 1995. *Brautwelt (Germany)* v. 136(5) p. 226-231. German. (AGRIC 97-057803).

3479 Roberts, JJ.; Johnson, JW.; Long, DL.; Fowler, HA.; Cunfer, BM.; Bland, DE. (1997) REGISTRATION OF 12 WINTER WHEAT GERMPLASM LINES RESISTANT TO LEAF RUST - CERUGA-7 TO CERUGA-18. *Crop Science*. 37(2):636. English. [UNIV GEORGIA DEPT CROP & SOIL SCI GRIFFIN, GA 30223 USA].

3480 Sears, RG.; Martin, TJ.; Cox, TS.; Chung, OK.; Curran, SP.; Heer, WF.; Witt, MD. (1997) REGISTRATION OF ARLIN WHEAT. *Crop Science*. 37(2):627. English. [KANSAS STATE UNIV DEPT AGRON MANHATTAN, KS 66506 USA].

3481 Sears, RG.; Martin, TJ.; Cox, TS.; Chung, OK.; Curran, SP.; Heer, WF.; Witt, MD. (1997) REGISTRATION OF KARL 92 WHEAT. *Crop Science*. 37(2):628. English. [KANSAS STATE UNIV DEPT AGRON MANHATTAN, KS 66506 USA].

3482 Sears, RG.; Martin, TJ.; Hatchett, JH.; Cox, TS.; Bequette, RK.; Curran, SP.; Chung, OK.; Heer, WF.; Long, JH.; Witt, MD. (1997) REGISTRATION OF 2137 WHEAT. *Crop Science*. 37(2):628. English. [KANSAS STATE UNIV DEPT AGRON MANHATTAN, KS 66506 USA].

3483 Sebesta, EE.; Hatchett, JH.; Friebe, B.; Gill, BS.; Cox, TS.; Sears, RG. (1997) REGISTRATION OF KS92WGRC17, KS92WGRC18, KS92WGRC19, AND KS92WGRC20 WINTER WHEAT GERMPLASMS RESISTANT TO HESSIAN FLY. *Crop Science*. 37(2):635. English. [KANSAS STATE UNIV DEPT AGRON MANHATTAN, KS 66506 USA].

3484 Van Schalkwyk, H.D. (Orange Free State Univ., Bloemfontein (South Africa). Dept. of Agricultural Economics); Van Zyl, J.; Doyer, O.T. (1996) Welfare effects of regulation in Lesotho's wheat market. *Agrekon (South Africa)* v. 35(4) p. 291-296. 2 tables; 14 ref. English. (AGRIC 97-072211).

3485 Vansanford, DA.; Swanson, CS.; Pearce, WL.; Tutt, CR.; Tones, LJ.; Hershman, DE. (1997) REGISTRATION OF FOSTER WHEAT. *Crop Science*. 37(2):627. English. [UNIV KENTUCKY DEPT PLANT PATHOL LEXINGTON, KY 40546 USA].

## E10 AGRICULTURAL ECONOMICS AND POLICIES

3486 Deleau, J. (1996) [French production of wheat: domestic market, exports]. La production francaise de ble: marche interieur, exportations. *Industries des Cereales (France)* (no 100) p. 47-48. French. (AGRIC 97-057885).

3487 Deleau, J. (Compagnie Continentale France (France)) (1996) [Milling wheat: European production and production of main exporting countries]. Bles de meunerie: productions europeennes et des principaux pays exportateurs dans le monde. Journees de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealieres]. Paris (France). 21-22 Nov 1996. *Industries des Cereales (France)* (no 100) p. 41-46. 15 tableaux, 5 graph. French. (AGRIC 97-057884).

3488 Schmitz, T.G.; Koo, W.W. (1996) An economic analysis of international feed and malting barley markets: an econometric spatial oligopolistic approach. *Agricultural economics report (USA)*; no. 357 100 p. Dept. of Agricultural Economics, Agricultural Experiment Station, North Dakota State University. ill. bibliographical ref. (p. 97-100). Cover title. "September 1996." English. (AGRIC 97-057908).

3489 Selvarajan, S.; Aggarwal, PK.; Pandey, S.; Lansigan, FP.; Bandyopadhyay, SK. (1997) SYSTEMS APPROACH FOR ANALYZING TRADEOFFS BETWEEN INCOME, RISK AND WATER USE IN RICE-WHEAT PRODUCTION IN NORTHERN INDIA. *Field Crops Research*. 51(1-2):147-161. English. [NATL CTR AGR ECON & POLICY RES NEW DELHI 110012 INDIA].

Tradeoffs between expected income, income risk and water use in a rice-wheat (R-W) cropping system in a representative area in northern India were analyzed through a systems approach. The application of crop growth simulation models in conjunction with risk programming models captured both the technical possibilities as well as the socioeconomic context while evaluating risk-efficient production strategies based on their water-use implications on a macro scale (district). The expected income from R-W system in the selected district ranged from rupees (Rs) 3.58 to Rs 4 billion (1996 values) and the income risk, expressed in terms of the coefficient of variation, varied from 5 to 7%. Conflict between income and income risk was controlled through water-use options. For realizing an income level of Rs 3.58 billion, farmers used 38% more water to reduce their income risk. Tradeoff between water use and income risk was moderate (10:1) at the current water use levels due to favorable policy environment. Promoting efficient water use in R-W system calls for rational water/energy pricing policies to reduce water use by 25% from the current level. Supportive water management technology and institutional policies would be more effective to economize the water use beyond 25% wherein, the water use-income risk trade off became acute (1.5:1). (C) Elsevier Science B.V. [References: 33].

3490 Wiese, AF.; Bean, BW.; Salisbury, CD.; Schoenhals, MG.; Amosson, S. (1997) ECONOMIC EVALUATION OF FIELD BINDWEED (CONVOLVULUS ARVENSIS) CONTROL. *Weed Science*. 45(2):288-295. English. [TEXAS A&M UNIV AMARILLO, TX 79106 USA].

This research compared seven field bindweed control treatments to a check in a 3-yr winter wheat-sorghum-fallow rotation. Treatments included 3 wk intervals of sweep tillage combined with one or two annual applications of 2, 4-D (tillage and 2, 4-D). Two other treatments were the same as tillage and 2, 4-D, except dicamba or a mixture of picloram and 2, 4-D were applied once in October after wheat harvest. A fourth treatment was identical to tillage and 2, 4-D, except imazapyr was sprayed immediately after harvest of wheat. Also, three no-tillage systems using glyphosate and 2, 4-D at monthly intervals were supplemented with either dicamba, picloram and 2, 4-D, or imazapyr the same as in treatments involving tillage and 2, 4-D. The check was sweep tilled every 6 wk. All treatments controlled field bindweed in one rotation of two fallow periods and two crops. After control was accomplished, wheat and sorghum yields were about twice the check. Using 1995 costs and returns, profit for an owner-operator for the two fallow periods and two crops was \$123 ha(-1) for tillage and 2, 4-D, compared to \$19 ha(-1) for the check. Tillage and 2, 4-D supplemented with picloram or imazapyr were almost as profitable as tillage and 2, 4-D. Because of high herbicide cost and low yields, no-tillage treatments lost money. Profits with a 33:67 owner-tenant rental agreement were \$105 and \$21 ha(-1), respectively, for owner and tenant using tillage



and 2, 4-D. With no field bindweed control practice, the tenant lost \$33 ha(-1) and the owner made \$51 ha(-1). [References: 24].

## E11 LAND ECONOMICS AND POLICIES

3491 Ahmadiesfahani, F.Z.; Stanmore, R.G. (1997) EXPORT DEMAND FOR ATTRIBUTES OF AUSTRALIAN WHEAT IN ASIA AND THE MIDDLE EAST. *Food Policy*. 22(2):145-154. English. [UNIV SYDNEY DEPT AGR ECON SYDNEY NSW 2006 AUSTRALIA].

Quality attributes of Australian wheat as demanded in the major Asian and Middle East markets are analyzed. The study employs an hedonic price function and a data sample from the Australian Wheat Board commercial contracts from 1984 to 1991. It is found that Japan is relatively quality conscious, while China and the Middle East markets pay little premium for quality. The sample is further divided into two separate time periods for testing the consistency in export demand for attributes and determining recent trends in premiums/discounts. There appears to have been a drop in the reward for quality in these markets since 1987, which may in part be explained by the US-EC wheat price war. The implications of the results for the Australian wheat economy are explored. (C) 1997 Elsevier Science Ltd. [References: 20].

## E16 PRODUCTION ECONOMICS

3492 Ali, M. (Asian Vegetable Research and Development Center, Shanua, Tainan (Taiwan). Production System Program) (1996) Quantifying the socio-economic determinants of sustainable crop production: an application to wheat cultivation in the Tarai of Nepal. *Agricultural Economics (Netherlands)* v. 14(1) p. 45-60. 29 ref. English. (AGRIS 97-072740).

3493 Bashir, M. (NWFP Agricultural Univ., Peshawar (Pakistan). Dept. of Agricultural Economics) (1994) Economics of wheat production in irrigated Dera Ismail Khan (Pakistan). *Sarhad Journal of Agriculture (Pakistan)* v. 10(3) p. 245-250. 5 tables, 5 ref. English. (AGRIS 97-072741).

Currently wheat yield is less in Pakistan than expected and the use of agricultural inputs is lower than the recommended level. This study was undertaken to determine the economics of various inputs used in wheat production and to measure the effect of changes in the prices of fertilizers and wheat on the optimal use of inputs. Results of the study indicate that farmers can substantially gain by increasing the use of nitrogen, phosphorous and tillage. Sensitivity analysis shows that an increase in the price of wheat and decrease in the price of fertilizers will lead increased wheat productivity through increased use of inputs.

3494 Giesler, G.G. (Louisiana State University Agricultural Center.); Salassi, M.E. (1996) Projected costs and returns: rice, Louisiana, 1996 and projected costs and returns: soybeans, corn, milo, wheat, and wheat-soybean double crop, southwest, Louisiana, 1996. *A.E.A. information series (USA)*; no. 140 84 p. In the series analytic: Projected costs and returns and whole farm analysis for major agricultural enterprises—Louisiana, 1996. English. (AGRIS 97-072730).

3495 Gotsch, N. (Eidgenössische Technische Hochschule, Zurich (Switzerland). Swiss Federal Inst. of Technology, Dept. of Agricultural Economics); Regev, U. (1996) Fungicide use under risk in Swiss wheat production. *Agricultural Economics (Netherlands)* v. 14(1) p. 1-9. 13 ref. English. (AGRIS 97-072739).

3496 Mohn, R.; Lukas, H. (Fachhochschule Nürtingen (Germany). Fachbereich Agrarwirtschaft) (1996) [In every deci tonne of wheat in the average nine marks are missing. Estimated costs of cereal production in South Germany]. Bei jeder Dezitonne Getreide fehlen im Schnitt neun Mark. Die Kosten der Getreideproduktion in Süddeutschland ermittelt. *Landwirtschaftliches Wochenblatt. Organ des Landesbauernverbandes in Baden-Württemberg. Ausg. WWL (Germany)* v. 163(50) p. 14-16. German. (AGRIS 97-058349).

Befragung in 53 süddeutschen Betrieben nach den Kosten der Getreideerzeugung aus der Ernte 1995. Die Festkosten wurden aus den Positionen Maschinenfestkosten, Lohn- und Pachtansatz ermittelt u. betrugen 1530 DM/ha. Variable Kosten sind zu 36% Maschinenkosten u. Lohnmaschinen, zu 31% Düngung u. zu 15% Pflanzenschutz u. betrugen 1103 DM/ha. Den Gesamtkosten von 2633 DM standen Marktleistung u. Prämien von 2611 DM/ha gegenüber, damit ergab sich im Mittel ein

Verlust von 22 DM/ha. Durch einen sehr hohen Markterlös von 80 DM/dt verbuchen die oekologisch wirtschaftenden Betriebe einen Gewinn von rund 40 DM/dt Getreide.

3497 Paxton, K.W. (Louisiana State University Agricultural Center.); Britt, D.W. (1996) Projected costs and returns: cotton, soybeans, corn, milo and wheat, Red River and Central Areas, Louisiana, 1996. *A.E.A. information series (USA)*; no. 139 46 p. In the series analytic: Projected costs and returns and whole farm analysis for major agricultural enterprises—Louisiana, 1996. English. (AGRIS 97-072699).

3498 Perez Perez, Severiano (1996) [Income in maize, wheat, barley and potato with traditional technology and the INIFAP under rainfed conditions in Tlaxcala State]. Analisis de ingreso de los cultivos de maiz, trigo, cebada y papa con tecnologia tradicional y del INIFAP bajo condiciones de temporal en el estado de Tlaxcala. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Economia Agricola. 113 p. + anexos. Spanish. (AGRIS 97-072668).

3499 Podolska, G.; Kukula, S.; Pawlowska, J.; Krasowicz, S.; Niescier, E. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland)) (1996) [Evaluation of the production technology for winter wheat with different input levels]. Ocena technologii uprawy pszenicy ozimej o roznym poziomie nakladow. *Pamiętnik Pulawski (Poland)* (no.107) p. 15-26. 5 tables; 13 ref. Polish. (AGRIS 97-072734).

The level of technology intensiveness as determined by capital inputs decided about the direct cost structure and profitability of wheat production. A low input technology with no chemical crop protection was found to be the cheapest. It was much superior to the base technology with respect to money returns although it was inferior with respect to grain yield. It should be noted, however, that there was no major incidence on fungal diseases in the years of the study. The technology developed by Bayer Rau Co. was found to show the worst economic performance under prices current in the years of the study, even though the yields were over 8 t per 1 ha.

3500 Vazquez Moreno, Fernando de Jesus (1996) [Profitability and comparative advantages in the production of barley, Hidalgo State. 1995]. Rentabilidad y ventajas comparativas de la produccion de cebada en el estado de Hidalgo, 1995. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Economia Agricola. 72 p. + anexos. Spanish. (AGRIS 97-072677).

## E20 ORGANIZATION, ADMINISTRATION AND MANAGEMENT OF AGRICULTURAL ENTERPRISES OR FARMS

3501 Ahouissoussi, N.B.C. (University of Georgia.); McIntosh, C.S.; Wetzstein, M.E. (1995) Rational expectations estimation of Georgia soybean acreage response. *Journal of agricultural and applied economics (USA)* v. 27(2) p. 500-509. references. English. (AGRIS 97-058462).

The general method of moments procedure is used for estimating a soybean acreage response function assuming that producers hold rational expectations. Results indicate that soybean, corn, and wheat futures prices, lagged acreage, and government programs are significant factors for determining soybean plantings. Implications of the results are that crop acreage selection by Georgia producers is not very responsive to demand shocks. Thus, producers in other regions are more likely to absorb impacts from these shocks on crop acreage selection.

3502 Britt, D.W. (Louisiana State University Agricultural Center.); Paxton, K.W. (1996) Projected costs and returns: cotton, soybeans, corn, milo and wheat, northeast Louisiana, 1996. *A.E.A. information series (USA)*; no. 138 57 p. In the series analytic: Projected costs and returns and whole farm analysis for major agricultural enterprises—Louisiana, 1996. English. (AGRIS 97-072783).

3503 Epplin, F.M. (Oklahoma State University.); Al Sakka, G.A. (1995) Risk-efficient tillage systems and program participation strategies for land subject to conservation compliance. *Review of agricultural economics (USA)* v. 17(3) p. 242, 311-321. references. English. (AGRIS 97-058510).

Those who farm highly-erodible land have been required to implement soil-conserving production practices to maintain eligibility for agricultural

payments and other federal programs. In Oklahoma, approximately three million acres of cropland, classified as highly erodible, are used for continuous wheat. Most compliance plans prepared for these acres include the use of a conservation tillage system designed to retain plant residue on the soil surface. However, tillage systems studies have found that wheat yield is inversely related to the amount of surface residue. Increasing surface residue to achieve conservation compliance may result in lower yields in the region. The objective of this study is to determine risk-efficient tillage program participation and grazing strategies for a representative wheat farm with land subject to conservation compliance. Wheat yield data for six tillage methods, ranging from a low residue moldboard plow system to a high residue no-till system, were obtained from an experiment station study. Target MOTAD and stochastic dominance were used to determine production strategies for four types of producers (risk-preferring, risk-neutral, slightly risk-averse, and strongly risk-averse). Differences in wheat forage yield and long-run soil productivity across tillage systems were not considered. The results indicate that high residue sweep tillage and no-till systems are not economically efficient. The greatest expected return is generated by participation and using a disk tillage system. The expected cost of noncompliance is approximately \$4 per acre. Nonparticipation plans that use the moldboard plow are not appropriate for risk-preferring or risk-averse producers. The 0/92 provision is important for risk-averse producers. The diversification strategy of grazing wheat forage during the winter and spring is included in the risk-efficient plans for all four types of decision makers.

3504 Kisiel, R. (University of Agriculture and Technology, Olsztyn (Poland). Dept. of Crop Production Economics) (1996) [Attempt to determine optimum level of nitrogen fertilization of winter triticale at variable costs of production means and grain]. *Proba okreslenia optymalnego nawożenia azotowego pszenicy ozimego przy zmiennej relacji cen środków produkcji i ziarna. Fragmenta Agronomica (Poland) v. 13(2) p. 136-146. 1 table; 9 ref. Polish. (AGRIS 97-072852).*

The objective of this work was to present the possibilities of using the production function for determining the optimum level of nitrogen fertilization of winter triticale from the point of view of minimization of costs per piece and maximization of profit. A detailed analysis of profit function showed that the optimum level of fertilization for price relation in the first three months of 1996 was 151.69 kg N/ha and function analysis of costs per piece amounted to 143.62 kg N/ha. The presented econometric models make it also possible to verify calculations.

3505 Krause, M.A. (North Dakota University.); Lee, J.H.; Koo, W.W. (1995) Program and nonprogram wheat acreage responses to prices and risk. *Journal of agricultural and resource economics (USA) v. 20(1) p. 96-107. references. English. (AGRIS 97-058544).*

## E21 AGRO-INDUSTRY

3506 Kleiber, D. (Ecole Supérieure d'Agriculture de Purpan, Toulouse (France). Laboratoire de Physiologie Végétale) (1995) [Quality and collection and storage enterprises]. *La qualité: un outil stratégique pour les entreprises de collecte et de stockage. Purpan (France) (no 176) p. 111-120. 15 ref. French. (AGRIS 97-072869).*

## E50 RURAL SOCIOLOGY

3507 Weber, C.W.; Ariffin, R.B.; Nabhan, G.P.; Idouraine, A.; Kohlhepp, E.A. (Department of Nutritional Sciences, University of Arizona, Tucson, AZ 85721 (USA)) (1996) Composition of Sonoran desert foods used by Tohono O'odham and Pima Indians. *Ecology of Food and Nutrition (United Kingdom) v. 35(2) p. 95-104. 40 ref. English. (AGRIS 97-073002).*

## E70 TRADE, MARKETING AND DISTRIBUTION

3508 Aarstad, L.E. (Norges Landbrukshøgskole, Aas (Norway). Inst. for Økonomi og Samfunnsfag) (1996) [What will the wheat price be tomorrow? Some theoretical and empirical reflections]. *Hva er hvetepriisen i morgen? Noen teoretiske og empiriske refleksjoner. Landbrukøkonomisk Forum (Norway). Tidsskrift for Landbruk, Miljø og Samfunn v. 13(1) p. 5-12. 2 tables, 2 figures; 7 ref. Norwegian. (AGRIS 97-073249).*

3509 Bach, P. (1994) [Agrarian-political and economical frame conditions: consequences for farm management and structural development]. *Agrarpolitische und ökonomische Rahmenbedingungen: Konsequenzen fuer die Betriebsfuehrung und Strukturentwicklung. Tagungsband zur landtechnischen Jahrestagung. Deggendorf (Germany). 22 Nov 1994. [Cultivation under changed conditions - new technologies for cost saving]. Ackerbau unter veraenderten Bedingungen - neue Techniken zur Kosteneinsparung Landtechnik-Schrift (Germany); no. 4. Bayerische Landesanstalt fuer Betriebswirtschaft und Agrarstruktur, Muenchen (Germany) p. 27-36. Landtechnik Weihenstephan. 5 ill. German. (AGRIS 97-058879).*

3510 Bollen, L.; Dardenne, P. (Centre de Recherches Agronomiques, Libramont (Belgium). Station de Haute Belgique) (1996) [Grading wheat lots at harvest in terms of quality]. *Classement des lots de blé à la récolte en fonction de leur qualité. Agricontact (Belgium) (no.284) p. 1-5. 2 ill.; 8 tables; 4 ref. French. (AGRIS 97-073185).*

3511 Funk, H. (Landwirtschaftskammer Hannover (Germany)) (1995) [Don't sell good wheat quality too cheap]. *Weizen wartet auf neuen Schwung: gute Qualitäten nicht unter Wert verkaufen. DLZ. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany) v. 11(3) p. 165. German. (AGRIS 97-059015).*

3512 Ghanem, I.A.A. (Ministry of Agriculture, Cairo (Egypt). Agricultural Economics Research Inst.) (1996) [Market prices efficiency of important strategic crops in Egypt]. *Menofiya Journal of Agricultural Research (Egypt) v. 21(2) p. 467-475. 5 tables; 4 ref. Arabic. (AGRIS 97-058876).*

3513 Jesch, P. (Punjab Agricultural Univ., Ludhiana (India). Dept. of Food Science and Technology) (1995) [Increased importance of starch as renewable resource]. *Stärke hat als nachwachsender Rohstoff an Bedeutung gewonnen. Ernährungsdienst (Germany) (95) p. 4. German. (AGRIS 97-058968).*

Die Staerkeproduktion in der EU (12 Laender) stieg von 5,6 Mio. t im Jahr 1991 auf 7,3 Mio. t im Jahr 1994. Von den 7,3 Mio. t im Jahr 1994 wurden etwa 53% in der Ernaehrungsindustrie verbraucht. Die restlichen 47% fanden im technischen Bereich (Non food) Verwendung. In der Bundesrepublik Deutschland wurden im Jahr 1994 1,6 Mio. t Staerke hergestellt, davon 38% Kartoffelstaerke und je 31% Mais- und Weizenstaerke.

3514 Johnson, D.D. (North Dakota State University, Fargo, ND.); Wilson, W.W. (1995) Evaluation of price/dockage strategies for U.S. wheat exporters. *Review of agricultural economics (USA) v. 17(2) p. 102, 147-158. references. English. (AGRIS 97-059006).*

Dockage is one of many quality attributes that affects U.S. wheat competitiveness in international trade. While other countries regulate the dockage level in their wheat exports, the United States does not. Dockage is a non-grade-determining factor in the U.S. system, meaning that its level in export shipments is a negotiable contract term. This article presents methods for assessing the impacts of cleanliness on foreign demand for U.S. wheat and for evaluating costs and benefits of cleaning prior to export. Two optimization models are developed-the first from the perspective of an import firm, and the second from the perspective of a U.S. export firm. The two models are linked and jointly solved, permitting an interpretation of dockage as an instrument of U.S. commercial strategy and policy. Results were used to demonstrate impacts of critical variables on the demand for cleaner wheat exported from the United States. In general, the value of cleaner wheat from the United States (from the buyer's perspective) is positively related to cleaning costs in the importing country, ocean shipping costs and tariffs, and the importer's cleanliness requirements before milling. The demand for cleaner wheat is negatively related to the screening value. To the extent that these factors vary across importing countries, the impact of providing cleaner wheat (in terms of U.S. export sales) will vary. The heterogeneity in demand for clean wheat makes policy prescriptions difficult. If import demands were homogeneous, then the optimal policy would be to establish a uniform limit for dockage in export shipments. However, applying restrictive factor limits in a world of heterogeneous market demands would result in a higher cost for all exports, even though only selected importers are willing to pay the premium necessary to induce commercial cleaning. An alternative policy is to facilitate the evolution of unique and varying quality requirements for individual buyers.



3515 Martinez Contreras, Armando (1996) [Commercial opening and the production of wheat and sorghum in Guanajuato State]. *La apertura comercial y la producción de trigo y sorgo en Guanajuato*. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Sociologia Rural. 175 p. Spanish. (AGRIS 97-073094).

3516 Normand, P. (Compagnie Continentale (France)) (1995) [European productions and main exporting countries [soft wheat] in the world]. *Productions europeennes et des principaux pays exportateurs [de ble tendre] dans le monde*. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealieres]. Paris (France). 1995. *Industries des Cereales (France) (no 95)* p. 2-6. 15 tableaux. French. (AGRIS 97-058811).

3517 Pinzon de la O, Anabel (1996) [Offer and demand of Mexican wheat in 1970-1994]. *Analisis para la oferta y demanda de trigo Mexicano en el periodo 1970-1994*. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Economia Agricola. 90 p. + anexo. Spanish. (AGRIS 97-073087).

3518 Renze Westendorf, J. (Landwirtschaftskammer Rheinland, Bonn (Germany)) (1995) [Selling wheat? Split price risk by partial sales]. *Weizen verkaufen? Durch Teilverkaufe das Preisrisiko splitten*. *DlZ. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany)* v. 46(12) p. 118. German. (AGRIS 97-058880).

3519 Salas Gonzalez, Jose M. (1996) [Agricultural politics and national wheat production]. *Politica agricola y producción nacional de trigo*. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Economia Agricola. 160 p. + anexos. Spanish. (AGRIS 97-073077).

## E71 INTERNATIONAL TRADE

3520 Johnson, D.D. (North Dakota State University, Fargo.); Wilson, W.W. (1995) *Competition and policy conflicts in Canada-U.S. barley trade*. *Journal of agricultural and resource economics (USA)* v. 20(1) p. 64-81. references. English. (AGRIS 97-059071).

3521 Will, N. (Syndicat Francais de la Meunerie d'Exportation, Paris (France)) (1995) [French milling industry for exporting and world market of flour]. *La meunerie française d'exportation et le marche mondial de la farine*. *Industries des Cereales (France) (no 94)* p. 28-32. 6 graph. French. (AGRIS 97-059057).

## F01 CROP HUSBANDRY

3522 [Crop yields per hectare and total yields in 1996]. *Hektarskoördar och totalskoördar 1996. Definitiva resultat. Rapport från skördeuppskattningsarna* (1997) Livsmedelsekonomiska Samarbetsnämnden, Stockholm (Sweden); Statistiska Centralbyrån, Örebro (Sweden). *Statistiska Meddelanden. Serie J, Jordbruk, Skogsbruk och Fiske (Sweden)*; 12.1 26 p. SCB. Chiefly tables. Swedish. (AGRIS 97-059267).

3523 Aery, NC.; Jain, GS. (1997) *EFFECT OF URANYL NITRATE ON SEED GERMINATION AND EARLY SEEDLING GROWTH OF TRITICUM AESTIVUM*. *Biologia*. 52(1):115-119. English. [ML SUKHADIA UNIV UNIV COLL SCI DEPT BOT UDAIPAR 313001 INDIA].

Toxic effects of various doses of uranium on different growth parameters in *Triticum aestivum* during early seedling growth were studied. Root-shoot length, fresh and dry weight and chlorophyll showed a decrease even at the lowest (1.25  $\mu\text{g mL}^{-1}$ ) uranyl dose studied. Soluble proteins and phenols showed an increasing trend with increasing uranium doses. Though germination speed was affected ultimate germination was always 100%. [References: 16].

3524 Alemayehu, F.; Parlevliet, JE. (1997) *VARIATION BETWEEN AND WITHIN ETHIOPIAN BARLEY LANDRACES*. *Euphytica*. 94(2):183-189. English. [HOLETTA RES CTR INST AGR RES POB 2003 ADDIS ABABA ETHIOPIA].

Up to 100 single plant derived lines of 18 barley landraces, collected from 18 localities of six barley growing regions of Ethiopia were studied for two years at Holetta, Ethiopia for variation in five quantitative traits; scald severity, earliness, plant height, 1000 grain weight, and leafiness. The relative latent period in the adult plant stage to barley leaf rust, a good measure for partial resistance, was assessed on the landrace lines at Wageningen, The Netherlands. The observed variation between and within landraces was very large for all traits. The magnitude of variation was so large that most, if not all, plants within a landrace had a different genotype. The landraces also varied in the degree of variation. Some landraces, 1726 and 3288 for instance, were more variable for most or all traits than other landraces such as 208925 and 212938. Days to heading and scald severity were significantly ( $P = 0.01$ ) correlated with altitude,  $t$  being 0.66 and -0.65, respectively. Resistance to scald and leafiness also increased with altitude. On average landraces became later, more resistant to scald and more leafy the higher the altitude of collection. This associated complex of traits could be an adaptation to the wetter and cooler conditions at higher altitudes. [References: 19].

3525 Amani, I.; Fischer, R.A.; Reynolds, M.P. (Gezira Univ., Medani (Sudan). Faculty of Agricultural Sciences and Natural Resources) (1996) [Canopy temperature depression association with yield of irrigated spring wheat cultivars in a hot climate]. *Beziehungen der Temperaturdepression der Bestandesoberfläche zum Ertrag von bewässerten Sommerweizenkultivaren in einem heissen Klima*. *Journal of Agronomy and Crop Science (Germany)* v. 176(2) p. 119-129. 4 ill., 5 tables; 22 ref. English. (AGRIS 97-059735).

3526 Amann, C.; Ott, J. (Landesanstalt fuer Pflanzenbau Forchheim, Rheinstetten (Germany)) (1997) [For every location the right variety. Results of the variety tests in spring cereals]. *Fuer jeden Standort die richtige Sorte. Ergebnisse der Landessortenversuche mit Sommergetreide*. *Landwirtschaftliches Wochenblatt. Organ des Landesbauernverbandes in Baden-Wuerttemberg. Ausg. WWL (Germany)* v. 164(2) p. 10-14. German. (AGRIS 97-073756).

Fuer Sommergerste, Hafer und Sommerweizen wird die Rangfolge der Sorten nach Ertrag, Standort und Krankheitsanfaelligkeit angegeben.

3527 Amann, C.; Ott, J. (Landesanstalt fuer Pflanzenbau Forchheim, Rheinstetten (Germany)) (1996) [Recommendation for the autumn seeding 1996 - Results of the variety tests with winter cereals]. *Sortenempfehlung fuer die Herbstsaat 1996 - Ergebnisse der Landessortenversuche mit Wintergetreide*. *Landwirtschaftliches Wochenblatt. Organ des Landesbauernverbandes in Baden-Wuerttemberg. Ausg. WWL (Germany)* v. 163(38) p. 16-22. German. (AGRIS 97-059728).

Leistung der Sorten, Vergleich der Behandlungen (extensive bzw. intensive Stufe (Pflanzenschutz, N-Duengung)) und Sortenempfehlungen fuer Winterweizen, -roggen und -triticale.

3528 Anon. (1995) [Is the sun destroying our barley? Barley yield losses caused by UV- ray damages]. *Brennt die Sonne unsere Ertraege weg? UV-Schaden bei Gerste schuld an Verlusten*. *DlZ. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany)* v. 46(9) p. 64-65. German. (AGRIS 97-059473).

3529 Anon. (1995) [Wheat varieties: a new model for quality: elite wheat and cookie wheat]. *Weizensorten: neues Schema fuer die Qualitaet. Eliteweizen und Keksweizen erstmalig eingefuehrt*. *DlZ. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany)* v. 46(9) p. 58, 60. German. (AGRIS 97-059729).

3530 Ashraf, M.; O'Leary, J.W. (Bahauddin Zakariya Univ., Multan (Pakistan). Inst. of Pure and Applied Biology) (1996) [Responses of some newly developed salt-tolerant genotypes of spring wheat to salt stress: 1. Yield components and ion distribution]. *Reaktionen einiger neuentwickelter salztoleranter Genotypen von Sommerweizen gegenueber Salzstress: 1. Ertragskomponenten und Ion-Verteilung*. *Journal of Agronomy and Crop Science (Germany)* v. 176(2) p. 91-101. 8 tables; 35 ref. English. (AGRIS 97-059731).

3531 Budzynski, W.; Fedejko, B.; Szemplinski, W.; Majewska, K. (University of Agriculture and Technology, Olsztyn (Poland)) (1995) [Energetical, productive and qualitative evaluation of different technologies of winter wheat production]. *Energetyczna, produkcyjna*

oraz jakościowa ocena różnych technologii uprawy ozimej pszenicy chlebowej. *Fragmenta Agronomica (Poland)* v. 12(3) p. 33-52. 8 fig., 6 tables; 34 ref. Polish. (AGRIS 97-073945).

It was found on the base of two-years studies that total input of cumulative energy amounted 2050 MJ per ha on soil tillage as ploughing at medium depth (20-22 cm) with application of complete tillage set. Substitution of medium depth ploughing by chisel with shallow ploughing caused increase of energy input by 24%. Chisel ploughing and rototiller increased energy by 7%. Obtained results proved that application chisel and shallow ploughing together with tillage complete set caused yield increase by 35%, compared to conventional pre-sowing tillage. Technological quality of wheat grain seems to be more differentiated by climatic conditions than by method of pre-sowing tillage.

3532 Carter, MR.; Gupta, UC. (1997) MICRONUTRIENT CONCENTRATIONS IN BARLEY AND SOYBEAN UNDER MINIMUM TILLAGE ON PODZOLIC SOILS IN A COOL CLIMATE. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 47(1):7-13. English. [AGR & AGRI FOOD CANADA RES CTR CHARLOTTETOWN PE C1A 7M8 CANADA].

Micronutrients can be limiting for crop production and quality in fine sandy loam Podzolic soils in the cool, humid climate of Atlantic Canada. This study was conducted to determine the effect of minimum tillage practices, in three long-term annual feed crop rotations, on micronutrient (B, Cu, Zn, Mn, Fe and Mo) content and grain quality of spring barley (*Hordeum vulgare* L.) and soybean (*Glycine max* L. Merrill). Reductions in soil tillage had various effects on micronutrient concentration in plant parts, especially for Cu, Zn, Mn, and Mo, which were probably related to pH changes at the soil surface. Grain micronutrient concentrations, however, for crop yield potential tended to be in the sufficiency range and were not limiting for crop growth or feed quality. Evidence suggesting a decline in Mo concentration over time underlines the need for periodic assessment of micronutrient assimilation in conservation tillage systems. [References: 24].

3533 Chasseray, P. (Ecole Nationale Supérieure de Meunerie et des Industries Cerealieres, Paris (France). Sciences Biologiques et Biotechnologie des Cereales) (1996) [Traits of wheat of the 1996 season (France)]. Carcterisation des bles de la recolte 1996 (France). Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealieres]. Paris (France). 21-22 Nov 1996. *Industries des Cereales (France)* (no 100) p. 9-14. French. (AGRIS 97-059255).

3534 Codianni, P.; Ronga, G.; Fonzo, N. di; Troccoli, A. (Istituto Sperimentale per la Cerealicoltura, Foggia (Italy)) (1996) [Performance of selected strains of 'farro' (*Triticum monococcum* L., *Triticum dicoccum* Schuebler, *Triticum spelta* L.) and durum wheat (*Triticum durum* Desf. cv. *Trinakria*) in the difficult flat environment of Southern Italy]. Leistung selektierter Linien von 'Farro' (*Triticum monococcum* L., *Triticum dicoccum* Schuebler, *Triticum spelta* L.) und Durumweizen (*Triticum durum* Desf. cv. *Trinakria*) in einem schwierigen Flachland des südlichen Italiens. *Journal of Agronomy and Crop Science (Germany)* v. 176(1) p. 15-21. 3 ill., 2 tables; 23 ref. English. (AGRIS 97-059743).

3535 Dalal, RC.; Strong, WM.; Weston, EJ.; Cooper, JE.; Thomas, GA. (1997) PREDICTION OF GRAIN PROTEIN IN WHEAT AND BARLEY IN A SUBTROPICAL ENVIRONMENT FROM AVAILABLE WATER AND NITROGEN IN VERTISOLS AT SOWING. *Australian Journal of Experimental Agriculture*. 37(3):351-357. English. [QUEENSLAND WHEAT RES INST POB 2282 TOOWOOMBA QLD 4350 AUSTRALIA].

In many subtropical environments, cereal crops develop and mature largely on residual water in the soil. This research involves evaluation of the impact of plant available nitrogen (N) and water in soil at sowing on grain protein in wheat and barley in such a subtropical environment. Estimates of grain protein concentration of wheat (cv. Hartog) were made using plant available water and available N (soil nitrate-N and fertiliser N, where applied) at sowing using data obtained from an experiment conducted at Warra, Queensland, from 1987 to 1995. Treatments included: grass + legume leys of 4-year duration followed by continuous wheat with 0 or 50 kg N/ha year applied as urea at sowing; 2-year rotation of lucerne and wheat; 2-year rotation of annual medics and wheat; 2-year rotation of chickpea and wheat, no-tillage wheat; and conventional tillage wheat. Fertiliser N as urea was applied to both no-tillage wheat and conventional tillage wheat at 0, 25 and 75 kg N/ha year. The conventional tillage wheat

also received N at 12.5 and 50 kg N/ha year. Estimates of wheat grain yield required both rainfall during the fallow period or plant available water in the soil profile at sowing and rainfall from sowing to anthesis and, therefore, it could not be predicted precisely at sowing. Increasing plant available water (mm) in soil at sowing linearly reduced grain protein. In comparison, available N at sowing increased grain protein curvilinearly from 10.0% at 50 kg N/ha to 14.5% at 200 kg N/ha (0-120 cm depth). Variation in grain protein concentration was best accounted for by the available water:available N ratio at 0-90, 0-120 or 0-150 cm depths. The protein concentrations of wheat (cv. Hartog) grown in 1996 at Warra and Nindigully, and wheat (cv. Cunningham) grown from 1991 to 1995 at Billa Billa, and barley (cv. Tallon) grown in 1996 at Nindigully and Formartin, Queensland, were successfully predicted using the relationship between the available water:available N ratio and wheat grain protein concentration developed using data from Warra during 1987-95. Thus, available water should be matched by N supply at sowing to ensure the production of Prime Hard grade wheat and malting grade barley in the subtropical environment. As a 'rule of thumb', for 0-120 cm depth of soil sampling, each millilitre of available water matched with each kilogram of N per hectare of available N, at sowing, would produce about 13% protein wheat in this semi-arid region. It requires only 0.5 kg of N/ha for each millilitre of available water in 0-120 cm depth of soil to produce malting grade barley of about 10.5% protein concentration. Available water in soil at sowing can be approximated with rainfall during the fallow period, with rainfall (mm):available N (kg/ha for 0-120 cm depth) ratios of 3.7 and 7.4 for respective 13 and 10.5% grain protein concentrations for both wheat and barley. [References: 18].

3536 Davis, S.P. (1996) From wheat to flour. Millers' National Federation (USA); Wheat Foods Council (USA). Millers' National Federation. ill. (some col.). bibliographical ref. (p. 73). Cover title. 75 p. English. (AGRIS 97-073968).

3537 Eissa, A.M.; Shehab, T.M.; Dawood, A.M. (King Saud Univ. Al Qassim (Saudi Arabia). Faculty of Agriculture and Veterinary Medicine) (1995) Row-spacing and seeding-rate effects on yield and yield components of spring wheat in Al-Qassim region, Saudi Arabia. *Assiut Journal of Agricultural Sciences (Egypt)* v. 26(3) p. 25-36. 5 tables; 19 ref. English. (AGRIS 97-073943).

3538 Estler, M.; Nawroth, P.; Neumair, B. (1994) [Threshing-seed-method for the extensive cereal and rape cropping]. Drusch-Saat-Verfahren fuer den extensivierten Getreideanbau und Rapsanbau. Tagungsband zur landtechnischen Jahrestagung. Deggendorf (Germany). 22 Nov 1994. [Cultivation under changed conditions - new technologies for cost saving]. Ackerbau unter veraenderten Bedingungen - neue Techniken zur Kosteneinsparung Landtechnik-Schrift (Germany); no. 4. Technische Univ. Muenchen, Freising (Germany). Inst. fuer Landtechnik p. 75-88. Landtechnik Weihenstephan. 8 ill.; 3 ref. German. (AGRIS 97-059727).

3539 Fangmeier, A.; Grueters, U.; Vermehren, B.; Jaeger, H. J. (1996) [Responses of some cereal cultivars to CO<sub>2</sub> enrichment and tropospheric ozone at different levels of nitrogen supply]. Reaktionen verschiedener Getreidesorten auf erhoehte CO<sub>2</sub>- und Ozon-Konzentrationen bei unterschiedlicher Stickstoffversorgung. *Angewandte Botanik (Germany)* v. 70(1-2) p. 12-18. 6 ill., 2 tables; 42 ref. English. (AGRIS 97-059734).

3540 Flores Reyes, J.A.; Huerta Diaz, J.; Buen Abad Dominguez, A.; Ramirez Hernandez, J.C. (1995) [Production system for barley rainfed in the highlands of San Luis Potosi State and Jalisco State]. Sistema de produccion para cebada de temporal en el altiplano potosino jalisciense. 26. Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 197. Sociedad Mexicana de la Ciencia del Suelo. 3 cuadros; 1 ref. Spanish. (AGRIS 97-073486).

3541 Glushchenko, D.P. (Ukrainian Academy of Agricultural Sciences, Kulynychi, Kharkiv region (Ukraine). Inst. of Animal Husbandry) (1996) [The ways of reducing energy capacity of feed production]. Shlyakhy

zmyzhennya energoyemnosti kormovyrobnystva. *Visnyk Ahrarnoyi Nauky (Ukraine)* (no.10) p. 28-32. 2 tables. Ukrainian. (AGRIS 97-059762).

Energetic efficiency of agricultural crops including grain fodder and feed crops of Forest-Steppe and Forest zones of Ukraine is studied. System analysis of efficiency of feed production energy assessment has shown a different level of their energy capacity. It is found out that the highest total energy consumption (per 1 ha) was at growing of feed roots, maize for silage and fodder (61, 83 and 52, 4 J/ha), the least - at growing of perennial grasses for hay, haylage and green fodder (15, 97-17, 94 J/ha).

3542 Harasim, A. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Crop Production) (1995) [Effect of some factors on the yields and labour requirements of commercially grown winter wheat]. *Wplyw niektorych czynnikow na plonowanie i pracochlonnosc uprawy pszenicy ozimej w warunkach produkcyjnych. Pamietnik Pulawski (Poland)* (no.106) p. 35-46. 5 tables; 25 ref. Polish. (AGRIS 97-073946).

The study was conducted in the years 1980-89 in four experiment farms with soils rated as good wheat complexes; it comprised 235 commercial lots of winter wheat. The study showed that among the major factors affecting wheat yields were the preceding crop, date and rate of sowing, number of plant and disease control measures and level of labour inputs. Labour consumption was found to be significantly affected by the size of the field, soil quality, preceding crop, number of sprays against pests and diseases, and requirements for transport.

3543 Jarosik, V.; Kovacicova, E.; Maslowska, H. (Charles Univ., Prague (Czech Republic). Faculty of Sciences) (1996) [The influence of planting location, plant growth stage and cultivars on microflora of winter wheat roots]. [Der Einfluss von Pflanzort, Pflanzenwachstumsstadium und Kultur auf die Mikroflora der Wurzeln von Winterweizen]. *Microbiological research (Germany)* v. 151(2) p. 177-182. 3 ill., 5 tables; 22 ref. English. (AGRIS 97-059732).

Das Vorkommen von parasitischer und saprophytischer Mikroflora an den Wurzeln von acht Winterweizen-Kulturen wurde in sieben Pflanzenversuchsbetrieben mit verschiedenen klimatischen und Bodenbedingungen innerhalb von vier Pflanzenwachstumsstadien untersucht. Die gegenseitigen Wechselwirkungen zwischen den Spezies der Mikroflora, die Pflanzbedingungen und die Pflanzenentwicklung beeinflussen die Feldresistenz der Pathogene.

3544 Jones, OR.; Popham, TW. (1997) CROPPING AND TILLAGE SYSTEMS FOR DRYLAND GRAIN PRODUCTION IN THE SOUTHERN HIGH PLAINS. *Agronomy Journal*. 89(2):222-232. English. [USDA ARS CONSERVAT & PROD RES LAB PO DRAWER 10 BUSHLAND, TX 79012 USA].

Low precipitation and high evaporative potential limit yields of dryland crops in the semiarid Southern High Plains. Improved residue management can reduce evaporation and improve water conservation. We compared no-tillage (NT) and stubble mulch (SM residue management effects from 1984 to 1993 on leveled minibenches at Bushland, TX, using winter wheat (*Triticum aestivum* L.)-fallow (WF), continuous wheat (CW), wheat-sorghum (*Sorghum bicolor* (L.) Moench)-fallow (WSF), and continuous sorghum (CS) systems. The soil was a Pullman clay loam (fine, mixed, thermic Torrertic Paleustoll). Our objective was to quantify and compare soil water storage, crop water use, and grain production in order to identify the most water-efficient production system. Relative to SM management, NT management of wheat residues increased average soil water contents at planting of the next crop by 22 mm with WSF, 15 mm with WF, and 29 mm with CW; it was not as effective with sorghum residues. Mean grain yields were not affected by residue management on any cropping system, because the additional water stored with NT management was slight in relation to seasonal evapotranspiration. Cropping systems had major effects on grain yield and production. Fallow systems (WSF, WF) normally resulted in higher yields than the corresponding annual cropping system (CW, CS). However, when grain production was adjusted to an annual basis including fallow time, the CS system was most efficient at using precipitation, producing 92% more grain than WSF, 240% more than CW, and 320% more than WF. Grain production was more than twice as great with sorghum than with wheat, due to greater biomass production and a 33% greater harvest index. Although wheat is the major dryland crop in the Southern High Plains, sorghum seems much better adapted to the region's predominant pattern of late spring-summer rainfall. [References: 12].

3545 Karpenstein Machan, M.; Maschka, R. (Kassel Univ., Gesamthochschule, Witzenhausen (Germany). Inst. fuer Nutzpflanzenkunde) (1996) [Investigations on yield structure and local adaptability of Triticale, Hybrid-Rye and Population-Rye based on data of regional variety trials]. *Untersuchungen zum Ertragsaufbau und zur Standorteignung von Triticale, Hybrid- und Populationsroggen auf der Basis der Landessortenversuche. Agribiological research (Germany)* v. 49(2-3) p. 130-143. 11 ill., 2 tables; 7 ref. German. (AGRIS 97-073905).

3546 Khabaz Saberi, H. (1993) Determination of appropriate seeding rates for promising barley varieties. Seed and Plant Improvement Institute, Karadj (Iran Islamic Republic). *Seed and Plant Journal of Agricultural Research (Iran Islamic Republic)* v. 9(1-2) p. 2. Persian. (AGRIS 97-073676).

3547 Kolev, T.; Terziev, Zh. (Vishh Selskostopanski Institut, Plovdiv (Bulgaria)); Belcheva, S.; Ivanova, I.; Nenkova, D. (1996) [Influence of the biostimulator tritimid on durum wheat productivity and quality]. *Vliyanie na biostimulatora tritimid v'rkhu produktivnosta i kachestvoto na tv'rdata psheinita. Selskostopanska Akademiya, Sofia (Bulgaria). Rasteniev'dni Nauki (Bulgaria). Plant Science* v. 33(1) p. 9-11. 4 tables; 8 ref. Bulgarian. (AGRIS 97-059742).

3548 Kozłowska Ptaszynska, Z. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Crops) (1995) [Effect of sowing density on canopy architecture and output of three winter barley cultivars]. *Wplyw gestosci siewu na architekture i wydajnosc lanow trzech odmian jeczmienia ozimego. Pamietnik Pulawski (Poland)* (no.106) p. 23-24. 3 fig., 5 tables; 10 ref. Polish. (AGRIS 97-073758).

In the years 1991-92 the effect of sowing rate on the canopy architecture and output of the two-rowed cv. Marinka and two six-rowed cvs. Sibra and BKH 1290 was compared in a microplot experiment. Under favourable weather conditions increasing sowing rate from 250 to 350 and 450 seeds per 1 square m had significantly raised the yields of the two-rowed cv. Marinka through a substantial increase in the number of ears per unit area. Yields of the six-rowed cvs. Sibra and BKH 1290 were unaffected by sowing rate due to a large percentage (80%) of tall tillers that bore ears with a high number of heavy seeds.

3549 Kozłowska Ptaszynska, Z. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Crops) (1995) [Structure and output of the multi-row spring barley canopy under different nitrogen rates and plant densities]. *Struktura i wydajnosc lanu jeczmienia jarego wielorzedowego w warunkach zroznicowanego nawozenia azotem i obsady roslin. Pamietnik Pulawski (Poland)* (no.106) p. 9-22. 3 fig., 6 tables; 16 ref. Polish. (AGRIS 97-073759).

A microplot experiment was run in the years 1991-92. Under favourable weather conditions (1992) there was a significant interaction of fertilization rate x sowing rate on the yield. Increasing the sowing density from 250 to 400 grains per 1 sq. m increased the yield in the 0-nitrogen treatment only. Application of 120 kg N significantly reduced the yield due to lower 1000-grain weight. As the sowing rate and fertilization level increased higher LAI values were recorded, especially at the period from shooting to the beginning of milk-ripe stage.

3550 Lafarga, A.; Lezaun, J.A.; Armentó, A.P.; Alonso, J. (1997) [Flour-bakery quality of new varieties of soft wheat in Navarra (Spain)]. *La calidad harino-panadera de las nuevas variedades de trigo blando ensayadas en Navarra. Navarra Agraria (Espana)* (no.100) p. 34-41. 12 graf., 2 cuadros. Spanish. (AGRIS 97-073426).

3551 Martin, G. (Institut Technique des Cereales et des Fourrages, Paris (France). Laboratoire Qualite des Cereales) (1996) [Climate of the 1995-1996 season and quality of bread wheat (France)]. *Bilan climatique de la campagne 1995-1996 et qualite des bles panifiables (France). Journees de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealières]. Paris (France). 21-22 Nov 1996. Industries des Cereales (France)* (no 100) p. 3-7. 5 graph. French. (AGRIS 97-059254).

3552 Mastel, K. (Landesanstalt fuer Pflanzenbau Forchheim, Rheinstetten (Germany)) (1996) [Where does the optimum of intensity lie? Suitable varieties for the extensive cultivation of winter cereals]. *Wo liegt das Intensitaetsoptimum? Geeignete Sorten fuer den extensiven Anbau von Wintergetreide. Landwirtschaftliches Wochenblatt. Organ des*

Landesbauernverbandes in Baden-Wuerttemberg. *Ausg. WWL (Germany) v. 163(42) p. 12-13. German. (AGRI 97-059402).*

Auswertung der Landessortenversuche der Jahre 1995 und 1996 fuer Winterweizen, -gerste, -triticale und -roggen. Es wurde das Leistungsvermoegen der Sorten sowohl bei extensiver Bestandesfuehrung (reduzierte N-Duengung, kein Einsatz von Fungiziden u. Wachstumsreglern) als auch unter ordnungsgemaessen Bedingungen geprueft. Bei den Durchschnittsertraegen 1995/96 rangierte Triticale vor Weizen, Roggen und Gerste. 1995 war die rentabelste Variante zur extensiven Futtergetreideerzeugung die Triticale sorten Binova, 1996 (relativ geringer Pilzdruck) war es die Weizensorte Flair.

3553 Milovanovic, M. (Centar za strna zita, Kragujevac (Yugoslavia)); Malesevic, M.; Saric, M.; Dencic, S.; Grubor, M.; Kovacevic, B.; Mladenov, M. (1996) [Possibilities of regionalization and better usage of genetic potential for crop yield and quality of Yugoslav winter wheat varieties]. *Mogucnost rejonizacije i boljeg iskoriscavanja genetskog potencijala rodnosti i kvaliteta jugoslovenskih sorti ozime pšenice. 12. savetovanje "Zito-hleb". Novi Sad (Yugoslavia). 24-26 Apr 1996. Cereal and flour production and processing: domestic [Yugoslav] potentials - international quality. Monograph, [proceedings of a conference]. Vukobratovic, R. (ed.). Proizvodnja i prerada zita i brasna: domaci [jugoslovenski] potencijali i svetski kvalitet. Monografija, [zbornik radova sa savetovanja] p. 105-120. Tehnoloski fakultet, Zavod za tehnologiju zita i brasna. 4 graphs; 4 tables; 15 ref. Serbian. (AGRI 97-059733).*

In this paper the possibilities of regionalization and better usage of genetic potential of crop yield and technological quality of Yugoslav varieties of winter wheat have been presented. Crop yield has been investigated during three year period, comprising totally 115 experiments in Serbia (Yugoslavia). Bread quality parameter was investigated in 25 experiments during at least 2 years. Based on the results of investigations a suggestion for variety regionalization and production technology aimed at maximum use of potential for crop yield and quality was made.

3554 Miralles, D.J.; Slafer, G.A. (Universidad de Buenos Aires (Argentina). Facultad de Agronomia. Dept. de Produccion Vegetal) (1996) [Grain weight reductions in wheat associated with semidwarfism: An analysis of grain weight at different positions within the spike of near-isogenic lines]. *Korngewichtsreduktionen bei Weizen in Verbindung mit Semidwarf-Typ. Eine Analyse des Korngewichtes unterschiedlicher Positionen innerhalb der Aehre bei nahezu isogenen Linien. Journal of Agronomy and Crop Science (Germany) v. 177(1) p. 9-16. 4 ill., 1 table; 32 ref. English. (AGRI 97-059738).*

3555 Morrison, J.E. Jr. (USDA, ARS, Temple, TX.); Rickman, R.W.; McCool, D.K.; Pfeiffer, K.L. (1997) Measurement of wheat residue cover in the Great Plains and Pacific Northwest. *Journal of soil and water conservation (USA) v. 52(1) p. 59-65. references. English. (AGRI 97-059765).*

3556 Moselhy, N.M.M. (1995) Raising wheat under desert conditions in Egypt. Zagazig Univ. (Egypt). Faculty of Agriculture. tables; Bibliography: p. 184-194. 194 p. English. (AGRI 97-059739).

3557 Moudry, J. (Jihoceska Univ., Ceske Budejovice (Czech Republic)); Vlasak, M. (1996) [Spelt (Triticum spelta) as the alternative crop]. *Pšenice spalda (Triticum spelta) - alternativni plodina. Metodiky pro Zemedelskou Praxi (Czech Republic); no. 6 28 p. Ustav Zemedelskych a Potravinarskych Informaci. 2 ill., 15 tables; 14 ref. Czech. (AGRI 97-059744).*

The information about the origin and the spread of bearded spelt (Triticum spelta) is covered by this booklet. Since the beginning of 90s the spelt is spread in the Czech Republic mainly in the systems of ecological agriculture. Biological characteristics, cultivated varieties, demands on growing conditions, farming (growing) technology, nutrition and fertilization, sowing technology, control of diseases and pests and harvesting is described in individual chapters. There are also involved problems of postharvesting processing, storage technology, processing and utilization, and also methods of evaluation of milling and baking quality. Economic evaluation of production and processing of spelt is described in the closing chapter.

3558 Nonhebel, S. (Landbouwniversiteit Wageningen (Netherlands). Vakgroep Theoretische Product Ecologie) (1996) Effects of temperature rise and increase in CO(2) concentration on simulated wheat yields in

Europe. *Climatic Change (Netherlands) v. 34(1) p. 73-90. 37 ref. English. (AGRI 97-073942).*

3559 Odonovan, J.T.; Blackshaw, R.E. (1997) EFFECT OF VOLUNTEER BARLEY (HORDEUM VULGARE L) INTERFERENCE ON FIELD PEA (PISUM SATIVUM L) YIELD AND PROFITABILITY. *Weed Science. 45(2):249-255. English. [ALBERTA ENVIRONM CTR VEGREVILLE AB T9C 1T4 CANADA].*

Relationships between volunteer barley plant density and both pea and volunteer barley yield were determined in field experiments conducted over 2 yr at Vegreville and Lethbridge, Alberta. Nonlinear regression analysis indicated that severe pea yield losses due to volunteer barley occurred at both locations. Averaged over both years, pea seed yield losses per volunteer barley plant (initial slopes) varied from 1.7% at Vegreville to 5.4% at Lethbridge. Based on certain assumptions, economic thresholds calculated from the equations were approximately 2 and 6 volunteer barley plants m(-2) at Lethbridge and Vegreville, respectively. Revenue from the volunteer barley seed partially alleviated the monetary losses caused by the reduced pea seed yield. The effects of pea density on pea and volunteer barley yield were inconsistent and marginal. This suggested that there was little advantage, in terms of increasing pea yield or reducing volunteer barley interference, to seeding pea above the recommended rate of 100 plants m(-2). [References: 23].

3560 Olumekun, V.O. (Ondo State Univ., Ado Ekiti (Nigeria). Dept. of Botany) (1996) [An analysis of the response of winter wheat (Triticum aestivum) components to cycocel (Chlormequat) application]. *Analyse der Reaktionen von Winterweizen (Triticum aestivum)-Komponenten gegenueber Cycocel (Chlormequat)-Anwendung. Journal of Agronomy and Crop Science (Germany) v. 176(3) p. 145-150. 6 ill., 1 table; 18 ref. English. (AGRI 97-059736).*

3561 Pecetti, L.; Hollington, P.A. (1997) APPLICATION OF THE CERES-WHEAT SIMULATION MODEL TO DURUM WHEAT IN TWO DIVERSE MEDITERRANEAN ENVIRONMENTS. *European Journal of Agronomy. 6(1-2):125-139. English. [IST SPERIMENTALE CULTURE FORAGGERE VIALE PIACENZA 29 I-20075 LODI ITALY].*

The CERES-Wheat model was applied to simulate growth and yield of durum wheat in two diverse Mediterranean environments, Breda (northern Syria) and Libertinia (eastern Sicily), using historical daily weather data. Two cultivars of known, good performance under Mediterranean conditions were examined. Three sowing dates were simulated: 'normal' (26 November), 'early' (1 November) and 'late' (20 December), for 12 seasons at Breda and six at Libertinia. Simulated grain yield and simulated date of anthesis were considered. Absolute differences between simulated and observed yield were independent of the recorded yield level. In a very harsh season at Breda, the model precision (in absolute terms) was of the order of magnitude of the low yield observed, thus making the simulation very inadequate. At both locations, 'early' sowing had the highest simulated yield, and 'late' sowing the lowest. The water stress index CSD?, affecting leaf expansion and growth, was estimated for various growth stages. At 'normal' sowing, simulated yield was mainly affected by simulated stress around anthesis at Breda, and by stress during grain filling at Libertinia. The simulation suggested that anthesis date may be influenced by interactions of sowing date or cultivar with the environment. Alteration of the phenology of the simulated cultivar by modification of the genetic coefficients highlighted the positive effect of earliness on yield in these environments. Prospects for the application of the model to durum wheat in the Mediterranean area are discussed. (C) 1997 Elsevier Science B.V. [References: 25].

3562 Penrose, L.D. (1997) PREDICTION OF EAR EMERGENCE IN WINTER WHEATS GROWN AT TEMORA, NEW SOUTH WALES. *Australian Journal of Agricultural Research. 48(4):433-445. English. [TASMANIAN ALKALOIDS PTY LTD POB 130 WESTBURY TAS 7303 AUSTRALIA].*

This study examined factors that determine ear emergence in winter wheats grown at Temora, New South Wales. Three development factors were considered: degree of winter habit, response to photoperiod, and intrinsic earliness. The effect of winter habit was first examined by using 3 pairs of related wheats that differed for spring-winter habit. Wheats were sown under irrigation from mid February to June, for up to 4 consecutive years. Ear emergence was recorded in days of the year for ease of field interpretation, and in photo-thermal time to measure delay in



development. Winter habit was found to delay ear emergence throughout this sowing range. Ear emergence was then studied in 23 winter wheats that as a group encompassed a broad range for each of the 3 development factors, and these winter wheats were grouped on the basis of combinations of development factors. Differences in ear emergence between these groups guided the construction and testing of regression equations that described ear emergence as a function of sowing date and of the 3 development factors. Many combinations of factors were associated with the time of ear emergence (i.e. 1 October) at Temora that best optimises the balance between frost risk and yield potential. Combinations of development factors also influenced the flexibility of sowing time for winter wheats grown at Temora. These findings may assist the breeding of new winter wheats that can be sown over a longer period than current winter cultivars. [References: 22].

3563 Pickett, AA.; Galwey, NW. (1997) A FURTHER EVALUATION OF HYBRID WHEAT. *Plant Varieties & Seeds*. 10(1):15-32. English. [NATL INST AGR BOT HUNTINGDON RD CAMBRIDGE CB3 0LE ENGLAND].

The development of F-1 hybrid varieties of wheat is reviewed under four main headings: male sterility, hybrid seed production, the performance of hybrids and commercial aspects. The three systems for male sterility raised in wheat (cytoplasmic male sterility, nuclear male sterility and chemical hybridizing agents) are described and it is noted that no system is without problems or has a clear advantage over the others. Hybrid seed production is considered from the basis of the reproductive system of wheat and it is concluded that major biological environmental constraints remain unresolved and conflict with the objective of a reliable supply of seed. A yield benefit sufficient to justify the cost of producing hybrid wheat seems remote at the present time. Indeed trial results tend to support the hypothesis that heterosis in wheat arises from dominance with the additional factors of linkage and interaction of alleles. It is therefore concluded that the case for commercializing hybrid wheat is not strong unless biotechnology is able significantly to reduce production costs. [References: 76].

3564 Rosenzweig, C. (Columbia Univ., New York, NY (USA). Goddard Inst. for Space Studies); Tubiello, F.N. (1996) Effects of changes in minimum and maximum temperature on wheat yields in the central US: a simulation study. *Agricultural and Forest Meteorology (Netherlands)* v. 80(2-4) p. 215-230. 32 ref. English. (AGRIS 97-073944).

3565 Rossberg, R.; Kratzsch, G. (Deutsche Landwirtschaftliche Gesellschaft, Frankfurt am Main (Germany)) (1997) [European cultural methods for wheat - The big comparison organized by the DLG]. Der grosse DLG-Vergleich. *DLG-Mitteilungen (Germany)* (no.2) p. 66-69. German. (AGRIS 97-073938).

3566 Royo, C.; Pares, D. (1996) YIELD AND QUALITY OF WINTER AND SPRING TRITICALES FOR FORAGE AND GRAIN. *Grass & Forage Science*. 51(4):449-455. English. [CTR UDL IRTA AREA CONREUS EXTENSUS ROVIRA ROURE 177 LLEIDA 25198 SPAIN].

In held experiments conducted over 2 years in Mediterranean conditions, five winter and five spring triticales were evaluated for forage and grain production in the same cropping season. The experiments had two treatments, namely harvesting for grain only, and dual-purpose forage and grain production. In the latter treatment, forage was cut when the first node was detectable (Zadoks' stage 31), without removing the apical meristems. Grain was harvested when ripe (Zadoks' stage 92) in both cut and uncut plots. Environmental conditions affected grain production and protein content more than forage yield and quality. Winter triticales yielded about 43% more forage than spring types, but after forage removal the spring types yielded about 36% more grain than winter triticales. Reductions in grain yield after clipping were more pronounced in winter (32%) than in spring (19%) types. Forage crude protein content was significantly higher in the spring types studied (24.6%) than in the winter types (23.5%), the opposite being true for fibre content (20.7 and 21.6% respectively). Grain crude protein content did not differ between grain and dual-purpose treatments, but was higher in the spring triticales (12.8%) than in the winter types (11.9%). There was more variability for the measured traits within the winter triticales studied than within the spring types. [References: 23].

3567 Royo, C.; Tribo, F. (1997) TRITICALE AND BARLEY FOR GRAIN AND FOR DUAL-PURPOSE (FORAGE PLUS GRAIN) IN A

MEDITERRANEAN-TYPE ENVIRONMENT .1. GROWTH ANALYSES. *Australian Journal of Agricultural Research*. 48(4):411-421. English. [IRTA CTR UDL AREA CONREUS EXTENSUS ROVIRA ROURE 177 LLEIDA 25198 SPAIN].

Field experiments were conducted for 2 growing seasons (1992 and 1993) at 2 sites in north-eastern Spain under irrigated conditions and high soil fertility. Two 6-rowed barley varieties, 3 spring triticales, and 2 winter triticales were evaluated for grain yield and for forage and grain production in the same cropping season. Forage was cut when the first node was detectable, and grain was harvested at ripening in both cut and uncut plots. Barley, spring triticale, and winter triticale did not differ in biomass at cutting. The number of tillers per plant at the beginning of jointing was about 3.2 in both barley and winter triticale, and 0.7 in spring triticale. Almost all of the biomass components at cutting were positively and significantly correlated with forage yield. Changes in dry matter accumulation and leaf area index and its components in the uncut treatment fitted accurately to the same logistic curve. The maximum number of living leaves per plant was reached between the beginning of jointing and booting in barley and spring triticale, and around jointing in winter triticale. The number of living tillers per plant at anthesis was significantly higher in barley than in triticale. The number of spikes per plant at anthesis was significantly lower in spring triticale than in barley and winter triticale. The efficiency of the plant to accumulate dry matter was greater in triticale than in barley. In barley, grain filling in both cut and uncut harvesting treatments was mainly dependent on current photosynthesis after anthesis. In triticale, which was more affected by terminal abiotic stresses, both photosynthesis and translocation of assimilates contributed to grain filling, independent of the harvesting treatment. [References: 37].

3568 Royo, C.; Tribo, F. (1997) TRITICALE AND BARLEY FOR GRAIN AND FOR DUAL-PURPOSE (FORAGE PLUS GRAIN) IN A MEDITERRANEAN-TYPE ENVIRONMENT .2. YIELD, YIELD COMPONENTS, AND QUALITY. *Australian Journal of Agricultural Research*. 48(4):423-432. English. [IRTA CTR UDL AREA CONREUS EXTENSUS ROVIRA ROURE 177 LLEIDA 25198 SPAIN].

Four field experiments were conducted over 2 years and at 2 sites under irrigation and with high soil fertility in north-eastern Spain. Two 6-rowed barley varieties, 3 spring triticales, and 2 winter triticales were evaluated for grain yield and for forage and grain production in the same cropping season. Forage was cut at the first node detectable stage and grain was harvested at ripening in both cut and uncut plots. Forage and grain yields did not differ significantly between species. Forage yield was positively and strongly related to the time between sowing and cutting. Forage quality and grain protein content were similar in barley, spring triticale, and winter triticale. Forage crude protein averaged 25.3%, digestible crude protein 19.4%, and acid detergent fibre 21.9%. Grain protein content averaged 15.4%. The reduction in grain yield caused by clipping ranged from 7 to 70% in barley, 10 to 21% in spring triticale, and 8 to 24% in winter triticale. Grain yield after cutting decreased drastically when the thermal time between cutting and physiological maturity was lower than 1000 growing degree-days (GDD), being independent of this duration for values >1100 GDD. Reductions in grain yield after forage removal were caused mainly by reductions in grain weight. A strong relationship appeared between grain yield in the uncut treatment and grain yield after forage removal, suggesting that breeding for dual purpose could take advantage of the efforts made to increase grain yield potential. [References: 38].

3569 Sanchez Vega, Francisco (1996) [Sorption isotherms of four wheat commercial varieties]. Obtencion de isoterms de sorcion de cuatro variedades comerciales de trigo (*Triticum aestivum* L.). Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Ingenieria Mecanica. 66 p. Spanish. (AGRIS 97-073503).

3570 Schittenhelm, S.; Okeno, J.A.; Friedt, W. (Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany). Inst. fuer Pflanzenbau) (1996) [Prospects of agronomic improvement in spring barley based on a comparison of old and new germplasm]. Aussichten fuer die agronomische Verbesserung von Sommergerste basierend auf einem Vergleich von altem und neuem genetischen Material. *Journal of Agronomy and Crop Science (Germany)* v. 176(5) p. 295-303. 2 ill., 2 tables; 23 ref. English. (AGRIS 97-059474).

3571 Schoenberger, H. (Landwirtschaftskammer Rheinland, Bonn (Germany). Pflanzenschutzamt) (1996) [Yield formation and crop management of winter wheat]. *Ertragsbildung und Bestandesfuehrung von Winterweizen. Getreide Magazin (Germany) v. 2(4) p. 4-8. German. (AGRI 97-059730).*

3572 Schoenberger, H.; Kratzsch, G. (NU Agrar GmbH, Flensburg (Germany)) (1997) [Crop management and yield structure]. *Bestandesfuehrung und Ertragsaufbau. DLG-Mitteilungen (Germany) (no.2) p. 70. German. (AGRI 97-073939).*

3573 Selim, A.H.E. (Monoufeiya Univ., Shebin El Kom (Egypt). Faculty of Agriculture); Atia, Z.M.A. (1996) Gamma-irradiation effects on germination, growth characters and yield attributes of wheat, *Triticum aestivum* L. *Menofiya Journal of Agricultural Research (Egypt) v. 21(2) p. 281-297. 3 tables; 26 ref. English. (AGRI 97-059741).*

3574 Singh, N.B.; Ahmad, Z. (1997) RESPONSE OF WHEAT (*TRITICUM AESTIVUM*) VARIETIES TO DIFFERENT DATES OF SOWING. *Indian Journal of Agricultural Sciences. 67(5):208-211. English. [CHANDRA SHEKHAR AZAD UNIV AGR & TECHNOL KANPUR 208002 UTTAR PRADESH INDIA].*

A field experiment was conducted during the winter season of 1988-89 to study the heat tolerance of 10 varieties (HI 977, 'HI 1116', 'HI 1123', 'HD 2270', 'HD 1558', 'GW 120', 'Sonalika', 'Lok 1', 'RHR 2825' and 'GIPSI 260') of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) in terms of phenological development, grain yield and its components, under 3 dates of sowing (15 November, 15 December and 15 January) in irrigated condition. Increased temperature significantly reduced the days of anthesis, maturity duration and flag-leaf area. Likewise, higher post-anthesis temperature, i.e. 26.6-30.6 degrees C, contributed to decline in productive number/ear, biological yield, 1000-grain weight and grain yield under late sowing compared with normal sowing. Relative decline in these attributes due to suboptimal temperature was lesser in 'HD 2279', 'HI 1116', 'DW 120', 'Sonalika' and 'Lok 1', enabling them to perform better under high temperature on late sowing. Coefficients of correlation of grain yield showed significant positive relationship with effective ear number, biological yield and 1000 - grain weight, indicating their involvement in heat tolerance of wheat under late-sown condition. [References: 12].

3575 Smissen, P. van der (1996) [Assay of three cereal crops in less favoured areas (of Belgium): spelt, triticale, winter barley]. *Trois cereales fourrageres au banc d'essai en region defavorisee: epeautres, triticales et escourgeon. Entreprise Agricole (Belgium) v. 3(3) p. 28-29. 3 tables. French. (AGRI 97-073948).*

3576 Stegemann, K.; Koerschens, M.; Pfefferkorn, A.; Weise, V.; Lezovic, P. (Halle Wittenberg Univ., Halle (Germany). Inst. fuer Acker und Pflanzenbau. Arbeitsgruppe Datenspeicher Feldversuche Bad Lauchstaedt) (1996) [The application of cluster analysis for the detection of similar fertilizing effects on cereal yields of winter wheat and spring barley within the framework of the Static Fertilizer Experiment at Bad Lauchstaedt]. *Die Anwendung der Clusteranalyse zur Ermittlung gleichartiger Pruefgliedwirkungen im Statistischen Duengungsversuch Bad Lauchstaedt fuer die Korntraege des Winterweizens und der Sommergerste. Archives of agronomy and soil science (Germany) v. 40(4) p. 249-261. 5 ill., 3 tables; 7 ref. German. (AGRI 97-073940).*

3577 Stephens, D.J. (Murdoch Univ., Murdoch, W.A. (Australia). Dept. of Environmental Science); Walker, G.K.; Lyons, T.J. (1994) Forecasting Australian wheat yields with a weighted rainfall index. *Agricultural and Forest Meteorology (Netherlands) v. 71(3-4) p. 247-263. 36 ref. English. (AGRI 97-073941).*

3578 Strazdina, V. (State Stende Selection and Experiment Station, Stende (Latvia)) (1997) [Which winter wheat varieties should be chosen]. *Kadas ziemas kviesu skimes izveleties. Latvijas Lauksaimnieks (Latvia) (no.2) p. 5-7. Latvian. (AGRI 97-073970).*

As the grain produced for processing must correspond to the State Purchasing Standards, the problem of closer contacts and cooperation between farmers and grain processing enterprises is discussed. Importance to choose perspective winter wheat varieties is explained. The winter wheat varieties already grown in Latvia are described. Two new winter wheat varieties developed in Latvia (Banga and Otto) as well as several

Swedish, Russian, German and Polish varieties are being tested at the Plant Varieties Testing Stations to determine their suitability and profitability in Latvia and to recommend them to local farmers.

3579 Waloszczyk, K. (Fachhochschule Anhalt, Bernburg (Germany). Fachgebiet Landwirtschaft, Oekotrophologie, Landespflege. Arbeitsgruppe Agrarökologie) (1996) [Yield formation of winter wheat on Calcic Cernozem soils under semiarid climatic conditions]. *Ertragsbildung von Winterweizen auf Loess-Schwarzerde unter semiariden Klimabedingungen. Archives of agronomy and soil science (Germany) v. 40(1) p. 1-12. 3 ill., 5 tables; 9 ref. German. (AGRI 97-059737).*

3580 Yen, Y.; Baenziger, P.S.; Bruns, R.; Reeder, J.; Morenoscilla, B.; Budak, N. (1997) AGRONOMIC PERFORMANCE OF HYBRIDS BETWEEN CULTIVARS AND CHROMOSOME SUBSTITUTION LINES. *Crop Science. 37(2):396-399. English. [UNIV NEBRASKA DEPT AGRON LINCOLN, NE 68583 USA].*

Previous studies have identified wheat (*Triticum aestivum* L.) chromosome substitution lines between 'Cheyenne' (CNN) and 'Wichita' on, that contain quantitative trait loci (QTLs) affecting yield and yield components, anthesis date, plant height, and grain volume weight. However, chromosome substitution lines can only identify additive or epistatic gene action. In this study, hybrids between CNN and WI, and between chromosome substitution lines and their recurrent parents were evaluated in four field environments to determine if the QTLs exhibited additive and dominant gene action which could result in heterosis. As expected, the chromosome substitution lines were significantly different for grain yield from their recurrent parents, which indicated the chromosomes contained additive genes. Three of four chromosome substitution line hybrids were not different from the midparent value, which indicated predominantly additive gene action. However, the fourth substitution line hybrid significantly differed from the midparent value for grain yield, which indicated the chromosome contained genes that were heterotic and had dominant gene action. Some hybrids did not significantly differ from one parent, which further indicated the possibility of dominant gene action. Midparent heterosis also was identified in the cultivar hybrid for grain yield. High parent heterosis was not found for any of the measured traits. Hence, genes on these chromosomes exhibited predominantly additive gene action, but also exhibited dominant gene action which may explain some of the heterosis found in the cultivar hybrid. [References: 12].

## F02 PLANT PROPAGATION

3581 Erdelska, O.; Vidovencova, Z.; Erdelsky, K. (Slovak Academy of Sciences, Bratislava (CSFR). Inst. of Botany) (1996) Cleavage polyembryos as explants for plant regeneration in wheat. *Plant Cell Reports (Germany) v. 15(5) p. 342-344. 2 ill., 2 tables; 13 ref. English. (AGRI 97-059952).*

3582 Haggag, M.E.A.; Mourad, S.S.B.; Yassein, H.E. (Azhar Univ., Cairo (Egypt). Faculty of Agriculture); Mohamed, M.A.M. (1993) Callus induction, plant regeneration and salt tolerance in some wheat varieties. *Al-Azhar Journal of Agricultural Research (Egypt) v. 17 p. 141-157. 2 graph. 3 tables; 20 ref. English. (AGRI 97-074112).*

3583 Haggag, M.E.A.; Mourad, S.S.B.; Yassein, H.E. (Azhar Univ., Cairo (Egypt). Faculty of Agriculture); Mohamed, M.A.M. (1993) Somaclonal variation in wheat plants from tissue culture. *Al-Azhar Journal of Agricultural Research (Egypt) v. 17 p. 161-175. 2 graph. 3 tables; 11 ref. English. (AGRI 97-074113).*

3584 Kang, T.J. (Korea Ginseng and Tobacco Research Institute, Taejeon (Korea Republic)) (1996) Influence of medium components on anther culture of spring wheat. *Korean Journal of Breeding (Korea Republic) v. 28(4) p. 366-372. 7 tables; 16 ref. English. (AGRI 97-059953).*

3585 Ozgen, M.; Turet, M.; Ozcan, S.; Sancak, C. (1996) CALLUS INDUCTION AND PLANT REGENERATION FROM IMMATURE AND MATURE EMBRYOS OF WINTER DURUM WHEAT GENOTYPES. *Plant Breeding. 115(6):455-458. English. [ANKARA UNIV FAC AGR DEPT FIELD CROPS TR-06110 ANKARA TURKEY].*

Seven genotypes of winter durum wheat (*Triticum durum* Desf.) were cultured to establish an efficient method of callus formation and plant



regeneration from mature embryo culture, and to compare the responses of immature and mature embryo cultures. Immature embryos were aseptically dissected from seeds and placed, with the scutellum upwards, in dishes containing Murashige and Skoog's (MS) mineral salts and 2 mg 2, 4-dichlorophenoxyacetic acid (2, 4-D) per litre. Calli and regenerated plants were maintained on 2, 4-D-free medium. Mature embryos were moved slightly on the imbibed seeds. For callus formation, the seeds with moved embryos were placed, furrow downwards, in dishes containing 8 mg 2, 4-D per litre. The developed calli and regenerated plants were maintained on the MS medium. Plants regenerated from both embryo cultures were vernalized and grown to maturity in soil. Variability was observed among the wheat genotypes tested for various culture responses in both explant cultures. Callus induction rate and regeneration capacity of callus were independent of each other. Mature embryos have a low frequency of callus induction but a high regeneration capacity. Considering availability, rapidity and reliability, this form of mature embryo culture can be used as an alternative method for immature embryo culture. [References: 28].

3586 Stoldt, A.; Wang, X.H.; Lorz, H. (1996) PRIMARY CALLUS AS SOURCE OF TOTIPOTENT BARLEY (*HORDEUM VULGARE* L) PROTOPLASTS. *Plant Cell Reports*. 16(3-4):137-141. English. [UNIV HAMBURG INST ALLGEMEINE BOT ZENTRUM ANGEW MOL BIOL PFLANZEN AMP 2 OHNHORSTSTR 18 D-22609 HAMBURG GERMANY].

Primary callus of barley (*Hordeum vulgare* L.) derived from scutella (cv. 'Disa') and anthers (cv. 'Igri') was used for protoplast isolation and plant regeneration. The protoplasts were embedded in agarose and cultured with nurse cells. The plating efficiency varied from 0.1% to 0.7%. Shoots regenerated from the developing callus. Plantlets were transferred to soil and cultivated in the greenhouse three to five months after protoplast isolation. All plants were normal in morphology, and most of them flowered and set seeds. [References: 20].

3587 Viertel, K. (Hohenheim Univ., Stuttgart (Germany). Inst. of Plant Physiology); Hess, D. (1996) Shoot tips of wheat as an alternative source for regenerable embryogenic callus cultures. *Plant Cell, Tissue and Organ Culture (Netherlands)* v. 44(3) p. 183-188. 19 ref. English. (AGRIS 97-074114).

### F03 SEED PRODUCTION

3588 Anon. (1995) [Wheat dressing: new ways for seed treatment]. *Weizen nach Schadschwellen beizen? Neue Wege bei der Saatgutbehandlung. DZ. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany)* v. 46(9) p. 54, 56-57. German. (AGRIS 97-060007).

3589 Drozd, D.; Szajnsner, H. (University of Agriculture, Wroclaw (Poland). Dept. of Plant Breeding and Seed Production); Koper, R. (University of Agriculture, Wroclaw (Poland). Dept. of Physics) (1996) [Influence pre-sowing laser radiation of spring wheat grain on germination capacity and coleoptile length]. *Wplyw przedsiwiewnego naswietlania laserem nasion pszenicy jarej na zdolnosc kielkowania i dlugosc koleoptyla. Fragmenta Agronomica (Poland)* v. 13(1) p. 44-51. 5 tables; 16 ref. Polish. (AGRIS 97-074202).

In this investigation seeds of 10 spring wheat cultivars were treated with 3 different doses of laser radiation. Germinative energy, germinative capacity and coleoptile length were evaluated. The results of the experiment were analysed statistically. It was found that the laser doses increased germinative energy and germination capacity. The cultivars responded similarly to the three doses of radiation in the case of germinative energy and capacity. Significant differences among cultivars were found for coleoptile length, after one dose radiation, having the greatest effect.

3590 Hofmann, P.; Steiner, A.M. (1995) [Influence of environmental conditions on field emergence and yield of presowing treated wheat (*Triticum aestivum* L.)]. *Einfluss der Umweltbedingungen auf Feldaufgang und Ertrag von vorsaatbehandeltem Weizen (Triticum aestivum L.)*. 107. VDLUFA-Kongress. Garmisch-Partenkirchen (Germany). 18-23 Sep 1995. [Grassland as production location and landscape element]. *Gruenland als Produktionsstandort und Landschaftselement VDLUFA-Schriftenreihe (Germany)*; . 40. Hohenheim Univ., Stuttgart (Germany). Inst.

fuer Pflanzenzuechtung, Saatgutforschung und Populationsgenetik p. 361-364. VDLUFA. 1 ill.; 3 ref. German. (AGRIS 97-060009).

3591 Kim, S.H. (Gyeongsang National University, Chinju (Korea Republic). College of Agriculture) (1996) Relations between seed vigor criteria and field performance in malting barley. *Korean Journal of Crop Science (Korea Republic)* v. 41(6) p. 656-664. 6 tables; 34 ref. English. (AGRIS 97-059984).

3592 Pfister, J.A. (Regierungspraesidium Stuttgart (Germany). Pflanzenschutzdienst) (1996) [Adequate dressing of winter cereals]. *Wintergetreide sachgerecht beizen. Landwirtschaftliches Wochenblatt. Organ des Landesbauernverbandes in Baden-Wuerttemberg. Ausg. WWL (Germany)* v. 163(38) p. 24-25. German. (AGRIS 97-060006).

Wirkungsbereiche von Beizmitteln fuer Winterweizen, -roggen und -triticale. Auf die Brachfliegenbekämpfung und die Abwehr von Kraehenschaden wird hingewiesen.

3593 Rodriguez Perez, Juan Enrique; Lopez T, Manuel; Martinez S, Juan (1996) [Dry mater accumulation and germinative capacity of triticale seed]. *Acumulacion de materia seca y capacidad germinativa de semilla de triticale*. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 30. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Cuadros; 2 Fig.; 1 ref. Spanish. (AGRIS 97-074137).

Spikes of four triticale genotypes were sampled every seven days from 10 to 66 days after anthesis. Three germination tests were made. Results show that earliness depends on vegetative development, the maximum accumulation of seed weight took place 56 days after anthesis, and it is possible to harvest 15 days before this maximum, without significant decrease on seed quality.

3594 Sanchez M, J.; Sandoval I, E.; Arellano R, L.J. (1996) [Effect of preharvest rainfall on storage capacity of wheat seed]. *Efecto de la lluvia en pre cosecha sobre la capacidad de almacenamiento de semilla de trigo*. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 29. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 3 ref. Spanish. (AGRIS 97-074136).

Results show that seed quality was clearly affected, however, seed germination was greater than 80 percent, which is considered to be legally acceptable even though seed was stored longer than twelve months. Seedling vigor was seriously affected, so that, once seed damage is present by rainfall before harvest, seed can only be used for cultivation the next year, at most.

3595 Wang, M. (Center for Phytotechnology RUL/TNO, Leiden (Netherlands). Department of Plant Molecular Biotechnology) (1997) The role of abscisic acid in the regulation of barley grain germination. *Proceedings of the International Seed Testing Association. Seed Science and Technology (Switzerland)*; v. 25(1) p. 67-74. *International Seed Testing Association's Secretariat, Reckenholz (Switzerland)*. International Seed Testing Association. 1 table, 2 graphs, 23 ref. English. (AGRIS 97-074183).

It was previously proposed that dormancy of barley grains is determined by at least three factors, (i) synthesis of the plant hormone abscisic acid (ABA), (ii) breakdown and/or removal of ABA, and (iii) sensitivity to ABA. In this paper some recent data on these three aspects are reviewed and additional evidence is provided to support this hypothesis. In different barley varieties isolated embryos showed an increased germination index as compared with intact grains. During germination the endogenous ABA in embryos of both intact dormant grains and isolated embryos from dormant grains was analyzed. A very high ABA level in the intact dormant grains was correlated with no germination of the grains. When isolated embryos were placed on filter paper or in water, the germination rate of embryos placed in water was much higher than the one of those on filter paper, which was negatively correlated with the ABA levels in the embryos. The inhibitory effect of filter paper vs. water on the germination rate of embryos might be due to a slower diffusion of endogenous ABA out of the embryos on paper. Removal of the husk caused also an enhancement of germination rate. Our results demonstrate that diffusion of endogenous ABA, in combination

with our previously observed de novo ABA synthesis and ABA sensitivity, plays an important role in the control of germination.

3596 Winter, W. (Eidg. Forschungsanstalt fuer Agrarökologie und Landbau (FAL), Zuerich Reckenholz (Switzerland)); Ruegger, A.; Baenziger, I.; Krebs, H.; Frei, P.; Gindrat, D. (1997) [Seed dressing according to threshold values: results with summer wheat]. *Beizung nach Schadschwellen: Ergebnisse mit Sommerweizen. Agrarforschung (Switzerland) v. 4(1) supplement (6 p.)*. 1 table, 1 graph, 8 photos, 10 ref. German. (AGRIC 97-060008).

In Switzerland the most important seed-borne fungal pathogens of wheat are *Gerlachia nivalis* (=Fusarium nivale, snow mould), *Septoria nodorum* (damping-off), and *Tilletia caries* (common bunt). Field experiments showed that on certified summer wheat seed up to 10 % F. nivale and 30 % S. nodorum can be tolerated without any loss in plant emergence or yield. From our observations and from literature we know that 10 Tilletia caries spores per seed can be tolerated without problems. Seedlots respecting these threshold values can be sown untreated in the plain regions of Switzerland. This would save important amounts of seed fungicides. In the future seed treatment of summer wheat could be pathogen-oriented and the decision whether or not to apply a dressing should be based on threshold values.

## F04 FERTILIZING

3597 Abd El Gawad, H.; El Sissy, L.; Ismail, S.E.; El Rais, S. (Ministry of Agriculture, Cairo (Egypt). Soil and Water Research Inst.) (1993) The effect of different sources of nitrogen fertilizers on yield of wheat and phosphorus uptake. *Al-Azhar Journal of Agricultural Research (Egypt) v. 17* p. 93-106. 2 graph. 4 tables; 8 ref. English. (AGRIC 97-074492).

3598 Abidin, M.Z.; Bansal, K.C.; Abrol, Y.P. (Hamdard Univ., New Delhi (India). Dept. of Botany. Faculty of Science) (1996) [Effect of split nitrogen application on growth and yield of wheat (T. aestivum L.). Genotypes with different N-assimilation potential]. *Einfluss einer geteilten Stickstoffanwendung auf Wachstum und Ertrag von Weizen (T. aestivum L.) - Genotypen mit unterschiedlichem N-Assimilationspotential. Journal of Agronomy and Crop Science (Germany) v. 176(2) p. 83-90*. 2 ill., 3 tables; 12 ref. English. (AGRIC 97-060263).

3599 Abou Salama, A.M.; Teama, E.A.; Allam, A.Y. (Assiut Univ. (Egypt). Faculty of Agriculture) (1995) Gradual application of nitrogen fertilization to wheat under sandy soil conditions. *Assiut Journal of Agricultural Sciences (Egypt) v. 26(3) p. 1-8*. 1 fig. 2 tables; 15 ref. English. (AGRIC 97-074489).

3600 Ahmad, K.; Khan, M.Q.; Shah, Z. (Gomal Univ., D.I. Khan (Pakistan). Faculty of Agriculture) (1994) Effect of fertility levels on the performance of wheat varieties in Dera Ismail Khan [Pakistan]. *Sarhad Journal of Agriculture (Pakistan) v. 10(2) p. 121-124*. 2 tables, 8 ref. English. (AGRIC 97-074498).

An experiment was conducted to study the effect of different fertility levels (40 + 20, 70 + 50 and 120 + 90 kg/ha N and P2O5 respectively) on the performance of wheat varieties viz. Pak-81, Pirsabak-85 and WL-711 at Agricultural Research Station Ratta Kulachi, D.I. Khan. The experiment was laid out in a split plot design. Plot receiving 120 + 90 kg/ha N and P2O5 produced the tallest plants, highest number of grains/spike, grain and straw yield as compared to other treatments. Number of tillers and 1000-grain weight were increased with fertilizer level of 70 + 50 kg/ha N and P2O5. Wheat variety Pak-81 gave maximum grains/spike, maximum grain and straw yield whereas Pirsabak-85 gave the highest 1000-grain weight. WL-711 produced tallest plants of all the varieties, but it did not yield to maximum straw yield probably due to its thin and weak stem.

3601 Ahmed, A.A. (1995) Response of wheat plants to nitrogen and biological fertilization under conditions of north west coasts of Egypt. Ain-Shams Univ., Cairo (Egypt). Faculty of Agriculture. 20 tables; Bibliography: p. 78-104. 109 p. English. (AGRIC 97-060266).

3602 Allam, A.Y.; Teama, E.A. (Assiut Univ. (Egypt). Faculty of Agriculture) (1995) Effect of rate and timing of NPK fertilization on yield and quality of two wheat cultivars. *Assiut Journal of Agricultural Sciences (Egypt) v. 26(4) p. 3-13*. 3 tables; 34 ref. English. (AGRIC 97-060264).

3603 Andrio Enriquez, Enrique; Rangel Lucio, Jose Antonio (1995) [Fertilization and plant density effect on physical quality and yield of Hordeum vulgare L.]. *Efecto de la fertilización y densidad de siembra en la calidad física y rendimiento de semilla de cebada (Hordeum vulgare L.)*. 26, Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. *La investigación edafológica en México 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 182. Sociedad Mexicana de la Ciencia del Suelo. 1 cuadro; 4 ref. Spanish. (AGRIC 97-074297).

3604 Aviles Marin, S. Monica; Cortes Castelan, J. Cipriano; Cordoba Cano, Maria de Jesus; Cruz Flores, Gerardo (1995) [Adaptability of the triticale (X Triticosecale sp. W) to several doses of calcium and phosphorus in andosols of Villa de Allende, Mexico State]. *Adaptabilidad del triticale (X Triticosecale sp. W) a diferentes dosis de calcio y fósforo en suelos de ando en el Municipio de Villa de Allende, Estado de México*. 26, Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. *La investigación edafológica en México 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 181. Sociedad Mexicana de la Ciencia del Suelo. 1 cuadro, 2 figs.; 9 ref. Spanish. (AGRIC 97-074296).

3605 Baier, J.; Baierova, V. (Research Institute of Plant Production, Prague Ruzyne (Czech Republic)) (1995) [Influence of NPK mineral fertilization on the magnesium uptake by winter wheat]. *Wplyw mineralnego nawożenia NPK na pobranie magnezu przez pszenice ozima. Fragmenta Agronomica (Poland) v. 12(4) p. 34-38*. 3 tables; 5 ref. English. (AGRIC 97-074501).

In the paper the results of 16 years investigation on uptake of magnesium by winter wheat (cultivated in 5 longterm crop rotation experiment) were presented. Magnesium uptake by winter wheat was lower on control (without NPK) in comparison with full mineral fertilization. The differences in uptake magnesium on soils with high content of available Mg was particularly big. It gives the evidence of synergistic influence of NPK fertilization on winter wheat nutritive state with magnesium.

3606 Barraclough, P.B. (IACR Rothamsted Experimental Station, Harpenden, Herts. (United Kingdom). Dept. of Crop Management); Haynes, J. (1996) The effect of foliar supplements of potassium nitrate and urea on the yield of winter wheat. *Fertilizer Research (Netherlands) v. 44(3) p. 217-223*. 22 ref. English. (AGRIC 97-074496).

3607 Bertholdsson, N. O.; Stoy, V. (Nilsson Ehle Lab., Svaloev (Sweden)) (1995) [Yields of dry matter and nitrogen in highly diverging genotypes of winter wheat in relation to N-uptake and N-utilization]. [Troeknamasseertraege und Stickstoff in hochdivergierenden Winterweizengenotypen in Beziehung zur Stickstoffaufnahme und zur Stickstoffnutzung]. *Journal of Agronomy and Crop Science (Germany) v. 175(5) p. 285-295*. 2 ill., 5 tables; 31 ref. English. (AGRIC 97-060257).

3608 Bolland, M.D.A. (Western Australian Dept. of Agriculture, South Perth, W.A. (Australia)); Barrow, N.J. (1996) Incubating superphosphate in 'dry' soil can reduce its effectiveness. *Fertilizer Research (Netherlands) v. 44(3) p. 205-215*. 24 ref. English. (AGRIC 97-074495).

3609 Castagna, R.; Minoia, C.; Porfiri, O.; Rocchetti, G. (Istituto Sperimentale per la Cerealicoltura, S. Angelo Lodigiano (Italy)) (1996) [Nitrogen level and seeding rate effects on the performance of hulled wheats (Triticum monococcum L., T. dicoccum Schuebler and T. spelta L.) evaluated in contrasting agronomic environments]. *Einfluss von Stickstoff und Aussaatdichte auf die Leistung von bespelzten Weizen (Triticum monococcum L., T. dicoccum Schuebler und T. spelta L.) in unterschiedlichen agronomischen Umwelten. Journal of Agronomy and Crop Science (Germany) v. 176(3) p. 173-181*. 2 ill., 3 tables; 30 ref. English. (AGRIC 97-060272).

3610 Choi, E.K. (Iowa State University.); Feinerman, E. (1995) Regulation of nitrogen pollution: taxes versus quotas. *Journal of agricultural and resource economics (USA)* v. 20(1) p. 122-134. references. English. (AGRIS 97-060156).

3611 Cruz Medina, Roberto (1995) [Response models to optimal economic dose of wheat fertilization]. *Modelos de respuesta y dosis optimas economicas de fertilizacion en trigo*. 26. Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. *La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 194. Sociedad Mexicana de la Ciencia del Suelo. 1 cuadro; 2 ref. Spanish. (AGRIS 97-074305).

3612 Derar, R.A.; Eid, R.A. (Ministry of Agriculture, Cairo (Egypt). Soils and Water Research Inst.) (1996) Effect of sewage sludge on the production and nutrients content of wheat grown in Fayoum soils [Egypt]. *Menofiya Journal of Agricultural Research (Egypt)* v. 21(2) p. 443-450. 4 tables; 13 ref. English. (AGRIS 97-060265).

3613 Djokic, D.; Kostic, M.; Stojanovic, J. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita) (1996) [Influence of amount and distribution of precipitation on fertilization efficiency of wheat]. *Uticaj kolicina i rasporeda padavina na efikasnost djubrenja pšenice*. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts*. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadržaja p. 63. Institut za istrazivanja u poljoprivredi "Srbija". (En, Sr). (AGRIS 97-060262).

3614 El Afandy, K.T.H. (1995) Physiological response of wheat under different levels of organic matter and nitrogen fertilization and its effects on yield and grain quality in South Sinai [Egypt]. *Ain-Shams Univ., Cairo (Egypt). Faculty of Agriculture*. 26 tables; Bibliography: p. 117-136. 141 p. English. (AGRIS 97-060267).

3615 Fageria, N.K. (EMBRAPA, Goiania GO, Brazil.); Zimmermann, F.J.P.; Baligar, V.C. (1995) Lime and phosphorus interactions on growth and nutrient uptake by upland rice, wheat, common bean, and corn in an oxisol. *Journal of plant nutrition (USA)* v. 18(11) p. 2519-2532. references. English. (AGRIS 97-060209).

Liming and phosphorus (P) applications are common practices for improving crop production in acid soils of the tropical as well as temperate regions. Four greenhouse experiments were conducted on an Oxisol (clayey, kaolinitic, isothermic, Typic Haplustox) to evaluate response of liming (0, 2, and 4 g/kg) and P application (0, 50, and 175 mg P/kg) in a factorial combination on growth and nutrient uptake by upland rice (*Oryza sativa* L.), wheat (*Triticum aestivum* L.), common bean (*Phaseolus vulgaris* L.), and corn (*Zea mays* L.). Phosphorus application significantly ( $P < 0.01$ ) increased dry weight of tops of all the four crop species as well as dry weight of roots of wheat and corn. Liming significantly ( $P < 0.01$ ) improved growth of common bean and corn but had significant negative effects on rice growth. Maximum dry weight of tops of rice and wheat was obtained at 175 mg P/kg without lime. Maximum dry weight of tops in common bean was obtained at 4 g lime/kg with 175 mg P/kg of soil. In all the crops, increasing levels of applied P significantly increased nutrient uptake. With some exceptions, increasing levels of lime tend to reduce uptake of P, zinc (Zn), copper (Cu), manganese (Mn), and iron (Fe) and increase the uptake of calcium (Ca) and magnesium (Mg) in all the crop species. Decrease in potassium (K) uptake, due to high lime, is probably due to antagonistic effects of Ca and Mg and reduced micronutrients uptake is probably due to increased soil pH resulting in decreased availability of these elements to plants. Therefore, in these types of acid soils, one should avoid over liming.

3616 Geleto, T. (Sinana Research Center, Robe (Ethiopia)); Tanner, D.G.; Mamo, T.; Gebeyehu, G. (1996) Response of rainfed bread and durum wheat to source, level and timing of nitrogen fertilizer on two Ethiopian Vertisols. 2. N uptake, recovery and efficiency. *Fertilizer Research (Netherlands)* v. 44(3) p. 195-204. 25 ref. English. (AGRIS 97-074494).

3617 Gezgin, S. (Selcuk University, Konya, Turkey.); Bayraklı, F. (1995) Ammonia volatilization from ammonium sulphate, ammonium nitrate, and urea surface applied to winter wheat on a calcareous soil. *Journal of plant nutrition (USA)* v. 18(11) p. 2483-2494. references. English. (AGRIS 97-060259).

Ammonia (NH<sub>3</sub>) volatilization losses from surface-applied ammonium sulphate (AS), ammonium nitrate (AN), and urea to winter wheat and the effects of the NBPT [N-(n-butyl) thiophosphoric triamide], PG (Phosphogypsum), and PR (byproduct-Pyrite) were determined in a field experiment. Effects on grain yield and protein content of the grain were also measured. Total NH<sub>3</sub> losses from AS, AN, and urea varied from 13.6-19.5%, 4.4-6.4%, and 3.9-12.0% depending on the compounds and their levels added to nitrogen (N) fertilizers, respectively. The compounds added to AS and AN increased NH<sub>3</sub>-N losses with respect to unamended fertilizers (control). On the other hand, while urea treatments with two tons of PG/ha increased NH<sub>3</sub> losses, the other compounds decreased the losses. The highest reductions of NH<sub>3</sub> loss were observed with NBPT 0.50% and NBPT 0.25% by 63.4% and 52.8%, respectively. Although the effect of nitrogenous fertilizers on total N losses and protein content of wheat grain was found statistically significant ( $p < 0.01$ ), as the compounds applied with N fertilizers have had no significant effect. Also, a negative and highly significant correlation ( $r = -0.69^{***}$ ) was found between total N loss and protein content of the grain.

3618 Ghosh, DC.; Mandal, BP.; Malik, GC. (1997) GROWTH AND YIELD OF WHEAT (TRITICUM AESTIVUM) AS INFLUENCED BY FERTILITY LEVEL AND SEED-SOAKING AGRO-CHEMICALS. *Indian Journal of Agricultural Sciences*. 67(4):144-146. English. [INST AGR SRINIKETAN 731236 W BENGAL INDIA].

A field study was conducted during the winter season of 1992-93 and 1993-94 at Sriniketan to find out the effect of seed-soaking agro-chemicals on growth and yield of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) at different fertility levels. Recommended fertility level (80 kg N/ha, 18 kg P/ha and 34 kg K/ha :N-80 P-18 K-34) improved the growth and increased the grain yield (2673 kg/ha) significantly compared with low fertility level (N40P9K17). Seeds soaked in 100 ppm solution of either Na<sub>2</sub>HPO<sub>4</sub> or dikegulac-sodium increased the tillers/m<sup>2</sup>, leaf-area indices, crop-growth rate, ears/m<sup>2</sup>, grains/ear, 1000-grain weight of grain and the grain yield. Greater efficiency of seed-soaking agro-chemicals was recorded at N80P18K34. Highest grain yield (3313 kg/ha) was recorded when the crop received seed treatment with 100 ppm solution of Na<sub>2</sub>HPO<sub>4</sub> at N80P18K34, followed by dikegulac-Na (100 ppm) under same fertility level. [References: 11].

3619 Govedarica, M.; Milosevic, N.; Jarak, M.; Ubavic, M.; Radanovic, Z. (Faculty of Agriculture, Novi Sad (Yugoslavia). Institute of Field and Vegetable Crops) (1996) The effect of earthworm and green manure on the microbiological activity in wheat. *Zemljiste i biljka (Yugoslavia)* v. 45(2) p. 121-126. 4 tables; 15 ref. English. (AGRIS 97-060260).

The incorporation of earthworm and green manure brought about an increase in soil microbiological activity in wheat. For the most part, the incorporation of earthworm manure resulted in an increase in microbial abundance and enzymic activity at both depths and at all sampling dates. Green manure application increased the total number of microorganisms, the number of oligonitrophilous bacteria, actinomycetes and cellulolytic microorganisms, as well as dehydrogenase activity, also at both depths and at all sampling dates. At the beginning of the growing period, the abundance of ammonifiers, fungi, and azotobacters was greater in the control plot than in the plot with incorporated green manure. In the middle and at the end of the growing period, the situation was vice versa. The addition of green manure also decreased urease activity at both depths and at all sampling dates.

3620 Grant, C.A. (Agriculture and Agri Food Canada, Brandon, Man. (Canada). Brandon Research Centre); Bailey, L.D.; Therrien, M.C. (1996) The effect of N, P and KCl fertilizers on grain yield and Cd concentration of malting barley. *Fertilizer Research (Netherlands)* v. 45(2) p. 153-161. 23 ref. English. (AGRIS 97-074411).

3621 Grylls, JP.; Webb, J.; Dyer, CJ. (1997) SEASONAL VARIATION IN RESPONSE OF WINTER CEREALS TO NITROGEN FERTILIZER AND APPARENT RECOVERY OF FERTILIZER NITROGEN ON CHALK SOILS IN SOUTHERN ENGLAND. *Journal of Agricultural Science*.



128(Part 3):251-262. English. [ADAS WOLVERHAMPTON WERGS RD WOLVERHAMPTON WV6 8TQ ENGLAND].

From 1985 to 1987, 20 experiments were carried out on shallow chalk soils, in which soil N reserves were expected to be small, to assess seasonal variations in the response of winter cereals to applied fertilizer N, and to relate these responses to measurements of soil mineral N (SMN), temperature and soil moisture deficits (SMD). Soil mineral N measured in autumn varied from 21 kg/ha (1986) to 73 kg/ha (1985), while SMN in spring ranged from 19 kg/ha (1987) to 91 kg/ha (1985), these values were typical of soils in longterm arable rotations. Estimates of apparent net N mineralization (AM) during the growing season were small at c. 26 kg/ha and suggested large seasonal variation. The small AM is considered to be due to the shallow topsoil drying out during the growing season. Whole crop N offtake without fertilizer N was only c. 40 kg/ha. Crop N offtake, grain yield without fertilizer N and AFR (apparent recovery of fertilizer N) could not be reliably predicted by regression on SMN in autumn, SMN in spring or AM. Little or none of the variation in crop yield could be accounted for by regression on accumulated temperature over winter, maximum SMD in April to July or mean temperature in April to July. Despite optimum grain yields being only moderate at 6.59 t/ha for winter wheat and 6.78 t/ha for winter barley, response to applied fertilizer N was large, between 3.77 and 5.38 t/ha. In consequence the requirement for fertilizer N (c. 240-250 kg/ha) was also large, but differed little between seasons. This large requirement is concluded to be a result of limited fertilizer recovery and mineralization of soil N during the growing season. [References: 26].

3622 Hassan, M.A.M. (Suez Canal Univ., El Arish (Egypt). Faculty of Environmental Agricultural Sciences); Mostafa, M.M. (1995) Influence of urea-formaldehyde and PK fertilizers on nutrient content and yield of barley grown under rainfed conditions. *Zagazig Journal of Agricultural Research (Egypt)* v. 22(3) p. 931-942. 6 tables; 19 ref. English. (AGRIC 97-074410).

3623 Hubbard, V.C. (Univ. of Missouri, Columbia, MO.); Jordan, D. (1996) Nitrogen recovery by corn from nitrogen-15 labeled wheat residues and intact roots and soil. *Soil Science Society of America (USA)* v. 60(5) p. 1405-1410. references. English. (AGRIC 97-060295).

Conservation tillage systems, which maintain crop residues on the soil surface, are becoming more widely used. Crop residues serve as ground cover to reduce soil erosion and act as a sink-source for plant nutrients. A better understanding of the processes involved in crop residue decomposition and N release in these systems is needed to develop more efficient residue and fertility management practices. A greenhouse study was conducted to determine N availability to corn (*Zea mays* L.) from wheat (*Triticum aestivum* L.) residues and intact roots and soil as affected by residue placement. Tracer <sup>15</sup>N was used to quantify the N recovered by corn from wheat residues and intact roots and soil. Wheat residues were either surface-placed or incorporated in a Mexico silt loam (fine, montmorillonitic, mesic Udollic Ochraqualf) in pots with intact wheat roots. Residue placement significantly influenced the amount of <sup>15</sup>N recovered by corn from wheat residues but not from intact roots and soil. Corn <sup>15</sup>N recovery was significantly higher from incorporated residues than from surface residues; however, this was not reflected in the dry weight. Corn dry weight was 12% greater from surface residues than from incorporated residues. Higher yield from surface residues was attributed to a more constant optimum soil water content.

3624 Jackson, G.D. (Western Triangle Ag Research Center, Conrad, MT.) (1995) Yield and protein response of Nuwest hard white winter wheat to nitrogen. *Montana agriculture (USA)* v. 12(2) p. 19-22. references. English. (AGRIC 97-074503).

3625 Khan, M.Q.; Himayatullah; Mohammad, N.; Khan, N.; Shah, Z. (Gomal Univ., D.I. Khan (Pakistan). Faculty of Agriculture) (1994) Effect of various levels of potassium on wheat crop. *Sarhad Journal of Agriculture (Pakistan)* v. 10(3) p. 337-343. 2 ill., 4 tables, 16 ref. English. (AGRIC 97-074500).

The effect of various levels of potassium on the yield of wheat variety "Khyber-87" and concentration of K in soil and plant leaves was studied at Agril. Research Institute, D.I. Khan during 1988-89. The levels used for potassium were 0, 40, 80, 120, 160, 200 and 240 kg/ha with basal doses of N at the rate of 120 kg/ha and P<sub>2</sub>O<sub>5</sub> at the rate of 90 kg/ha. On treatment without fertilizer was also included. The effect of potassium fertilization

on wheat grain yield was significant but the differences between various K treatments were nonsignificant. The highest grain yield of 4650 kg/ha was noted in plot receiving 160 kg K<sub>2</sub>O/ha, however, maximum value cost ratio of 9.0 was recorded from the treatment receiving 40 kg K<sub>2</sub>O/ha. K application did not increase the potassium concentration in leaves collected before heading while in soil it was increased with various potassium levels non-significantly. The critical levels of potassium in soil and leaves were found to be 113 mg/kg and 2.15% respectively.

3626 Kramp, B.A. (Texas AandM University Vegetable Research Station, Munday, TX.); Bordovsky, D. (1995) Dryland wheat response to nitrogen and phosphorus fertilization. *Bulletin (Texas Agricultural Experiment Station) (USA)*; no. 1723 4 p. references. English. (AGRIC 97-060253).

3627 Kundu, S.; Singh, M.; Manna, MC.; Tripathi, AK.; Takkar, PN. (1996) CONTRIBUTION OF NITROGEN FROM SOIL-INCORPORATED N-15-LABELLED SOYBEAN (GLYCINE MAX) RESIDUE IN WHEAT (TRITICUM AESTIVUM). *Indian Journal of Agricultural Sciences*. 66(12):722-724. English. [INDIAN INST SOIL SCI TRACER LAB BHOPAL 462011 MADHYA PRADESH INDIA].

3628 Lehrsch, G.A.; Robbins, C.W. (USDA, Agricultural Research Service, Northwest Irrigation and Soils Research Lab., 3793 N.3600 E., Kimberly, ID 83341 5076 (USA)) (1996) Cheese whey effects on surface soil hydraulic properties. *Soil Use and Management (United Kingdom)* v. 12(4) p. 205-208. 24 ref. English. (AGRIC 97-060234).

3629 Malesevic, M. (Institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)); Starcevic, Lj.; Bogdanovic, D.; Mihajlovic, D. (1996) [The change in the protein content in wheat kernel depending on the temperatures and nitrogen nutrition level]. Promena sadrzaja proteina u zmu pšenice u zavisnosti od temperatura i nivoa azotne ishrane. 12. savetovanje "Zito-hleb". Novi Sad (Yugoslavia). 24-26 Apr 1996. *Cereal and flour production and processing: domestic [Yugoslav] potentials - international quality. Monograph, [proceedings of a conference]. Vukobratovic, R. (ed.). Proizvodnja i prerada zita i brasna: domaci [jugoslovenski] potencijali - svetski kvalitet. Monografija, [zbornik radova sa savetovanja] p. 91-104. Tehnoloski fakultet, Zavod za tehnologiju zita i brasna. 12 graphs; 1 table; 20 ref. Serbian. (AGRIC 97-060261).*

In this paper the researches performed in the period 1972-1995 are presented. The trials were performed on the chernozem soil type (Rimski Sancevi locality, Yugoslavia), well supplied with P and K. Kernel protein was correlated with various climate factors in order to establish critical moments during vegetative period for the kernel protein content level. It was proved that it was the wheat spiking period till the beginning of kernel ripening. The increase of the temperature sum in that period led to the decrease of the protein content no matter the level of nitrogen nutrition. Nitrogen taken from feeding provided higher protein content level, so in the case of extremely unfavourable temperatures, the quality of wheat remained at acceptable levels. However, there remained one practical problem - how to optimise nitrogen nutrition from the aspect of protein content, and yet to preserve kernel yield level.

3630 Malesevic, M.; Bogdanovic, D.; Starcevic, Lj. (Institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)) (1996) [The effect of the amount and distribution of precipitation on the system of N [nitrogen] application in wheat [Triticum aestivum L.]]. Uticaj kolicine i rasporeda padavina na sistem unosenja azota pod pšenicu (Triticum aestivum L.). Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadrzaja p. 192. Institut za istrazivanja u poljoprivredi "Srbija". (En, Sr). (AGRIC 97-060270).*

3631 Mamo, T.; Richter, C.; Hoppenstedt, A. (Kassel Univ. (Gesamthochschule), Witzenhausen (Germany). Inst. fuer Pflanzenbau) (1996) [Phosphorus response studies on some varieties of durum wheat (Triticum durum Desf.) and tef (Eragrostis tef (Zucc.) Trotter) grown in sand culture]. Untersuchungen zur Reaktion von Durum (Triticum durum Desf.) und Tef (Eragrostis tef (Zucc.) Trotter)-Sorten auf Phosphor in Sandkultur. *Journal of Agronomy and Crop Science (Germany)* v. 176(3) p. 189-197. 2 ill., 2 tables; 25 ref. English. (AGRIC 97-060271).

3632 Milosev, D. (Poljoprivredni fakultet, Novi Sad (Yugoslavia). Institut za ratarstvo i povrtarstvo) (1996) [Effects of temperature and nitrogen at grain formation on wheat yields and grain nitrogen content]. *Uticaj temperature i azota u fazi formiranja zrna na prinos i sadržaj azota u zrnju pšenice. Letopis naučnih radova (Yugoslavia) v. 20(2) p. 41-50. 1 ill.; 2 tables; 7 ref. Serbian. (AGRIS 97-074488).*

A two-year trial using Mitscherlich's pots was established under semi-controlled and controlled conditions. The objective was to determine the effects of different nitrogen (N) rates and temperatures at grain formation and grain fill on the quality of several winter wheat genotypes. The effect of N applications proved to be extremely positive, but only up to a certain point. Which particular N rate turned out to be the optimum depended on the production conditions in that particular year. Temperatures above 30-35 deg C were shown to be very deleterious to wheat, causing premature ripening, the occurrence of blind seeds, poorly filled grains, low yields, and low yield quality. Grain N content increased with an increase in N rates, the highest being in the warmer greenhouse and the lowest in the cooler one.

3633 Modaihsh, AS. (1997) FOLIAR APPLICATION OF CHELATED AND NON-CHELATED METALS FOR SUPPLYING MICRONUTRIENTS TO WHEAT GROWN ON CALCAREOUS SOIL. *Experimental Agriculture. 33(2):237-245. English. [KING SAUD UNIV COLL AGR DEPT SOIL SCI POB 2460 RIYADH 11451 SAUDI ARABIA].*

A field experiment was conducted from 1992 to 1994 to study the effect of supplying micronutrients to wheat (*Triticum aestivum* L., cv. Yecora rojo) grown on calcareous soil. Chelated and/or non-chelated forms of Fe, Mn, Zn and Cu were administered through a wide range of foliar applications, sprayed either individually or in combination. All the chelated micronutrients were applied in the form of EDTA with the exception of Fe (EDDHA). However, all the non-chelated elements were in the form of sulphate. The grain yield was significantly increased by the application of individual micronutrients either in the form of sulphate or chelate, but much higher amounts of sulphates were required. Application of micronutrient combinations either in chelated or non-chelated forms gave greater biological and grain yields than individual applications of the micronutrients. Wheat response to micronutrient applications followed in rank order: combined elements > Fe > Cu > Zn > Mn. Application of the micronutrients in sulphate form generally resulted in higher concentrations of these elements in grain than when the chelated forms were applied. Foliar application of the micronutrients in the form of sulphates at higher application rates may be more effective than the chelates due to lower cost despite the higher application rates. [References: 22].

3634 Moinuddin, S.; Afridi, MMRK. (1997) GRAIN YIELD AND QUALITY OF TRITICALE AS AFFECTED BY PROGRESSIVE APPLICATION RATES OF NITROGEN AND PHOSPHORUS FERTILIZER. *Journal of Plant Nutrition. 20(4-5):593-600. English. [JAMIA MILLIA ISLAMIA CTR BIOSCI NEW DELHI 110025 INDIA].*

In a field experiment conducted at Aligarh, India, nine combinations of nitrogen (N) and phosphorus (P) were factorially randomized with four triticales and one check each of wheat and rye to investigate the effect of progressive rates of application (180-300 kg N+P ha<sup>-1</sup>) of combined N+P fertilizer on grain yield and quality. Grain yield, protein content, and values for yield components significantly increased with increasing combined N+P fertilizer rates up to 240 kg N+P ha<sup>-1</sup> (200 kg N + 40 kg P ha<sup>-1</sup>). The response of further increases in N+P rates gradually diminished, thereafter, despite increasing N and/or P in the fertilizer combinations. The data facilitated the selection of improved cultivars in terms of yield and quality of grain and simultaneously revealed the harmful effects of overfertilization. [References: 20].

3635 Montaner, JHG.; Maddonni, GA.; Dinapoli, MR. (1997) MODELING GRAIN YIELD AND GRAIN YIELD RESPONSE TO NITROGEN IN SPRING WHEAT CROPS IN THE ARGENTINEAN SOUTHERN PAMPA. *Field Crops Research. 51(3):241-252. English. [UNIV BUENOS AIRES FAC AGRON CATEDRA CEREAICULTURA AV SAN MARTIN 4453 RA-1417 BUENOS AIRES DF ARGENTINA].*

Agronomic efficiency (kg grain yield kg<sup>-1</sup> N applied) is conditioned by environmental factors and nitrogen availability during the growing period. Hence, a fertilization model that considers environmental factors affecting wheat crop growth and effective N supply should be based on crop N demand. In this work, a simple model based on N balance during

the growing season is used as the frame to simulate both the demand and the availability of N, and to determine grain yield. Fertilization experiments were conducted under different environments (50 sites, 8 y) of the Southern Pampa of Argentina. Nitrogen fertilization rates ranged between 25 and 125 kg N ha<sup>-1</sup>. Soil initial conditions and water balance during the crop cycle were found to modify both N demand and soil N supply. The amount of N taken up by crops, water balance during the crop growth period and mean maximum temperature during grain filling, all affected grain yield components. The proposed model provided a good agreement between observed independent data sets and simulated values of grain yield (root mean square error = 9% of the mean value). Model operation was performed for one site within the region using climatic records to estimate annual grain yield variability under three levels of N availability. [References: 54].

3636 Morrison, JE.; Rickman, RW.; Mccool, DK.; Pfeiffer, KL. (1997) MEASUREMENT OF WHEAT RESIDUE COVER IN THE GREAT PLAINS AND PACIFIC NORTHWEST. *Journal of Soil & Water Conservation. 52(1):59-65. English. [USDA ARS TEMPLE, TX 76502 USA].*

Nine devices were used to visually measure percent residue cover on fields following a crop of winter wheat (*Triticum aestivum* L.). The devices were four lines with various arrangements of bead markers, a measuring tape, and four wheels with markers located on or near the wheel perimeter. Emphasis was on wheat residues, including low residue cover as found following intense tillage of Pacific Northwest non-irrigated wheatlands. Sources of measurement variation were studied for each of the nine devices to determine if any of the method/devices were preferable for documenting residue cover in conditions of extended weathering and multiple tillages. The fields were located in the Southern Great Plains and the Columbia Plateau area of the Pacific Northwest. A total of nine field sites were intensely measured, with three operators taking 1000 point readings with each device. Residue cover varied from 6 to 84% cover ("%-cover" is the unit of measure). Field conditions ranged from fallow with as many as seven tillages to long-term no-till. Measurement precision and operation time were similar for the four line and wheel type devices. Precision, as evaluated by the mean range of data values, ranged between 7.7 to 9.7%-cover. Excluding another type of transect line, the measuring tape, field time to take 1000 points averaged only 22.3 min. The tape took 50% more field time and is not recommended. Any differences in measured cover caused by the line bead arrangements or wheel designs, were either small or were masked by large variations among operators and spatial differences across the fields. Other factors, including length, height, stubble row spacing, and initial amount of residue, as well as surface roughness were also either masked or not important. Measurement variations by operators within replications and across replications were of the same order of magnitude, at +/-2 to 7%-cover. When combined, these sources of variation generally exceeded the arbitrary criteria of allowable variations of +/-3%-cover (originally based on +/-10% of 30% mean cover, which defined the critical value of residue cover for a tillage system to be "Conservation Tillage" (CTIC, 1995)). Of course, as residue cover values become small, such as 6 to 10%-cover, then the +/-3%-cover is really an allowable tolerance of +/-33 to 50%. This points out the need either for more appropriate allowance criteria or for the development of measurement instruments which will achieve more precision than is currently possible with any of the visual-measurement devices/methods used in this study. Results showed that fields with low amounts of weathered wheat residues may be measured with the same devices and methods as fields with higher amounts of residues. The range of observed values and absolute variation became smaller at cover decreased. Because the field sites spanned a wide range of conditions, the results should apply to most dryland wheat production areas. [References: 8].

3637 Padeken, K.; Helal, H.M. (1995) [Cd uptake of rape and wheat in dependence on different nutrient supply]. Cd-Aufnahme von Raps und Weizen bei variiertem Nährstoffangebot. 107. VDLUFA-Kongress. Garmisch-Partenkirchen (Germany). 18-23 Sep 1995. [Grassland as production location and landscape element]. *Gruenland als Produktionsstandort und Landschaftselement VDLUFA-Schriftenreihe (Germany): . 40. Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany) p. 881-884. VDLUFA. German. (AGRIS 97-060061).*

3638 Pisulewska, E. (Agricultural University, Krakow (Poland). Dept. of Crop Production) (1995) [Effect of increasing nitrogen fertilization levels

on the yield, protein content and amino acid composition of winter triticale grain]. Wplyw wzrastajacych dawek nawozow azotowych na plon ziarna oraz zawartosc i sklad aminokwasowy bialka pszenzyta ozimego. *Fragmenta Agronomica (Poland)* v. 12(3) p. 87-95. 3 fig., 2 tables; 8 ref. English. (AGRIS 97-074487).

The purpose of the study was to determine the effect of three nitrogen fertilization levels on yield, protein content and its amino acid composition of four cultivars of winter triticale. Of the three grain crops examined, the highest yields were obtained for triticale. The yields were 22 and 4% higher than those of wheat and rye, respectively. Equally, triticale had the highest yields of total protein when compared wheat and rye (3 and 10% higher respectively). Of the four cultivars of triticale examined, cv. Almo had the highest grain and grain total protein yields, and cv. Lasko (a small-grain cultivar) the lowest.

3639 Ponce, G.R.; Salas, M.L. (Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Centro de Ciencias Medioambientales); Mason, S.C. (Nebraska Univ., Lincoln (USA). Dept. of Agronomy) (1996) [Influence of seeding and N rates on grain characteristics of winter barley under semi-arid conditions]. *Influenza delle dosi di seme e di somministrazione azotata sulle caratteristiche della granella di orzo invernale in condizioni semi-aride. Agrochimica (Italy)* v. 40(2-3) p. 114-122. 4 tables; 1 graph; 9 ref. English. (AGRIS 97-060147).

Producers need to carefully consider environmental conditions and relative price incentives for producing high yield and high feeding value grain when choosing the appropriate N rate for winter barley. In favorable years, increasing the N rate increased yield at the expense of grain characteristics associated with livestock feed value, while in adverse years the opposite occurred. However, increasing N rate always increased the protein yield of barley. Altering seeding rates had no effect on the parameters measured. Livestock producers should recognize that differences in barley grain yield, protein concentration and bulk density commonly occur in semi-arid climates, and are often influenced by the N rate used [I produttori devono considerare attentamente le condizioni ambientali e i relativi incentivi di prezzo per produrre elevate quantita' di granella con alto valore nutritivo nello scegliere i livelli appropriati di azoto per l'orzo invernale. Negli anni favorevoli, l'aumento del livello di N determinava un aumento delle rese a discapito delle caratteristiche della granella associate con il valore alimentare per il bestiame, mentre nelle annate avverse accadeva l'opposto. Comunque, l'incremento dell'N determinava in ogni condizione l'aumento della produzione di proteine. La variazione della dose di semina non presentava alcun effetto sui parametri misurati. Gli allevatori dovrebbero rendersi conto che le differenze nella produzione di granella e nella concentrazione di proteine si verificano abitualmente nei climi semi-aridi e sono spesso influenzate dal livello di N utilizzato].

3640 Portilla Cruz, Issa; Cruz Flores, Gerardo; Molina Gayoso, Eduardo; Manske, Gunter G.B. (1995) [Effect of phosphorus on phosphatic root activity and infection grade of mycorrhizae in wheat (*Triticum aestivum*) and triticale (*X Triticosecale wittmackii*). Efecto de fosforo sobre actividad fosfatasa radicular y grado de infeccion micorrizica de trigo (*Triticum aestivum*) y triticale (*X Triticosecale wittmackii*). 26. Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. *La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. *Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.)* p. 63. Sociedad Mexicana de la Ciencia del Suelo. 5 ref. Spanish. (AGRIS 97-074249).

3641 Qasim, M.; Himayatullah; Khan, H.; Shah, Z. (Gomal Univ., D.I. Khan (Pakistan). Faculty of Agriculture) (1994) Efficiency of phosphatic fertilizers through premixing with farm yard manure on wheat crop. *Sarhad Journal of Agriculture (Pakistan)* v. 10(3) p. 331-335. 2 tables, 9 ref. English. (AGRIS 97-074499).

A field experiment was conducted during 1990-91 at the Faculty of Agriculture, Gomal University, Dera Ismail Khan to study the effect of mixing FYM with different P fertilizers on yield of wheat. Basal dose of NPK at the rate of 120, 90, 60 and FYM at the rate of 300 kg/ha was applied. The sources of phosphatic fertilizers used were DAP, NP, SSP and TSP. Results obtained on yield parameters of wheat revealed that the application of different P fertilizers alone and in combination with FYM significantly increased the yield parameters as compared to control

treatment. However, there was no significant difference in most of the yield parameters where P was applied alone or in combination with FYM. Maximum yield was obtained from treatment receiving NP + Urea + SOP + FYM and comparatively higher economic yield was also obtained from the same treatment.

3642 Rabie, M.H.; El Saadani, A.M. (Ministry of Agriculture, Cairo (Egypt). Soils and Water Research Inst.); Abd El Sabour, M.F.; Mousa, I.A.I. (1995) The use of water hyacinth, *Eichhornia crassipes* as an organic manure to amend soils. *Egyptian Journal of Soil Science (Egypt)* v. 35(1) p. 105-116. 4 tables; 13 ref. English. (AGRIS 97-074512).

3643 Rees, R.M.; Roelcke, M.; Li, S.X.; Wang, X.Q.; Li, S.Q.; Stockdale, E.A.; McTaggart, I.P.; Smith, K.A.; Richter, J. (1997) THE EFFECT OF FERTILIZER PLACEMENT ON NITROGEN UPTAKE AND YIELD OF WHEAT AND MAIZE IN CHINESE LOESS SOILS. *Nutrient Cycling in Agroecosystems*. 47(1):81-91. English. [SCOTTISH AGRICULTURAL DEPT SOILS W MAINS RD EDINBURGH EH9 3JG MIDLOTHIAN SCOTLAND].

Field trials were carried out to study the fate of N-15-labelled urea applied to summer maize and winter wheat in loess soils in Shaanxi Province, north-west China. In the maize experiment, nitrogen was applied at rates of 0 or 210 kg N ha<sup>-1</sup>, either as a surface application, mixed uniformly with the top 0.15 m of soil, or placed in holes 0.1 m deep adjacent to each plant and then covered with soil. In the wheat experiment, nitrogen was applied at rates of 0, 75 or 150 kg N ha<sup>-1</sup>, either to the surface, or incorporated by mixing with the top 0.15 m, or placed in a band at 0.15 m depth. Measurements were made of crop N uptake, residual fertilizer N and soil mineral N. The total above-ground dry matter yield of maize varied between 7.6 and 11.9 t ha<sup>-1</sup>. The crop recovery of fertilizer N following point placement was 25% of that applied, which was higher than that from the surface application (18%) or incorporation by mixing (18%). The total grain yield of wheat varied between 4.3 and 4.7 t ha<sup>-1</sup>. In the surface applications, the recovery of fertilizer-derived nitrogen (25%) was considerably lower than that from the mixing treatments and banded placements (33 and 36%). The fertilizer N application rate had a significant effect on grain and total dry matter yield, as well as on total N uptake and grain N contents. The main mechanism for loss of N appeared to be by ammonia volatilization, rather than leaching. High mineral N concentrations remained in the soil at harvest, following both crops, demonstrating a potential for significant reductions in N application rates without associated loss in yield. [References: 27].

3644 Ritz, K.; Wheatley, R.E.; Griffiths, B.S. (1997) EFFECTS OF ANIMAL MANURE APPLICATION AND CROP PLANTS UPON SIZE AND ACTIVITY OF SOIL MICROBIAL BIOMASS UNDER ORGANICALLY GROWN SPRING BARLEY. *Biology & Fertility of Soils*. 24(4):372-377. English. [SCOTTISH CROP RES INST DEPT CELLULAR & ENVIRONM PHYSIOL UNIT INTEGRAT BIOSCI DUNDEE DD2 5DA SCOTLAND].

Temporal behaviour of microbial biomass C, N and respiration was measured under barley crops in two experiments on successive years in a recently converted organic production system in Scotland. Soils were fertilised with farmyard manure or poultry manure. Control soils received no manure at the start of the growing season. The effects of plants was also investigated by maintaining fallow subplots. C-flush values approximately doubled over the growing season in both years of the trial, showing a decline to pre-sowing values between the two seasons. This occurred in all soils, whether manured or not, or planted or fallow. Manure tended to increase the C-flush in the 2nd year only. N-flush in the 2nd year showed no increase in planted control plots but did increase in fallow soils. Manures significantly increased the N-flush. Respiration rates were stimulated by the presence of plants. Respiration rates were measured from soils taken from the field at post-sowing, mid-season and postharvest occasions and incubated under constant conditions for up to 1 year. Here there was evidence that the effects of sampling and adjusting the moisture status could be as great upon microbial activity as the addition of the manures. C-flush also showed a consistent and persistent increase in these incubated soils. This suggests that the fundamental C-supplying characteristics of these soils was such that the biomass was moving towards a new equilibrium value fuelled by the relatively recent introduction of the organic farming regime. [References: 34].

3645 Ruppert, W. (1994) [Agrarian-political and economical frame conditions: field and plant cropping possibilities]. *Agrarpolitische und oekonomische Rahmenbedingungen: ackerbauliche und*



pflanzenbauliche Möglichkeiten. Tagungsband zur landtechnischen Jahrestagung. Deggendorf (Germany). 22 Nov 1994. [Cultivation under changed conditions - new technologies for cost saving]. Ackerbau unter veränderten Bedingungen - neue Techniken zur Kosteneinsparung Landtechnik-Schrift (Germany); no. 4. Bayerische Landesanstalt fuer Bodenkultur und Pflanzenbau, Freising (Germany) p. 37-55. Landtechnik Weißenstephan. German. (AGRIS 97-060256).

3646 Ryan, J.; Nsarellah, N.; Mergoum, M. (1997) NITROGEN FERTILIZATION OF DURUM WHEAT CULTIVARS IN THE RAINFED AREA OF MOROCCO - BIOMASS, YIELD, AND QUALITY CONSIDERATIONS. *Cereal Research Communications*. 25(1):85-90. English. [INRA ARIDOCULTURE CTR SETTAT MOROCCO].

Nitrogen is the dominant fertilizer element required for cereals in Morocco. While fertilization is less common in the semi-arid (250-450 mm) cereal belt than at higher rainfall zones, the benefits in terms of yield increases and economics are potentially important. However, research has been focused mainly on bread wheat (*Triticum aestivum* L), notwithstanding the importance of durum wheat (*T. Turgidum* var durum L). This on-farm trial in a shallow soil (Petrocalcic Palixeroll) in the dryland Chaouia area of south-central Morocco evaluated the impact of N (0, 30, 60, 90, 120 kg N/ha) in five durum cultivars (Kyperounda or 2777, Marzak, Massa, Cocorit, Karim). Data were influenced by both N and cultivar, with no interaction between them. Nitrogen significantly increased biomass and grain yields up to 90 kg/ha; it had little effect on either grain N concentration, except at the highest level (120 kg/ha), or kernel weight, but tended to decrease the percentage of "yellow berry". Yields were significantly higher for Kyperounda, Marzak, and Karim than either Cocorit or Massa. Grain N and kernel weight were little influenced by cultivar, but the incidence of "yellow berry" varied with the cultivar. While recognizing cultivar differences, the study highlights the role of N for yield and quality components of durum wheat. [References: 11].

3647 Sandhu, K.S. (Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils); Sidhu, A.S. (1996) Response of dryland wheat to supplemental irrigation and rate and method of N application. *Fertilizer Research* (Netherlands) v. 45(2) p. 135-142. 20 ref. English. (AGRIS 97-074497).

3648 Sharma, S.N. (Indian Agricultural Research Inst., New Delhi (India). Div. of Agronomy); Prasad, R. (1996) Use of nitrification inhibitors (neem and DCD) to increase N efficiency in maize-wheat cropping system. *Fertilizer Research* (Netherlands) v. 44(3) p. 169-175. 21 ref. English. (AGRIS 97-074518).

3649 Stevanovic, D. (Poljoprivredni fakultet, Beograd Zemun (Yugoslavia)); Martinovic, Lj.; Cakmak, D. (1996) [Influence of fertilizing on stability of yield in wheat and corn]. Učica i djubrenja na stabilnost prinosa pšenice i kukuruza. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts*. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadržaja p. 189. Institut za istraživanja u poljoprivredi "Srbija". (En, Sr). (AGRIS 97-060299).

3650 Suri, VK.; Puri, UK. (1997) EFFECT OF PHOSPHORUS APPLICATION WITH AND WITHOUT FARMYARD MANURE ON RAINFED MAIZE (ZEA MAYS) WHEAT (TRITICUM AESTIVUM) MAIZE SEQUENCE. *Indian Journal of Agricultural Sciences*. 67(1):13-15. English. [HIMACHAL PRADESH AGR UNIV DEPT SOIL SCI PALAMPUR 176062 HIMACHAL PRADESH INDIA].

A field experiment was conducted in low-hill submontane zone of Himachal Pradesh during 1990-91 to evaluate the direct, residual and cumulative effects of farmyard manure and phosphorus application in maize (*Zea mays* L.) - wheat (*Triticum aestivum* L. emend. Fiori & Paol.) - maize sequence. Farmyard manure and P showed significant direct and residual effects on the 3 sequential crops. Farmyard manure applied during the rainy season 1990 increased the maize-grain yield by 837 kg/ha and the grain yield of the following wheat by 332 kg/ha. P 26 kg/ha gave 1 334 kg/ha grain yield of wheat compared with the control. The residual farmyard manure increased the grain yield of the next maize crop by 235 kg/ha. P 26 kg/ha to the preceding wheat increased the grain yield of second maize crop by 300 kg/ha. A fresh P application to the second crop 13 kg/ha increased its grain yield by 357 kg/ha. All the interactions were found significant. Analysis of soil after harvesting the maize crop showed

a significant build up of organic carbon and available P in the plots treated with P and farmyard manure. [References: 10].

3651 Tanacs, L.; Matuz, J.; Bartok, T.; Gero, L. (1997) EFFECT OF NPK FERTILISATION ON THE AMINO ACID COMPOSITION OF WHEAT GRAIN YIELDS. *Novemlytermeles*. 46(1):43-51. Hungarian. [KERTESZETI ELELMISZERIPARI EGYETEM ELELMISZERIPARI FOISKOLAI KAR MARX TER 7 H-6724 SZEGED HUNGARY].

The individual amino acid contents of wheat seeds from long-term NPK fertilizer trials grown on strongly calcareous and humus-rich meadow soil in 1991 were examined with the RP HPLC method, in order to determine the effect of increasing NPK supplies. Higher N doses increased the amounts of ASP, GLU, SER, HIS, GLY, THR, ARG, ALA, TYR, VAL, PHE, ILE, LEU and LYS by 14-36%. The highest values were obtained at a fertilizer level of 180 kg N/ha, except for ARG and HIS. Increased PK doses significantly decreased the quantities of ASP, GLU, SER, HIS, GLY, THR, ARG, ALA, TYR, CYS, VAL, PHE, ILE and LEU. When N and PK were applied together, the amounts of amino acids did not change to such an extent as in the case of separate N or PK doses. The two wheat varieties studied showed significant differences only in the amount of SER, CYS and PHE. [References: 12].

3652 Tanaka, DL.; Bauer, A.; Black, AL. (1997) ANNUAL LEGUME COVER CROPS IN SPRING WHEAT-FALLOW SYSTEMS. *Journal of Production Agriculture*. 10(2):251-255. English. [USDA ARS NO GREAT PLAINS RES LAB POB 459 MANDAN, ND 58554 USA].

Soil erosion is a problem in conventional tillage spring wheat (*Triticum aestivum* L.)-fallow rotations in semiarid regions. Early research using legumes to provide surface cover for erosion control in dryland crop rotations showed no yield benefits to a succeeding crop. Better residue management practices have improved fallow soil water storage and could reduce detrimental soil water influences of legumes to a succeeding crop. Objectives of our research were to determine whether field pea (*Pisum sativum* L.) and Tangier flatpea (*Lathyrus tingitanus* L.) could be grown during part of the fallow period in a hard red spring wheat-fallow rotation to provide dry matter (DM) and surface cover for erosion control and to evaluate the influences of legumes on a succeeding spring wheat crop. Legumes were seeded during the fallow phase of a spring wheat-fallow rotation from 1989 through 1992. During dry years, total DM and surface cover were reduced more for Tangier flatpea than field pea. Legumes produced sufficient DM to exceed 35% surface cover by the flowering plant development stage when precipitation was not limiting. If growing conditions were good, legumes used soil water to a depth of 5 ft when legume growth was terminated at pod formation or grown for the full season. The N contribution to a succeeding spring wheat crop was not evident in grain N concentration or uptake. When legume growth was terminated at or before flowering, legumes provided sufficient DM and surface cover to control erosion without consistent detrimental influences to a succeeding wheat crop. [References: 17].

3653 Tosheva, E. (Institut po Pochvoznazanie i Agroekologiya "N. Pushkarov", Sofia (Bulgaria)); Stoeva, I. (1996) [Effect of fertilizing and supply of leached smolnitza on triticale quality]. Vliyanie na toreneto i zapasenostta na izluzhenata smolnitza v"rkhu kachestvoto na tritikale. Selskostopanska Akademiya, Sofia (Bulgaria). *Pochvoznazanie, Agrokimiya i Ekologiya* (Bulgaria). *Soil Science, Agrochemistry and Ecology* v. 31(3) p. 11-13. 2 tables; 9 ref. Bulgarian. (AGRIS 97-060078).

3654 Tripathi, B.P. (Soil Science Division, Khumaltar, Lalitpur (Nepal)) (1996) Long-term of farm yard manure and mineral fertilizer on rice and wheat yields and nutrient balance in rice-wheat system at Khumaltar condition. *LARC Seminar Paper* (Nepal); no. 96/35 9 p. Lumle Agricultural Research Centre. 6 tables; 10 ref. English. (AGRIS 97-060124).

Long-term effects of organic and mineral fertilizers on rice and wheat yields and on soil chemical properties were studied in an imceptisol at Khumaltar, Nepal, where intensive cultivation of rice-wheat rotation was followed from 1978 to 1986. The application of 100 kg N/ha alone could sustain the rice yield of 6 t/ha in the long-run. A response to phosphorus and potassium was not observed both in either rice or wheat crops. A declining trend of wheat yield was noted in the later years, however, the yield decline in 10 t farm yard manure (FYM/ha) treatment was much reduced.

3655 Tripathy, A.; Sahu, R.K. (1997) EFFECT OF COAL FLY ASH ON GROWTH AND YIELD OF WHEAT. *Journal of Environmental Biology*. 18(2):131-135. English. [KHALLIKOTE COLL POST GRAD DEPT BOT ENVIRONM RES CTR BERHAMPUR 760001 ORISSA INDIA].

A pot experiment was conducted to study the effect of the Talcher Thermal Power Station fly ash on growth and yield of wheat. Data of the pot experiment on growth and yield reveal that 50% fly ash applied to soil increased seedling height, plant height, girth, leaf number, leaf area, spike length, dry weight etc. The values of the effect of soil + fly ash on growth and yield are well comparable with those of soil + 10% compost and soil + 0.6% NPK treatment. Thus soil application of fly ash not only has the potential for improving their production but for solving of the flyash disposal problem. [References: 16].

3656 Verma, UN.; Pal, SK.; Singh, MK.; Thakur, R. (1997) FERTILIZER REQUIREMENT OF LATE-SOWN WHEAT (TRITICUM AESTIVUM) UNDER CONDITIONS OF BIHAR PLATEAU. *Indian Journal of Agricultural Sciences*. 67(5):204-207. English. [BIRSA AGR UNIV DEPT AGRON RANCHI 834006 BIHAR INDIA].

A field experiment was conducted during winter season of 1992-94 to study the fertilizer requirement of late-sown wheat (*Triticum aestivum* L. emend. Fiori & Paol.) on sandy-loam soil of Bihar plateau. In main plot were taken 4 seeding dates, viz 7 December (moderately late), 21 December (late), 7 January (very late) and 21 January (extremely late), and in subplot 4 fertilizer levels, viz N0P0K0, N40P8.7K16.6, N80P17.4K24.9 and N120P26.2K33.2. Split-plot design was followed. Moderately late-sown crop responded up to N80P17.4K24.9 (3973 kg/ha) with net return of Rs 11940/ha. The crops sown late (2573 kg/ha) and very late (2324 kg/ha) responded only up to N40P8.7K16.6 with net return of Rs 6447 and 4624/ha respectively. Crop duration was reduced by 7, 15 and 21 days when sown under late, very late and extremely late conditions respectively compared with the crop sown moderately late. However, heat-unit requirement was almost similar (1417 to 1468 degree-days) to attain maturity. [References: 5].

3657 Vietinghoff, J.; Gienapp, C. (Landesforschungsanstalt Mecklenburg Vorpommern, Guelzow (Germany)) (1995) [Winter grain: Recommendations for nitrogen application]. *Wintergetreide: Stickstoff nicht nach "Schema F" duengen. Top agrar / Spezial fuer Mecklenburg-Vorpommern, Brandenburg, Sachsen-Anhalt, Sachsen, Thuringen (Germany)* (no.2) p. 36-37. German. (AGRIS 97-060258).

Der Einfluss der Stickstoffduengung (Hoehe, Verteilung, Duengerform) wurde untersucht und die Ergebnisse dargestellt, die eine signifikante Ertragssteigerung brachten.

3658 Yilmaz, A.; Ekiz, H.; Torun, B.; Gultekin, I.; Karanlik, S.; Bagci, SA.; Cakmak, I. (1997) EFFECT OF DIFFERENT ZINC APPLICATION METHODS ON GRAIN YIELD AND ZINC CONCENTRATION IN WHEAT CULTIVARS GROWN ON ZINC-DEFICIENT CALCAREOUS SOILS. *Journal of Plant Nutrition*. 20(4-5):461-471. English. [CUKUROVA UNIV FAC AGR DEPT SOIL SCI ADANA TURKEY].

The effect of six different zinc (Zn) application methods on grain yield and concentrations of Zn in whole shoots and grain was studied in wheat cultivars (*Triticum aestivum* L. cvs. Gerek-79, Dagdas-94 and Bezostaja-1 and *Triticum durum*, Desf. cv. Kunduru-1149) grown on severely Zn-deficient calcareous soils (DTPA-extractable Zn: 0.12 mg.kg<sup>-1</sup> soil) of Central Anatolia which is the major wheat growing area of Turkey. Zinc application methods tested were: a) control (no Zn application), b) soil, c) seed, d) leaf, e) soil+leaf, and f) seed+leaf applications. Irrespective of the method, application of Zn significantly increased grain yield in all cultivars. Compared to the control, increases in grain yield were about 260% with soil, soil+leaf, and seed+leaf, 204% with seed and 124% with leaf application of Zn. In a similar manner, biomass production (dry weight of above-ground parts) was increased by Zn treatments. The highest increase (109%) was obtained with the soil application and the lowest increase (40%) with the leaf application. Significant effects of Zn application methods were also found on the yield components, i.e., spike number.m<sup>-2</sup>, grain number.spike<sup>-1</sup>, and thousand kernel weight. Spike number.m<sup>-2</sup> was affected most by Zn applications, particularly by soil and soil+leaf applications. Concentrations of Zn in whole shoots and grain were greatly affected by different Zn treatments. In plants without added Zn, concentrations of Zn were about 10 mg.kg<sup>-1</sup> both in shoots and grain and increased to 18 mg.kg<sup>-1</sup> dry weight (DW) by soil application of Zn, but not affected by seed application of Zn. Soil+leaf application of Zn had

the highest increase in concentration of Zn in shoot (82 mg.kg<sup>-1</sup> DW) and grain (38 mg.kg<sup>-1</sup> DW). Soil application of Zn was economical and had long-term effects far enhancing grain yield of wheat grown on Zn deficient soils. When high grain yield and high Zn concentration in grains are desired, soil+leaf application of Zn was most effective method of Zn application. [References: 19].

3659 Yun, B.K. (Rural Development Administration, Naju (Korea Republic). Jeonnam Provincial Rural Development Administration); Jung, P.K.; Oh, S.J.; Kim, S.K. (Rural Development Administration, Suwon (Korea Republic). National Institute of Agricultural Science and Technology); Ryu, I.S. (Dankook University, Cheonan (Korea Republic). Department of International Agriculture Development) (1996) Effects of compost application on soil loss and physico-chemical properties in lysimeters. *Journal of Korean Society of Soil Science and Fertilizer (Korea Republic)* v.29(4) p. 336-341. 3 illus.; 5 tables; 15 ref. Korean. (AGRIS 97-060138).

3660 Zaghloul, R.A. (Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture); Amer, A.A.; Mostafa, M.H. (1996) Efficiency of some organic manures and biofertilization with *Azospirillum brasilense* for wheat manuring. *Annals of Agricultural Science, Moshtohor (Egypt)* v. 34(2) p. 627-640. 9 tables; 23 ref. English. (AGRIS 97-074493).

## F06 IRRIGATION

3661 Khosla, BK.; Gupta, RK. (1997) RESPONSE OF WHEAT TO SALINE IRRIGATION AND DRAINAGE. *Agricultural Water Management*. 32(3):285-291. English. [CENT SOIL SALIN RES INST KARNAL 132001 HARYANA INDIA].

The response of wheat (*Triticum aestivum* L.) to varying depths of irrigation, quantity of water applied and to the drainage conditions was studied in 2 m x 2 m x 2 m size lysimeters filled in with a sandy loam soil. Saline water with an electrical conductivity of 8.6 dS m<sup>-1</sup> was used for irrigation. The treatments included four irrigations of 5 cm depth, four irrigations of 7 cm, and three irrigations of 9 cm, scheduled on the basis of cumulative pan evaporation, while the drainage conditions were represented by the drained and undrained lysimeters. Another treatment, using good quality water for irrigation, represented the potential yield of the crop. The growth parameters, as well as the yield, showed an improvement with larger irrigation depth increments in the drained lysimeters. But, in contrast, in the undrained lysimeters, the yield was reduced with larger irrigation depth increments, mainly due to a sharp rise in water table depth during the irrigation cycles. The rise and fall in water table showed a high sensitivity and were also highly disproportionate to the irrigation and evapotranspiration events. The yield tended to be higher with a smaller depth of water applied more frequently in the undrained lysimeters. But, in view of the limitations of conventional surface irrigation to apply water in smaller depth increments, an improved drainage is imperative for cropping in shallow saline water table conditions. (C) 1997 Elsevier Science B.V. [References: 5].

3662 Tapia Vargas, Luis Mario; Gomez Lucatero, Blanca Leticia; Alcantar Rocillo, Juan Jose (1995) [Technical and economic evaluation of restricted irrigation in winter wheat var. Salamanca, in the low Lerma, Michoacan State]. *Evaluacion tecnica y economica del riego restringido en trigo de invierno (var. Salamanca), en el bajo Lerma, Michoacan*. 26, Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. *La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. *Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.)* p. 118. Sociedad Mexicana de la Ciencia del Suelo. 1 cuadro; 1 ref. Spanish. (AGRIS 97-074547).

## F07 SOIL CULTIVATION

3663 Amir, J. (Gilat Regional Experiment Station, Negev Mobile Post 2 (Israel)); Sinclair, T.R. (1996) A straw mulch system to allow continuous wheat production in an arid climate. *Field Crops Research (Netherlands)* v. 47(1) p. 21-31. 30 ref. English. (AGRIS 97-074649).

3664 Arshad, M.A. (Agriculture and Agri Food Canada, Beaverlodge, Canada.); Gill, K.S.; Coy, G.R. (1995) Barley, canola, and weed growth

with decreasing tillage in a cold, semiarid climate. *Agronomy journal (USA)* v. 87(1) p. 49-55. references. English. (AGRIS 97-060367).

Conventional tillage systems are reported to cause soil degradation, yet appropriate conservation tillage practices have not been developed for cold regions of the northern Canadian Prairies. Effects of conventional, reduced, and zero tillage systems (CT, RT, and ZT) on the growth of dryland spring barley (*Hordeum vulgare* L.), canola (*Brassica campestris* L.), and weeds were studied on a clay soil (Natriboral) near Rycroft in northern Alberta. Each crop-tillage combination was fixed in space from 1989 through 1991. Each season, the CT plots were tilled once in the preceding fall and twice in the spring prior to seeding; the RT plots were tilled once prior to seeding in the spring; the ZT plots received a preseeding glyphosate [N-(phosphonomethyl) glycine] application in the spring. Crop residue in ZT was spread evenly by harrowing in the spring just prior to seeding. The 1991 available NO<sub>3</sub>-N, NH<sub>4</sub>-N, and P in soil or total plant N and P were unaffected by tillage, except that NO<sub>3</sub>-N was lower under ZT canola. No consistent effect of tillage was detected on total soil moisture, except for lower moisture in the 0- to 10-cm depth under CT in dry periods. As the study progressed, there was a trend of increased weed population response to tillage, relatively greater weed density under ZT, and a shift in species composition. Mean barley total dry matter (TDM) yield was 3.37, 3.09, and 2.93 Mg ha<sup>-1</sup> and grain yield was 1.59, 1.41, and 1.35 Mg ha<sup>-1</sup> under RT, ZT, and CT, respectively. Mean canola TDM yield was 2.92, 2.3h and 2.12 Mg ha<sup>-1</sup> and grain yield was 0.84, 0.66, and 0.59 Mg ha<sup>-1</sup>, under RT, CT, and ZT, respectively. In most cases, however, tillage effects on mean crop yields were nonsignificant (P less than or equal to 0.05). Overall, RT was considered to be agronomically and environmentally desirable, due to somewhat better crop yield than either CT or ZT systems and two fewer cultivations than CT.

3665 Baumhardt, R.L. (Texas Agricultural Experiment Station, Lubbock, TX.); Lascano, R.J. (1996) Rain infiltration as affected by wheat residue amount and distribution in ridged tillage. *Soil Science Society of America (USA)* v. 60(6) p. 1908-1913. references. English. (AGRIS 97-074644).

Texas South Plains production systems for conserving rainfall and reducing wind erosion in cotton (*Gossypium hirsutum* L.), a low-residue crop, include the spring chemical termination of winter wheat (*Triticum aestivum* L.) overseeded post-harvest into cotton. This practice often increases cotton lint yields under irrigation, but residues hinder weed control and increase production costs. This study characterized infiltration response to (i) residue weathering and soil consolidation with ridges, (ii) residue distribution on the ridge or in the furrow, and (iii) flat or standing architectures and residue amounts. Simulated rain was applied at 65 mm h<sup>-1</sup> for 1 h into a bare Olton clay loam (fine, mixed, thermic Aridic Paleustoll). Mean cumulative infiltration was lowest for bare soil (28.7 mm), but increased curvilinearly with increasing residue amounts, leveling at 49.0 mm. Cumulative infiltration with residues distributed on the ridge (42 mm) or in the furrows (44 mm) were the same even though water in the furrow absorbed drop impact. A minimum amount of residue (0.7 Mg ha<sup>-1</sup>) to intercept raindrop impact was needed to increase rain infiltration, but increasing residue above a residue threshold of 2.4 Mg ha<sup>-1</sup> had no effect because of sufficient drop impact interception. Increases in infiltration were related to the residue amount rather than to the bed or furrow location. Partial residue cover and tillage operations that lodge crop residues may increase infiltration.

3666 Berglund, K. (Swedish University of Agricultural Sciences, Department of Soil Sciences, P.O. Box 7014, S 750 07 Uppsala (Sweden)) (1996) Agricultural improvement of cultivated organic soils. I. Effects of deep cultivation, liming, irrigation and P-fertilization on crop yields. *Soil Use and Management (United Kingdom)* v. 12(4) p. 169-175. 12 ref. English. (AGRIS 97-060408).

3667 Cheong, J.I.; Kim, B.K.; Ha, K.Y.; Lee, J.K.; Shin, H.T. (Rural Development Administration, Iksan (Korea Republic). National Honam Agricultural Experiment Station) (1996) Changes in chemical components of stagnant water, germination rate and seedling elongation of rice varieties under different amount of barley straw mulching. *Korean Journal of Crop Science (Korea Republic)* v. 41(5) p. 505-513. 9 illus.; 3 tables; 15 ref. Korean. (AGRIS 97-060385).

3668 Drazic, D. (Institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)); Starcevic, Lj. (1997) [Effect of soil tillage systems on weed status in crops]. *Uticaj sistema obrade zemljišta na zakorovljenost useva*. 31.

seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naucni institut za ratarstvo i povrtarstvo (Yugoslavia) (no.29)* p. 171-176. 3 tables; 13 ref. Serbian. (AGRIS 97-074646).

This paper deals with results of a study on the effect of reduced tillage systems on weed status in wheat, corn and soybean. The tables show the interdependence of the number of weed species in the three locations and three tillage systems - conventional plowing, chisel and no-tillage. Based on the literature data and results obtained in this research, an opinion is given on the applicability of reduced tillage systems in the prevailing situation of weed status. In the prevailing situation with the presence of Johnsongrass (*Sorghum halepense*) in the fields, reduced tillage is applicable for the sowing of winter wheat, a dense crop which develops a high competition against weeds. Regarding the conventional tillage systems for the sowing of spring row crops, it must be timely, effective and combined with herbicide application, in order to control the status of perennial weeds.

3669 Gomaa, M.R. (Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture) (1995) Evaluation of various degrees of soil tillage on wheat yield, associated weeds and some soil properties. *Annals of Agricultural Science, Moshtohor (Egypt)* v. 33(4) p. 1211-1224. 6 tables; 17 ref. English. (AGRIS 97-074647).

3670 Hammel, J.E. (University of Idaho, Moscow, ID.) (1995) Long-term tillage and crop rotation effects on winter wheat production in northern Idaho. *Agronomy journal (USA)* v. 87(1) p. 16-22. references. English. (AGRIS 97-060377).

Reduced tillage practices designed to control soil loss in the Palouse region of northern Idaho may adversely affect soil physical properties and decrease yields. The objective of this study was to determine the effects of long-term tillage and rotation practices on wheat (*Triticum aestivum* L.) yields following 10 yr of continuous management. Yields were obtained from 1984 to 1987 on a long-term tillage rotation experiment established in 1974 near Moscow, ID. Tillage treatments included conventional (CONV, moldboard plow), minimum (MIN, chisel), and no-tillage (NT). Crop rotations were a 2-yr winter wheat-spring pea (*Pisum sativum* L.) (WW-SP) rotation and a 3-yr winter wheat-spring barley (*Hordeum vulgare* L.)-spring pea (WW-SB-SP) rotation. Yields of the MIN and NT treatments averaged over the 4-yr period were 92 and 78% of the CONV treatment. Differences between yields were significant (P < 0.05). No-till yields were significantly less (P < 0.05) than both the CONV and MIN treatments during all years, whereas MIN and CONV yields were not significantly different during 1986 and 1987. Wheat grown under the WW-SB-SP rotation yielded significantly greater (P < 0.05) than the WW-SP rotation. Profile water extraction and N uptake were reduced in the MIN and NT treatments. The apparent decrease in root function may have resulted from higher surface layer impedance, or possibly, greater root disease pressure under MIN and NT management. Results indicate that winter wheat production under continuous no-till management in the Palouse region may not be feasible without substantial yield reductions. A reduced tillage system that utilizes some limited tillage appears to be a viable management alternative to conventional practices.

3671 Konstantinovic, J.; Malesevic, M. (Institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)) (1996) [Tillage and seed bed preparation for wheat under the conditions of lowered soil moisture]. *Obrada i predsetvena priprema zemljišta za pšenicu u uslovima smanjene vlažnosti zemljišta*. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts*. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadržaja p. 193. Institut za istraživanja u poljoprivredi "Srbija". (En, Sr). (AGRIS 97-060406).

3672 Kukula, S.; Krasowicz, S. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland)) (1995) [Comparison of winter wheat production technologies of different intensity level]. *Porównanie technologii uprawy pszenicy ozimej o różnej intensywności produkcji*. *Fragmenta Agronomica (Poland)* v. 12(4) p. 96-105. 5 tables; 5 ref. Polish. (AGRIS 97-074651).

The aim of research was to compare three winter wheat production technologies of different input levels. Results of large-area experiments conducted in 3 agricultural experimental stations in different regions of Poland in 1992-94 were used in the estimation. It was stated that



technologies of lower intensity level (I.E. reduced input) required lower direct costs but caused a decrease in grain yield. They can be recommended only on efficient farms of high soil fertility, well done tillage, with a very good forecrop.

3673 Prasad, J. (Central Inst. of Agricultural Engineering, Bhopal, Madhya Pradesh (India)) (1996) **A comparison between a rotavator and conventional tillage equipment for wheat-soybean rotations on a vertisol in Central India.** *Soil and Tillage Research (Netherlands)* v. 37(2-3) p. 191-199. 6 ref. English. (AGRI 97-074648).

3674 Sharratt, B.S. (North Central Soil Conservation Research Lab. USDA ARS, Morris, MN (USA)) (1996) **Tillage and straw management for modifying physical properties of a subarctic soil.** *Soil and Tillage Research (Netherlands)* v. 38(3-4) p. 239-250. 31 ref. English. (AGRI 97-074635).

3675 Sinclair, T.R. (Florida Univ., Gainesville, FL (USA). Agronomy Physiology Lab.); Amir, J. (1996) **Model analysis of a straw mulch system for continuous wheat in an arid climate.** *Field Crops Research (Netherlands)* v. 47(1) p. 33-41. 12 ref. English. (AGRI 97-074650).

## F08 CROPPING PATTERNS AND SYSTEMS

3676 Banik, P. (Agricultural Science Unit, Calcutta (India). Indian Statistical Inst.) (1996) **[Evaluation of wheat (*Triticum aestivum*) and legume intercropping under 1:1 and 2:1 row-replacement series system].** *Bewertung von Weizen (*Triticum aestivum*) + Leguminosen im Mischanbau in einem 1:1 und 2:1 Reihen System. Journal of Agronomy and Crop Science (Germany)* v. 176(5) p. 289-294. 4 tables; 12 ref. English. (AGRI 97-060510).

3677 Bocanegra Medel, Fernando; Carrillo Alfaro, Jose (1996) **[Competitive ability of eleven wheat varieties against oats].** *Habilidad competitiva de once variedades de trigo (*Triticum aestivum* L.) contra la avena (*Avena* spp.).* Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Fitotecnica. 74 p. Spanish. (AGRI 97-074670).

3678 Chan, K.Y. (Biological and Chemical Research Inst. NSW Agriculture, Rydalmere, N.S.W. (Australia)); Heenan, D.P. (1996) **The influence of crop rotation on soil structure and soil physical properties under conventional tillage.** *Soil and Tillage Research (Netherlands)* v. 37(2-3) p. 113-125. 25 ref. English. (AGRI 97-074720).

3679 Duer, I. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Crop Rotation) (1996) **[Mulching effect of catch crop on barley yield, soil water and nitrogen storage].** *Mulczujacy wpływ miedzyplonu na plonowanie jęczmienia jarego oraz zawartosc wody i azotanow w glebie. Fragmenta Agronomica (Poland)* v. 13(1) p. 29-43. 4 fig., 3 tables; 17 ref. Polish. (AGRI 97-074713).

Yielding effect of catch crops biomass was higher on loamy sand than on brown alluvial soil. Straw incorporation as even straw surface mulching during winter decreased 10% yield of barley. Surface plant biomass mulching and soil cultivation before barley sowing decreased its yield neither. Catch crop cultivation reduced soil moisture underneath in autumn, but mulching during winter increased soil water storage in sowing time spring barley. Soil nitrogen content after ending catch crop vegetation had been lower about 30%, comparing with soil without catch crop. Nitrogen release from plant residues incorporated with soil before winter was higher than from residues left on the surface.

3680 Eid, M.I. (Ministry of Agriculture, Cairo (Egypt). Horticulture Research Inst.); El Gazy, S.M. (1995) **Effect of intercropping safflower with broad bean on plant growth and yield.** *Menofiya Journal of Agricultural Research (Egypt)* v. 20(4) p. 1611-1625. 2 graph. 4 tables; 15 ref. English. (AGRI 97-074711).

3681 El Wakil, N.A. (1993) **Studies on intercropping between wheat and faba bean.** Zagazig Univ. (Egypt). Faculty of Agriculture. tables; Bibliography. 211 p. English. (AGRI 97-074753).

3682 Elliott, L.F. (USDA, ARS, National Forage Seed Production Research Center, Corvallis, OR.); Chevalier, P. (1996) **Diversification for new management systems opportunities in the Pacific Northwest.** *American journal of alternative agriculture (USA)* v. 11(2/3) p. 77-82. references. Paper

presented at the U.S.-Middle East Conference and Workshop on "Dryland Farming Systems and Technologies for a more Sustainable Agriculture" held October 18-23, 1993, Moscow, Idaho. English. (AGRI 97-074700).

Sustainable rainfed cropping systems are needed in the Pacific Northwest of the United States to reduce or eliminate wind and water erosion, improve soil quality, and control weeds with reduced chemical inputs. A grass seed cropping system is excellent for improving soil quality and for controlling erosion, and can be grazed by sheep to produce meat and wool. Tillage and residue management methods that create a rough surface to reduce wind and water erosion and increase water infiltration include: use of a chisel to create large clods; leaving residue on the surface; and use of the Paratill to shatter the soil to increase water infiltration with little disturbance of the soil surface. Including a legume in the rotation may help to break disease cycles, add N and C to the soil, and improve soil biological properties. The use of surface residues and tillage to control erosion and increase water infiltration may demand new approaches to weed control. Rhizobacteria that attack the roots of weeds but not of wheat may reduce the need for chemical herbicides. Research being conducted on these techniques in the Pacific Northwest of the United States and in other countries should soon result in guidelines for sustainable agricultural systems for the dryland, rainfed areas of the world.

3683 Gawronska Kulesza, A.; Suwara, J. (Warsaw Agricultural University (Poland). Dept. of Soil and Plant Cultivation); Brogowski, Z. (Warsaw Agricultural University (Poland). Dept. of Soil Science) (1995) **[Thirty eight years crop rotation and N-NO<sub>3</sub> content in soil].** *Wplyw wieloletniego zmianowania na zawartosc w glebach N-NO<sub>3</sub>. Polish Journal of Soil Science (Poland)* v. 28(1) p. 59-62. 4 tables; 8 ref. English. (AGRI 97-074740).

In a static field experiment, established in 1955 in Chylce on black earth, the following fertilizer combinations were compared: control, mineral - NPK, organic - farmyard manure, and 0.5 mineral NPK + 0.5 organic - farmyard manure. It was found that the applied mineral and organic-mineral fertilizers caused the most abundant yield with N-NO<sub>3</sub> in the soil during the spring season, but the nitrification processes were highest on the farmyard manure plots and some more were detected on the farmyard manure mixed with mineral NPK fertilizers.

3684 Ghazal, H.M.; Haloubi, A.N. (Aleppo univ. (Syria). faculty of agriculture); Osman, A.E. (Icarda, Aleppo (Syria)) (1994) **[A study on the performance and nutritional value of some Legumes in ley farming with Barley].** *Research journal of Aleppo university (Syria). Agricultural sciences series (no.22)* p. 9-22. 4 tables; 7 ref. Arabic. (AGRI 97-074704).

3685 Grzebisz, W. (University of Agriculture, Poznan (Poland). Dept. of Agricultural Chemistry); Gawronska Kulesza, A. (Warsaw Agricultural University (Poland). Dept. of Soil and Plant Cultivation) (1995) **[Effect of crop rotation on potassium forms and their bioavailability in a long-term trial on a black earth. Pt. 2. Four-course crop rotation].** *Wplyw zmianowania w doswiadczeniu wieloletnim na formy potasu w czarnej ziemi i ich biologiczna dostepnosc. Cz. 2. Zmianowanie czteropolowe. Polish Journal of Soil (Poland)* v. 28(2) p. 119-124. 3 fig., 3 tables; 7 ref. English. (AGRI 97-074746).

Effect of nine cycles of four-course crop rotation: potatoes, spring barley, red clover, and winter wheat on the status of total (6M HCL), non-exchangeable (1M boiling HNO<sub>3</sub>), exchangeable (NH<sub>4</sub> OAc), water soluble and Egner-Riehm K in black earth was investigated. The Egner-Riehm K was significantly dependent on exchangeable K pool. The multiple regression and the path coefficient analyses confirmed the importance of Kex for grain yield and K uptake by spring barley.

3686 Grzebisz, W. (University of Agriculture, Poznan (Poland). Dept. of Agricultural Chemistry); Gawronska Kulesza, A. (Warsaw Agricultural University (Poland). Dept. of Soil and Plant Cultivation) (1995) **[Effect of crop rotation on potassium forms and their bioavailability in long-term trial on a black earth. Pt. 1. Three-course crop rotation].** *Wplyw zmianowania w doswiadczeniu wieloletnim na formy potasu w czarnej ziemi i ich biologiczna dostepnosc. Cz. 1. Zmianowanie trojpolowe. Polish Journal of Soil Science (Poland)* v. 28(2) p. 111-117. 3 fig., 4 tables; 8 ref. English. (AGRI 97-074745).

Effect of twelve cycles of three-course crop rotation: potatoes, spring barley, winter rye on the status of total (6M HCL), non-exchangeable (1M boiling HNO<sub>3</sub>), exchangeable (1M NH<sub>4</sub> OAc) water soluble and Egner-

Riehm K in black earth was investigated. The Egner-Riehm K was significantly dependent on both exchangeable and non-exchangeable K pools. The multiple regression and the path coefficient analyses also showed that non-exchangeable pool of K plays an important role in its uptake and yield of spring barley.

3687 Hammel, J.E. (University of Idaho, Moscow, ID.) (1996) Water conservation practices for sustainable dryland farming systems in the Pacific Northwest. *American journal of alternative agriculture (USA)* v. 11(2/3) p. 58-63. references. Paper presented at the U.S.-Middle East Conference and Workshop on "Dryland Farming Systems and Technologies for a more Sustainable Agriculture" held October 18-23, 1993, Moscow, Idaho. English. (AGRIS 97-074715).

Water limits crop production in most of the Pacific Northwest wheat region. Effective tillage and residue management systems are required to conserve precipitation, which provides 60 to 70% of the water for crop needs during the growing season. Annual cropping systems with winter wheat grown in rotation with spring cereals and legumes are used where winter precipitation is sufficient (> 450 mm) to recharge the soil profile. A winter wheat-spring cereal-fallow system is common in areas receiving 330 to 450 mm annual precipitation. Where annual precipitation is less than 330 mm, a winter wheat-fallow system is used. Summer fallow is practiced on approximately 60% of the dry-farmed cropland. Frozen soil greatly influences overwinter water storage efficiency and contributes to runoff and erosion. Most erosion occurs on fall-seeded wheat fields. To meet soil and water conservation requirements, various tillage and residue management practices have been developed to account for the diversity and variability in soils and climate across the region. For long-term sustainability, dry-farming practices require both water conservation and residue management that effectively protect the soil. This paper details tillage and residue management practices employed to conserve soil and water and achieve stable crop production in dry-farmed regions of the Pacific Northwest.

3688 Hassan, M.T. (Ministry of Agriculture, Cairo (Egypt). Field Crop Research Inst.) (1994) Wheat production in rainfed agroforestry systems in Northern Egypt. 1. International Symposium on Silviculture of Protection Forestry in Arid Regions and the Agroforestry Potential. Alexandria (Egypt). 21-24 Mar 1994. *Proceedings of the first international symposium on silviculture*. Kandeel, S.A.E.; Nasr, T.A.; El-Adly, A.E.; Hassan, M.T. (eds.). Ministry of Agriculture, Cairo (Egypt). National Agricultural Research Project (NARP); USAID (USA); IUFRO, Vienna (Austria) p. 18-24. 1 table; 5 ref. English. (AGRIS 97-074752).

3689 Hendawy, S.H. (1995) Growing some natural forage species with *Acacia saligna* for increasing yield potentiality in Western Desert (Egypt). Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture. 27 tables; Bibliography: p. 127-138. 164 p. English. (AGRIS 97-074712).

3690 Kertikov, T. (Institut po Furazhite, Pleven (Bulgaria)) (1995) [Economical efficiency of the crop- accompanying of the crop- rotation maize- maize- maize for silage- barley]. *Ikonomicheska efektivnost ot upl"tnyavane to s mezhdinni kulturi na seitbooborota tsarevitsa-tsarevitsa- tsarevitsa za silazh- echemik*. Selskostopanska Akademiya, Sofia (Bulgaria). *Rasteniev"dni Nauki (Bulgaria)*. *Plant Science* v. 32(9-10) p. 116-119. 1 ill., 1 tables; 11 ref. Bulgarian. (AGRIS 97-060514).

3691 Kieffer, M. (1995) [Examinations about the differentiation of wheat from ecologically and conventionally farming]. Bonn Univ. (Germany). *Untersuchungen zur Unterscheidbarkeit von Weizen aus oekologischem und konventionellem Anbau* 217 p. German. (AGRIS 97-074728).

3692 Kurdali, F.; Sharabi, N.E. (1995) [Symbiotic dinitrogen fixation measurement in vetch barley mixed swards using N15 methodology]. Atomic energy commission, Damascus (Syria). AEC. 36 ref.; 15 tables. 46 p. Arabic. (AGRIS 97-074714).

3693 Maidl, F.X.; Haunz, F.X.; Panse, A.; Fischbeck, G. (Technische Univ. Muenchen, Freising (Germany). Lehrstuhl fuer Pflanzenbau und Pflanzenzuechtung) (1996) [Transfer of grain legume nitrogen within a crop rotation containing winter wheat and winter barley]. *Verwertung von Leguminosenstickstoff in einer Fruchtfolge mit Winterweizen und Wintergerste*. *Journal of Agronomy and Crop Science (Germany)* v. 176(1) p. 47-57. 3 ill., 5 tables; 23 ref. English. (AGRIS 97-060513).

3694 Mazurek, J.; Sulek, A. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland). Dept. of Cereal Crops) (1996) [Yield of spring wheat on different soils as affected by sowing density]. *Plonowanie pszenicy jarej na roznych glebach w zalezności od gestosci siewu*. *Pamiętnik Pulawski (Poland) (no.107)* p. 5-13. 5 tables; 10 ref. Polish. (AGRIS 97-074756).

Experiments were conducted in the years 1972-89. The response of the plants to sowing density was depending on soils. Significant effect was found only on soils of the good wheat-growing complex and of the very good rye-growing complex. The optimum sowing rate was 400 grains/square m on the soils of the very good wheat-growing complex and 500-600 grains/square m on the remaining soils. At delayed sowing date had to be increased up to 600 grains/square m on the good wheat-growing complex and up to 700 grains/square m on the very good rye-growing complex.

3695 Navarro Garza, Hermilo; Flores-Sanchez, Diego (1995) [Wheat productivity in a hardened volcanic soil "tepetate" under several rotational cropping]. *Productividad de trigo en suelo volcanico endurecido (tepetate) bajo diferente rotacion de cultivo*. 26. Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. *Proceedings of 26 National meeting of Soil Science*. Cd. Victoria, Tamaulipas, 1995]. *La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 195. Sociedad Mexicana de la Ciencia del Suelo. 1 cuadro; 1 fig.; 1 ref. Spanish. (AGRIS 97-074662).

3696 Papendick, R.I. (USDA, ARS, Washington State University, Pullman, WA.) (1996) Farming systems and conservation needs in the Northwest Wheat Region. *American journal of alternative agriculture (USA)* v. 11(2/3) p. 52-57. references. Paper presented at the U.S.-Middle East Conference and Workshop on "Dryland Farming Systems and Technologies for a more Sustainable Agriculture" held October 18-23, 1993, Moscow, Idaho. English. (AGRIS 97-074758).

The Northwest Wheat Region is a contiguous belt of 3.3 million ha in Idaho, Oregon and Washington. Its climate varies from subhumid (< 650 mm annual precipitation) to semiarid (<350 mm), with more than 60% of the annual occurring during the winter. Winter wheat yields range from a high of 8 t/ha in the wetter zones to a low of 1.5 t/ha in the drier zones. Winter wheat is grown in rotation with spring cereals and pulses where annual precipitation exceeds 450 mm; winter wheat-fallow prevails where annual precipitation is less than 330 mm. Tillage practices are designed to maximize infiltration and retention of water through soil surface and crop residue management. Because of the combination of winter precipitation, steep topography, and winter wheat cropping, much of the region is subject to a severe water erosion hazard, accentuated by freeze-thaw cycles that increase surface runoff and weaken the sod structure. Wind erosion is a major problem in the drier zones, where cover is less and sods are higher in sand. Residue management, primarily through reduced tillage and no-till systems, is the first defense against both wind and water erosion, but yields often are higher with conventional intensive tillage. Factors that limit yields with conservation farming include weed and disease problems and the lack of suitable tillage and seeding equipment strategies must shift from relying on traditional tillage methods to development of complete no-till systems. Spring cropping as a replacement for winter wheat also needs to be investigated. In some cases, tillage for water conservation must be made compatible with tillage for erosion control.

3697 Podlesny, J. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland). Dept. of Fodder Crops Cultivation) (1996) [Yielding of pea (*Pisum sativum* L.) in dependence upon sowing density of supporting plant - spring wheat]. *Plonowanie grochu siewnego (Pisum sativum L.) w zalezności od gestosci siewu rosliny podporowej - pszenicy jarej*. *Pamiętnik Pulawski (Poland) (no.107)* p. 39-51. 6 fig., 3 tables; 12 ref. Polish. (AGRIS 97-074733).

The field experiments were conducted in the years 1990-92. The total mean yield of pea seeds and grains of wheat was greater than the yield of pure sowing pea in the every experiment and was greater with the increase of wheat grains in the mixed sowing. The density of sowing spring wheat 100 grains/square m was the best for the pea cultivated with wheat both for the relatively high yield of pea seeds and small losses during harvest. Spring wheat variety Eta proved a good supporting crop

for the mixed sowing. Seeds of pea originated from the mixed sowing were less incidenced of fungi diseases than the seeds from the pure ones.

3698 Seif El Nasr, F.M.; Attia, Z.M.; Khalil, H.E.; Shams, S.A.A.; Kamel, A.S. (Ministry of Agriculture, Cairo (Egypt). Field Crops Research Inst.) (1996) **Growing long duration winter crop in cotton rotation**. *Annals of Agricultural Science, Moshtohor (Egypt)* v. 34(2) p. 501-512. 5 tables; 13 ref. English. (AGRI 97-074708).

3699 Shafi, M. (NWFP Agricultural Univ., Peshawar (Pakistan)); Khan, S.; Jamal, A. (1993) **Effect of intercropping on the yield, yield components and economic return of wheat and safflower crop**. *Sarhad Journal of Agriculture (Pakistan)* v. 9(4) p. 275-279. 3 tables, 6 ref. English. (AGRI 97-074755).

An experiment was carried out at Research Farm, NWFP, Agricultural University, Peshawar during 1986-87 to study the yield and yield components of wheat and Safflower sown alone and in combination under different planting patterns. Number of tillers per plant, number of grains per spike, 1000 grains weight and harvest index were not significantly increased in case of wheat crop. However grain yield (2471.5 kg/ha) and straw yield (8670.5 kg/ha) were increased in mono culture as compared with inter cropping. The number of grains/head, 1000 grains weight and grain yield of safflower was significantly increased in mono safflower, while head diameter and oil content was not significantly affected by various planting patterns. highest cost benefit ratio, net income from different rows strips were found economical. High gross profitability clearly showed the superiority of 3 rows strip of wheat and safflower in inter cropping over each sole cropping.

3700 Stojanovic, Z.; Dodik, D.; Stankovic, S. (Institut za istrazivanja u poljoprivredi "Srbija", Zajecar (Yugoslavia). Centar za poljoprivredna i tehnoloska istrazivanja) (1996) **[Soil cultivation systems and wheat sowing in dry conditions]. Sistemi obrade zemljišta i setva pšenice u susnim uslovima gajenja**. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts*. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadržaja p. 191. Institut za istrazivanja u poljoprivredi "Srbija". (En, Sr). (AGRI 97-060509).

3701 Subedi, KD. (1997) **WHEAT INTERCROPPED WITH TORI (BRASSICA CAMPESTRIS VAR. TORIA) AND PEA (PISUM SATIVUM) IN THE SUBSISTENCE FARMING SYSTEM OF THE NEPALESE HILLS**. *Journal of Agricultural Science*. 128(Part 3):283-289. English. [UNIV READING PLANT ENVIRONM LAB CUTBUSH LANE READING RG2 9AD BERKS ENGLAND].

A field experiment was carried out at Lumle Agricultural Research Centre (LARC) farm, Nepal, during the winter seasons of 1992/93 and 1993/94 in order to study the profitability of intercropping wheat (*Triticum aestivum* L.) with tori (*Brassica campestris* var. toria) and pea (*Pisum sativum* L.). A sole crop of wheat planted at 120 kg seed ha<sup>-1</sup> was compared with sole crops of tori and of pea planted at 8 kg ha<sup>-1</sup> and 60 kg seed ha<sup>-1</sup>, respectively, wheat + tori mixed-intercropped at 120:6, 120:4 and 120:2 kg seed ha<sup>-1</sup> and wheat + pea at 120:45, 120:30 and 120:15 kg seed ha<sup>-1</sup>. Results over the two seasons showed that the intercropping of wheat + pea was profitable in terms of overall grain yield, land advantage, monetary advantage, economic return and meeting the dietary requirements of the subsistence farmers, although the sole crop of pea gave the highest net return. Mixing pea with wheat did not reduce wheat yields in either year except when pea was sown at 45 kg seed ha<sup>-1</sup>, which reduced wheat yield significantly in the first season. For wheat + pea intercropping, sowing pea at 30-45 kg ha<sup>-1</sup> was the most profitable. The wheat + tori intercrop did not perform as well and was not as profitable as either sole crop. Intercropping of tori had a negative effect on wheat yield at all seed rates in the first year. [References: 12].

3702 Wallace, S.U. (Clemson Univ., Clemson, SC (USA). Dept. of Agronomy); Bacanamwo, M.; Palmer, J.H.; Hull, S.A. (1996) **Yield and yield components of relay-intercropped wheat and soybean**. *Field Crops Research (Netherlands)* v. 46(1-3) p. 161-168. 21 ref. English. (AGRI 97-074754).

## F30 PLANT GENETICS AND BREEDING

3703 GENETIC ENGINEERING COULD END ALUMINIUM BARRIER TO HIGHER WHEAT YIELDS (1997) *Outlook on Agriculture*. 26(1):55. English.

3704 [Resistance of adult wheat plant (*Triticum aestivum*) to yellow rust (*Puccinia striiformis* f. sp. tritici). Santa Catalina, Pichincha]. Resistencia de planta adulta en trigo (*Triticum aestivum*) a roya amarilla (*Puccinia striiformis* f. sp. tritici). Santa Catalina, Pichincha (1994) Instituto Nacional de Investigaciones Agropecuarias, Quito (Ecuador). Est. Exp. Santa Catalina. Departamento de Protección Vegetal. *Informe Anual Tecnico - INIAP (Ecuador)*. 1994 12 p. INIAP. Spanish. (AGRI 97-074799).

La roya amarilla causada por *Puccinia striiformis* f. sp. tritici constituye la principal enfermedad del trigo en Ecuador, pudiendo provocar pérdidas del rendimiento de hasta el 100 por ciento en variedades susceptibles. Se evaluaron 17 genotipos de trigo, preseleccionados por sus características de resistencia horizontal, incluyendo genotipos susceptibles y otros que perdieron su resistencia. La investigación se realizó en dos etapas, la primera en invernadero y la segunda en campo, en la Estación Experimental Santa Catalina INIAP, a 3058 msnm. Se concluye que la resistencia de planta adulta debe ser de naturaleza cuantitativa, y probablemente este controlada con genes menores aditivos que pueden ser duraderos, por lo que la acumulación de altos niveles de resistencia de planta adulta podría facilitarse. Para evaluar la resistencia de planta adulta puede realizarse en el campo evaluando la severidad en diferentes periodos ya sea en la hoja bandera, en la segunda hoja en toda la parcela, o midiendo sus componentes en el invernadero. Los componentes de la resistencia de planta adulta son el periodo de latencia, la frecuencia de la infección y el largo de la lesión. Por la respuesta al patógeno observada en años anteriores y su comportamiento en este ensayo, los genotipos Altar con un AUDPC P. de 489, un periodo de latencia de 22 días, y Atacazo con un AUDPC P. de 962, un periodo de latencia de 20 días, se reportan como genotipos con resistencia duradera a roya amarilla. Los genotipos Chimborazo y Cotopaxi con un AUDPC medido en la parcela de 1348 y 1413 respectivamente, a pesar de haber perdido el nivel de resistencia con el que originalmente fueron liberados, mantienen un nivel de resistencia residual, la cual seguramente es de naturaleza cuantitativa. Finalmente se aconseja continuar con la identificación de la presencia de nuevas razas fisiológicas de *Puccinia striiformis* f. sp. tritici en las zonas productoras de cereales y Realizar una investigación similar para el patosistema roya amarilla en cebada.

3705 Abd El Nour, N.A.R. (1995) **Breeding studies on common wheat, *Triticum aestivum* L.** Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture. 27 graph. 17 tables; Bibliography: p. 84-94. 98 p. English. (AGRI 97-075526).

3706 Abou Salama, A.M.; Ismail, A.A. (Assiut Univ. (Egypt). Faculty of Agriculture) (1995) **Application of multiple regression modelling based on some physiological and yield related traits in selection for yield in wheat**. *Assiut Journal of Agricultural Sciences (Egypt)* v. 26(3) p. 9-17. 3 tables; 12 ref. English. (AGRI 97-075524).

3707 Ahokas, H. (Plant Breeding Section, ARC, Jokioinen, Finland.); Uutela, P.; Erkkila, M.J.; Vahamiko, S. (1996) **Another source of genes with high beta-amylase activity in barley grain: Finnish landraces**. *Barley genetics newsletter (USA)* v. 25 p. 36-40. references. English. (AGRI 97-060772).

3708 Anon. (1995) **1995 Kansas performance tests with winter wheat varieties**. *Report of progress (Kansas Agricultural Experiment Station) (USA)*; no. 740 49 p. English. (AGRI 97-060821).

3709 Arabi, M.I.E. (1996) **[Determination of genetic change of some early maturing and semi-dwarf barley (*Hordeum* L.) mutants]**. Atomic energy commission, Damascus (Syria). AEC. 7 ref.; 3 tables. 25 p. Arabic. (AGRI 97-075245).

Back cross was made between the pure mutants line (Thibaut 240 (Gy)-64) and its mother cv. Thibaut. Hybrid seeds (FO), first hybrid plants (F1) and second segregating generation (F2) were obtained. These genotypes were used in one experiment to determine genetic control of early-maturing and semi-dwarf barley mutants. The results indicated that the



mutant possessed recessive gene for early maturity with very high heritability ( $H=96,4$ ).

3710 Ashoush, H.A.H. (1996) Analysis of diallel cross of some quantitative characters in common wheat, *Triticum aestivum* L. Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture. 16 graph. 20 tables; Bibliography: p. 158-167. 173 p. English. (AGRIS 97-075525).

3711 Ban, T. (Kyushu National Agricultural Experiment Station, Fukuoka, Japan.); Kawada, N. (1996) Linkage analysis of high pI esterase isozyme Est11 in barley. *Barley genetics newsletter* (USA) v. 25 p. 59-61. references. English. (AGRIS 97-060775).

3712 Benitez Riquelme, Ignacio (1996) [Selfed half-sib and full-sib progeny selection in wheat]. *Selección en progenies autofecundadas de medios hermanos y hermanos completos en trigo*. 16, Congreso de Fitogenética, Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 16. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 2 Cuadros; 1 ref. Spanish. (AGRIS 97-074835).

Three selfed half-sib and full-sib family selection methods in wheat were analyzed. Comparing the expected genetic gain per year of this methods, with the original methods (that use non inbred families), the former were 75 % more efficient, principally when the recombination was with harvest seed from the evaluation plot.

3713 Benitez Riquelme, Ignacio (1996) [Selfed Topcross progeny selection of S2 lines in wheat]. *Selección recurrente para ACG en líneas S2 en trigo*. 16, Congreso de Fitogenética, Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 17. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 1 Cuadro; 3 ref. Spanish. (AGRIS 97-074836).

A procedure is presented which will allow breeders of wheat to conduct topcross progeny selection in a population without large numbers of pollinations. The procedure is based on the use of the selfed topcross and S2 lines. The genetic efficiency per year of this method versus original method, was of the 25 %.

3714 Bernardo, A.; Luque, A.; Cuadrado, A.; Negro, A.; Jouve, N.; Soler, C. (1997) THE ASSESSMENT OF GENETIC VARIATION IN SPANISH PRIMITIVE CULTIVARS OF BARLEY, *HORDEUM VULGARE* L. BY A COMBINATION OF ISOZYMES AND HORDEINS. *Genetic Resources & Crop Evolution*. 44(3):217-226. English. [UNIV ALCALA DE HENARES DEPT CELL BIOL & GENET ALCALA DE HENARES 28871 SPAIN].

Five isozyme and endosperm reserve protein systems were analysed using electrophoretic techniques in order to investigate the genetic diversity of 222 accessions of Spanish, local varieties of barley, *Hordeum vulgare* L., maintained at the Centro de Conservación de Recursos Fitogenéticos of the I.N.I.A. (Alcala de Henares, Spain). The esterase (EST) isozymes provided more information than did the other systems analysed, showing a total of 14 variable markers. The cathodic peroxidases (CPX) and acid phosphatases (ACPH) were also polymorphic. Malate dehydrogenase (MDH) and glutamate oxaloacetate transaminase (GOT) were monomorphic. The hordeins showed patterns of up to 15 bands, the majority of which were very useful in distinguishing genotypes. 17.2% of accessions showed a uniform genotype, 29.8% showed practically identical genotypes and 53% showed mixtures of different genotypes. It is noteworthy that the use of only two systems (EST and hordeins) and the analysis of only six loci (Est-1, Est-2, Est-4, Hor-1, Hor-2 and Hor-3) is sufficient to reveal the genetic diversity of the collection. [References: 43].

3715 Borner, A. (Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben, Germany.) (1996) GA response in semidwarf barley. *Barley genetics newsletter* (USA) v. 25 p. 24-26. references. English. (AGRIS 97-060767).

3716 Borner, A. (Institut für Pflanzengenetik und Kulturpflanzenforschung, Germany.); Korzun, V. (1996) Genetical studies of two barley mutants differing in their GA response. *Barley genetics newsletter* (USA) v. 25 p. 27-29. references. English. (AGRIS 97-060768).

3717 Bowman, D.T. (North Carolina State University.) (1995) Measured crop performance. Small grains: 1995. *Research report* (North Carolina State University. Dept. of Crop Science) (USA); no. 153 39 p. English. (AGRIS 97-060886).

3718 Bryan, G.J.; Collins, A.J.; Stephenson, P.; Orry, A.; Smith, J.B.; Gale, M.D. (1997) ISOLATION AND CHARACTERISATION OF MICROSATELLITES FROM HEXAPLOID BREAD WHEAT. *Theoretical & Applied Genetics*. 94(5):557-563. English. [SCOTTISH CROP RES INST CROP GENET DEPT DUNDEE DD2 5DA SCOTLAND].

The development of large panels of simple-to-analyse genetic markers for tagging agronomically important genes and diversity studies in hexaploid bread wheat is an important goal in applied cereal genetic research. We have isolated and sequenced over 200 clones containing microsatellites from the wheat genome and have tested 153 primer pairs for genetic polymorphism using a panel of ten wheat varieties, including the parents of our main mapping cross. A subset comprising 49 primer pairs detects 76 loci, of which 74 can be unequivocally allocated to one of the wheat chromosomes. A relatively low frequency of the loci detected are from the D genome, and these loci show less polymorphism than those from the A and B genomes. Generally, the microsatellites show high levels of genetic polymorphism and an average of 3.5 alleles per locus with an average polymorphism information content (PIC), value of 0.51. The observed levels of polymorphism are positively correlated with the length of the microsatellite repeats. A high proportion, approximately two-thirds, of primer pairs designed to detect simple sequence repeat (SSR) variation in wheat do not generate the expected amplification products and, more significantly, often generate unresolvable PCR products. In general, our results agree closely with those obtained from other recent studies using microsatellites in plants. [References: 20].

3719 Cagiran, M.I. (Akdeniz University, Antalya, Turkey.); Yildirim, M.B.; Tugay, M.E. (1996) A gigantum mutant in 'Quantum' barley. *Barley genetics newsletter* (USA) v. 25 p. 81-82. references. English. (AGRIS 97-060779).

3720 Calixto Cruz, Neftali (1996) [Genetic improvement on tolerant drought wheats by cross-over]. *Mejoramiento genético en trigos tolerantes a la sequía por retrocruzamiento*. 16, Congreso de Fitogenética, Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 22. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 1 Cuadro; 3 ref. Spanish. (AGRIS 97-074841).

Two wheat drought-tolerant lines were crossed with six commercial varieties to obtain the agronomically best genotype with good yield through the cross-over method. The lines will be recurrents and the six varieties will be donors. In this first cross-over were obtained 140 F1 progenies.

3721 Camargo, C.E.O.; Ferreira Filho, A.W.P. (Instituto Agronomico Campinas, Sao Paulo (Brazil)); Tulmann Neto, A. (1995) Genetic diversity in wheat and breeding for tolerance to acid soils. *International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement*. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. *Proceedings. Proceedings Series* (IAEA) p. 321-333. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM-340/5. English. (AGRIS 97-075518).

3722 Cantone, F. (Ministero delle Risorse Agricole, Alimentari e Forestali, Rome (Italy). Direzione Generale della Produzione Agricola); Perenzin, M.; Minoia, C.; Redaelli, R.; Delogu, G.; Biancolatte, E.; Pasquini, M.; Galterio, G.; Ninno, G. de; Boggini, G.; Borghi, B. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)); Snidaro, M. (Ente Regionale di Sviluppo Agricolo per il Friuli Venezia Giulia (ERSA), Gorizia (Italy)); Padovan, S. (Istituto di Genetica e Sperimentazione Agraria N. Strampelli, Lonigo, Vicenza (Italy)); Frattini, F.; Bianchi, M. (Ente Nazionale Sementi Elette (ENSE), Milan (Italy)); Concar, L. (Azienda Sperimentale Stuard, S. Pancrazio, Parma (Italy)); Porfiri, O. (Centro di Miglioramento Genetico Vegetale N. Strampelli, Abbazia di Fiadra, Macerata (Italy)) (1996) [The new varieties of bread wheat - durum wheat and barley registered in the Italian National Catalogue in the year 1995]. *Le nuove varietà di cereali*

vernini iscritte al Registro Varietale nel 1995 [Italia]. *Sementi Elette (Italy)* v. 42(5) p. 3-14. 13 tables; 6 ref. Italian. (AGRI 97-060663).

The results of the variety trials carried out in several locations in the seasons 1993-94, 1994-95 are tabulated. Five winter barley varieties evaluated in 14 locations, 3 spring barley evaluated in 9 locations, 4 bread wheat varieties evaluated in 12 locations, 9 varieties of durum wheat evaluated in 13 locations have been registered in 1995 in the Italian National Catalogue [Vengono presentati i risultati delle prove varietali condotte in numerose località italiane nelle stagioni 1993-94 e 1994-95. Nel 1995 sono state iscritte nel Registro Varietale italiano 5 varietà di orzo autunnale valutate in 14 località, 3 varietà di orzo primaverile valutate in 9 località, 4 varietà di frumento tenero valutate in 12 località, 9 varietà di frumento duro valutate in 13 località].

3723 Cao, W.G.; Scoles, G.J.; Hucl, P. (1997) THE GENETICS OF RACHIS FRAGILITY AND GLUME TENACITY IN SEMI-WILD WHEAT. *Euphytica* 94(1):119-124. English. [UNIV SASKATCHEWAN DEPT CROP SCI & PLANT ECOL 51 CAMPUS DR SASKATOON SK S7N 5A8 CANADA].

The inheritance of rachis fragility and glume tenacity in semi-wild wheat was studied in an attempt to help establish the taxonomic status and genetic origin of semi-wild wheat. Progenies of crosses and backcrosses of semiwild wheat with the cultivar Columbus (common wheat) indicated that the fragile rachis and non-free-threshing character of semi-wild wheat were dominant to the tough rachis and free-threshing character of common wheat. F-2 and backcross data indicated that the rachis fragility and glume tenacity of semi-wild wheat were each controlled by a single gene in the cross of semi-wild wheat with Columbus. In the cross of semi-wild wheat with *Triticum aestivum* spp. spelta, the F-2 and F-3 population did not segregate for glume tenacity, but did segregate for rachis fragility. The F-2 and backcross data suggest that three genes interact to control three types of rachis fragility, i.e. semi-wild wheat-type, spelta-type and the tough rachis of common wheat. Semi-wild wheat differs from common wheat in rachis fragility and glume tenacity. This wheat also differs from other wheats with fragile rachis and tenacious glumes (*T. aestivum* ssp. spelta, macha and vavilovii) in the pattern and degree of rachis disarticulation. We conclude that semi-wild wheat is likely a subspecies within *T. aestivum* at the same taxonomic level as spp. spelta, macha and vavilovii. [References: 17].

3724 Cervantes Santana, Tarcicio (1996) [Selection in wheat varieties obtained by irradiation]. *Selección en variedades de trigo obtenidas por irradiación*. 16, Congreso de Fitogenética. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 23. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 2 Cuadros; 2 ref. Spanish. (AGRI 97-074842).

Selection was practiced for greater grain size and density in CP-1, CP-2 and CP-3 wheat varieties, obtained in M10 from Salamanca variety by irradiation and selection. High yielding lines were obtained, superior to these four varieties.

3725 Cheng, S.H. (Nevada Univ., Reno, NV (USA). Dept. of Biochemistry); Keller, B.; Condit, C.M. (1996) Common occurrence of homologues of petunia glycine-rich protein-1 among plants. *Plant Molecular Biology (Netherlands)* v. 31(1) p. 163-168. 31 ref. English. (AGRI 97-075531).

3726 Cholakova, N. (Institut po Genetika "Akad. D. Kostov", Sofia (Bulgaria)) (1994) [Use of barley hordein spectra as markers of variety identification]. *Izpolzvanie na khordeinovite spektri na echemika kato markeri za sortova identifikatsiya*. B'lgarska Akademiya na Naukite Sofia (Bulgaria). *Genetika i Seleksiya (Bulgaria)*. *Genetics and Breeding* v. 27(3-4) p. 170-176. 2 ill., 2 tables; 13 ref. Bulgarian. (AGRI 97-060759).

3727 Christopher, D.A. (Hawaii Univ., Honolulu, HI (USA). Dept. of Plant Molecular Physiology) (1996) Leaf development and phytochrome modulate the activation of psbD-psbC transcription by high-fluence blue light in barley chloroplasts. *Photosynthesis Research (Netherlands)* v. 47(3) p. 239-251. Bibliography (58 ref.). English. (AGRI 97-075243).

3728 Cuellar T, H. (1996) [Stability of yield of the genotypes of wheat and triticale in the seasonal high plateau]. *Estabilidad del rendimiento de genotipos de trigo y triticale en el altiplano temporalero*. 16, Congreso de

Fitogenética. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 21. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 1 Cuadro; 4 ref. Spanish. (AGRI 97-074840).

With regard to selection genotypes of wheat and triticale for the seasonal zone of the High Plateau during the cycle Spring-Summer '88, 49 genotypes of wheat and triticale were evaluated and it was found that the genotype that was prominent by its potentiality of yield, overcoming widely the regional witness was the triticale lines MZA-CML 202/IGA, on the other hand the genotypes that were steady and prominent by their high yield were Penjamo T-62, Caborca T-79 and the wheat line MAYA 74-PVN76.

3729 Dencic, S.; Mladenov, N.; Roncevic, P.; Pankovic, L.; Djuric, V. (Naucni institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)) (1997) [Genetic and production potentials of wheat cultivars developed in Novi Sad (Yugoslavia)]. *Genetski i proizvodni potencijali novosadskih [jugoslovenskih] sorti pšenice*. 31. seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naucni institut za ratarstvo i povrtarstvo (Yugoslavia)* (no.29) p. 195-203. 2 graphs; 3 tables; 24 ref. Serbian. (AGRI 97-075519).

In the paper are presented results which show the genetic potential of grain yield, bread-making quality and adaptability of wheat cultivars grown in different periods in Yugoslavia. In order to elucidate genetic potential, the maximum value of grain yield and bread-making quality parameters for each cultivar have been chosen from microtrials data. Stability of the cultivars have been calculated from data based on the three years and five locations. The results show that new wheat cultivars have performed significantly better than older cultivars.

3730 Diaz S, Fidel Rene; Borodanenko, A. (1996) [Wheat x maize crosses for the production of wheat double haploids (*Triticum aestivum* L.)]. *Cruzas de trigo x maíz para la producción de dihaploides de trigo (Triticum aestivum L.)*. 16, Congreso de Fitogenética. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 12. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 2 Cuadros; 3 ref. Spanish. (AGRI 97-074832).

Crosses between wheat and maize were carried out, some ears had a marker (2 florets in the bottom of the ear). The fertilization percentages between ears with marker and with no marker showed great differences (2.58 fold than with no marker). Some plants obtained from the embryos rescued were treated with colchicine. Plants with no colchicine were sterile and were different to those treated with colchicine, on some "seeds" were obtained. All the seeds obtained were sown and produced fertile plants. The technique of wheat X maize crosses could be a great tool for wheat improvement programmes.

3731 Dimitrijevic, M. (Poljoprivredni institut, Novi Sad (Yugoslavia). Institut za ratarstvo i povrtarstvo); Petrovic, S.; Kraljevic Balalic, M.; Mladenov, N. (1997) [The components of phenotypic variability and the influence of plant height on grain weight per plant in wheat (*Triticum aestivum* ssp. vulgare)]. *Komponente fenotipske varijabilnosti i uticaj visine na masu zrna po biljci pšenice (Triticum aestivum ssp. vulgare)*. 31. seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naucni institut za ratarstvo i povrtarstvo (Yugoslavia)* (no.29) p. 261-267. 2 graphs; 3 tables; 7 ref. Serbian. (AGRI 97-075535).

There were twenty wheat varieties originated from different geographical regions, examined for the components of phenotypic variability and distances, as well as, mutual relationship between plant height and grain weight per plant. Genetic components of total phenotypic variance played greater role in phenotype formation of both examined traits. However, the influence of the environmental variance, was more expressive in grain weight per plant (40), than in plant height (9). A trend of negative correlation was observed for two studied traits. Cluster analysis revealed three distinctive groups of wheat varieties, according to plant height and grain weight per plant.

3732 Doust, M.A.; Boggini, G. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)); Pecetti, L. (Istituto Sperimentale per le Colture Foraggere, Lodi (Italy)); Lombardo, G.M. (Catania Univ. (Italy). Istituto di Agronomia

Generale e Colture Erbacee) (1996) [Characterization of Triticum durum Desf. genotypes with high yield ability in semi-arid environments (Sicily)]. Caratterizzazione di genotipi di Triticum durum Desf. di elevata capacita' produttiva in ambienti semi-aridi [Sicilia]. Sementi Elette (Italy) v. 42(1) p. 7-10. 2 tables; 16 ref. Italian. (AGRIS 97-061101).

Five durum wheat genotypes of exotic origin performed consistently well for three seasons in Eastern Sicily. Their morpho-physiological features were compared with those of the whole germplasm collection examined and of Simeto, a variety particularly adapted to the environment of evaluation. Different plant architectures in the five genotypes attained similar good and stable yields. Although comparable with Simeto for yield levels, the five lines were remarkably different from it for other traits. Widening the existing, the rather narrow genetic basis of the Italian varieties by introgressing the variation associated with selected alien germplasm could be envisaged [Cinque genotipi di frumento duro di origine esotica hanno conseguito buoni risultati durante tre annate nella Sicilia orientale. Le loro caratteristiche morfo-fisiologiche sono state confrontate con quelle dell'intera collezione di germoplasma analizzata e con quelle di Simeto, una varieta' particolarmente adattata all'ambiente considerato. Le differenti architetture della pianta nei cinque genotipi hanno consentito l'ottenimento di risultati produttivi simili e stabili. Sebbene paragonabili a Simeto per i livelli produttivi, le cinque linee risultavano marcatamente differenti da questa per gli altri caratteri. Si potrebbe prevedere di ampliare la base genetica piuttosto limitata delle varieta' italiane mediante introgressione della variazione associata con germoplasma selezionato estraneo].

3733 Eissa, A.G.M. (King Saud Univ., Al Qassim (Saudi Arabia). Faculty of Agriculture and Veterinary Medicine) (1996) Improving earliness, grain weight and yield of spring wheat via selection among and within F3 families. Bulletin of Faculty of Agriculture, Cairo Univ. (Egypt) v. 47(4) p. 541-552. 5 tables; 16 ref. English. (AGRIS 97-075522).

3734 Elhaddad, L.; Sarrafi, A.; Fabre, J.L.; Aussenac, T. (1996) GENETIC CONTROL OF SOME POLYMERIC GLUTENIN FRACTIONS IN HEXAPLOID WHEAT (TRITICUM AESTIVUM). Plant Breeding. 115(6):514-516. English. [INP ENSAT BAP LAB BIOTECHNOL & AMELIORAT PLANTES UA INRA 145 AVE DE MURET F-31076 TOULOUSE FRANCE].

Reciprocal crosses were made between seven different hexaploid wheat genotypes. Hybrid kernels and their parents were used to determine the amount of polymeric glutenin fractions by size-exclusion highperformance liquid chromatography (SE-HPLC) analysis. Quantitative aspects of the genetic control for various glutenin fractions were investigated through diallel cross analysis. The association between the potential effect on hexaploid wheat quality of various allelic types and the quantitative expression of the polymeric glutenin fractions was confirmed. Significant average heterosis effects were demonstrated for insoluble glutenin (pFi), total soluble and insoluble glutenin (pF1 + pF2 + pFi) and the ratio of soluble to insoluble glutenin, (pF1 + pF2)/pFi. Some genotypes showed significant positive or negative combining abilities and general reciprocal effects for the glutenin fractions studied. For gluten quality, 'Qualital' was the best combiner for determining an optimal glutenin composition (high values for pFi and pF1 + pF2 + pFi and low values for pF1/pF2 and (pF1 + pF2)/pFi, respectively). These results should be of great interest in breeding programmes aimed at improving hexaploid wheat quality. [References: 25].

3735 Endo, T.R. (Kyoto University, Kyoto, Japan.); Gill, B.S. (1996) The deletion stocks of common wheat. The Journal of heredity (USA) v. 87(4) p. 295-307. references. English. (AGRIS 97-061098).

Chromosomal breaks occurred in the progeny of a common wheat (Triticum aestivum L. em Thell; 2n = 6x = 42, genome formula AABBDD) cultivar Chinese Spring with a monosomic addition of an alien chromosome from Aegilops cylindrica Host (2n = 4x = 28, CCDD) or A. triuncialis L. (2n = 4x = 28, UUC) or a chromosomal segment from A. speltoides Tausch (2n = 2x = 14, SS). We identified 436 deletions by C-banding. The deletion chromosomes were transmitted stably to the offspring. We selected deletion homozygotes in the progeny of the deletion heterozygotes and established homozygous lines for about 80% of the deletions. We failed establish homozygous lines for most of the deletions in the short arm of chromosome 2A and for all deletions in the short arm of chromosome 4B, because plant homozygous for these

deletions were sterile. We could not obtain any homozygotes for larger deletions in the long arms of chromosomes 4A, 5A, 5B, and 5D. The deletion stocks showed variations in morphological, physiological, and biochemical traits, depending on the size of their chromosomal deficiency, and are power tools for physical mapping of wheat chromosomes.

3736 Favela, S. R.; Gutierrez del Rio, Emiliano (1996) [Wheat productivity in high risk systems applying a model of the agronomic stability]. Productividad de trigo aplicando un modelo de estabilidad agronomica. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 20. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Cuadro; 1 Graf.; x3ref. Spanish. (AGRIS 97-074839).

Twelve wheat genotypes were studied in three locations of Mexico. The stability technique parameters methods were developed using Eberhart and Russell (1). It was found that six materials show adaptation to the three testing locations and two of them became to be the best (AN-1447 and AN-V47-114), due to its stability consistency and high yield.

3737 Fedak, G. (Agriculture and Agri Food Canada, Ottawa, Ontario.) (1996) Coordinator's report: Chromosome 7. Barley genetics newsletter (USA) v. 25 p. 100-101. references. English. (AGRIS 97-060785).

3738 Fedak, G.; Armstrong, K.; Ji, W. Q.; Petroski, R. (Plant Research Centre, Ottawa, Ontario (Canada). Central Experimental Farm) (1995) Genome analysis of partial amphiploids by means of in situ hybridization. International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. Proceedings. Proceedings Series (IAEA) p. 51-64. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM/340/8. English. (AGRIS 97-075516).

3739 Fennell, S.; Ginkel, M. van; Luna, B.; Brito R, M.; Hernandez, R.; Hoisington, D.; Bohorova, N. (1996) [Towards the production of transgenic bread wheat with enhanced disease resistance]. Avances en la produccion de trigo harinero transgenico con incremento de resistencia a enfermedades. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 28. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 5 ref. Spanish. (AGRIS 97-074847).

After screening forty-eight elite CIMMYT bread wheats for their ability to regenerate plants in vitro, four have been selected for transformation studies. Using microprojectile bombardment, putative transgenic plants have been produced using marker/reporter gene constructs as well as those containing anti-fungal genes (chitinase, glucanase, ribosome inhibiting protein). Molecular test on these plants are underway.

3740 Forster, B.P. (Scottish Crop Research Institute, Dundee, UK.) (1996) Co-ordinator's report: Chromosome 4. Barley genetics newsletter (USA) v. 25 p. 93-95. references. English. (AGRIS 97-060783).

3741 Forster, B.P.; Packniyat, H.; Simpson, C.G.; Handley, L.L. (Scottish Crop Research Inst., Invergowrie (United Kingdom)) (1995) Genetic control of salt tolerance in barley. International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. Proceedings. Proceedings Series (IAEA) p. 347-353. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM-340/36. English. (AGRIS 97-075237).

3742 Fraga Mancillas, Homero; Gutierrez, E. (1996) [Stability in nine genotypes of wheat]. Parametros de estabilidad en nueve genotipos de trigo. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 19. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Cuadro; 1 Fig.; 3 ref. Spanish. (AGRIS 97-074838).

Nine genotypes of wheat were evaluated in four environments using the Eberhart and Russell's stability method for characterizing adaptation. Results indicate that three of the genotypes showed a stable behavior and two of these have a most yield (AN-1461 and AN-1445).

3743 Franckoberaspach, SL.; Keller, B. (1997) CONSEQUENCES OF CLASSICAL AND BIOTECHNOLOGICAL RESISTANCE BREEDING FOR FOOD TOXICOLOGY AND ALLERGENICITY [Review]. *Plant Breeding*. 116(1):1-17. English. [SWISS FED RES STN AGROECOL & AGR DEPT RESISTANCE & QUAL BREEDING RECKENHOLZSTR 191 CH-8046 ZURICH SWITZERLAND].

The first food products derived from transgenic plants that are resistant to diseases, insects or viruses are now reaching the market and there is growing public concern about problems of allergenicity and toxicological changes in such transgenic food plants. We review the modifications being carried out or envisaged in molecular resistance breeding and specifically consider the allergenic and toxicological potential of the gene products used. Several protein families that contribute to the defence mechanisms of food plants have members which are allergens or putative allergens and some of these proteins are used in molecular approaches to increase resistance. These include alpha-amylase and trypsin inhibitors, lectins and pathogenesis-related proteins. An assessment procedure to avoid the transfer of such allergens is described. The source of the transgene is of great importance for the application of immunological assays. In addition to putative changes in the allergenic potential, the toxicological implications of classical and molecular resistance breeding are discussed. Several 'self defence' substances made by plants are highly toxic for mammals, including humans. Examples of molecular approaches that could be of toxicological concern are given. The source of the transgene is of no relevance in assessing the toxicological aspects of foods from transgenic plants. Food safety can also be severely influenced by invading pathogens and their metabolic products. This may result in a trade-off situation between 'nature's pesticides' produced by transgenic plants or varieties from traditional breeding programmes, synthetic pesticides and mycotoxins or other poisonous products of pests. [References: 210].

3744 Franckowiak, J.D. (North Dakota State University, Fargo, ND.) (1996) Coordinator's report: Chromosome 2. *Barley genetics newsletter (USA)* v. 25 p. 88-90. references. English. (AGRIS 97-060781).

3745 Franckowiak, J.D. (North Dakota State University, Fargo, ND.) (1996) Coordinator's report: Semidwarf genes. *Barley genetics newsletter (USA)* v. 25 p. 112. references. English. (AGRIS 97-060794).

3746 Fritsch, R.; Hammer, K. (eds.); Holubec, V. (1996) [Collecting of germplasm with emphasis on Triticeae in Asia]. [Sammlung von pflanzengenetischen Ressourcen in Asien mit besonderer Berücksichtigung der Triticeae]. Internationales Festkolloquium "anlässlich des 65. Geburtstages von Dr. Peter Hanelt". Gatersleben (Germany). 5-6 Dec 1995. Informationszentrum fuer Genetische Ressourcen, Bonn (Germany); Zentralstelle fuer Agrardokumentation und -information, Bonn (Germany).. *Schriftenreihe des Informationszentrums fuer Genetische Ressourcen (IGR) (Germany)*; v. 4 p. 203-216 13 p. IGR, ZADI. 1 ill., 2 tables, 3 maps; 3 ref. (En, De). (AGRIS 97-075033).

Es wird ueber zwei Sammelreisen nach Asien (Mongolei und Kamtschatka) berichtet, von denen pflanzengenetische Ressourcen meist von Wildpflanzen der Triticeae fuer die Genbank von Tschechien und fuer Spezialkollektionen mitgebracht wurden. Im Bericht werden die Umweltbedingungen und die Flora beschrieben und die Verbreitung von wilden Triticeae-Taxa auf Karten vorgestellt. Two germplasm collecting expeditions to Asia, to Mongolia and Russian Kamchatka are described. Generally useful germplasm with a special emphasis to the tribe Triticeae mainly of wild origin, was collected for the Czech Gene Bank and specialised collections. Environmental conditions and flora are mentioned. Distribution of wild Triticeae grasses along the expedition route is shown on maps.

3747 Fritsch, R.; Hammer, K. (eds.); Perrino, P. (1996) [Collection and use of genetic resources of Triticum]. [Sammlung und Nutzung der genetischen Ressourcen von Triticum]. Internationales Festkolloquium "anlässlich des 65. Geburtstages von Dr. Peter Hanelt". Gatersleben (Germany). 5-6 Dec 1995. Informationszentrum fuer Genetische Ressourcen, Bonn (Germany); Zentralstelle fuer Agrardokumentation und -information, Bonn (Germany).. *Schriftenreihe des Informationszentrums fuer*

*Genetische Ressourcen (IGR) (Germany)*; v. 4 p. 179-202 23 p. IGR, ZADI. 1 ill., 8 tables; 46 ref. (En, De). (AGRIS 97-075515).

Zur Verbesserung der kultivierten Weizen-Arten geeignete Taxa von Triticum und anderen Gattungen der Triticeae werden hinsichtlich ihrer geographischen, taxonomischen und genetischen Umgrenzung charakterisiert. Obwohl grossere Teile der genetischen Mannigfaltigkeit dieser Taxa bereits gesammelt und genutzt worden sind, muss noch viel getan werden, um nützliche Gene von wilde auf kultivierte Arten zu uebertragen. Die genaue Analyse vorhandener Kollektionen, die Entwicklung neuer Gen-Transfer-Techniken sowie Untersuchungen darueber, ob neue Weizentypen fuer neue Landwirtschaftsregionen geschaffen werden koennen, erfordern noch einen grossen Forschungsaufwand. In diesem Zusammenhang muss die Rolle der Genbanken neu durchdacht werden. Geographical, taxonomic and genetical borders of the genus Triticum, including other genera of the Triticeae, are tentatively described with the aim to show the potentiality of wild relatives for further improvement of the cultivated wheats. A large amount of genetic resources, both cultivated and wild have already been collected, though a lot remains to be done for transferring useful genes from wild to cultivated species. Yet, intensive research is needed for screening germplasm collections, for developing new gene transfer techniques and to explore possibilities for developing new wheat crops for new agricultural areas. In this context it is necessary to define or redefine the role of gene banks.

3748 Gebremariam, H.; Larter, EN. (1996) GENETIC RESPONSE TO INDEX SELECTION FOR GRAIN YIELD, KERNEL WEIGHT AND PER CENT PROTEIN IN FOUR WHEAT CROSSES. *Plant Breeding*. 115(6):459-464. English. [AGR & AGRI FOOD CANADA EASTERN CEREAL & OILSEED RES CTR OTTAWA ON K1A 06C CANADA].

Quantitative genetic theory was used to investigate selection differentials, expected and observed direct and correlated responses to simultaneous improvement of grain yield, kernel weight, and grain protein content in F-3 and F-4 populations of four spring wheat (*Triticum aestivum* L.) crosses. Selection in the F-3 generation based on the Smith-Hazel index (SH) and yield was found to be superior to the other methods studied in identifying high-yielding lines, but resulted in substantial decrease in grain protein level. Consequently, a 1.0% increase in protein from selection for protein depressed grain yield as much as 536 kg/ha below the population mean, reducing the expected yield gains per generation selection cycle by 250%. The weight-free indices (EW), particularly the index involving only yield and kernel weight (EW3) and its linear approximation (EW4), and the desired gains indices were effective in improving protein content but were less efficient in selecting top-yielding lines. Selection in the opposite direction using truncation of the lowest 10% of the population based on weight-free-index involving yield, kernel weight and protein (EW2) reduced all traits significantly compared with the mean of the unselected population indicating the effectiveness of the unweighted selection index. The observed genetic gains (Ra) from selection based on yield, the SH, EW3 and EW4 indices were slightly lower than the expected advances per cycle (R) in populations from crosses 'Sinton' x 'Glenlea' (C1), 'Glenlea' x 'NB505' (C2), and 'A2P5' x 'NB320' (C6) (Ra/R = 70 to 85%) but were higher in cross 'NB505' x 'A2P5' (C5) (Ra/R = 126 to 143%). It was concluded that weight-free and the desired gains indices can be used to improve wheat grain yield and grain protein simultaneously in F-3 generation selection, as revealed by response to selection measured in the F-4 generation. [References: 26].

3749 Getahun Mulat; Dibaba Damesa (Plant Genetic Resources Centre, Addis Ababa (Ethiopia)) (1996) Collecting germplasm in the North and West Shewa administrative regions of Ethiopia. *Plant Genetic Resources Newsletter (IPGRI/FAO). Bulletin des Ressources Phytogenetiques (IPGRI/FAO); Noticiario de Recursos Fitogeneticos (IPGRI/FAO)* (no. 105) p. 39-41. English. (AGRIS 97-075250).

3750 Ghanem, E.H.; Ali, A.A.; Hanna, N.S.; Mahmoud, S.K.; Sabry, S.R.S.; Abd El Aleem, M.M.; Zaid, H.M.M.; Moussa, A.M.; Abd El Majeed, S.A. (Ministry of Agriculture, Cairo (Egypt). Field Crops Research Inst.); Sherif, S. (1996) Grain yield and stability of the new bread wheat, *Triticum aestivum* L. cultivar Sids 1 in different agroclimatic zones of Egypt. *Bulletin of Faculty of Agriculture, Cairo Univ. (Egypt)* v. 47(4) p. 565-575. 3 graph. 3 tables; 6 ref. English. (AGRIS 97-075523).



3751 Gill, B.S.; Friebe, B.; Gill, K.S. (Kansas State Univ., Manhattan (USA). Wheat Genetics Resource Center); Endo, T.R. (1995) Chromosomal engineering and crop improvement in bread wheat. International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. Proceedings. *Proceedings Series (IAEA)* p. 171-177. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM/340/44. English. (AGRIC 97-075533).

3752 Goncharov, NP.; Kononov, AA.; Chikida, NN. (1997) GENETIC VARIATION AT THE GPI-1 LOCI AMONG AEGILOPS AND TRITICUM GENERA AND PHYLOGENY OF POLYPLOID WHEATS. *Zhurnal Obshchei Biologii*. 58(2):75-79. English. [RUSSIAN ACAD SCI INST CYTOL & GENET NOVOSIBIRSK 630090 RUSSIA].

The compound nature of the Gpi-1 loci among polyploid, including Saratovskaya 29 aneuploid stocks, and diploid Triticum and Aegilops species, the A, B, and D genomes donors of common wheat, was studied. Diploid species produced single and multibanded electrophoretic zymograms of glucose phosphate isomerase (GPI), namely three variants in T. urartu, the A(u) genome donor, and four in the goatgrass species of the Sitopsis section, the putative donors of the B and G genomes. Being monomorphic, Ae. tauschii, the D genome donor, produce the one-banded CC type. All the studied tetraploid species carrying the AB genome showed the identical three-banded BD type. Polymorphism was observed among the ABD genome hexaploids, i.e., 1R(1B) wheat rye chromosome substitution and 1RS-1BL chromosome translocation cultivars or aneuploid stocks in common wheat. The Gpi-1 bands were compared in diploid species and Saratovskaya 29 nullisomic and ditelosomic stocks. Based on comparative results, it was concluded that in common wheat chromosome 1A has DD variant of Gpi-1 derived from T. urartu and chromosome 1B derived from the Sitopsis section species contains the BB variant. [References: 13].

3753 Gonzalez Iniguez, Rebeca (1996) [New varieties of wheat and triticale for High-altitude]. Nuevas variedades de trigo y triticale de temporal para valles altos. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 25. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Cuadro; 1 Fig. Spanish. (AGRIC 97-074844).

The INIFAP's wheat and triticale breeding program developed two new varieties for high-altitude. These produce the highest yield among currently cultivated varieties in the evaluated environments. The advantages of these varieties are: Adapt to acid soils, raining 500mm, resistance or tolerance to Septoria and Fusarium spp.

3754 Gonzalez, R.; Rajaram, Sanjaya (1996) [Bread wheat germoplasm with phosphorus uptake efficiency to acid soils in Mexico]. Germoplasma de trigo harinero con eficiencia a fosforo para suelos acidos de Mexico. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 10. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Cuadro; 1 Fig.; 2 ref. Spanish. (AGRIC 97-074830).

Nine wheat genotypes including two standard released varieties and 7 advanced lines were evaluated under 0 P and 80 P in 1992, 1993 and 1994. The results indicated that 5 advanced lines had high yield potential (responsiveness), at the same time gave better performance at 0 P (efficiency).

3755 Guillen Andrade, Horacio; Khairallah, M.; Singh, R.P.; Castillo Gonzalez, Fernando; Gonzalez de Leon, D. (1996) [Genetic mapping of durable leaf rust resistance in wheat]. Mapeo genetico de la resistencia durable a la roya de la hoja en trigo. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 27. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Fig.; 4 ref. Spanish. (AGRIC 97-074846).

225 F6 RILs coming from the cross between Frontana and INIA 66 were characterized by their reaction to leaf rust in the field. An RFLP analysis is in progress in order to identify where the genes that are involved in durable leaf rust resistance are located. So far, 55 marker loci have been mapped. Preliminary results are presented.

3756 Guiltinan, M.J. (Pennsylvania State Univ., University Park, PA (USA). Dept. of Horticulture); Niu, X. (1996) cDNA encoding a wheat (Triticum aestivum cv. Chinese Spring) glycine-rich RNA-binding protein. *Plant Molecular Biology (Netherlands)* v. 30(6) p. 1301-1306. 32 ref. English. (AGRIC 97-075530).

3757 Gutierrez Castorena, Maria del Carmen; Terrazas V, F.J. (1996) [Evaluation of thiourea for increases of yield in three cultivars of wheat]. Evaluacion de tiourea para incrementar rendimiento en tres variedades de trigo. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 13. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 3 Cuadros; 1 ref. Spanish. (AGRIC 97-074833).

Thiourea in 3 concentrations (0, 2 and 4 percent) was evaluated in three cultivars of the wheat (Bacanora T88, Oasis F86 and Opata M86) in the Valley of Yaqui in Sonora. The applications of thiourea increases significantly the number of shoot and spikes for plant, as well in the grain's number and weight with the concentration of 2 percent in the 3 cvs.

3758 Hagberg, A. (The Swedish University of Agricultural Sciences, Svalov, Sweden.) (1996) Coordinator's report: Duplication of chromosome segments. *Barley genetics newsletter (USA)* v. 25 p. 114. references. English. (AGRIC 97-060796).

3759 Han, F.; Ullrich, S.E.; Kleinhofs, A.; Clancy, J.A. (1996) Towards fine structure mapping and tagging major malting quality QTL in barley. *Barley genetics newsletter (USA)* v. 25 p. 71-75. references. English. (AGRIC 97-060777).

3760 Hang, A. (USDA, ARS, National Small Grains Germplasm Research Facility, Aberdeen, ID.) (1996) Coordinator's report: Barley genetic stock collection. *Barley genetics newsletter (USA)* v. 25 p. 102-103. references. English. (AGRIC 97-060786).

3761 Hang, A. (USDA, ARS, National Small Grains Germplasm Research Facility, Aberdeen, ID.) (1996) Coordinator's report: Trisomic and aneuploid stocks. *Barley genetics newsletter (USA)* v. 25 p. 104. English. (AGRIC 97-060787).

3762 Hang, A. (USDA, ARS, Aberdeen, ID.); Satterfield, K. (1996) Additional information on the primary trisomic and telotrismic analysis of the chlorina mutant B2-4 or f13 in barley. *Barley genetics newsletter (USA)* v. 25 p. 30. references. English. (AGRIC 97-060769).

3763 Hang, A.; Satterfield, K. (1997) IN-VITRO CULTURE INDUCED DEFICIENCY IN BARLEY. *Cereal Research Communications*. 25(1):21-26. English. [USDA ARS POB 307 ABERDEEN, ID 83210 USA].

A plant with a structural chromosome deficiency was isolated from a population of 407 green plants regenerated from microspore culture of ten barley (*Hordeum vulgare* L.) cultivars. Based on acetocarmine staining and N-banding patterns, the deficient chromosome was identified as chromosome 1 with 67% of the long arm missing, acrocentric chromosome 1S(L). At meiosis, six ring bivalents and one open bivalent were observed. Among 111 progenies that resulted from selfing of the deficient plant and crossing with a diploid, all had 14 chromosomes. This indicated that the deficient chromosome was not transmitted through male or female gametes. The deficient plant was late and had reduced vigor and seed set. [References: 17].

3764 Hassan, E.E. (Zagazig Univ. (Egypt). Efficient Productivity Inst.); Saad, A.M.M. (1996) Combining ability, heterosis, correlation and multiple linear regression for yield and its contributing characters in some bread wheat genotypes. *Annals of Agricultural Science, Moshtohor (Egypt)* v. 34(2) p. 487-499. 6 tables; 17 ref. English. (AGRIC 97-075527).

3765 Holappa, LD.; Walkersimmons, MK. (1997) THE WHEAT PROTEIN KINASE GENE, TaPK3, OF THE PKABA1 SUBFAMILY IS DIFFERENTIALLY REGULATED IN GREENING WHEAT SEEDLINGS. *Plant Molecular Biology*. 33(5):935-941. English. [WASHINGTON STATE UNIV USDA ARS PULLMAN, WA 99164 USA].

We have identified a new wheat PKABA1-like protein kinase gene, TaPK3, that is expressed in greening wheat seedlings. TaPK3 has high sequence homology (97% similarity with some sequence diversity at the 3' end) to the wheat PKABA1 protein kinase mRNA, which is upregulated by cold-temperature treatment, dehydration and abscisic acid (ABA). Use of a TaPK3 gene-specific probe has revealed that TaPK3 is differentially expressed with respect to PKABA1. TaPK3 mRNA accumulates in greening shoot tissue of wheat, but is not affected by dehydration, cold-temperature treatment or ABA. Based on sequence and expression differences, we conclude that expression of the PKABA1-like protein kinases is not limited to stress responses. [References: 24].

3766 Hong, B.H.; Park, C.S. (Korea University, Seoul (Korea Republic). Department of Agronomy) (1996) Phylogenetic analysis of wheat near-isogenic lines for culm length with RAPD marker. *Korean Journal of Breeding (Korea Republic)* v. 28(4) p. 420-428. 2 illus.; 5 tables; 21 ref. Korean. (AGRIS 97-061095).

3767 Hu, T.; Kasha, KJ. (1997) IMPROVEMENT OF ISOLATED MICROSPORE CULTURE OF WHEAT (TRITICUM AESTIVUM L) THROUGH OVARY CO-CULTURE. *Plant Cell Reports*. 16(8):520-525. English. [UNIV GUELPH DEPT CROP SCI GUELPH ON N1G 2W1 CANADA].

Embryogenesis from isolated microspore cultures of wheat was improved by ovary co-culture when compared to a completely defined medium. This indicates that essential factor(s) in addition to PAA or its analogs may be supplied by the ovaries. Isolated microspores cocultured with 20 ovaries of wheat on the top of semi-solid MMS3 induction medium for 21-30 days gave the best response. Both the number and quality of the embryos was significantly increased. The maximum frequencies of dividing microspores and of embryogenesis were 94% and 2.4%, respectively. Up to 2583 embryos were formed per 100 anthers of cv 'Chris' and between 18% and 43% of the larger embryos regenerated into green plants upon transfer. Genotype differences for both induction and embryogenesis phases were reduced using ovary co-culture. However, there was still a strong genotype influence on plant regeneration with cv 'Chris', with the F1 of 'Chris' x 'Sinton' displaying the highest frequencies. These results are important with respect to enhancing haploidy applications in wheat biotechnology and plant breeding. [References: 15].

3768 Huang, T.C.; Zhang, A.M.; Sun, B.Q. (China Agricultural Univ., Beijing (China). Dept. of Plant Genetics and Breeding) (1996) Achievements and problems of wheat breeding in China and its demand on machinery. 10. International Conference on Mechanization of Field Experiments, Paris (France). 8-12 Jun 1996. *Proceedings of the tenth international conference on mechanization of field experiments (IAFFE/France '96), Paris/Versailles, France, July 8-12, 1996. Leuchovius, T.; Oeyjord, E.; Billot, J.F. (eds.)* p. 407-413. SLU. 8 ref. English. (AGRIS 97-061087).

3769 Huh, GH.; Nakayama, T.; Meshi, T.; Iwabuchi, M. (1997) STRUCTURAL CHARACTERISTICS OF TWO WHEAT HISTONE H2A GENES ENCODING DISTINCT TYPES OF VARIANTS AND FUNCTIONAL DIFFERENCES IN THEIR PROMOTER ACTIVITY. *Plant Molecular Biology*. 33(5):791-802. English. [KYOTO UNIV DEPT BOT GRAD SCH SCI SAKYO KU KYOTO 60601 JAPAN].

To investigate the regulation of plant histone H2A gene expression, we isolated two H2A genes (TH254 and TH274) from wheat, which encode two variants of H2A. Both genes had an intron in the coding region. In the promoters, some characteristic sequences, such as Oct and Nona motifs, which are conserved among plant histone genes, were located in a short region (about 120 bp) upstream from the putative TATA box. Transient expression analyses of promoter activity with H2A-Gus fusion genes using tobacco protoplasts revealed novel types of positive cis-acting sequences in the TH254 promoter: a direct repeat of a 13 bp sequence (AGTTACATTATTG) and a stretch composed of an AT-rich sequence (ATATAGAAAATTAAAA) and a G-box (CACGTG). Quantitative S1 assay of the mRNA amounts from the TH254/GUS and TH274/GUS chimeric genes in stably transformed and cell cycle-synchronized tobacco

cell lines showed that the promoters of both genes contained at least one cis-acting element responsible for S phase-specific expression. Histochemical analysis of transgenic tobacco plants carrying the chimeric genes showed that the promoters of the two H2A genes were active in developing seedlings and flower organs but were regulated in a different manner. [References: 34].

3770 Inagaki, MN.; Nagamine, T.; Mujeekazi, A. (1997) USE OF POLLEN STORAGE AND DETACHED-TILLER CULTURE IN WHEAT POLYHAPLOID PRODUCTION THROUGH WIDE CROSSES. *Cereal Research Communications*. 25(1):7-13. English. [CIMMYT LISBOA 27 COL JUAREZ APARTADO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

The effects of pollen storage and detached-tiller culture on polyhaploid production of hexaploid wheat were examined using maize and pearl millet crosses. Pollen storage at ultra-low temperature did not affect polyhaploid production frequency in pearl millet crosses, but greatly reduced frequency in maize crosses. Stored pearl millet pollen can be used as an alternative medium for wheat polyhaploid production when fresh pollen is not available. Detaching wheat tillers with spikes at crossing time and culturing them in a solution containing sucrose, sulfuric acid and 2, 4-dichlorophenoxyacetic acid (2, 4-D) resulted in no distinct reduction of polyhaploid production frequency in crosses with both maize and pearl millet. Hot-water emasculation after detaching wheat tillers was successful for these wide crosses. Detached-tiller culture makes it possible to collect the spikes from wheat plants growing in distant sites and handle them for wide crosses in a laboratory. These techniques avoid having to synchronize flowering times of both parents and result in considerable savings in terms of labor and space required for handling parent plants. [References: 15].

3771 Islam, A.K.M.R. (University of Adelaide, Glen Osmond, Australia.) (1996) Coordinator's report: wheat-barley genetic stocks. *Barley genetics newsletter (USA)* v. 25 p. 114. references. English. (AGRIS 97-060797).

3772 Ismail, A.A. (Assiut Univ. (Egypt). Faculty of Agriculture) (1995) Pedigree selection for grain yield, grain weight and earliness in two segregating populations of spring wheat. *Assiut Journal of Agricultural Sciences (Egypt)* v. 26(4) p. 59-71. 1 fig. 7 tables; 15 ref. English. (AGRIS 97-061071).

3773 Ismail, A.A. (Assiut Univ. (Egypt). Faculty of Agriculture) (1995) The performance and stability of some wheat genotypes under different environments. *Assiut Journal of Agricultural Sciences (Egypt)* v. 26(4) p. 15-37. 2 graph. 6 tables; 36 ref. English. (AGRIS 97-061091).

3774 Jacquemin, J.M.; Mingeot, D. (Centre de Recherches Agronomiques, Gembloux (Belgium). Station d'Amélioration des Plantes) (1996) [Cereal breeding and molecular markers]. *Amélioration des cereales et marqueurs moléculaires. Agriconact (Belgium)* (no.286) p. 9-12. 2 ill. French. (AGRIS 97-075521).

3775 Janos, M.; Bela, B.; Zsuzsa, K. (1997) EFFECT OF CROPYEAR ON THE QUALITY OF WINTER DURUM WHEAT (TRITICUM DURUM DESF.) LINES AND THE INHERITANCE OF QUALITY TRAITS IN F-1, F-2 AND F-3 GENERATIONS. *Noventytermeles*. 46(1):1-11. Hungarian. [CEREAL RES INST PF 391 H-6701 SZEGED HUNGARY].

The value of durum wheat depends on their quality traits. In the present work the effect of cropyear on quality and the inheritance of some quality characters were studied in early generations of winter durum wheat crosses. The results of the study showed that the cropyear could have a strong effect on the quality of durum wheat in Hungary. In the years studied the semolina yield, yellow pigment content and gluten extensibility changed a great deal. The yellow and brown indexes of the pasta were changed only to a slight extent by the year. The effect of cropyear influenced the cooking values of pasta made from the semolina of different lines. Negative overdominance was observed in the wet and dry gluten contents of hybrids in the F-1 generation, but in the F-2 and F-3 generations positive heterosis was sometimes observed. The gluten extensibility values of the hybrids were similar to their midparent values in all three generations. Both positive and negative overdominance was found in the inheritance of semolina yield in hybrids in the F-1 generation, but in the F-2 and F-3 generations the semolina yields of hybrids were similar to the midparent values. Low pigment content was dominant in the F-1 generation, but in F-2 and F-3 generations the pigment content of the

hybrids was close to that of the midparent. The vitreousness of the grain was inherited intermediately, and positive heterosis was often observed. Low protein content dominated in one hybrid, but in other combinations it showed recessive inheritance. The overdominance of the low yellow index (YI) was observed in the F-1 generation of the hybrids. The yellow colour of pasta made from the semolina of the hybrids was poorer than that of pasta made from the semolina of the line which had the lowest YI. The negative overdominance of the low brown index (BI) of the pasta was observed in one hybrid, but BI was inherited intermediately in the other hybrid, where it was close to the midparent value. The cooking value of the pasta of the hybrids (measured by aleurograph) after cooking times of 15 and 30 minutes was similar to that value of the poorer parent. [References: 25].

3776 Jaradat, AA. (1997) WILD EMMER WHEAT IN JORDAN 1. ECOTYPES AND PHENOTYPIC VARIATION. *Israel Journal of Plant Sciences*. 45(1):31-37. English. [INT PLANT GENET RESOURCES INST W ASIA & N AFRICA REG OFF POB 5466 ALEPPO SYRIA].

Univariate and multivariate analyses and numerical taxonomy procedures were utilized on the standardized mean values of 17 quantitative traits in the base collection of wild emmer wheat, *Triticum dicoccoides* Korn., from Jordan, in an effort to identify ecotypes by trait measurements. Five ecotypes were identified on the basis of morphological, developmental, and productive traits. The five ecotypes exhibited different adaptive trait complexes as revealed by principal component and pairwise correlation analyses. It is postulated that particular environmental conditions across the distributional ranges of the species in Jordan resulted in the evolution of adaptive gene complexes which are conserved by genetic linkage or natural selection. The five ecotypes represented the marginal, peripheral, and central distributional range of the species in the country. Two extreme and three intermediate ecotypes were recognized. The extreme ecotypes represent the "grassy" and "robust" types recognized earlier. The three intermediate ecotypes differed markedly from the former two and from each other. They exhibited different patterns of trait associations. A gradual increase in Euclidean distances among these ecotypes was observed as their collection sites moved from marginal to peripheral, and then to central regions of the species' distributional range in Jordan. [References: 21].

3777 Jaradat, AA. (1997) WILD EMMER WHEAT IN JORDAN 2. GENETIC DISTANCES BETWEEN AND WITHIN POPULATIONS. *Israel Journal of Plant Sciences*. 45(1):39-44. English. [INT PLANT GENET RESOURCES INST W ASIA & N AFRICA REG OFF POB 5466 ALEPPO SYRIA].

Evaluation data on 17 morpho-agronomic traits for twelve populations of wild emmer wheat, *Triticum dicoccoides*, Korn. from central, peripheral, and marginal regions of its distribution in Jordan, were subjected to univariate, principal component, and canonical discriminant analyses. Interrelationships and adjustments in traits under study were used to identify genetic distances and spatial variation among and within these populations. Principal component analysis revealed that the interrelationships implied among traits, in the same principal component, were not the same among and within populations. This spatial variability in principal components reflects specific adaptation to, or interaction with, the environment. Three canonical variables explained 85.0% of total variation in these populations. Spikelet size, flag leaf width, and days to maturity were the most discriminating traits. Mahalanobis distances suggest that spatial distances are not indicative of genetic distances among and within central, peripheral, and marginal populations. A number of trait combinations arising through multilocus genetic association or developmental correlations, which are conserved by genetic linkage and natural selection, are readily available for wheat breeding and improvement. [References: 17].

3778 Jaradat, AA. (1997) WILD EMMER WHEAT IN JORDAN 3. A CORE COLLECTION. *Israel Journal of Plant Sciences*. 45(1):45-51. English. [INT PLANT GENET RESOURCES INST W ASIA & N AFRICA REG OFF POB 5466 ALEPPO SYRIA].

The germplasm base collection (BC) of wild emmer wheat, *Triticum dicoccoides*, from Jordan consists of over 2,000 accessions. Data on 10 quantitative and 8 qualitative traits were analyzed using multivariate statistical analysis procedures. A stratified and proportional sampling procedure was used to select 10 and 5% of the BC to form two core collections: CC10 and CC5, respectively. Phenotypic variation in the BC, as

estimated by the phenotypic diversity index,  $h(s,j)$ , was unevenly distributed among accessions, among populations, and among ecogeographical regions. Moreover, its level differed significantly among and within quantitatively and qualitatively inherited traits. This characteristic led to successfully selecting a core collection which represents all levels of hierarchy in the base collection. Examination of the data for the same 18 traits in the BC, CC10, and CC5 indicated that CC10 and CC5 retained, on average, 86.0 and 74.3% of the variation in the BC, respectively. Percent discrete phenotypic classes, with frequency >0.10 (i.e., common widespread and common localized phenotypes), recovered in CC10 and CC5 were 79.6 and 51.5%, respectively. Results of hierarchical analyses of variance showed that percent contribution by traits to total variance in  $h(s,j)$  estimates increased from 64.0% in the BC to 78.0% in CC10, and to 96.3% in CC5. Nevertheless, and as theoretically expected, CC10 was more efficient than CC5 in retaining the amount and composition of the variation originally found in the base collection. [References: 36].

3779 Jende Strid, B. (Carlsberg Research Laboratory, Valby Copenhagen, Denmark.) (1996) Coordinator's report: Anthocyanin genes. *Barley genetics newsletter (USA)* v. 25 p. 110. references. English. (AGRI 97-060792).

3780 Jensen, J. (Plant Genetics Section, Environmental Science and Technology Department, Riso National Laboratory, Roskilde, Denmark.) (1996) Coordinator's report: chromosome 5. *Barley genetics newsletter (USA)* v. 25 p. 96-99. references. English. (AGRI 97-060784).

3781 Johnston, J.S. (Texas AandM University, College Station, TX.); Jensen, A.; Czeschin, D.G. Jr.; Price, H.J. (1996) Environmentally induced nuclear 2C DNA content instability in *Helianthus annuus* (Asteraceae). *American journal of botany (USA)* v. 83(9) p. 1113-1120. references. English. (AGRI 97-060751).

Experiments were conducted to detect developmental and environmental factors that influence nuclear DNA content in *H. annuus* inbred lines RHA 271 and RHA 299. DNA content (2C) was determined by laser flow cytometry of nuclei isolated from the first leaf pair of seedlings grown in a greenhouse and in growth chambers. DNA content of greenhouse grown seedlings was highly variable, ranging from approximately 3.2 to 8.0 pg for RHA 299 and approximately 5.2 to 8.2 pg for RHA 271. DNA content only weakly correlated to the position of the achene in the head from which the seedlings derived, and not at all to the position of the head on the plant. Experimentally varied environmental parameters of heat stress and water deficit, phosphate fertilizer levels in the substrate, and pH had little or no effect on the DNA content of seedlings. Seedlings grown with increased levels of substrate nitrogen in the form of  $\text{NH}_4\text{NO}_3$  showed a significant increase in the mean DNA content. Plants grown in one of two types of growth chambers possessed less variability in DNA content, approximately 6.2-8.4 pg for RHA 299 and approximately 6.8-7.4 pg for RHA 271. Plants grown in a second growth chamber were highly variable with DNA content ranging from =3.0 to 8.6 pg for RHA 299 and = 3.0 to 7.8 pg for RHA 271. Measurable physical differences between the growth chambers were irradiance level and the ratio of red to far red light. The hypothesis is presented that DNA stability of sunflowers is influenced by light quantity and/or quality.

3782 Jones, SS.; Cadle, MM. (1997) EFFECT OF VARIATION AT GLU-D1 ON CLUB WHEAT END-USE QUALITY. *Plant Breeding*. 116(1):69-72. English. [WASHINGTON STATE UNIV DEPT CROP & SOIL SCI PULLMAN, WA 99164 USA].

Club wheats (*Triticum aestivum* L.), having the allele at the C locus conferring short spike rachis internodes and giving compact appearance of spikes, which have unique and highly desirable soft white wheat end-use quality characteristics are a vital submarket class of soft white wheat in the US Pacific Northwest. Two important varieties, 'Tye' and 'Albit', are heterogeneous for high molecular weight glutenin subunits 2 + 12 and 5 + 10 encoded by the Glu-D1 locus. Replicated near-isogenic lines (NILs) of club wheats 'Tye' and 'Albit' were grown in four field environments and used to determine the effect of Glu-D1 coded high molecular weight glutenin subunits (HMWGS) 5 + 10 and 2 + 12 on various end-use quality traits. The greatest effect of variation at this locus was observed for mixing time to peak, where there was significant variation ( $P < 0.01$ ) between each 5 + 10 and 2 + 12 NIL group in each environment. Mixing time values for the 2 + 12 NILs for both 'Albit' and 'Tye' ranged from 0.60 to 1.23 min lower than the 5 + 10 NILs. Mean values for traits mixing time to peak,

cake volume, and viscosity were more favourable for the 2 + 12 NIL groups for all genotypes in all environments. No effects of these HMWGS were detected for test weight, kernel hardness, whole wheat protein, flour yield, ash, flour protein or cookie diameter. Selection for HMWGS 2 + 12 in club wheat breeding programmes should have positive effects on end-use quality. [References: 17].

3783 Jorgensen, J.H. (Plant Genetics, Riso National Laboratory, Roskilde, Denmark.) (1996) Coordinator's report: Disease and pest resistance genes. *Barley genetics newsletter (USA)* v. 25 p. 106-107. references. English. (AGRIS 97-060789).

3784 Jui, PY.; Choo, TM.; Ho, KM.; Konishi, T.; Martin, RA. (1997) GENETIC ANALYSIS OF A TWO-ROW X SIX-ROW CROSS OF BARLEY USING DOUBLED-HAPLOID LINES. *Theoretical & Applied Genetics*. 94(5):549-556. English. [AGR & AGRI FOOD CANADA EASTERN CERAL & OILSEED RES CTR OTTAWA ON K1A 0C6 CANADA].

A study was conducted on a two-row/six-row cross of barley to (1) determine the yield potential, (2) detect epistasis and genetic correlations, (3) estimate the heritabilities of six agronomic traits, and (4) study the effect of the V locus on the agronomic traits in the barley cross. The effects of five other marker loci (Re2, s, R, Est1, and Est5) on the six agronomic traits were also studied. One hundred and ninety doubled-haploid (DH) lines were derived from a Leger/C19831 cross using the bulbosum method. The DH lines and the two parents were tested for grain yield, test weight, seed weight, plant height, lodging, and heading/maturity at two locations in Eastern Canada in 1993. Additive x additive epistasis and genetic correlations were detected for some of the agronomic traits. Many of the heritability estimates were high; however, significant progress in yield improvement would be difficult to achieve because of a low mean yield of the DH lines. Under the growing conditions in Eastern Canada, six-row lines outyielded two-row by 20-27%. Six-row lines, however, were associated with low test weight, low seed weight, and severe lodging. Some two-row lines yielded higher than the two-row parent C19831, but none of the six-row lines yielded higher than the six-row parent 'Leger'. The R, s, and Est5 loci were associated with the six agronomic traits, but the Est1 locus was apparently not associated with the agronomic traits. The effect of the Re2 locus was probably due to its close linkage with the V locus. Further studies are needed to determine if superior six-row lines can be developed from two-row/six-row crosses. [References: 20].

3785 Kaku, H.; Shibuya, N.; Xu, PL.; Aryan, AP.; Fincher, GB. (1997) N-ACETYLCHITOOLIGOSACCHARIDES ELICIT EXPRESSION OF A SINGLE (1-3)-BETA-GLUCANASE GENE IN SUSPENSION-CULTURED CELLS FROM BARLEY (HORDEUM VULGARE). *Physiologia Plantarum*. 100(1):111-118. English. [UNIV ADELAIDE DEPT PLANT SCI WAITE CAMPUS GLEN OSMOND SA 5064 AUSTRALIA].

N-acetylchitooligosaccharides of degree of polymerization 6 to 8 elicit the synthesis of (1→3)-beta-glucan endohydrolase (EC 3.2.1.39) activity in suspension-cultured cells derived from immature barley (*Hordeum vulgare*) embryos. Corresponding de-acetylated chitooligosaccharides have no effect. Concentrations of N-acetylchitoheptaose in the 200 nM range are sufficient to elicit the response. A 2- to 3-fold increase in (1→3)-beta-glucanase activity is detected 24 h after the addition of the oligosaccharide. Non-denaturing, gel electrophoresis, coupled with the in situ detection of (1→3)-beta-glucanase activity in the gels, has enabled the separation of specific isoforms of the enzyme. The increase in (1→3)-beta-glucanase activity following N-acetylchitoheptaose induction is attributable predominantly to enhanced levels of isoenzyme GII, although the barley (1→3)-beta-glucanase gene family encodes at least seven different isoforms of the enzyme. Northern hybridization analyses with gene-specific probes confirmed the presence of mRNA encoding isoenzyme GII as the major mRNA in cells treated with the oligosaccharide elicitor. The results therefore demonstrate a specific induction of the (1→3)-beta-glucanase isoenzyme GII gene following stimulation of barley cells with oligosaccharides of fungal cell wall origin, and further suggest that a plant's response to microbial attack involves transcription of quite specific members of the gene families that encode pathogenesis-related proteins. [References: 38].

3786 Kang, T.J. (Korea Ginseng and Tobacco Research Institute, Taejeon (Korea Republic)) (1996) Plant regeneration from anther culture of spring wheat (*Triticum aestivum* L.). *Korean Journal of Plant Tissue Culture (Korea*

*Republic)* v. 23(6) p. 367-370. 2 illus.; 2 tables; 17 ref. English. (AGRIS 97-075529).

3787 Karsai, I.; Meszaros, K.; Hayes, PM.; Bedo, Z. (1997) EFFECTS OF LOCI ON CHROMOSOMES 2 (2H) AND 7 (5H) ON DEVELOPMENTAL PATTERNS IN BARLEY (*HORDEUM VULGARE* L) UNDER DIFFERENT PHOTOPERIOD REGIMES. *Theoretical & Applied Genetics*. 94(5):612-618. English. [HUNGARIAN ACAD SCI AGR RES INST H-2462 MARTONVASAR HUNGARY].

Heading-date in cereals is the final result of a number of interacting characters that include vernalization requirement, photoperiod sensitivity, and earliness per se. Progress in developing adapted varieties may be achieved by determining the chromosomal locations of genes controlling these characters. Nineteen doubled-haploid (DH) lines from the Dicktoo x Morex mapping population were phenotyped in controlled-environment photoperiod experiments to determine the role of two previously detected QTLs on the developmental patterns of barley. The QTLs are hypothesised to represent the effects of the Ppd and Sh2 loci on chromosomes 2 (2H) and 7 (5H), respectively. Alleles at the Ppd locus were found to be vary in response to photoperiod duration. Vernalization had some effect on alleles at both loci. The presence of early and late-flowering transgressive segregants in this mapping population can be explained by interactions between the Ppd and Sh2 loci. The Ppd and Sh2 loci are hypothesised to be homoeologous with the Ppd and Vrn1 loci of wheat. [References: 22].

3788 Kleinhofs, A. (Washington State University, Pullman, WA.) (1996) NABGMP mapping update. *Barley genetics newsletter (USA)* v. 25 p. 62-70. references. English. (AGRIS 97-060776).

3789 Klindworth, DL.; Klindworth, MM.; Williams, ND. (1997) TELOSOMIC MAPPING OF FOUR GENETIC MARKERS IN DURUM WHEAT. *Journal of Heredity*. 88(3):229-232. English. [USDA ARS NO CROP SCI LAB STATE UNIV STN POB 5677 FARGO, ND 58105 USA].

3790 Konishi, T. (1996) Coordinator's report: Chromosome 3. *Barley genetics newsletter (USA)* v. 25 p. 91-92. references. English. (AGRIS 97-060782).

3791 Konishi, T. (Kyushu University, Fukuoka, Japan.); Fukushima, Y. (1996) Geographical distribution of genotypes for hybrid sterility in barley. *Barley genetics newsletter (USA)* v. 25 p. 17-18. references. English. (AGRIS 97-060764).

3792 Korzun, L. (Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany.); Kunzel, G. (1996) Integration of translocation breakpoints of barley chromosomes 3 and 7 into the Igr1/Franka derived RFLP maps. *Barley genetics newsletter (USA)* v. 25 p. 13-16. references. English. (AGRIS 97-060763).

3793 Kunzel, G. (Institute of Plant Genetics and Crop Plant Research, Gatersleben, Germany.) (1996) Coordinator's report: Translocations and balanced tertiary trisomics. *Barley genetics newsletter (USA)* v. 25 p. 105. references. English. (AGRIS 97-060788).

3794 Larson, SR.; Habernicht, DK.; Blake, TK.; Adamson, M. (1997) BACKCROSS GAINS FOR SIX-ROWED GRAIN AND MALT QUALITIES WITH INTROGRESSION OF A FEED BARLEY YIELD QTL. *Journal of the American Society of Brewing Chemists*. 55(2):52-57. English. [MONTANA STATE UNIV BOZEMAN, MT 59717 USA].

Fifty experimental barley lines were derived from a backcross of Morex and DH72, using the latter as donor parent of the Steptoe chromosome 3. These BC1 derived lines, plus the parental checks, were grown by the Montana Agriculture Experiment Station in irrigated and dryland experiments at Bozeman in 1994 and 1995 and in a dryland trial at the Havre station in 1995. The Steptoe chromosome 3 carries positive-value alleles for head-shattering and lodging resistance quantitative trait loci (QTL) that effectively increased relative yield and adaptation characteristics in the environments tested. These parents and lines were used to test the hypothesis that Morex-level malt quality characteristics can be recovered by backcrossing, with the addition of the yield-enhancing genes from the Steptoe chromosome 3. Four grain quality traits were analyzed in all five experiments, and nine malting traits were analyzed from micromalted samples from the 1995 Bozeman irrigated experiment. The results support the contention that the Steptoe chromosome 3 yield



QTL has no adverse pleiotropic effects on malt quality, relative to Morex, although a slight decline in test weights may occur (similar to 1-2% of the average observed over all experiments). [References: 20].

3795 Laurie, D. (John Innes Centre, Norwich, UK.) (1996) Coordinator's report: Chromosome 1. *Barley genetics newsletter (USA)* v. 25 p. 86-87. references. English. (AGRIS 97-060780).

3796 Li, Y.M.; Chaney, R.L.; Schneider, A.A.; Miller, J.F.; Elias, E.M.; Hammond, J.J. (1997) SCREENING FOR LOW GRAIN CADMIUM PHENOTYPES IN SUNFLOWER, DURUM WHEAT AND FLAX. *Euphytica*. 94(1):23-30. English. [USDA ARS ENVIRONM CHEM LAB BELTSVILLE, MD 20705 USA].

Cadmium (Cd) level in nonoilseed sunflower (*Helianthus annuus* L.), flax (*Linum usitatissimum* L.), and durum wheat (*Triticum turgidum* L. var. durum) grown on uncontaminated, alkaline soils has exceeded limits established in Northern Europe. Separate field experiments were conducted to investigate variability of grain Cd levels among sunflower, durum wheat and flax germplasm, and to seek an efficient screening method for future breeding. There were large variations in leaf Cd concentration among 200 sunflower lines. These lines performed more consistently for Cd uptake at the R5 stage than at the V8 stage across 4 locations with markedly differing soils. Cd concentration in V8 leaves was not related to Cd in grain. The positive correlation between R5 leaf Cd and kernel Cd level was obtained from nonoilseed hybrid (Sigo 954) ( $R^2 = 0.74^{**}$ ), and 200 lines ( $R^2 = 0.44^{**}$ ) tested over 4 locations in 2 field trials, respectively. This indicates that an efficient and low cost screening method can be developed for genotype selection, but plants must be grown to the R5 stage. A preliminary evaluation of 30 durum wheat and 74 flax lines indicated large variations in grain Cd level of durum wheat and flax. Grain Cd concentration ranged from 0.11 to 0.34 mg Cd kg<sup>-1</sup> DW for durum wheat, and 0.14 to 1.37 mg Cd kg<sup>-1</sup> DW for flax, respectively. This variability indicates that breeding for low grain Cd in durum wheat and flax should be feasible. [References: 29].

3797 Liu, B.; Segal, G.; Vega, J.M.; Feldman, M.; Abbo, S. (1997) ISOLATION AND CHARACTERIZATION OF CHROMOSOME-SPECIFIC DNA SEQUENCES FROM A CHROMOSOME ARM GENOMIC LIBRARY OF COMMON WHEAT. *Plant Journal*. 11(5):959-965. English. [WEIZMANN INST SCI DEPT PLANT GENET IL-76100 REHOVOT ISRAEL].

Isolation, physical mapping and polymorphism of chromosome-specific DNA sequences in wheat are reported. Following the microdissection of the long arm of chromosome 5B (5BL) of common wheat, its DNA was amplified by degenerate oligonucleotide-primed PCR and directly cloned into plasmid vectors. Characterization of the chromosome arm library showed that similar to 55% of the inserts are of low-copy nature. Southern analysis using aneuploid lines of common wheat revealed that five of 11 low-copy inserts analyzed map to chromosome arm 5BL; four of these are 5BL-specific. By deletion mapping, the 5BL-specific sequences were located to sub-chromosome arm regions. Based on the hybridization patterns of three 5BL-specific sequences to DNA from a diverse collection of goat-grass (*Aegilops*) and wheat (*Triticum*) species, it was concluded that these sequences emerged at different times in the course of evolution of this group of plant species. [References: 24].

3798 Lomeli Flores, J.R.; Lopez Castaneda, Candido; Pena Martinez, R.; Camacho A, D. (1996) [Variability in the response of wheat lines to *Metopolophium dirhodum* (Walker), (Homoptera: Aphididae)]. Variabilidad en la respuesta de líneas de trigo a la incidencia de *Metopolophium dirhodum* (Walker), (Homoptera: Aphididae). 16, Congreso de Fitogenética. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 26. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 1 Cuadro; 2 Figs.; 2 ref. Spanish. (AGRIS 97-074845).

Monitoring of aphid incidence was conducted on commercial and experimental strains of wheat selected for drought resistance under rainfed conditions. The experiment was set up during the winter-spring crop season in Central Mexico. The number of aphids was recorded weekly. Lower numbers of aphids in water-stressed plants and in some experimental strains indicate potential genetic advantage.

3799 Lopez Castaneda, Candido; Hernandez R, E.; Martinez Vera, Rafael R. (1996) [Selection for agronomic and phenological traits in wheat under drought]. Selección por características agronómicas y fenológicas en trigo bajo sequía. 16, Congreso de Fitogenética. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 24. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 2 Cuadros; 2 ref. Spanish. (AGRIS 97-074843).

Selection by a low tiller number per plant and good agronomic traits resulted in higher grain quality and yield. The higher yield of low tiller lines was due to a greater dry matter, whereas the yield of lines selected by good agronomic traits was due to higher harvest index.

3800 Luna R, J.J.; Ramage, R.T.; Martin del Campo Valle, Salvador; Lopez G, M. (1996) [Stability of the non-elongating subcrown internode character under light deficiency and plant competition in barley (*Hordeum vulgare* L.)]. Estabilidad del carácter no-elongación del internodo subcoronal bajo condiciones de luz deficiente y competencia poblacional en cebada (*Hordeum vulgare* L.). 16, Congreso de Fitogenética. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenética, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 9. Sociedad Mexicana de Fitogenética, A.C.; Colegio de Postgraduados. 1 Cuadro; 3 ref. Spanish. (AGRIS 97-074829).

The stability of the non-elongating subcrown internode (SCI) character in barley line P4 was studied by applying light deficiency and plant competition treatments. Two additional genotypes (Seco and Yemen) with long and intermediate SCI were included. Line P4 had no-SCI elongation in all treatments but the other genotypes had significant responses to light and competition effects. Above ground parts of all three genotypes had similar responses to the treatments. It seems that lack of SCI length in P4 is stable regardless if the same line responds similarly to other barleys.

3801 Lundqvist, U. (Svalof Weibull AB, Svalov, Sweden.) (1996) Coordinator's report: Ear morphology genes. *Barley genetics newsletter (USA)* v. 25 p. 111. references. English. (AGRIS 97-060793).

3802 Lundqvist, U. (Svalof Weibull AB, Svalov, Sweden.) (1996) Coordinator's report: Earliness genes. *Barley genetics newsletter (USA)* v. 25 p. 113. references. English. (AGRIS 97-060795).

3803 Lundqvist, U. (Svalof Weibull AB, Svalov, Sweden.) (1996) Coordinator's report: Eceriferum genes. *Barley genetics newsletter (USA)* v. 25 p. 108-110. references. English. (AGRIS 97-060790).

3804 Luo, M.C. (University of California, Davis, CA.); Dubcovsky, J.; Dvorak, J. (1996) Recognition of homeology by the wheat Ph1 locus. *Genetics (USA)* v. 144(3) p. 1195-1203. references. English. (AGRIS 97-061099).

Chromosome 1A(m) of *Triticum monococcum* is closely homeologous to *T. aestivum* chromosome 1A but recombines with it little in the presence of the wheat suppressor of homeologous chromosome pairing, Ph1. In the absence of Ph1, the two chromosomes recombine as if they were completely homologous. Chromosomes having either terminal or interstitial segments of chromosome 1A(m) in 1A were constructed and their recombination with 1A was investigated in the presence of Ph1. No recombination was detected in the homeologous (1A(m)/1A) segments, irrespective of whether terminally or interstitially positioned in a chromosome, whereas the levels of recombination in the juxtaposed homologous (1A/1A) segments was normal or close to normal relative to completely homologous 1A chromosomes. These observations show that Ph1 does not regulate chromosome pairing by premeiotic chromosome alignment and a mitotic spindle-centromere interaction, as has been suggested, but processes homology along the entire length of chromosomes.

3805 Lyngkjær, M.F.; Carver, T.W.; Zeyen, R.J. (1997) SUPPRESSION OF RESISTANCE TO ERYSIPE GRAMINIS F SP HORDEI CONFERRED BY THE MLO5 BARLEY POWDERY MILDEW RESISTANCE GENE. *Physiological & Molecular Plant Pathology*. 50(1):17-36. English. [RISO NATL LAB DEPT PLANT BIOL & BIOGEOCHEM DK-4000 ROSKILDE DENMARK].

Suppression of resistance against penetration by *Erysiphe graminis* f.sp. *hordei* conferred by the *mlo5* barley powdery mildew resistance gene was accomplished by using the glucose analogue, 2-deoxy- D-glucose (DDG) or mannose applied to true leaf tissue of the *mlo5* containing Riso-R/barley isolate. Additional suppression of *mlo5* penetration resistance against the avirulent *E. graminis* isolate was achieved by using DDG, mannose, or glucose in combination with the phenylalanine ammonia lyase inhibitor alpha-aminooxy-beta-phenylpropionic acid (AOPP). A *mlo* virulent isolate of *E. graminis* was also tested against Riso-R and the isolate Riso-S. The penetration efficiency of the *mlo* virulent isolate against both isolines was also enhanced by treatment of leaf tissues with DDG or mannose alone or in combination with AOPP. It was concluded that Riso-R penetration resistance utilizes a backup defence involving phenolic compound synthesis, but that phenolics are not responsible for the primary mechanism of *mlo5* penetration resistance. Sequestration of phosphate ions caused by complexing with DDG or mannose may lower the energy available for penetration resistance in these barley lines, obviating both inherent and *mlo5* based penetration resistance. Barley epidermal cell papillae were associated with penetration resistance in both barley isolines, and all papillae contained callose. However, papillae were significantly smaller and less frequent when tissues were treated with DDG or mannose. The potential inhibitory effects of glucose, DDG and mannose on activity of the enzyme callose synthase *in vitro* were tested and proved negative. (C) 1997 Academic Press Limited. [References: 43].

3806 Maestra, B.; Naranjo, T. (1997) HOMOEOLGIOUS RELATIONSHIPS OF TRITICUM SHARONENSE CHROMOSOMES TO T-AESTIVUM. *Theoretical & Applied Genetics*. 94(5):657-663. English. [UNIV COMPLUTENSE MADRID FAC BIOL DEPT GENET E-28040 MADRID SPAIN].

Homoeologous pairing at metaphase I was analyzed in standard-type, ph2b, and ph1b hybrids of *Triticum aestivum* (common, bread or hexaploid wheat) and *T. sharonense* in order to establish the homoeologous relationships of *T. sharonense* chromosomes to hexaploid wheat. Chromosomes of both species, and their arms, were identified by C-banding. Normal homoeologous relationships for the seven chromosomes of the S-sh genome, and their arms, were revealed, which implies that no apparent chromosome rearrangement occurred in the evolution of *T. sharonense* relative to wheat. All three types of hybrids with low-, intermediate-, and high-pairing level showed preferential pairing between A-D and B-S-sh. A close relationship of the S-sh genome to the B genome of bread wheat was confirmed, but the results provide no evidence that the B genome was derived from *T. sharonense*. Data on the pairing between individual chromosomes of *T. aestivum* and *T. sharonense* provide an estimate of interspecific homoeologous recombination. [References: 37].

3807 Mather, DE.; Tinker, NA.; Laberge, DE.; Edney, M.; Jones, BL.; Rossnagel, BG.; Legge, WG.; Briggs, KG.; Irvine, RB.; Falk, DE.; Kasha, KJ. (1997) REGIONS OF THE GENOME THAT AFFECT GRAIN AND MALT QUALITY IN A NORTH AMERICAN TWO-ROW BARLEY CROSS. *Crop Science*. 37(2):544-554. English. [MCGILL UNIV DEPT PLANT SCI 21111 LAKESHORE ST ANNE DE BELLEVUE PQ H9X 3V9 CANADA].

Malting is an important end use of barley (*Hordeum vulgare* L.). The suitability of barley for malting depends on numerous quality characteristics, all of which are affected by genetic and environmental variation and many of which are inter-related. Here, our objective was to use genome mapping to improve knowledge about the genetic basis for variation and covariation in grain and malt quality characteristics. Kernel plumpness, kernel weight, grain protein, fine-grind extract, fine-coarse difference, soluble protein, extract beta P-glucan, extract viscosity, diastatic power, and alpha-amylase activity were measured on grain produced in six field environments, from parents and doubled-haploid progeny of a two-row barley cross, 'Harrington'/'TR306'. Quantitative trait loci and QTL x environment interactions were detected by means of 127 mapped markers and two methods of QTL analysis: simple interval mapping (SIM) and simplified composite interval mapping (SIM). Each trait was affected by two to four primary QTL (those detected using both SIM and sCIM) and similar numbers of secondary QTL (those detected by only one of SIM or sCIM). Together, these QTL explained 21 to 67% of the phenotypic variance per trait. The numbers, effects, and relative positions of these QTL were in concordance with the quantitative trait distributions and with correlations among traits. All chromosomes, except chromosome 2, contained regions with at least one important QTL. Several genomic

regions affected multiple traits. Most QTL interacted with environment, but many showed effects consistent enough that they might serve as targets for marker-assisted selection. There was little similarity in the QTL positions detected here and those detected previously for the same traits in crosses representing other germplasm groups. [References: 31].

3808 Maurino, VG.; Drincovich, MF.; Casati, P.; Andreo, CS.; Edwards, GE.; Ku, MSB.; Gupta, SK.; Franceschi, VR. (1997) NADP-MALIC ENZYME - IMMUNOLocalIZATION IN DIFFERENT TISSUES OF THE C-4 PLANT MAIZE AND THE C-3 PLANT WHEAT. *Journal of Experimental Botany*. 48(308):799-811. English. [WASHINGTON STATE UNIV DEPT BOT PULLMAN, WA 99164 USA].

*In situ* immunolocalization and Western blot analysis of separated cellular and subcellular fractions, were used to determine the localization of different isoforms of NADP-malic enzyme in both wheat (C-3) and maize (C-4) plants. In both techniques, an affinity purified anti(maize 62 kDa NADP-ME) IgG from the maize green leaf isoform also reacted with a 72 kDa protein in tissues of C-4 plants as well as C-3 plants. The light-inducible 62 kDa isoform is located in bundle sheath chloroplasts of maize leaves. In etiolated leaves and in roots of maize there is evidence for the occurrence of a 72 kDa isoform which co-migrates on 2-D (SDS and isoelectric focusing) PAGE. The 72 kDa isoform is also present in low levels in green leaves. This form may occur in multiple intracellular compartments; but in situ immunolocalization experiments and Western blot and activity assays on fractionated protoplasts indicate that a significant amount of this isoform occurs in plastids. With regards to C-3 plants such as wheat, a 72 kDa isoform in leaves is largely confined to the chloroplasts based on *in situ* immunolocalization and Western blots and enzyme activity assays with fractionated protoplasts. In maize, it appears that the constitutive expression pattern of a possible C-3 ancestral gene for NADP-malic enzyme has been maintained, and a high level expression of a light-inducible isoform located in bundle sheath chloroplasts (62 kDa) has been acquired during its evolution. [References: 41].

3809 Memon, A.R. (Texas A and M Univ., College Station, TX (USA). Dept. of Biochemistry and Biophysics); Meng, B.; Mullet, J.E. (1996) RNA-binding proteins of 37/38 kDa bind specifically to the barley chloroplast psbA 3'-end untranslated RNA. *Plant Molecular Biology (Netherlands)* v. 30(6) p. 1195-1205. 34 ref. English. (AGRI 97-075234).

3810 Merker, A.; Lantai, K. (1997) HYBRIDS BETWEEN WHEATS AND PERENNIAL LEYMUS AND THINOPYRUM SPECIES. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 47(1):49-51. English. [SWEDISH UNIV AGR SCI DEPT PLANT BREEDING RES POB 7003 S-75007 UPPSALA SWEDEN].

Hexaploid and tetraploid wheats were pollinated by the wild perennial wheat relatives *Leymus arenarius*, *L. mollis*, *L. racemosus* and *Thinopyrum junceiforme*. Hybrids were obtained from all attempted cross combinations, two of which are reported here for the first time. They are tall and perennial and have the expected chromosome numbers. Strategies for the future use of these hybrids in wheat improvement are discussed and outlined. [References: 12].

3811 Mohan, M.; Nair, S.; Bhagwat, A.; Krishna, TG.; Yano, M.; Bhatia, CR.; Sasaki, T. (1997) GENOME MAPPING, MOLECULAR MARKERS AND MARKER-ASSISTED SELECTION IN CROP PLANTS [Review]. *Molecular Breeding*. 3(2):87-103. English. [INT CTR GENET ENGN & BIOTECHNOL ARUNA ASAF ALI MARG NEW DELHI 110067 INDIA].

3812 Moharrampour, S.; Tsumuki, H.; Sato, K.; Yoshida, H. (1997) MAPPING RESISTANCE TO CEREAL APHIDS IN BARLEY. *Theoretical & Applied Genetics*. 94(5):592-596. English. [OKAYAMA UNIV BIORESOURCES RES INST LAB BIOL COMMUN KURASHIKI OKAYAMA 710 JAPAN].

A set of 150 doubled-haploid (DH) barley (*Hordeum vulgare* L.) lines derived from the cross of Harrington/TR306 was used to determine the number and chromosomal location of quantitative trait loci (QTLs) controlling resistance to cereal aphids. The experiments were conducted under natural infestation in the field during two growing seasons: 1994 and 1995. Aphid resistance was measured by counting the number of aphids per plot. Counts were made on a weekly basis. Each year at the time of maximum aphid density there was an obvious difference in reaction between the parental genotypes. The DH lines showed continuous variation for aphid density. Simple interval mapping and simplified

composite interval mapping revealed that the principal QTL determining cereal aphid resistance is on the distal region of the short arm of chromosome 1. This aphid-resistance QTL is linked with a heading-date QTL. At the time of highest aphid infestation, this QTL accounted for 31% and 22% of the total variance of aphid density in 1994 and 1995, respectively. A QTL on chromosome 5 was also detected but only by simplified composite interval mapping. However, the largest consistent effect was due to the QTL on the short arm of chromosome 1. This QTL may be a useful target for marker-assisted selection for adult plant cereal aphid resistance in barley. [References: 20].

3813 Moieni, A.; Sarrafi, A. (1997) GENETIC IMPROVEMENT OF ANDROGENETIC HAPLOID FORMATION IN HEXAPLOID WHEAT (*TRITICUM AESTIVUM* L.). *Cereal Research Communications*. 25(1):15-20. English. [ENSAT INP BAP INRA LAB BIOTECHNOL & AMELIORAT PLANTES 145 AV MURET F-31076 TOULOUSE FRANCE].

Androgenetic response in two segregating populations (F3 and F4) and their parents ('Ghods' and 6605) was investigated. The F3 and F4 generations were obtained by Single Seed Descent (SSD) in a greenhouse. The experiment consisted of 69 pots, each containing four plants ('Ghods', 6605, F3 and F4). Embryo production, green and albino plants per 100 anthers as well as total plant regeneration per 100 anthers have been determined. The difference between F3 generation and mid-parents was significant and positive for embryo production, green plant regeneration, and total plant regeneration. The difference between F4 generation and mid-parents was positive and significant only for green and total plant regeneration. Heritability estimates were high and important genetic advances based on 10% selection were predicted. The best F3 and F4 plants have produced 329.46 and 492.59 embryos per 100 anthers, and 62.72 and 65.11 green plants per 100 anthers, respectively. As androgenetic traits are highly heritable, so a rapid gain from selection of such F3 or F4 genotypes should be possible. [References: 29].

3814 Molina, A.; Mena, M.; Carbonero, P.; Garciaolmedo, F. (1997) DIFFERENTIAL EXPRESSION OF PATHOGEN-RESPONSIVE GENES ENCODING TWO TYPES OF GLYCINE-RICH PROTEINS IN BARLEY. *Plant Molecular Biology*. 33(5):803-810. English. [UNIV POLITECN MADRID ETS INGN AGRON DEPT BIOTECHNOL LAB BIOQUIM & BIOL MOL E-28040 MADRID SPAIN].

Gene-specific probes (3' ends of cDNAs) were obtained from barley cDNAs encoding two types of glycine-rich proteins: HvGRP2, characterized by a cytochrome-like and a cysteine-rich domain, and HvGRP3, whose main feature was an RNA-binding domain. Expression of genes Hvgrp2 and Hvgrp3, which are present at one (or two) copies per haploid genome, was ubiquitous and gene Hvgrp3 was under light/darkness modulation. Cold treatment increased Hvgrp2 and Hvgrp3 mRNA levels. Methyl jasmonate (10  $\mu$ M) switched off the two genes. Expression of Hvgrp2, but not that of Hvgrp3, was induced by ethylene treatment (100 ppm). Fungal pathogens *Erysiphe graminis* and *Rhynchosporium secalis* increased the mRNAs levels of the two genes, both in compatible and in incompatible interactions, while bacterial pathogens did not. [References: 47].

3815 Moreno, F.; Pelegrin, F.; Fernandez, J.E.; Murillo, J.M. (1997) SOIL PHYSICAL PROPERTIES, WATER DEPLETION AND CROP DEVELOPMENT UNDER TRADITIONAL AND CONSERVATION TILLAGE IN SOUTHERN SPAIN. *Soil & Tillage Research*. 41(1-2):25-42. English. [CSIC INST RECURSOS NAT & AGROBIOL POB 1052 E-41080 SEVILLE SPAIN].

Tillage methods affect soil physical properties and, thus, have a direct influence on the replenishment and depletion of soil water storage and crop performance. This study was conducted to determine the effects of traditional and conservation tillage on soil physical properties, soil water replenishment and depletion, and crop development and yield under southern Spanish conditions. The experiments were carried out from 1992 to 1995 in a sandy clay loam soil (Xerofluvent). The traditional tillage (TT) method consisted mainly of the use of mouldboard ploughing, and the conservation tillage (CT) was characterized by not using mouldboard ploughing, by reduction of the number of tillage operations and leaving the crop residues on the surface as mulch. In both tillage treatments a wheat (*Triticum aestivum*, L.)-sunflower (*Helianthus annuus*, L.) crop rotation was established. In each treatment, systematic measurements of bulk density, resistance to penetration, infiltration rate and hydraulic conductivity (using tension disc infiltrometers) in the soil top layer were

carried out. Changes in water profiles through the experimental period were also followed using a neutron probe. Crop development and yield were determined. The soil bulk density in the 0 to 20 cm layer was significantly higher in the CT than in the TT treatment, mainly after tillage operations (between 10% and 24% higher in CT than in TT). After 3 years of continuous tillage treatments, the soil bulk density did not increase. The resistance to penetration at any time was higher in the CT than in the TT treatment, but not always significantly different. Infiltration rates were significantly higher in the TT than in the CT treatment (about 35% higher in TT than in CT). After 3 years of the tillage treatments the hydraulic conductivity of the soil surface layer, at a pressure head of 0 mm, was significantly higher in the CT (124 mm h<sup>-1</sup>) than in the TT (66 mm h<sup>-1</sup>). This is related to the existence of preferential paths created by an increase of the earthworm population in the CT treatment. Soil water profiles showed higher replenishment of soil water storage in the CT than in the TT treatment, particularly from October 1994 to June 1995 when the lowest precipitation of the experimental period was recorded. Plant height, leaf area index (LAI) and root length density (RLD) of the first sunflower crop were significantly higher in the TT than in the CT treatment. Nevertheless, the seed yield was slightly higher in the CT than in the TT treatment. In the second sunflower crop, plant height, LAI, RLD were significantly higher in the CT than in the TT treatment except early in the season, and yield was significantly (and extremely) higher in the CT (1521 kg ha<sup>-1</sup>) than in the TT (473 kg ha<sup>-1</sup>) treatment. During the wheat crop season, plant height and RLD were higher in the TT than in the CT treatment, but grain yield was again slightly higher in the CT than in the TT treatment. The conservation tillage applied seems to be highly effective in enhancing soil water recharge and water conservation, particularly in years with much lower than average precipitation. [References: 35].

3816 Mornhinweg, D.W. (USDA, ARS, Stillwater, OK.); Porter, D.R.; Webster, J.A. (1996) Inheritance of Russian wheat aphid resistance in spring barley germplasm line STARS-9577B. *Barley genetics newsletter (USA)* v. 25 p. 34-35. references. English. (AGRI 97-060771).

3817 Morris, C.F. (Western Wheat Quality Lab. USDA ARS, Pullman, WA (USA)); Raykowski, J.A. (1994) A computer-aided approach to the evaluation of wheat grain and flour quality. *Computers and Electronics in Agriculture (Netherlands)* v. 11(2-3) p. 229-237. 5 ref. English. (AGRI 97-075532).

3818 Nagaoka, T.; Ogiwara, Y. (1997) APPLICABILITY OF INTER-SIMPLE SEQUENCE REPEAT POLYMORPHISMS IN WHEAT FOR USE AS DNA MARKERS IN COMPARISON TO RFLP AND RAPD MARKERS. *Theoretical & Applied Genetics*. 94(5):597-602. English. [YOKOHAMA CITY UNIV KIHARA INST BIOL RES MAIOKA CHO 64112 YOKOHAMA 244 JAPAN].

Inter-simple sequence repeat polymorphic DNA (ISSR) was evaluated for its applicability as a genetic marker system in wheat. PCR was carried out with primers that annealed to simple sequence repeats. The resultant products were subjected to agarose-gel electrophoresis, and the banding patterns were compared among six wheat accessions containing diploid, tetraploid, and hexaploid members. Out of 100 examined, 33 primers produced distinguishable as well as polymorphic bands in each of the six accessions. Although most of the primers that gave distinct bands (30 primers out of 33) contained dinucleotide repeats, each of the primers with tri-, tetra-, and penta-nucleotide motifs also yielded discrete bands. Primers based on (AC)<sub>n</sub> repeats gave the most polymorphic bands. In total, 224 polymorphic bands were found in the comparison between Einkorn wheats whereas, on the average, 120 polymorphic bands were detected between common wheats. ISSR primers produced several times more information than RAPD markers. The extent of band polymorphism was similar to that of RFLP markers, and greater than that of RAPDs. The genetic relationships of wheat accessions estimated by the polymorphism of ISSR markers were identical with those inferred by RFLP and RAPD markers, indicating the reliability of ISSR markers for estimation of genotypes. These polymorphic bands are potential candidates as novel markers for use in linkage-map construction in wheat. The characteristic features of ISSR markers, i.e. polymorphism, generation of information and ease of handling, suggest their applicability to the analysis of genotypes as well as to the construction of PCR-based genome maps of wheats. [References: 22].

3819 Nevo, E.; Apelbaumelkahr, I.; Garty, J.; Beiles, A. (1997) NATURAL SELECTION CAUSES MICROSCALE ALLOZYME DIVERSITY IN WILD BARLEY AND A LICHEN AT EVOLUTION CANYON, MT CARMEL, ISRAEL. *Heredity*. 78(Part 4):373-382. English. [UNIV HAIFA INST EVOLUT MT CARMEL IL-31905 HAIFA ISRAEL].

Allozymic diversity was studied for proteins encoded by 28 putative loci in 170 plants of wild barley, *Hordeum spontaneum*, and for 13 loci in 78 different thalli of the lichen *Caloplaca aurantia*, from the Lower Nahal Oren microsite, Mt. Carmel, Israel, designated by us 'Evolution Canyon'. The samples of wild barley were collected from six stations: three (upper, middle, lower) on the south-facing slope (SF-slope) and three (lower, middle, upper) on the north-facing slope (NF-slope). The samples of *C. aurantia* were collected from three stations: two (middle and upper) on the SF-slope and one (upper) on the NF-slope. Higher solar radiation on the SF- than on the NF-slope makes it warmer, drier, spatiotemporally more heterogeneous, and climatically more fluctuating and stressful. Consequently, it exhibits an open park forest representing an 'African' savanna landscape. Significant inter- and intraslope allozymic differentiation was found in both organisms with generally higher polymorphism, heterozygosity, allele and gene diversity on the more variable and stressful upper station of the SF-slope, as expected by the niche-width variation hypothesis, and the environmental theory of genetic diversity. Solar radiation, temperature and aridity stress caused interslope and intraslope differences on the SF-slope in genotypes and phenotypes of wild barley and the lichen at the 'Evolution Canyon' microsite, as was the case for beetles, diplopods and earthworms tested at the site. Diversifying natural (microclimatic) selection appears to be the major evolutionary driving force causing interslope and SF-intraslope adaptive genetic divergence. 'Evolution Canyon' proves an optimal model for unravelling evolution in action, across life and organizational levels. [References: 54].

3820 Niu, X. (Pennsylvania State University, University Park, PA.); Adams, C.C.; Workman, J.L.; Guiltinan, M.J. (1996) Binding of the wheat basic leucine zipper protein EmBP-1 to nucleosomal binding sites is modulated by nucleosome positioning. *The Plant cell (USA)* v. 8(9) p. 1569-1587. references. English. (AGRIC 97-061097).

To investigate interactions of the basic leucine zipper transcription factor EmBP-1 with its recognition sites in nucleosomal DNA, we reconstituted an abscisic acid response element and a high-affinity binding site for EmBP-1 into human and wheat nucleosome cores in vitro. DNA binding studies demonstrated that nucleosomal elements can be bound by EmBP-1 at reduced affinities relative to naked DNA. EmBP-1 affinity was lowest when the recognition sites were positioned near the center of the nucleosome. Binding was achieved with a truncated DNA binding domain; however, binding of full-length EmBP-1 caused additional strong DNase I hypersensitivity flanking the binding sites. Similar results were observed with nucleosomes reconstituted with either human or wheat histones, demonstrating a conserved mechanism of transcription factor-nucleosome interactions. We conclude that positioning of recognition sequences on a nucleosome may play an important role in regulating interactions of EmBP-1 with its target sites in plant cells.

3821 Nkongolo, K. (Laurentian University, Sudbury, Ontario, Canada.); Perinot, G.; Ratiarson, A. (1996) Identification of a repeat sequence of rye DNA in wheat and related species. *Plant molecular biology reporter (USA)* v. 14(4) p. 343-352. references. English. (AGRIC 97-061100).

3822 Nobre, J. (IACR Rothamsted, Herts, UK.); Leon, R.; Davey, M.; Lazzeri, P.A. (1996) Regeneration of fertile plants from protoplasts isolated directly from immature embryos of barley (*Hordeum vulgare* L.). *Barley genetics newsletter (USA)* v. 25 p. 46-49. references. English. (AGRIC 97-060730).

3823 Oettler, G. (1996) VARIATION AND COVARIATION OF AGRONOMIC TRAITS AND QUALITY IN TRITICALE AT LOW NITROGEN INPUT. *Plant Breeding*. 115(6):445-450. English. [UNIV HOHENHEIM LANDESSAATZUCHTANSTALT FRUWIRTHSTR 21 D-70599 STUTTGART GERMANY].

The use of high nitrogen (N) inputs is becoming restricted in many countries due to environmental and economic considerations and reliable information is needed about parameters pertinent for breeding N-use efficient triticales (xTriticosecale Wittmack). This study reports estimates of variances, heritabilities, correlations, and regression for 36 triticales, grown at three locations for 2 years with two N regimes (zero and normal

N supply). Eleven traits were assessed. A 45% mean reduction in grain yield by low N input was mainly the result of a 25% lower number of tiller-bearing spikes per m<sup>2</sup> and 17% fewer kernels per spike, whereas 1000-kernel weight was little affected. Genotype-nitrogen interaction was of importance only in some environments and for certain traits. Heritability estimates at both N levels were similar and moderate to high. Correlations between N levels were high for nearly all traits. Regression analysis for grain yield revealed only few N-efficient triticales with lower than unity slope together with a high grain yield. Based on the genetic parameters, it is concluded that a special low input breeding programme does not appear to be necessary in triticales. The breeder can select at either of the N levels with similar response. But he should include tests in low productivity environments at some early stages in the breeding process to avoid loss of genetic variation for N-use efficiency. [References: 34].

3824 Ortiz, J.P.A.; Reggiardo, M.I.; Ravizzini, R.A.; Altabe, S.G.; Cervigni, D.L.; Spitteler, M.A.; Morata, M.M.; Elias, F.E.; Vallejos, R.H. (Universidad Nacional, Rosario (Argentina). Centro de Estudios Fotosintéticos y Bioquímicos) (1996) [Hygromycin resistance as an efficient selectable marker for wheat stable transformation]. [Hygromycinresistenz als effizienter selektierbarer Marker fuer stabile Transformation bei Weizen (*Triticum aestivum*)]. *Plant Cell Reports (Germany)* v. 15(12) p. 877-881. 4 ill., 1 table; 19 ref. English. (AGRIC 97-060690).

3825 Owuor, E. (University of Haifa, Haifa, Israel.); Kimani, P.M.; Mendlinger, S.; Chweya, J.; Whittaker, L. (1996) Comparative allozymic multilocus analysis of genetic diversity in wild barley from Turkmenistan (former USSR) and Israel: implications on sampling strategies. *Barley genetics newsletter (USA)* v. 25 p. 10-12. references. English. (AGRIC 97-060758).

3826 Panayotov, I.; Tsujimoto, H. (1997) FERTILITY RESTORATION AND NOR SUPPRESSION CAUSED BY AEGILOPS MUTICA CHROMOSOMES IN ALLOPLASMIC HYBRIDS AND LINES. *Euphytica*. 94(2):145-149. English. [INST WHEAT & SUNFLOWER DOBROUDJA BU-9520 GENERAL TOSHEVO BULGARIA].

By crossing *Aegilops mutica* with *Triticum dicoccum* as a bridge species and backcrossing with common wheat as a recurrent pollen parent, male sterile alloplasmic line(s) were produced. In progeny of the crosses, a self fertile plant with 42 chromosomes was selected and named R 20. From this plant several lines that possessed Rf (fertility restoring) genes and/or powdery mildew resistant genes were obtained. Apparently, the system of sterility-fertility of pollen can be applied for hybrid wheat production. In addition, the disease resistance may be used in breeding. The male fertile lines possessed one or more Ae. mutica sat-chromosome(s), which show the ability to suppress the nucleolar organizing regions of chromosomes 1B and 6B of common wheat. The relation between the sat-chromosomes and male fertility restoration is not yet clear. [References: 10].

3827 Patterson, A.H. (Texas AandM University, College Station, TX.); Lan, T.H.; Reischmann, K.P.; Chang, C.; Lin, Y.R.; Liu, S.C.; Burrow, M.D.; Kowalski, S.P.; Katsar, C.S.; DelMonte, T.A. (1996) Toward a unified genetic map of higher plants, transcending the monocot-dicot divergence. *Nature genetics (USA)* v. 14(4) p. 380-382. references. English. (AGRIC 97-060584).

3828 Petersen, G. (Copenhagen Univ. (Denmark). Botanical Inst.); Johansen, B.; Seberg, O. (1996) PCR and sequencing from a single pollen grain. *Plant Molecular Biology (Netherlands)* v. 31(1) p. 189-191. 11 ref. English. (AGRIC 97-075242).

3829 Petersen, G. (Copenhagen Univ. (Denmark). Botanical Inst.); Seberg, O. (1996) ITS regions highly conserved in cultivated barleys. *Euphytica (Netherlands)* v. 90(2) p. 233-234. 10 ref. English. (AGRIC 97-075241).

3830 Petrovic, S. (Poljoprivredni fakultet, Novi Sad (Yugoslavia). Institut za ratarstvo i povrtarstvo); Kraljevic Balalic, M.; Dimitrijevic, M.; Mladenov, N. (1997) [The effect analysis of plant height on harvest index and the components of phenotypic variability in wheat genotypes]. Analiza efekta visine biljke na zetveni index genotipova pšenice i komponente fenotipske varijabilnosti. 31. seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naucni institut za ratarstvo i povrtarstvo (Yugoslavia) (no.29)* p. 253-259. 2 graphs; 3 tables; 11 ref. Serbian. (AGRIC 97-075520).



Plant height and harvest index were analyzed for phenotypic variability and distances using twenty different wheat varieties. The greater influence on phenotype had genetic component. Negative correlation between plant height and harvest index was observed. According to cluster analysis, there were several groups and subgroups on the different hierarchical levels, regarding examined traits.

3831 Phillips, JR.; Dunn, MA.; Hughes, MA. (1997) MRNA STABILITY AND LOCALISATION OF THE LOW-TEMPERATURE-RESPONSIVE BARLEY GENE FAMILY BLT14. *Plant Molecular Biology*. 33(6):1013-1023. English. [UNIV NEWCASTLE UPON TYNE DEPT BIOCHEM & GENET NEWCASTLE UPON TYNE NE4 2HH TYNE & WEAR ENGLAND].

Transcription and translation inhibitors have been used to investigate the role of mRNA stability in the low-temperature-regulated expression of the post-transcriptionally controlled low temperature responsive barley gene family, blt14. Genomic clones (blt14.1, blt14.2) representing additional members of the blt14 gene family have been isolated and sequenced. Gene specific probes have been used to analyse the spatial expression of each individual member of the blt14 gene family. Findings indicate that all of the genes are responsive to low temperature, but the organ distribution is different for each gene. The results indicate that blt14.0 mRNA is stabilised by a low-temperature-dependent protein factor. Taken together, the results suggest that organ-specific post-transcriptional mechanisms are important in the low-temperature regulation of blt14 gene expression. [References: 41].

3832 Pinheiro Alves, F. (Estacao Nacional de Melhoramento de Plantas, Elvas (Portugal)); Mexia, J.T. (Nova de Lisboa Univ., Monte da Caparica (Portugal)); Baeta, J.; Gusmao, L.; Gusmao, M.R. (Estacao Agronomica Nacional, Oeiras (Portugal)) (1995) [Differentiators of the general mixing capacity in triticales]. *Diferenciadores da capacidade geral para a mistura em triticales*. Sociedade de Ciencias Agrarias de Portugal, Lisbon (Portugal). *Revista de Ciencias Agrarias (Portugal)* v. 8(1) p. 41-50. 8 tables; 6 ref. Portuguese. (AGRIS 97-061085).

3833 Pogna, N.E.; Pasquini, M.; Mazza, M.; Pagliaricci, S. (Istituto Sperimentale Cerealicoltura, Rome (Italy)); Redaelli, R.; Vaccino, P. (1995) Technological and nutritional quality of wheat: genetic basis and breeding by chromosomal and gene mutations. International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. *Proceedings. Proceedings Series (IAEA)* p. 77-91. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM/340/20. English. (AGRIS 97-075517).

3834 Prasad, G. (SDJ Post Graduate College, Azamgarh, India.) (1996) Varietal effect on mutation frequency and spectrum induced by gamma rays in barley. *Barley genetics newsletter (USA)* v. 25 p. 19-21. references. English. (AGRIS 97-060765).

3835 Prat Gay, G. de (Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil.) (1996) Spectroscopic characterization of the growing polypeptide chain of the barley chymotrypsin inhibitor-2. *Archives of biochemistry and biophysics (USA)* v. 335(1) p. 1-7. references. English. (AGRIS 97-075247).

A series of N-terminal fragments of increasing size covering the complete sequence of chymotrypsin inhibitor-2 were previously produced using a combination of peptide synthesis and chemical cleavage at engineered methionine residues. Circular dichroism (CD) and NMR spectroscopic studies of the fragments are presented, as well as the folding characterization of the methionine mutants. The far-uv circular dichroism spectra of the small fragments correspond to disordered structures with some weak interactions indicated by temperature effects on certain spectral bands. There is evidence of a formation of a beta-turn around residues 24-26 in fragment C1-2(1-28), not observable on the NMR time scale. The intermediate fragment (1-50) is disordered at low temperature but more ordered when the temperature is increased. The 1D NMR spectra of the large fragments show an increased chemical shift dispersion in the amide hydrogen region, which indicates that tertiary interactions appear in fragment (1-53) together with a major secondary structure change, as shown by the concomitant change in the CD spectra. A key structural transition occurs on addition of residues Phe-50 and Val-51 and fragment (1-60) is largely folded. A second important structural transition in the elongation of the polypeptide occurs on addition of residue Val-63, where

a compact fully folded fragment (1-63) is formed albeit with largely reduced stability. Near-uv circular dichroism indicates that the environment of the Trp-5 is fully recovered only in (1-63), probing the correct side-chain packing.

3836 Prina, A.R. (CICA, INTA, Castelar, Argentina.) (1996) Mutator-induced cytoplasmic mutants in barley: genetic evidence of activation of a putative chloroplast transposon. *The Journal of heredity (USA)* v. 87(5) p. 385-389. references. English. (AGRIS 97-060761).

The four mutants described here were visually selected among the selfed progeny of a chloroplast mutator (cpm/cpm) genotype. Due to their mode of inheritance they were designated as cytoplasmic lines (CLs). One of them, CL3 was a homogeneous viridis (light-green) type, while the other three presented diverse positional patterns of variegation and also had different expression depending on the stage of growth. They showed different levels of additional variation, observed as longitudinal streaks, either lighter or darker than the color of each mutant background. By crossing CL plants as female with normal-green and genetically stable plants, it was possible to obtain, in subsequent generations, mutant families with the general characteristics of the corresponding CL but, in a stable state, free of additional variation. This was mainly evident for CL4, which in the progenies from selfing showed a much higher level of additional variation than the other CLs analyzed, having most of the variation of the normal-green type. Backcrosses of pure and stable CL4 plants as female with a mutator genotype, showed seedlings with normal-green streaks, after one generation of selfing, indicating they were not a consequence of a delayed chloroplast sorting. The high rate of reversion, several times higher than that of forward mutations, suggests the origin of CL4 was the insertion of a putative transposable element in the corresponding mutant gene of the chloroplast. It is hypothesized that the Cpm/cpm gene is involved in cpDNA repair, while transposon activation is explained based on the genome stress hypothesis, in which a RecA-like protein is postulated to play a central role.

3837 Prina, A.R. (Instituto de Genetica Ewald A. Favret, Castelar, Argentina.); Arias, M. del C.; Fuente, M.C. de la (1996) A new mutant allele for Xa/xs gene and its use for location of newly induced mutants in the long arm of barley's chromosome 1. *Barley genetics newsletter (USA)* v. 25 p. 31-33. references. English. (AGRIS 97-060770).

3838 Rasmusson, DC.; Phillips, RL. (1997) PLANT BREEDING PROGRESS AND GENETIC DIVERSITY FROM DE NOVO VARIATION AND ELEVATED EPISTASIS [Review]. *Crop Science*. 37(2):303-310. English. [UNIV MINNESOTA DEPT AGRON & PLANT GENET ST PAUL, MN 55108 USA].

Breeding programs in major crops normally restrict the use of parents to those improved for a variety of traits. Gain from utilizing these good x good crosses appears to be high, and improvements are sufficient to encourage continued breeding within narrow gene pools even though each cycle is expected to lead to reduced genetic variability. These finely tuned programs have gradually limited the amount of new diversity introduced into the breeding gene pool. This breeding strategy has led to a genetic gap where there is a large difference in the favorable gene frequency between the improved and unimproved lines and to a narrowing of genetic diversity within elite gene pools. At the same time, evidence has accumulated in plant breeding programs and long-term selection experiments in several organisms that the genome is more plastic and amenable to selection than previously assumed. In the barley (*Hordeum vulgare* L.) case study reported here, incremental genetic gains were made for several traits in what appears, based on pedigree analysis, to be a narrow gene pool. Given this situation, we call for an examination of the generally held belief that the variation on which selection is based in elite gene pools is provided almost exclusively from the original parents. Classical and molecular genetic analyses have shown that many mechanisms exist to generate variation de novo, such as gene amplification and transposable elements. Accordingly, we put forward the hypothesis that newly generated variation makes an important contribution. We also hypothesize that gene interaction, epistasis, is more important than commonly viewed and that it arises from de novo generated diversity as well as the original diversity. [References: 69].

3839 Reinbothe, C.; Parthier, B.; Reinbothe, S. (1997) TEMPORAL PATTERN OF JASMONATE-INDUCED ALTERATIONS IN GENE EXPRESSION OF BARLEY LEAVES. *Planta*. 201(3):281-287. English.

Leaf tissues of barley (*Hordeum vulgare* L. cv. Salome) respond to methyl jasmonate (JaMe) treatment with a characteristic pattern of gene expression. Jasmonate-induced proteins (JIPs), such as leaf thionins (jip15 gene product) and ribosome-inactivating proteins (jip60 gene product), rapidly accumulate. Their genes are transiently transcriptionally activated, as shown here by the determination of in-vitro transcription rates in run-off assays. In contrast to jip genes, expression of photosynthetic genes encoding the small subunit of ribulose-1, 5-bisphosphate carboxylase/oxygenase (rbcS gene product) and a type III light-harvesting chlorophyll-a/b-binding protein (LHCP; lhcC1 gene product), for example, was rapidly down-regulated in JaMe-treated barley leaves. Despite decreasing rates of rbcS and lhcC1 gene transcription, their transcripts were maintained in JaMe-treated leaf tissues for at least 36 h. Only at a later stage, was there a decline in the levels of rbcS and lhcC1, but not jip, transcripts, suggesting a selective destabilization of photosynthetic mRNAs in JaMe-treated leaf tissues. [References: 34].

3840 Ribeirocarvalho, C.; Guedes Pinto, H.; Harrison, G.; Heslop-harrison, J.S. (1997) WHEAT-RYE CHROMOSOME TRANSLOCATIONS INVOLVING SMALL TERMINAL AND INTERCALARY RYE CHROMOSOME SEGMENTS IN THE PORTUGUESE WHEAT LANDRACE BARBELA. *Heredity*. 78(Part 5):539-546. English. [JOHN INNES CTR PLANT SCI RES KARYOBIOL GRP COLNEY LANE NORWICH NR4 7UH NORFOLK ENGLAND].

The old Portuguese wheat landrace aggregate, known as Barbela, shows good productivity under low fertility conditions often associated with acid soils. Using genomic in situ hybridization with rye DNA, we were able to show that Barbela wheat lines contain small, spontaneously occurring, rye chromosome segments representing up to 5 per cent of a chromosome. Two independent accessions were studied which included terminal rye segments, and a further accession had one chromosome pair with a terminal segment and a second pair with an intercalary chromosome segment (3.5 per cent) of rye origin. Small alien chromosome segments are valuable in cereal breeding for transfer of useful characteristics into wheat without deleterious characteristics from the alien. These results show that such translocations may occur spontaneously and be of such high agronomic value that they are selected by farmers as landraces. [References: 34].

3841 Robinson, J.; Jalli, M.; Lindqvist, H. (1997) RESISTANCE TO RHYNCHOSPORIUM SECALIS IN SIX NORDIC BARLEY GENOTYPES. *Plant Breeding*. 116(1):101-103. English. [MTT AGR RES CTR FINLAND INST CROP & SOIL SCI PLANT BREEDING RES SECT FIN-31600 JOKIOINEN FINLAND].

Six six-row Nordic spring barley genotypes (*Hordeum vulgare* L.) were assessed in the field in Finland (1994 and 1995) for resistance to *Rhynchosporium secalis* (Oud.) J.J. Davis, the causal pathogen of scald, in artificially inoculated plots. The barleys were known not to contain major genes for resistance to scald and the purpose of these experiments was to identify quantitative differences in resistance to scald which might be exploitable in a breeding programme. Disease development was monitored, grain yield and yield components were recorded, and these data were compared with measurements taken from plants in plots kept free of disease. Data, averaged over both years, for disease development on the uppermost three leaves - areas under disease progress curves, terminal severity and apparent infection rates - indicated that 'Verner', 'Pohto' and 'Pokko' were symptomatically significantly more resistant to scald than 'Arve', 'Loviisa' and 'Jo 1599'. Grain yields, thousand-grain weights, test weights and proportions of plump grains were all significantly reduced in plots inoculated with scald compared with those kept free of disease. 'Verner' appeared to be the most useful genotype for use in crossing programmes to improve scald resistance in Finnish barleys. [References: 9].

3842 Rouster, J.; Leah, R.; Mundy, J.; Cameronmills, V. (1997) IDENTIFICATION OF A METHYL JASMONATE-RESPONSIVE REGION IN THE PROMOTER OF A LIPOXYGENASE 1 GENE EXPRESSED IN BARLEY GRAIN. *Plant Journal*. 11(3):513-523. English. [CARLSBERG LAB DEPT PHYSIOL GAMLE CARLSBERG VEJ 10 DK-2500 COPENHAGEN DENMARK].

A genomic DNA fragment was isolated containing 5' upstream sequences and part of the open reading frame corresponding to the

lipoxygenase 1 cDNA (LoxA) expressed in barley grains during development and germination. Lox1 transcription was shown to be methyl jasmonate (MeJA)- and wound-inducible in leaves, but Lox1 transcripts were not detected in mildew-infected leaves, although this is a commonly observed response to pathogenic attack in various plants. Transient gene expression assays were used to identify a promoter region involved in MeJA-responsive expression. Analysis of 5' and 3' promoter deletions indicated that sequences between -363 and -294 conferred MeJA-responsive expression. Deletions/replacements covering this part of the promoter further defined a MeJA-responsive region between -331 and -291. Insertion of the region -328 to -293 into the constitutive CaMV 35S promoter conferred MeJA-responsive expression. The 36 bp fragment contains the motif TGACG as inverted repeats, which has been previously identified as a binding site for bZIP transactivating factors. Site-directed mutagenesis on these TGACG motifs abolished MeJA-responsive expression, clearly identifying them as MeJA-responsive elements. Sequence comparisons found no similar motif in other characterized promoters of MeJA-inducible genes, but suggested a common spatial structure which may serve as a binding site for transacting factors involved in the MeJA signal transduction pathway. [References: 60].

3843 Rouves, S.; Boeuf, C.; Zwickertmenteur, S.; Gautier, MF.; Joudrier, P.; Bernard, M.; Jestin, L. (1996) LOCATING SUPPLEMENTARY RFLP MARKERS ON BARLEY CHROMOSOME 7 AND SYNTENY WITH HOMOELOGOUS WHEAT GROUP 5. *Plant Breeding*. 115(6):511-513. English. [INRA DOMAINE DE CROUELLE F-63000 CLERMONT FERRAND FRANCE].

In order to develop QTL applications, eight new loci were mapped on barley chromosome 7 using 124 doubled haploid lines of the North American Barley Genome Mapping Project (NABGMP) progeny ('Steptoe' x 'Morex'). These loci involve six genomic DNA restriction fragment length polymorphisms (RFLPs) and two cDNA-RFLPs including a puroindoline gene. The distribution of these markers on barley chromosome 7 was compared with that of homoeologous wheat counterparts, i.e. wheat group 5. One locus on chromosome 7 was associated with a QTL for beta-glucanase activity measured in green and finished barley malt. [References: 23].

3844 Sadiq, MS.; Arain, CR.; Azmi, AR. (1997) WHEAT BREEDING IN A WATER STRESSED ENVIRONMENT .5. CARBON ISOTOPE DISCRIMINATION AS A SELECTION CRITERION. *Cereal Research Communications*. 25(1):43-49. English. [NUCL INST AGR & BIOL POB 128 FAISALABAD PAKISTAN].

To assess the potential of carbon isotope discrimination as a selection criterion for enhancing stress yield, simulated water deficit field studies were undertaken to measure its genetic variation and association with yield and yield related traits. Discrimination was significantly reduced in terminal stress compared to well watered conditions. Carbon isotope discrimination was significantly correlated with grain yield, biological yield, harvest index, and productive tillers under terminal and preanthesis stress. [References: 22].

3845 Sanchez Garcia, Victor Manuel (1995) [Wheat tolerant to dry conditions inoculation with *Azospirillum* spp. under rainfed conditions in Chapingo]. Inoculacion de trigo (*Triticum aestivum* L.) tolerante a sequia con *Azospirillum* spp. bajo condiciones de temporal en Chapingo. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Fitotecnia. 49 p. Spanish. (AGRI 97-074950).

3846 Senft, P.; Wricke, G. (1996) AN EXTENDED GENETIC MAP OF RYE (SECALE CEREALE L.). *Plant Breeding*. 115(6):508-510. English. [UNIV HANNOVER INST ANGEW GENET HERRENHAUSER STR 2 D-30419 HANNOVER GERMANY].

A genetic linkage map of rye consisting of 92 markers was constructed by using isozyme and molecular marker techniques. For this purpose an F-2 population of 137 individuals was established on which RFLP studies with homologous and heterologous probes were performed. After establishing a reliable polymerase chain reaction (PCR) protocol, 280 random primers were screened for polymorphisms and 17 random amplified polymorphic DNA (RAPD) loci were mapped. The digestion of the template DNA prior to PCR increased the degree of polymorphism. Previously published markers could also be integrated into this map by using the JoinMap computer program. The resulting linkage map

comprises a total of 127 markers and spans a distance of about 760 cM. [References: 18].

3847 Seo, YW.; Johnson, JW.; Jarret, RL. (1997) A MOLECULAR MARKER ASSOCIATED WITH THE H21 HESSIAN FLY RESISTANCE GENE IN WHEAT. *Molecular Breeding*. 3(3):177-181. English. [UNIV GEORGIA GEORGIA EXPT STN USDA ARS GENET RESOURCES UNIT 1109 EXPT ST GRIFFIN, GA 30223 USA].

Near-isogenic lines in conjunction with bulked segregant analysis were used to identify a DNA marker in wheat (*Triticum aestivum* L.) associated with the H21 gene conferring resistance to biotype L of Hessian fly [*Mayetiola destructor* (Say)] larvae. Near-isogenic lines were developed by backcross introgression BC3F3:4 ('Coker 797' \*4/'Hamlet') and differed by the presence or absence of H21 (on 2RL) derived from 'Chaupon' rye (*Secale cereale* L.). Bulk DNA samples were prepared from near-isogenic lines and BC3F2 population individuals segregating for reaction to Hessian fly biotype L and screened for random amplified polymorphic DNA markers using 46 10mer primers. Random-amplified polymorphic DNA markers from resistant and susceptible individuals and parental lines were scored and these data were used to identify a 3 kb DNA fragment that was related to the occurrence of H21. This fragment was amplified from DNA isolated from Hamlet, a near-isogenic line carrying 2RL, and bulked DNA from resistant BC3F2 individuals, but not from the recurrent parent Coker 797 or DNA bulks from susceptible BC3F2 plants. Analysis of 111 BC3F2 segregating individuals and BC3F2:3 segregants confirmed the co-segregation of the 3 kb DNA marker with the H21 resistance gene to Hessian fly. Use of this marker could facilitate more rapid screening of plant populations for Hessian fly resistance and monitoring the introgression of H21. [References: 29].

3848 Serik, O.; Ainur, I.; Murat, K.; Tetsuo, M.; Masaki, I. (1996) SILICON CARBIDE FIBER-MEDIATED DNA DELIVERY INTO CELLS OF WHEAT (*TRITICUM AESTIVUM* L.) MATURE EMBRYOS. *Plant Cell Reports*. 16(3-4):133-136. English. [KYOTO UNIV FAC SCI DEPT BOT SAKYO KU KYOTO 60601 JAPAN].

We have demonstrated that foreign DNA can be delivered into cells of mature embryos of wheat (*Triticum aestivum* L.) using silicon carbide fibers (SCF). The highest transient expression of the gusA (GUS) gene was detected when dry embryos were vortexed for 10-30 min in a SCF-DNA solution containing 90-120 g/l of sucrose. Up to 100 (on average 20-40) blue expression units per embryo were observed. Scutellum side and epiblast of the intact wheat are preferentially transformed. When embryos with the coleoptilar tip removed were treated and allowed to germinate, GUS staining was observed in emerging leaf tissues. potential of this new approach for transformation of wheat is under investigation. It has been found that callus tissues induced from the SCF treated embryos contain GUS-expressing sectors one month after treatment. [References: 20].

3849 Shakirova, FM.; Bezrukova, MV. (1997) INDUCTION OF WHEAT RESISTANCE AGAINST ENVIRONMENTAL SALINIZATION BY INDOLYLACETIC ACID. *Izvestia Akademii Nauk SSSR. Seriya Biologicheskaya*. (2):149-153. Russian. [RUSSIAN ACAD SCI DEPT BIOCHEM & CYTOL 69 OCTOBER AVE UFA 450054 RUSSIA].

The effects of exogenous treatment of wheat (*Triticum aestivum*) seeds or seedlings with salicylic acid (SA) on the rate of germination and the ratio of indolylacetic acid (IAA) to abscisic acid (ABA), as well as on the lectin level in the roots of 4-day wheat seedlings during salt stress were studied. SA at 0.1 mM increased the rate of seed germination at various degrees of medium salinization (0.5-1.5% NaCl). Pretreatment of the seedling with SA led to marked accumulation of ABA in the roots of the seedlings, which, however, did not inhibit growth processes due, apparently, to the stimulating effect of SA on the IAA level. SA induced a twofold accumulation of lectin in the roots of 4-day wheat seedlings and fully relieved the salt stress (2% NaCl)-induced decrease of the IAA level and lectin accumulation and reduced the salinization-induced sharp increase of the ABA content in the roots of the seedlings. The data obtained suggest a protective effect of SA on wheat plants during salt stress. [References: 20].

3850 Sharma, RC.; Dubin, HJ.; Bhatta, MR.; Devkota, RN. (1997) SELECTION FOR SPOT BLOTCH RESISTANCE IN FOUR SPRING WHEAT POPULATIONS. *Crop Science*. 37(2):432-435. English. [CIMMYT APDO 6-641 MEXICO CITY 06600 DF MEXICO].

Spot blotch of wheat (*Triticum aestivum* L.), caused by *Bipolaris sorokiniana* (Sacc.) Shoem., is a serious constraint in South Asia, and leading cultivars have low levels of resistance. The response to selection for low and high area under disease progress curve (AUDPC) of spot blotch in four wheat populations, involving different Chinese hexaploid parents with high level of resistance and a commercial cultivar moderately resistant to spot blotch, was investigated. Selections were made in the F-3 generation for low and high AUDPC of spot blotch and selected progenies evaluated in a replicated field test in the F-4 generation at Rampur, Nepal, in 1994. Selection in the F-3 for low and high AUDPC was effective in identifying F-4 lines with low and high AUDPC, respectively. Low AUDPC resulted in higher biomass and grain yield, higher harvest index, and 1000-kernel weight. On average, the low AUDPC lines headed later than the high AUDPC lines. Realized heritability estimates for AUDPC were intermediate to high in magnitude (0.48 to 0.76). AUDPC was negatively correlated with biomass ( $r = -0.195$  to  $-0.451$ ), grain yield ( $r = -0.169$  to  $-0.452$ ), harvest index ( $r = -0.256$  to  $-0.597$ ), days to heading ( $r = -0.319$  to  $-0.570$ ), and 1000-kernel weight ( $r = -0.322$  to  $-0.530$ ). Results indicate that selection for low AUDPC of spot blotch in segregating generations would be effective in identifying wheat lines with high levels of resistance and would have positive effects on other characters. [References: 9].

3851 Sharma, RC.; Dubin, HJ.; Devkota, RN.; Bhatta, MR. (1997) HERITABILITY ESTIMATES OF FIELD RESISTANCE TO SPOT BLOTCH IN FOUR SPRING WHEAT CROSSES. *Plant Breeding*. 116(1):64-68. English. [INST AGR & ANIM SCI RAMPUR CHITWAN NEPAL].

Spot blotch of wheat (*Triticum aestivum* L.) caused by *Bipolaris sorokiniana* (Sacc. in Sorok.) Shoem., is a major disease in South Asia. Popular commercial cultivars have low levels of resistance to spot blotch. Information on the inheritance of spot blotch resistance in wheat is lacking. Field studies were conducted in four wheat crosses. each involving a Chinese hexaploid parent with high levels of resistance and a commercial cultivar with low to intermediate levels of resistance to spot blotch. Data were recorded in the F-2, F-3 and F-4 generations to estimate heritability. Field studies were conducted in three years (1992-94) at Rampur, Nepal, involving 150 lines in each cross. The spot blotch score was recorded as the percentage necrosis and associated chlorosis of the two upper most leaf surface. In the F-2 generation three spot blotch readings on the flag leaf were taken whereas in the F-3 and F-4 generations four readings were recorded at 5-day intervals on the flag and the penultimate leaves. The highest disease score (HDS) and the area under disease progress curve (AUDPC) were analysed. Heritability ( $h^2$ ) estimates for spot blotch resistance were intermediate to high measured in terms of HDS ( $0.47 < h^2 < 0.67$ ) and also AUDPC ( $0.58 < h^2 < 0.77$ ) both in F-3 and F-4 generations in each of the four crosses. Heritability values were somewhat higher for AUDPC than HDS. There were significant negative correlations ( $r$ ) of days to heading with HDS ( $-0.186 < r < -0.515$ ) and AUDPC ( $-0.218 < r < -0.623$ ). One-hundred kernel weight was significantly negatively correlated to AUDPC ( $-0.245 < r < -0.454$ ) in all crosses in each generation. The results suggest that selection for resistance to spot blotch could be effective in the segregating populations generated from hexaploid wheat parents having different levels of resistance. Although AUDPC appeared to be a better measure to determine genetic differences for spot blotch in wheat, HDS would be adequate in screening trials for resistance to spot blotch. [References: 23].

3852 Sharma, S.; Subedi, M.; Joshi, K.D.; Sah, R.P.; Kadayat, K.B. (Lumle Agricultural Research Centre, Pokhara, Kaski (Nepal)) (1996) Wheat varietal improvement research report, 1996. *LARC Seminar Paper (Nepal)*; no. 96/31 8 p. Lumle Agricultural Research Centre. 7 tables; 1 ref. English. (AGRIS 97-061086).

Varietal improvement experiments on wheat were carried out at Lumle Centre and at testing sites at Arghaun and Rishing Patan in the winter/autumn season of 1995/96 with the objectives to develop high yielding varieties with low rust and sterility for maize and rice based systems for low and middle hills of the western region. Superior genotypes were selected based on yield, yield components, disease, sterility reaction, phenology, and grain quality. From the generation bulk 16 populations advanced at low hill were selected for further use in 1996/97. From the generation bulk advanced at mid hill 14 population were selected. Similarly 15 lines from advanced lines and 10 lines from the Nepal Rainfed Wheat Nurseries were also selected. In the Coordinated

Varietal Trial, NL-665, NL-714, WK-823, WK-838 and NL-776 were selected for yield, resistance to rust, sterility, and grain type. In a Farmer Field Varietal Trial (FFVT) in the low hills, conducted at Yampa and Rishing Patan and a FFVT in mid hills conducted at Keware and Sigana over two seasons, BL-1496 and NL-683 for low hills and NL-665 and NL-645 for mid hills are the promising varieties of wheat in the western hills of Nepal.

3853 Shilko, T.S.; Kul'minskaya, I.V.; Guzyuk, L.I.; Ukrainko, A.P.; Podunova, T.V. (Academy of Sciences of Belarus, Minsk (Belarus). Institute of Genetics and Cytology) (1996) [Influence of rye telomere heterochromatin on the efficiency of wheat-rye crossing]. *Vliyanie telomernogo heterochromatina rzh na ehffektivnost' pshenichno-rzgarykh skreshchivaniy. Vestsi Akademiі Navuk Belarusi. Seryya biyalagichnykh navuk (Belarus) (no.4) p. 61-63. 8 ref. Russian. (AGRIS 97-061088).*

Efficiency of wheat-rye crossing under particular condition was shown to be defined to a great extent by the amount of telomere heterochromatin in a chromosome set of rye inbred lines.

3854 Shrestha, M.; Gurung, B.D. (Pakhribas Agricultural Centre, Dhankuta (Nepal)) (1996) Evaluation of genetic potential of barley varieties at PAC Majuwa sub-station (1993/94). *PAC Working Paper (Nepal); no. 158 19 p. Pakhribas Agricultural Centre. 3 tables; 7 ref. English. (AGRIS 97-061117).*

3855 Singh, KH.; Singh, TB. (1997) RANDOM BULK VS INDIVIDUAL PLANT SELECTION IN F-2 GENERATION OF BREAD WHEAT. *Cereal Research Communications. 25(1):51-53. English. [GOVIND BALLABH PANT UNIV AGR & TECHNOL DEPT GENET & PLANT BREEDING PANTNAGAR 263145 UTTAR PRADESH INDIA].*

Comparison was made between random bulk and individual plant selection for grain yield and its contributing characters on the basis of performance of progenies derived from F-2 plants under different groups. It was found that the progenies under both the methods produced yield, statistically at par, however higher estimates; for component characters were observed under individual plant selection than that of random bulk in some of the populations. But this trend was not consistent across all the populations. It was concluded that it would be appropriate to advance the generation from F-2 to F-3 without any selection. [References: 3].

3856 Singh, RP.; Huertaespino, J. (1997) EFFECT OF LEAF RUST RESISTANCE GENE LR34 ON GRAIN YIELD AND AGRONOMIC TRAITS OF SPRING WHEAT. *Crop Science. 37(2):390-395. English. [CIMMYT INT MAIZE & WHEAT IMPROVEMENT CTR LISBOA 27 APDO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].*

Leaf rust, caused by *Puccinia recondita* Roberge ex Desmaz. f. sp. *tritici*, is an important disease of wheat (*Triticum aestivum* L.) worldwide. The Lr34 gene is known to confer durable resistance. We evaluated the effect of Lr34 on grain yield and other traits in the absence and presence of leaf rust. 'Jupateco 73R' and 'Jupateco 73S' (near-isogenic selections from the Mexican spring wheat cultivar 'Jupateco 73' for the presence and absence of Lr34, respectively) and 22 random inbred F-6 lines, 11 with and 11 without Lr34 (derived from the cross 'Jupateco 73R'/'Jupateco 73S'), were planted in replicated held trials during the 1992-1993 and 1993-1994 seasons in northwestern Mexico. The mean grain yield of Jupateco 73R was 5.9% lower ( $P < 0.05$ ) than that of Jupateco 73S in protected plots in the 1992-1993 experiment. Significant reductions ( $P < 0.05$ ) were also observed for biomass, kernels per spike and kernels m<sup>-2</sup>. Significant ( $P < 0.01$ ) reductions of 5% in mean grain yield and 3.7% in mean kernel weight were again evident in one of the two experiments sown during the 1993-1994 season. Comparison of grain yield in protected and non-protected treatments indicated that though leaf rust could significantly ( $P < 0.01$ ) reduce grain yield by approximately 15% in the presence of Lr34, the reductions in the absence of Lr34 were substantially higher and ranged between 42.5 to 84% depending on planting date and year. Reductions in all other traits were also significantly higher in the absence of Lr34. We conclude that although the presence of Lr34, which is linked with leaf tip necrosis of adult plants, may carry a slight yield penalty in some disease free environments, its use in leaf rust prone areas could provide substantial protection to grain yield and other traits. [References: 12].

3857 Sodkiewicz, T. (Polish Academy of Sciences, Poznan, Poland.); Sodkiewicz, W.; Hagberg, A. (1996) Five new duplications of segments in

chromosomes 5 and 6 in barley. *Barley genetics newsletter (USA) v. 25 p. 5-7. references. English. (AGRIS 97-060762).*

3858 Song, J.W.; Jung, B.K.; Bai, D.G.; Im, H.T.; Hwang, B. (Chonnam National University, Kwangju (Korea Republic). Department of Biology); Nahm, B.H. (Myongji University, Yongin (Korea Republic). Department of Biology); Cheong, H.S. (Chosun University, Kwangju (Korea Republic). Department of Genetic Engineering) (1994) Studies on the induction of transformation in cereal plants-(5)-Transformation of wheat by electroporation. *Korean Journal of Plant Tissue Culture (Korea Republic) v. 21(4) p. 187-192. 6 illus.; 1 table; 34 ref. Korean. (AGRIS 97-075528).*

3859 Soule, J. (Washington State University, Pullman, WA.); Skodova, I.; Kudrna, D.; Kilian, A.; Kleinhofs, A. (1996) Molecular and genetic characterization of barley flower development mutants. *Barley genetics newsletter (USA) v. 25 p. 76-80. references. English. (AGRIS 97-060778).*

3860 Streiff, K.; Blouet, A.; Guckert, A. (1997) HYBRID WHEAT SEED PRODUCTION POTENTIAL USING THE CHEMICAL HYBRIDIZING AGENT SC2053. *Plant Growth Regulation. 21(2):103-108. English. [INRA ENSALA LAB AGRON & ENVIRONM 2 AV FORET DE HAYE F-54500 VANDOEUVRE LES NANCY FRANCE].*

The success of hybrid wheat depends greatly on the female seed production. The objectives of this experiment were to evaluate the effects of two doses of a Chemical Hybridizing Agent (CHA) on the stigma receptivity. In a growth chamber, plants were hand emasculated or treated with a normal (D1) or an excessive dose (D2) of the CHA. Spikes were hand pollinated at different dates during the flowering period. The CHA did not affect significantly the female receptivity neither in duration nor in intensity. We pointed out that for the hybrid seed production there was an optimal period of 5 days. If pollination took place during this period, the seed set and the 1000 grain weight were the highest. [References: 24].

3861 Sun, RC.; Lawther, JM.; Banks, WB.; Xiao, B. (1997) EFFECT OF EXTRACTION PROCEDURE ON THE MOLECULAR WEIGHT OF WHEAT STRAW LIGNINS. *Industrial Crops & Products. 6(2):97-106. English. [UNIV WALES BIOCUMPOSITES CTR BANGOR LL57 2UW GWYNEDD WALES].*

Wheat straw was treated with sodium hydroxide at various conditions, or ball-milled for 4, 8, 16, and 144 h in a porcelain rotary ball-mill and sequentially hydrolyzed by a cellulase for 3 days, and it was delignified by ethanol/water mixture (60:40, v/v) with 0.02 N H<sub>2</sub>SO<sub>4</sub> as a catalyst at 75 degrees C for 1, 1.5, 2, 2.5, 3, 5 and 12 h, respectively. The alkali lignin fractions (LA) were isolated by two step precipitation. Milled lignins (LM) and enzyme lignins (LE) were extracted from the residues by 90% dioxane. Organosolv lignins (LO) were obtained by a traditional acidification method. The molecular weights of wheat straw lignins were determined by gel permeation chromatography (GPC). The effects of the extraction procedure on lignin molecular weight were examined in this study. The four lignin preparations showed low molecular-average weight (M-w 1400-2020). Alkali lignins LA, which were relatively free of associated polysaccharides, appeared to offer the greatest potential for structural characterization of straw and grass lignins. (C) 1997 Elsevier Science B.V. [References: 33].

3862 Suoniemi, A. (Helsinki Univ. (Finland). Inst. of Biotechnology); Ananthawat Jonsson, K.; Arna, T.; Schulman, A.H. (1996) Retrotransposon BARE-1 is a major, dispersed component of the barley (*Hordeum vulgare* L.) genome. *Plant Molecular Biology (Netherlands) v. 30(6) p. 1321-1329. 44 ref. English. (AGRIS 97-075239).*

3863 Swanston, J.S. (Scottish Crop Research Institute, Dundee, UK.) (1996) Deleterious associations with quality, in high amylose inbred lines, are not readily broken. *Barley genetics newsletter (USA) v. 25 p. 50-53. references. English. (AGRIS 97-060773).*

3864 Szarejko, I.; Guzy, J. (Silesian Univ., Katowice (Poland). Dept. of Genetics); Jimenez Davalos, J.; Roldan Chaves, A.; Maluszynski, M. (1995) Production of mutants using barley DH systems. International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. *Proceedings. Proceedings Series (IAEA) p. 517-530. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM-340/31. English. (AGRIS 97-075236).*



3865 Takeda, K. (Okayama Univ., Kurashiki (Japan). Research Inst. for Bioresources); Chang, C.L. (1996) Inheritance and geographical distribution of phenol reaction-less varieties of barley. *Euphytica* (Netherlands) v. 90(2) p. 217-221. 15 ref. English. (AGRIS 97-075240).

3866 Therrien, M.C. (Agriculture and AgriFood Canada, Brandon, Mb.); Plett, S.K. (1996) Determining the best recombinant parent for yield using male-sterile testers in barley. *Barley genetics newsletter* (USA) v. 25 p. 22-23. English. (AGRIS 97-060766).

3867 Thorbjørnsen, T. (Norges Landbrukshegskole, Aas (Norway). Lab. for Molekylær Plantebiologi) (1996) [ADP glucose pyrophosphorylase: Gene structure and expression in barley, and enzyme localization in barley and maize endosperm cells]. ADP glukose pyrofosforylase: Genstruktur og ekspresjon i bygg og enzymlokalisering i endosperm celler fra bygg og mais. Norges Landbrukshegskole, Aas (Norway).. *Agricultural University of Norway. Doctor Scientiarum Theses* (Norway); no. 96:1 pp. Norges Landbrukshegskole. tables, figures; ref. 3 papers are incl. in the thesis. English. (AGRIS 97-075244).

3868 Tranquilli, G.E.; Suarez, E.Y.; Saione, H.; Sacco, F.; Tozzini, A. (1997) EFFECT OF HOST ALLELIC DOSAGE ON TRITICUM AESTIVUM PUCCINIA RECONDITA SPECIFIC INTERACTION. *Plant Breeding*. 116(1):98-100. English. [INTA CIRM INST BIOL RESOURCES CC 25 CASTELAR CASTELAR ARGENTINA].

Allelic dosage changes in host-pathogen interactions (*Triticum aestivum*-*Puccinia recondita*) explain different situations where resistance or susceptibility is observed. Remarkably, the prediction of an interaction change (from compatible to incompatible) by increasing single host allelic dosage is confirmed. Cases of more lasting resistance could also be explained on the basis of these dosage effects. In addition a parallel between specific and non-specific resistance is established pointing out their basic differences in expression with respect to allelic dosage effects. These situations, together with new possibilities for breeding arising from this knowledge, are discussed. [References: 21].

3869 Ullrich, S.E.; Han, F.; Jones, B.L. (1997) GENETIC COMPLEXITY OF THE MALT EXTRACT TRAIT IN BARLEY SUGGESTED BY QTL ANALYSIS. *Journal of the American Society of Brewing Chemists*. 55(1):1-4. English. [WASHINGTON STATE UNIV DEPT CROP & SOIL SCI PULLMAN, WA 99164 USA].

Many economically important traits of crop species are complexly inherited quantitative traits (QT). Trait expression tends to be continuous due to control by multiple genes (G), the environment (E), and G x G and G x E interactions. The development of comprehensive genome maps and quantitative trait locus (QTL) analysis procedures allowed the first significant examination of the genetic control of QTs. Malt extract is a good example of a QT in barley. Heretofore, little has been known about the genetic control of malt extract. The objective of this study was to elucidate the genetic characteristics of malt extract primarily from QTL analyses of the Steptoe x Morex cross. QTL analysis of data from the Steptoe x Morex F-1-derived double haploid mapping population has revealed the location of five malt extract QTLs on three of barley's seven chromosomes. Most of the chromosome regions involved also contain QTLs for other related malting quality traits including alpha-amylase activity, diastatic power, barley and malt beta-glucan content, beta-glucanase activity, and/or seed dormancy. The overlapping QTLs indicate either linked genes or pleiotropy or both. Analyses also indicated additive and G x E interactions for malt extract. Fine mapping of a critical region of chromosome 1 is in progress to elucidate the overlapping QTL situation among malt extract and the other quality traits listed above. Location of specific genes for malt extract will facilitate more precise breeding for the improvement of this important trait in barley through molecular marker assisted selection. [References: 26].

3870 Vanbeuningen, L.T.; Busch, R.H. (1997) GENETIC DIVERSITY AMONG NORTH AMERICAN SPRING WHEAT CULTIVARS .1. ANALYSIS OF THE COEFFICIENT OF PARENTAGE MATRX. *Crop Science*. 37(2):570-579. English. [UNIV MINNESOTA USDA ARS PLANT SCI RES UNIT 411 BORLAUG HALL ST PAUL, MN 55108 USA].

Genetic diversity constitutes the raw material for plant improvement, and it can provide protection against genetic vulnerability to biotic and abiotic stresses. Our objectives were to determine patterns of relatedness using the coefficient of parentage (COP) matrix among 270 spring wheat

(*Triticum aestivum* L.) cultivars and to compute mean COP values for major regional breeding programs. The collection included most important cultivars released during this century from Canada (47), the USA (133), and Mexico (90). Cluster analysis, based on the COP matrix, resulted in 20 major clusters of four or more entries and six small clusters of two cultivars each. The first three axes from a principle coordinate analysis of the intercluster COP matrix showed (i) a group of seven clusters including most hard red spring cultivars (HRS) from the USA, and Canada (CWRS), based mainly on a 'Marquis' background, (ii) a group of nine interrelated clusters including most cultivars from CIMMYT (Mexico), (iii) two interrelated clusters including mostly white wheats, and (iv) two small clusters including mostly old Canadian cultivars. Mean COP values were computed among cultivars released during three successive time periods for major regional breeding programs. The CWRS cultivars have become progressively more interrelated based on a Thatcher background. Average COP values (0.58 among modern cultivars) for this class were higher than values reported for winter wheat, barley (*Hordeum vulgare* L.), and oat (*Avena sativa* L.) gene pools. The HRS wheats showed a fairly high but slowly decreasing interrelatedness (COP = 0.22) among modern cultivars, with some regional differences. CIMMYT cultivars were less interrelated (COP = 0.15-0.20) and comparable to levels reported for soft red winter wheat and barley. Quality requirements and kernel type have probably been major factors in maintaining relatively high COP in the CWRS but somewhat less in the HRS in the USA. CIMMYT cultivars, in general, do not have quality restrictions, allowing the introduction of more diversity. [References: 32].

3871 Vanbeuningen, L.T.; Busch, R.H. (1997) GENETIC DIVERSITY AMONG NORTH AMERICAN SPRING WHEAT CULTIVARS 2. ANCESTOR CONTRIBUTIONS TO GENE POOLS OF DIFFERENT ERAS AND REGIONS. *Crop Science*. 37(2):580-585. English. [UNIV MINNESOTA USDA ARS PLANT SCI RES UNIT 411 BORLAUG HALL ST PAUL, MN 55108 USA].

A broad genetic base for a crop species such as wheat (*Triticum* spp.) may be important to reduce genetic vulnerability and assure long-term potential for genetic gain. The number and diversity of original ancestors can provide insight into relative genetic diversity within and among gene pools. Based on the coefficient of parentage values between cultivars and ancestral lines, the relative genetic contributions of ancestral lines to spring wheat (*Triticum aestivum* L.) cultivars were computed for successive 25-yr time periods. The cultivars were from Canada (47), the USA (133), and Mexico (90). Genetic backgrounds were studied for important changes in the ancestral base over time and to determine trends that continue today. About 124 ancestors, tracing to 32 countries on five continents, were found to have contributed to the North American spring wheat gene pool. Canadian western red spring cultivars released before 1950 had an intermediate level of ancestral diversity. Their post-1975 cultivars have narrow ancestral diversities probably due to strict quality regulations. They consist primarily of 'Thatcher' germplasm modified by a set of pest resistance genes carefully managed in backcross schemes. Before 1950, the U.S. hard red spring wheat cultivars traced to the same Thatcher ancestors but also to 'Kota' and 'Yaroslav'. Many more ancestors were added to this base after 1950 and especially after 1975. This was a side effect of the incorporation of pest resistance, most notably from sources 'Gabo-Timstein', 'Frontana', and 'Kenya 58', and reduced height sources, most notably CIMMYT cultivars with new ancestry from 'Kenya 324' and Turkey. CIMMYT cultivars have also expanded their genetic base over time, with the systematic incorporation of new ancestry from various sources including winter wheats. Introduction of novel alleles from wild ancestors or other sources should contribute to future broadening of the genetic base, maximizing genetic gains, and reducing genetic vulnerability of the gene pools. [References: 20].

3872 Vanoverbeek, L.S.; Vanveen, J.A.; Vanelsas, J.D. (1997) INDUCED REPORTER GENE ACTIVITY, ENHANCED STRESS RESISTANCE, AND COMPETITIVE ABILITY OF A GENETICALLY MODIFIED PSEUDOMONAS FLUORESCENS STRAIN RELEASED INTO A FIELD PLOT PLANTED WITH WHEAT. *Applied & Environmental Microbiology*. 63(5):1965-1973. English. [RES INST PLANT PROTECT DLO POB 9060 NL-6700 GW WAGENINGEN NETHERLANDS].

The fates of *Pseudomonas fluorescens* R2fR and its mutant derivative RIWE8, which contains a lacZ reporter gene responsive to wheat root exudate, were compared in a field microplot, inoculant survival, root colonization, translocation, resistance to stress factors, and reporter gene

activity were assessed in bulk and wheat rhizosphere soils. Populations of both strains declined gradually in bulk and wheat rhizosphere soils and on the wheat rhizoplane as determined by specific CFU and immunofluorescence (IF). In samples from both bulk soil and wheat rhizosphere, IF cell counts were up to 3 orders of magnitude greater than the corresponding numbers of CFU after 120 days, indicating the presence of nonculturable inoculant cells. Estimates of RIWE8-specific target DNA molecule numbers in bulk soil samples 3 and 120 days after inoculation by most-probable-number PCR coincided with the corresponding CFU values. Transport of both strains to deeper soil layers was observed by 3 days after introduction into the microplot. Both strains colonized wheat roots similarly, and cells were seen scattered on the surface of 1-month-old wheat seedling roots by immunogold labelling-scanning electron microscopy. On average, reporter gene activity was significantly higher in wheat rhizosphere soil containing RIWE8 cells than in bulk soil or in soils containing R2fR cells. For both strains, resistance to the four stress factors ethanol, high temperature, high osmotic tension, and oxidative stress increased progressively with residence in soil. Cells from the rhizosphere of 11-day-old seedlings showed similar levels of resistance to osmotic and oxidative stresses and enhanced resistance to ethanol and heat as compared to cells from bulk soil. By 37 days, populations of R2fR and RIWE8 in the rhizosphere were significantly more sensitive to osmotic stress than were populations in bulk soil, whereas differences in response to the other stress factors were less evident. Hence, except for the induction of reporter gene expression in strain RIWE8 in the wheat rhizosphere, the data indicated that there were no great differences in the ecological properties in soil between the lacZ-modified and parental strains. [References: 53].

3873 Varghese, J.P.; Struss, D.; Kazman, M.E. (1996) **RAPID SCREENING OF SELECTED EUROPEAN WINTER WHEAT VARIETIES AND SEGREGATING POPULATIONS FOR THE GLU-D1D ALLELE USING PCR.** *Plant Breeding*. 115(6):451-454. English. [UNIV GOTTINGEN INST PFLANZENBAU & PFLANZENZUCHTUNG VON SIEBOLD STR 8 D-37075 GOTTINGEN GERMANY].

Forty-two winter wheat Varieties and 193 F-2 and BC1F2 seeds were screened for Glu-D1d allele encoding the HMW glutenin subunits 5 + / - 10 using polymerase chain reaction (PCR). The segregating populations originated from crosses involving wheat parents with good and poor bread-making quality. A clear PCR product of 450bp, representing 1Dx5 of the Glu-D1d allele was identified in 24 varieties and 111 hybrid seeds. Four different Glu-D1 alleles: a (2 + 12), b (3 + 12), c (4 + 12) and d (5 + 10) were detected using sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE). Only genotypes possessing Glu-D1d gave a positive PCR signal. hexaploid triticale and 4 x wheat lacking Glu-D1 locus gave a negative signal. The efficiency of PCR selection for bread-making quality in early generations using half seed is discussed. [References: 13].

3874 Von Wettstein, D. (Carlsberg Lab., Copenhagen (Denmark). Dept. of Physiology) (1995) **Breeding of value added barley by mutation and protein engineering.** International Symposium on the Use of Induced Mutations and Molecular Techniques for Crop Improvement. Vienna (Austria). 19-23 Jun 1995. Induced mutations and molecular techniques for crop improvement. Proceedings. *Proceedings Series (IAEA)* p. 67-76. IAEA, Vienna (Austria); FAO, Rome (Italy). IAEA. IAEA-SM/340/15. English. (AGRIS 97-075235).

3875 Wan, Y.F.; Yen, C.; Yang, J.L. (1997) **SOURCES OF RESISTANCE TO HEAD SCAB IN TRITICUM.** *Euphytica*. 94(1):31-36. English. [SICHUAN AGR UNIV TRITICEAE RES INST DUJIANGYAN 611830 SICHUAN PEOPLES REPUBLIC OF CHINA].

Multi-floret and single-floret injection inoculation methods were used to test 1076 accessions of Triticum for resistance to initial infection and resistance to pathogen spread within spike tissue respectively. The data obtained between years or inoculation dates were comparatively similar and were little influenced by climatic factors, especially humid condition. All the tested materials uniformly exhibited susceptibility to initial infection, but there were great differences in resistance to spread among species or cultivars. The diploid and tetraploid wheats were severely susceptible. Only 30 genotypes of common wheat of TT: aestivum conv. vulgare showed high resistance to spread. The highest frequency of high spread resistance existed in these landraces which were distributed in Zhejiang, Hubei, Hunan, Jiangsu provinces and Shanghai City, Guizhou, Sichuan and Yunnan provinces ranked second. The majority of wheat

landraces from Hebei, Shanxi, Shaanxi Province and Beijing City showed susceptibility or high susceptibility. No resistance was found in Tibetan wheats. [References: 11].

3876 Wang, T.B.; Glass, A.D.M. (1997) **AN IMPROVED METHOD FOR SUBTRACTIVE CLONING OF DIFFERENTIALLY EXPRESSED GENES IN HIGHER PLANTS BY PROTECTIVE EXONUCLEASE DIGESTION AND DISCRIMINATING PCR AMPLIFICATION.** *Plant Cell Reports*. 16(7):509-512. English. [UNIV BRITISH COLUMBIA DEPT BOT 6270 UNIV BLVD VANCOUVER BC V6T 1Z4 CANADA].

An improved method for subtractive cloning with enhanced efficiency was developed by modifying the enzymatic degrading subtraction. The thionucleotide-modified tester cDNA fragments under control of one linker-primer were hybridized with excess driver cDNA fragments flanked by the other distinct linker-primer. After selective digestion of incompletely protected tester/driver and of unprotected driver/driver molecules with exonuclease III and VII, the protected tester/tester reassociates due to thionucleotides were exclusively amplified by PCR with the tester-cDNA-specific primer. The subtractively enriched target cDNA fragments, showing distinct bands in an agarose gel, were inserted into pUC19, and random colonies with inserts were screened by Northern hybridization to tester and driver RNA. Four distinct clones were confirmed to be up-regulated by the withdrawal of potassium from the nutrient solution of seedling barley growing hydroponically. The original protocol generated only smeared amplicons due to non-selective PCR amplification of the hybridized cDNA mixture including remains of undigested driver cDNA. [References: 9].

3877 Wettstein, D. von (Carlsberg Laboratory Gamle Carlsberg Vej, Copenhagen Valby, Denmark.) (1996) **Coordinator's report: Nuclear genes affecting the chloroplast.** *Barley genetics newsletter (USA)* v. 25 p. 110. references. English. (AGRIS 97-060791).

3878 Weyen, J. (Justus Liebig University, Giessen, Germany.); Ordon, F.; Friedt, W. (1996) **Genetic characterization of resistance against BaYMV-2, the ym4 resistance breaking strain of the Barley Yellow Mosaic Virus Complex.** *Barley genetics newsletter (USA)* v. 25 p. 54-56. references. English. (AGRIS 97-075246).

3879 Wolfe, R.I. (AAFC, Lacombe, Canada.); Hayes, P.M.; Shugar, L. (1996) **Multiple dominant and recessive genetic marker stock development.** *Barley genetics newsletter (USA)* v. 25 p. 57-58. references. English. (AGRIS 97-060774).

3880 Wraith, J.M. (Montana State University, Bozeman, MT.); Baker, J.M.; Blake, T.K. (1995) **Barley genotypes vary in the ability to rapidly resume water uptake after drought.** *Montana agresearch (USA)* v. 12(2) p. 13-18. references. English. (AGRIS 97-075248).

## F40 PLANT ECOLOGY

3881 Beltrano, J.; Montaldi, E.; Bartoli, C.; Carbone, A. (1997) **EMISSION OF WATER STRESS ETHYLENE IN WHEAT (TRITICUM AESTIVUM L) EARS - EFFECTS OF REWATERING.** *Plant Growth Regulation*. 21(2):121-126. English. [NATL UNIV LA PLATA FAC CIENCIAS AGRARIAS & FORESTALES INST FISIOL VEGETAL CC 327 RA-1900 LA PLATA ARGENTINA].

In this work it has been found that ethylene production increased only slightly under conditions of a moderate or severe water stress. However, the rehydration of the plants at full turgor after desiccation caused a high emission of ethylene. The desiccation would not irreversibly inactivate the enzymes of the ethylene pathway, since rehydration made the synthesis recommence almost immediately. Water deficit also increased the free radical levels and the antioxidant scavengers, such as superoxide dismutase. Free radicals promote the conversion of 1-amino-cyclopropane-1-carboxylic acid to ethylene, then it is logical to think that both chemical species are involved in the phenomenon of the acceleration of the grain maturity before the plant collapses. [References: 27].

3882 Deputat, T.; Demidowicz, G. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland). Dept. of Agrometeorology); Kaczynski, L. (Research Centre of Cultivar Testing, Slupia Wielka (Poland)) (1996) **[Climatic factors of the development of winter barley].** *Klimatyczne*



uwarunkowania rozwoju jęczmienia ozimego. *Pamiętnik Pulawski (Poland)* (no.107) p. 27-38. 5 fig., 3 tables; 12 ref. Polish. (AGRI 97-075651).

Effective sum of temperature necessary for barley to reach the successive development stages were determined. Subsequently, multiple stepwise regression was used to measure the quantitative effect of temperature, daylength, and insolation on development rate. The occurrence of all development stages is speeded up along with the increase in temperature. The temperature being the dominant factor. The increase of daylength causes the development rate to rise. The delay in the onset of springtime weather, increase in geographic latitude and insolation result in diminishing the thermal requirements of long-day plants. The data can be used to predict the dates of development stages, especially grain ripeness and to evaluate the possibility of growing aftercrops.

3883 Finnan, J.M. (Dublin Univ. (Ireland). Trinity Coll., Dept. of Botany); Jones, M.B.; Burke, J.I. (1996) A time-concentration study on the effects of ozone on spring wheat (*Triticum aestivum* L.). 1. Effects on yield. *Agriculture, Ecosystems and Environment (Netherlands)* v. 57(2-3) p. 159-167. 24 ref. English. (AGRI 97-075680).

3884 Finnan, J.M. (Dublin Univ. (Ireland). Trinity Coll., Dept. of Botany); Jones, M.B.; Burke, J.I. (1996) A time-concentration study on the effects of ozone on spring wheat (*Triticum aestivum* L.). 2. A comparison of indices. *Agriculture, Ecosystems and Environment (Netherlands)* v. 57(2-3) p. 169-177. 29 ref. English. (AGRI 97-075681).

3885 Paustian, K.; Elliott, E.T.; Peterson, G.A.; Killian, K. (1996) MODELLING CLIMATE, CO<sub>2</sub> AND MANAGEMENT IMPACTS ON SOIL CARBON IN SEMI-ARID AGROECOSYSTEMS. *Plant & Soil* 187(2):351-365. English. [COLORADO STATE UNIV NAT RESOURCE ECOL LAB FT COLLINS, CO 80523 USA].

In agroecosystems, there is likely to be a strong interaction between global change and management that will determine whether soil will be a source or sink for atmospheric C. We conducted a simulation study of changes in soil C as a function of climate and CO<sub>2</sub> change, for a suite of different management systems, at four locations representing a climate sequence in the central Great Plains of the US. Climate, CO<sub>2</sub> and management interactions were analyzed for three agroecosystems: a conventional winter wheat-summer fallow rotation, a wheat-corn-fallow rotation and continuous cropping with wheat. Model analyses included soil C responses to changes in the amount and distribution of precipitation and responses to changes in temperature, precipitation and CO<sub>2</sub> as projected by a general circulation model for a 2xCO<sub>2</sub> scenario. Overall, differences between management systems at all the sites were greater than those induced by perturbations of climate and/or CO<sub>2</sub>. Crop residue production was increased by CO<sub>2</sub> enrichment and by a changed climate. Where the frequency of summer fallowing was reduced (wheat-corn-fallow) or eliminated (continuous wheat), soil C increased under all conditions, particularly with increased (640  $\mu$ mol L<sup>-1</sup>) CO<sub>2</sub>. For wheat-fallow management, the model predicted declines in soil C under both ambient conditions and with climate change alone. Increased CO<sub>2</sub> with wheat-fallow management yielded small gains in soil C at three of the sites and reduced losses at the fourth site. Our results illustrate the importance of considering the role of management in determining potential responses of agroecosystems to global change. Changes in climate will determine changes in management as farmers strive to maximize profitability. Therefore, changes in soil C may be a complex function of climate driving management and management driving soil C levels and not be a simple direct effect of either climate or management. [References: 37].

3886 Rudnicki, F. (University of Technology and Agriculture, Bydgoszcz (Poland). Dept. of Soil and Plant Cultivation) (1995) [Comparison of reaction of spring barley and the oats to rainfall and thermic condition]. Porównanie reakcji jęczmienia jarego i owsa na warunki opadowo-termiczne. *Fragmenta Agronomica (Poland)* v. 12(3) p. 21-32. 1 fig., 6 tables; 12 ref. Polish. (AGRI 97-075623).

On the base of the data collected for thirty two years an evaluation of the dependence of spring barley and the oats yields on rainfall and mean temperatures during their vegetation was performed. A strong reaction of both species to the studied conditions was proved, in particular to the distribution of the weather factors in various months. The highest yields were noted if in each month of the April-July period the rainfall sums were higher by 0.5 to 1.0 of standard deviation of the rainfall multi-year

variability for these months. A significant decrease of the yields was observed if dry conditions lasted for two or more sequent months.

## F50 PLANT STRUCTURE

3887 Kobayashi, Y.; Kobayashi, I.; Funaki, Y.; Fujimoto, S.; Takemoto, T.; Kunoh, H. (1997) DYNAMIC REORGANIZATION OF MICROFILAMENTS AND MICROTUBULES IS NECESSARY FOR THE EXPRESSION OF NON-HOST RESISTANCE IN BARLEY COLEOPTILE CELLS. *Plant Journal* 11(3):525-537. English. [MIE UNIV FAC BIORESOURCES PLANT PATHOL LAB TSU MIE 514 JAPAN].

To show the involvement of microfilaments and microtubules in non-host resistance of barley, partially dissected coleoptiles which had been inoculated with a non-pathogen, *Erysiphe pisi*, were treated with several actin and tubulin inhibitors. If the coleoptiles were not treated with any of the inhibitors, the non-pathogen always failed to penetrate the coleoptile cells. However, when coleoptiles were treated with actin or tubulin polymerization or depolymerization inhibitors, the non-pathogen was able to penetrate successfully and to form haustoria in coleoptile cells of a non-host plant, barley. Actin polymerization inhibitors, cytochalasins, were more effective in causing an increase in penetration efficiency of *E. pisi* than tubulin inhibitors. The effects of cytochalasins depended on the kind of cytochalasin; the strength of the actin depolymerizing activity correlated significantly with the efficiency of increasing the penetration of the non-pathogen. When both actin and tubulin inhibitors were added simultaneously, the polarization of defense-related responses, such as massive cytoplasmic aggregation, deposition of papillae and accumulation of autofluorescent compounds, at fungal penetration sites was suppressed. Actin inhibitors did not affect arrangement and stability of microtubules and vice versa, and a double treatment of coleoptile cells with both microfilament and microtubule inhibitors showed an additive effect in increasing the penetration efficiency of *E. pisi*. Furthermore, cytochalasin A treatment allowed other non-pathogens, *Colletotrichum lagenarium* and *Alternaria alternata*, to penetrate successfully into the non-host barley cells. These results strongly suggest that microfilaments and microtubules might play important roles in the expression of non-host resistance of barley. [References: 72].

3888 Martin, P.K.; Koebner, R.M.D. (John Innes Centre, Colney (United Kingdom). Dept. of Cereal Research) (1995) [Role of seed size in the non-genetic variation exhibited in salt tolerance studies involving the bread wheat cv. Chinese Spring]. Wielkość ziarniaków w niegenetycznej zmienności pszenicy cv. Chinese Spring tolerancyjnej na zasolenie. *Acta Societatis Botanicorum Poloniae (Poland)* v. 64(4) p. 371-374. 2 fig., 3 tables; 8 ref. English. (AGRI 97-075736).

The intention of the study was to confirm the role of seed size in the non-genetic variation exhibited during salinity tolerance experiments involving the bread wheat cv. Chinese Spring. The nutrient film rockwool hydroponic technique was utilized. This study concluded that seed size does not play a significant role in the non-genetic variation generated during a study of salinity tolerance of the bread wheat cv. Chinese Spring.

3889 Nierobca, A.; Faber, A. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland). Dept. of Mathematics and Informatics Application) (1996) [Leaf area index as an indicator of growth and grain yield of winter wheat]. Indeks powierzchni liści jako wskaźnik stanu wegetacji oraz wielkości spodziewanego plonu pszenicy ozimej. *Fragmenta Agronomica (Poland)* v. 13(3) p. 54-66. 2 fig., 1 table; 10 ref. Polish. (AGRI 97-075737).

The changes of LAI are predicted by using of daily heat units (CDD;  $T_b = 0$  deg C) and nitrogen rates. The relations are described by equations (1) and (2) up to flowering of plants and by equation (3) from flowering to maturity of wheat. In the period of study no water limitation of plant growth was found. The total above-ground dry weight of plants/SM; kg per ha is predicted from equations (4) up to the flowering and (5) for generative stages of development. The dependence of wheat grain yield/PI; t/ha on LAImax (equation 6) and LAImax and number of ears (KL, equation 7) are found.

3890 Ruiz, M.; Varela, F.; Carrillo, J.M. (1997) ANALYSIS OF THE DISCRIMINATING POWER OF AGRO/MORPHOLOGICAL AND BIOCHEMICAL DESCRIPTORS IN A SAMPLE OF THE SPANISH COLLECTION OF BARLEY (*Hordeum vulgare* L.). *Genetic Resources & Crop Evolution* 44(3):247-255. English. [INIA AUTOVIA

A sample representative of the national collection of barley (*Hordeum vulgare* L.) has been evaluated with different agro/morphological and biochemical descriptors in order to determine their usefulness for discriminating accessions. Multivariate analysis performed on three sets of traits (agro/morphological traits, biochemical traits and agro/morphological plus biochemical traits) showed that, in general, the relationships between agro/morphological and biochemical descriptors were low. Cluster analysis revealed that the classification of the accessions by the agro/morphological data was different from the classification obtained according to the biochemical data, indicating that the two types of markers reflect different patterns of diversity. However, neither agro/morphological nor biochemical characters identified all the accessions as unique phenotypes. Conversely, all the accessions were individually separated using a combination of agro/morphological and biochemical traits since the two types of markers provided complementary information. [References: 19].

3891 Tikhonova, L.I.; Pottosin, I.I.; Dietz, K.J.; Schonknecht, G. (1997) FAST-ACTIVATING CATION CHANNEL IN BARLEY MESOPHYLL VACUOLES - INHIBITION BY CALCIUM. *Plant Journal*. 11(5):1059-1070. English. [UNIV WURZBURG LEHRSTUHL BOT 1 MITTLERER DALLENBERGWEG 64 D-97082 WURZBURG GERMANY].

In contrast to the vacuolar ion channels which are gated open by an increase of cytosolic  $Ca^{2+}$  the vacuolar ion currents at resting cytosolic  $Ca^{2+}$  are poorly explored. Therefore, this study was performed to investigate the properties of the so-called fast-activating vacuolar (FV) current which dominates the electrical characteristics of the tonoplast at physiological free  $Ca^{2+}$  concentrations. Patch-clamp measurements were performed on whole barley (*Hordeum vulgare*) mesophyll vacuoles and on excised tonoplast patches. Single ion channels were identified, which, based on their selectivity, activation kinetics,  $Ca^{2+}$ - and voltage-dependence, carry the whole-vacuole FV current. Reversal potential determinations indicated a  $K^{+}$  over  $Cl^{-}$  permeability ratio of about 30. Both inward and outward whole-vacuole currents as well as the activity of single FV channels were inhibited by an increase of cytosolic  $Ca^{2+}$ , with a  $K_d$  approximate to 6  $\mu M$ . At physiological vacuolar  $Ca^{2+}$  activities, the FV channel is an outward-rectifying potassium channel. The FV channel was activated in less than a few milliseconds both by negative and positive potential steps, having a minimal activity that is 40 mV negative of the  $K^{+}$  equilibrium potential. It is proposed that transport of  $K^{+}$  through this cation channel controls the electrical potential difference across the tonoplast. [References: 31].

## F60 PLANT PHYSIOLOGY AND BIOCHEMISTRY

3892 Amtmann, A.; Laurie, S.; Leigh, R.; Sanders, D. (1997) MULTIPLE INWARD CHANNELS PROVIDE FLEXIBILITY IN  $Na^{+}/K^{+}$  DISCRIMINATION AT THE PLASMA MEMBRANE OF BARLEY SUSPENSION CULTURE CELLS. *Journal of Experimental Botany*. 48(Special Issue SI):481-497. English. [UNIV YORK DEPT BIOL POB 373 YORK YO1 5YW N YORKSHIRE ENGLAND].

Ion transport across the plasma membrane of suspension-culture cells derived from immature barley embryos has been studied in low (15 mM KCl) and high (additional 150 mM NaCl) salt conditions to understand how plants discriminate between  $K^{+}$  and  $Na^{+}$  during ion uptake. In both media about 50% of the cells exhibited resting potentials more negative than any of the passive diffusion potentials. In whole-cell patch clamp experiments membrane hyperpolarization activated large inward currents. Whilst the instantaneous current components did not discriminate between  $K^{+}$  and  $Na^{+}$ , the time-dependent current,  $I_{in}$ , was selective for  $K^{+}$  over  $Na^{+}$ . Further analysis of  $I_{in}$  revealed the following properties: double exponential current activation (time-constants 0.03 s and 0.3 s, half activation potential similar to 171 mV); no inactivation; complete block by  $Ba^{2+}$  (30 mM in 100 mM KCl) and part block by TEA $^{+}$  (maximum 50% with 20 mM); dependence on millimolar concentrations of cytoplasmic ATP; no block by external or cytoplasmic  $Na^{+}$ . The selectivity sequences  $K^{+} \gg Rb^{+} > NH_4^{+} > Na^{+} \gg Cl^{-}$  and  $K^{+} \gg NH_4^{+} > Na^{+} > Rb^{+}$  were determined from measurements of reversal potentials and relative steady-state currents respectively.  $P_{Na}:P_K$  was  $0.07 \pm 0.02$  (from reversal potentials) and  $I_{Na}:I_K$  was  $0.17 \pm 0.05$  (from relative currents). A high variance among the observed permeability ratios suggested that several channels with different ion-selectivities contributed to the time-dependent

whole-cell currents. In single channel experiments, several inward channels with distinct properties were found. The major channels were voltage-gated,  $K^{+}$ -selective channel (12 pS), (ii) an ATP-activated non-selective cation channel (7 pS) and (iii) an inward-rectifying anion-channel (150 pS, all unitary conductances given for 100 mM KCl). No significant differences were found in whole-cell currents or single-channel characteristics between cells that had been adapted to a high-salt growth-medium (150 mM NaCl) and non-adapted cells. The idea that differential regulation of plasma membrane ion channels gives rise to a physiological flexibility, allowing the cells to control  $Na^{+}$  uptake under varying external conditions, is discussed. [References: 49].

3893 Araus, J.L.; Febrero, A.; Buxo, R.; Camalich, M.D.; Martin, D.; Molina, F.; Rodriguezariza, M.O.; Romagosa, I. (1997) CHANGES IN CARBON ISOTOPE DISCRIMINATION IN GRAIN CEREALS FROM DIFFERENT REGIONS OF THE WESTERN MEDITERRANEAN BASIN DURING THE PAST SEVEN MILLENNIA - PALAEOENVIRONMENTAL EVIDENCE OF A DIFFERENTIAL CHANGE IN ARIDITY DURING THE LATE HOLOCENE. *Global Change Biology*. 3(2):107-118. English. [UNIV BARCELONA FAC BIOL UNITAT FISIOLOGIA VEGETAL AVDA DIAGONAL 645 E-08028 BARCELONA SPAIN].

Carbon isotope discrimination ( $\Delta$ ) was determined for kernels of six-row barley and durum wheat cultivated in the western Mediterranean basin during the last seven millennia. Samples came from different archaeological sites in Catalonia (north-east Spain) and in the south-east of Spain (mainly eastern Andalusia). Samples from the present were also analysed. Mean values of  $\Delta$  for barley and durum wheat grains decreased slightly from Neolithic (7000-5000 BP) to Chalcolithic-Bronze (5000-3000 BP) and Iron ages (3000-2200 BP) both in Catalonia and in south-east (SE) Spain. Values were consistently lower in SE Spain than in Catalonia throughout these five millennia, which suggests that Catalonia was less arid than SE Spain in this period. Within a given region, current discrimination values for kernels of the same cereal species cultivated under rainfed conditions were lower than those of archaeological grains, which implies more arid conditions at present. Furthermore, an empirical relationship between  $\Delta$  of mature kernels and total precipitation (plus irrigation where applicable) during grain filling ( $r^2 = 0.73$ ,  $N = 25$ ) was established for barley, currently cultivated at different locations in the western Mediterranean basin in Spain. The resulting relationship was applied to the  $\Delta$  data for barley kernels from 10 archaeological sites in Catalonia and 10 sites in SE Spain, to estimate the precipitation during grain filling at the time the kernels were produced. For both regions, current climatic conditions are consistently more arid than those inferred for the Neolithic, Bronze and Iron ages. In addition, although Catalonia was estimated to have had consistently wetter conditions (about 20% more precipitation) than SE Spain throughout these millennia, differences in precipitation between these two regions have recently increased, with 79% more precipitation in Catalonia. Results indicate a more rapid increase in aridity in SE Spain than in Catalonia, probably produced during the last few centuries, and due to anthropogenic causes. [References: 61].

3894 Boldt, R.; Koshuchowa, S.; Gross, W.; Borner, T.; Schnarrenberger, C. (1997) DECREASE IN GLYCOLATE PATHWAY ENZYME ACTIVITIES IN PLASTIDS AND PEROXISOMES OF THE ALBOSTRIANS MUTANT OF BARLEY (*HORDEUM VULGARE* L.). *Plant Science*. 124(1):33-40. English. [UNIV POTSDAM INST BIOCHEM & MOL PHYSIOL MAULBEERALLEE 2A D-14469 POTSDAM GERMANY].

The in-vitro activities of various enzymes involved in the glycolate pathway were analyzed in crude leaf extracts of the albostrians mutant of barley. This mutant line is characterized by the lack of plastid ribosomes in white leaf tissue, thus causing a complex modification of nuclear gene expression. In white leaf cells the activities of the plastidic enzymes phosphoglycolate phosphatase and glycerate kinase, as well as the activities of the peroxisomal enzymes glycolate oxidase, catalase, and hydroxypyruvate reductase, are drastically reduced by as much as 80-99% compared to green wild-type leaf tissue. The activity of plastidic NADPH-glyoxylate reductase, the total activity of serine hydroxymethyltransferase and the activity of mitochondrial fumarate was reduced by only 30-52%. The activities of the glyoxysomal enzymes isocitrate lyase and malate synthase were neither detectable in green nor white mutant leaf tissue. Electron microscopy showed fewer and smaller peroxisomes in white leaf tissue, accounting for at least part of the reduction of peroxisomal enzyme activities. Northern blot analysis for the catalase and glycolate oxidase



transcripts revealed strongly reduced levels of steady-state mRNA accumulation. It is suggested that a putative plastidic signal(s) influences the expression of nuclear-encoded plastidic and peroxisomal enzymes of the glycolate pathway. (C) 1997 Elsevier Science Ireland Ltd. [References: 43].

3895 Bonnin, E. (Institut National de la Recherche Agronomique, Nantes (France). Centre de Nantes, Biochimie et Technologie des Glucides); Mesguen, C.; Thibault, J.F. (1996) ["Arabinoxylanases" of wheat grain: extraction and preliminary characterization]. Les "arabinoxylanases" du grain de blé: extraction et caractérisation préliminaire. 46. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 15-16 Nov 1995. *Industries des Céréales (France)* (no 96) p. 23. 7 graph. French. (AGRIS 97-061366).

3896 Botrel, A.; Kaiser, WM. (1997) NITRATE REDUCTASE ACTIVATION STATE IN BARLEY ROOTS IN RELATION TO THE ENERGY AND CARBOHYDRATE STATUS. *Planta*. 201(4):496-501. English. [UNIV WURZBURG JULIUS VON SACHS INST BIOWISSENSCH MITTLERER DALLEBERGWEG 64 D-97082 WURZBURG GERMANY].

The NADH-dependent nitrate reductase (NR, EC 1.6.6.1) in roots of hydroponically grown barley seedlings was extracted, desalted and the activity measured in buffer containing either  $Mg^{2+}$  (10 mM) or EDTA (5 mM). The former gives the actual NR activity (NRact) equivalent to dephospho-NR, whereas the latter gives the maximum NR capacity of the dephospho-form (NRmax). Both values together permit an estimation of the NR-phosphorylation state. Changes in NRact and NRmax were followed in response to root aeration or to shoot illumination or shoot removal, and were correlated with sugar contents and adenylate levels. Ethanol formation was also measured in roots differing in NR activity in order to obtain information on the relation between anaerobic alcoholic fermentation and nitrate reduction. In aerated roots, NR was highly phosphorylated (about 80%) and largely inactive. It was partly dephosphorylated (activated) by anoxia or by cellular acidification (pH 4.8 plus propionic acid). Anaerobic activation (dephosphorylation) of NR was stronger at acidic external pH (5) than at slightly alkaline pH (8), although ATP levels decreased and AMP levels increased at pH 5 and at pH 8 to the same extent. Thus, rapid changes in the NR-phosphorylation state in response to anaerobiosis were not directly triggered by the adenylate pool, but rather by cytosolic pH. Under prolonged darkness (24 h) or after shoot removal, NRmax decreased slowly without a large change in the phosphorylation state. This decrease of NRmax was correlated with a large decrease in the sugar content, and was prevented by glucose feeding, which had only minor effects on the phosphorylation state. Cycloheximide also prevented the decrease in NRmax without affecting the phosphorylation state. In contrast, anaerobiosis or cellular acidification prevented the decrease of NRmax and at the same time decreased the NR-phosphorylation state. It is suggested that NR turnover in roots is controlled by several factors: NR synthesis appears to depend on sugar availability, which has little effect on the phosphorylation state; in addition, NR degradation appears to be strongly affected by the phosphorylation state in such a way that the inactive phospho-NR is a better substrate for NR degradation than the dephospho-form. The rate of anaerobic ethanol formation was not affected by NR activity, indicating that the purpose of NR activation under hypoxia or anoxia is not to decrease or prevent alcoholic fermentation. [References: 21].

3897 Bravo, LA.; Zuniga, GE.; Corcuera, L.J.; Argandona, V.H. (1997) FREEZING TOLERANCE OF BARLEY SEEDLINGS INFESTED BY APHIDS. *Journal of Plant Physiology*. 150(5):611-614. English. [CONCEPCION UNIV FAC CIENCIAS NAT & OCEANOGR DEPT BOT CASILLA 2407 CONCEPCION CHILE].

The effects of the aphids *Schizaphis graminum* (Rondani) and *Rhopalosiphum padi* L. infestation on freezing tolerance of barley cv. Aramir and Atlas were studied. Seven day-old plants were infested with two aphids each. After 6 d, the freezing tolerance of the leaves was determined. Non infested leaves of cv. Atlas were significantly more tolerant than leaves of cv. Aramir ( $LT_{50} = -6.65$  and  $-5.75$  degrees C, respectively). The freezing tolerance of cv. Aramir did not vary when these plants were infested with aphids. However, the Freezing tolerance of cv. Atlas infested by *S. graminum* and *R. padi*, decreased in 1.5 and 3.3 degrees C, respectively. Basal ABA content in non infested plants was higher in cv. Aramir than Atlas, 285 and 69 nmol/kg, fresh mass,

respectively. When plants were infested with *S. graminum* or *R. padi*, ABA content increased to 389 and 364 nmol/kg. Fresh mass respectively, only in Aramir. Sucrose content in cv. Atlas infested with *R. padi* or with *S. graminum* decreased to 1.2 and 5.0 mmol/kg, fresh mass respectively. The results show that aphid infestation could affect the capacity of some cultivars of barley to tolerate freezing stress. [References: 27].

3898 Bykov, OD. (1997) KINETICS OF DARK CO<sub>2</sub> RESPIRATION IN WHEAT DURING PLANT DEHYDRATION. *Russian Journal of Plant Physiology*. 44(3):322-327. English. [INT SCI & APPL ACAD CTR COMPARAT & ECOL PATHOL VOLZHISKI 5-10 ST PETERSBURG 199034 RUSSIA].

Infrared gas analysis and gravimetric analysis were used to study the relation between the rate of dark respiration and moisture content in 10-day-old wheat (*Triticum aestivum* L.) seedlings of 14 cultivars during the gradual dehydration of seedlings in the air at  $25 \pm 2$  degrees C. For all 14 cultivars, similar relationships between the respiration rate and specific moisture content were obtained. These experimental relationships satisfactorily fit both exponential and hyperbolic functions. The fit-function parameters were evaluated, and their intraspecific variation and mutual correlation were revealed. Based on the results of this study, the method of comparing the respiration capacity in plants and tissues with different moisture content can be recommended. In this approach, the parameter of "standard dark respiration" is introduced, which represents the respiration rate normalized to a certain level of specific moisture content. [References: 18].

3899 Casano, LM.; Gomez, LD.; Lascano, HR.; Gonzalez, CA.; Trippi, VS. (1997) INACTIVATION AND DEGRADATION OF CUZn-SOD BY ACTIVE OXYGEN SPECIES IN WHEAT CHLOROPLASTS EXPOSED TO PHOTOOXIDATIVE STRESS. *Plant & Cell Physiology*. 38(4):433-440. English. [UNIV ALCALA DE HENARES DEPT BIOL VEGETAL E-28871 ALCALA DE HENARES MADRID SPAIN].

Changes in CuZn-SOD activity and content in isolated wheat chloroplasts under the light, and the involvement of protease(s) and/or active oxygen species in this process were studied. Both SOD activity and content decayed with exposure time to photooxidative stress. Ascorbate, a H<sub>2</sub>O<sub>2</sub> scavenger, prevented photooxidation-associated inactivation of SOD, while benzoate, a (OH)-O<sub>2</sub><sup>-</sup> scavenger, prevented SOD degradation. Wheat chloroplasts incubated in the dark did not hydrolyze exogenous or endogenous SOD, either H<sub>2</sub>O<sub>2</sub>-pretreated or not. Protease inhibitors did not prevent SOD degradation under photooxidative treatment, suggesting that plastid protease(s) did not participate in this process. Purified chloroplast CuZn-SOD was exposed to H<sub>2</sub>O<sub>2</sub> and O<sub>2</sub><sup>-</sup> or (OH)-O<sub>2</sub><sup>-</sup> generating systems. O<sub>2</sub><sup>-</sup> had no effect on either SOD activity or stability (estimated by native PAGE). H<sub>2</sub>O<sub>2</sub> up to 700  $\mu$ M inhibited SOD in a dose-dependent manner and induced charge/mass changes as seen by native PAGE. (OH)-O<sub>2</sub><sup>-</sup> also reduced SOD activity by inducing its fragmentation. High levels of active oxygen, as can be generated under strong stress conditions, could directly inactivate and degrade chloroplastic SOD. [References: 37].

3900 Chahal, P.S. (Institut Armand Frappier, Université du Québec, Canada.); Chahal, D.S.; Le, G.B.B. (1996) Production of cellulase in solid-state fermentation with *Trichoderma reesei* MCG 80 on wheat straw. *Applied biochemistry and biotechnology (USA)* v. 57/58 p. 433-442. references. Proceedings of the Seventeenth Symposium on Biotechnology for Fuels and Chemicals, May 7-11, 1995, Vail, Colorado. English. (AGRIS 97-076234).

It is an accepted fact that ethanol production from lignocellulosic materials is not economical as yet because of the high cost of cellulase production. To reduce the cost of cellulase production, lignocellulosic material (wheat straw [WS]), a comparatively much cheaper substrate, was used instead of costly substrates (pure cellulose or lactose). A pan bioreactor was developed for solid-state fermentation (SSF) that required a small capital investment. High yields of complete cellulase system were obtained compared to that in the liquid-state fermentation (LSF) from WS, when treated with 4.25% NaOH at 121 degrees C for 1 h and mixed with Mandels' medium. A complete cellulase system is defined as one in which the ratio of beta-glucosidase activity to filter paper activity in the enzyme solution is close to 1.0. The cellulase system derived from SSF using the pan bioreactor gave more than 85% hydrolysis of delignified WS. The prototype pan bioreactor requires further improvements so that optimum quantity of substrate can be fermented to obtain high yields of complete

cellulase system per unit space. The SSF process provides a means for the production of complete cellulase system for the economical bioconversion of renewable biomass into ethanol.

3901 Chanda, S.V.; Singh, Y.D. (Saurashtra Univ., Rajkot (India). Dept. of Biosciences) (1996) [Biochemical analysis of developing wheat grains]. *Biochemische Analyse der Weizenkoerner in der Entwicklung. Journal of Agronomy and Crop Science (Germany)* v. 176(2) p. 131-139. 5 ill., 1 table; 48 ref. English. (AGRIS 97-062072).

3902 Chen, L. (La Trobe University, Bundoora, Victoria, Australia.); Garrett, T.P.J.; Fincher, G.B.; Hoj, P.B. (1995) A tetrad of ionizable amino acids is important for catalysis in barley beta-glucanases. *The Journal of biological chemistry (USA)* v. 270(14) p. 8093-8101. references. English. (AGRIS 97-061663).

Determination of the crystal structures of a 1, 3-beta-D-glucanase (E.C.3.2.1.39) and a 1, 3-1, 4-beta-D-glucanase (E.C. 3.2.1.73) from barley (*Hordeum vulgare*) (Varghese, J. N, Garrett, T. P. J., Colman, P. M., Chen, L., Hoj, P. B., and Fincher, G. B. (1994) *Proc. Natl. Acad. Sci. U. S. A.* 91, 2785-2789) showed the spatial positions of the catalytic residues in the substrate-binding clefts of the enzymes and also identified highly conserved neighboring amino acid residues. Site-directed mutagenesis of the 1, 3-beta-glucanase has now been used to investigate the importance of these residues. Substitution of glutamine for the catalytic nucleophile Glu231 (mutant E231Q) reduced the specific activity about 20, 000-fold. In contrast, substitution of glutamine for the catalytic acid Glu288 (mutant E288Q) had less severe consequences, reducing kcat approximately 350-fold with little effect on Km. Substitution of two neighboring and strictly conserved active site-located residues Glu279 (mutant E279Q) and Lys282 (mutant K282M) led to 240- and 2500-fold reductions of kcat, respectively, with small increases in Km. Thus, a tetrad of ionizable amino acids is required for efficient catalysis in barley beta-glucanases. The active site-directed inhibitor 2, 3-epoxypropyl beta-laminaribioside was soaked into native crystals. Crystallographic refinement revealed all four residues (Glu231, Glu279, Lys282, and Glu288) to be in contact with the bound inhibitor, and the orientation of bound substrate in the active site of the glucanase was deduced.

3903 Fabre, J.L. (Ecole Supérieure d'Agriculture de Purpan, Toulouse (France). Laboratoire de Physiologie Végétale); Aussenac, T. (1995) [Interest of high performance liquid chromatography (size exclusion and reverse phase) in selection of soft wheat cultivars related with quality]. *L'interet des chromatographies liquides haute performance (tamisage moléculaire et phase inverse) dans la selection varietale chez le ble tendre visant la qualite. Industries des Cereales (France) (no 92)* p. 3-8. 37 ref., 5 graph. French. (AGRIS 97-061364).

3904 Fotyma, E.; Fotyma, M.; Igras, J. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland). Dept. of Soil Fertility and Fertilization) (1996) [Field water consumption by spring barley grown on sandy-loam soil]. *Bilans wody w polu jeczmienia jarego uprawianego na glebie wytworzonej z piaskow gliniastych. Fragmenta Agronomica (Poland)* v. 13(2) p. 123-134. 6 fig., 3 tables; 10 ref. Polish. (AGRIS 97-075992).

The results of three years experiments on field water consumption by spring barley grown in 4 course rotation and fertilized with different nitrogen doses are presented. The soil moisture up to 100 mm soil profile was determined with the neutron probe and potential evapotranspiration was calculated from empirical equation for Polish conditions. The field water consumption per day was the highest in June and the lowest in July. Productive water consumption per 100 kg of barley depended on weather and decreased with the increasing doses of nitrogen fertilizers. The daily and productive field water consumption rates for spring barley exceeded the respective values for winter wheat.

3905 Fotyma, E.; Fotyma, M.; Igras, J. (Institute of Soil Science and Cultivation of Plant, Pulawy (Poland). Dept. of Soil Fertility and Fertilization) (1996) [Field water consumption by winter wheat grown on sandy-loam soil]. *Bilans wody w polu pszenicy uprawianej na glebie wytworzonej z piaskow gliniastych. Fragmenta Agronomica (Poland)* v. 13(2) p. 107-122. 7 fig., 4 tables; 16 ref. Polish. (AGRIS 97-076248).

The soil moisture was measured in weekly intervals by means of neutron probe provided with computer. The field water consumption (equivalent to actual evapotranspiration) was related to potential

evapotranspiration calculated from empirical equation. The daily actual evapotranspiration rate in May was 4 mm/day and in June 4.5 mm/day and exceeded by factor 1.1 the potential evapotranspiration. The field water consumption in mm per day was independent on nitrogen doses while the productive evapotranspiration in mm per dt of winter wheat grain decreased with increasing doses of fertilizers.

3906 Galletti, G.C.; Bocchini, P.; Guadalix, M.E.; Almendros, G.; Camarero, S.; Martinez, A.T. (1997) PYROLYSIS PRODUCTS AS MARKERS IN THE CHEMICAL CHARACTERIZATION OF PAPERBOARDS FROM WASTE PAPER AND WHEAT STRAW PULPS. *Bioresource Technology*. 60(1):51-58. English. [CSIC CTR CIENCIAS MEDIOAMBIENTALES SERRANO 115 DPDO E-28006 MADRID SPAIN].

Analytical pyrolysis was used to characterize paperboard prepared with wheat straw subjected either to semichemical or biomechanical pulping (the latter including solid-state fermentation with the ligninolytic fungi *Pleurotus ostreatus* and *P. floridanus*) and variable proportions of waste paper. Pyrolysis products were also quantified and selected in attempt to match the industrial and laboratory parameters used in the assessment of pulp quality. Although the pyrolytic compounds from straw pulp and from waste paper pulp (mainly derived from wood fibres) were essentially the same, significant quantitative differences were found. The yields of up to 14 pyrolytic compounds were related to the percentage of waste paper in the pulps: typical cinnamyl- and syringyl-phenolics being the most diagnostic for straw whereas the methoxyphenols with an oxidized n-chain (aldehyde-ketone) were diagnostic for waste paper. Only the yields of six pyrolysis products (mainly anhydrosugar molecules) were significantly different as regards the pulping method, suggesting different hemicellulose removal patterns. (C) 1997 Elsevier Science Ltd. [References: 22].

3907 Guerin, J.; Carbonero, P. (1997) THE SPATIAL DISTRIBUTION OF SUCROSE SYNTHASE ISOZYMES IN BARLEY. *Plant Physiology*. 114(1):55-62. English. [UPM ESCUELA TECN SUPER INGN AGRON DEPT BIOTECNOL LAB BIOQUIM & BIOL MOL MADRID 28040 SPAIN].

The sucrose (Sue) synthase enzyme purified from barley (*Hordeum vulgare* L.) roots is a homotetramer that is composed of 90-kD type 1: Suc synthase (SS1) subunits. K-m values for Suc and UDP were 30 mM and 5  $\mu$  M, respectively. This enzyme can also utilize ADP at 25% of the UDP rate. Anti-SS1 polyclonal antibodies, which recognized both SS1 and type 2 Suc synthase (SS2) (88-kD) subunits, and antibodies raised against a synthetic peptide, LANGSTDNNFV, which were specific for SS2, were used to study the spatial distribution of these subunits by immunoblot analysis and immunolocalization. Both SS1 and SS2 were abundantly expressed in endosperm, where they polymerize to form the five possible homo- and heterotetramers. Only SS1 homotetramers were detected in young leaves, where they appeared exclusively in phloem cells, and in roots, where expression was associated with cap cells and the Vascular bundle. In the seed both SS1 and SS2 were present in endosperm, but only SS1 was apparent in the chalazal region, the nucellar projection, and the vascular bundle. The physiological implications for the difference in expression patterns observed are discussed with respect to the maize (*Zea mays* L.) model. [References: 46].

3908 Handley, L.L.; Robinson, D.; Forster, B.P.; Ellis, R.P.; Scrimgeour, C.M.; Gordon, D.C.; Nevo, E.; Raven, J.A. (Scottish Crop Research Inst., Invergowrie, Dundee (United Kingdom). Dept of Cellular and Environmental Physiology) (1997) [Shoot delta(15)N correlates with genotype and salt stress in barley]. [Delta (15)N aus Sprossen korreliert mit Genotyp und Salzstress in Gerste]. *Planta (Germany)* v. 201(1) p. 100-102. 1 ill.; 17 ref. English. (AGRIS 97-075988).

3909 Holtorf, H.; Apel, K. (Swiss Federal Inst. of Technology, Zuerich (Switzerland)) (1996) The regulation of NADPH-protochlorophyllide oxidoreductases A and B in green barley plants kept under a diurnal light/dark cycle. *Planta (Germany)* v. 199(2) p. 289-295. 6 ill.; 26 ref. English. (AGRIS 97-061659).

3910 Home, S.; Wilhelmson, A.; Tammisola, J.; Husman, J. (1997) NATURAL VARIATION AMONG BARLEY KERNELS. *Journal of the American Society of Brewing Chemists*. 55(2):47-51. English. [VTI BIOTECHNOL & FOOD RES POB 1501 ESPOO 02044 FINLAND].

The variation of barley kernels was studied among and within small breeders' plots and within individual barley plants. Differences between the basal, middle, and apical regions of the ear, and differences among individual kernels from different positions in the ear were examined. Kernel weight and protein content varied widely in single kernels of Alexis barleys grown in small plots in different European countries. Sieving tests of three regional fractions of the ear indicated that the kernels of apical fractions were smaller than those of the other two regions. This was also clearly demonstrated by weights of single kernels. The average protein contents of the three regional fractions of the ear did not differ significantly in most cases. However, the variation within one ear and between main and secondary stems of the same plants was of the same magnitude as that among different plants. The beta-glucan contents did not vary significantly between the three regional fractions, among individual kernels, or between main and secondary stems. Germination behavior determined by traditional methods did not vary significantly within the ear. However, the Germination Index of the apical fractions was, in some cases, slightly higher than that of the other fractions of the ear. [References: 8].

3911 Horvath, G.; Droppa, M.; Oravec, A.; Raskin, V.L.; Marder, J.B. (Biological Research Center, Szeged (Hungary). Inst. of Plant Biology) (1996) Formation of the photosynthetic apparatus during greening of cadmium-poisoned barley leaves. *Planta (Germany)* v. 199(2) p. 238-243. 7 ill., 1 table; 29 ref. English. (AGRIS 97-061658).

3912 Huang, B.R.; Johnson, J.W.; Nesmith, D.S. (1997) RESPONSES TO ROOT-ZONE CO<sub>2</sub> ENRICHMENT AND HYPOXIA OF WHEAT GENOTYPES DIFFERING IN WATERLOGGING TOLERANCE. *Crop Science*. 37(2):464-468. English. [KANSAS STATE UNIV DEPT HORT FORESTRY & RECREAT RESOURCES MANHATTAN, KS 66506 USA].

Knowledge of wheat (*Triticum aestivum* L.) responses to CO<sub>2</sub> and O<sub>2</sub> in the root environment could improve understanding of the mechanisms of waterlogging tolerance and thus help develop waterlogging-tolerant wheat plants. This experiment was designed to investigate the responses to elevated CO<sub>2</sub> and hypoxia of two wheat genotypes, Bayles and Savannah, which differ in waterlogging tolerance. Plants were grown in a growth chamber in nutrient solutions. Nutrient solutions were bubbled with ambient air (control), N-2 containing 5 kPa O<sub>2</sub> and ambient CO<sub>2</sub> (hypoxia), N-2 containing 10 kPa CO<sub>2</sub> and ambient O<sub>2</sub> (high CO<sub>2</sub>, ambient O<sub>2</sub>), and N-2 containing 10 kPa CO<sub>2</sub> and 5 kPa O<sub>2</sub> (high CO<sub>2</sub>, low O<sub>2</sub>). Hypoxia alone had adverse effects on net photosynthesis (P<sub>n</sub>), stomatal conductance (g(s)), water relations, leaf chlorophyll (chl) content, and shoot and root growth. The effects were greater for waterlogging-sensitive Bayles. When compared with the aerated control, the combination of elevated CO<sub>2</sub> and hypoxia caused significant reductions in P<sub>n</sub>, g(s), leaf water potential, and leaf chl content for Bayles, and in shoot and root growth for both Bayles and Savannah. Photosynthetic rate and leaf chl content of Savannah were increased when roots of hypoxic plants were exposed to elevated CO<sub>2</sub>, but this was not true for Bayles. Root-zone CO<sub>2</sub> enrichment at ambient O<sub>2</sub> had no significant effects on shoot growth, but reduced root growth in both genotypes. The results showed that CO<sub>2</sub> enrichment under root hypoxia can alleviate some negative effects of hypoxia on P<sub>n</sub>, leaf chl content, and shoot growth, the effect being larger for waterlogging-tolerant Savannah. [References: 34].

3913 Ilyas, M.; Abbasi, M.K. (University Coll. of Agriculture, Rawalakot (Pakistan)) (1994) Yield prediction of wheat as related to evapotranspiration in Pakistan. *Sarhad Journal of Agriculture (Pakistan)* v. 10(3) p. 313-320. 4 ill., 3 tables, 23 ref. English. (AGRIS 97-076247).

Prediction of relative yields and evapotranspiration (ET) of wheat (*Triticum aestivum*) were made under different climatic and soil conditions using the model PLANTGRO which was developed in Western USA. Field measurements of ET from several locations (Bhalwal, Faisalabad, Bhakar and Mianchannu) in Punjab were used to verify the predictions. The model generally predicted very well and showed good agreement between computed and measured ET. Computed seasonal ET for Bhalwal, Faisalabad, Bhakar and Mianchannu was 40, 36, 44 and 44 cm respectively, and was within 4 cm of measured ET. Since prediction were accurate the model was found to be a tool to aid in crop management and irrigation scheduling.

3914 Ishida, H.; Nishimori, Y.; Sugisawa, M.; Makino, A.; Mae, T. (1997) THE LARGE SUBUNIT OF RIBULOSE-1, 5-BISPHOSPHATE

CARBOXYLASE/OXYGENASE IS FRAGMENTED INTO 37-KDA AND 16-KDA POLYPEPTIDES BY ACTIVE OXYGEN IN THE LYSATES OF CHLOROPLASTS FROM PRIMARY LEAVES OF WHEAT. *Plant & Cell Physiology*. 38(4):471-479. English. [TOHOKU UNIV FAC AGR DEPT APPL BIOL CHEM 1-1 TSUTSUMIDORI AMAMIYAMACHI SENDAI MIYAGI 981 JAPAN].

Lysates of chloroplasts isolated from wheat (*Triticum aestivum* L. cv. Aoba) leaves were incubated on ice (pH 5.7) for 0 to 60 min in light (15  $\mu$ mol quanta m<sup>-2</sup> s<sup>-1</sup>), and degradation of the large subunit (LSU) of ribulose-1, 5-bisphosphate carboxylase/oxygenase (Rubisco; EC 4.1.1.39) was analyzed by applying immunoblotting with site-specific antibodies against the N-terminal, internal, and C-terminal amino acid sequences of the LSU of wheat Rubisco. The most dominant product of the breakdown of the LSU and that which was first to appear was an apparent molecular mass of 37-kDa fragment containing the N-terminal region of the LSU, A 16-kDa fragment containing the C-terminal region of the LSU was concomitantly seen. This fragmentation of the LSU was inhibited in the presence of EDTA or 1, 10-phenanthroline. The addition of active oxygen scavengers, catalase (for H<sub>2</sub>O<sub>2</sub>) and n-propyl gallate (for hydroxyl radical) to the lysates also inhibited the fragmentation. When the purified Rubisco from wheat leaves was exposed to a hydroxyl radical-generating system comprising H<sub>2</sub>O<sub>2</sub>, FeSO<sub>4</sub> and ascorbic acid, the LSU was degraded in the same manner as observed in the chloroplast lysates. The results suggest that the large subunit of Rubisco was directly degraded to the 37-kDa fragment containing the N-terminal region and the 16-kDa fragment containing the C-terminal region of the LSU by active oxygen, probably the hydroxyl radical, generated in the lysates of chloroplasts. [References: 60].

3915 Jackowski, G. (Adam Mickiewicz Univ., Poznan (Poland). Dept. of Plant Physiology) (1996) [Senescence-related changes in the subcomplex arrangement of the major light-harvesting chlorophyll a/b-protein complex of photosystem II (LHCII) as influenced by cytokinin]. [Alterungsbedingte Veränderungen in der Unterkomplexzusammensetzung des durch Cytokinin beeinflussten wichtigsten Chlorophyll a/b-proteinlichtemittierenden Komplexes von Photosystem II (LHCII)]. *Zeitschrift fuer Naturforschung, Section C, Bioscience (Germany)* v. 51(7-8) p. 464-472. 4 ill., 2 graphs; 47 ref. English. (AGRIS 97-075986).

3916 Jackowski, G. (Adam Mickiewicz Univ., Poznan (Poland). Dept. of Plant Physiology) (1996) [The subcomplex organization of the major chlorophyll a/b-protein light-harvesting complex of photosystem II (LHCII) in barley thylakoid membrane]. [Die Unterkomplexorganisation des wichtigsten Chlorophyll-a/b-Proteinlichtemittierenden Komplexes von Photosystem II (LHCII) in Gersten-Thylakoidmembranen]. *Zeitschrift fuer Naturforschung, Section C, Bioscience (Germany)* v. 51(7-8) p. 454-463. 5 ill., 1 table; 42 ref. English. (AGRIS 97-075985).

3917 Jarrett, S.J.; Marschke, R.J.; Symons, M.H.; Gibson, C.E.; Henry, R.J.; Fox, G.P. (1997) ALPHA-AMYLASE/SUBTILISIN INHIBITOR LEVELS IN AUSTRALIAN BARLEYS. *Journal of Cereal Science*. 25(3):261-266. English. [QUEENSLAND DEPT PRIMARY IND CTR FOOD TECHNOL 19 HERCULES ST HAMILTON QLD 4007 AUSTRALIA].

An enzyme-linked immunosorbent assay (ELISA) was used to determine the bifunctional alpha-amylase/subtilisin inhibitor (EAST) content of barley grain from 11 cultivars grown in six diverse locations in Australia. The inhibitor ranged from 119 to 254  $\mu$ g/g in 57 barley samples. Genotype had a significant ( $P < 0.05$ ) effect on BASI content but there was no effect due to environment. Total protein varied independently of BASI and was influenced by environment and genotype. BASI content was higher ( $P < 0.05$ ) in malting barley than in feed barley and was correlated positively ( $r = 0.29$ ;  $P < 0.05$ ) with alpha-amylase activity in corresponding malts. The ELISA used monoclonal and polyclonal antibodies raised against purified BASI. In immunoblot analysis the monoclonal antibody showed high specificity for the inhibitor in barley and also detected the inhibitor in wheat. Low levels of inhibitor (mean 3.2  $\mu$ g/g) were found in 12 Australian wheat cultivars using the ELISA developed for barley. The assay had a linear working range of 5-50 ng/mL with a detection limit of 2 ng/mL. Reproducibility between assays was good (CV = 4.9%) but mean recoveries were high, ranging from 116-129% when purified inhibitor was added to barley extracts. The ELISA

may have useful applications in brewing research and barley breeding programmes. (C) 1997 Academic Press Limited. [References: 16].

3918 Jones, BL.; Marinac, LA. (1997) PURIFICATION, IDENTIFICATION, AND PARTIAL CHARACTERIZATION OF A BARLEY PROTEIN THAT INHIBITS GREEN MALT ENDOPROTEINASES. *Journal of the American Society of Brewing Chemists*. 55(2):58-64. English. [USDA ARS CEREAL CROPS RES UNIT MADISON, WI 53705 USA].

Endoproteinases control the rate of hydrolysis of storage proteins during barley germination and are thus critically important to the malting process. We have shown that endoproteinases comprising all four proteinase classes are present in green malt, with the cysteine proteinases probably being most important for hydrolyzing storage proteins during malting. Compounds from both barley and malt inhibit some of these cysteine proteinases. This article reports the purification and characterization of a 10-kDa barley protein, purified from both seed and beer extracts, that specifically inhibits green malt cysteine endoproteinases. Amino acid composition, matrix-assisted laser desorption/ionization mass spectrometric and N-terminal amino acid sequence data indicated that the inhibitor is identical to barley lipid transfer protein 1 (probable amylase/proteinase inhibitor, PAPI), a nonspecific lipid-transfer protein. The protein did not inhibit the activities of either papain or subtilisin but did suppress the activities of many of the green malt cysteine endoproteinase activities that are separated on a two-dimensional isoelectric focusing and polyacrylamide gel electrophoresis system. Some serine proteinases were also partially inhibited. The purified inhibitor totally inhibited the activity of a purified 31-kDa cysteine endoproteinase from green malt. In the absence of inhibitor, the 31-kDa enzyme rapidly hydrolyzed barley storage proteins. LTP1-PAPI may well play an important role in controlling protein hydrolysis during malting. [References: 30].

3919 Khalil, I.A. (Peshawar Univ. (Pakistan). Dept. of Agricultural Chemistry) (1996) [Biosynthetic artefacts in crop plants by systemic fungicides]. *Artefatti biosintetici nelle piante coltivate causati da fungicidi sistemici. Agrochimica (Italy) v. 40(2-3) p. 123-131. 2 tables; 20 ref. English. (AGRIS 97-061661).*

3920 Khokhlova, LP.; Olinevich, OV.; Pankratova, OV. (1997) EFFECT OF THE CYTOSKELETON MODIFIERS ON THE WATER-HOLDING CAPACITY OF WINTER WHEAT TISSUES. *Russian Journal of Plant Physiology*. 44(3):328-332. English. [KAZAN VI LENIN STATE UNIV UL LENINA 18 TATARSTAN 420008 RUSSIA].

Effects of the inhibitors of the cytoskeletal framework, 10  $\mu$ M cytochalasin and 1 mM colchicine, on the tissue water-holding capacity (WHC) in winter wheat (*Triticum aestivum* L.) seedlings were studied. WHC was defined as the amount of water that could not be extracted by 20% polyethylene glycol (PEG-6000). The inhibitors decreased WHC. Severe water stress (30% PEG) and the membranotropic compound pipolphone both further augmented the effects of cytochalasin and colchicine. A low concentration (5  $\mu$ M) of exogenous calcium prevented and a high concentration (1 mM) enhanced the inhibitor action. A relationship between WHC and the integrity of the cytoskeleton components was proposed, and WHC dependence on the cellular  $\text{Ca}^{2+}$  concentration was shown. Destructive changes in the cytoskeletal framework result in the reduction of the total water-holding surfaces of the cytoskeletal filaments and associated macromolecules and, as a consequence, in changes of the cellular water state and a decrease in tissue WHC. [References: 24].

3921 Kobayashi, A.; Kim, M.J.; Kawazu, K. (Osaka Univ. (Japan). Faculty of Engineering, Dept. of Biotechnology) (1996) [Uptake and exudation of phenolic compounds by wheat and antimicrobial components of the root exudate]. [Aufnahme und Exudation von phenolischen Verbindungen bei Weizen und antimikrobielle Bestandteile der Wurzelexsudate]. *Zeitschrift fuer Naturforschung, Section C, Bioscience (Germany) v. 51(7-8) p. 527-533. 1 ill., 4 graphs, 1 table; 10 ref. English. (AGRIS 97-076242).*

3922 Korona, A.; Korona, E. (Polish Academy of Science, Popielno (Poland). Research Station of Ecological Agriculture and Preservative Breeding) (1996) [Relationship between leaves photosynthetic area and seed yield of spring triticale]. *Zależność między powierzchnią asymilacyjną liści a plonem zimą pszenżyta jarego. Fragmenta*

*Agronomica (Poland) v. 13(2) p. 87-94. 5 tables; 7 ref. Polish. (AGRIS 97-076241).*

The experiments were performed in Region of Big Masurian Lakes during 1987-89 on two cultivars Jago and Maja. The photosynthetic leaves area was measured on the main stalk in the phase of plant flowering. The significant effect of weather conditions on the leaves area was found. Grain weight per spike was significantly correlated with leaves area in cv. Maja, whereas relationship was not stated for cv. Jago. It could be assumed that for cv. Jago more important role played intensity of photosynthesis than leaves size. For both cultivars the positive correlation between grain number per spike and grain weight was observed.

3923 Kuroda, M.; Kiyosaki, T.; Arai, S.; Abe, K. (1997) PURIFICATION AND PROPERTIES OF A CYSTEINE PROTEINASE OCCURRING IN DORMANT WHEAT SEEDS. *Bioscience Biotechnology & Biochemistry*. 61(4):732-734. English. [HOKURIKU NATL AGR EXPTL STN INADA JOETSU NIIGATA 94301 JAPAN].

A cysteine proteinase was purified from dormant seeds of wheat (*Triticum aestivum*, cultivar Norin 61) and its molecular mass was estimated to be about 23 kDa by gel filtration. The K<sub>m</sub> of this proteinase at pH 5.5 was calculated as 2  $\mu$ M for Z-Phe-Arg-MCA, and its activity was inhibited by cysteine proteinase inhibitors including antipain, E-64, and leupeptin. Oryzacystatin-I, a proteinaceous cysteine proteinase inhibitor in rice seeds, also inhibited its activity. [References: 25].

3924 Lakatos, L. (1996) METHOD FOR CALCULATING WINTER WHEAT DRY MATTER MASS INCREASE DURING THE GROWING SEASON ON THE BASIS OF CLIMATIC PARAMETERS. *Novemtermeles*. 45(5-6):487-502. Hungarian. [UNIV AGR PF 36 H-4015 DEBRECEN HUNGARY].

A dynamic model was developed to describe the total aboveground and ear dry matter mass increase of the winter wheat, Yubileynaya 50. It also provides estimations of the occurrence of phenological times and yields with an accuracy of approximately  $\pm 10$  days and  $\pm 0.5$  t/ha, respectively. The model uses 4 variables, while the nutrient supply calculation submodel, worked out earlier, uses 3 variables. These variables are the data on air temperature (degrees C) measured at 2 metres to characterize thermal conditions, data on plant-available water in a 1 m deep soil layer (mm) to represent the hydrological conditions, data on global radiation (MJ/m<sup>2</sup>) to characterize the radiation, and the nutrient supplying power of the soil, calculated with the submodel developed earlier (mg/100 g), to describe the nutrient conditions. The 3 variables of the submodel are the following: temperature at soil depth of 1 m (degrees C), moisture content of a 1 m deep soil layer and precipitation, both expressed in mm. The result calculated with this model apply to the Eastern part of the Great Hungarian Plain and to any other place where the annual average variation of climatological elements is similar. The model uses a 5-day time scale. It describes the plant dry matter mass increase using the sum of the product of response functions - temperature, plant - available water, solar radiation, nutrient supply - and weight functions based on probability data. As a consequence, the dual, deterministic and stochastic character of plant development is considered. [References: 27].

3925 Leavitt, SW.; Paul, EA.; Galadima, A.; Nakayama, FS.; Danzer, SR.; Johnson, H.; Kimball, BA. (1996) CARBON ISOTOPES AND CARBON TURNOVER IN COTTON AND WHEAT FACE EXPERIMENTS. *Plant & Soil*. 187(2):147-155. English. [UNIV ARIZONA TREE RING RES LAB TUCSON, AZ 85721 USA].

The Maricopa cotton and wheat FACE (free-air CO<sub>2</sub> enrichment) experiments offer propitious opportunity to quantify carbon turnover. The commercial CO<sub>2</sub> ( $\delta^{13}\text{C}$ ) approximate to 37 parts per thousand used to elevate CO<sub>2</sub> concentration in field plots provided a strongly C-12-depleted tracer. Soil CO<sub>2</sub> and  $\delta^{13}\text{C}$  of soil organic carbon (SOC) in CO<sub>2</sub>-enriched and Control plots were measured between the final cotton FACE project (October 1991) and the end of the second wheat experiment (June 1994). The initial C-13-depletion in SOC of cotton FACE plots (measured by the difference in  $\delta^{13}\text{C}$  between FACE and Control plots) persisted at the same level (1.9 parts per thousand) 1.5 years after the experiment ended. A similar depletion was observed in soil CO<sub>2</sub> evolved in the same plots, indicating ongoing decomposition of the new SOC. The SOC  $\delta^{13}\text{C}$  of wheat plots before and after two growing seasons showed increasing C-13-depletion in FACE relative to Control. Isotopic mass balance was consistent with 5-6% new carbon input from the



two wheat crops. This is lower than the 12-13% calculated for FACE cotton and perhaps a consequence of the larger root system of cotton or the 3-year duration of the cotton experiments versus 2 years for the wheat. [References: 16].

3926 Lee, J. (ARS.) (1996) Hardy oats stand up to a cold world. *Agricultural Research (Washington, D.C.) (USA)* v. 44(12) p. 8. English. (AGRIS 97-075993).

3927 Lee, S.Y. (Rural Development Administration, Suwon (Korea Republic). Agricultural Science and Technology Institute); Kim, C.S.; Cho, J.W.; Kang, Y.G. (Chungnam National University, Taejeon (Korea Republic). College of Agriculture) (1996) Physiological response of barley seedlings to salt stress. *Korean Journal of Crop Science (Korea Republic)* v. 41(6) p. 665-671. 6 tables; 16 ref. Korean. (AGRIS 97-061662).

3928 Mannheim, T.; Braschkat, J.; Marschner, H. (1997) AMMONIA EMISSIONS FROM SENESCING PLANTS AND DURING DECOMPOSITION OF CROP RESIDUES. *Zeitschrift für Pflanzenernährung und Bodenkunde*. 160(2):125-132. German. [UNIV HOHENHEIM INST PFLANZENERNÄHRUNG FRUWIRTHSTR 20 D-70593 STUTTGART GERMANY].

NH<sub>3</sub> emissions from plant stands, measured under simulated environmental conditions with the wind tunnel method, ranged between 0.8 and 1.4% of the N content of the shoot, equivalent to 1.1 to 2.9 kg NH<sub>3</sub>-N ha<sup>-1</sup>. The highest emissions were observed in faba beans whereas the emissions in winter wheat, spring rape and white mustard were lower. The total NH<sub>3</sub> emissions were not affected by removing a part of the ears (sink reduction), but emissions occurred earlier, as did the plant senescence. This suggests that the NH<sub>3</sub> emissions are closely related to senescence. NH<sub>3</sub> emissions from decomposing crop residues ranged from 0.9 to 3.7% of the N content; The emissions from sugar beet leaves and potato shoots with high water content reached from 8.6 up to 12.6 kg N ha<sup>-1</sup>, whereas the emissions from field bean straw with high dry matter and N content were relatively low. (3.1 kg N ha<sup>-1</sup>); or 0.9% of the N content). The NH<sub>3</sub> emissions from sugar beet leaves were reduced by 81% by ploughing and 63% by mulching. [References: 27].

3929 Martin, G. (Institut Technique des Cereales et des Fourrages, Paris (France). Laboratoire Qualite des Cereales) (1995) [Harvest 1995: determining effect of winter rains on protein levels (soft wheat in France)]. *Recolte 1995: effet determinant des pluies hivernales sur la teneur en proteines (ble tendre en France)*. Journees de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealières]. Paris (France). 1995. *Industries des Cereales (France)* (no 95) p. 7-10. French. (AGRIS 97-061365).

3930 Matile, P.; Schellenberg, M.; Vicentini, F. (Zuerich Univ. (Switzerland). Dept. of Plant Biology) (1997) [Localization of chlorophyllase in the chloroplast envelope]. [Lokalisierung von Chlorophyllase in der Chloroplastenhuelle]. *Planta (Germany)* v. 201(1) p. 96-99. 1 ill., 2 tables; 21 ref. English. (AGRIS 97-075987).

3931 Mattsson, J.E. (1997) TENDENCY TO BRIDGE OVER OPENINGS FOR CHOPPED PHALARIS AND STRAW OF TRITICUM MIXED IN DIFFERENT PROPORTIONS WITH WOOD CHIPS. *Biomass & Bioenergy*. 12(3):199-210. English. [SWEDISH UNIV AGR SCI DEPT OPERAT EFFICIENCY S-23053 ALNARP SWEDEN].

Solid biofuels with poor flow properties can cause problems in heating and power plants. Bridging over openings is one problem that was studied for chopped reed canary grass (*Phalaris arundinacea*) and wheat straw (*Triticum aestivum*) mixed in different proportions with wood chips. The aim was to determine whether the bridging tendency in chopped reed canary grass and in chopped wheat straw depends on the particle size, and if it would be reduced if grass and straw were mixed with dry wood chips. The bridging tendency was defined as the slot opening when a "bridge" of material formed over the opening breaks, and was measured with equipment developed and tested for wood fuels. Earlier studies showed that long and thin particles have a high tendency to bridge. This was confirmed for the straw and grass studied. Their tendency to bridge was 6-8 times higher than that of wood chips. Mixing wood chips in grass or straw decreased the bridging tendency, but only marginally. Even when 80% of the dry matter was wood chips the mixtures had a bridging tendency that was 3-5 times higher than that of pure wood chips. The

results indicate that mixing wood chips into chopped reed canary grass or straw is not a promising concept to decrease their bridging tendencies. The lack of suitable methods to classify particle shape in mixtures of wood chips and straw or grass was an obstacle to a closer analysis of how the particle shape affects the bridging tendency. (C) 1997 Elsevier Science Ltd. [References: 10].

3932 Narasimhan, B.; Pliskamatyshak, G.; Kinnard, R.; Carstensen, S.; Ritter, M.A.; Vonweymann, L.; Murthy, P.P.N. (1997) NOVEL PHOSPHOINOSITIDES IN BARLEY ALEURONE CELLS - ADDITIONAL EVIDENCE FOR THE PRESENCE OF PHOSPHATIDYL-SCYLLO-INOSITOL. *Plant Physiology*. 113(4):1385-1393. English. [MICHIGAN TECHNOL UNIV DEPT CHEM HOUGHTON, MI 49931 USA].

A novel isomer of phosphatidylinositol that differs in the structure of the head group was detected in barley (*Hordeum vulgare* cv Himalaya) seeds. In this paper we describe our efforts to elucidate the structure of the novel isomer. Evidence from a variety of techniques, including chemical modification of *in vivo* (32)Pi- and myo-[H-3]inositol-labeled compounds, gas chromatography-mass spectrometry analysis, *in vivo* incorporation of scyllo-[H-3]inositol, and enzymatic studies that suggest that the structure is phosphatidyl-scyllo-inositol (scyllo-PI), is presented. The use of microwave energy to significantly enhance the slow rate of hydrolysis of phosphoinositides is described. The presence of scyllo-PI can be easily overlooked by the methods commonly employed; therefore, experimental considerations important for the detection of scyllo-PI are discussed. [References: 44].

3933 Parkkonen, T.; Tervilawilo, A.; Hopeakoskinurminen, M.; Morgan, A.; Poutanen, K.; Autio, K. (1997) CHANGES IN WHEAT MICROSTRUCTURE FOLLOWING *IN VITRO* DIGESTION. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 47(1):43-47. English. [VTI BIOTECHNOL & FOOD RES POB 1500 FIN-02044 ESPOO FINLAND].

A three-step digestion simulation model was used to study the effects of monogastric digestive enzymes and exogenous microbial enzymes on the microstructure of wheat. Sections were stained for cell wall polysaccharides, protein, starch and phytate. Bright field and fluorescence microscopy was used to study the microstructural changes following each step of the digestion process. Starchy endosperm protein was not detected after the pepsin step, although aleurone protein was largely unaffected. After pancreatin treatment, starch had also disappeared. Xylanase decreased the fluorescence of the aleurone protein and collapsed the cell walls in the subaleurone. Unbroken cell walls of the aleurone and endosperm were not influenced by any of the treatments. [References: 14].

3934 Poetter, E.; Beator, J.; Kloppstech, K. (Hannover Univ. (Germany). Inst. fuer Botanik) (1996) The expression of mRNAs for light-stress proteins in barley: Inverse relationship of mRNA levels of individual genes within the leaf gradient. *Planta (Germany)* v. 199(2) p. 314-320. 6 ill.; 27 ref. English. (AGRIS 97-061660).

3935 Rasmussen, C.B.; Henriksen, A.; Abelskov, A.K.; Jensen, R.B.; Rasmussen, S.K.; Hejgaard, J.; Welinder, K.G. (1997) PURIFICATION, CHARACTERIZATION AND STABILITY OF BARLEY GRAIN PEROXIDASE BP 1, A NEW TYPE OF PLANT PEROXIDASE. *Physiologia Plantarum*. 100(1):102-110. English. [UNIV COPENHAGEN INST MOL BIOL DEPT PROT CHEM OSTER FARIMAGSGADE 2A DK-1353 COPENHAGEN K DENMARK].

The major peroxidase of barley grain (BP 1) has enzymatic and spectroscopic properties that are very different from those of other known plant peroxidases (EC 1.11.1.7) and can therefore contribute to the understanding of the many physiological functions ascribed to these enzymes. To study the structure-function relationships of this unique model peroxidase, large-scale and laboratory-scale purifications have been developed. The two batches of pure BP 1 obtained were identical in their enzymatic and spectral properties, and confirmed that BP 1 is different from the prototypical horseradish peroxidase isoenzyme C (HRP C). However, when measuring the specific activity of BP 1 at pH 4.0 in the presence of 1 mM CaCl<sub>2</sub>, the enzyme was as competent as HRP C at neutral pH towards a variety of substrates (mM mg<sup>-1</sup> min<sup>-1</sup>): coniferyl alcohol (930+/-48), caffeic acid (795+/-53), ABTS (2, 2(1)-azino-di-[3-ethyl-benzothiazoline-(6) sulfonic acid]) (840+/-47), ferulic acid (415+/-20), p-coumaric acid (325+/-12), and guaiacol (58+/-3). The absorption spectrum

of BP 1 is blue-shifted compared to that of HRP C with a Soret maximum of 399-402 nm, depending on pH. The prosthetic group was shown to be iron-protoporphyrin IX, which is characteristic of plant peroxidases. BP 1 is stable from pH 3 to 11, indicating that its unusual spectral characteristics do not result from enzyme instability. The thermostability is also normal with a melting temperature of 75 degrees C at pH 6.6, and 67 degrees C at pH 4.0 and 8.3. It is clear that the unusual properties of BP 1 are genuine, and reflect a novel regulation of plant peroxidase function. [References: 29].

3936 Regnier, T. (Montpellier II University, Montpellier, France.); Macheix, J.J. (1996) Changes in wall-bound phenolic acids, phenylalanine and tyrosine ammonia-lyases, and peroxidases in developing durum wheat grains (*Triticum turgidum* L. var. *Durum*). *Journal of agricultural and food chemistry (USA)* v. 44(7) p. 1727-1730. references. English. (AGRIS 97-062077).

Some aspects of phenolic metabolism have been followed during the development of durum wheat grain. Bound ferulic (FA) and p-coumaric (PCA) acids have been extracted after alkaline hydrolysis and quantified by high-performance liquid chromatography. They increased to reach a maximum during the hydric step and then decreased rapidly during grain dehydration. Changes in phenylalanine ammonia-lyase (PAL) (E.C. 4.1.1.5) and L-tyrosine ammonia-lyase (TAL) (E.C. 4.3.1.5) activities have been monitored all along the development of the grain. TAL activity was maximal 2 days before PAL, at the beginning of the hydric step. The presence of a maximal peroxidase activity at the end of the hydric step should be linked to the decrease of alkaline-resistant bound forms of FA. These results may suggest a possible role of peroxidase in the progressive changes from ester-linked forms of phenolic acids to insoluble derivatives, resistant to alkaline hydrolysis.

3937 Selim, A.H. (Monoufeyia Univ., Shebin El Kom (Egypt). Faculty of Agriculture); Atia, Z.M.A. (1996) Physiological and biochemical behaviour of wheat plants produced from gamma-irradiated grains. *Menofiya Journal of Agricultural Research (Egypt)* v. 21(2) p. 299-315. 5 tables; 30 ref. English. (AGRIS 97-062073).

3938 Tulin, E.E. (Iwate University, Iwate, Japan.); Tsutsumi, K.; Ejiri, S. (1995) Continuously coupled transcription-translation system for the production of rice cytoplasmic aldolase. *Biotechnology and bioengineering (USA)* v. 45(6) p. 511-516. references. English. (AGRIS 97-061824).

A continuously coupled cell-free transcription-translation system was developed for the production of rice cytoplasmic aldolase, an enzyme involved in both glycolytic and gluconeogenic pathways in eukaryotic cells. The system works with a continuous flow of feeding solution containing nucleoside triphosphates and amino acids into a 1-mL reactor containing wheat-germ extract, plasmid DNA, and transcription enzyme, and continuous removal of translation product through an ultrafiltration membrane fitted in the reactor. Addition of free nucleotide primer, m7G(5')ppp(5')G, to this reactor was necessary for efficient transcription, thus producing biologically active mRNA for translation. The rate of aldolase synthesis was constant during the continuous translation reaction. It was observed that from 3 h onward only aldolase was synthesized by the system. After 30 h, the total amount of protein synthesized reached 205.6 micrograms, which is comparable with the amount synthesized (255.6 micrograms) in the translation system only where separately prepared capped mRNAs were added to the reactor for translation. Autoradiogram and Western blot analyses of the translated product showed a distinct band corresponding to the calculated molecular weight of the protein. These results have shown the establishment of a continuously coupled eukaryotic transcription-translation system for the expression of genes from eukaryotic cells.

3939 Volynets, A.P.; Pshenichnaya, L.A.; Lupej, A.Yu.; Voluevich, E.A.; Morozik, G.V. (Academy of Sciences of Belarus, Minsk (Belarus). Institute of Experimental Botany. Institute of Genetics and Cytology) (1996) [Influence of alien cytoplasm on phenolic conjugate complex in common wheat seedlings]. *Vliyanie chuzherodnykh tsitoplasm na kompleks phenol'nykh kon'yugatov prorostkov myagkoj pshenitsy. Vestsi Akademiï Nauk Belarusi. Seriya biyagichnykh nauk (Belarus)* (no.4) p. 56-61. 3 tables; 12 ref. Russian. (AGRIS 97-062071).

Significant plasmon influence on the content and composition of flavonoid glycosides and phenolcarboxylic acid esters was revealed in seedlings of wheat alloplasmic lines. Alloplasmic lines with higher

resistance to *Septoria nodorum* had an increased level of some phenolic conjugates in healthy plants.

3940 Waldron, K.W.; Parr, A.J.; Ng, A.; Ralph, J. (Department of Food Biophysics, Institute of Food Research, Norwich Research Park, Colney, Norwich NR4 7UA (United Kingdom)) (1996) Cell wall esterified phenolic dimers: identification and quantification by reverse phase high performance liquid chromatography and diode array detection. *Phytochemical Analysis (United Kingdom)* v. 7(6) p. 305-312. 24 ref. English. (AGRIS 97-061664).

3941 Wang, Z. (SKLEAC, Beijing, P.R. China.); Xu, Y.; Peng, A. (1996) Influences of fulvic acid on bioavailability and toxicity of selenite for wheat seedling and growth. *Biological trace element research (USA)* v. 55(1/2) p. 147-162. references. English. (AGRIS 97-076249).

3942 Williams, M.; Harwood, J.L. (1997) EFFECTS OF CARBON DIOXIDE CONCENTRATION AND TEMPERATURE ON LIPID SYNTHESIS BY YOUNG WHEAT LEAVES. *Phytochemistry*. 45(2):243-250. English. [UNIV WALES COLL CARDIFF SCH MOL & MED BIOSCI POB 911 CARDIFF CF1 3US GLAM WALES].

The effects of incubation temperature and CO<sub>2</sub> concentration on lipid synthesis in leaves from 7-day-old wheat plants were studied. Plants were cultivated at 350 mu mol mol<sup>-1</sup> (approximately ambient CO<sub>2</sub>) and 20 degrees so that, irrespective of the subsequent incubation conditions, the samples were all derived from plants at the same phenological stage of development. Leaf tissue was incubated with [1-C-14]acetate at 350 mu mol mol<sup>-1</sup> or 700 mu mol mol<sup>-1</sup> CO<sub>2</sub> concentration and at 20 degrees or 24 degrees. Doubling the CO<sub>2</sub> concentration had little or no effect on lipid metabolism. In contrast, a 4 degrees rise in incubation temperature not only increased the rate of radiolabelling but also altered lipid synthesis qualitatively. Most noticeable of these changes was a marked increase in phosphatidylcholine labelling evidently at the expense of that of diacylglycerol. The increase in carbon flux to this extrachloroplastic lipid appeared to be restricted to the distal portions of the leaf tissue, thus indicating that the stage of tissue development was critical. Surprisingly, an increase of polyunsaturated fatty acid labelling was found at the higher incubation temperature. This increase was accompanied by a decrease in labelling of oleate in the main radiolabelled membrane lipids. In phosphatidylcholine the decrease in oleate labelling was compensated by a rise in that of linoleate while in monogalactosyldiacylglycerol, both linoleate and a-linolenate were better labelled at 24 degrees. A molecular basis for these alterations in lipid synthesis and acyl desaturation is suggested. (C) 1997 Elsevier Science Ltd. [References: 51].

3943 Yamashita, K.; Kasai, M.; Yamamoto, Y.; Matsumoto, H. (1997) ENHANCEMENT OF NITRATE EFFLUX AND THE PLASMA MEMBRANE HYDROGEN ION TRANSPORT ACTIVITY OF BARLEY ROOTS BY NITRATE TREATMENT. *Journal of Plant Nutrition*. 20(6):657-668. English. [OKAYAMA UNIV BIORESOURCES RES INST KURASHIKI OKAYAMA 710 JAPAN].

The effect of nitrate (NO<sub>3</sub>) on the activities of hydrogen (H<sup>+</sup>)-ATPase and H<sup>+</sup>-transport in the plasma membrane vesicles isolated from barley (*Hordeum vulgare* L. cv. Kikaihadaka) roots was investigated. After treatment with 10 mM NO<sub>3</sub> for longer than 24 h, both activities of H<sup>+</sup>-ATPase and H<sup>+</sup>-transport assayed in the presence of chloride (Cl<sup>-</sup>) were stimulated less than 20%. While H<sup>+</sup>-transport activity was approximately two times higher in NO<sub>3</sub>-grown roots than in control roots when assayed in the presence of NO<sub>3</sub> instead of Cl<sup>-</sup>. This result suggests that NO<sub>3</sub> is permeable in the plasma membrane vesicles isolated from NO<sub>3</sub>-grown roots rather than that of the control, and thereby stimulate H<sup>+</sup>-transport activity through the collapse of positive potentials established by H<sup>+</sup>-ATPase. Furthermore, NO<sub>3</sub> efflux from roots was markedly enhanced after 48 h of the exposure to NO<sub>3</sub>. Taken together, NO<sub>3</sub> efflux may be mediated by the permeability to NO<sub>3</sub> which is induced by NO<sub>3</sub>. [References: 30].

3944 Zaman, A.; Choudhuri, S.K. (Bidhan Chandra Krishi Viswavidyalaya, Kalyani (India). Dept. of Agronomy. Faculty of Agriculture) (1995) [Water use and yield of wheat under unmulched and mulched conditions in laterite soil of the Indian Sub-continent]. *Wassernutzung und Ertrag von Weizen ohne Mulch und unter Mulchbedingungen in einem Laterit des indischen Subkontinents. Journal of Agronomy and Crop Science (Germany)* v. 175(5) p. 349-353. 4 tables; 6 ref. English. (AGRIS 97-062070).

3945 Ziegler, P.; Loos, K.; Wagner, G. (1997) POSTTRANSLATIONAL ORIGIN OF WHEAT LEAF BETA-AMYLASE POLYMORPHISM. *Journal of Plant Physiology*. 150(5):537-545. English. [UNIV BAYREUTH LEHRSTUHL PFLANZENPHYSIOL D-95440 BAYREUTH GERMANY].

beta-Amylase (EC 3.2.1.2.) from wheat leaves was resolved by anion exchange chromatography into five active species. These were designated as beta I-beta V in accordance with the order of their elution from the anion exchange column and their increasing R<sub>f</sub>-values upon non-denaturing polyacrylamide gel electrophoresis. The major proteins of the isolated activity species reacted with an immune serum raised against barley seed beta-amylase and showed only very slight differences in molecular mass (all in the range of 57-59 kD). beta I-beta V thus appear to most characteristically represent differently charged isomers of one protein. beta V, which is the only beta-amylase species found in very young leaf tissues, was converted to beta II and beta III (which appear in vivo upon leaf tissue maturation) and beta IV upon in vitro incubation at pH 6. Massive beta V conversion was related to a specifically gelatin-degrading proteolytic activity in the protein extract. Both the conversion of beta V to other isoforms and the gelatin-degrading activity were specifically inhibited by PMSF. It is concluded that the polymorphism exhibited by wheat leaf beta-amylase largely results from limited proteolysis effecting significant charge modification of a singly expressed primary form of the exohydrolase. [References: 20].

## F61 PLANT PHYSIOLOGY-NUTRITION

3946 Belda, R.M. (Instituto de Agrobiología y Recursos Naturales, Salamanca, Spain.); Sanchez de la Puente, L. (1995) Analysis of nine mathematical functions as models for leaf diagnosis in wheat grown in fields. *Journal of plant nutrition (USA)* v. 18(11) p. 2347-2363. references. English. (AGRIS 97-062248).

Winter wheat was grown at five different experimental sites using various nutrient combinations of two nitrogen (N) and three calcium (Ca) doses. The three youngest leaves, including the flag leaf were sampled at anthesis together with the flag leaf post-anthesis and the grain at final harvest. The leaves were weighed and their mineral nutrient contents analyzed and the grain was also weighed. Of the nine equations that were fitted the potential (log y versus log x) most consistently had the best correlation and, thus, best represents the relationships between leaf dry weights, while the inverse in both variables was best for estimating grain weight from leaf weight. The nutrient content of the leaves was related to leaf dry weight according to the following sequence of maximum R<sup>2</sup> (R = 0.703), potassium (K) (R = 0.580), Ca (R = 0.444), phosphorus (P) (R = 0.359), iron (Fe) (R = 0.291), and magnesium (Mg) (R = 0.290). The square-root and the quadratic equations best reflected the maximum and minimum values for P and K, respectively. Highly significant relationships between Ca and Mg, and leaf dry weight were less frequent. The leaf nutrients correlated with grain weight in the following order: Mg (R<sup>2</sup> max = 0.521), N (0.455), Ca (0.434), Fe (0.348), P (0.346), Mn (0.339), and K (0.323). Of these nutrients, only Ca affected grain weight according to a parabolic equation (quadratic or square-root) while the rest were best fitted by logarithmic functions, both on X and Y or one variable separately and by a straight-line in one instance.

3947 Bollons, H.M.; Barraclough, P.B. (1997) INORGANIC ORTHOPHOSPHATE FOR DIAGNOSING THE PHOSPHORUS STATUS OF WHEAT PLANTS. *Journal of Plant Nutrition*. 20(6):641-655. English. [IACR ROTHAMSTED CROP & DIS MANAGEMENT DEPT HARPENDEN AL5 2JQ HERTS ENGLAND].

Winter wheat (*Triticum aestivum* L.) was grown to the 6-leaf stage hydroponically under wide-ranging conditions of phosphorus (P) supply. Tissue concentrations of inorganic orthophosphate (Pi) were measured in different plant parts and related to growth. The Pi was extracted from microwave-dried plant material which is an effective and practical way of preserving Pi at levels close to those prevailing in fresh tissue. Extremely deficient wheat contained low levels of "metabolic" Pi (1.4 mM), while wheat abundantly supplied with P accumulated Pi to concentrations of 40 mM without adverse effects on growth. The main effect of P on shoot growth was to increase the number and weight of tillers. The maximum weight of different organs was attained with different internal Pi concentrations. Critical leaf Pi (last fully expanded main-shoot leaf) and critical whole shoot Pi for maximum whole shoot growth were 2.8 mM (0.043%) and 2.6 mM (0.040%), respectively. The Pi in mature main-shoot leaves was closely related to whole shoot Pi. The diagnosis of plant

nutrient status using P "storage pool" concentrations is discussed. [References: 16].

3948 Botella, M.A.; Martinez, V.; Nieves, M.; Cerda, A. (1997) EFFECT OF SALINITY ON THE GROWTH AND NITROGEN UPTAKE BY WHEAT SEEDLINGS. *Journal of Plant Nutrition*. 20(6):793-804. English. [CSIC CTR EDAFOL & BIOL APLICADA SEGURA DEPT PLANT BIOL APDO 4195 E-30080 MURCIA SPAIN].

Saline conditions affect nitrogen (N) assimilation of higher plants. To study the effect of salinity and N source on growth and N uptake in wheat (*Triticum aestivum* L.), plants were grown in a growth chamber under controlled conditions. The nutrient solution contained 4 mM N, applied as either calcium nitrate [Ca(NO<sub>3</sub>)<sub>2</sub>] or ammonium sulfate [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>], or a mixture of both, and the salinity treatments consisted in two levels of sodium chloride (NaCl) (1 and 60 mM). Salinity significantly reduced shoot and root growth and the effect of the N source was dependent on which salinity treatment was applied. Salinity decreased the net uptake rate of nitrate (NO<sub>3</sub>) and NO<sub>3</sub>+ammonium (NH<sub>4</sub>), but had little effect on NH<sub>4</sub> uptake when this nutrient was applied alone. Dark conditions affected NO<sub>3</sub> uptake to a greater extent than NH<sub>4</sub> uptake. The best N source for wheat growth was a mixture of NO<sub>3</sub> and NH<sub>4</sub>, especially under saline conditions or periods of low irradiance. [References: 36].

3949 Bukhov, N.G. (1997) LEAF SENESCENCE - AN EVALUATION OF LIMITING STEPS IN PHOTOSYNTHESIS BY MEANS OF CHLOROPHYLL FLUORESCENCE-QUENCHING COEFFICIENTS AND P700 REDOX CHANGES IN LEAVES. *Russian Journal of Plant Physiology*. 44(3):303-310. English. [RUSSIAN ACAD SCI KA TIMIRYAZEV PLANT PHYSIOL INST UL BOT SKAYA 35 MOSCOW 127276 RUSSIA].

Photochemical and nonphotochemical quenching of chlorophyll fluorescence and absorbance changes at 820 nm were studied in 6- and 15-day-old first barley leaves. Nonphotochemical quenching was saturated at substantially lower irradiances in senescing leaves, thus revealing the reduced ability of chloroplasts for photochemical conversion of absorbed quanta during senescence. Analysis of dark relaxation kinetics of nonphotochemical quenching has shown an increased contribution of a "high-energy" or Delta pH-dependent quenching mechanism to the nonradiative dissipation of absorbed light energy in old leaves. This fact indicates that the decrease in capacity of the Calvin cycle during leaf senescence is greater than the decline in the rate of coupled photosynthetic electron transport. In the course of senescence, the component of dark relaxation kinetics of a nonphotochemical quenching attributed to state 1-state 2 transition disappeared. The primary quinone acceptor of photosystem II, Q(A), was accumulated in its reduced form under light in senescing leaves, while, in young leaves, Q(A) was largely oxidized by photosystem I. This specific feature of old leaves may also be related to a Delta pH-dependent restriction of electron transport between photosystems, which seems to account for the higher WOO accumulation observed during illumination of dark-adapted senescing leaves. [References: 34].

3950 Carvajal, M.; Cooke, D.T.; Clarkson, D.T. (Bristol Univ., Long Ashton (United Kingdom). Dept. of Agricultural Sciences, Long Ashton Research Station) (1996) Responses of wheat plants to nutrient deprivation may involve the regulation of water-channel function. *Planta (Germany)* v. 199(3) p. 372-381. 7 ill., 7 tables; 43 ref. English. (AGRIS 97-062244).

3951 Christopher, D.A.; Li, X.L.; Kim, M.; Mullet, J.E. (1997) INVOLVEMENT OF PROTEIN KINASE AND EXTRAPLASTIDIC SERINE/THREONINE PROTEIN PHOSPHATASES IN SIGNALING PATHWAYS REGULATING PLASTID TRANSCRIPTION AND THE PSBD BLUE LIGHT-RESPONSIVE PROMOTER IN BARLEY. *Plant Physiology*. 113(4):1273-1282. English. [UNIV HAWAII MANOA COLL TROP AGR & HUMAN RESOURCES DEPT PLANT MOL PHYSIOL ST JOHN 503 HONOLULU, HI 96822 USA].

We investigated the signaling pathways that control changes in plastid transcription in response to development and light. Plastid gene expression was analyzed in dark-grown barley (*Hordeum vulgare* L.) seedlings treated in vivo with an inhibitor of protein phosphatases 1 and 2A, okadaic acid (OA), or an inhibitor of protein kinases (K252a), followed by exposure of the seedlings to either red, blue, or white light. OA prevented blue light from activating the plastid psbD blue-light-responsive promoter (BLRP) and prevented red and blue light from



activating the expression of the plastid-encoded *rbcl* and *psbA* and the nuclear-encoded *RbcS* and *Lhcb* genes. OA reduced total plastid transcription activity in dark- and light-grown seedlings by 77 to 80%, indicating that OA prevented light-responsive transcription by reducing total plastid transcription. In contrast, K252a activated the accumulation of mRNAs arising from the BLRP. Blue light in combination with K252a increased *psbD* mRNA levels in an additive manner. The results indicate that protein phosphatases 1 and/or 2A, which reside external to the organelle, are required for proper function of plastid transcription and chloroplast development, whereas a protein kinase represses the BLRP in plants grown in the dark. [References: 60].

3952 Cieslinski, G.; Vanrees, KCJ.; Szmigielska, AM.; Huang, PM. (1997) LOW MOLECULAR WEIGHT ORGANIC ACIDS RELEASED FROM ROOTS OF DURUM WHEAT AND FLAX INTO STERILE NUTRIENT SOLUTIONS. *Journal of Plant Nutrition*. 20(6):753-764. English. [UNIV SASKATCHEWAN DEPT SOIL SCI 51 CAMPUS DR SASKATOON SK S7N 5A8 CANADA].

Knowledge of the composition and quantity of organic substances released from roots of different plant species is necessary for understanding the chemical and biological processes in the rhizosphere. The present study was undertaken to quantify low molecular weight organic acids (LMWOAs) released from roots of five cultivars/lines of durum wheat (*Triticum turgidum* var. durum L.): Kyle, Sceptre, DT618, DT627, and DT637 and four cultivars. lines of flax (*Linum usitatissimum* L.): Somme, Flanders, BC Emerson, and YSED 2. Plants were grown in sterile nutrient solution cultures and amounts of organic acids exuded by roots were analyzed by gas chromatography. The LMWOAs varied significantly among both durum wheat and flax cultivars and oxalic, malonic, fumaric, succinic, acetic, malic, citric and tartaric acids were detected in root exudates of both species. Generally, oxalic and acetic acids were predominant in durum wheat exudates and oxalic, acetic and malic acids were predominant in flax root exudates. High oxalic acid concentrations occurred in root exudates of durum wheat cultivars DT627 and DT637, and nax cultivar YSED 2. Compared with the other durum wheat cultivars, Kyle released the lowest total amount of LMWOAs, whereas among the flax cultivars, YSED 2 had the highest total amount of acids secreted from roots. The data showed that the release of LMWOAs from roots was cultivar dependent. The results provide valuable background information for studying the role of root exudates in soil-plant relationships. [References: 30].

3953 Clement, JMAM.; Loorbach, J.; Meijer, J.; Vanhasselt, PR.; Stulen, I. (1997) THE IMPACT OF ATMOSPHERIC AMMONIA AND TEMPERATURE ON GROWTH AND NITROGEN METABOLISM OF WINTER WHEAT. *Plant Physiology & Biochemistry*. 35(5):395-404. English. [UNIV GRONINGEN BIOL CTR HAREN DEPT PLANT BIOL POB 14 NL-9750 AA HAREN NETHERLANDS].

The effect of atmospheric ammonia in combination with low and moderate growth temperature on growth and nitrogen metabolism of winter wheat plants (*Triticum aestivum* L. cv. Urban) was investigated. Plants were exposed to 0, 1000 and 2000 nl l<sup>-1</sup> NH<sub>3</sub> for 1 week at moderate day/night temperatures (18.5/15 degrees C) and subsequently for 1 week at low temperatures (4/3 degrees C). At moderate temperatures, NH<sub>3</sub> exposure at 1000 nl l<sup>-1</sup> lead to an increase in protein content, but free ammonium, amino acid and total nitrogen content were not affected. Exposure to 2000 nl l<sup>-1</sup> NH<sub>3</sub> resulted in a significantly higher amino acid, protein content and total nitrogen content, while free ammonium content was not increased. Net nitrate uptake rate by the roots was decreased by 21% and 34% upon exposure to 1000 and 2000 nl l<sup>-1</sup> NH<sub>3</sub> respectively. Atmospheric ammonia did not affect biomass, carbohydrates or nitrate content significantly. Lowering the temperature to 4/3 degrees C resulted in an inhibition of growth. Ammonium, amino acids, and total nitrogen accumulated in plants exposed to 1000 and 2000 nl l<sup>-1</sup> NH<sub>3</sub>, while protein content was not increased at this temperature. At moderate temperatures winter wheat metabolized the atmospheric ammonia and counteracted the extra N input via the leaves by a reduction of the nitrate uptake by the roots. At low temperatures, the complete incorporation of ammonia was reduced, resulting in an increased ammonium and amino acid content. However, this disturbance of the nitrogen metabolism did not lead to any direct toxic effects. It was concluded that winter wheat is tolerant to high atmospheric ammonia concentrations, even under unfavourable growth conditions. [References: 44].

3954 Cruz Flores, Gerardo; Tirado Torres, Juan Luis; Alcantar Gonzalez, Gabriel; Santizo Rincon, J. Antonio (1995) [Absorption efficiency of phosphorus of wheat and triticale]. *Evaluacion de la eficiencia de absorcion de fosforo de trigo y triticale*. 26, Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. *Proceedings of 26 National meeting of Soil Science*. Cd. Victoria, Tamaulipas, 1995]. *La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo*. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 64. Sociedad Mexicana de la Ciencia del Suelo. 4 cuadro; 4 ref. Spanish. (AGRIS 97-076314).

3955 Denev, ID.; Minkov, IN. (1997) USE OF FLUORESCENCE PROBES 1-ANILINE-8-NAPHTHALENE SULFONATE AND PYRENE FOR STUDYING THE LOCALISATION OF PROTEINS IN INNER MEMBRANES FROM WHEAT ETIOPLASTS. *Photosynthetica*. 33(2):303-312. English. [PAISI] HILENDARSKI UNIV PLOVDIV DEPT PLANT PHYSIOL BG-4000 PLOVDIV BULGARIA].

The fluorescence probes 1-aniline-8-naphthalene sulfonate (ANS) and pyrene were applied for characterisation of the light-induced changes in etioplast inner membranes (EPIMs) from 7 d-old dark-grown wheat seedlings (*Triticum aestivum* L. cv. Pobeda). The major aim was to obtain information about the localisation of membrane proteins in the EPIMs, using probes situated in different regions of the membranes. The quenching of tryptophan fluorescence showed that the main parts of proteins were accessible to the pyrene buried in the lipid bilayer which suggests that most of the proteins also enter the lipid bilayer. The substantial quenching of the tryptophan fluorescence by the surface-situated ANS demonstrated that a part of the tryptophan residues was probably localised close to the membrane surface. The registered changes after irradiation could be explained by the presence of large aggregates of NADPH-protochlorophyllide oxidoreductase (POR), protochlorophyllide (PChlide) and NADPH in membranes that start to disconnect and redistribute along the prothylakoids. [References: 29].

3956 El Nabawy, A.M. (1995) Study on ion absorption by different varieties of wheat plants under saline conditions. *Cairo Univ. (Egypt)*. Faculty of Agriculture. 15 graph. 16 tables; Bibliography: p. 69-80. 100 p. English. (AGRIS 97-076412).

3957 Foroutanpour, K.; Ma, BL.; Smith, DL. (1997) PROTEIN ACCUMULATION POTENTIAL IN BARLEY SEEDS AS AFFECTED BY SOIL- AND PEDUNCLE-APPLIED N AND PEDUNCLE-APPLIED PLANT GROWTH REGULATORS. *Physiologia Plantarum*. 100(1):190-201. English. [MCGILL UNIV MACDONALD CAMPUS 21 111 LAKESHORE RD ST ANNE DE BELLEVUE PQ H9X 3V9 CANADA].

Although much investigated, the factors constraining cereal grain protein accumulation are not well understood. As a result of the development of a new technique, new approaches to this question are now possible. A peduncle perfusion system was used to deliver a range of plant growth regulators (PGRs) and/or N solutions into barley (*Hordeum vulgare*) plants during the grain-filling period. The perfusion technique floods the peduncle interior with a treatment solution for periods of weeks to months, allowing the plant to take up administered substances from the perfused solution. The objectives of the present work were to determine: (1) whether some PGRs could alter the overall pattern of N allocation within barley plants, perhaps leading to higher protein accumulation in the seeds, (2) whether the addition of N through the peduncle could increase the seed N concentration even when the concentration of N in the rooting medium was high, and (3) whether or not PGR stimulated elevations in grain protein levels and peduncle-added N increases in grain protein levels were additive. Three experiments were conducted to determine the physiological effects of (1) peduncle-administered PGRs (2) combinations of soil- and peduncle-applied N and (3) selected combinations of soil- and peduncle-administered N, and peduncle-applied PGRs on photosynthetic rate, dry matter partitioning and N accumulation of barley plants during grain filling. The first experiment tested four PGRs: abscisic acid (ABA), kinetin, gibberellic acid (GA(3)), and 2, 4-dichlorophenoxy acetic acid (2, 4-D) each at three concentrations. The second experiment tested three levels of soil N (N<sub>4</sub>NO<sub>3</sub>) fertility, and two concentrations of peduncle-added N (urea). The third experiment tested four PGRs: ABA, kinetin, GA(3), and 2, 4-D with two soil N concentrations and two concentrations of peduncle-added N. ABA and 2, 4-D decreased



total seed weight of the perfused spike. The addition of peduncle-perfused N increased seed protein concentration and content under conditions of high soil N fertility suggesting that seed protein accumulation is more limited by the ability of roots to take up N from the soil than by the seed to take up N from the rest of the plant. The effects of the PGRs on N allocation among plant parts varied with the amount of N available to the plant. Because it resulted in less protein stored in the flag leaf and more in the seeds, GA(3) perfusion caused an overall change in the allocation of N among plant parts. Peduncle perfusion of kinetin and ABA affected some aspects of photosynthetic physiology. [References: 57].

3958 Gupta, U.C. (Agriculture and Agri Food Canada, Charlottetown, P.E.I.) (1995) Effects of Selcote Ultra and sodium selenate (laboratory versus commercial grade) on selenium concentration in feed crops. *Journal of plant nutrition (USA)* v. 18(8) p. 1629-1636. references. English. (AGRIS 97-062185).

Field studies were conducted at two locations in P.E.I., Canada on cereals and forages on the effect of soil applications of Selcote Ultra and on a comparison of sodium selenate (laboratory versus commercial grade) on selenium (Se) concentration in plant tissue. Soil at both locations was sandy loam in texture and the soil pH ranged from 5.8 to 6.0. The data showed that 5 g Se ha<sup>-1</sup> added as Selcote Ultra was adequate to raise the Se level in the first two cuts of forage tissue above the minimum required level of 100 microgram kg<sup>-1</sup>. For cereals, 10 g Se was necessary to achieve the same level. The residual effect of 10 g Se ha<sup>-1</sup> from Selcote Ultra added in the first year maintained plant Se at > 100 microgram kg<sup>-1</sup> in the second year in the first cut of alfalfa at one location and ryegrass at both locations. A comparison of selenate-Se (laboratory vs commercial grade) showed that both sources at similar levels of Se fertilization were equally effective in enriching barley grain with Se with no significant differences. Addition of 10 g Se ha<sup>-1</sup> rate was necessary to ensure adequate Se (> 100 microgram kg<sup>-1</sup>) concentration in the ensuing grain. Increasing rates of Se increased the Se levels in grain Selenium concentrations were much higher in the barley boot stage vegetative tissue than in the grain. Results of this study showed that only 5 g Se ha<sup>-1</sup>, as Selcote Ultra, is needed to maintain adequate Se in forages. The laboratory and commercially available selenate-Se sources were equally effective in raising Se in barley.

3959 Horst, W.J.; Abdou, M.; Wiesler, F. (Hannover Univ. (Germany). Inst. fuer Pflanzenernaehrung) (1996) [Differences between wheat cultivars in acquisition and utilization of phosphorus]. Genotypische Unterschiede im Aneignungsvermoegen und der Nutzung von Phosphor bei Weizen. *Zeitschrift fuer Pflanzenernaehrung und Bodenkunde (Germany)* v. 159(2) p. 155-161. 9 ill., 5 tables; 30 ref. English. (AGRIS 97-062242).

3960 Jacob, H.J.; Augustin, J.; Merbach, W.; Toussaint, V. (1995) [(14)C utilization of wheat during ontogenesis]. (14)C-Verwertung von Weizen im Verlauf der Ontogenese. [Carbon and nitrogen turnover in the system plant-soil]. Merbach, W.; Bork, H.-R. (eds.). *Kohlenstoff- und Stickstoffumsatz im System Pflanze-Boden ZALF-Berichte (Germany)*; no. 23. Zentrum fuer Agrarlandschafts- und Landnutzungsforschung, Muencheberg (Germany). Inst. fuer Rhizosphärenforschung und Pflanzenernaehrung p. 53-55. Selbstverlag. German. (AGRIS 97-062241).

3961 Jurkowska, H.; Rogoz, A.; Wojciechowski, T. (University of Agriculture, Krakow (Poland). Dept. of Agricultural Chemistry) (1995) [Effect of sodium on lithium uptake by plants]. Wplyw sodu na pobieranie litu przez rosliny. *Polish Journal of Soil (Poland)* v. 28(2) p. 135-138. 2 tables; 6 ref. English. (AGRIS 97-076419).

The effect of sodium on lithium uptake by plants was investigated in pot experiments. Sodium fertilization increased lithium concentration in all examined parts of beans when the plants grew in soil without the addition of lithium or with a small addition of this element. Sodium caused also an increase in lithium content in tops and roots of barley and mustard.

3962 Keutgen, N.; Roeb, G.W.; Fuehr, F.; Reisener, H.J. (Forschungszentrum Juelich GmbH (Germany). Inst. fuer Radioagronomie) (1995) [Accumulation of assimilates in stem-rust-infected wheat leaves]. Untersuchungen zur Assimilatakkumulation im Weizenblatt nach Schwarzrostinfektion. *Journal of Agronomy and Crop Science (Germany)* v. 175(5) p. 297-305. 7 ill., 1 table; 16 ref. German. (AGRIS 97-062246).

3963 Lazar, D.; Ilik, P. (1997) HIGH-TEMPERATURE INDUCED CHLOROPHYLL FLUORESCENCE CHANGES IN BARLEY LEAVES - COMPARISON OF THE CRITICAL TEMPERATURES DETERMINED FROM FLUORESCENCE INDUCTION AND FROM FLUORESCENCE TEMPERATURE CURVE. *Plant Science*. 124(2):159-164. English. [PALACKY UNIV FAC SCI DEPT EXPT PHYS TR SVOBODY 26 OLOMOUC 77146 CZECH REPUBLIC].

The shape of the chlorophyll fluorescence induction curve (FIC) measured using a plant efficiency analyser (PEA, Hansatech, England) is characterised by several peaks signed from the shortest time as O, J, I and P. High-temperature stressed plants show a change of the shape of FIC and also a new peak K appears between the O and J peaks. Using a well defined linear heating regime applied to barley leaves, we determined the temperature of K peak appearance (T-K) from FIC, as the heat stress parameter. We compared it with the parameter of photosystem II inactivation (T-C) which was determined from high-temperature fluorescence increase in fluorescence temperature curve (FTC). With increasing time of high-temperature incubation the value of T-C rose, which reflects acclimation process, and was accompanied with the rise of T-K parameter. A good correlation between these two parameters upon the progressive high-temperature incubation was found. Further, we compared and discussed the high-temperature induced changes of the F-V/F-P ratio determined from FIC and M1/F(T30) ratio determined from FTC. A good correlation between these parameters was found too. The relationship between the four parameters is an evidence that both FTCs and FICs can be used for evaluation of changes in thylakoid membrane caused by high temperature stress. (C) 1997 Elsevier Science Ireland Ltd. [References: 27].

3964 Lipavska, H. (Landbouwniversiteit Wageningen (Netherlands). Vakgroep Plantenfysiologie); Vreugdenhil, D. (1996) Uptake of mannitol from the media by in vitro grown plants. *Plant Cell, Tissue and Organ Culture (Netherlands)* v. 45(2) p. 103-107. 17 ref. English. (AGRIS 97-076411).

3965 Loth, F. G.; Hoefner, W. (Giessen Univ. (Germany). Inst. fuer Pflanzenernaehrung) (1995) [Influence of sewage sludge treated soils on the infectivity of VA-mycorrhizal fungi isolates in different plants]. Einfluss von klaerschlammbehandelten Boeden auf die Infektiositaet von VA-Mykorrhiza-Pilzisolaten bei verschiedenen Kulturpflanzen. *Agrobiological research (Germany)* v. 48(3-4) p. 269-281. 4 ill., 5 tables; 37 ref. German. (AGRIS 97-062181).

3966 Mamushina, N.S.; Zubkova, E.K.; Voitsekhevskaya, O.V. (1997) INTERACTION OF PHOTOSYNTHESIS AND RESPIRATION IN UNICELLULAR ALGAE AND C-3 HIGHER PLANTS [Review]. *Russian Journal of Plant Physiology*. 44(3):390-400. English. [RUSSIAN ACAD SCI VL KOMAROV BOT INST UL PROF POPOVA 2 ST PETERSBURG 197376 RUSSIA].

This review deals with recent publications discussing the interactions between photosynthesis and respiration in green unicellular algae and C-3 higher plants. The algae clearly manifest the species-specific response of dark respiration to illumination. In some algae, in contrast to mesophyll cells, glycolytic enzymes are located only in chloroplasts. As a result, these two cell types differ in their controls over respiratory pathways under conditions of photosynthesis. The effect of nitrate and ammonium nutrition on light-stimulated respiration and the inhibition of photosynthesis is discussed using *Selenastrum* and *Chlorella* cells as examples. The authors believe that gas exchange studies in the leaves of C-3 plants are not sufficient to estimate the operation of the respiratory pathway in the light, because it is impossible to evaluate reassimilation both on the surface and within mesophyll cells. Other approaches should be employed to look into the separate steps of respiration in the light: by using the labeled respiratory substrates or by studying the kinetic and regulatory properties of key enzymes in cytoplasm and mitochondria. With these methodologies at hand, we find that, while the leaf grows and functions as a sink for assimilates, glycolysis and the oxidative pentose phosphate pathway actively participate in oxidation of the "external" carbohydrates. As soon as leaf growth is over, these respiration pathways are partly suppressed. However, in the ephemeroïd species, during their short period of development at low temperatures, none of the respiratory pathways is restricted. There are two opposite views as to the functioning of the Krebs cycle in the light: (1) the cycle is modified and suppressed; or (2) the cycle exerts its full capacity and, under additional metabolic load,

e.g., when nitrogen is assimilated, is enhanced and serves a singular amphibolic function of supplying carbon substrates for the synthesis of amino acids and other compounds. The experimental evidence for the electron transport chain in mitochondria indicates that this respiratory pathway is not inhibited in the light; on the contrary, the electron transport chain serves as an additional source of ATP for mesophyll cells, which actively synthesize sucrose. The authors conclude that leaf age and plant life strategy must be taken into account in the studies of dark respiration in the light. The concept of competition between photosynthesis and respiration has lately been replaced by the idea of complementary interaction or cooperation of the two functions in green cell metabolism. [References: 95].

3967 Merbach, W.; Knof, G.; Miksch, G. (1995) [Carbon balancing in the system plant - soil]. C-Bilanzierung im System Pflanze - Boden. [Carbon and nitrogen turnover in the system plant - soil]. Merbach, W.; Bork, H.-R. (eds.). Kohlenstoff- und Stickstoffumsatz im System Pflanze - Boden ZALF-Berichte (Germany); no. 23. Zentrum fuer Agrarlandschafts- und Landnutzungsforschung, Muencheberg (Germany). Inst. fuer Rhizosphaerenforschung und Pflanzenernaehrung p. 48-52. Selbstverlag. 1 ill., 4 tables; 7 ref. German. (AGRIS 97-062240).

3968 Miglietta, F. (Institute of Agrometeorology and Environmental Analysis IATA CNR, Florence (Italy)); Giuntoli, A.; Bindi, M. (1996) The effect of free air carbon dioxide enrichment (FACE) and soil nitrogen availability on the photosynthetic capacity of wheat. *Photosynthesis Research* (Netherlands) v. 47(3) p. 281-290. 40 ref. English. (AGRIS 97-076410).

3969 Morcuende, R.; Perez, P.; Martinezcarrasco, R. (1997) SHORT-TERM FEEDBACK INHIBITION OF PHOTOSYNTHESIS IN WHEAT LEAVES SUPPLIED WITH SUCROSE AND GLYCEROL AT TWO TEMPERATURES. *Photosynthetica*. 33(2):179-188. English. [CSIC INST RECURSOS NAT & AGROBIOL SALAMANCA APARTADO 257 E-37071 SALAMANCA SPAIN].

The inhibition of photosynthesis by reduced sink demand or low rates of end product synthesis was investigated by supplying detached wheat (*Triticum aestivum* L. cv. Tauro) leaves with 50 mM sucrose, 50 mM glycerol or water through the transpiration stream for 2 h, either at 23 or 12 degrees C. Lowering the temperature and sucrose and glycerol feeding decreased photosynthetic oxygen evolution at high irradiance and saturating CO<sub>2</sub>. The decrease in temperature reduced the pools of sucrose and starch, and the ratio glucose 6-phosphate (G6P)/fructose 6-phosphate (F6P), while it increased the concentrations of G6P and F6P (hexose phosphates). Sucrose feeding, in contrast to glycerol feeding, increased sucrose, glucose and fructose contents and the G6P/F6P ratio. Sucrose and glycerol incubations at 23 degrees C, as well as decreasing the temperature in leaves incubated in water, increased the concentration of triose-phosphates (glyceraldehyde 3-phosphate and dihydroxyacetone phosphate, TP) and decreased the glycerate 3-phosphate (PGA) content, thus increasing the TP/PGA ratio; they also tended to increase the ribulose 1, 5-bisphosphate (RuBP) content and the RuBP/PGA ratio. Sucrose and glycerol feeding at 12 degrees C and the decrease in temperature of leaves incubated in these solutions decreased TP and RuBP contents and the TP/PGA and RuBP/PGA ratios. The results suggest that the phosphate limitation caused by accumulation of end products, restriction of their synthesis and sequestration of cytosolic phosphate can inhibit photosynthesis through decreased carboxylation of RuBP or, with increased phosphate limitation, through lowered supply of ATP. [References: 37].

3970 Paolacci, AR.; Badiani, M.; Dannibale, A.; Fusari, A.; Matteucci, G. (1997) ANTIOXIDANTS AND PHOTOSYNTHESIS IN THE LEAVES OF TRITICUM DURUM DESF SEEDLINGS ACCLIMATED TO NON-STRESSING HIGH TEMPERATURE. *Journal of Plant Physiology*. 150(4):381-387. English. [UNIV VITERBO DIPARTIMENTO AGROBIOL & AGROCHIM VIA SC DE LELLIS I-01100 VITERBO ITALY].

The foliar antioxidant status and the photosynthetic capacity were compared in the leaves of non-acclimated *Triticum durum* Desf. cv. Duilio seedlings grown at an optimal temperature of 25 +/- 0.4 degrees C or at a supraoptimal temperature of 30 +/- 0.3 degrees C, under moderate light levels and ad libitum available water. The plants grown at 30 +/- 0.3 degrees C did not show the symptoms commonly observed in response to high temperature stress, such as acceleration of development, reduction in

size, loss of photosynthetic pigments and reduction in the photochemical efficiency of PSII. However, mesophyll conductance to CO<sub>2</sub> uptake, net photosynthesis, and photon yield were drastically reduced in leaves grown at 30 +/- 0.3 degrees C. Neither were the extractable capacities of superoxide dismutase, catalase and guaiacol peroxidase increased nor were lipid peroxidation and electrolyte leakage stimulated in leaves grown at 30 +/- 0.3 degrees C. Limited hyperthermia caused 60 - 80% increases in the contents of dehydroascorbic acid and glutathione disulfide, thus lowering significantly the redox ratios of the ascorbic acid and glutathione pools, respectively. The above results indicate that the photosynthetic performance of *T. durum* seedlings can be negatively affected even by moderately elevated, non-injurious temperatures, which could favour the photo-oxidative carbon cycle over the photo-reductive one. This might lead to an overproduction of reactive oxygen species, with the ascorbic acid and glutathione foliar pools acting as a "first line" of antioxidant defense. Analogies were found with previous data concerning the effects of suboptimal, non-chilling growth temperatures on the same plant material. [References: 36].

3971 Reyes Valencia, Graciela; Rios Gomez, Ramiro (1995) [Effect of the salinity of X. *Triticosecale* Wittmack, *Avena sativa* and *Daucus carota*]. Efecto de la salinidad en X. *Triticosecale* Wittmack, *Avena sativa* y *Daucus carota*. 26. Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 57. Sociedad Mexicana de la Ciencia del Suelo. 2 Figs.; 3 ref. Spanish. (AGRIS 97-076311).

3972 Reynolds, TL.; Crawford, RL. (1997) EFFECTS OF LIGHT ON THE ACCUMULATION OF ABSCISIC ACID AND EXPRESSION OF AN EARLY CYSTEINE-LABELED METALLOTHIONEIN GENE IN MICROSPORES OF TRITICUM AESTIVUM DURING INDUCED EMBRYOGENIC DEVELOPMENT. *Plant Cell Reports*. 16(7):458-463. English. [UNIV N CAROLINA DEPT BIOL 9201 UNIV CITY BLVD CHARLOTTE, NC 28223 USA].

A cloned cDNA to the wheat (*Triticum aestivum*) early cysteine-labeled metallothionein has many characteristics of a molecular marker for pollen embryogenesis in this plant. This transcript was not detected in uninucleate microspores at the time of culture or in pollen at any stage during normal ontogeny; its mRNA did begin to increase in embryogenic microspores within 6 h of culture, peaked at around 24 h, declined, then leveled off through the 21-day-old embryoid stage. Additionally, the accumulation of the embryoid-abundant EcMt gene transcript showed a direct and positive correlation with an increase of ABA in embryogenic microspores and developing pollen embryoids. Irradiating cultures with high intensity white light or with far-red, or blue light, suppressed EcMt transcript accumulation and the ability of microspores to form embryoids; however, light did not affect ABA concentrations during the early stages of culture. These results suggest that although a promoter of pollen embryogenesis in bread wheat, ABA alone cannot maintain the sporophytic differentiation of microspores subjected to inhibitory regimes of light in vitro. Whether or not light acts directly or indirectly in suppressing EcMt gene expression and pollen embryogenesis remains unknown. [References: 25].

3973 Rodriguez, D. (Facultad de Agronomia Universidad de Buenos Aires, San Martin, Argentina.); Goudriaan, J. (1995) Effects of phosphorus and drought stresses on dry matter and phosphorus allocation in wheat. *Journal of plant nutrition* (USA) v. 18(11) p. 2501-2517. references. English. (AGRIS 97-062249).

The effect of phosphorus (P) and soil water availability (W) on the growth and development of wheat plants (*Triticum aestivum* L. cv. Minaret) was studied in a pot experiment. Four levels of P supply (0, 15, 30, and 100 micrograms P/g soil) were applied before sowing. Thirty-four days after sowing (DAS), the pots were kept near 100% of field capacity (FC). From 34 DAS until one week before anthesis (67 DAS), half of the pots were maintained between 60-70% FC. Control pots were kept at 85-95% FC by weighing and watering the pots every two to three days. Shoots were harvested four times before anthesis and twice after. At each harvest, dry matter and P accumulation were measured in leaves, stems, and ears. In this study, thermal time until anthesis was inversely related to the level

of P application. Phosphorus addition affected the allocation of biomass and P in aerial plant organs. Plants growing only with soil P showed a delay in the allocation of dry matter and P into leaves and stems with respect to plants fertilized with 100 microgram P/g of soil. In this study, the final composition of the grain depended on re-mobilization from other plant organs. Evidence of independent re-mobilization of carbohydrates and P towards the ear is presented, and the pattern of plant development as well as the relationships between development and dry matter and P allocation are discussed.

3974 Ruiz Torres, N.; Bjorn, Martin (1996) [Carbon isotope discrimination and its relationship with water-use efficiency in wheat]. *Discriminacion del isotopo de carbon y su relacion con uso deficiente del agua en trigo*. 16, Congreso de Fitogenetica. Texcoco, Mex. (Mexico). 6-11 Oct 1996. [16, Plant Breeding Congress, Texcoco, Mexico State. 1996 (Proceedings)]. 16, Congreso de Fitogenetica, Texcoco, Estado de Mexico. 1996 (Memoria). Sahagun Castellanos, Jaime; Ramirez Vallejo, Porfirio; Castillo Gonzalez, Fernando (Comp.) p. 14. Sociedad Mexicana de Fitogenetica, A.C.; Colegio de Postgraduados. 1 Cuadro; 2 ref. Spanish. (AGRIS 97-076304).

The correlation between water use efficiency (WUE) and carbon isotope discrimination ( $\delta$ ) was studied in winter wheat. A weak negative correlation ( $r=0.51$ ,  $P=0.11$ ) was found. Significant canopy effects were observed for ( $\delta$ ). Genotype effects were significant for ( $\delta$ ), WUE, and total biomass. No genotype by environment interaction was detected.

3975 Savitch, L.V.; Gray, G.R.; Huner, N.P.A. (Western Ontario Univ., London (Canada). Dept. of Plant Sciences) (1997) [Feedback-limited photosynthesis and regulation of sucrose-starch accumulation during cold acclimation and low-temperature stress in a spring and winter wheat]. [Feedback-begrenzte Photosynthese und Regulation der Saccharose- und Staerkeanreicherung waehrend der Akklimatisierung und Stress durch niedrige Temperaturen in Sommer- und Winterweizen]. *Planta (Germany)* v. 201(1) p. 18-26. 4 ill., 4 tables; 28 ref. English. (AGRIS 97-076409).

3976 Shalygo, NV.; Voronetskaya, VV.; Averina, NG. (1997) EFFECT OF  $Mn^{2+}$  ON PORPHYRINOGENESIS IN ETIOLATED AND GREENING BARLEY SEEDLINGS. *Russian Journal of Plant Physiology*. 44(3):311-316. English. [BYELARUSSIAN ACAD SCI INST PHOTOBIOLOG UL F SKORINY 27 MINSK 220072 BYELARUS].

Porphyrogenesis was studied in the greening leaves of etiolated barley (*Hordeum vulgare* L.) seedlings incubated in  $Mn^{2+}$  solutions.  $Mn^{2+}$  cations were shown to inhibit chlorophyll biosynthesis and enhance the accumulation of protoporphyrin IX (PP) and Mg-protoporphyrin IX monomethyl ester (Mg-PPE). In darkness,  $Mn^{2+}$  did not induce porphyrogenesis. Maximum amounts of Mg-PPE and PP and the optimum conditions for their accumulation markedly differed. Porphyrogenesis induced by  $Mn^{2+}$  cations was fully reversible by  $Fe^{2+}$  cations. The content of the active Fe in leaf tissues was not changed by the incubation of leaf segments in  $Mn^{2+}$  solutions. It is suggested that, without affecting the total pool of active Fe,  $Mn^{2+}$  cations can bind to endogenous chelators, which transfer  $Fe^{2+}$  to the sites of porphyrin metabolism or selectively replace  $Fe^{2+}$  in the active centers of enzymes involved in tetrapyrrole synthesis, thus causing  $Fe^{2+}$  deficiency in situ. [References: 18].

3977 Sharma, PK.; Shetye, R.; Bhonsle, S. (1997) EFFECT OF SUPPLEMENTARY ULTRAVIOLET-B RADIATION ON YOUNG WHEAT SEEDLINGS. *Current Science*. 72(6):400-405. English. [AFRC INST ARABLE CROPS RES DEPT BIOCHEM & PHYSIOL HARPENDEN AL5 2JQ HERTS ENGLAND].

Effect of supplementary UV-B radiation (1 mW m<sup>-2</sup>) on photosynthesis, flavonoid content and anatomical changes was studied in young wheat leaves. It was observed that supplementary UV-B radiation did not affect PS II activity, assayed as water to phenylenediamine, However, PS I activity, assayed as reduced dichlorophenol indophenol to methyl viologen, showed an increase. UV-B treatment resulted in qualitative and quantitative changes in UV-B absorb; ing phenolic compounds, Flavonol (Kaempferol) and coumarin showed quantitative increase due to supplementary UV-B exposure to the wheat leaves. Synthesis of cinnamic acid was observed only after 4 days of UV-B treatment, UV-B treatment resulted in significant anatomical changes in the leaves. There was a massive increase in the cutin synthesis, Epidermal

cells were. largely destroyed, while hypodermal cells were seen to replace the epidermal cells. [References: 26].

3978 Sharma, S.N. (Indian Agricultural Research Inst., New Delhi (India). Div. of Agronomy); Prasad, R.; Singh, S. (1996) Residual effects of growing mungbean and uridbean on the yield and nitrogen uptake of a succeeding wheat crop. *Fertilizer Research (Netherlands)* v. 44(3) p. 163-168. 15 ref. English. (AGRIS 97-076415).

3979 Slafer, G.A.; Rawson, H.M. (1997) PHYLLCHRON IN WHEAT AS AFFECTED BY PHOTOPERIOD UNDER TWO TEMPERATURE REGIMES. *Australian Journal of Plant Physiology*. 24(2):151-158. English. [UNIV BUENOS AIRES FAC AGRON DEPT PROD VEGETAL AV SAN MARTIN 4453 RA-1417 BUENOS AIRES DF ARGENTINA].

In this paper we describe the effects of photoperiod (9, 12, 15, 17, 19 and 21 h) and temperature (21/17 and 16/12 degrees C) on rate of leaf appearance and phyllochron in two spring wheats, a semi-winter wheat, and a winter wheat. Under long photoperiods only, all leaves on the main culm of a cultivar emerged at a common rate within a temperature regime, so it was acceptable to assign a specific phyllochron to leaves irrespective of their level of insertion. Increased temperature significantly decreased phyllochron, but the degree of this effect differed between cultivars. As photoperiod was shortened below the optimum, phyllochron lengthened marginally and similarly in all varieties (by approximately 0.1 days per hour change in photoperiod). For very short photoperiods this was true only for the first six leaves, whilst for leaves at higher insertions there was a major effect of reducing photoperiod on lengthening phyllochron. The actual daylength required for producing this major effect on phyllochron was cultivar-dependent. These results suggest that, when making predictions of heading date using phyllochron, it may not be acceptable to assume that leaf number and time are always linearly related at shorter photoperiods, particularly when considering leaves at higher insertions. [References: 46].

3980 Stopes, C. (Elm Farm Research Centre, Newbury (United Kingdom)); Millington, S.; Woodward, L. (1996) Dry matter and nitrogen accumulation by three leguminous green manure species and the yield of a following wheat crop in an organic production system. *Agriculture, Ecosystems and Environment (Netherlands)* v. 57(2-3) p. 189-196. 17 ref. English. (AGRIS 97-076414).

3981 Tveitnes, S. (Agricultural Univ. of Norway, Aas (Norway). Dept. of Soil and Water Sciences); Singh, B.R.; Ruud, L. (1996) Selenium concentration in spring wheat as influenced by basal application and top dressing of selenium-enriched fertilizers. *Fertilizer Research (Netherlands)* v. 45(2) p. 163-167. 19 ref. English. (AGRIS 97-076416).

3982 Tyerman, S.D.; Skerrett, M.; Garrill, A.; Findlay, G.P.; Leigh, R.A. (1997) PATHWAYS FOR THE PERMEATION OF  $Na^{+}$  AND  $Cl^{-}$  INTO PROTOPLASTS DERIVED FROM THE CORTEX OF WHEAT ROOTS. *Journal of Experimental Botany*. 48(Special Issue S1):459-480. English. [FLINDERS UNIV S AUSTRALIA SCH BIOL SCI ADELAIDE CTR PLANT MEMBRANE BIOL GPO BOX 2100 ADELAIDE SA 5001 AUSTRALIA].

Sodium permeation into cortex cells of wheat roots was examined under conditions of high external  $NaCl$  and low  $Ca^{2+}$ . Two types of  $K^{+}$  inward rectifier were observed in some cells. The time-dependent  $K^{+}$  inward rectifier was  $Ca^{2+}$ -sensitive, increasing in magnitude as external  $Ca^{2+}$  was decreased from 10 mM to 0.1 mM, but did not show significant permeability to  $Na^{+}$ . However, the spiky inward rectifier showed significant  $Na^{+}$  permeation at  $Ca^{2+}$  concentrations of 1 and 10 mM. In cells that initially did not show  $K^{+}$  inward rectifier channels, fast and sometimes slowly activating whole-cell inward currents were induced at membrane potentials negative of zero with high external  $Na^{+}$  and low  $Ca^{2+}$  concentrations. With 1 mM  $Ca^{2+}$  in the external solution, large inward currents were carried by  $Rb^{+}$ ,  $Cs^{+}$ ,  $K^{+}$ ,  $Li^{+}$ , and  $Na^{+}$ . The permeability sequence shows that  $K^{+}$ ,  $Rb^{+}$  and  $Cs^{+}$  are all more permeant than  $Na^{+}$ , which is about equally as permeant as  $Li^{+}$ . When some  $K^{+}$  was present with high concentrations of  $Na^{+}$  the inward currents were larger than with  $K^{+}$  or  $Na^{+}$  alone. About 60% of the inward current was reversibly blocked when the external  $Ca^{2+}$  activity was increased from 0.03 mM to 2.7 mM (half inhibition at 0.31 mM  $Ca^{2+}$  activity). Changes in the characteristics of the current noise indicated that increased  $Ca^{2+}$  reduced the apparent single channel amplitude. In outside-out patches

inward currents were observed at membrane potentials more positive than the equilibrium potentials for K<sup>+</sup> and Cl<sup>-</sup> when the external Na<sup>+</sup> concentration was high. These channels were difficult to analyse but three analysis methods yielded similar conductances of about 30 pS. [References: 92].

3983 Vardaka, E.; Cook, C.M.; Lanaras, T. (1997) INTERELEMENTAL RELATIONSHIPS IN THE SOIL AND PLANT TISSUE AND PHOTOSYNTHESIS OF FIELD-CULTIVATED WHEAT GROWING IN NATURALLY ENRICHED COPPER SOILS. *Journal of Plant Nutrition*. 20(4-5):441-453. English. [UNIV THESSALONIKI DEPT BOT POB 109 GR-54006 THESSALONIKI GREECE].

Several interelemental relationships have been examined in field-cultivated wheat (*Triticum aestivum* L. cv Vergina) growing on naturally enriched copper (Cu) soils. Mean soil Cu concentration per site ranged from 103-394 µg g<sup>-1</sup> dry weight (DW). Interrelationships between Cu, iron (Fe), calcium (Ca), potassium (K), zinc (Zn), lead (Pb), and magnesium (Mg) concentrations in the soil and plant tissue (roots, stems, and leaves) were examined using Principle Components Analysis. Soil samples were clustered according to collection site and were primarily differentiated according to their Cu concentrations. Soil Cu concentrations were positively correlated with Zn, Ca, Fe, and K in the soil, with Cu, K, and Ca in the roots, and Cu and Fe in the leaves and negatively correlated with Fe in the roots. The increase in Cu in the roots and leaves was positively correlated with increases in K and Ca in the roots and Fe and Ca in the leaves, but negatively with Fe in the roots. Increases in leaf Ca concentrations were correlated with increases in Mg and decreases in Zn concentrations in the leaf. Plants growing in soil with high Cu concentration exhibited toxicity symptoms with reduced height, decreased total leaf area and lower chlorophyll concentrations. Photosynthesis expressed per unit leaf area was not affected by increasing Cu concentrations in the soil or plant tissue. [References: 22].

3984 Walter, A. (Universität Hohenheim, Stuttgart, Germany.); Pich, A.; Scholz, G.; Marschner, H.; Romheld, V. (1995) Effects of iron nutritional status and time of day on concentrations of phytosiderophores and nicotianamine in different root and shoot zones of barley. *Journal of plant nutrition (USA)* v. 18(8) p. 1577-1593. references. English. (AGRIS 97-062184).

The diurnal pattern in concentrations of phytosiderophores (PS) and its precursor nicotianamine (NA) was studied in different root and shoot zones of iron (Fe)-sufficient and Fe-deficient barley (*Hordeum vulgare* L. cv. Europa) grown in nutrient solution. Roots were separated into apical (0-3 cm) and basal zones (> 3 cm) and shoots into young (3 cm basal zones of youngest two leaves) and old (remaining zones of youngest two leaves and oldest leaf) parts. The main PS in barley was identified as epi-hydroxymugineic acid (epi-HMA). Regardless of the sampling zone and time of day, epi-HMA concentrations were several times higher in Fe-deficient than in Fe-sufficient plants and several times higher in the roots than in the shoots. In roots and shoots, epi-HMA concentrations were always higher in the younger compared with the older zones. In both root zones of Fe-deficient plants, an inverse diurnal rhythm occurred in epi-HMA concentrations and in its release by the roots. In contrast, such a rhythm was absent in roots of Fe-sufficient plants and in the shoots regardless of the Fe nutritional status. Nicotianamine concentrations in roots were not affected by the Fe nutritional status in apical zones but slightly enhanced under Fe deficiency in basal zones. In contrast to roots, NA concentrations in both shoot parts were lower in Fe-deficient than in Fe-sufficient plants. Regardless of the Fe nutritional status in roots and shoots, NA concentrations were higher in young than in old parts and no consistent diurnal variations were observed. The results suggest that PS are also synthesized in the shoot, although at much lower rates than in roots. As with roots, PS synthesis in the shoot is enhanced under Fe deficiency and is mainly localized in young growing tissue. The distinct diurnal rhythm in PS release in roots is apparently not regulated by variation in the rate of PS synthesis during the day.

3985 Wenzel, W.W.; Blum, W.E.H.; Brandstetter, A.; Jockwer, F.; Koechl, A.; Oberforster, M.; Oberlaender, H.E.; Riedler, C.; Roth, K.; Vlodeva, I. (Universität fuer Bodenkultur, Wien (Austria). Inst. fuer Bodenforschung) (1996) [Effects of soil properties and cultivar on cadmium accumulation in wheat grain]. Einfluss von Bodeneigenschaften und Sorte auf die Cadmiumaufnahme in Weizenkorn. *Zeitschrift fuer Pflanzenernaehrung und*

*Bodenkunde (Germany)* v. 159(6) p. 609-614. 1 ill., 8 tables; 16 ref. English. (AGRIS 97-076422).

3986 Wieneke, J. (Institute of Radioagronomy, Jülich, Germany.) (1995) Altered influx-efflux relations of nitrate in roots due to nutrient stress. I. Effect of phosphorus and zinc deprivation. *Journal of plant nutrition (USA)* v. 18(8) p. 1547-1561. references. English. (AGRIS 97-062182).

Short-term experiments were carried out with squash and barley seedlings to analyse the nitrate (NO<sub>3</sub><sup>-</sup>) influx/efflux relations as a response by the carrier-mediated transport to phosphorus (P) and zinc (Zn) stress in the nutrient solution by using <sup>13</sup>N-labelling and continuous monitoring. Nitrate influx was markedly decreased after transient P deficiency followed by a 2 h P restoration but also when P deficiency was maintained. Similarly, Zn stress induced a strong reduction of the NO<sub>3</sub><sup>-</sup> influx. In both P- and Zn-stressed plants NO<sub>3</sub><sup>-</sup> efflux was only modestly affected at the level of the high affinity uptake but contributed to a certain degree to the depression of the NO<sub>3</sub><sup>-</sup> net uptake. The NO<sub>3</sub><sup>-</sup> influx recovered soon after the short-term stress was relieved. The results are discussed in the light of NO<sub>3</sub><sup>-</sup> uptake and its relation to membrane integrity.

3987 Wieneke, J. (Institute of Radioagronomy, Jülich, Germany.) (1995) Altered influx/efflux relations of nitrate in roots due to nutrient stress. II. Effect of calcium limitations. *Journal of plant nutrition (USA)* v. 18(8) p. 1563-1576. references. English. (AGRIS 97-062183).

The effect of calcium (Ca<sup>2+</sup>), aluminum (Al<sup>3+</sup>), and high salinity stress on the influx-efflux relations of nitrate (NO<sub>3</sub><sup>-</sup>) was investigated in barley and squash seedlings using continuous monitoring techniques and <sup>13</sup>N labelling. After 24 h of Ca<sup>2+</sup> deficiency NO<sub>3</sub><sup>-</sup> influx was substantially reduced at the level of unsaturated NO<sub>3</sub><sup>-</sup> uptake. With prolonged Ca<sup>2+</sup> deficiency the repression of NO<sub>3</sub><sup>-</sup> influx drastically increased in squash involving irreversible impairment of the whole root function whereas the impairment only progressed more moderately in barley. Treatment with 160 micromolar Al<sup>3+</sup> for 24 h also induced a repression of NO<sub>3</sub><sup>-</sup> influx probably due to an interaction between Al<sup>3+</sup> and Ca<sup>2+</sup> ions. In both Ca<sup>2+</sup> deficiency and Al<sup>3+</sup> toxicity experiments, the NO<sub>3</sub><sup>-</sup> efflux was only slightly affected. Suddenly imposed high salinity at a species-specific level resulted in an instantaneous repression of NO<sub>3</sub><sup>-</sup> influx accompanied by a heavy release of NO<sub>3</sub><sup>-</sup> to the ambient nutrient solution. The results are discussed in the light of the key role which Ca<sup>2+</sup> is suggested to play in membrane integrity and at the level of intracellular processes and in view of the relations to carrier-mediated NO<sub>3</sub><sup>-</sup> influx.

3988 Zsoldos, F.; Vashegyi, A.; Pecsvári, A.; Haunold, E.; Herger, P. (1997) INHIBITION OF ION UPTAKE AND GROWTH OF WHEAT AND RICE EXPOSED TO NITRITE AT LOW PH. *Cereal Research Communications*. 25(1):35-42. English. [ATTILA JOZSEF UNIV DEPT PLANT PHYSIOL POB 654 H-6701 SZEGED HUNGARY].

The effects of NO<sub>2</sub><sup>-</sup> on the ion uptake and growth of wheat (*Triticum aestivum* L. cv. GK Othello) and rice (*Oryza sativa* L. cv. Oryzella) seedlings were studied in hydroponic cultures at different pH values. Increasing concentrations of NaNO<sub>2</sub> decreased the K<sup>+</sup>, H<sub>2</sub>PO<sub>4</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup> and NO<sub>3</sub><sup>-</sup> uptake of the roots. The inhibitory effect of 1 mM NO<sub>2</sub><sup>-</sup> on ion uptake and growth was small or negligible between pH 6-7, but increasingly severe at lower pH. The inhibitory effect of NO<sub>2</sub><sup>-</sup> differed considerably for nutrients and was also different for species. Rice seedlings were more sensitive than wheat seedlings to NO<sub>2</sub><sup>-</sup> treatment. The parallel efflux studies revealed no significant effect of even high concentration of NaNO<sub>2</sub> (10 mM) on the K<sup>+</sup> efflux of the roots at pH 6.5, but strongly enhanced the K<sup>+</sup> efflux of the roots at pH 4 already at 1 mM NaNO<sub>2</sub>. The results indicate that NO<sub>2</sub><sup>-</sup> may initiate membrane damage at low pH. The presence of NO<sub>3</sub><sup>-</sup> in the uptake and/or growth solution decreased the inhibitory effect of NO<sub>2</sub><sup>-</sup>. [References: 21].

## F62 PLANT PHYSIOLOGY-GROWTH AND DEVELOPMENT

3989 Abrams, S.R.; Rose, P.A.; Cutler, A.J.; Balsevich, J.J.; Lei, B.; Walkersimmons, M.K. (1997) 8'-METHYLENE ABSCISIC ACID - AN EFFECTIVE AND PERSISTENT ANALOG OF ABSCISIC ACID. *Plant Physiology*. 114(1):89-97. English. [NATL RES COUNCIL CANADA INST PLANT BIOTECHNOL 110 GYMNASIUM PL SASKATOON SK S7N 0W9 CANADA].



We report here the synthesis and biological activity of a new persistent abscisic acid (ABA) analog, 8'-methylene ABA. This ABA analog has one additional carbon atom attached through a double bond to the 8'-carbon of the ABA molecule. (+)-8'-Methylene ABA is more active than the natural hormone (+)-ABA in inhibiting germination of cress seed and excised wheat embryos, in reducing growth of suspension-cultured corn cells, and in reducing transpiration in wheat seedlings. The (+)-8'-methylene analog is slightly weaker than (+)-ABA in increasing expression of ABA-inducible genes in transgenic tobacco, but is equally active in stimulating a transient elevation of the pH of the medium of corn cell cultures. In corn cells, both (C)-ABA and (+)-8'-methylene ABA are oxidized at the 8' position. ABA is oxidized to phaseic acid and (+)-8'-methylene ABA is converted more slowly to two isomeric epoxides; The alteration in the ABA structure causes the analog to be metabolized more slowly than ABA, resulting in longer-lasting and more effective biological activity relative to ABA. [References: 34].

3990 Barnard, A.; Purchase, J.L. (Agricultural Research Council, Bethlehem (South Africa). Small Grain Inst.); Smith, M.F.; Van Lill, D. (1997) Determination of the preharvest sprouting resistance of South African winter wheat (*Triticum aestivum* L.) cultivars. *South African Journal of Plant and Soil (South Africa)* v. 14(1) p. 4-8. 5 tables; 2 fig., 20 ref. English. (AGRIS 97-076580).

3991 Belcheva, L. (Institut po Z'meni khрани i Furazhna Promishlenost, Kostinbrod (Bulgaria)); Tseneva, E.; Cheleev, D. (1996) [State of the flour carbohydrate- amylase complex related to the endosperm hardness of the Bulgarian common winter red wheat varieties]. S'toyanie na v'glekhidratno-amilazniya kompleks na brashnata v'v vrzka s tv'rdozta na endosperma na b'lgarskite sortove obiknovena zimna chervena pshenitsa. Selskostopanska Akademiya, Sofia (Bulgaria). *Rasteniev'dni Nauki (Bulgaria). Plant Science* v. 33(1) p. 12-17. 4 tables; 26 ref. Bulgarian. (AGRIS 97-062369).

3992 Blaha, L.; Janacek, J. (1997) EVALUATION OF WHEAT CULTIVARS ROOT TRAITS AT STANDARD AND LOW PH ENVIRONMENT CONDITIONS WITH HIGHER CONCENTRATION OF ALUMINUM IONS. *Biologia*. 52(1):95-98. English. [RES INST CROP PROD DRNOVSKA 507 CZ-16106 PRAGUE CZECH REPUBLIC].

Winter wheat cultivars Atlas 66 and Zdar were cultivated in sand and water culture with two types of nutrient solution-pH 6.5 and pH 4.5 with 2 mmol.L<sup>-1</sup> of aluminium ions. After one week of cultivation the root system was sampled. The morphology was analysed by the image analyser LUCIA-D and total length, surface area and number of root tips were determined. The largest differences of measured root traits were at water culture. Cultivar Zdar has the higher number of lateral root tips, root surface and total length of root in comparison with Atlas. While primordia of lateral roots of more tolerant cv. Atlas 66 continue in their growth, in case of cv. Zdar primordia stopped their growth very early, which resulted in inhibition of total root length. The image analysis provides easy way to estimate morphological traits of roots in different types of environment which are very useful for physiological interpretation and for utilisation in plant breeding. [References: 15].

3993 Chang, SC.; Gallie, DR. (1997) RNASE ACTIVITY DECREASES FOLLOWING A HEAT SHOCK IN WHEAT LEAVES AND CORRELATES WITH ITS POSTTRANSLATIONAL MODIFICATION. *Plant Physiology*. 113(4):1253-1263. English. [UNIV CALIF RIVERSIDE DEPT BIOCHEM RIVERSIDE, CA 92521 USA].

Heat shock results in a coordinate loss of translational efficiency and an increase in mRNA stability in plants. The thermally mediated increase in mRNA half-life could be a result of decreased expression and/or regulation of intracellular RNase enzyme activity. We have examined the fate of both acidic and neutral RNases in wheat seedlings that were subjected to a thermal stress. We observed that the activity of all detectable RNases decreased following a heat shock, which was a function of both the temperature and length of the heat shock. In contrast, no reduction in nuclease activity was observed following any heat-shock treatment. Antibodies raised against one of the major RNases was used in western analysis to demonstrate that the RNase protein level did not decrease following a heat shock, and the data suggest that the observed decrease in RNase activity in heat-shocked leaves may be due to modification of the protein. Two-dimensional gel/western analysis of this RNase revealed three isoforms. The most acidic isoform predominated in control leaves,

whereas the most basic isoform predominated in leaves following a heat shock and correlated with the heat-shock-induced reduction in RNase activity and increase in mRNA half-life. These data suggest that RNase activity may be regulated posttranslationally following heat shock as a means to reduce RNA turnover until recovery ensues. [References: 44].

3994 Corbellini, M.; Canevar, MG.; Mazza, L.; Ciaffi, M.; Lafiandra, D.; Borghi, B. (1997) EFFECT OF THE DURATION AND INTENSITY OF HEAT SHOCK DURING GRAIN FILLING ON DRY MATTER AND PROTEIN ACCUMULATION, TECHNOLOGICAL QUALITY AND PROTEIN COMPOSITION IN BREAD AND DURUM WHEAT. *Australian Journal of Plant Physiology*. 24(2):245-260. English. [IST SPERIMENTALE CEREALICOLTURA VIA MULINO 3 I-20079 SAN ANGELO LODIGIANO ITALY].

High temperatures occurring during grain filling are known to affect wheat grain yield and quality considerably. In this paper we report the results of experiments carried out with two cultivars of bread wheat (*Triticum aestivum* L.) and two cultivars of durum wheat (*Triticum durum* Desf.). The plants, cultivated in pots, were subjected to 13 heat treatments (temperature up to 40 degrees C) differing in duration and timing and starting 7 days after anthesis. Heat treatments were applied by temporary transfer of the pots to a glasshouse where the temperature rose to 40 degrees C as a consequence of solar radiation for periods ranging from 5 to 30 days. The applied heat shocks substantially affected dry matter and protein accumulation in the different parts of the plant. Early heat shock (5 days with a total of 18 h of temperature in the range 35-40 degrees C) caused a small reduction of kernel mass and no effect on protein per kernel; the damage was greater in the central and in the final stage of grain filling. Plants subjected to a progressive increase of temperature, or to an early heat shock, acquired thermotolerance to further heat shocks. Continuous exposure to very high temperatures from 27 days after pollination to maturity did not negatively affect grain yield and it facilitated the remobilisation of nitrogen from vegetative to reproductive organs. Rheological properties were severely affected by heat shocks at all stages of grain filling: 5 days of heat shock were sufficient to reduce mixing tolerance by 40-60%. These variations in rheological properties were accompanied by modification of the level of protein aggregation: soluble polymeric proteins and low molecular weight gliadins progressively increased according to the intensity of the stress, while insoluble polymeric proteins decreased. Our experiments, carried out in conditions close to the Mediterranean climate, indicate that the occurrence of very high temperature in the range 35-40 degrees C during grain filling substantially affects dry matter and protein accumulation in the different parts of the plant. The formation of the complex protein aggregates responsible for positive dough mixing properties is significantly reduced by very high temperature. When heat shock came late in grain filling, grain yield and protein concentration were not negatively affected but a 'dough weakening' effect, which may reduce the commercial value of the production, is to be expected. [References: 39].

3995 Dreccer, MF.; Grashoff, C.; Rabbinge, R. (1997) SOURCE-SINK RATIO IN BARLEY (*HORDEUM VULGARE* L.) DURING GRAIN FILLING - EFFECTS ON SENESCENCE AND GRAIN PROTEIN CONCENTRATION. *Field Crops Research*. 49(2-3):269-277. English. [UNIV BUENOS AIRES FAC AGRON DEPT PROD VEGETAL CATEDRA CEREALICULTURA SAN MARTIN 4453 RA-1417 BUENOS AIRES DF ARGENTINA].

The impact of source-sink manipulations on plant senescence and grain nitrogen (N) concentration was studied in barley plants (*Hordeum vulgare* L.) by ear halving or partial defoliation after anthesis. Plants were sown in pots at two different dates (Experiment 1 and Experiment 2) under ample N supply and were periodically detilled. In Experiment 1, plants were grown at similar temperature regime (15/9 degrees C) until 5 days after flowering, and then were subjected to either 15/9 degrees C or 22/16 degrees C during grain filling. The temperature treatments were imposed to test if the effects of source-sink ratio on the characteristics under study were independent of temperature during grain filling. The decrease in green leaf area and N concentration in stem and leaves after flowering were insensitive to alterations in source-sink ratio and similarly accelerated by temperature rise. The final weight of individual grains decreased only moderately with temperature rise and was not responsive to variation in the supply of assimilates. Instead, reduction in ear size increased grain N concentration under all environmental conditions, indicating that N accumulation in the grain was source-limited in control

plants. It appeared that the grain N concentration necessary to achieve maximum grain weight was below that which maximizes grain N accumulation. Grain N limitation by the source appeared after the initial phase of grain growth but was not evident at other times during grain filling. The temporal changes in grain N concentration in response to source-sink ratio during grain fill and the potential significance of the results for modelling of grain N concentration are discussed. [References: 37].

3996 Egli, DB.; Tekrony, DM. (1997) SPECIES DIFFERENCES IN SEED WATER STATUS DURING SEED MATURATION AND GERMINATION. *Seed Science Research*. 7(1):3-11. English. [UNIV KENTUCKY DEPT AGRON LEXINGTON, KY 40546 USA].

Maize (*Zea mays* L., cv. B73 x Mo17), wheat (*Triticum aestivum* L., cv. Clark), and soybean (*Glycine max* L. Merrill, cv. Elgin 87) were grown in the field and seed samples were collected at frequent intervals for the determination of seed fresh and dry weight and water potential of excised embryos (maize and wheat) and axes (soybean). Seed water concentration declined during seed development and the concentration at physiological maturity (PM, maximum seed dry weight) was highest in soybean (550-590 g kg<sup>-1</sup> FW), lowest in maize (326-377 g kg<sup>-1</sup>) and intermediate in wheat (437 g kg<sup>-1</sup>). The embryo/axis water potential was relatively constant during much of seed filling before decreasing rapidly as the seeds approached PM and there was little variation among species (soybean -1.52 to -1.63 MPa, maize -1.61 to -1.99 MPa and wheat -1.66 MPa). Seed water concentration when 10% of the seeds germinated (radicle greater than or equal to 3 mm) was highest in soybean (514 g kg<sup>-1</sup>), lowest in maize (332 g kg<sup>-1</sup>) and intermediate in wheat (345 g kg<sup>-1</sup>) while the water potential of the embryo/axis varied from -2.07 to -2.20 MPa across the three species. There was little variation in the water potential of the embryo/axis among species at the end of seed growth (PM) or at the beginning of germination. This similarity is consistent with the suggestion that the water status of critical seed structures may play a regulatory role in seed growth and germination. [References: 42].

3997 Green, LS.; Faergestad, EM.; Poole, A.; Chandler, PM. (1997) GRAIN DEVELOPMENT MUTANTS OF BARLEY - ALPHA-AMYLASE PRODUCTION DURING GRAIN MATURATION AND ITS RELATION TO ENDOGENOUS GIBBERELLIC ACID CONTENT. *Plant Physiology*. 114(1):203-212. English. [CSIRO DIV PLANT IND GPO BOX 1600 CANBERRA ACT 2601 AUSTRALIA].

Barley (*Hordeum vulgare* L. Himalaya) mutants with altered grain morphology were isolated to investigate whether defects in grain development, possibly involving gibberellins (GAs) and abscisic acid, would lead to altered patterns of alpha-amylase gene expression. Following treatment with sodium azide, 75 mutants, typically showing grain shriveling, were identified. At grain maturity 15 of the 75 mutants had higher alpha-amylase activities in shriveled grains compared with either phenotypically normal grains that developed on the same heterozygous plant or with grains of cv Himalaya. Studies of four of these mutants demonstrated increased levels of both high- and low-isoelectric point alpha-amylase isozymes midway through grain development. This category of mutant has been designated pga, for premature grain alpha-amylase. One such mutant (M326) showed an endosperm-determined inheritance pattern. When crossed into a (GA-deficient) dwarfing background there was a 10- to 20-fold reduction in alpha-amylase activity, suggesting a requirement for GA biosynthesis. Endogenous GAs and abscisic acid were quantified by combined gas chromatography-specific ion monitoring in normal and mutant grains of heterozygous M326 plants during the period of alpha-amylase accumulation. Mutant grains had significantly higher (5.8-fold) levels of the bioactive GA(1) compared with normal grains but much lower (approximately 10-fold) levels of the 2 beta-hydroxylated ("inactive") GAs, typical of developing barley grains (e.g. GA(8), GA(34), GA(48)). We propose that a reduced extent of Pp-hydroxylation in the mutant grains results in an increased level of GA(1), which is responsible for premature alpha-amylase gene expression. [References: 25].

3998 Haro, ES.; Allan, RE. (1997) EFFECTS OF HEADING DATE ON AGRONOMIC PERFORMANCE OF WINTER WHEAT ISOLINES. *Crop Science*. 37(2):346-351. English. [WASHINGTON STATE UNIV USDA ARS WHEAT GENET QUAL PHYSIOL & DIS RES UNIT 209 JOHNSON HALL PULLMAN, WA 99164 USA].

Heading and photoperiod response are key processes affecting adaptiveness of wheat (*Triticum aestivum* L.). Few soft white winter (SWW) wheat cultivars of the U.S. Pacific Northwest (PNW) express early heading. Earliness offers several advantages including early harvest, reduced pre-harvest sprouting loss, and increased operational efficiency. The objective of this study was to determine if early heading genotypes warrant greater breeding emphasis. Near-isogenic lines (NILs) were developed by transferring early heading character from Early Blackhull and an Early Blackhull derivative to 'Nugaines' (NGN), an adapted PNW SWW cultivar. The NILs comprise a near-continuous range of phenotypes that head 0 to 10 d earlier than NGN. The parents and NILs were tested during two to four yr in three diverse field environments. Results showed that genotypes 3 to 7 d earlier than NGN warrant increased breeding emphasis because they had high yield potential across all environments and often had enhanced test weight, kernel weight and harvest index. The earliest NILs had limited yield potential in the cool-moist medium growing season environment, but they had high yield potential in the temperate long-growing season environment. Grain-fill duration of NILs was strongly influenced by environment and only partially associated with heading date. Two early-heading NILs were less sensitive to photoperiod than NGN, but less sensitivity was not a requirement for early heading. Rate of apical meristem development was partially associated with early heading date at the distinct blister-like spikelet stage. Breeding programs centered in cool-moist environments of the PNW should consider increasing emphasis on early heading SWW germplasm. [References: 20].

3999 Horne, J.E. (The Kerr Center for Sustainable Agriculture, Inc., Poteau, OK.); Kalevitch, A.E.; Filimonova, M.V. (1995) Soil acidity effect on initial wheat growth and development. *Journal of sustainable agriculture (USA)* v. 7(2/3) p. 5-13. references. English. (AGRIS 97-062339).

4000 Hudeova, M.; Psota, V.; Vitkova, H. (1997) ACTIVITY OF GIBBERELLINS IN CARYOPSES OF SPRING BARLEY (*HORDEUM VULGARE* L.) DURING POST-HARVEST MATURATION. *Rostlinna Vyroba*. 43(5):237-241. Czech. [MENDEL UNIV AGR & FORESTRY ZEMEDELSKA 1 BRNO 61300 CZECH REPUBLIC].

The activity of endogenous gibberellins was studied in the stage of milk ripeness (10 July), full ripeness (24 July) and during post-harvest maturation (1, 7, 14 and 28 August) in caryopses of three varieties of spring barley (Alexis, Akcent and Rubin). The activity of gibberellins in the course of post-harvest maturation was studied in caryopses germinated after 24 and 48 hours together with caryopses which had only swollen after 24 and 48 hours but not germinated. At the same time, the values of energy and index of germination were investigated. Gibberellin activity in dry caryopses was the highest in the Akcent variety, with an increasing tendency in all three varieties for the studied period. Gibberellin activity was found to correspond with the values of energy of germination and index of germination. The quickest to germinate were caryopses of the Alexis and Akcent varieties. Gibberellin activity in caryopses which germinated after 24 hours was somewhat higher than those that germinated after 48 hours. During post-harvest maturation, gibberellin activity declined in the germinated caryopses. Gibberellin activity in caryopses which did not germinate after 24 and 48 hours, was approximately the same as in the germinated caryopses. In these caryopses, the activity of gibberellin also decreased during post-harvest maturation. Based on the above results it can be said that post-harvest maturation of caryopses of spring barley is significantly influenced by the activity of endogenous gibberellins. However, the resulting values of the energy and index of germination are also affected by many other factors. The interaction of phytohormones is indisputable and also the ability of cells and tissues to respond to the effect of the phytohormones. [References: 13].

4001 Ishag, H.M. (Agricultural Research Corp., Wad Medani (Sudan)); Mohamed, B.A. (1996) Phasic development of spring wheat and stability of yield and its components in hot environments. *Field Crops Research (Netherlands)* v. 46(1-3) p. 169-176. 20 ref. English. (AGRIS 97-076575).

4002 Kernich, G.C.; Halloran, G.M. (University of Melbourne (Australia). School of Agriculture and Forestry. Dept. of Agriculture. Joint Centre for Crop Improvement) (1996) [Temperature effects on the duration of the spikelet growth phase and spikelet abortion in barley]. *Temperaturwirkungen auf die Dauer der Aehrchenwachstumsphase und die Aehrchenabortion bei Gerste. Journal of Agronomy and Crop*

4003 Kruk, B.C.; Calderini, D.F.; Slafer, G.A. (1997) GRAIN WEIGHT IN WHEAT CULTIVARS RELEASED FROM 1920 TO 1990 AS AFFECTED BY POST-ANTHESIS DEFOLIATION. *Journal of Agricultural Science*. [Part 3]:273-281. English. [UNIV BUENOS AIRES FAC AGRON DEPT ROD VEGETAL CATEDRA CEREALICULTURA AV SAN MARTIN 1433 RA-1417 BUENOS AIRES DF ARGENTINA].

Although it has been generally recognized that the difference in yield potential amongst wheat cultivars released in different eras is related to differences in their reproductive sink strength, there have been few investigations about changes in source-sink ratios as a consequence of wheat breeding. In the present study, two field experiments, in which plots were fertilized and irrigated and lodging and diseases were prevented, were carried out with seven cultivars (including a commercial hybrid) representing different periods of plant breeding in Argentina from 1920 to 1990. The cultivars were defoliated during post-anthesis to analyse the response of grain weight at particular positions within the spike (which have intrinsic differences in potential size). Individual grain weight was virtually unaffected by defoliation in the old cultivars, but modern cultivars exhibited a significant reduction in individual grain weight for several positions within the spike, although this reduction was small (c. 15%) and many grains were unaffected. In addition, no relationship was found between individual grain weight in the controls and its reduction due to defoliation. We concluded that if the source-sink ratio is further reduced, the grain yield of modern wheats will be simultaneously limited by the source and the sink. Future breeding should therefore attempt to improve simultaneously both sink and source strengths. [References: 29].

4004 McMaster, G.S. (USDA, ARS, Fort Collins, CO.) (1997) Phenology, development, and growth of the wheat (*Triticum aestivum* L.) shoot apex: a review. *Advances in agronomy (USA)* v. 59 p. 63-118. references. English. (AGRI 97-076579).

4005 Mlady, M.; Jurekova, Z. (1997) BALANCE OF ENDOGENOUS PLANT HORMONES IN WINTER WHEAT EAR AFTER INDUCTION OF ETHYLENE PRODUCTION INCREASE. *Biologia*. 52(1):111-114. English. [UNIV AGR NITRA DEPT PLANT PHYSIOL TR A HLINKU 2 SK-94976 NITRA SLOVAKIA].

The content of free beta-indolylacetic acid (IAA), zeatin (Z), zeatin riboside (ZR), isopentenyl adenosine (iP), isopentenyl adenine (iPA), and endogenous ethylene production in winter wheat ear in milk development phase was investigated. The plants used for measurement were sprayed with water solutions of IAA, silver thiosulphate (STS), and the combination of them. All that treatments resulted in the increasing of ethylene release from ears. According to data about the balance of plant hormones in ear, we suppose that influence of treatments to ethylene release could also be mediated by free IAA level changes. One of the other ways could be direct influence cytokinins to ethylene synthesis or their common effect with auxins. [References: 16].

4006 Moot, D.J. (Lincoln Univ., Canterbury (New Zealand). Dept. of Plant Science); Henderson, A.L.; Porter, J.R.; Semenov, M.A. (1996) Temperature, CO<sub>2</sub> and the growth and development of wheat: changes in the mean and variability of growing conditions. *Climatic Change (Netherlands)* v. 33(3) p. 351-368. 46 ref. English. (AGRI 97-076576).

4007 Oh, S.K. (Rural Development Administration, Milyang (Korea Republic). National Yeongnam Agricultural Experiment Station); Kamanai, M. (Tokyo University of Agriculture, Tokyo (Japan)) (1997) Cytological behavior and transmission rate of extra chromosome in durum wheat trisomics. *Korean Journal of Breeding (Korea Republic)* v. 29(1) p. 34-40. 2 illus.; 5 tables; 15 ref. Korean. (AGRI 97-076581).

4008 Rasmussen, R.D.; Hole, D.; Hess, J.R.; Carman, J.G. (1997) WHEAT KERNEL DORMANCY AND PLUS ABSCISIC ACID LEVEL FOLLOWING EXPOSURE TO FLURIDONE. *Journal of Plant Physiology*. 150(4):440-445. English. [UNIV MINNESOTA DEPT AGRON & PLANT GENET ST PAUL, MN 55108 USA].

Detached spikes from soft white winter wheat (*Triticum aestivum* L.) cultivars that produce caryopses with high dormancy levels (Brevor) or low dormancy levels (Greer) were cultured from anthesis in basal media and media amended with fluridone or fluridone plus ABA. Effects of

fluridone and exogenous ABA on kernel development and dormancy acquisition and maintenance were assessed by measuring fresh and dry mass of embryos and caryopses, ABA content in embryos and caryopses, and kernel post-desiccation dormancy levels. Caryopses and embryos exposed to fluridone accumulated very little ABA. Detached spike culture increased ABA concentration and reduced fresh and dry mass in both caryopses and embryos. Fluridone did not affect fresh and dry mass. Addition of ABA to culture media slightly reduced media uptake by detached spikes. During desiccation, ABA and dry matter decreased in caryopses whereas embryos continued to accumulate both. After 2 d, 95 % of Greer kernels exposed to fluridone germinated while only 80 % of Brevor kernels were germinated after 4 d. Culture of detached spikes in media amended with fluridone and ABA induced higher dormancy levels in Brevor than in Greer. Results from this study support the hypothesis that ABA may be involved in acquisition of dormancy as well as maintenance of dormancy in wheat kernels. [References: 23].

4009 Schipper, J. (Royal Dutch Agricultural Committee, Delft (Netherlands). Inst. for Higher Agricultural Education) (1996) [Relation between pattern of development of wheat seedlings and growth rate of leaves, tillers and roots]. *Die Beziehung zwischen der Wachstumsgeschwindigkeit der Blätter, der Seitensprosse und Wurzeln zur Entwicklung junger Weizenpflanzen (Triticum aestivum L. em. Fiori et Paol.)*. *Journal of Agronomy and Crop Science (Germany)* v. 176(3) p. 199-211. 12 ill., 5 tables; 26 ref. English. (AGRI 97-062371).

4010 Slafer, G.A. (Melbourne Univ., Parkville, Vic. (Australia). Dept. of Agriculture); Rawson, H.M. (1996) Responses to photoperiod change with phenophase and temperature during wheat development. *Field Crops Research (Netherlands)* v. 46(1-3) p. 1-13. 43 ref. English. (AGRI 97-076574).

4011 Stoffel, S.; Gutser, R.; Claassen, N. (Technische Univ. Muenchen, Freising (Germany). Lehrstuhl fuer Gruenland und Futterbau) (1995) [Root growth in an agricultural landscape of the "Tertiaer-Huegelland"]. *Wurzelwachstum in einer Agrarlandschaft des Tertiaer-Huegellandes. Agribiological research (Germany)* v. 48(3-4) p. 330-340. 5 ill., 5 tables; 20 ref. German. (AGRI 97-062370).

4012 Ueno, K.; Takahashi, H. (1997) VARIETAL VARIATION AND PHYSIOLOGICAL BASIS FOR INHIBITION OF WHEAT SEED GERMINATION AFTER EXCESSIVE WATER TREATMENT. *Euphytica*. 94(2):169-173. English. [TOKYO UNIV AGR & TECHNOL FAC BIOIND LAB PLANT RESOURCES ABASHIRI HOKKAIDO 09924 JAPAN].

Soaking the seeds of most upland plants in water before sowing results in poor germination. Varietal differences in flooding tolerance of seeds have been reported in maize, soybean, barley and so on. This study was conducted to evaluate the varietal difference in wheat (2n = 42) seeds to soaking injury and to examine the importance of ethanol accumulation and seed coat as determinants of flooding tolerance. Of 342 varieties tested, many from Asia appeared more tolerant of flooding than the varieties from the Middle East. Soak-induced inhibition of germination and amounts of ethanol excreted were increased with soaking duration. Seeds of 26 wheat varieties were soaked 8 days at 20 degrees C. Subsequent germination was correlated with amounts of ethanol excreted. Seeds with a red-colored coat exhibited higher tolerance to flooding than white ones, however, a varietal difference existed even in the case where the seed coat was peeled. These data suggest that soak-induced inhibition of wheat seed germination relates to accumulation of ethanol rather than seed coat color. [References: 16].

4013 Wang, M. (1997) THE ROLE OF ABSCISIC ACID IN THE REGULATION OF BARLEY GRAIN GERMINATION. *Seed Science & Technology*. 25(1):67-74. English. [TNO DEPT PLANT MOL BIOTECHNOL CTR PHYTOTECNOL RUL WASSENAARSEWEG 64 NL-2333 AL LEIDEN NETHERLANDS].

It was previously proposed that dormancy of barley grains is determined by at least three factors, (i) synthesis of the plant hormone abscisic acid (ABA), (ii) breakdown and/or removal of ABA, and (iii) sensitivity to ABA. In this paper, some recent data on these three aspects are reviewed and additional evidence is provided to support this hypothesis. In different barley varieties, isolated embryos showed an increased germination index as compared with intact grains. During germination, the endogenous ABA in embryos of both intact dormant

grains and isolated embryos from dormant grains was analyzed. A very high ABA level in the intact dormant grains was correlated with no germination of the grains. When isolated embryos were placed on filter paper or in water, the germination rate of embryos placed in water was much higher than of those on filter paper, which was negatively correlated with the ABA levels in the embryos. The inhibitory effect of filter paper vs. water on germination rate of embryos might be due to a slower diffusion of endogenous ABA out of the embryos on paper. Removal of the husk caused also an enhancement of germination rate. Our results demonstrate that diffusion of endogenous ABA, in combination with our previously observed *de novo* ABA synthesis and ABA sensitivity, plays an important role in the control of germination. [References: 23].

4014 Wang, ZL.; Fu, JM.; He, MR.; Yin, YP.; Cao, HM. (1997) PLANTING DENSITY EFFECTS ON ASSIMILATION AND PARTITIONING OF PHOTOSYNTHATES DURING GRAIN FILLING IN THE LATE-SOWN WHEAT. *Photosynthetica*. 33(2):199-204. English. [SHANDONG AGR UNIV DEPT AGRON TAI AN 271018 SHANGDONG PROV PEOPLE'S REPUBLIC OF CHINA].

Leaf blades of the late-sown winter wheat produced the major portion, i.e., more than 60 %, of the total C-14-photosynthates at grain filling, but ear (rachis and glumes) only about 15 %, sheaths about 11 %, and stem internodes about 11 %. The change of plant density in this experiment had little influence on the (CO<sub>2</sub>)-C-14-photoassimilation of the ear (rachis and glumes), flag leaf lamina, sheaths and stem internodes, but markedly affected photosynthesis of the second, the third and lower leaves. The photosynthetic rate [expressed as specific radioactivity s(-1) kg(-1)(d.m.)] and the amount of (CO<sub>2</sub>)-C-14 photosynthates decreased significantly in the second, the third and other lower leaves at a high plant density. Upon grain-filling of the late-sown wheat, the grain was the major importer of photosynthates. Yet partitioning to the stem internodes depended on the plant density. Stem was the importer of photosynthates at a low plant density, but the exporter at a high plant density. In plants at a low plant density a fairly large proportion of photosynthates was distributed into the roots. The middle and lower above-ground parts of the late-sown wheat at a high plant density decreased or lost their function early. As a result, the plant senesced earlier. However, the grain setting, filling and yielding were restricted. An appropriately low plant density was suitable for prolonging the function of the middle and lower organs, delaying the senescence of plant, increasing the source supply for grain filling, and improving the grain yield. [References: 14].

4015 Wedzony, M.; Filek, M. (Polish Academy of Sciences, Krakow (Poland). Dept. of Plant Physiology) (1996) [Changes of electric potential in wheat pistils induced by pollination]. *Zmiany potencjalu elektrycznego w słupkach pszenicy pod wpływem zapylania*. 7. Conference of Plant Embryologists. Lublin (Poland). 14-16 Sep 1995. *Acta Societatis Botanicorum Poloniae (Poland)* v. 65(1-2) p. 97-100. 3 fig., 1 table; 15 ref. English. (AGRIS 97-076578).

Control experiment showed that maize pollen tubes grew slower than wheat ones. The potential was recorded for 20 min after pollination in 10 self-pollinated wheat pistils and for 70 min in 16 wheat pistils pollinated with maize. After measurements pollen tube growth was examined with aniline blue under fluorescent microscope. In self-pollinated pistils of wheat the potential decreased quickly and stabilized at 10 mV (+/-)3 mV to the initial level. The fastest rate of changes accompanied the penetration of the stigmatic hair and the growth of pollen tubes in stylodia. In wheat maize crosses the potential decreased in every pistil before emergence of pollen tubes. When germination was successful, the potential remained negative.

4016 Wulfsohn, D. (Saskatchewan Univ., Saskatoon, Sask. (Canada). Dept. of Agricultural and Bioresource Engineering); Gu, Y.; Wulfsohn, A.; Mojilaj, E.G. (1996) Statistical analysis of wheat root growth patterns under conventional and no-till systems. *Soil and Tillage Research (Netherlands)* v. 38(1-2) p. 1-16. 22 ref. English. (AGRIS 97-076577).

4017 Zhang, WH.; Tyerman, SD. (1997) EFFECT OF LOW OXYGEN CONCENTRATION ON THE ELECTRICAL PROPERTIES OF CORTICAL CELLS OF WHEAT ROOTS. *Journal of Plant Physiology*. 150(5):567-572. English. [UNIV WESTERN AUSTRALIA FAC AGR DEPT SOIL SCI & PLANT NUTR NEDLANDS WA 6901 AUSTRALIA].

Short-term effect of oxygen-deficiency on the membrane potential difference (PD), membrane resistance of cortical cells and electrical

coupling between cortical cells was investigated using excised wheat roots. Hypoxia rapidly depolarised the membrane potential of the cortical cells by about 60 mV, while hypoxia had little effect on the membrane resistance of the cells. No significant change in membrane resistance by potassium channel blockers, TEA(+) and verapamil, under hypoxia was observed. The electrical coupling ratio, which is a measure of plasmodesmatal resistance, between cortical cells of wheat roots was 5.9 % in aerated solution and was not affected by the low oxygen treatment, suggesting that solute transport through cytoplasmic annulus of plasmodesmata could not be affected. The possible involvement of the endoplasmic reticulum in intercellular transport of solute and water is discussed. [References: 34].

## F63 PLANT PHYSIOLOGY-REPRODUCTION

4018 Milosev, D. (Poljoprivredni fakultet, Novi Sad (Yugoslavia)) (1997) [The occurrence of sterile spikelets in wheat spikes depending on nitrogen rates and temperatures at grain formation]. *Pojava sterilnih klasaka u klasu pšenice u zavisnosti od azota i temperature u fazi formiranja zrna*. 31. seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naucni institut za ratarstvo i povrtarstvo (Yugoslavia) (no.29)* p. 243-251. 1 ill.; 2 tables; 13 ref. Serbian. (AGRIS 97-076623).

A trial by means of Mitscherlich's pots was conducted. The number of sterile spikelets in primary spikes is much smaller in the plants subjected to nitrogen fertilization than with those to which no nitrogen has been added. Among the fertilized treatments, this number began to increase when nitrogen rates exceeded 1 g per pot, especially in the first year of the study. In the case of secondary spikes, however, the situation was exactly the opposite. The number of sterile spikes showed a highly significant decrease all the way up to the maximum rate of 3 g per pot. With regard to temperatures, on the other hand, it can be concluded that, on the whole, their effect was neither consistent nor significant, since the variation came at the point when the number of sterile spikelets had already been largely determined.

## F70 PLANT TAXONOMY AND GEOGRAPHY

4019 Yun, S.G. (Ansong National University, Ansong (Korea Republic). Department of Agronomy); Ataku, K.; Yoshihira, T. (Rakuno Gakuen University, Hokkaido (Japan). Department of Dairy Science); Cho, C.H. (Dankook University, Cheonan (Korea Republic). College of Agriculture) (1996) Varietal classification of spring-triticale cultivars by agronomic and feed component traits. *Korean Journal of Breeding (Korea Republic)* v. 28(4) p. 373-378. 1 illus.; 5 tables; 13 ref. English. (AGRIS 97-062495).

## H01 PROTECTION OF PLANTS-GENERAL ASPECTS

4020 Brodersen, C.M. (1996) [The importance of individualization of the concept of damage threshold for the plant protection]. *Die Bedeutung der Individualisierung des Schadschwellenkonzeptes fuer den Pflanzenschutz*. Kiel Univ. (Germany). *Berichte aus der Agrarwissenschaft (Germany)* 156 p. Shaker. Also: Diss. (Dr.), Kiel Univ. (Germany). German. (AGRIS 97-062529).

4021 Snoo, G.R. de (Leiden Univ. (Netherlands). Centre of Environmental Science) (1994) Unsprayed field margins on arable land. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(2b) p. 549-559. 8 ill.; 12 ref. English. (AGRIS 97-076774).

In the Dutch Field Margin Project in the Haarlemmermeerpolder (1990-1994) a management strategy is being developed for promoting nature conservation on arable land and reducing pesticide drift to non-target areas. To this end, 3 and 6 m wide strips along the edges of winter wheat, sugar beet and potato crops have been left unsprayed with herbicides or insecticides and compared with sprayed edges. The effects on weeds, invertebrates, vertebrates, pesticide drift and costs to the farmer are being studied. This article reviews the results obtained to date. In the unsprayed edges weed cover increased substantially, as did the overall number of weed species. The impact on soil invertebrates such as carabids (activity density) was relatively minor. However, there was a pronounced effect on



insects living on plants. Butterflies were 3-4 times more abundant in unsprayed winter wheat edges than in sprayed edges. The number of visits by *Motacilla flava flava* (Blue-headed wagtail), an insectivorous bird, was also 3-4 times higher. Interviews with farmers indicated that field margins were sprayed intensively. Drift measurements using water-sensitive paper demonstrated that pesticide deposition in adjacent ditches was less than 0.1 percent of the deposition in the target area for knapsack sprayers and max. 2.2 percent for field sprayers at low wind speed (3 m/s). At higher wind speed (5 m/s) these figures are 3.2 percent and about 7 percent respectively. The creation of unsprayed buffer zones of 3 m wide proves to be a very effective way of reducing pesticide drift to the ditch (by about 90 percent). Compared with sprayed edges, the average yield loss in unsprayed edges 3 m wide was 2 percent in potatoes, 13 percent in winter wheat and 30 percent in sugar beet. Cost-benefit analysis shows that in winter wheat and potatoes unsprayed crop edges can well be adopted in agricultural practice. In sugar beet, however, the cost is too high.

## H10 PESTS OF PLANTS

4022 Alhag, E.A.; Al Rokibah, A.A.; Zaitoon, A.A. (King Saud Univ., Al Qassim (Saudi Arabia). Faculty of Agriculture and Veterinary Medicine) (1996) **Natural enemies of cereal aphids in sprinkler irrigated wheat in central Saudi Arabia.** *Bulletin of Faculty of Agriculture, Cairo Univ. (Egypt)* v. 47(4) p. 649-664. 3 graph. 4 tables; 19 ref. English. (AGRIS 97-077582).

4023 Amir, J. (Gilat Regional Experiment Station, Negev Mobile Post 2 (Israel)); Sinclair, T.R. (1996) **Cereal cyst nematode effects on wheat water use, and on root and shoot growth.** *Field Crops Research (Netherlands)* v. 47(1) p. 13-19. 21 ref. English. (AGRIS 97-077585).

4024 Andersen, A. (The Norwegian Crop Research Institute, Plant Protection Centre, Department of Entomology and Nematology, Fellesbygget, N 1432 As (Norway)) (1996) **Naturally occurring and introduced slug and snail pests in Norway.** *Slug and snail pests in agriculture. Proceedings of a Symposium, University of Kent, Canterbury, UK, 24-26 September 1996.* p. 333-334. British Crop Protection Council. 4 ref. English. (AGRIS 97-062947).

4025 Basky, Z.; Jordaan, J. (1997) **COMPARISON OF THE DEVELOPMENT AND FECUNDITY OF RUSSIAN WHEAT APHID (HOMOPTERA, APHIDIDAE) IN SOUTH AFRICA AND HUNGARY.** *Journal of Economic Entomology.* 90(2):623-627. English. [HUNGARIAN ACAD SCI INST PLANT PROTECT POB 102 H-1525 BUDAPEST HUNGARY].

Several life history parameters (nymphal development time, prereproductive period, reproductive period, postreproductive period, total life span, total fecundity, and age-specific natality) of *Diuraphis noxia* (Mordvilko) from South Africa and Hungary were compared on 2 South African wheat varieties ('Betta', which is *D. noxia*-susceptible, and 'SST 333', which is *D. noxia*-resistant) and 1 Hungarian spring barley variety ('Isis', which is *D. noxia*-susceptible). Nymphal development time, reproductive period, and total life span were significantly longer in Hungary than in South Africa. South African nymphs developed to adults between 9.3 and 9.7 d, whereas those in Hungary took 10.7-11.1 d (the ranges indicate variation in mean values among host plant species). The adult reproductive period lasted 22.9-24.0 d in South Africa and 35.2-37.1 d in Hungary. Total life span was 41.7-45.2 d in South Africa and 52.0-52.2 d in Hungary. Total fecundity was significantly higher in South Africa (67.1-75.1) than in Hungary (53.0-62.2) on Betta, SST 333, and Isis. Hungarian *D. noxia* not only produced fewer nymphs but took much longer to do so; therefore, it is possible that the Russian wheat aphid in South Africa would reach economic thresholds in the field sooner than in Hungary. [References: 17].

4026 Blodgett, S.L.; Denke, P.M.; Ivie, M.A.; O'Brien, C.W.; Lenssen, A.W. (1997) **LISTRONOTUS MONTANUS DIETZ (COLEOPTERA, CURCULIONIDAE) DAMAGING SPRING WHEAT IN MONTANA.** *Canadian Entomologist.* 129(2):377-378. English. [MONTANA STATE UNIV DEPT ENTOMOL BOZEMAN, MT 59717 USA].

4027 Booth, J.W.; Dussart, G.B.J.; Paglia, A. (Christ Church College, Canterbury, North Holmes Rd., Canterbury, CT1 1QU, Kent (United Kingdom)) (1996) **Ecology of terrestrial molluscs in relation to farm land-**

**use practice. Slug and snail pests in agriculture. Proceedings of a Symposium, University of Kent, Canterbury, UK, 24-26 September 1996.** p. 125-131. British Crop Protection Council. 12 ref. English. (AGRIS 97-062866).

4028 Clement, S.L.; Wilson, A.D.; Lester, D.G.; Davitt, C.M. (1997) **FUNGAL ENDOPHYTES OF WILD BARLEY AND THEIR EFFECTS ON DIURAPHIS NOXIA POPULATION DEVELOPMENT.** *Entomologia Experimentalis et Applicata.* 82(3):275-281. English. [WASHINGTON STATE UNIV USDA ARS PLANT GERMPLASM INTRODUCT & TESTING RES UNIT PULLMAN, WA 99164 USA].

Laboratory experiments were conducted to compare the expression of *Diuraphis noxia* (Mordvilko) (Homoptera: Aphididae) resistance in four plant introduction (PI) lines of wild barley (*Hordeum*) infected with different species or strains of endophytic fungi (tribe Balansieae, family Clavicipitaceae, *Neotyphodium* gen. nov. [formerly *Acremonium*]). Aphid densities were significantly lower on endophyte-infected plants of PI 314696 (*H. bogdanii* Wilensky) and PI 440420 (*H. brevisubulatum* subsp. *violaceum* (Boissier & Hohenacker)), compared with densities on endophyte-free plants of both PI lines in population growth experiments. This endophyte-associated resistance was the result of antibiosis effects or starvation. In other experiments, endophyte-free plants of PI 269406 and PI 440413 (*H. bogdanii*) were not superior to endophyte-infected conspecifics as host plants of *D. noxia*. Our results demonstrate the influence of host plant species/genotype and endophyte species/strain on expression of aphid resistance, provide an explanation of the high levels of *D. noxia* resistance in PI 314696 and PI 440420 previously reported in the literature, and underscore the potential importance of endophytic fungi in conferring insect resistance in wild barley. [References: 24].

4029 Cook, R.T.; Bailey, S.E.; McCrohan, C.R. (1997) **THE POTENTIAL FOR COMMON WEEDS TO REDUCE SLUG DAMAGE TO WINTER WHEAT - LABORATORY AND FIELD STUDIES.** *Journal of Applied Ecology.* 34(1):79-87. English. [KINGSTON UNIV SCH LIFE SCI PENRYN RD KINGSTON UPON THAMES KT1 2EE SURREY ENGLAND].

1. Slugs are serious pests of winter wheat crops in temperate climates, but current methods of chemical control are often unreliable. This paper investigates the potential for common agricultural broad-leaved weeds to act as an alternative food source for slugs, thereby reducing damage to the crop, as part of an integrated approach to pest slug management in wheat crops. 2. An experiment carried out in the field examined the relative effectiveness of metaldehyde pellets and three weed species in reducing damage to wheat seeds and seedlings. Treatments were carried out in open-topped arenas, each containing eight adult field slugs *Deroceras reticulatum*. The presence of weeds that were palatable to slugs did limit damage to the crop but, over a 72-h period, metaldehyde provided the most effective level of control. 3. A laboratory experiment was carried out to study the feeding behaviour of the slugs in more detail. A single slug was placed in an arena containing food items attached to electronic probes that could detect bites by a slug. The presence of dandelion *Taraxacum officinale* leaves, a palatable species, reduced the number of wheat seeds damaged, but chickweed *Stellaria media* leaves, which are less palatable to slugs, had no effect. Most slugs ate the first food item encountered. When dandelion was eaten first, significantly fewer wheat seeds were damaged, and slugs subsequently took fewer bites on seeds than when either a seed or chickweed was eaten first. Slugs were more likely to ignore wheat seeds after a meal on dandelion. 4. Metaldehyde pellets tend to degrade a few days after application. It is suggested that weeds could provide an on-going degree of protection to the crop after the pellets have degraded and until the wheat plants have developed beyond the vulnerable stages. However, the importance of the palatability of the weeds to slugs, and a high weed density to ensure an early encounter with a weed plant during a foraging session, are highlighted by the laboratory study. [References: 35].

4030 Elliott, R.H.; Mann, L.W. (1997) **CONTROL OF WHEAT MIDGE, SITODIPLOSI MOSELLANA (GEHIN), AT LOWER CHEMICAL RATES WITH SMALL-CAPACITY SPRAYER NOZZLES.** *Crop Protection.* 16(3):235-242. English. [AGR & AGRI FOOD CANADA RES CTR 107 SCI PL SASKATOON SK S7N 0X2 CANADA].

A three-year study was conducted to identify methods of applying sprays at lower chemical rates for control of wheat midge, *Sitodiplosis mosellana* (Gehin). Tracer dye experiments focused on methods of increasing the volume and reducing the variation of deposits on wheat

heads, the primary target of field sprays against wheat midge. Deposits increased from 2.6 mu l to 4.6 mu l when 8002F nozzles, spaced 0.51 m apart, were directed 40 degrees forward rather than 10 degrees forward. Deposits declined from 5.4 mu l with a 0.35 m spray path, the forward diagonal distance between nozzles and base of wheat heads, to 4.4 mu l with a 0.45 m or 0.60 m path. A 0.45 m path reduced the variation to 9.7%. Deposits from 8001F nozzles, spaced 0.255 m apart, increased from 2.9 mu l to 5.2 mu l when nozzles were reoriented from 10 to 40 degrees forward. Deposits increased curvilinearly from 4.7 mu l with a 0.15 m path to 6.1 mu l and 5.1 mu l with 0.30 m and 0.35 m, paths, respectively. A 0.35 m path reduced variation to 9.2%. Different settings were required for uniform deposits on horizontal and vertical paper targets. In four field tests, recommended and reduced rates of chlorpyrifos were applied with a track sprayer or field sprayer fitted with 8001F nozzles spaced 0.255 m apart. Nozzles were directed 40 degrees forward, 0.20-0.25 m above the crop to provide a 0.32-0.37 m spray path. Assessments of midge larvae and damaged kernels indicated that the rate of chlorpyrifos can be lowered from 0.40 to 0.24 kg Al ha<sup>-1</sup> with little or no loss in control and protection. Differences in midge damage between the two rates never exceeded 2%. Therefore, nozzle settings that increased deposits on the biological target also facilitated lower chemical rates without compromising efficacy. Lower chemical rates would reduce control costs and environmental contamination and may improve the compatibility of chemical and biological controls. Crown copyright (C) 1997 Published by Elsevier Science Ltd. [References: 16].

4031 Evans, K.A.; Spaul, A.M. (SAC, West Mains Road, Edinburgh EH9 3JG (United Kingdom)) (1996) Differential tolerance of winter wheat cultivars to grain hollowing by the grey field slug (*Deroceras reticulatum*): a laboratory study. *Slug and snail pests in agriculture. Proceedings of a Symposium, University of Kent, Canterbury, UK, 24-26 September 1996*. p. 433-438. British Crop Protection Council. 3 ref. English. (AGRIS 97-063063).

4032 Gallegos B, L.; Fabian V, F. (Asociacion de Agricultores del Valle de Canete (Peru). Estacion Experimental Agricola) (1993) [Substrata for the mass breeding of *Sitotroga cerealella*]. *Sustratos para la crianza masiva de Sitotroga cerealella. [Summary of the investigations supported by FUNDEAGRO [Foundation for the Development of Agriculture] 1988-1992]. Resumen de investigaciones apoyadas por FUNDEAGRO [Fundacion para el Desarrollo del Agro] 1988-1992. Quevedo Iturri, F.; Arroyo Vergara, R. (eds.). Proyecto Transformacion de la Tecnologia Agropecuaria (TTA), Lima (Peru). Fondo para el Aumento de Oportunidades de Investigacion; Fundacion para el Desarrollo del Agro, Lima (Peru) v. 1 p. 261-262. TTA. Spanish. (AGRIS 97-076949).*

4033 Grey, C.B.; Watkins, R.W.; Cowan, D.P. (Central Science Laboratory, MAFF, Sand Hutton, York, YO4 1LZ (United Kingdom)) (1996) Wheat leaf silicification: an inducible defence against vertebrate herbivores. *Brighton Crop Protection Conference: Pests and Diseases - 1996: Volume 3: Proceedings of an International Conference, Brighton, UK, 18-21 November 1996*. p. 829-834. British Crop Protection Council. 8 ref. English. (AGRIS 97-063076).

4034 Holland, J.M.; Thomas, S.R. (Game Conservancy Trust, Fordingbridge, Hampshire SP6 1EF (United Kingdom)) (1996) Quantifying the impact of polyphagous invertebrate predators in controlling cereal pests and in preventing quantity and quality reductions. *Brighton Crop Protection Conference: Pests and Diseases - 1996: Volume 2: Proceedings of an International Conference, Brighton, UK, 18-21 November 1996*. p. 629-634. British Crop Protection Council. 8 ref. English. (AGRIS 97-077314).

4035 Kuo Sell, H.L. (Institut fuer Pflanzenpathologie und Pflanzenschutz, Goettingen (Germany)) (1994) Resistance of wheats, triticales and oats to the aphids *Metopolophium dirhodum*, *Sitobion avenae* and *Rhopalosiphum padi* (Homoptera: Aphididae) [in Germany]. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium) v. 59(2b) p. 505-514. 6 ill.; 21 ref. English. (AGRIS 97-077575).*

Twenty-two cultivars and breeding lines of wheats, triticales and oats were tested in the laboratory for resistance to three species of cereal aphids *Metopolophium dirhodum*, *Sitobion avenae* and *Rhopalosiphum padi*. All

tests were done on flag leaves of mature plants at growth stage 39. When feeding on resistant cultivars, aphids of all three species always showed longer nymphal development time, reduced adult weight, shorter longevity and reduced fecundity compared to those feeding on susceptible plants. Host plant suitability (HPS) was calculated for each tested cultivar with respect to the control cultivar used. Cultivars having a HPS reduction of less than 25 percent were considered to be as susceptible as the control cultivar; those having a HPS reduction of 26 percent to 50 percent, 51 percent to 75 percent and 76 percent to 100 percent were classified as having low, moderate and high resistance, respectively. According to this, two oat cvs. Selma and Flaemingsstern were moderately and highly resistant to all three aphid species compared to the control cv. Leanda. Conversely, only low resistance against *S. avenae* or *R. padi* was found in spring wheats, winter triticales and especially in winter wheats. None of these cultivars were resistant to *M. dirhodum*. Also, the resistance of winter wheat was found to be unstable. For unknown reasons the performance of the aphids on the same cultivar varied strongly between tests. The laboratory results were confirmed by field assessments in most cases, especially in years with high aphid population densities. In such years, even the low resistance of wheats and triticales became more evident. The significance of using cultivar resistance in IPM systems against cereal aphids, especially in combination with native natural enemies, will be discussed.

4036 Longley, M.; Jepson, P.C.; Izquierdo, J.; Sotherton, N. (1997) TEMPORAL AND SPATIAL CHANGES IN APHID AND PARASITOID POPULATIONS FOLLOWING APPLICATIONS OF DELTAMETHRIN IN WINTER WHEAT. *Entomologia Experimentalis et Applicata*. 83(1):41-52. English. [UNIV SOUTHAMPTON SCH BIOL SCI AGROCHEM EVALUAT UNIT BASSETT CRESCENT E SOUTHAMPTON SO16 7PX HANTS ENGLAND].

The spatial and temporal effects of the pyrethroid insecticide, deltamethrin, on populations of cereal aphids and their primary parasitoids and hyperparasitoids were investigated in a large scale field experiment in winter wheat. Four hectare plots were treated at the recommended field concentration or a reduced concentration representing one twentieth of field rate. A control plot was left unsprayed. Invertebrate populations were sampled at sites within a grid layout covering the whole plots, enabling the use of geostatistical analysis. Hymenopteran populations were monitored using transparent sticky traps and suction sampling. Aphid populations were recorded by visual counts. Monitoring continued for 36 days after treatment. The full rate deltamethrin treatment resulted in initial reductions of aphid populations by 78%. Primary parasitoid and hyperparasitoid populations were reduced in suction samples by 90% and 47% respectively, when corrected for control fluctuations. The reduced deltamethrin concentration caused reductions of aphid, primary parasitoid and hyperparasitoid populations of 40, 60 and 54% respectively. Aphid population recovery over the full rate plot occurred slowly and in a 'patchy' manner following treatment. No significant reinvasion gradients were detected. Aphid population density recovered more rapidly in the reduced rate treatment; with initial evidence for increased densities at the plot centre. Significant patterns of reinvasion were initially detected for both groups of Hymenoptera in the full rate treatment, suggesting that reinvasion of the sprayed area was taking place from untreated surrounding reservoirs. It was concluded that experiments that examine pesticide impacts within small plots will lead to underestimates of effects on dispersive groups including parasitic Hymenoptera. [References: 27].

4037 MacKay, P.A. (University of Manitoba, Winnipeg, Canada.); Lamb, R.J. (1996) Dispersal of five aphids (Homoptera: Aphididae) in relation to their impact on *Hordeum vulgare*. *Environmental entomology (USA) v. 25(5) p. 1032-1044. references. English. (AGRIS 97-062995).*

Insect herbivores that have high impacts on their host plants reduce the longevity of their habitats and require dispersal mechanisms. This hypothesis was tested by comparing the life history traits, particularly short- and long-distance dispersal mechanisms, of 5 aphid species in relation to their impact on barley, *Hordeum vulgare* L. The aphids were bird cherry-oat aphid, *Rhopalosiphum padi* (L.), and rose-grain aphid *Metopolophium dirhodum* (Walker), important pests of cereal crops; corn leaf aphid, *Rhopalosiphum maidis* (Fitch), an occasional pest; and rusty plum aphid, *Hysteroneura setariae* (Thomas), and *Sitobion nr. fragariae*, which are not pests. The specific impacts of the 5 species on barley were similar, based on a biomass conversion ratio of a 3.4-mg reduction in plant

growth for each milligram gained in aphid biomass. The value of the numerical impacts varied, being highest for large species that produced offspring earliest in their reproductive periods. The density dependence of biomass increase was highest for species with high numerical impacts on the plant. Three measures of short-distance dispersiveness varied substantially among the species, but were not related to their numerical impact. Long-distance dispersiveness, measured as the proportion of winged offspring produced in response to crowding, was related to numerical impact for 4 of the 5 species. The 5th, *Sitobion nr. fragariae* produced many winged offspring without crowding and is probably adapted to inherently short-lived habitats. Aphid species that rapidly affect the quality of their host plants have evolved a level of long-distance dispersiveness proportional to their impact on their host plants.

4038 Mann, J.A.; Harrington, R. (IACR Rothamsted, Harpenden, AL5 2JQ (United Kingdom)) (1996) Key factors for modelling secondary spread of barley yellow dwarf virus. *HGCA Project Report (United Kingdom)*; no. 129 24 p. Home Grown Cereals Authority. 22 ref. English. (AGRIS 97-077486).

4039 Marchant, J.A. (Silsoe Research Inst., Silsoe, Bedford (United Kingdom)) (1996) Tracking of row structure in three crops using image analysis. *Computers and Electronics in Agriculture (Netherlands)* v. 15(2) p. 161-179. 15 ref. English. (AGRIS 97-077022).

4040 Mongrain, D.; Couture, L.; Dubuc, J.P.; Comeau, A. (1997) OCCURRENCE OF THE ORANGE WHEAT BLOSSOM MIDGE [DIPTERA, CECIDOMYIIDAE] IN QUEBEC AND ITS INCIDENCE ON WHEAT GRAIN MICROFLORA. *Phytoprotection*. 78(1):17-22. English. [AGR & AGROALIMENTAIRE CANADA CTR RECH & DEV SOLS & GRANDES CULTURES 2560 BOUL HOCHELAGA ST FOY PQ G1V 2J3 CANADA].

Samples of wheat spikes (*Triticum aestivum*) were collected in the summer of 1995 from different crop districts in Quebec and the occurrence of orange wheat blossom midge (*Sitodiplosis mosellana*) and seed microflora were determined. Estimated yield loss caused by wheat larvae averaged 6.3%. The percentage of infested spikes was significantly correlated with total seed contamination by fungi and bacteria ( $r=0.79$ ). The specific occurrence of *Fusarium graminearum* in grains was also significantly correlated with number of larvae per spike ( $r=0.67$ ) or per spikelet ( $r=0.67$ ). Consequently, the wheat midge might play a role in dissemination of *F. graminearum*. [References: 20].

4041 Morrill, W.L. (Montana State University, Bozeman, MT.); Kushnak, G.D. (1996) Wheat stem sawfly (Hymenoptera: Cephidae) adaptation to winter wheat. *Environmental entomology (USA)* v. 25(5) p. 1128-1132. references. English. (AGRIS 97-062872).

The wheat stem sawfly, *Cephus cinctus* Norton, originally occurred in North American large-stemmed wild grasses. The pest adapted to spring-planted wheat, *Triticum aestivum* L., within 10 yr after cultivation began. Fall-planted winter wheat originally avoided attack, but was consistently heavily damaged by 1985. We reviewed the factors affecting the recent adaptation of *C. cinctus* to winter wheat. No changes could be detected in the seasonal phenology of winter wheat. Decreased acreage of spring wheat from 1921 to 1945 reduced host availability. *C. cinctus* wasps are now emerging 20 d earlier than previously, and oviposition activity currently closely coincides with susceptible growth stages of winter wheat. Larval cannibalism of eggs and younger larvae also provides natural selection for early season activity. Annual emergence of wasps from a population in wild grasses consistently begins later than in wheat.

4042 Novokshonova, V.G. (1996) [Efficiency of ecologically safe biological preparations against the dominating pests of barley]. *Ehffektivnost' ehkologicheskikh bezopasnykh biologicheskikh preparatov protiv dominantnykh vreditel'ey yachmenya*. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 1. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkoloko-ehkonomicheskie osnovy usovershenstvovaniya integrirovannykh sistem zashchity rastenij ot vreditel'ey, boleznej i sornyakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 156-157. BRIPP. Russian. (AGRIS 97-077173).

4043 Odderskaer, P.; Prang, A.; Poulsen, J.G.; Andersen, P.N.; Elmegaard, N. (1997) SKYLARK (*ALAUDA ARVENSIS*) UTILISATION OF MICRO-HABITATS IN SPRING BARLEY FIELDS. *Agriculture Ecosystems & Environment*. 62(1):21-29. English. [NATL ENVIRONM RES INST DEPT LANDSCAPE ECOL GRENAVEJ 12 RONDE 8410 DENMARK].

Within-field-habitat utilisation by skylarks *Alauda arvensis* was studied in spring barley crops by means of radio-tracking and visual sighting. Arthropod food abundance and dropping densities were monitored within three different micro-habitats. The effect of maintaining open areas within a cereal field on local skylark densities was examined on two experimental fields. Radio-tracked skylarks showed a strong preference for the tramline micro-habitat. There was a positive correlation between crop height and the proportion of birds located in tramlines. This preference was supported by visual observation of ascending and descending birds as well as the mean density of droppings found in the three habitat types. Tramlines and unsown plots were utilised significantly more than expected and the crop was avoided. The density of arthropod food items was highest in crop and lowest in tramlines and unsown plots. This indicates that the skylarks' preference for tramlines and unsown plots was probably due to unhindered ground locomotion, facilitating detection of prey items, rather than prey density. Artificially maintained open areas had a positive effect on the density of breeding pairs and territorial males, and on the duration of the breeding period. These results suggest a positive effect of the open areas within field crops on the number of re-nesting attempts. The management implications of the results are discussed. [References: 37].

4044 Petrovic, O. (Faculty of Agriculture, Belgrade Zemun (Yugoslavia)) (1996) Aphids (Aphididae, Homoptera) on cereal crops. [A short version of master thesis]. *Review of Research Work at the Faculty of Agriculture (Yugoslavia)* v. 41(2) p. 159-168. 3 graphs; 1 table; 19 ref. English. (AGRIS 97-077033).

The objective was to study the aphid species of cereals in Serbia (Yugoslavia) and the number of cereal aphids in winter wheat in the region of Belgrade (Yugoslavia). The study was conducted in the period 1989-1991. The following ten species of aphids were detected on the upper parts of the cereal plants: *Diuraphis noxia*, *Metopolophium dirhodum*, *Metopolophium festucae*, *Rhopalosiphum maidis*, *Rhopalosiphum padi*, *Schizaphis graminum*, *Sitobion avenae*, *Sitobion fragariae*, *Sipha (Rungisia) elegans* and *Sipha (Rungisia) maydis*. *S. avenae* was the most frequent species on all kinds of cereals analyzed. *M. dirhodum* and *R. padi* were second and third ranking regarding the frequency of incidence. *S. graminum* was frequent on oats. *R. maidis* was present on barley mainly. However, it was not detected on wheat. The most abundant species on winter wheat in the region of Belgrade were *S. avenae* and *M. dirhodum*.

4045 Pike, K.S. (Washington State University, Prosser, WA.); Tanigoshi, L.K. (1996) Insect pests and management technologies in dryland wheat in Washington. *American journal of alternative agriculture (USA)* v. 11(2/3) p. 104-107. references. Paper presented at the U.S.-Middle East Conference and Workshop on "Dryland Farming Systems and Technologies for a more Sustainable Agriculture" held October 18-23, 1993, Moscow, Idaho. English. (AGRIS 97-077615).

Six species of aphids (Homoptera: Aphididae) are the most economically significant insect pests of wheat in Washington. Management technologies under development or in use in Washington emphasize biorational approaches, including development and use of resistance germplasm, manipulation of pest populations through cropping systems, and development of biological controls. We review wheat yield losses caused by aphids, their biological control, and the effects of conservation tillage and systemic seed treatment.

4046 Rafi, M.M.; Zemetra, R.S.; Quisenberry, S.S. (1997) FEEDING DAMAGE OF RUSSIAN WHEAT APHID ON RESISTANT AND SUSCEPTIBLE WHEAT GENOTYPES. *Cereal Research Communications*. 25(1):63-68. English. [UNIV CALIF DAVIS DEPT LAND AIR & WATER RESOURCES DAVIS, CA 95616 USA].

Effects of Russian wheat aphid (*Diuraphis noxia* Mordvilko) feeding on resistant wheat (*Triticum aestivum* L.) plant introduction line, PI 137739 (antibiotic line), and a susceptible cultivar, Stephens, were examined. Reduction in leaf chlorophyll content was determined after different densities (0, 40 and 80) of aphids were allowed to feed for 3, 6, 9, and 11 days in leaf cages attached to seedlings. In the non-caged region of infested



plants, leaf chlorophyll content was significantly higher in PI 137739 compared with Stephens. Reduction in chlorophyll content was not aphid-density or duration of aphid-feeding dependent in the non-caged regions. In the caged region, increased physical damage to leaves and significant reduction in total chlorophyll content were observed in PI 137739 compared with Stephens. Increased aphid density and prolonged aphid-feeding caused greater reduction in leaf chlorophyll content in caged sections. Increased probing of aphids because of restricted movement in the caged section and tissue unpalatability of the resistant genotype could have caused severe chlorophyll reduction in the resistant plant introduction line, PI 137739. [References: 15].

4047 Sekun, N.P. (Ukrainian Academy of Agricultural Sciences, Kiev (Ukraine). Institute of Plant Protection) (1996) [Ways of preserving entomophages at the integrated protection of winter wheat from pests in south of Ukraine]. Puti sokhraneniya ehntomofagov pri integrirovannoj zashchite ozimoj pshenitsy ot vreditelej na yuge Ukrainy. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 1. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologo-ehkonomicheskie osnovy usovershenstvovaniya integrirovannykh sistem zashchity rastenij ot vreditelej, boleznej i sornjakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 170-172. BRIPP. Russian. (AGRIS 97-077579).

4048 Smiley, R.W. (Oregon State University, Pendleton, OR.) (1996) Diseases of wheat and barley in conservation cropping systems of the semiarid Pacific Northwest. *American journal of alternative agriculture (USA)* v. 11(2/3) p. 95-103. references. Paper presented at the U.S.-Middle East Conference and Workshop on "Dryland Farming Systems and Technologies for a more Sustainable Agriculture" held October 18-23, 1993, Moscow, Idaho. English. (AGRIS 97-077295).

Diseases continue to be important constraints in wheat and barley conservation cropping systems in the semiarid Pacific Northwest. Several diseases are more damaging in high- than low-residue seedbeds, and in crops planted during early autumn to reduce soil erosion during winter, especially unirrigated winter wheat in rotation with summer fallow in low rainfall zones (250-400 mm). Changes in cropping systems in the region have made disease management and maintenance of yield goals and farm profitability more challenging because disease management often is more complex and expensive with conservation tillage than inversion tillage. Practices being developed to meet this challenge are reviewed for diseases that are particularly troublesome in conservation farming systems of the Pacific Northwest.

4049 Withers, TM.; Harris, MO. (1997) INFLUENCE OF WIND ON HESSIAN FLY (DIPTERA, CECIDOMYIIDAE) FLIGHT AND EGG-LAYING BEHAVIOR. *Environmental Entomology*. 26(2):327-333. English. [COOPERAT RES CTR TROP PET MANAGEMENT ALAN FLETCHER RES STN POB 36 SHERWOOD QLD 4075 AUSTRALIA].

The influence of wind velocity on the behavior of ovipositing female Hessian flies, *Mayetiola destructor* (Say), was examined in a wind tunnel. Females exposed to wind speeds ranging from 0 to 2.0 m/s, tended to stay for longer on wheat, *Triticum aestivum* L., plants when the wind speeds experienced were higher, than when they were lower. However, although flight departing from plants was suppressed at higher wind speeds, on-plant behavior was not suppressed under these conditions. Thus, females that stayed longer on plants because of higher wind speeds laid more eggs per visit than females at lower wind speeds. Flight direction upon leaving a host plant was also influenced by wind. As winds increased > 0.9 m/s, females no longer exhibited flights to upwind groups of wheat plants and were more likely to land in downwind groups of plants or to be blown out the end of the wind tunnel. When groups of females were released into host plant patches in low (0.1 m/s) or high (0.7 or 1.2 m/s) wind speeds, females in higher winds laid most of their eggs in the patches they were released into and in patches downwind patches. In this experiment, the total number of eggs laid during the test period was greater in lower versus higher winds. The effects of the above responses to the reproductive biology of Hessian flies are discussed. [References: 30].

4050 Young, J.E.B.; Talbot, G.A. (ADAS Boxworth, Boxworth, Cambridgeshire CB3 8NN (United Kingdom)) (1996) Cultural control of wheat bulb fly in rotational set-aside. Brighton Crop Protection Conference:

Pests and Diseases - 1996: Volume 2: Proceedings of an International Conference, Brighton, UK, 18-21 November 1996. p. 661-666. British Crop Protection Council. 9 ref. English. (AGRIS 97-077522).

## H2O PLANT DISEASES

4051 [Determination of the variability, distribution and effect of BYDV on small grain cereals]. Determinacion de la variabilidad, distribucion y efecto de BYDV en cereales de grano pequeno (1994) Instituto Nacional de Investigaciones Agropecuarias, Quito (Ecuador). Est. Exp. Santa Catalina. Departamento de Proteccion Vegetal. *Informe Anual Tecnico - INIAP (Ecuador)*. 1994 8 p. INIAP. Spanish. (AGRIS 97-077656).

El ensayo pretende determinar la presencia, variabilidad, distribucion y efecto de variantes de BYDV presentes en cereales en el Ecuador. Ademas determinar la interaccion de estas variantes con germoplasma de trigo seleccionado por CYMMYT e INIAP. Se concluye que MAV es la variante del virus del enanismo amarillo de la cebada BYDV prevaleciente en Ecuador, seguido por RPV y PAV. La incidencia del virus en condiciones de infeccion natural en Santa Catalina fue del 30 por ciento a pesar de que visualmente podria aparecer mayor. Veinte y cuatro genotipos no presentaron sintomas de la enfermedad. Por lo tanto existe la posibilidad de que existan fuentes de resistencia o tolerancia entre los materiales evaluados. La observacion visual no es el mejor metodo para evaluar la incidencia de la enfermedad. Finalmente se aconseja utilizar metodos de diagnostico mas confiables como ELISA, incluso en programas de mejoramiento.

4052 Appel, J.; Zinkernagel, V. (Technische Univ. Muenchen, Freising Weihenstephan (Germany). Lehrstuhl fuer Phytopathologie) (1994) A decision model to control diseases on spring and winter barley in particular consideration of *Rhynchosporium secalis*. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(3a) p. 987-992. 4 ill.; 1 table; 16 ref. English. (AGRIS 97-077945).

The IPP (Integrated Plant Protection) Barley is a disease threshold based decision support system to control barley diseases on spring and winter barley. Threshold values for *Rhynchosporium secalis* and *Erysiphe graminis* are defined as incidence of infection on different leaf layers according to the actual growth stage. The threshold value to control *Puccinia hordei* is based on incidence of infection per plant, whereas incidence of sporulation is used to estimate the need of an application to control *Drechslera teres* and *Bipolaris sorokiniana*. The use of the decision model requires exact qualitative and quantitative diagnosis of the occurring pathogens which is based on a 30 plant sample. If a threshold value is reached in combination with suitable weather criteria a fungicide application is indicated. The knowledge of the entire disease situation of a crop enables to choose the most effective fungicide to control the target disease and to use side-effects on other pathogens.

4053 Balaz, F.; Bagi, F.; Glidzic, I. (Poljoprivredni fakultet, Novi Sad (Yugoslavia). Institut za zastitu bilja i zivotnu sredinu) (1996) [Microdochium bolleyi - a pathogen of wheat in Yugoslavia]. *Microdochium bolleyi* patogen pšenice u Jugoslaviji. *Zastita bilja (Yugoslavia)* v. 47(2) p. 179-188. 3 ill.; 1 graph; 2 tables; 18 ref. Serbian. (AGRIS 97-063422).

A two-year etiological study of root and stems of wheat has shown the fungus *Microdochium bolleyi* (Sprague) De Hoog and Hermandies-Nijof to be a frequently present pathogen. Under the conditions of artificial inoculations the majority of isolates from wheat, maize, the soil, and some from some weed species proved to be highly pathogenic on the young wheat plants. The presence of *Microdochium bolleyi* was much greater in 1994 as a dry year than in 1995 in which there was more moisture and the conditions were more favourable for the growth and development of crops. The incidence of this fungus was at its peak towards the end of booting and at the beginning of flowering. Other highly present fungi in addition to *Microdochium bolleyi* were those of the genus *Fusarium* and the species *Cochliobolus sativus*, while *Gaeumannomyces graminis* occurred only sporadically.

4054 Bartos, P. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyně (Czech Republic)); Huszar, J. (1996) Virulence of Slovak wheat leaf rust population of 1995 on twenty near-isogenic lines with different Lr genes.



Ochrana Rostlin - UZPI (Czech Republic) v. 32(4) p. 251-261. 6 tables; 9 ref. English. (AGRI 97-063424).

The reactions to single pustule isolates of wheat leaf rust collected at 16 localities in Slovakia were tested on near-isogenic lines of cv. Thatcher possessing Lr1, Lr2a, Lr2b, Lr2c, Lr3, Lr3bg, Lr3ka, Lr9, Lr10, Lr11, Lr15, Lr16, Lr17, Lr19, Lr21, Lr23, Lr24, Lr26< Lr28 and Lr30. Resistance genes Lr9, Lr19, Lr24 and Lr28 were effective to all isolates. Ineffective to all isolates were genes Lr2c, Lr11, Lr16, Lr21 and Lr23. Genes Lr1 and Lr2a conferred resistance to the majority of isolates.

4055 Beer, E. (Bundesanstalt fuer Fleischforschung, Kulmbach (Germany)) (1995) [Targeted dressing of summer cereals - can dressing be eliminated? Sommergetreide ganz gezielt beizen: Laesst sich bei der Getreidebeizung sparen? *Diz. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany)* v. 46(1) p. 27-29. German. (AGRI 97-063419).

4056 Bezlyudnyj, V.N.; Zubkovich, A.A. (Belarus Research Institute of Arable Farming and Fodders, Zhodino (Belarus)) (1996) [Level of trypsin-inhibiting activity in the leaves of barley shoots in the connection with the resistance to powdery mildew]. Uroven' tripsinogibiruyushchej aktivnosti v list'yakh prorstokov yachmenya v svyazi s ustojchivost'yu k muchnistoj rose. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologicheskono-micheskie osnovy usovershenstvovaniya integrirrovannykh sistem zashchity rastenij ot vreditel'ej, boleznej i sornjakov. Belarus Research Institute of Plant Protection, Minsk (Belarus)* p. 3-4. BRIPP. Russian. (AGRI 97-077948).

4057 Brzezicka Szymczyk, K.; Golinowski, W. (Warsaw Agricultural University (Poland). Dept. of Botany); Zamorski, C. (Warsaw Agricultural University (Poland). Dept. of Phytopathology) (1995) [Cytological changes observed in the successive phases of the wheat rust caused by *Puccinia recondita* F. sp. *tritici* after the treatment with Tilt 250EC]. Zmiany cytologiczne obserwowane w kolejnych fazach rdzy brunatnej pszenicy wywołanej przez *Puccinia recondita* F. sp. *tritici* po zastosowaniu Tiltu 250EC. *Acta Societatis Botanicorum Poloniae (Poland)* v. 64(4) p. 349-358. 18 fig.; 20 ref. English. (AGRI 97-078295).

The disease process of wheat (*Triticum aestivum*) cv. Parada caused by rust (*Puccinia recondita* Rob. ex Desm. f. sp. *tritici*) and the effect of applying the fungicide Tilt 250EC are described. The application of spraying at the time of inoculation, during incubation and at the beginning of the actual disease is most effective, thus attests to the highest pathogen susceptibility to that chemical agent at these phases of the disease. Tilt 250EC (propiconazole) inhibits the ergosterol biosynthesis in the fungus cells. Application of the preparation caused the inhibition of the development and necrosis of the intra- and extracellular mycelium.

4058 Bulojchik, A.A.; Voluevich, E.A. (Academy of Sciences of Belarus, Minsk (Belarus)) (1996) [Effects of intraspecific and allogenic cytoplasm of host plant on the resistance of soft wheat to the powdery mildew population]. Effekty vnutrividovych i chuzherodnykh tsitoplazm rastenija-khozyaina na ustojchivost' myagkoj pszenitsy k populyatsii muchnistoj rosy. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologicheskono-micheskie osnovy usovershenstvovaniya integrirrovannykh sistem zashchity rastenij ot vreditel'ej, boleznej i sornjakov. Belarus Research Institute of Plant Protection, Minsk (Belarus)* p. 4-6. BRIPP. Russian. (AGRI 97-078289).

4059 Cavellier, M.; Steyer, S. (Centre de Recherches Agronomiques, Gembloux (Belgium). Station de Phytopathologie); Couvreur, L.; Oger, R. (1994) Damage caused by eyespot and sharp eyespot in winter wheat. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(3a) p. 993-1007. 4 ill.; 7 tables; 15 ref. English. (AGRI 97-078286).

4060 Cazin Bourguignon, P. (Service Regional de la Protection des Vegetaux de Picardie (France)); Delos, M.; Faure, A.; Leroy, J.P.; Lochon,

S.; Murer, F.; Pillon, O.; Vergnaud, A. (1996) [A review of a calm season (1995-1996, cereal crops, France)]. Une campagne calme et une protection raisonnee toujours necessaire [1995-1996, cultures cerealierees, France]. *Phytoma La Defense des Vegetaux (France)* (no 489) p. 47-49. French. (AGRI 97-063094).

4061 Ceynowa, J.; Lindenberg, H. (1995) [Cereal diseases. Fungi control: do laboratory tests and computers help?]. Getreidekrankheiten. Pilzbekaempfung: Helfen Labortests und Computer weiter? Entscheidungshilfen bei Winterweizen im Vergleich. *Diz. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany)* v. 46(3) p. 20-24, 26-27. German. (AGRI 97-063421).

4062 Chay, C.A. (Monsanto Corp, Chesterfield, MO.); Gunasinge, U.B.; Dinesh Kumar, S.P.; Miller, W.A.; Gray, S.W. (1996) Aphid transmission and systemic plant infection determinants of barley yellow dwarf luteovirus-PAV are contained in the coat protein readthrough domain and 17-kDa protein, respectively. *Virology (USA)* v. 219(1) p. 57-65. references. English. (AGRI 97-078185).

Proteins encoded by open reading frames (ORF) 3, 4, and 5 of the barley yellow dwarf luteovirus genome are translated from a single subgenomic RNA. The structural proteins are encoded by ORF 3 (coat protein) and ORF 5 (readthrough domain) and contain undefined domains that regulate the movement of virus through aphid vectors. The biological function of the nonstructural 17-kDa protein encoded by ORF 4 is unknown. A complementation method was employed to test the ability of barley yellow dwarf virions carrying mutations within the readthrough domain and the 17-kDa protein to be transmitted by aphids and to cause systemic infections in plants. We show that the readthrough domain is required for aphid transmission; however, it is not required for virus to be taken up by aphid hindgut cells and released into the hemocoel. The circulative pathway of luteoviruses in aphid vectors requires that virus be actively transported from the hemolymph into the salivary system. Thus, it appears that the readthrough domain is required for transport of virus through membranes of the aphid salivary glands. Furthermore, the readthrough domain was not required for systemic infection of plants, but did influence the accumulation of virus in infected plants. The 17-kDa protein is required for the systemic infection of plants.

4063 Chenault, K.D. (Oklahoma State University, Stillwater, OK.); Hunger, R.M.; Sherwood, J.L. (1996) Comparison of the nucleotide sequence of the coat protein open reading frame of nine isolates of wheat streak mosaic rymovirus. *Virus genes (USA)* v. 13(3) p. 187-188. references. English. (AGRI 97-078195).

4064 Chiusa, G.; Orsi, C.; Rossi, V. (Universita Cattolica del Sacro Cuore, Piacenza (Italy). Istituto di Entomologia e Patologia Vegetale) (1996) [Preliminary studies on variability among *Alternaria alternata* strains causing black point on durum wheat]. Studi preliminari sulla variabilita' di *Alternaria alternata* nel causare la volpatura del frumento duro. *Petria (Italy)* v. 6(1) p. 51-58. 3 tables; 30 ref. Italian. (AGRI 97-063433).

In vitro and in planta inoculations on Castello (very susceptible to black point) and Vezio (less susceptible) durum wheat kernels and heads were performed using several *Alternaria alternata* strains isolated from black pointed kernels collected from several wheat-growing areas. All isolates were able to cause black point, but disease severity changed significantly from a strain to another. In some cases the ability to cause black point was different in planta and in vitro inoculations L'inoculazione artificiale di cariossidi in vitro e spighe in planta di frumento duro Castello (molto suscettibile alla volpatura) e Vezio (poco suscettibile) con alcuni ceppi di *Alternaria alternata*, precedentemente isolati da cariossidi imbrunite di diversa origine geografica, hanno sempre determinato la comparsa della volpatura, ma con gravita' differente. Alcuni ceppi hanno mostrato in planta capacita' di causare la volpatura differente da quella dimostrata in vitro.

4065 Colbach, N.; Duby, C.; Cavellier, A.; Meynard, J.M. (1997) INFLUENCE OF CROPPING SYSTEMS ON FOOT AND ROOT DISEASES OF WINTER WHEAT - FITTING OF A STATISTICAL MODEL. *European Journal of Agronomy*. 6(1-2):61-77. English. [INRA STN AGRON 17 RUE SULLY BV 1540 F-21034 DIJON FRANCE].

In a series of trials carried out in France from 1986 to 1993, 503 winter wheat plots were assessed at heading for eyespot (*Pseudocercospora*

herpotrichoides), take-all (*Gaeumannomyces graminis* var. *tritici*) and sharp eyespot (*Rhizoctonia cerealis*). For each disease, a model was developed to estimate disease risk as a function of environment and cropping system. Eyespot depended on environment, crop succession, soil tillage (inversion vs. non-inversion), sowing date and tiller number per plant; take-all depended on environment, crop succession, sowing date and total nitrogen supply from soil plus fertiliser; and sharp eyespot depended on environment, crop succession, soil tillage and sowing date. Interactions between cultivation techniques were integrated by using a multiplicative model. The hierarchy of techniques is discussed. These models allow us to classify cropping systems according to their inherent disease risk and to foresee the impact of changes in system strategies. Comparison with previous studies also suggested new conclusions on the effect of "risk amplifying non-host crops". (C) 1997 Elsevier Science B.V. [References: 53].

4066 Collin, S. (Universidad Autonoma, Madrid, Spain.); Fernandez Lobato, M.; Gooding, P.S.; Mullineaux, P.M.; Fenoll, C. (1996) The two nonstructural proteins from wheat dwarf virus involved in viral gene expression and replication are retinoblastoma-binding proteins. *Virology* (USA) v. 219(1) p. 324-329. references. English. (AGRIS 97-078188).

Tumor-inducing viruses like simian virus 40 or the human adenovirus produce oncoproteins which interfere with the cellular retinoblastoma (Rb) tumor-suppressor protein to create an appropriate molecular environment in the nucleus for viral transcription and replication. Such a strategy has been considered to be restricted to animal viruses. Here we demonstrate that plant viruses may use similar mechanisms for recruiting host factors. Wheat dwarf virus (WDV) encodes two potential nonstructural proteins, C1 and C1:C2, both containing the consensus Rb-binding motif LeuXCysXGlu that allows the oncoproteins from animal viruses to inactivate Rb. C1:C2 is a key determinant of viral replication and V(virion)-sense expression. Using a yeast two-hybrid protein assay, we demonstrate for the first time that the C1:C2 protein from WDV interacts with a retinoblastoma protein, providing an explanation for the previously observed dependence of viral replication on an intact Rb-binding motif. We also show that C1, for which no function has been demonstrated, is required for V-sense gene expression. This suggests that V-sense expression might be dependent on the interaction of C1 with Rb. Our findings provide further evidence for the presence of transforming-like proteins in a plant virus and will help to explain the production of symptoms in a plant viral infection through a mechanism mediated by a key regulator of cell cycle and differentiation.

4067 Dickopp, S.; Hindorf, H. (Rheinische Friedrich Wilhelms Univ., Bonn (Germany). Inst. fuer Pflanzenkrankheiten) (1994) [Disease progress and pycnidia development of Septoria on winter wheat in relation to climatic conditions [in Germany]]. *Befallsverlauf und Pyknidienentwicklung von Septoria spp. auf Winterweizen in Abhaengigkeit von der Witterung*. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(3a) p. 859-867. 8 ill.; 21 ref. German. (AGRIS 97-078284).

To develop decision-making systems for agricultural crops to predict optimum fungicide application precise data on disease occurrence is needed. In general disease assessment carried out in the field is used to determine the first appearance of the disease and/or damage exceeding threshold levels. A prediction of climatic data does not alone lead to precisely working decision system with Septoria. Therefore, the number of pycnidia were counted to describe the disease progress curve. In the Rhineland from 1989 to 1992 at four different localities, disease assessments were carried out in winter wheat. Rainfall and temperature patterns were also recorded. A high incidence of disease in 1989 correlated with average rainfall and temperatures of 10-25 degrees from mid June to the end of July. In 1990 disease development was weak due to low rainfall and temperatures between 15 and 23 degrees. In 1991 the disease started late the end of June, but reached moderate to high incidences. In 1992 the first appearance of the disease occurred at the end of May, but due to a continuation of dry weather in June the incidence of Septoria was not severe.

4068 Donald, R.G.K. (University of Pennsylvania, Philadelphia, PA.); Lawrence, D.M.; Jackson, A.O. (1997) The barley stripe mosaic virus 58-kilodalton betab protein is a multifunctional RNA binding protein.

*Journal of virology* (USA) v. 71(2) p. 1538-1546. references. English. (AGRIS 97-078182).

The barley stripe mosaic virus (BSMV) betab gene product is the major viral nonstructural protein synthesized during early stages of the infection cycle and is required for systemic movement of the virus. To examine the biochemical properties of betab, a histidine tag was engineered at the amino terminus and the protein was purified from BSMV-infected barley tissue by metal affinity chromatography. The betab protein bound ATPs in vitro, with a preference for ATP over dATP, and also exhibited ATPase activity. In addition, betab bound RNA without detectable sequence specificity. However, binding was selective, as the betab protein had a strong affinity for both single-stranded (ss) and double-stranded (ds) RNAs but not for tRNA or DNA substrates. Mutational analyses of betab purified from *Escherichia coli* indicated that the protein has multiple RNA binding sites. These sites appear to contribute differently, because mutants that were altered in their binding affinities for ss and ds RNA substrates were recovered.

4069 Dreiseitl, A. (Vyzkumny Ustav Zemedelsky, Kromeriz (Czech Republic)) (1996) [Utilization of barley varietal resistance for maintaining a collection of pure powdery mildew pathotypes]. *Vyuziti odrudove odolnosti jecmene k udrzovani kolekce clistych patotypu padli travniho. Ochrana Rostlin - UZPI (Czech Republic)* v. 32(4) p. 313-317. 1 table; 10 ref. Czech. (AGRIS 97-063238).

To reproduce pathotypes of *Erysiphe graminis hordei*, we inoculate primary leaves of fresh plants by shaking infected plants over them in isolators (glass boxes). A lot of conidia get out of the isolators and the pathotypes can contaminate each other. Therefore, a variety (a pair of varieties) possessing a suitable resistance, to which a given pathotype is virulent, is selected. The inoculation is performed in such a sequence, so that resistance of each subsequent variety is a filter one and disables any of preceding pathotypes to reproduce. During the process in other sequence protection against mutual contamination would be lost.

4070 Dubin, H.J. (CIMMYT, Mexico, D.F., Mexico.); Rajaram, S. (1996) Breeding disease-resistant wheats for tropical highlands and lowlands. *Annual review of phytopathology* (USA) v. 34 p. 503-526. references. English. (AGRIS 97-063121).

4071 Etebarian, H.R.; Torabi, M. (1996) Studies on resistance of Wheat cultivars to *Fusarium* head blight. *Plant Pests and Diseases Research Institute, Tehran (Iran Islamic Republic). Iranian Journal of Plant Pathology. Vol., 32 (1-2) 1996 (Iran Islamic Republic) p. 3. Persian.* (AGRIS 97-078167).

4072 Fernandez, MR.; Clarke, JM.; Depauw, RM.; Lefkovitch, LP. (1997) EMERGENCE AND GROWTH OF DURUM WHEAT DERIVED FROM RED SMUDGE-INFECTED SEED. *Crop Science*. 37(2):510-514. English. [AGR & AGRI FOOD CANADA SEMIARID PRAIRIE AGR RES CTR POB 1030 SWIFT CURRENT SK S9H 3X2 CANADA].

All durum wheat (*Triticum turgidum* L. var. durum Desf.) cultivars grown in western Canada are susceptible to red smudge of kernels, caused by *Pyrenophora tritici-repentis* (Died.) Drechs. This kernel discoloration reduces commercial grade, but its effect on the health and development of the crop when planted is unknown. Seedling emergence, plant growth, and grain yield were evaluated in held and controlled-environment studies using four cultivars that were established from seed which had 0, 50, or 100% infection. The 2-yr field study was conducted on a Swinton loam soil (Aridic Haploborall). Infection resulted in a slower emergence rate and decreased total seedling emergence id both held and controlled-environment studies. Poor seedling emergence resulted in sparse stands, fewer spikes, less above-ground dry matter per unit area, and lower grain yield in the field. Seedlings from infected seed required significantly more time to head than those from non-infected seed; however, plant growth and yield of growth chamber-grown plants were not affected. Greater yield per plant derived from infected seed than from non-infected seed in field studies was attributed to reduced interplant competition as a result of poorer emergence. We conclude that red smudge infection has the potential to reduce durum wheat grain yield, although the degree of reduction in a commercial crop will depend on the level of seed infection and on the ability of the crop to compensate for reduced stands. The latter will depend on plant vigor and the growing conditions associated with various seasonal environments. [References: 11].

4073 Filichkin, S.A. (Montana State University, Bozeman, MT.); Brumfield, S.; Filichkin, T.P.; Young, M.J. (1997) In vitro interactions of the aphid endosymbiotic SymL chaperonin with barley yellow dwarf virus. *Journal of virology (USA)* v. 71(1) p. 569-577. references. English. (AGRIS 97-063139).

Barley yellow dwarf virus (BYDV)-vector relationships suggest that there are specific interactions between BYDV virions and the aphid's cellular components. However, little is known about vector factors that mediate virion recognition, cellular trafficking, and accumulation within the aphid. Symbionins are molecular chaperonins produced by intracellular endosymbiotic bacteria and are the most abundant proteins found in aphids. To elucidate the potential role of symbionins in BYDV transmission, we have isolated and characterized two new symbionin symL genes encoded by the endosymbionts which are harbored by the BYDV aphid vectors *Rhopalosiphum padi* and *Sitobion avenae*. Endosymbiont symL-encoded proteins have extensive homology with the pea aphid SymL and *Escherichia coli* GroEL chaperonin. Recombinant and native SymL proteins can be assembled into oligomeric complexes which are similar to the GroEL oligomer. R. padi SymL protein demonstrates an in vitro binding affinity for BYDV and its recombinant readthrough polypeptide. In contrast to the R. padi SymL, the closely related GroEL does not exhibit a significant binding affinity either for BYDV or for its recombinant readthrough polypeptide. Comparative sequence analysis between SymL and GroEL was used to identify potential SymL-BYDV binding sites. Affinity binding of SymL to BYDV in vitro suggests a potential involvement of endosymbiotic chaperoning in interactions with virions during their trafficking through the aphid.

4074 Fujita, Y. (Kyoto University, Kyoto, Japan.); Mise, K.; Okuno, T.; Ahlquist, P.; Furusawa, I. (1996) A single codon change in a conserved motif of a bromovirus movement protein gene confers compatibility with a new host. *Virology (USA)* v. 223(2) p. 283-291. references. English. (AGRIS 97-063362).

Brome mosaic virus (BMV) and cowpea chlorotic mottle virus (CCMV) are closely related bromoviruses with tripartite RNA genomes, but distinct host ranges BMV systemically infects the monocot barley, while CCMV systemically infects the dicot cowpea. We have previously shown that in approximately 10% of inoculated cowpea plants, a CCMV hybrid [CCMV(B3a)] with the 3a cell-to-cell movement protein gene replaced by that of cowpea-nonadapted BMV directs systemic infections, which are caused by secondary mutation(s) of the hybrid virus. Here, to further analyze the role of RNA3 in adaptation to a new host, RNA3 cDNA clones were constructed from total RNA recovered from the uninoculated upper leaves of systemically infected cowpea plants inoculated with CCMV(B3a). Sequence and mutational analysis of two such RNA3 clones revealed that a single codon change (A776 leads to C) in a conserved motif of the 3a movement protein gene conferred compatibility for systemic infection of a new host, cowpea, suggesting that this site in the 3a gene is directly or indirectly involved in crucial host interactions associated with host-range specificity. The adaptive hybrid viruses carrying this mutation induced exacerbated symptoms, while wt CCMV appeared nearly symptomless, showing that the bromovirus 3a movement protein gene can significantly contribute to regulating symptom development. However, introducing this cowpea-adaptive mutation into the BMV genome had little effect on the ability of BMV to systemically infect barley.

4075 Ges', D.K.; Serova, Z. Ya. (Academy of Sciences of Belarus, Minsk (Belarus). Institute of Experimental Botany) (1996) [Characterization of pathogenicity of *Helminthosporium teres* Sacc.]. *Kharakteristika patogennosti Helminthosporium teres* Sacc. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologo-ehkonomicheskie osnovy usovershenstvovaniya integrirovannykh sistem zashchity rastenij ot vreditel'ej, boleznej i sornyakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 10-11. BRIPP. Russian. (AGRIS 97-077949).

4076 Gindrat, D.; Frei, P. (Station federale de recherches en production vegetale (RAC), Nyon (Switzerland)) (1997) [Eyespot of cereals: W and R strains, and resistance to benzimidazoles in Western Switzerland (1984-1995)]. Le pietin-verse des cereales: les souches rapides et lentes, et la resistance aux benzimidazoles en Suisse romande (1984-1995). *Revue*

*suisse d'agriculture (Switzerland)* v. 29(2) p. 65-70. 4 tables, 6 graphs, 1 photo, 17 ref. French. (AGRIS 97-078275).

The evolution of the W and R types and the resistance to carbendazim in *Pseudocercospora herpotrichoides* have been investigated in Western Switzerland between 1984 and 1995. In winter wheat and barley average base populations of *P. herpotrichoides* (from untreated plants) contained about 30 % of R isolates. On wheat 1 % of isolates were of the R type in 1984, while this proportion fluctuated between 25 and 50 % from 1988 to 1995. From 1984 to 1993 an average of 11-12 % of isolates from wheat and barley was resistant to carbendazim (MBC-res isolates). MBC-res isolates were rarely found from 1984 to 1987 (0 to 2 %). They increased from 11 % in 1988 to 39 % in 1993 in wheat. There were regional differences in the relative populations of the W and R types. Type R was dominant in the Gros-de-Vaud/Jorat area (650-880 m above sea level), while W type predominated in the Lake of Geneva area (400-450 m). The numbers of R isolates from eyespot lesions on untreated plants progressively increased from late April on. There was no significant correlation between the severity of eyespot at GS85 and the proportions of R isolates in the base populations. MBC-res isolates were slightly more abundant in the R type than in the W type. There was a trend towards a significant correlation between the proportions of R isolates and those of MBC-res isolates in base populations. R isolates were predominant in MBC-res populations. W isolates which were MBC-res significantly increased from 1987 to 1993, while R isolates which were MBC-res did not.

4077 Halama, P. (Institut Supérieur d'Agriculture, Lille (France)) (1994) [Cultural biology and natural biology of *Phaeosphaeria nodorum* Hedj. [*Leptosphaeria nodorum* Muell.], causal agent of Septoria-like disease in wheat]. *Biologie naturelle et biologie culturale de Phaeosphaeria nodorum*, agent responsable d'une septoriose du ble. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(3a) p. 869-876. 4 tables; 29 ref. French. (AGRIS 97-078285).

4078 Harvey, T.L.; Martin, T.J.; Seifers, D.L.; Sloderbeck, P.E. (1997) CHANGE IN VIRULENCE OF WHEAT CURL MITE DETECTED ON TAM 107 WHEAT. *Crop Science*. 37(2):624-625. English. [KANSAS STATE UNIV AGR RES CTR HAYS, KS 67601 USA].

Wheat streak mosaic is the most important wheat (*Triticum aestivum* L.) disease in western Kansas. The wheat cultivar TAM 107 has been resistant to the wheat curl mite (WCM, *Aceria tosichella* Keifer), which is the vector of wheat streak mosaic virus (WSMV) and as the most popular wheat cultivar in western Kansas has effectively reduced the incidence of the disease. In 1991, several observations indicated that the incidence of WSMV infection in TAM 107 was much heavier than usual. In 1992, a survey of 10 field collections of WCM showed that one collection from TAM 107 was virulent to that cultivar. In 1995, WCM collections from TAM 107 and 'Karl' (susceptible to WCM) were made from 14 western Kansas counties and tested for virulence to TAM 107. All collections of WCM obtained from TAM 107 were adapted to TAM 107, and nine of the 14 collections from Karl were adapted to TAM 107. The high incidence of a WCM strain virulent to TAM 107 may explain the increased losses to WSMV recently observed in that cultivar. TAM 107 probably cannot be relied on in the future to provide protection against WSMV in western Kansas. Lines derived from sources of resistance that are effective against WCM virulent to TAM 107 or that are resistant to WSMV are being advanced in wheat breeding programs and should be deployed in the field as soon as possible. [References: 12].

4079 Hedke, K.; Klink, H.; Krieg, U.; Wehrmann, A.; Verreet, J. A. (Kiel Univ. (Germany). Inst. fuer Phytopathologie) (1997) [Integrated plant protection system - Model for wheat on example of Amistar]. *IPS Modell Weizen am Beispiel Amistar. Getreide Magazin (Germany)* v. 3(1) p. 26-36. 23 ill. German. (AGRIS 97-078277).

4080 Herman, J.L.; Couvreur, L. (Centre de Recherches Agronomiques de l'Etat, Gembloux (Belgium). Station de Phytotechnie) (1994) [Cultural practices and the fungicide control in winter wheat crops]. *Approche phytotechnique de la lutte fongicide en froment d'hiver*. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(3a) p. 1035-1045. 5 ill.; 10 tables; 7 ref. French. (AGRIS 97-078287).

4081 Jensen, B.; Munk, L. (1997) NITROGEN-INDUCED CHANGES IN COLONY DENSITY AND SPORE PRODUCTION OF ERYSIPIE GRAMINIS F SP HORDEI ON SEEDLINGS OF SIX SPRING BARLEY CULTIVARS. *Plant Pathology*. 46(2):191-202. English. [ROYAL VET & AGR UNIV DEPT PLANT BIOL PLANT PATHOL SECT THORVALDSENSVEJ 40 DK-1871 FREDERIKSBERG C DENMARK].

The influence of increasing nitrogen supply (30, 60, 120 and 240 mg N per pot) on susceptibility was studied on seedlings of six cultivars of spring barley inoculated with virulent isolates of powdery mildew. The colony density (CD) measured as colonies per cm<sup>2</sup> was significantly increased with increasing application of nitrogen on all cultivars, and a significant interaction was found between N and cultivar. The different reactions of the cultivars could not be ascribed to lack of N uptake. In general, increasing N application enhanced the sporulation capacity of colonies (CSC) irrespective of increased CD and the cumulative production of spores per cm<sup>2</sup> leaf (CSCM) increased strongly with N application in all cultivars. No interaction between N and cultivar was found for the latter component. The increase in CSCM closely corresponded with the increase in N content and fresh weight of uninoculated leaves. No interaction between N treatment and powdery mildew isolates was found for infection efficiency and spore production per colony, when tested on one cultivar. The N-induced changes in infection and sporulation can explain the main part of the increasing effect of N fertilization on powdery mildew development in the field. The results indicate that it may be possible to breed for or select barley cultivars with low N impact on powdery mildew development. [References: 49].

4082 Jevtic, R. (Naucni institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)); Stojanovic, S.; Dopudja, M.; Matijevic, D.; Milosevic, M. (1997) [Occurrence of bunts and smuts in Serbia [Yugoslavia]]. *Pojava glavnice i gari u Srbiji* [Yugoslavia]. 31. seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naucni institut za ratarstvo i povrtarstvo (Yugoslavia)* (no.29) p. 217-223. 1 table; 11 ref. Serbian. (AGRI 97-078283).

In Serbia (Yugoslavia), the major agent of common bunt is *Tilletia tritici*, while *Tilletia levis* is the minor agent. *Ustilago tritici* is the loose smut agent on wheat, *Ustilago nuda* the loose smut agent on barley. In 1993, 179 samples from 43 locations were analyzed. Common bunt was registered in 73.7 of the samples; 51.5 of these had bunt-infected grains and 48.5 were contaminated with *Tilletia tritici* chlamydospores. In 1996, the microscopic analysis of the 120 samples showed that chlamydospores were present in 85.3 of the samples. In 1995, 103 wheat cultivars were tested for resistance to common bunt in the field. Based on the exhibited infection intensity, the cultivars were grouped into six categories. The occurrence of loose smut in wheat was insignificant while the six-row barleys had up to 10 of infected grains. Two-row barleys were found to be more resistant to the disease than the six-row ones.

4083 Jonsson, R.; Bryngelsson, T.; Gustafsson, M. (1997) VIRULENCE STUDIES OF SWEDISH NET BLOTCH ISOLATES (*DRECHSLERA TERES*) AND IDENTIFICATION OF RESISTANT BARLEY LINES. *Euphytica*. 94(2):209-218. English. [SWEDISH UNIV AGR SCI DEPT PLANT BREEDING RES S-26831 SVALOV SWEDEN].

Six Swedish and one Canadian single spore isolate of *Drechslera teres* f. *teres* were used to screen 109 barley lines for disease resistance and to select a differential set of barley lines for use in assessing pathogen virulence. A large variation for net blotch resistance was found among the 109 barley lines which were classified into four groups, those showing: 1) only resistant reactions; 2) differential reactions; 3) only intermediate reactions and 4) only susceptible reactions. The European commercial varieties included, showed susceptibility to all Swedish isolates, but a few were resistant to the Canadian isolate. The 18-member differential set separated 25 Swedish and two Canadian isolates of *D. teres* into 14 pathotypes, three of which made up 59% of the isolates. Only one barley differential (CI 9776) was resistant to all net form isolates. Host selection on the pathogen seems to be present as all six isolates obtained from cv. Golf belonged to the same pathotype and 4 of 5 isolates from cv. Karin shared the same virulence pattern. The net form of net blotch (*D. teres* f. *teres*) predominated in the sampled regions and only one of 26 Swedish isolates was of the spot form (*D. teres* f. *maculata*). [References: 41].

4084 Kalberer, N.; Gisi, U. (1997) EFFECT OF SOIL MATRIC POTENTIAL ON SHARP EYESPOT IN GERMINATING WHEAT

FOLLOWING SEED TREATMENT. *Zeitschrift für Pflanzenernährung und Bodenkunde*. 160(2):195-199. English. [NOVARTIS CROP PROTECT AG AGR VERSUCHSSTN CH-4108 WITTERSWIL SWITZERLAND].

The influence of soil matric potential on sharp eyespot was examined in wheat seedlings following seed treatment with the fungicide cyproconazole. Emergence of wheat was tested at matric potentials between 0 and -850 hPa in non-infested soil and in soil infested with *Rhizoctonia cerealis*. Optimal shoot emergence was at -50 and -20 hPa in non-infested and infested soil, respectively. Disease severity was strongly affected by soil matric potential. It continuously increased as matric potential decreased from -5 to -200 hPa. In contrast, optimum growth conditions for the pathogen was at matric potentials between -50 and -200 hPa. With decreasing matric potential the drought stress for the plant seems to increase its predisposition to the pathogen. Seed treatment with cyproconazole reduced sharp eyespot although disease severity increased with decreasing soil matric potential. [References: 21].

4085 Katis, N.; Tzavellaklonari, K.; Adams, M.J. (1997) OCCURRENCE OF BARLEY YELLOW MOSAIC AND BARLEY MILD MOSAIC BYMOVIRUSES IN GREECE. *European Journal of Plant Pathology*. 103(3):281-284. English. [ARISTOTELIAN UNIV THESSALONIKI FAC AGR PLANT PATHOL LAB GR-54006 THESSALONIKI GREECE].

In March 1991, large chlorotic patches appeared in an autumn-sown barley crop growing near Thessaloniki, Greece. Leaves had characteristic mosaic symptoms and immunosorbent electron microscopy and enzyme-linked immunosorbent assay confirmed the presence of both soil-borne mosaic viruses of barley, barley mild mosaic and barley yellow mosaic bymoviruses. In the following year, similar symptoms appeared in a crop at Souroti, 30 km east of Thessaloniki but the disease has not been found in other areas of Macedonia. This report is the first record of these viruses from Greece and is the most southerly European record. [References: 20].

4086 Kim, H.K. (Gyeongsang National University, Chinju (Korea Republic). Department of Agricultural Biology); Sands, D.C. (Montana State University, Bozeman (USA). Department of Plant Pathology) (1996) Development of a selective medium for *Xanthomonas campestris* pv. *translucens*. *Korean Journal of Plant Pathology (Korea Republic)* v. 12(4) p. 381-388. 7 tables; 16 ref. English. (AGRI 97-077952).

4087 Kintia, P.K. (Academy of Sciences of Moldova, Chisinau, Moldova.); Lupashku, G.A. (1996) Regulatory effects of saponins in the pathogenesis of root rots in cereal crops. *Saponins used in food and agriculture* p. 75-82. Plenum Press. references. Proceedings of the 210th National Meeting of the American Chemical Society Symposium on "Saponins: Chemistry and Biological Activity" held August 22-25, 1995, in Chicago, Illinois. English. (AGRI 97-077934).

4088 Kolmer, J.A. (Agriculture and Agri Food Canada, Winnipeg, Manitoba, Canada.) (1996) Genetics of resistance to wheat leaf rust. *Annual review of phytopathology (USA)* v. 34 p. 435-455. references. English. (AGRI 97-063431).

4089 Law, C.N.; Worland, A.J. (1997) THE CONTROL OF ADULT-PLANT RESISTANCE TO YELLOW RUST BY THE TRANSLOCATED CHROMOSOME 5BS-7BS OF BREAD WHEAT. *Plant Breeding*. 116(1):59-63. English. [JOHN INNES CTR PLANT SCI RES COLNEY LANE NORWICH NR4 7UJ NORFOLK ENGLAND].

The reciprocal translocation 5BL-7BL and 5BS-7BS was widespread in West European wheats 30 years ago, and is probably present in many of their descendants today. In varieties with a history of durable adult-plant resistance to yellow rust and carrying this translocation, removal of the 5BS-7BS chromosome gave adult plants which were much more susceptible. It was suggested that this chromosome might therefore carry the gene(s) responsible for a major part of their resistance and possibly their durability. To test this, a series of lines was developed in which 5BS-7BS chromosomes from both resistant and susceptible varieties were substituted into a number of the durably resistant varieties. In every case, the substituted 5BS-7BS chromosome, irrespective of origin, was found to produce the resistant phenotype, indicating that background chromosomes were responsible for the differences between the varieties. The resistance and durability of the resistant varieties cannot therefore be due solely to the translocated chromosome. In similar experiments, the 5BS and 7BS arms from varieties not carrying the translocation were substituted into a variety carrying the trans location. In each instance, the



lines with the substituted arms were much more susceptible than their recipient, confirming the major effect of the 5BS-7BS chromosome on resistance. The complete correlation between the translocation and resistance and between increased susceptibility and its absence suggests that the gene(s) for adult-plant resistance, located on the 5BS-7BS chromosome, may be closely linked to the break point. Alternatively, it may be a consequence of the close relatedness of some of the varieties. The presence of this gene(s) might be a factor explaining the prevalence of this translocation in some West European wheats. [References: 11].

4090 Lesovaya, G.M.; Sozinov, I.A.; Goshlyev, A.N. (Ukrainian Academy of Agricultural Sciences, Kiev (Ukraine). Institute of Arable Farming) (1996) [Assessment of wheat resistance to diseases using the molecular-genetic markers as ecologically safe method of plant protection]. *Otsenka ustojchivosti pshenitsy k boleznyam s pomoshch'yu molekulyarno-geneticheskikh markerov kak ehkologicheskii bezopasnyy metod zashchity rastenij*. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologo-ehkonomicheskie osnovy usovershenstvovaniya integririrovannykh sistem zashchity rastenij ot vreditel'ev, boleznej i sornjakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 28-29. BRIPP. Russian. (AGRIS 97-078290).

4091 Levashova, G.I.; Anpilogova, L.K. (VNIIBZR, Krasnodar (Russian Federation)) (1996) [Role of wheat varieties in the spread of physiological races and selection of genes of virulence of powdery mildew agent on Northern Caucasus]. *Rol' sortov pshenitsy v rasprostraneni fiziologicheskikh ras i otbore genov virulentnosti vozbuditelya muchnistoj rosy na Severnom Kavkaze*. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologo-ehkonomicheskie osnovy usovershenstvovaniya integririrovannykh sistem zashchity rastenij ot vreditel'ev, boleznej i sornjakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 29-30. BRIPP. Russian. (AGRIS 97-078291).

4092 Lyons Johnson, D. (1997) Two leaf rusts found where one expected. *Agricultural research (Washington, D.C.) (USA) v. 45(2) p. 22*. English. (AGRIS 97-078282).

4093 Manzhelsova, N.E.; Morozik, G.V. (Academy of Sciences of Belarus, Minsk (Belarus). Institute of Experimental Botany) (1996) [Phenolic compounds content and peroxidase activity in immunized barley plants]. *Soderzhanie fenol'nykh soedinenij i aktivnost' peroksidazy v immunizirovannykh rasteniyakh yachmenya*. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests, diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkologo-ehkonomicheskie osnovy usovershenstvovaniya integririrovannykh sistem zashchity rastenij ot vreditel'ev, boleznej i sornjakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 31-32. BRIPP. Russian. (AGRIS 97-077950).

4094 Mathre, D.E. (Montana State University, Bozeman, MT.) (1996) Dwarf bunt: politics, identification, and biology. *Annual review of phytopathology (USA) v. 34 p. 67-85*. references. English. (AGRIS 97-063430).

4095 Mathre, D.E.; Kushnak, G.D.; Martin, J.M.; Grey, W.E.; Johnston, R.H. (1997) EFFECT OF RESIDUE MANAGEMENT ON BARLEY PRODUCTION IN THE PRESENCE OF NET BLOTCH DISEASE. *Journal of Production Agriculture*. 10(2):323-326. English. [MONTANA STATE UNIV DEPT PLANT PATHOL BOZEMAN, MT 59717 USA].

Three residue management schemes were evaluated to determine the effect of barley (*Hordeum vulgare* L.) straw residue on disease incidence and agronomic qualities of two barley cultivars over a 3-yr period. Half of the no-till, one cultivation, or burned plots that were planted with either a leaf spot susceptible or a leaf spot resistant cultivar, were sprayed with several applications of Tilt fungicide (propiconazole-1-[[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]methyl]-1H-1,2,4-triazole) at 4

fl oz/acre. The disease resistant cultivar Baronesse had a higher yield than the susceptible cultivar Harrington in all 3 yr by an average of 14 bu/acre. Application of Tilt fungicide had a similar effect on both cultivars and increased the yield of Harrington by an average of 9.6 bu/acre and Baronesse by an average of 9.0 bu/acre. Test weight and percentage plump seed were higher with Baronesse than with Harrington. Percentage seed protein and percentage thin kernels increased with disease susceptibility. Although the experimental design did not allow for direct comparisons among residue management treatments, the impact of residue management tended to vary over the 3 yr. Highest yields were harvested from the burned treatment in 1994 and 1995, while this same treatment produced the lowest yields in 1993. [References: 13].

4096 McCay Buis, T.S. (Indiana Department of Natural Resources, Indianapolis, IN.); Huber, D.M.; Graham, R.D.; Phillips, J.D.; Miskin, K.E. (1995) Manganese seed content and take-all of cereals. *Journal of plant nutrition (USA) v. 18(8) p. 1711-1721*. references. English. (AGRIS 97-063429).

Manganese (Mn) is a critical regulator of many physiological defense reactions of plants to disease; and the severity of take-all root, crown, and foot rot of cereals has been correlated with such cultural practices as form of nitrogen (N), pH adjustment, and crop rotation which all influence the availability of Mn. This study was initiated to determine if the content of Mn in seed influences the severity of take-all. Five cultivars of soft red winter wheat (*Triticum aestivum* L.) were grown under two widely different ecological conditions (alkaline, low Mn soil and Mn sufficient soil) to modify their Mn seed content. Four cultivars (Cardinal, Lincoln, Steele, and Twain) differed by 10 to 18 microgram g<sup>-1</sup> in Mn seed content (0.33 to 60 microgram seed<sup>-1</sup>) while the Mn seed content of one cultivar (Caldwell) was similar from both locations. All cultivars were grown at three field locations in Indiana with natural infestations of *Gaeumannomyces graminis* var. *tritici* (Ggt). Under these moderately-severe to severe disease conditions, plants from seed with the higher Mn seed content were generally more vigorous, had an average of 11% less take-all (white heads), and yielded an average of 165 kg/ha more grain than plants from seed of the same cultivar with a lower Mn content. No significant differences in vigor, yield, or take-all severity were observed with either source of the cultivar grown from seed produced under widely different environments unless there was a significant difference in Mn seed content.

4097 McGrath, P.F. (Purdue Univ., West Lafayette, IN (USA). Dept. of Botany and Plant Pathology); Lister, R.M.; Hunter, B.G. (1996) A domain of the readthrough protein of barley yellow dwarf virus (NY-RPV isolate) is essential for aphid transmission. *European Journal of Plant Pathology (Netherlands) v. 102(7) p. 671-679*. 37 ref. English. (AGRIS 97-077716).

4098 Meeus, P. (Centre de Recherches Agronomiques, Gembloux (Belgium). Station de Phytopharmacie); Bodson, B. (1994) [Modulation of fungicide dose applied at flag leaf stage to control foliar diseases on winter barley in Belgium]. *Modulation de la dose de fongicide applique au stade demiere feuille pour lutter contre les maladies foliaires de l'orge d'hiver en Belgique*. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium) v. 59(3a) p. 1141-1148*. 5 tables; 5 ref. French. (AGRIS 97-077946).

Trials carried out on winter barley crops (*Hordeum vulgare* L. polystichum L.) show the importance of fungicide protection at stage 31 (1st node) and especially stage 39 (flag leaf). An analysis of climatical conditions enables to confirm risks of cryptogamic developments and to justify necessary interventions. An optimisation of fungicide protection at stage 39 can be obtained by increasing the dose of fungicide applied. The use of an increased dose at stage 39 depends on the state of the crop and on interventions carried out at stage 31 as well as rainfall between stages 31 and 39. By increasing the dose at stage 39, the yield level reached is close to that obtained following a double application at normal dose at stages 31 and 39. This improves cost-efficiency of fungicide protection and decreases the number of interventions.

4099 Meyer, M. (Institut National de la Recherche Agronomique, Versailles, France.); Dessens, J.T. (1996) The complete nucleotide sequence of barley mild mosaic virus RNA1 and its relationship with

other members of the Potyviridae. *Virology (USA)* v. 219(1) p. 268-273. references. English. (AGRIS 97-078203).

The complete nucleotide sequence of RNA1 of a French barley mild mosaic bymovirus isolate has been determined. The molecule is composed of 7261 nucleotides and contains a single large open reading frame encoding a protein of 2258 amino acids with a calculated Mr of 256, 375. Amino acid sequence comparison with poty- and rymoviruses reveals eight domains corresponding to the potyviral P3, 6K1, CI, 6K2, Nla-VPg, Ma-Pro, Nlb and capsid proteins, respectively. Seven putative cleavage sites, similar to those mediated by potyvirus Nla proteinases, were identified. The presence of two, so far undescribed putative cleavage sites (6K2/Nla-VPg and Nla-VPg/Nla-Pro) in the polyproteins encoded by RNA1 of barley yellow mosaic virus and wheat spindle streak mosaic virus, was predicted. These data indicate that the bymovirus RNA1 fits the consensus potyviral genetic map downstream of the helper component gene.

4100 Miedaner, T.; Gang, G.; Reinbrecht, C.; Geiger, HH. (1997) LACK OF ASSOCIATION BETWEEN FUSARIUM FOOT ROT AND HEAD BLIGHT RESISTANCE IN WINTER RYE. *Crop Science*. 37(2):327-331. English. [UNIV HOHENHEIM STATE PLANT BREEDING INST 720 D-70593 STUTTGART GERMANY].

Foot rot and head blight caused by *Fusarium culmorum* (W.G. Sm.) Sacc. may lead to considerable loss of yield and grain quality in winter rye (*Secale cereale* L.). Breeding for resistance to the two diseases would be facilitated if the same resistance mechanisms were involved. The purpose of this study was to estimate the genetic correlation between the resistance to the two diseases in advanced winter rye breeding materials. Twenty self-fertile inbred lines were grown at two locations in South Germany in 1992, 1993, and 1994 (six environments). Lines were arranged in three adjacent treatment blocks: no inoculation, inoculation for foot rot, and inoculation for head blight. Disease severity was rated on a 1-to-9 scale for foot rot and head blight. Besides the foot rot and head blight rating scale, ELISA (enzyme-linked immunosorbent assay) was used to quantify the amount of *Fusarium* protein within stem tissue from the foot rot treatment and relative grain weight was measured from the head blight treatment. In all but one environment, *F. culmorum* was re-isolated from diseased stems at high percentages (greater than or equal to 90%). Disease severity was moderate for foot rot and head blight rating at all environments. Mean ELISA absorbance was 0.55 and mean relative grain weight 77.4%. Significant genotypic variation existed for all resistance traits. Broad-sense heritabilities, calculated on an entry-mean basis, were high for foot rot and head blight rating ( $h^2$ ) approximate to 0.8) and somewhat lower for ELISA absorbance and relative grain weight ( $h^2$ ) approximate to 0.5-0.6). No significant correlation was found between the resistances to foot rot and head blight. This was confirmed by a highly significant ( $P = 0.01$ ) genotype-plant organ interaction. Thus, resistance mechanisms most likely differ for the two diseases. Resistance selection requires separate multi-environmental screening tests for *F. culmorum* foot rot and head blight. [References: 34].

4101 Mueller, K. (Swiss Federal Inst. of Technology, Zuerich (Switzerland). Inst. of Plant Sciences); McDermott, J.M.; Wolfe, M.S.; Limpert, E. (1996) Analysis of diversity in populations of plant pathogens: the barley powdery mildew pathogen across Europe. *European Journal of Plant Pathology (Netherlands)* v. 102(4) p. 385-395. 38 ref. English. (AGRIS 97-077719).

4102 Obst, A. (Landesanstalt fuer Bodenkultur und Pflanzenbau Muenchen, Freising (Germany). Lehrstuhl fuer Phytopathologie) (1995) [Plant production - fungi control in barley. Barley diseases]. Pflanzenproduktion - Pilzbekämpfung in Gerste. Gerstenkrankheiten: Diagnosehilfe und Entscheidungshilfe zum Gerstenmodell Bayern. Dlz. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany) v. 46(3) p. 28-30, 32-36, 38-40, 42. German. (AGRIS 97-063239).

4103 Olasyuk, O.P. (Ukrainian Academy of Agricultural Sciences, Kiev (Ukraine). Institute of Plant Protection) (1996) [Resistance of wheat genetical resources to the agent of leaf rust]. Ustojchivost' geneticheskikh resursov shenitsy k vozbuditel'yu burj listovoj rzhavchiny. Abstracts of reports of science-production conference dedicated to the 25th anniversary of BRIPP (Minsk-Priluki, 14-16 February of 1996). Part 2. Minsk (Belarus). 14-16 Feb 1996. [Ecological and economical bases for perfecting the integrated systems of protection of plants from pests,

diseases and weeds]. Samersov, V.F.; Sorochinskij, L.V. (eds.). *Ehkolohicheskoe osnovy usovershenstvovaniya integrirovannykh sistem zashchity rastenij ot vreditel'ej, boleznej i sornyakov*. Belarus Research Institute of Plant Protection, Minsk (Belarus) p. 33-34. BRIPP. Russian. (AGRIS 97-078292).

4104 Perkowski, J. (Agricultural Univ. of Poznan (Poland). Dept. of Chemistry); Kiecana, I.; Schumacher, U.; Mueller, H.M.; Chelkowski, J.; Golinski, P. (1996) Head blight and biosynthesis of *Fusarium* toxins in barley kernels field inoculated with *Fusarium culmorum*. *European Journal of Plant Pathology (Netherlands)* v. 102(5) p. 491-496. 28 ref. English. (AGRIS 97-077953).

4105 Pfister, A. (Bundesanstalt fuer Fleischforschung, Kulmbach (Germany)) (1995) [Fungal diseases - watch for foot diseases, leaf diseases and spike diseases]. Pilzkrankheiten im Visier: Auf Fusskrankheiten, Blattkrankheiten und Aehrenkrankheiten achten. Dlz. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany) v. 46(1) p. 30-33. German. (AGRIS 97-063420).

4106 Ramakrishna, N.; Lacey, J.; Smith, JE. (1996) ASPERGILLUS FLAVUS COLONIZATION AND AFLATOXIN B-1 FORMATION IN BARLEY GRAIN DURING INTERACTION WITH OTHER FUNGI. *Mycopathologia*. 136(1):53-63. English. [AFRC INST ARABLE CROPS RES ROTHAMSTED EXPT STN HARPENDEN AL5 2JQ HERTS ENGLAND].

Colonization of barley grain by *Aspergillus flavus* and formation of aflatoxin B-1 in the presence of *Penicillium verrucosum*, *Fusarium sporotrichioides*, and *Hyphopichia burtonii* were studied over a three-week period in all combinations of 20 or 30 degrees C and 0.97, 0.95 or 0.90 a(W). Grain colonization was assessed initially by observing hyphal extension on the grain surface, using scanning electron microscopy, and then from the proportion of seeds infected and numbers of colony forming units (cfu) formed. Aflatoxin B-1 concentrations were determined by enzyme linked immunosorbent assay using a monoclonal antibody. These studies showed that interaction between *A. flavus* and other fungi in paired culture had different effects on both colonization and aflatoxin formation depending on the species involved and environmental conditions. Germination of *A. flavus* spores was unaffected by the presence of other species on the grain surface. Subsequently, three principal patterns of *A. flavus* colonization of barley grain were observed through the incubation period in the presence of other fungal species: (a) colonization unaffected by the presence of other species; (b) colonization initially slower in the presence of other species but later differing little from pure cultures; and (c) colonization adversely affected by the presence of other species. Five main patterns of aflatoxin B-1 production were observed relative to pure culture but with no consistent relationship with species, a(W), temperature or incubation period; (a) little changed; (b) increased slowly; (c) decreased; (d) enhanced; and (e, f) increased initially but later decreased to (e) the same level as in pure culture or (f) to less than in pure culture. Generally, production of aflatoxin B-1 by *A. flavus* was less than in pure culture but sometimes was changed only slightly by the presence of *P. verrucosum*, *F. sporotrichioides* or *H. burtonii* or was temporarily enhanced. [References: 29].

4107 Rengel, Z. (1997) DECREASED CAPACITY OF TAKE-ALL FUNGUS TO OXIDIZE MANGANOUS IONS IS ASSOCIATED WITH TAKE-ALL DECLINE. *Journal of Plant Nutrition*. 20(4-5):455-460. English. [UNIV WESTERN AUSTRALIA FAC AGR NEDLANDS WA 6907 AUSTRALIA].

The phenomenon of decline of take-all [a disease on wheat caused by *Gaeumannomyces graminis* var. *tritici* (Ggt)] is poorly understood. In this study, the capacity of Ggt strains, isolated from wheat roots grown in the field plots exhibiting various levels of take-all decline, to oxidize Mn<sup>2+</sup> ions was tested. Growth of all Ggt isolates on agar was increased by an addition of up to 100 mg.L<sup>-1</sup> Mn<sup>2+</sup> and was decreased by greater concentrations. The Ggt isolates oxidized Mn<sup>2+</sup> to Mn<sup>3+</sup> and/or Mn<sup>4+</sup>. There was a negative relationship ( $r = -0.69$ ) between the Mn<sup>2+</sup> oxidation ranking and the extent of take-all decline. A decreased capacity to oxidize Mn<sup>2+</sup> causes a decrease in Ggt virulence and may result in decline in take-all. This mechanism of take-all decline is expected to act additively with other factors. [References: 16].

4108 Restrepo Hartwig, M.A. (University of Wisconsin, Madison, WI.); Ahlquist, P. (1996) Brome mosaic virus helicase- and polymerase-like proteins colocalize on the endoplasmic reticulum at sites of viral RNA

synthesis. *Journal of virology (USA)* v. 70(12) p. 8908-8916. references. English. (AGRIS 97-063361).

The helicase-like 1a and polymerase-like 2a proteins of brome mosaic virus (BMV) are required for viral RNA replication in vivo, are present in membrane-bound viral RNA polymerase extracts, and share conservation with the many other members of the alphavirus-like superfamily. To better understand BMV RNA replication and BMV-host interactions, we used confocal microscopy and double-label immunofluorescence to determine and compare the sites of 1a, 2a, and nascent viral RNA accumulation in BMV-infected barley protoplasts. 1a and 2a showed nearly complete colocalization throughout infection, accumulating in defined cytoplasmic spots usually adjacent to or surrounding the nucleus. These spots grew throughout infection and by 16 h postinoculation often assumed a vesicle-like appearance. The BMV RNA replication complex incorporated 5-bromouridine 5'-triphosphate into RNA in vitro and in vivo, allowing immunofluorescent detection of nascent RNA. The cytoplasmic sites of BMV-specific RNA synthesis coincided with the sites of 1a and 2a accumulation, and at the resolution of confocal microscopy, all sites of 1a and 2a accumulation were sites of BMV RNA synthesis. Double-label immunofluorescence detection of selected subcellular markers and 1a or 2a showed that BMV replication complexes were tightly associated with markers for the endoplasmic reticulum but not the medial Golgi or later compartments of the cellular secretory pathway. Defining this association of BMV RNA replication complexes with endoplasmic reticulum markers should assist in identifying and characterizing host factors involved in BMV RNA replication.

4109 Robertson, S.; Gilmour, J.; Newman, D.; Lennard, J.H.; Hollomon, D.W. (SAC, West Mains Road, Edinburgh EH9 3JG (United Kingdom)) (1996) Sensitivity of barley powdery mildew to morpholine fungicides: I. Work in Scotland; II. Work in England and Wales. *HGCA Project Report (United Kingdom)*; no. 127 v+77 p. Home Grown Cereals Authority. 31 ref. English. (AGRIS 97-078071).

4110 Robinson, J.; Jalli, M. (1997) QUANTITATIVE RESISTANCE TO PYRENOPHORA TERES IN SIX NORDIC SPRING BARLEY ACCESSIONS. *Euphytica*. 94(2):201-208. English. [AGR RES CTR FINLAND MTT INST CROP & SOIL SCI PLANT BREEDING RES SECT JOKIOINEN 31600 FINLAND].

Resistance to *Pyrenophora teres* Drechs. f. *teres* Smedeg., the net blotch pathogen, was studied in six 6-row Nordic spring barleys (*Hordeum vulgare* L.) in the field and in the greenhouse. The barley genotypes were: Arve, Agneta, Artturi, H6221, Pohto and WW7977. Disease progress was monitored in the field (1994 and 1995) in small artificially infected plots, sown at commercial seeding rates, and in infected hill plots (1994). Areas under the disease progress curves (AUDPC) and apparent infection rates (r) were calculated for the uppermost 3 or 4 leaves. Terminal severities (TS) were also recorded. Infection response of seedlings to a range of *P. teres* isolates was assessed in the greenhouse using a standard scale. In small plots in the field, Arve and Agneta were very susceptible to *P. teres* infection, as indicated by large values for AUDPC and TS. H6221 and WW7977 were highly resistant, while Artturi and Pohto were moderately resistant. In hill plots the situation was similar, except that Artturi and Pohto appeared less resistant than in the small plots. The relatively greater resistance of H6221 and WW7977 was reflected in seedling infection responses. According to the results of these experiments, H6221 and WW7977 possess adequate levels of quantitative resistance to *P. teres* to make them useful parents in future crossing programs aimed at improving net blotch resistance in Finnish spring barleys. [References: 13].

4111 Sachs, E.; Klappach, K. (Biologische Bundesanstalt fuer Land und Forstwirtschaft, Kleinmachnow (Germany). Aussenstelle) (1996) [Diagnosis of net blotch disease of barley]. *Netzflecken sicher erkennen. DLG-Mitteilungen (Germany)* (no.12) p. 37-39. German. (AGRIS 97-077756).

4112 Sakova, L.; Curn, V.; Kutner, V. (Jihoceska Univ., Ceske Budejovice (Czech Republic). Zemedelska Fakulta) (1996) [Influence of variety mixtures on yield components in spring wheat under the infection by stem rust]. Vliv smesi odrud na vynosove komponenty jarni pšenice po napadení rzí travní. *Sborník Jihoceska Univerzita. Zemedelska Fakulta Ceske Budejovice, Rada Fytotechnicka (Czech Republic)* v. 13(1) p. 63-70. 4 graphs, 3 tables; 12 ref. Czech. (AGRIS 97-078293).

4113 Santorelli, S.; Porta Puglia, A. (Istituto Sperimentale per la Patologia Vegetale, Rome (Italy)) (1996) [Health condition of wheat seed lots produced in Italy during 1991-1993]. *Situazione sanitaria di sementi di frumento prodotte in Italia nel triennio 1991-1993. Sementi Elette (Italy)* v. 42(5) p. 21-24. 5 tables; 9 ref. Italian. (AGRIS 97-063432).

Seed samples from lots of wheat harvested during 1991-1993 have been tested for seed mycoflora. *Fusarium* spp., *Microdochium nivale* and *Bipolaris sorokiniana* were frequently observed, although with different incidence, according to year and location. Out of 85 samples examined both for bread and durum wheat, four and ten, respectively, were heavily infected (total infection >15%) by pathogenic fungus species. Seed lots produced in Southern Italy were consistently less infected than those produced elsewhere. Seed dressing is therefore advisable for most seed lots produced in Northern and Central Italy [Campioni di sementi derivanti da partite di frumento raccolto negli anni 1991-1993 sono stati analizzati per quanto riguarda la micoflora. Sono stati osservati di frequente *Fusarium* spp., *Microdochium nivale* e *Bipolaris sorokiniana*, con differente incidenza in relazione all'annata e alla località. Di 85 campioni analizzati, sia di frumento tenero, sia di frumento duro, quattro e dieci, rispettivamente, presentavano un forte livello di infezione da specie fungine patogene (infezione complessiva >15%). Le partite di sementi prodotte in Italia meridionale presentavano minori infezioni rispetto a quelle prodotte altrove. La concia del seme risulta pertanto consigliabile per la maggior parte delle partite prodotte in Italia settentrionale e centrale].

4114 Saur, L.; Mille, B. (1997) DISEASE PROGRESS OF PSEUDOCERCOSPORELLA HERPOTRICHOIDES IN MIXED STANDS OF WINTER WHEAT CULTIVARS. *Agronomie*. 17(2):113-118. French. [INRA SRIV ROUTE ST CYR F-78026 VERSAILLES FRANCE].

Epidemic development of *Pseudocercospora herpotrichoides* in pure stands of a susceptible variety and a variety with the Pch1 resistance gene, and in their (1:1) mixture was examined in six situations differing for location, fungicide protection or contamination. At growth stage 32, no significant difference was found between the disease level in mixtures and the mean of the disease levels of the mixture components in pure stand. At booting and milky ripe stages, plants sampled in the mixtures were separated according to the variety. No significant difference was found between the disease level in pure stand and in mixed stand either for the susceptible variety nor for the Pch1 one. [References: 16].

4115 Schoeffl, U.; Zinkernagel, V.; Verreet, J.A. (Technische Univ. Muenchen, Freising Weihenstephan (Germany). Lehrstuhl fuer Phytopathologie) (1994) Decision support system to control *Puccinia hordei* on barley based on disease threshold values and weather criteria (United Kingdom 1992 to 1993). 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. *Mededelingen - Faculteit Landbouwkunde en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium)* v. 59(3a) p. 977-985. 3 ill.; 2 tables; 13 ref. English. (AGRIS 97-077944).

A series of field trials was carried out in Suffolk, England, during 1992 and 1993 to evaluate an integrated disease control model for barley. In each year high levels of barley leaf rust established on the upper leaf layers of the winter barley cultivar 'Marinka' whereas other pathogens were present only at low levels that had little or no effects on yield. Although a high proportion of plants was already infected at early growth stages (GS 30 onwards) strong disease development did not occur before GS 71/75. This was mainly due to dependence of *Puccinia hordei* on high temperatures combined with frequent rainfall. The calculated regression equation between weekly mean temperature and disease progress showed exponential character (R-Square = 81 percent) therefore much development of *Puccinia hordei* below weekly mean temperatures of 15 degrees is very unlikely. Using this, with a disease threshold value of more than 30 per cent of infected tillers, it is possible to estimate the need for a fungicide application and then to determine the optimal application timing for most effective control of the fungus. A range of single sprays as well as two and three spray programmes were used to test these decision criteria. Within the trials, yield losses of up to 18 per cent were caused by brown rust and single applications of tebuconazole (Folicur) at GS 45/49 were very effective against this disease, yielding the same as two and three spray programmes at half or full rates of use. The decision criteria enable an effective application timing under variable climatic conditions and have been integrated into a decision support system to control diseases on winter and spring barley.

4116 Serova, Z.Ya; Ges', D.K.; Shanbanovich, G.N.; Sviridov, M.F. (Academy of Sciences of Belarus, Minsk (Belarus). Institute of Experimental Botany) (1996) [Influence of humates on the manifestation by barley plants of defence reaction to the net blotch agent]. *Dejstvie gumatov na proyavlenie rasteniyami yachmenya zashchitnoj reaktsii k vzbuditelyu setchatoj pyatnistosti. Vestsi Akadehmii Navuk Belarusi. Seryya Biyalagichnykh Navuk (Belarus) (no.3) p. 42-46. 1 table, 1 figure, 17 ref. Russian. (AGRIS 97-077947).*

The pre-sowing incrustation of barley seeds with humates increases the viability of vegetating plants and reduces the affection of leaves by *Helminthosporium teres* Sacc. during the first three phases of ontogenesis. Hydro- and oxyhumates are to be regarded as the most effective ones.

4117 Sharma, S.; Gharti Chhetri, Y.D. (Lumle Agricultural Research Centre, Pokhara, Kaski (Nepal)) (1996) Wheat pathological research report, LARC 1996. LARC Seminar Paper (Nepal); no. 96/32 9 p. Lumle Agricultural Research Centre. 3 tables; 5 ref. English. (AGRIS 97-063359).

Wheat disease monitoring conducted during 1995/96 season revealed that leaf blight/leaf spot and leaf rust were most important disease of wide occurrence in low hill of Lumle Agricultural Research Centre's (LARC) Research Command Area. Nepal Wheat Disease Screening Nursery containing 477 entries was planted at LARC in 1995/96. From the nursery, NL645, PWL141, PWL142, BL1648 and H11408 varieties were selected for disease resistance as well as for agronomic traits. The promising varieties NL776, NL773, NL714 and NL665 were found resistant to leaf rust, yellow rust and powdery mildew at Lumle condition. One hundred and fifty five entries of wheat genotypes were screened at Rising Patan with an objective to identify resistant donors for *Helminthosporium* blight disease. Nineteen lines/varieties were selected for low blight disease in flag leaf and also for agronomic traits. They were Chirya1, Chirya7, NL665 and WPH170.

4118 Steden, C. (Ciba Geigy Ltd., Bale (Suisse). Division Crop Protection); Rambach, O.; Forster, B. (1997) [Wheat powdery mildew. Split applications select more less sensitive strains [fenpropimorph]]. *Oldium du ble. Les applications fractionnees selectionnent davantage les souches moins sensibles [fenpropimorphe]. Phytoma La Defense des Vegetaux (France) (no 490) p. 35-38. French. (AGRIS 97-063097).*

4119 Stojanovic, S. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita); Milijic, S.; Stojanovic, J. (1996) [The influence of climatic conditions on intensity of stem rust development]. *Uticaj klimatskih prilika na intenzitet razvoja stabljicne rdje pšenice. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. Drought and plant production: international symposium. The book of abstracts. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadržaja p. 67. Institut za istrazivanja u poljoprivredi "Srbija". (En, Sr). (AGRIS 97-063423).*

4120 Sun, YL.; Steffenson, B.J. (1997) EFFECT OF INCUBATION TIME AND TEMPERATURE ON THE PHENOTYPIC EXPRESSION OF RPG4 TO PUCCINIA GRAMINIS F SP TRITICI IN BARLEY. *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 19(1):25-29. English. [N DAKOTA STATE UNIV DEPT PLANT PATHOL FARGO, ND 58105 USA].*

To study the effect of incubation time and temperature on the phenotypic expression of rpg4, five barley genotypes with this resistance gene were infected with pathotype QCCJ of *Puccinia graminis* f. sp. tritici at the seedling stage, then subjected to various times of incubation at either 18-19 degrees C or 27-28 degrees C. Genotypes with rpg4 exhibited low (0, 0; and 1), mesothetic (e.g. 3-210; 120;3(-)), and high (3(-), 3) infection types at 18-19 degrees C after initial incubation at 27-28 degrees C for 0-28, 40-76, and 88 or more hours, respectively. A period of 65 or more hours of initial incubation at high temperature rendered the rpg4 resistance completely ineffective against this pathotype of P. g. f. sp. tritici. In contrast, high, mesothetic, and low infection types were found for the same genotypes at 27-28 degrees C after initial incubation at 18-19 degrees C for 0-40, 52-100, and 112 or more hours, respectively. The resistant infection types conferred by rpg4 are apparently established within the first 112 hours after the end of the infection period since subsequent shifts to higher temperature did not result in marked changes in the resistance response. These data indicate the critical importance of maintaining precise temperature control when assessing the infection phenotypes of barley genotypes carrying the stem rust resistance gene rpg4. [References: 18].

4121 Tamas, L.; Huttova, J.; Zigova, Z. (1997) PATHOGENESIS-RELATED PROTEINS IN NEAR-ISOGENTIC BARLEY LINES INDUCED BY POWDERY MILDEW INFECTION. *Biologia. 52(1):99-104. English. [SLOVAK ACAD SCI INST BOT DUBRAVSKA CESTA 14 SK-84223 BRATISLAVA SLOVAKIA].*

Induction of pathogenesis-related (PR) proteins in intercellular spaces of near-isogenic barley leaves was examined after inoculation with a virulent and an avirulent race of powdery mildew (*Erysiphe graminis* f. sp. hordei) 24, 48, 72h post-inoculation. Induction of two the pathogen-induced proteins was ascertained 24 h post inoculation. 72h post-inoculation 7 to 8 major pathogen-induced proteins (bands on native PAGE) were identified. The accumulation pattern of PR proteins was very similar in both compatible and incompatible host-pathogen interaction but it was more expressive and appeared earlier at host-parasite incompatibility than at compatibility. These results have confirmed that the resistance gene plays a key role in early recognition of pathogens as well as in early activation of the defence response. [References: 15].

4122 Tari, F. (Silsoe Research Inst., Silsoe, Bedford (United Kingdom). Mathematics and Decision Systems Group) (1996) A Bayesian Network for predicting yield response of winter wheat to fungicide programmes. *Computers and Electronics in Agriculture (Netherlands) v. 15(2) p. 111-121. 21 ref. English. (AGRIS 97-078281).*

4123 Treikale, O.; Trusko, N.; Ipatova, T. (Latvian State Plant Protection Centre (Latvia)); Brokane, R.; Sprindzuks, D. (1997) [The application of pesticides for the intensive technologies of spring wheat (the economical and ecological aspects)]. *Pesticidu lietosana vasaras kviesu intensivajas tehnikas (ekonomiskie un ekologiskie aspekti). Raziiba (Latvia) (no.3) p. 7-9. 3 tables. Latvian. (AGRIS 97-078265).*

4124 Vechet, L. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyně (Czech Republic)) (1996) [Interaction of stem rust (*Puccinia graminis*) and winter wheat in varietal mixtures]. *Interakce rzi travni (Puccinia graminis) a pšenice ozime ve smesi odrud. Ochrana Rostlin - UZPI (Czech Republic) v. 32(4) p. 307-312. 3 tables; 6 ref. Czech. (AGRIS 97-063425).*

The development of stem rust (the race 11) on two components varietal mixtures (the middle resistant Sparta and the middle susceptible Regina) was evaluated on small plot trials. From epidemiological parameters were evaluated a number of affected plants, infection type, disease severity and AUDPC. The mixtures of varieties mainly one with 75 % proportion of middle resistant variety provided significant reducing of the disease. The level of epidemic in mixtures of varieties with 75 and 50 % proportion of the resistant variety approached the level of the middle resistant variety. The mixture with 75 % proportion of the middle susceptible variety had diseased the same number of ears as the variety in the pure stand.

4125 Verjux, N. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1997) [Foliar diseases in wheat. Effects of cultivation practices]. *Maladies foliaires du ble. L'incidence des techniques culturales. Perspectives Agricoles (France) (no 220) p. 86-91. 5 illus., 12 ref., 10 graph. French. (AGRIS 97-077684).*

4126 Vrabcheva, T.; Gessler, R.; Usleber, E.; Martlbauer, E. (1996) FIRST SURVEY ON THE NATURAL OCCURRENCE OF FUSARIUM MYCOTOXINS IN BULGARIAN WHEAT. *Mycopathologia. 136(1):47-52. English. [UNIV MUNICH FAC VET INST HYG & TECHNOL FOOD ANIM ORIGIN VET STR 13 D-80539 MUNICH GERMANY].*

Wheat for human consumption (140 samples) was collected after harvest from all regions of Bulgaria. The 1995 crop year was characterized by heavy rainfall in the spring and summer months. The internal mycoflora of wheat samples was dominated by *Fusarium* spp. and *Alternaria* spp., and storage fungi were rarely present. The samples were analysed for contamination with *Fusarium* mycotoxins deoxynivalenol (DON), 3-acetyldeoxynivalenol (30AcDON), 15-acetyldeoxynivalenol (15-AcDON), T-2 Toxin (T2), diacetoxyscirpenol (DAS), and zearalenone (ZEA), using enzyme immunoassay methods. DON and ZEA were the predominant toxins, with a contamination frequency of 67% and 69%, respectively. The average levels of these toxins in positive samples were 180 mu g/kg (DON) and 17 mu g/kg (ZEA), maximum concentrations were 1800 mu g/kg(-1) and 120 mu g/kg(-1), respectively. Acetyl derivatives of DON, namely 3-AcDON and 15-AcDON, were found in 2.1% and 0.7% of the samples, at a maximum level of about 100 mu g/kg(-1).



1). Only one sample was positive for T-2 (55 µg/kg), DAS was not detected. This is the first report about the natural occurrence of a range of Fusarium mycotoxins in wheat for human consumption in Bulgaria. [References: 24].

4127 Wan, YF.; Yen, C.; Yang, J.L.; Liu, FQ. (1997) EVALUATION OF ROEGNERIA FOR RESISTANCE TO HEAD SCAB CAUSED BY FUSARIUM GRAMINEARUM SCHWABE. *Genetic Resources & Crop Evolution*. 44(3):211-215. English. [SICHUAN AGR UNIV TRITICEAE RES INST DUJIANGYAN 611830 SICHUAN PEOPLES REPUBLIC OF CHINA].

71 accessions from 13 Roegneria species were evaluated for resistance to wheat scab. The results showed that 31 of the 71 accessions possessed high resistance (HR) to initial infection and high resistance (HR) to pathogen spread. The disease spread from inoculated floret to head rachis was not observed, and the incidence of head infection were lower under natural than under artificial inoculation conditions. The intergeneric hybrid F1 of Roegneria tsukushiensis (Honda) B.R. Lu, Yen et J.L. Yang. var. transiens (Hack.) B.R. Lu, Yen et J.L. Yang x Hordeum vulgare Linn. exhibited resistance (R) to pathogen invasion and high resistance (HR) to spread. Therefore, Roegneria could be used as scab resistant resources in cereal breeding. In addition, the relationship between its resistance and ecological environments where Roegneria was distributed was discussed in this paper. [References: 8].

4128 Willems, G.H.; Cetinkaya, N.; Schloesser, E. (Justus Liebig Univ., Giessen (Germany). Inst. fuer Phytopathologie und Angewandte Zoologie) (1994) Induced resistance in oats, barley and wheat through pre-inoculation with incompatible f. spp. of Erysiphe graminis DC. 46th International Symposium on Crop Protection. Gent (Belgium). 3 May 1994. Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent (Belgium) v. 59(3a) p. 961-969. 10 ill.; 1 tables; 19 ref. English. (AGRI 97-077752).

4129 Winter, W. (Eidg. Forschungsanstalt fuer Agrarökologie und Landbau (FAL), Zuerich Reckenholz (Switzerland)); Rogger, C.; Baenziger, I.; Krebs, H.; Rueegg, A.; Frei, P.; Gindrat, D.; Tamm, L. (1997) [Common bunt in wheat: control with skim milk powder]. Weizenstinkbrand: Bekämpfung mit Magermilchpulver. *Agrarforschung (Switzerland) v. 4(4)* p. 153-156. 2 tables, 1 graph, 3 photos, 7 ref. German. (AGRI 97-078276).

In two-year field trials the incidence of common bunt in winter wheat was strongly reduced by seed treatment with skim milk powder (untreated seeds: 73 diseased ears per square m; treated seeds 3 diseased ears per square m). At a high infection level warm water treatment at 45 deg C, 2 hours, was less efficient than the chemical Panocrine DL (18.9 % Guazatine + 2.36 % Difenoconazol, 300 ml/100kg seed) and the skim milk powder seed treatment. However, at a low infection level the warm water treatment of wheat seeds is an alternative to the chemical dressing. The warm water treatment had no damaging effect on germination. Regarding the skim milk powder treatment, future studies on seed germination and field emergence for the main wheat cultivars grown in Switzerland as well as on the application technique are needed. Skim milk powder and warm water treatment should be applied only to certified seed of cultivars with low or medium susceptibility to common bunt.

4130 Yarham, D.J. (ADAS Cambridge, Brooklands Avenue, Cambridge CB2 2BL (United Kingdom)) (1996) Screening of fungicides for the control of ergot (Claviceps purpurea). *HGCA Project Report (United Kingdom)*; no. 126 15 p. Home Grown Cereals Authority. 5 ref. English. (AGRI 97-078068).

4131 Zhou, H. (Fox Chase Cancer Center, Philadelphia, PA.); Jackson, A.O. (1996) Analysis of cis-acting elements required for replication of barley stripe mosaic virus RNAs. *Virology (USA) v. 219(1)* p. 150-160. references. English. (AGRI 97-078186).

The replicative abilities of mutant RNA transcripts derived from barley stripe mosaic virus cDNA clones were investigated in barley protoplasts that had been coinoculated with wild-type RNAalpha and -gamma transcripts. The 5' and 3' noncoding regions were required for replication, and lack of a 5' cap structure (GpppG) reduced the replicative ability substantially. All internal deletions within RNAalpha abrogated replication in trans. A 2-base change that produced a truncated alphaa protein lacking the first 16 amino acids also compromised the ability of RNAalpha to be replicated. In contrast, RNAbeta transcripts containing

deletions involving each ORF and the downstream poly(A) tract were effectively amplified by RNAs alpha and gamma, but collective deletion of all four ORFs drastically reduced accumulation. The intergenic region between betaa and betab was not absolutely required for replication, but small deletions within this region reduced the abundance of RNAbeta by at least 10-fold. Deletions within the first 507 nt of the gammaa ORF abrogated replication. However, transcripts containing deletions within the central and 3' regions of the gammaa ORF, the gammaa-gammab intergenic region, and the gammab ORF could be amplified in trans. Two mutants containing extensive deletions encompassing the central region of the gammaa ORF and most of gamma behaved like defective interfering RNAs because they multiplied to high levels in trans and caused a pronounced reduction in accumulation of the coinoculated wild-type RNAs alpha and gamma.

## H50 MISCELLANEOUS PLANT DISORDERS

4132 Annicchiarico, P. (1997) JOINT REGRESSION VS AMMI ANALYSIS OF GENOTYPE-ENVIRONMENT INTERACTIONS FOR CEREALS IN ITALY. *Euphytica*. 94(1):53-62. English. [IST SPERIMENTALE COLTURE FORAGGERE 29 VIALE PIACENZA I-20075 LODI ITALY].

Joint regression and Additive Main effects and Multiplicative Interaction (AMMI) models were compared for i) capacity of describing genotype-location (GL) and genotype-environment (GE) interaction effects (environments = location-season combinations), assessed in terms of estimated variance of heterogeneity of genotype regressions and of the sum of the variances of significant interaction principal component (PC) axes, and) repeatability between cropping seasons of measures of genotype stability across locations. These measures were Finlay and Wilkinson's regression coefficient for joint regression, and the Euclidean distance from the origin of significant interaction PC axes (D) and the absolute value of PC 1 score (|PC 1|) for AMMI. Shukla's stability variance (sigma(2)) was considered in addition. The study included three data sets for durum wheat, two for maize and one each for bread wheat and oat. Relationships between climatic variables and GL interaction occurrence were also assessed. AMMI proved distinctly more valuable in six data sets for description of GE effects and in four for description of GL effects over seasons. Its superiority was not crop-specific and tended to occur when more, distinct environmental constraints affected genotype responses. When both methods were appropriate, they provided a similar ordination of sites and genotypes for GL effects. The models that adequately described GL interaction over seasons generally provided also stability measures that were moderately repeatable between seasons. D was better repeatable than |PC 1| and sigma(2) in a few cases. Ordination or locations on GL interaction PC 1 tended to be consistent both between wheat and between maize data sets having either no seasons or no genotypes in common. [References: 38].

4133 Annicchiarico, P. (Istituto Sperimentale per le Colture Foraggere, Lodi (Italy)); Mariani, G. (1996) Prediction of adaptability and yield stability of durum wheat genotypes from yield response in normal and artificially drought-stressed conditions. *Field Crops Research (Netherlands) v. 46(1-3)* p. 71-80. 36 ref. English. (AGRI 97-078370).

4134 Cakmak, I.; Ekiz, H.; Yilmaz, A.; Torun, B.; Koleli, N.; Gultekin, I.; Alkan, A.; Eker, S. (1997) DIFFERENTIAL RESPONSE OF RYE, TRITICALE, BREAD AND DURUM WHEATS TO ZINC DEFICIENCY IN CALCAREOUS SOILS. *Plant & Soil*. 188(1):1-10. English. [CUKUROVA UNIV FAC AGR DEPT SOIL SCI ADANA TURKEY].

Field and greenhouse experiments were carried out to study the response of rye (Secale cereale L. cv. Aslim), triticale (x Triticosecale Wittmark. cv. Presto), two bread wheats (Triticum aestivum L. cvs. Bezostaja-1 and Atay-85) and two durum wheats (Triticum durum L. cvs. Kunduru-1149 and C-1252) to zinc (Zn) deficiency and Zn fertilization in severely Zn-deficient calcareous soils (DTPA-Zn=0.09 mg kg(-1) soil). The first visible symptom of Zn deficiency was a reduction in shoot elongation followed by the appearance of whitish-brown necrotic patches on the leaf blades. These symptoms were either absent or only slight in rye and triticale, but occurred more rapidly and severely in wheats, particularly in durum wheats. The same was true for the decrease in shoot dry matter production and grain yield. For example, in field experiments at the milk stage, decreases in shoot dry matter production due to Zn deficiency were absent in rye, and were on average 5% in triticale, 34% in bread wheats

and 70%, in durum wheats. Zinc fertilization had no effect on grain yield in rye but enhanced grain yield of the other cereals. Zinc efficiency of cereals, expressed as the ratio of yield (shoot dry matter or grain) produced under Zn deficiency compared to Zn fertilization were, on average, 99% for rye, 74% for triticale, 59% for bread wheats and 25% for durum wheats. These distinct differences among and within the cereal species in susceptibility to Zn deficiency were closely related to the total amount (content) of Zn per shoot, but not with the Zn concentrations in shoot dry matter. For example, the most Zn-efficient rye and the Zn-inefficient durum wheat cultivar C-1252 did not differ in shoot Zn concentration under Zn deficiency, but the total amount of Zn per whole shoot was approximately 6-fold higher in rye than the durum wheat. When Zn was applied, rye and triticale accumulated markedly more Zn both per whole shoot and per unit shoot dry matter in comparison to wheats. The results demonstrate an exceptionally high Zn efficiency of rye and show that among the cereals studied Zn efficiency declines in the order rye>triticale>bread wheat>durum wheat. The differences in expression of Zn efficiency are possibly related to a greater capacity of efficient genotypes to acquire Zn from the soil compared to inefficient genotypes. [References: 32].

4135 Deandrade, LRM.; Ikeda, M.; Ishizuka, J. (1997) LOCALIZATION OF ALUMINUM IN ROOT TIP TISSUES OF WHEAT VARIETIES DIFFERING IN ALUMINUM TOLERANCE. *Journal of the Faculty of Agriculture Kyushu University*. 41(3-4):151-156. English. [KYUSHU UNIV FAC AGR PLANT NUTR LAB FUKUOKA 81281 JAPAN].

The purpose of this study was to investigate the mechanisms of Al tolerance in wheat varieties by the direct observation of Al distribution in root cells using the hematoxylin stain method. Five-day-old seedlings of Al-tolerant varieties, Atlas 66 and Shirosanjyaku, and an Al-sensitive variety, Chikushikomugi, were treated with 150  $\mu$ M Al in 0.4 mM  $\text{CaCl}_2$ , pH 4.5 for 24 hours under aseptic conditions; afterwards the roots were stained with hematoxylin. Comparison of hematoxylin stain of root tips among the varieties showed that the root cap of Al-sensitive seedlings was stained intensively, reflecting high accumulation of Al in this region. The roots developed symptoms of Al toxicity such as increased vacuolation, and swelling and rupture of the cells of the epidermis. On the other hand, in Al-tolerant varieties the central cap cells and the cortical region of the meristem and elongation zone were not stained. The site of the earliest Al accumulation in Al-tolerant varieties seemed to be the edge cells of the root cap. In the elongation zone, Al accumulated mainly in the cell wall and nuclei. Those differences in the staining pattern were probably due to immobilization of Al in the cytosol that could not react with hematoxylin and/or due to the ability of Al-tolerant varieties to better exclude Al from cytoplasm. [References: 22].

4136 Diabate, S.; Strack, S. (1997) ORGANICALLY BOUND TRITIUM IN WHEAT AFTER SHORT-TERM EXPOSURE TO ATMOSPHERIC TRITIUM UNDER LABORATORY CONDITIONS. *Journal of Environmental Radioactivity*. 36(2-3):157-175. English. [FORSCHUNGSZENTRUM KARLSRUHE HAUPTABT SICHERHEIT ABT UMWELTSCHUTZ POSTFACH 3640 D-76021 KARLSRUHE GERMANY].

The uptake, loss, conversion and translocation of tritium in wheat plants were determined following a unique short-time exposure to atmospheric tritium under laboratory conditions. Potted plants were exposed between anthesis and maturity, under day-time conditions at two different light intensities and during night conditions. Two data sets with exposure conditions and corresponding tritium concentrations in plants are given for rise in appropriate models. In leaves, the tritium uptake into tissue water was about four times lower under night conditions than under day conditions. The initial relative concentrations of organically bound tritium in leaves observed under night conditions were about 50% of those observed under day conditions. Translocation of organically bound tritium to grain was found to depend on rate growth rate of the grain. Once translocation to grain has taken place, organically bound tritium is lost only slowly. (C) 1997 Elsevier Science Limited. [References: 14].

4137 Eriksson, JE.; Soderstrom, M. (1996) CADMIUM IN SOIL AND WINTER WHEAT GRAIN IN SOUTHERN SWEDEN .1. FACTORS INFLUENCING CD LEVELS IN SOILS AND GRAIN. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 46(4):240-248. English.

[SWEDISH UNIV AGR SCI DEPT SOIL SCI POB 7014 S-75007 UPPSALA SWEDEN].

The guideline level for Cd contents in cereals of 100  $\mu$ g kg<sup>-1</sup> proposed by the Coder Committee on Cereals, Pulses and Legumes has increased concern regarding Cd levels in Swedish winter wheat. In this study, Cd levels in soil and grain and factors influencing these variables were investigated in Skane, the southernmost province in Sweden. In 1992, soils and winter wheat grain were sampled at sites distributed randomly over Skane. Soil Cd contents were influenced only slightly by the pH, clay content and organic matter content of the soil, but were rather strongly correlated with soil contents of both Cu and Zn. Cadmium levels in grain were generally rather low owing to a prolonged summer drought. Still, in a few of the samples, mostly from sites with Cd-rich soils, Cd contents exceeded 100  $\mu$ g kg<sup>-1</sup>. Also, at less extreme sites, grain Cd contents generally increased with the soil Cd content. The distribution of grain Cd contents was such that in a less dry year, also a portion of wheat grown on soils with a Cd content of only up to 50% above average may have Cd contents near or above 100  $\mu$ g kg<sup>-1</sup>. A comparison with data from other investigations showed that Cd contents in both soil and grain were higher in Skane than in other parts of Sweden. However, the difference in grain Cd contents was larger than the difference in soil Cd contents, indicating that Cd in soils may be more available in Skane than in other parts of Sweden. [References: 29].

4138 Fangmeier, A.; Gruters, U.; Hogy, P.; Vermehren, B.; Jager, HJ. (1997) EFFECTS OF ELEVATED CO<sub>2</sub> NITROGEN SUPPLY AND TROPOSPHERIC OZONE ON SPRING WHEAT 2. NUTRIENTS (N, P, K, S, CA, MG, FE, MN, ZN). *Environmental Pollution*. 96(1):43-59. English. [INST PFLANZENOKOL HEINRICH BUFF RING 38 D-35392 GIESSEN GERMANY].

CO<sub>2</sub> enrichment is expected to alter leaf demand for nitrogen and phosphorus in plant species with C-3 carbon dioxide fixation pathway, thus possibly causing nutrient imbalances in the tissues and disturbance of distribution and redistribution patterns within the plants. To test the influence of CO<sub>2</sub> enrichment and elevated tropospheric ozone in combination with different nitrogen supply, spring wheat (*Triticum aestivum* L. cv. Minaret) was exposed to three levels of CO<sub>2</sub> (361, 523, and 639  $\mu$ mol liter<sup>-1</sup>), 24 h mean from sowing to final harvest), two levels of ozone (28.4 and 51.3 nl liter<sup>-1</sup>) and two levels of nitrogen supply (150 and 270 kg ha<sup>-1</sup>) in a full-factorial design in open-top field chambers. Additional fertilization experiments (120, 210, and 330 kg N ha<sup>-1</sup>) were carried out at low and high CO<sub>2</sub> levels. Macronutrients (N, P, K, S, Ca, Mg) and three micronutrients (Mn, Fe, Zn) were analysed in samples obtained at three different developmental stages: beginning of shoot elongation, anthesis, and ripening. At each harvest, plant samples were separated into different organs (green and senescent leaves, stem sections, ears, grains). According to analyses of tissue concentrations at the beginning of shoot elongation, the plants were sufficiently equipped with nutrients. Elevated ozone levels neither affected tissue concentrations nor shoot uptake of the nutrients. CO<sub>2</sub> and nitrogen treatments affected nutrient uptake, distribution and redistribution in a complex manner. CO<sub>2</sub> enrichment increased nitrogen-use efficiency and caused a lower demand for nitrogen in green tissues which was reflected in a decrease of critical nitrogen concentrations, lower leaf nitrogen concentrations and lower nitrogen pools in the leaves. Since grain nitrogen uptake during grain filling depended completely on redistribution from vegetative pools in green tissues, grain nitrogen concentrations fell considerably with severe implications for grain quality. Ca, S, Mg and Zn in green tissues were influenced by CO<sub>2</sub> enrichment in a similar manner to nitrogen. Phosphorus concentrations in green tissues, on the other hand, were not, or only slightly, affected by elevated CO<sub>2</sub>. In stems, 'dilution' of all nutrients except manganese was observed, caused by the huge accumulation of water soluble carbohydrates, mainly fructans, in these tissues under CO<sub>2</sub> enrichment. Whole shoot uptake was either remarkably increased (K, Mn, P, Mg), nearly unaffected (N, S, Fe, Zn) or decreased (Ca) under CO<sub>2</sub> enrichment. Thus, nutrient cycling in plant-soil systems is expected to be altered under CO<sub>2</sub> enrichment. (C) 1997 Elsevier Science Ltd. [References: 55].

4139 Gauch, HG.; Zobel, RW. (1997) IDENTIFYING MEGA-ENVIRONMENTS AND TARGETING GENOTYPES [Review]. *Crop Science*. 37(2):311-326. English. [CORNELL UNIV 1021 BRADFIELD HALL ITHACA, NY 14853 USA].

To maximize yield throughout a crop's heterogeneous growing region, despite differences in cultivar rankings from place to place due to genotype-environment interactions, frequently it is necessary to subdivide a growing region into several relatively homogeneous mega-environments and to breed and target adapted genotypes for each mega-environment. The objectives of this study are to identify relevant criteria for evaluating mega-environment analyses and to apply the Additive Main Effects and Multiplicative Interaction (AMMI) model to mega-environment analysis. The proposed analysis is illustrated using a Louisiana corn (*Zea mays* L.) trial. Statistical strategies for identifying mega-environments should meet four criteria: flexibility in handling yield trials with various designs, focus on that fraction of the total variation that is relevant for identifying mega-environments, duality in giving integrated information on both genotypes and environments, and relevance for the primary objective of showing which genotypes win where. The AMMI model meets these criteria effectively when the usual biplots are supplemented with several new types of graphs designed to address questions about mega-environments. Preliminary results indicate that a small and workable number of mega-environments often suffices to exploit interactions and increase yields. [References: 68].

4140 Ghosh, A.; Chandra, D.; Sahoo, N. (1996) SEASONAL INFLUENCE ON PERFORMANCE OF NEW WHEAT (*TRITICUM AESTIVUM*) VARIETIES GROWN AT DIFFERENT N LEVELS IN PENINSULAR ORISSA. *Indian Journal of Agricultural Sciences*. 66(12):708-710. English. [CENT RICE RES INST DIV AGRON CUTTACK 753006 ORISSA INDIA].

4141 Grossmann, K.; Retzlaff, G. (1997) BIOREGULATORY EFFECTS OF THE FUNGICIDAL STROBILURIN KRESOXIM-METHYL IN WHEAT (*TRITICUM AESTIVUM*). *Pesticide Science*. 50(1):11-20. English. [BASF AG AGR RES STN D-67114 LIMBURGHOF GERMANY].

Apart from its fungicidal effect, the strobilurin kresoxim-methyl (BAS 490 F) was found to induce physiological and developmental alterations in wheat (*Triticum aestivum* L.) which are seen in connection with improved yield. In a series of biotests including heterotrophic maize and photoautotrophic algal cell suspensions, duckweed, isolated mustard shoots and germinating cress seeds, kresoxim-methyl showed a similar response pattern to standard auxins (e.g. indol-3-ylacetic acid, IAA; 2-(1-naphthyl)acetic acid, alpha-NAA). Auxin-like activity of kresoxim-methyl was also found when stem explants of tobacco were cultured on a hormone-free medium. Kresoxim-methyl stimulated shoot formation, particularly at 10(-7) M. The same effect was induced by 10(-8) M IAA. The determination of phytohormone-like substances in shoots of wheat plants foliar-treated with 7 x 10(-4) M kresoxim-methyl revealed only slightly changed levels of endogenous IAA, gibberellins and abscisic acid. In contrast, the contents of dihydrozeatin riboside-type cytokinins increased to 160% of the control, while trans-zeatin riboside- and isopentenyladenosine-type cytokinins remained nearly unchanged. The most remarkable alterations were the reductions in 1-aminocyclopropane-1-carboxylic acid (ACC) levels and ethylene formation which were demonstrated in intact plants, leaf discs and the shoots of wheat subjected to drought stress. Kresoxim-methyl affected the induction of ACC synthase activity which converts S-adenosyl-methionine to ACC in ethylene biosynthesis. In shoots from foliar-treated wheat plants, 10(-4) M kresoxim-methyl inhibited stress-induced increases in endogenous ACC synthase activity, ACC levels and ethylene formation by approximately 50%. Reductions in ACC synthase activity and ACC levels of 30% were also obtained at low concentrations of alpha-NAA (10(-6) M). In contrast, ACC synthase activity in vitro was not influenced by adding the compounds. In wheat leaf discs, the inhibiting effect of kresoxim-methyl, alpha-NAA and IAA on ethylene formation was accompanied by delayed leaf senescence, characterized by reduced chlorophyll loss. However, in contrast to kresoxim-methyl which showed only inhibitory activity on ethylene synthesis over a wide range of concentrations applied, the auxins stimulated ethylene production at high concentrations of about 10(-4) M. The inhibition of ethylene biosynthesis by kresoxim-methyl, together with an increase in endogenous cytokinins could explain the retardation of senescence and the intensified green leaf pigmentation in wheat exposed to this strobilurin. [References: 28].

4142 Iranete, I.; Perez de Ciriza, J.J.; Segura, A.; Carro, P.; Ruilope, R. (1997) [Sulphur deficiency in cereals, why does it occur?]. *Carencia de azufre en cereales, por que se da? Navarra Agraria (Espana) (no.100) p. 49-54. 5 cuadros, 2 graf.* Spanish. (AGRIS 97-078328).

4143 Johnson, J.P.; Carver, B.F.; Baligar, V.C. (1997) PRODUCTIVITY IN GREAT PLAINS ACID SOILS OF WHEAT GENOTYPES SELECTED FOR ALUMINIUM TOLERANCE. *Plant & Soil*. 188(1):101-106. English. [DEKALB GENET CORP GOTHENBURG, NE 69138 USA].

Soil acidity in the Great Plains of the USA can reduce forage and grain yields of winter wheat, primarily by Al toxicity. Indigenous cultivars may vary in seedling tolerance to Al toxicity, but the benefit that Al tolerance provides to forage and grain production is not well documented in this region. Backcrossed-derived lines of 'Chisholm' and 'Century' were selected with an additional gene from 'Atlas 66' conferring Al tolerance in solution culture. Our objective was to determine the impact of this source of Al tolerance on forage production prior to the jointing stage and subsequent grain yield. Experiments were conducted at several locations on non-limed (pH=4.5-4.7) and limed soils (pH=5.2-6.1) in Oklahoma. Two cultivars ('TAM 105', susceptible; '2180', tolerant) with extreme differences in Al tolerance were used as controls. In limed conditions, forage and grain production did not differ between Al-tolerant and -susceptible genotypes, indicating a neutral effect of the Atlas 66 gene in the absence of Al toxicity. Despite visual differences in early-season plant vigor in non-limed acid soil, the Al-tolerant selections did not yield greater season-long forage than their susceptible parents. At sites where Al saturation in the non-limed soil exceeded 30%, spike production at maturity was nearly doubled in the Century background by the addition of Al tolerance, but final grain yield was not significantly improved. In the Chisholm background, grain yield was improved 50 to 74% by Al tolerance. The magnitude of the agronomic benefit of Al tolerance was highly influenced by the edaphic environment and genetic background. Acid soils of the Great Plains appear highly variable in Al toxicity; hence, consideration of the target environment is essential to predict the potential impact of Al tolerance selected in solution culture. [References: 16].

4144 Karpate, R.R.; Choudhary, A.D. (1997) EFFECT OF THERMAL POWER STATIONS WASTE ON WHEAT. *Journal of Environmental Biology*. 18(1):1-10. English. [NAGPUR UNIV DEPT BOT UNIV CAMPUS NAGPUR 440010 MAHARASHTRA INDIA].

The effect of fly ash and fly ash water was studied on *Triticum aestivum* Var. Kalyan Sona. Plants were either irrigated with 25%, 50%, 75% and 100% fly ash water or grown in 50%, 70%, 90% fly ash amended soil. At lower concentrations the fly ash water and fly ash had stimulatory effect on the crop. However, at higher concentrations the treatment showed deleterious effect. Moreover, all concentrations of fly ash water and fly ash were found to have damaging effect on cytology and genetic material. This was reflected in high frequency of mitotic and meiotic abnormalities. Plants growing on the fly ash may accumulate the heavy metals, found in fly ash and fly ash water, at higher levels in plant products and if consumed may have similar effect on live stock and human beings. [References: 18].

4145 Kummerova, M.; Slovak, L.; Holoubek, I. (1997) GROWTH RESPONSE OF SPRING BARLEY TO SHORT- OR LONG-PERIOD EXPOSURES TO FLUORANTHENE. *Rostlinna Vyroba*. 43(5):209-215. Czech. [MASARYK UNIV FAC SCI KOTLARSKA 2 CS-61137 BRNO CZECH REPUBLIC].

Polycyclic aromatic hydrocarbons (PAHs) participate to a considerable extent in the increasing anthropogenic pollution of environment. These persistent organic compounds penetrate into the food-chain and can operate as potential carcinogens, mutagens and teratogens (Wang, Freemark, 1995). The increased loading of PAHs can be a decisive factor for the future diversity of plant species in the habitat and it often determines the level of economic yields. The monitoring of PAHs in the environment gives information about a long-term loading of the biotope but it does not permit to judge the influence of their short-time effect. Polycyclic aromatic hydrocarbons can affect all stages of plant growth (Grasset et al., 1993). A sensitive response to PAHs loading can be assumed above all in the first stages of ontogenesis. In this relatively short period the plant has not yet sufficient detoxicative ability. It was a reason why the effect of short-time (48 hrs) and a long-time (28 days) exposure of barley seedlings in a nutrient solution with an increasing concentration (10, 100 and 1000 µg l(-1)) of fluoranthene (FLT) was examined with a special regard to their growth and the content of assimilatory pigments at the beginning of ontogenesis. The FLT amount and its translocation in the plants were investigated too. A suitable parameter for measuring of the effect of PAHs, in this case fluoranthene, on the growth of the plant organism is determined by its dry matter. Dry matter content and its



distribution permits to find the extent of growth response of individual plant organs (Kummerova et al., 1996). Higher fluoranthene concentrations (100 and 1000  $\mu\text{g l}^{-1}$ ) caused a significant inhibition of biomass production (Tabs I and II) and of the content of photosynthetic pigments (chlorophyll a, b, carotenoids) in spring barley plants (Tabs VII and VIII), both in long-time and short-time exposures. The leaf area size (Tabs V and VI) and the content of photosynthetic pigments are, by a lot of authors, included among the primary symptoms of the possible effect of PAHs on plants (Lewis, 1995a, b). They inform about the internal injury of the plant organism before the external symptoms of effect of loading are evident. The results of the present study confirm the sensitivity of the above-mentioned parameters. The lowest concentration of FLT applied (10  $\mu\text{g k}^{-1}$ ) caused a stimulation or an inhibition of plant growth which depended on the length of exposure. The results obtained documented the fact that the inhibition of plant growth of spring barley was due to the short-time exposure combined with the higher concentrations of fluoranthene. The FLT content in the plant tissue correlated with the FLT content in the culture medium (Tabs III and IV). The highest FLT content in the course of the period studied was found in the roots, the lowest one in the leaves. FLT translocation into the shoots was demonstrated. The FLT effect was more intensive if the length of cultivation extended and it was the function of the accumulated amount in the tissue. The study has confirmed a significant effect of short-time exposure to FLT on the growth of plants. It has proved the fact that the FLT content accumulated by spring barley in short-time exposure can create comparable symptoms (growth stimulation or inhibition) with the long-term load. [References: 16].

4146 Lee, C.J.; Manthey, F.A.; Ellefson, R.S.; Horsley, R.D.; Schwarz, P.B. (1997) EFFECTS OF THE FUNGICIDE PROPICONAZOLE ON AGRONOMIC AND QUALITY TRAITS OF HULLED AND HULLESS BARLEY. *Journal of Production Agriculture*. 10(2):320-322. English. [N DAKOTA STATE UNIV DEPT PLANT SCI FARGO, ND 58105 USA].

The hypocholesterolemic effect of hulless waxy barley (*Hordeum vulgare* L.) has increased its use in food products. Hulless cultivars currently grown in the Upper Midwest U.S. barley growing region are susceptible to a foliar disease, spot blotch, that can severely reduce yield. Spot blotch and kernel blight generally occur in the eastern area of the region; thus, hulless barley production is limited to the western area. Research on chemical control of spot blotch and kernel disease in hulless barley genotypes grown in the Upper Midwest has not been conducted. The objectives of this study were to determine whether natural field infections of the pathogen responsible for causing spot blotch and partly responsible for causing kernel blight similarly affect kernel and flour brightness of hulled and hulless barley genotypes, and to determine whether disease control with the fungicide propiconazole [1[(2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl)methyl]-1H-1,2,4-triazole] similarly affect agronomic and quality traits of hulled and hulless barley genotypes. Propiconazole reduced spot blotch severity. This resulted in increased yield and yield-related traits in hulled and hulless genotypes. Responses to propiconazole by the hulled and hulless genotypes were generally similar for spot blotch control, and similar for grain yield and 1000-kernel weight. The reduction in spot blotch severity did not result in brighter kernels or flour, nor did it affect mean total or soluble beta-glucan content of hulled and hulless genotypes. Thus, hulless barley cultivars susceptible to spot blotch can be produced in the eastern area of the Upper Midwest barley growing region if they are protected with propiconazole. [References: 13].

4147 Masion, A.; Bertsch, P.M. (1997) ALUMINIUM SPECIATION IN THE PRESENCE OF WHEAT ROOT CELL WALLS - A WET CHEMICAL STUDY. *Plant Cell & Environment*. 20(4):504-512. English. [CEREGE BP 80 F-13545 AIX EN PROVENCE 04 FRANCE].

Hydrolysis of  $\text{Al}^{3+}$  was performed in the presence of isolated root cell walls from a series of wheat cultivars (*Triticum aestivum* L.) known to have differential tolerance to Al contamination. Aluminium speciation was dependent on the cell wall concentration. At low cell wall concentrations, significant amounts of the very toxic  $\text{Al-13}$  species were formed. At higher cell wall concentrations, formation of the tridecamer was hindered or completely inhibited. The sensitive wheat cultivars displayed a higher affinity for aluminium than the tolerant cultivars. A possible Al tolerance mechanism based on cell wall permeability is discussed. [References: 49].

4148 Merrington, G.; Winder, L.; Green, I. (1997) THE UPTAKE OF CADMIUM AND ZINC BY THE BIRD-CHERRY OAT APHID RHOPALOSIPHUM PADI (HOMOPTERA, APHIDIDAE) FEEDING ON WHEAT GROWN ON SEWAGE SLUDGE AMENDED AGRICULTURAL SOIL. *Environmental Pollution*. 96(1):111-114. English. [BOURNEMOUTH UNIV SCH CONSERVAT SCI TALBOT CAMPUS POOLE BH12 5BB DORSET ENGLAND].

A greenhouse trial investigated the uptake of cadmium and zinc by the bird-cherry oat aphid (*Rhopalosiphum padi*) feeding on wheat grown on sewage sludge amended soil. The trial was conducted at application rates of 0, 5, 7.5, 10, 15 and 20 tonnes  $\text{ha}^{-1}$  dry solids. Concentrations of Cd and Zn were within current UK limits for potentially toxic elements in soils amended with sewage sludge. Cd and Zn in wheat plants were significantly greater than controls. Batches of aphids feeding on the wheat also showed a significant increase in the uptake of Cd and Zn. This study demonstrates a potential route of exposure to Cd and Zn for the predators of cereal aphids. (C) 1997 Elsevier Science Ltd. [References: 21].

4149 Mongelli, E.; Desmarchelier, C.; Coussio, J.; Ciccio, G. (1997) THE POTENTIAL EFFECTS OF ALLELOPATHIC MECHANISMS ON PLANT SPECIES DIVERSITY AND DISTRIBUTION DETERMINED BY THE WHEAT ROOTLET GROWTH INHIBITION BIOASSAY IN SOUTH AMERICAN PLANTS. *Revista Chilena de Historia Natural*. 70(1):83-89. English. [UNIV BUENOS AIRES FAC FARM & BIOQUIM CATEDRA BIOTECNOL & MICROBIOL IND RA-1113 JUNIN BUENOS AIRES ARGENTINA].

Phytotoxicity of aqueous extracts from 60 plant species from tropical and temperate communities was tested by wheat rootlet growth inhibition assay. Differences in the inhibition and stimulation of the growth of the wheat rootlets were observed among both communities. 26.7% of the total sample belonging to the tropical community showed considerable allelopathic activity in this bioassay, while 23.3% of the total sample stimulated rootlet growth. On the other hand, 71.9% of the temperate plants studied presented this activity, while none of the species showed stimulating effects. The possible influence of allelopathic effects on the coexistence of a particular mixture of plant species in a determined area is discussed. [References: 26].

4150 Nicholls, N. (1997) INCREASED AUSTRALIAN WHEAT YIELD DUE TO RECENT CLIMATE TRENDS. *Nature*. 387(6632):484-485. English. [BUR METEOROL RES CTR MELBOURNE VIC 3000 AUSTRALIA].

The possibility that future climate change may affect agriculture has attracted considerable attention(1, 2). As a step towards evaluating such influences, the effect of climate trends over the past few decades(3) needs to be assessed. Here I estimate the contribution of climate trends in Australia(4, 5) to the substantial increase in Australian wheat yields since 1952. Non-climatic influences-such as new cultivars and changes in crop management practices-are removed by detrending the wheat yield and climate variables and using the residuals to calculate quantitative relationships between variations in climate and yield. Climate trends appear to be responsible for 30-50% of the observed increase in wheat yields, with increases in minimum temperatures being the dominant influence. This approach should be applicable in other regions for which sufficient data exist. [References: 10].

4151 Ortega, F.; Bastide, J.; Hawkes, TR. (1996) COMPARISON BETWEEN THIFENSULFURON METHYL-INDUCED INACTIVATION OF BARLEY ACETOHYDROXYACID SYNTHASE AND ESCHERICHIA COLI ACETOHYDROXYACID SYNTHASE ISOZYME II. *Pesticide Biochemistry & Physiology*. 56(3):231-242. English. [UNIV PERPIGNAN CTR PHYTOPHARM CNRS URA 461 52 AVE DE VILLENEUVE F-66860 PERPIGNAN FRANCE].

Thifensulfuron methyl, a sulfonylurea herbicide, inhibited acetoxyhydroxyacid synthase (AHAS) from *Escherichia coli* (isozyme II) and barley in a similar, time-dependent, manner. This was modeled in terms of a slow first-order transition (0.036 and 0.048  $\text{min}^{-1}$ ), respectively) from an initial, relatively weak complex of the enzyme with inhibitor to a final, more potently inhibited form. AHAS from both barley and *E. coli* appeared permanently inactivated. In neither case was activity recovered following removal of the inhibitor by gel filtration or dilution. However, removal of the inhibitor by precipitation with ammonium sulfate yielded a quite different and surprising result. Bacterial AHAS recovered its full activity, whereas the barley enzyme recovered none. Thus, inhibitor-



induced inactivation of barley AHAS corresponds to a much less readily reversed change than in the case of bacterial enzyme. Experiments were carried out to explore whether enzyme inactivation required factors in addition to the inhibitor. Contrary to reports elsewhere, pyruvate (and therefore catalytic turnover) was not required. In the case of the bacterial enzyme, thiamine pyrophosphate (TPP)-Mg<sup>2+</sup> was an absolute requirement. TPP bound some 220-fold more strongly to barley than to bacterial AHAS and, correspondingly, was also released a great deal more slowly (a half-time for dissociation of the enzyme:cofactor complex of similar to 10 days compared to similar to 1 hr). Here we suggest a mechanism whereby these differences in affinity for TPP-Mg<sup>2+</sup> might underpin the apparent differences in the reversibility of sulfonylurea-induced inactivation of AHAS from the plant and bacterial sources. (C) 1996 Academic Press. [References: 31].

4152 Pakniyat, H.; Handley, LL.; Thomas, WTB.; Connolly, T.; Macaulay, M.; Caligari, PDS.; Forster, BP. (1997) COMPARISON OF SHOOT DRY WEIGHT, NA<sup>+</sup> CONTENT AND DELTA-C-13 VALUES OF ARI-E AND OTHER SEMI-DWARF BARLEY MUTANTS UNDER SALT-STRESS. *Euphytica*. 94(1):7-14. English. [SCOTTISH CROP RES INST DUNDEE DD2 5DA SCOTLAND].

Four brevistaratum (short awned and semi-dwarf) barley mutants; ari-e.1, ari-e.119, ari-e.156 and ari-e.228 were compared with other semi-dwarf mutants; Golden Promise, Alf, Pallas and Diamant along with their non-mutant parents; Bonus, Foma, Maythorpe, Bomi and Valticky, for response to salt stress. Plants were exposed to hydroponic salt treatments (NaCl at 25 and 175 mol m<sup>-3</sup>) for 4 weeks, after which response was measured in terms of shoot dry weight, sodium content and delta(13)C. In general ari-e mutants and Golden Promise had significantly lower Na<sup>+</sup> contents than the other mutants. They also had significantly more negative delta(13)C values than the other lines in stressed (175 mol m<sup>-3</sup> NaCl) conditions. There was a positive correlation ( $r = 0.71$ ,  $p < 0.01$ ) between shoot Na<sup>+</sup> and delta(13)C values so that delta(13)C became less negative with increasing Na<sup>+</sup> content. Shoot dry weights were compared to shoot Na<sup>+</sup> and delta(13)C values. The ari-e and Golden Promise mutants showed less reduction in dry matter production in salt stress relative to the control treatment than all the other lines. The data suggest that ari-e mutants and Golden Promise are better adapted to salt stressed environments than the other lines examined. Tests for gibberellic acid sensitivity revealed that ari-e mutants and Golden Promise responded weakly to GA(3), while other dwarf mutants Pallas, Diamant and Alf along with their parents Bonus, Foma, Maythorpe, Valticky and Bomi were highly sensitive. Our results support previous findings that ari-e mutants and the GPert mutant are allelic. [References: 23].

4153 Perkowski, J.; Jelen, H.; Kiecana, I.; Golinski, P. (1997) NATURAL CONTAMINATION OF SPRING BARLEY WITH GROUP A TRICHOHECENE MYCOTOXINS IN SOUTH-EASTERN POLAND. *Food Additives & Contaminants*. 14(4):321-325. English. [ACAD AGR POZNAN DEPT CHEM UL WOJSKA POLSKIEGO 75 PL-60624 POZNAN POLAND].

Strains (10 705) of microscopic fungi were isolated from spring barley heads in the region of Lublin (south-eastern Poland). Fusarium sporotrichioides Sherb was found in 418 (3.9%) of isolated strains. Group A trichothecene mycotoxins were detected in the collected barley kernels colonized by F. sporotrichioides, with Fusarium head blight symptoms. Among 24 samples analysed, 12 were T-2 toxin positive in a range of contamination from 0.02 to 2.40 mu g/g (average 0.45), while in five samples HT-2 toxin ranged from 0.01 to 0.37 mu g/g (average 0.23) and T-2 tetraol was detected in two samples in a range of 0.01-0.21 mu g/g (average 0.11). Twelve samples were free of detectable amounts of the toxic metabolites analysed. [References: 28].

4154 Pleijel, H.; Ojanpera, K.; Mortensen, L. (1997) EFFECTS OF TROPOSPHERIC OZONE ON THE YIELD AND GRAIN PROTEIN CONTENT OF SPRING WHEAT (TRITICUM AESTIVUM L.) IN THE NORDIC COUNTRIES. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 47(1):20-25. English. [IVL POB 47986 S-40258 GOTHENBURG SWEDEN].

Eight Nordic open-top chamber experiments with field-grown spring wheat were combined to obtain relationships between ozone exposure and yield loss. Two exposure indices, AOT30 and AOT40 (AOT = accumulated exposure over threshold), were tested. Strongly significant linear regressions between relative yield and exposure were obtained with both

indices. The coefficient of determination ( $r^2$ ) was higher and the model assumptions of linear regression were satisfied to a larger extent with AOT30 than with AOT40. The exclusion of charcoal-filtered treatments from the analysis made little difference to the regressions. The AOT30 regression model predicted larger yield loss than the AOT40 regression model, especially for the range of exposures, which is likely to occur in the Nordic countries. The protein content of the grain increased with increasing ozone exposure in all eight experiments, but to a varying degree. [References: 19].

4155 Prasad, TSD.; Singh, RP.; Sastry, KV. (1997) ACCUMULATION OF CHROMIUM AND NICKEL IN WHEAT IN A FIELD IRRIGATED WITH INDUSTRIAL EFFLUENTS AND WATER HYACINTH IN SONEPAT CITY, HARYANA, INDIA. *Journal of Environmental Biology*. 18(1):33-36. English. [MAHARSHI DAYANAND UNIV DEPT BIOSCI ROHTAK 124001 HARYANA INDIA].

The effluents of cycle manufacturing factory at Sonapat (Haryana) tanneries and other industries containing chromium and nickel are released into a sewage drain. The sewage water from the drain is used to irrigate cereals and vegetables in the adjacent fields. The levels of chromium and nickel in sewage water of the drain, Eichornia growing on the sides of the drain and in the roots, stem and leaves of Triticum aestivum was estimated. [References: 9].

4156 Royo, C.; Abaza, M.; Cantero, C.; Caldero, A.; Ramos, J.M.; Garcia del Moral, L.F. (Centre UdL IRTA, Lleida (Spain)) (1996) [Likening between the effect of drought and terminal water-stress simulated by a senescing agent in triticale]. Zusammenhang zwischen dem Einfluss von Duerre und terminalem Wasserstress simuliert durch Alterungschemikalien bei Triticale. *Journal of Agronomy and Crop Science (Germany)* v. 176(1) p. 31-38. 3 ill., 4 tables; 14 ref. English. (AGRI 97-063519).

4157 Ryan, PR.; Reid, RJ.; Smith, FA. (1997) DIRECT EVALUATION OF THE CA<sup>2+</sup>-DISPLACEMENT HYPOTHESIS FOR AL TOXICITY. *Plant Physiology*. 113(4):1351-1357. English. [CSIRO DIV PLANT IND GPO BOX 1600 CANBERRA ACT 2601 AUSTRALIA].

One explanation for Al toxicity in plants suggests that Al displaces Ca<sup>2+</sup> from critical sites in the apoplasm. We evaluated the Ca<sup>2+</sup>-displacement hypothesis directly using near-isogenic lines of wheat (Triticum aestivum L.) that differ in Al tolerance at a single locus. We measured both the growth and total accumulation (apoplasmic plus symplasmic) of Ca-45 and Al into roots that had been exposed to Al alone or to Al with other cations. Root growth in the Al-sensitive line was found to be severely inhibited by low activities of Al, even though Ca<sup>2+</sup> accumulation was relatively unaffected. In solutions containing the same activity of the Al<sup>3+</sup> and Ca<sup>2+</sup> ions as above, but also including either 3.0 mM Mg<sup>2+</sup>, 3.0 mM Sr<sup>2+</sup>, or 30 mM Na<sup>+</sup>, growth improved, whereas Ca-45(2+) significantly decreased. Since most of the Ca-45(2+) accumulated by roots during short-term treatments will reside in the apoplasm, these results indicate that displacement of Ca<sup>2+</sup> from the apoplasm by Al cannot account for the Al-induced inhibition of root growth and, therefore, do not support the Ca<sup>2+</sup>-displacement hypothesis for Al toxicity. We also show that total accumulation of Al by root apices is greater in the Al-sensitive genotype than the Al-tolerant genotype and suggest that cation amelioration of Al toxicity is caused by the reduction in Al accumulation. [References: 55].

4158 Sinha, RC.; Savard, ME. (1997) CONCENTRATION OF DEOXYNIVALENOL IN SINGLE KERNELS AND VARIOUS TISSUES OF WHEAT HEADS. *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie*. 19(1):8-12. English. [AGR & AGRI FOOD CANADA EASTERN CEREAL & OILSEED RES CTR OTTAWA ON K1A 0C6 CANADA].

An improved method of extraction of deoxynivalenol (DON) from small samples of plant tissues is described. Using a ball mill, the extraction time was reduced from 60 minutes to 1 minute and the amount of monoclonal antibodies required for a reliable competitive direct (CD)-ELISA was reduced from 100 mu g/mL to 5 mu g/mL. Using this method, we analysed the kernels, chaff, rachis and peduncle of individual heads of wheat plants that had been field-inoculated with Fusarium graminearum. The DON concentration varied considerably among the same tissues from different plants. The median concentration of DON was highest in the rachis (93 ppm), followed by chaff (50 ppm), kernels (25 ppm), and peduncles (16 ppm). We also determined the DON concentration in single

kernels obtained from a naturally-affected commercial wheat field. One hundred each of visibly unaffected ("normal-looking") kernels, shrivelled kernels, and fusarium damaged ("white tombstone" and "pink tombstone") kernels were analysed. DON was detected in about 50% of the normal-looking and shrivelled kernels, but typically at concentrations of 5 ppm or less. DON levels in tombstone kernels varied from less than 1 ppm to 600 ppm, with a mean of 275 ppm and 118 ppm in pink tombstone and white tombstone kernels, respectively. [References: 11].

4159 Soderstrom, M.; Eriksson, J.E. (1996) CADMIUM IN SOIL AND WINTER WHEAT GRAIN IN SOUTHERN SWEDEN .2. GEOGRAPHICAL DISTRIBUTION AND ITS RELATION TO SUBSTRATUM. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 46(4):249-257. English. [GOTHENBURG UNIV DEPT PHYS GEOG CTR EARTH SCI S-41381 GOTHENBURG SWEDEN].

Concentrations of cadmium in agricultural soils in the province of Skane, southern Sweden, were shown to vary with geological substratum. The highest levels were found in areas dominated by Cambrian bedrock. Significant differences between general soil types were also recorded. Regional maps of cadmium in soil and winter wheat grain were produced with geostatistical interpolation. The variability of soil cadmium was relatively small in most parts of the area investigated, with high values restricted to the southeastern part. A spatial correlation pattern existed between a map of cadmium deposition based on moss analysis and the map of cadmium in wheat. Biogeochemical cadmium data and soil cadmium were correlated only in areas extremely high in biochemical cadmium. [References: 23].

4160 Stahlman, P.W.; Currie, R.S.; Elhamid, M.A. (1997) NITROGEN CARRIER AND SURFACTANT INCREASE FOLIAR HERBICIDE INJURY IN WINTER WHEAT (TRITICUM AESTIVUM). *Weed Technology*. 11(1):7-12. English. [KANSAS STATE UNIV AGR RES CTR 1232 240TH AVE HAYS, KS 67601 USA].

A three-year field study in west-central Kansas investigated the effects of combinations of spray carrier, nonionic surfactant (NIS), triasulfuron, and/or 2, 4-D on winter wheat foliar injury and grain yield. Herbicides applied in water without NIS caused little or no foliar injury in two of three years. Urea-ammonium nitrate (UAN) at 112 L/ha (40 kg N/ha) alone or as a carrier for herbicides caused moderate to severe foliar injury in all three years. Adding NIS to UAN spray solutions increased foliar injury, especially with the tank mixture of triasulfuron + 2, 4-D. Effects of triasulfuron + NIS or 2, 4-D applied in UAN were additive. Foliar injury was related inversely to temperature following application. Foliar injury was most evident 4 to 7 d after application and disappeared within 2 to 3 wk. Diluting UAN 50% with water lessened foliar injury in two of three years, especially in the presence of NIS, regardless of whether herbicides were in the spray solution. Treatments did not reduce wheat grain yield in any year despite estimates of up to 53% foliar injury one year. [References: 27].

4161 Stojanovic, J.; Stojanovic, S. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita) (1996) [Influence of soil moisture stress at various stages of growth on the yield of wheat]. Uticaj smanjenja sadrzaja vode u zemljistu u razlicitim fazama porasta na prinos pšenice. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts*. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadrzaja p. 194. Institut za istrazivanja u poljoprivredi "Srbija". (En, Sr). (AGRIS 97-063524).

4162 Stojanovic, Z.; Djordjevic, N.; Dodik, D.; Stankovic, S.; Petrovic, D. (Institut za istrazivanja u poljoprivredi "Srbija", Zajecar (Yugoslavia). Centar za poljoprivredna i tehnoloska istrazivanja) (1996) [Importance of winter barley as source of concentrated fodder in areas deficient in water]. Znacaj ozimog jecma kao izvora koncentrovane stocne hrane na podrucjima deficitarnim vodom. Internacionalni simpozijum Susa i biljna proizvodnja. Lepenski Vir (Yugoslavia). 17-20 Sep 1996. *Drought and plant production: international symposium. The book of abstracts*. Jevtic, S. (ed.). Susa i biljna proizvodnja: internacionalni simpozijum. Zbornik kratkih sadrzaja p. 65. Institut za istrazivanja u poljoprivredi "Srbija". (En, Sr). (AGRIS 97-063489).

4163 Taylor, G.J.; Basu, A.; Basu, U.; Slaski, J.J.; Zhang, G.C.; Good, A. (1997) AL-INDUCED, 51-KILODALTON, MEMBRANE-BOUND PROTEINS ARE ASSOCIATED WITH RESISTANCE TO AL IN A SEGREGATING POPULATION OF WHEAT. *Plant Physiology*. 114(1):363-372. English. [UNIV ALBERTA DEPT SCI BIOL EDMONTON AB T6G 2E9 CANADA].

Incorporation of S-35 into protein is reduced by exposure to Al in wheat (*Triticum aestivum*), but the effects are genotype-specific. Exposure to 10 to 75  $\mu$ M Al had little effect on S-35 incorporation into total protein, nuclear and mitochondrial protein, microsomal protein, and cytosolic protein in the Al-resistant cultivar PT741. In contrast, 10  $\mu$ M Al reduced incorporation by 21 to 38% in the Al-sensitive cultivar Katepwa, with effects becoming more pronounced (31-62%) as concentrations of Al increased. We previously reported that a pair of 51-kD membrane-bound proteins accumulated in root tips of PT741 under conditions of Al stress. We now report that the 51-kD band is labeled with S-35 after 24 h of exposure to 75  $\mu$ M Al. The specific induction of the 51-kD band in PT741 suggested a potential role of one or both of these proteins in mediating resistance to Al. Therefore, we analyzed their expression in single plants from an F-2, population arising from a cross between the PT741 and Katepwa cultivars. Accumulation of 1, 3-beta-glucans (callose) in root tips after 24 h of exposure to 100  $\mu$ M Al indicated that this population segregated for Al resistance in about a 3:1 ratio. A close correlation between resistance to Al (low callose content of root tips) and accumulation of the 51-kD band was observed, indicating that at least one of these proteins cosegregates with the Al-resistance phenotype. As a first step in identifying a possible function, we have demonstrated that the 51-kD band is most clearly associated with the tonoplast. Whereas Al has been reported to stimulate the activity of the tonoplast H<sup>+</sup>-ATPase and H<sup>+</sup>-PPase, antibodies raised against these proteins did not cross-react with the 51-kD band. Efforts are now under way to purify this protein from tonoplast-enriched fractions. [References: 50].

4164 Veisz, O.; Harnos, N.; Meszaros, K.; Tischner, T. (1996) FROST RESISTANCE OF WINTER CEREALS AS A FUNCTION OF ATMOSPHERIC CO<sub>2</sub>-CONCENTRATION, TEMPERATURE AND SOIL MOISTURE CONTENT. *Novenytermeles*. 45(5-6):445-452. Hungarian. [HUNGARIAN ACAD SCI AGR RES INST PF 19 H-2462 MARTONVASAR HUNGARY].

The effect of atmospheric CO<sub>2</sub> concentration, freezing temperature and soil moisture content on the hardening and frost resistance of winter cereals was tested under controlled conditions. The frost resistance of winter wheat rye and triticale varieties grown and hardened at an atmospheric CO<sub>2</sub> concentration of 700  $\mu$ mol x mol<sup>-1</sup> was better than that of plants grown at normal atmospheric CO<sub>2</sub> concentration (350  $\mu$ mol x mol<sup>-1</sup>). The increase in the CO<sub>2</sub> level had a favourable effect on the hardening process, thanks to which the mean survival rate was significantly better than that of the control plants. In all the varieties the increased CO<sub>2</sub> concentration caused an increase in the leaf area and in the majority of cases the dry mass was also significantly greater. The varieties gave differing responses to freezing for a short period at a very low temperature or for a longer period at a somewhat higher temperature. The wheat variety Martonvasari 4 survived better when treated at a higher freezing temperature (-12 degrees C) for a longer period (72 hours) than at a lower temperature (-18 degrees C) for a shorter time (24 hours). The opposite behaviour was observed for Martonvasari 8. An increase in the moisture content of the soil caused only a slight increase in the killed plant rate for varieties with good frost resistance, but led to considerably greater damage in varieties with medium or poor frost resistance. [References: 27].

## H60 WEEDS

4165 [The use of agrochemicals in field crops. Winter wheat and barley (in Belgium)]. Utilisation des produits phytopharmaceutiques en grandes cultures. Premiere partie: froment d'hiver et escourgeon (1996) *Agriccontact (Belgium) (no.285) p. 19-24*. 3 tables. French. (AGRIS 97-078504).

4166 Ahmed, K.; Shah, Z.; Awan, I.; Khan, H.; Khan, H. (Gomal Univ., D.I. Khan (Pakistan). Dept. of Agronomy) (1993) Effect of some post-emergence herbicides on wheat (*Triticum aestivum* L.) and associated weeds. *Sarhad Journal of Agriculture (Pakistan) v. 9(4) p. 323-326*. 3 tables, 13 ref. English. (AGRIS 97-078506).

An experiment was conducted to determine the effect of six herbicides viz., Arelon 50 SC, Graminon 500 SC, Tribunil 70 WP, 2, 4-D (Powder),

Buctril M 40 EC and Dicuran MA 60 WP as post-emergence compared with one hand weeding and weedy check on weed population and grain yield of wheat, cultivar Pirsabak-85 during 1990-91. The experiment was laid out in a Randomized Complete Block Design with four replications. The results revealed that the application of herbicides and hand weeding significantly affected the number of productive tillers/m<sup>2</sup> and grain yield (t/ha) while plant height at maturity (cm), head weight (g), number of grains per spike and 1000-grain weight (g) were not significantly affected by either the herbicides application or hand weeding over weedy check. The treated plots boosted grain yield of wheat over weedy check plots. However, Tribunil 70 WP gave the maximum grain yield of 4.863 t/ha followed by Arelon 50 SC (4.783 t/ha) while the minimum grain yields were recorded in weedy check plots (4.014 t/ha). Economic analysis of yield data indicated higher benefit-cost ratio in case of Tribunil 70 WP (31.240 %) followed by Arelon 50 SC (26.97 %) and Dicuran MA 60 WP (18.506%) which is a difference from weedy check.

4167 Banaszkiewicz, T.; Murawa, D.; Wicha, J. (University of Agriculture and Technology, Olsztyn (Poland). Dept. of Plant Protection) (1996) [Activity of sulphonylurea herbicides and flusilazol in winter wheat]. *Działanie herbicydów sulfonilomocznikowych i flusilazolu w pszenicy ozimej. Fragmenta Agronomica (Poland) v. 13(1) p. 52-60. 1 fig., 4 tables; 17 ref. Polish. (AGRIS 97-078510).*

During the years 1993-94 field experiments conducted in Tomaszkowo in the vicinity of Olsztyn the activity of sulphonylureas herbicides and flusilazol applied in spring in winter wheat has been investigated. Effectiveness of chemicals was variable mainly under influence of weather condition. Improvement of yield quality after chemical treatments was observed.

4168 Barhoma, M.A.; Ibrahim, H.M.; Moshtohry, M.R. (Ministry of Agriculture, Cairo (Egypt). Field Crops Research Inst.) (1996) Influence of certain herbicides in controlling broad-leaved and grassy weeds in wheat fields. *Annals of Agricultural Science, Moshtohor (Egypt) v. 34(2) p. 465-472. 2 tables; 12 ref. English. (AGRIS 97-078505).*

4169 Barhoma, M.A.; Kholosy, A.S. (Ministry of Agriculture, Cairo (Egypt). Field Crops Research Inst.) (1996) Effect of certain herbicides on controlling weeds in barley fields. *Annals of Agricultural Science, Moshtohor (Egypt) v. 34(2) p. 455-464. 2 tables; 14 ref. English. (AGRIS 97-078470).*

4170 Doll, H. (1997) THE ABILITY OF BARLEY TO COMPETE WITH WEEDS. *Biological Agriculture & Horticulture. 14(1):43-51. English. [RISO NATL LAB DEPT ENVIRONM SCI & TECHNOL DK-4000 ROSKILDE DENMARK].*

The influence of crop plant density and variety on weed growth was studied in spring barley at a biodynamic and a conventional farm in two years. There was ample germination of weeds at both test sites, but the population of weed species was more diverse at the biodynamic farm. A reduction in barley plant density from normal to half or quarter density resulted in a 2-5 fold increase in shoot weed dry matter at harvest. The gain in grain yield obtained by herbicide treatment was 13, 24 and 34%, respectively at normal, half, and quarter barley density. Normal plant density of barley was more important for the ability to compete with weeds than it was for obtaining a high grain yield. The amount of weed dry matter varied twofold between some of the barley varieties. This variation was not statistically significant within any of the experiments, but the reported high and low competitive ability of some of the varieties was confirmed. There were significant, negative correlations between grain yield and weed dry matter in the individual varieties at the biodynamic farm. Generally a negative relation between grain yield level and weed growth was indicated by the experiments. [References: 8].

4171 Duer, I. (Institute of Soil Science and Cultivation of Plants, Pulawy (Poland). Dept. of Crop Rotation) (1996) [Allelopathic potential of biomass of some weed species in relation to winter wheat seedlings (*Triticum Aestivum* var. *vulgare*)]. *Potencjał allelopatyczny biomasy niektórych gatunków chwastów, w stosunku do siewek pszenicy ozimej (Triticum Aestivum var. vulgare). Fragmenta Agronomica (Poland) v. 13(2) p. 6-56. 11 fig., 13 tables; 116 ref. Polish. (AGRIS 97-078509).*

The research was performed in the laboratory conditions, growth chamber, greenhouse as well as in the pots without bottom and microplots in field conditions. The allelopathic potential of the weed biomass was

characterised by the number of germinated wheat seeds, by the inhibition or stimulation of the coleoptile and radicles or roots length, by seedlings chemical composition and by mineral nutrient uptake. It was found, that biomass of weeds and its water and methanol extracts are potential sources of biologically active substances. In field conditions the effect of weeds on the growth of seedlings was regulated by precipitations as well as by the soil sorption of biological active substances.

4172 Feldman, S.R.; Alzugaray, C.; Torres, P.S.; Lewis, P. (1997) THE EFFECT OF DIFFERENT TILLAGE SYSTEMS ON THE COMPOSITION OF THE SEEDBANK. *Weed Research. 37(2):71-76. English. [UNIV NACL ROSARIO FAC CIENCIAS AGRARIAS CC 14 RA-2123 ZAVALLA ARGENTINA].*

The soil seedbank of a wheat crop grown with four tillage systems (mouldboard plough, disk, chisel and no-tillage) for 3 years was analysed. Density and composition of seedbanks varied according to tillage system and depth. The mouldboard plough crop had seedbanks with the lowest seed density and there was no difference in density or composition at 0-5 cm and 5-10 cm depth whereas no-tillage had a more dense seed bank, especially in the upper part of the soil profile. Diversity of seedbanks also increased from mouldboard plough, to disk, to chisel, to no-tillage, which had the most diverse bank. Therefore, the data strongly support the hypothesis that the systems causing less disturbance allow the build-up of a larger and more diverse soil seed bank. [References: 27].

4173 Hageman, N.R. (Monsanto, Louis, MO.); Blank, S.E.; Cramer, G.L.; Isakson, P.J.; Ryerson, D.K.; Parrish, S.K. (1996) MON 37500: a new selective herbicide to control annual and perennial weeds in wheat. *Western Society of Weed Science (USA) v. 49 p. 78-82. references. Meeting held March 11-14, 1996, Albuquerque, New Mexico. English. (AGRIS 97-063725).*

4174 Hassan, S.W.; Khan, S.; Khan, M.A.; Rahmatullah (NWFP Agricultural Univ., Peshawar (Pakistan). Dept. of Agronomy) (1994) Effect of different levels of herbicides on weeds population and grain yield of wheat. *Sarhad Journal of Agriculture (Pakistan) v. 10(2) p. 117-120. 3 tables, 7 ref. English. (AGRIS 97-078508).*

The above captioned experiment was laid out in RCB design with split plot arrangement of treatments on a plot size of 2.5 x 3.5m; replicated three times during 1991-92. Wheat variety Pirsabak-85 at the rate of 100 kg/ha was seeded using two bags of diammonium phosphate (18:46) as a basal fertilizer. Four different levels depending upon efficacy of four herbicides, were applied as post emergence at proper soil moisture after first irrigation. The first, second and 3rd rates of all the herbicides were designated at minimum, optimum and maximum besides one control. Arelon at the rate of 0, 0.87, 1.75 and 2.0 kg/ha; Buctril-M at the rate of 0, 0.6, 1.23 and 1.85 lit./ha DMA at the rate of 0, 1.23, 2.47 and 3.08 kg/ha and 2, 4-D at the rate of 0, 0.5, 1.0 and 1.2 kg/ha were sprayed at 3 to 4 leaf stage of wheat crop. Weeds count was made randomly in a 10 x 10 cm unit area after a month's time of seeding. Weeds population was significantly reduced at the rate of minimum levels of all herbicides while buctril-M and arelon at optimum and maximum level had completely wiped out weeds from the respective plots. The rest of the herbicides were statistically significant in controlling weeds at various levels. Arelon sprayed at the rate of minimum dose of 0.87 kg/ha resulted in highest grain yield of 3.568t/ha followed by Buctril-M with 3.294t/ha.

4175 Hussain, F.; Ayaz, M. (Peshawar Univ. (Pakistan). Dept. of Botany); Hayat, S.; Saljoqi, A.R. (NWFP Agricultural Univ., Peshawar (Pakistan). Dept. of Plant Protection) (1993) Life form, leaf spectra, seed out-put and biomass of weeds in the wheat fields of Mayar-Jandool, district Dir [Pakistan]. *Sarhad Journal of Agriculture (Pakistan) v. 9(6) p. 539-542. 2 tables, 15 ref. English. (AGRIS 97-078507).*

The leaf size spectra, life form, biomass accumulation, seed out-put and seed weight of some of the weeds in the wheat fields of Mayar-Jandool, District Dir, was determined during April and May 1992. Of the 53 recorded species, 28 (58.83%) species were microphyllous, 18 (33.96%) were nanophyllous weeds, 7 species (13.21%) were leptophyllous weeds. There were 4 geophytes (7.54%) and 49 species (92.45%) therophytes. The total weed biomass/quadrat was greater in May than in the April. The average seed out-put for *Silene conoidea* was 165.30/plant, followed by *Adonis aestivalis* (114 seeds/plant). Average seed weight ranged in between 0.5 mg. (*Silene conoidea*) to 4.5 mg (*Lathyrus hirsutus*). The study concludes that majority of weeds are therophytes and microphyllous. Seed

output of these weeds must further be analysed as this single observation is inconclusive.

4176 Jacobs, J.M. (Dartmouth Medical School, Hanover, NH.); Jacobs, N.J.; Duke, S.O. (1996) Protoporphyrinogen destruction by plant extracts and correlation with tolerance to protoporphyrinogen oxidase-inhibiting herbicides. *Pesticide biochemistry and physiology (USA) v. 55(1) p. 77-83*. references. English. (AGRIS 97-063633).

Herbicide damage by photobleaching diphenylether herbicides is the indirect result of inhibition of an enzyme in chlorophyll biosynthesis. The substrate of the inhibited enzyme, protoporphyrinogen, accumulates and is subsequently converted to protoporphyrin, a potent photoactive compound which causes light-dependent membrane damage. In the present study, we report characteristics of a factor in the soluble fraction of leaves which can decompose protoporphyrinogen to nonporphyrin products. This process may be important in protecting plants from herbicide damage, since it would interfere with accumulation of the phototoxic porphyrin, protoporphyrin. We found that this protoporphyrinogen destruction is associated with the protein fraction of the soluble leaf homogenate, suggesting its enzymatic nature. Protoporphyrinogen destruction is stable to mild heat, but is eliminated by boiling. Protoporphyrinogen destruction is present in the soluble leaf homogenate but is not localized within the stromal fraction of the chloroplast. The reductants dithiothreitol and beta-mercaptoethanol, but not glutathione, inhibit protoporphyrinogen destruction at high concentrations. In contrast, ascorbic acid markedly inhibits destruction even at low concentrations, suggesting a role for cellular ascorbic acid in protecting protoporphyrinogen from destruction, thereby enhancing herbicide action. Protoporphyrinogen destruction was least active in young cucumber leaves, a plant highly susceptible to herbicides. Higher levels of protoporphyrinogen destruction were found in leaves of broadleaf mustard and radish, two plants exhibiting herbicide tolerance. For cucumber, the extent of destruction increased with the age of the plant. These findings suggest a correlation between increased protoporphyrinogen destruction and herbicide tolerance in some plant species.

4177 Koscelny, J.A.; Peeper, T.F. (1997) EVALUATION OF REGISTERED HERBICIDES FOR CHEAT (BROMUS SECALINUS) CONTROL IN WINTER WHEAT (TRITICUM AESTIVUM). *Weed Technology. 11(1):30-34*. English. [OKLAHOMA STATE UNIV STILLWATER, OK 74078 USA].

Seven field experiments were conducted in Oklahoma to compare efficacy and wheat response to currently registered cheat suppression or control herbicide treatments. Chlorsulfuron + metsulfuron premix (5:1 w/w) at 26 g ai/ha applied PRE controlled cheat 20 to 61%, increased wheat grain yields at two of seven locations, and decreased dockage due to cheat at five of seven locations. Chlorsulfuron + metsulfuron at 21 g/ha tank-mixed with metribuzin at 210 g/ha, applied early fall POST, controlled cheat 36 to 98% and increased wheat yield at four of seven locations. Metribuzin applied POST in the fall at 420 g/ha controlled cheat 56 to 98% and increased wheat yields at five of seven locations. Both POST treatments decreased dockage at all locations. [References: 8].

4178 Koscelny, J.A.; Peeper, T.F. (1997) HERBICIDES FOR WINTER-HARDY WILD OAT (AVENA FATUA) CONTROL IN WINTER WHEAT (TRITICUM AESTIVUM). *Weed Technology. 11(1):35-38*. English. [OKLAHOMA STATE UNIV DEPT AGRON STILLWATER, OK 74078 USA].

Diclofop at 840 g ai/ha, fenoxaprop at 90 g ai/ha, and imazamethabenz at 530 g ai/ha fall-applied controlled wild oat 96, 99, and 95% and increased wheat grain yields 26, 29, and 24%, respectively. These herbicides controlled wild oat over a wider range of growth stages than current labels indicate. The same treatments applied in March were less effective for wild oat control and did not increase wheat yield. [References: 15].

4179 Maciorowski, R.; Piech, M.; Stankowski, S.; Murkowski, A. (Academy of Agriculture, Szczecin (Poland). Dept. of Plant Experimentation) (1996) [Chlorophyll fluorescence as a rapid test for reaction to urea herbicides in triticale]. Fluorescencja chlorofilu jako szybki test do badania pszenżyta ozimego na herbicydy mocznikowe. *Fragmenta Agronomica (Poland) v. 13(1) p. 61-69*. 3 tables; 23 ref. Polish. (AGRIS 97-078503).

In the laboratory conditions (on a liquid solution), the response of the triticale cultivars (Malno, Bogo, Moreno, Vero, Lasko, Bolero) to the urea

herbicides (isoproturon, chlorotoluron) was estimated. The herbicides were applied in two doses (6 and 12 mg/l). Seedlings 5 days old were treated by root application of herbicide for 24 h. The measurements of chlorophyll fluorescence parameters: Fv/Fm, Sc/Fm and Fm/F12 were performed after 24 hours and 7 days, since the moment of the herbicides application. The higher doses (12 mg/l) of the both herbicides have differentiated best the reaction of triticale cultivars. Cv. Bolero and cv. Malmo were the most susceptible to the isoproturon and cv. Lasko was tolerant to the chlorotoluron.

4180 Moyer, JR.; Huang, H.C. (1997) EFFECT OF AQUEOUS EXTRACTS OF CROP RESIDUES ON GERMINATION AND SEEDLING GROWTH OF TEN WEED SPECIES. *Botanical Bulletin of Academia Sinica. 38(2):131-139*. English. [AGR CANADA RES CTR POB 3000 LETHBRIDGE AB T1J 4B1 CANADA].

Detrimental effects of residues from crops such as canola and lentils on subsequent crops have been observed in petri-dish bioassays and in the field. Suppression of wheat growth by canola and lentil residues has occurred, in producer fields, primarily in the area behind the combine where the residues are concentrated. Adequate straw spreading has permitted producers to grow wheat following canola and lentil crops. The effect of these and other crop residues on common weeds in western Canada has not been assessed. Aqueous extracts of the residues of six different crops were bioassayed for their effect on the germination and seedling growth of ten weeds common in western Canada. Extracts of lentil (*Lens culinaris* Medic), oat (*Avena sativa* L.), canola (*Brassica napus* L.), and barley (*Hordeum vulgare* L.) were more toxic to flaxweed (*Descurainia sophia* L. Webb), stinkweed (*Thlaspi arvense* L.), and downy brome (*Bromus tectorum* L.) than extract of canola was to wheat. The greater toxicity of these crop residues to flaxweed, stinkweed, and downy brome than to wheat may permit selective management of these weeds in wheat. Flaxweed, stinkweed, and downy brome are major winter annual weeds in winter wheat and usually require late fall or early spring herbicide treatments in no-tillage systems. Therefore, residues of canola, lentil, oat and barley have potential for reducing herbicide use in winter wheat production and in no-tillage direct seeding farming systems. Crop extracts were not toxic enough to affect the growth in the field of seven other weeds in this study. [References: 23].

4181 Ognjanovic, R. (Agronomski fakultet, Cacak (Yugoslavia)); Bozic, D.; Milovanovic, M. (1996) [Influence of fertilization by calcium and liming on weeds at wheat, maize and soybean]. Uticaj djubrenja kalcijumom i kalcizacije na zakorovljenost pšenice, kukuruza i soje. Peti kongres o korovima. Banja Koviljaca (Yugoslavia). 18-21 Jun 1996. *Fifth congress of weeds. Proceedings. Janjic, V. (ed.). Peti kongres o korovima. Zbornik radova p. 432-440*. Herbolosko drustvo Srbije. 3 tables; 10 ref. Serbian. (AGRIS 97-063723).

Influence of fertilization by calcium, as well as liming on weeds association at wheat, maize and soybean was investigated. Significantly the highest presence of weeds was established for control (without of calcium application). With higher amount of applied calcium (lime fertilizer - Njival Ca), general weeds presence for three crops reduces. Investigated factors and theirs interactions for most of instances were significantly influenced weeds presence in agrophytocenosis of wheat, maize and soybean.

4182 Ognjanovic, R. (Agronomski fakultet, Cacak (Yugoslavia)); Veljovic, V.; Markovic, A. (1996) [As. Galeopsi-Calystegietum sepii - the weed community in small grains in valley of Zapadna Morava river (Serbia, Yugoslavia)]. As. Galeopsi-Calystegietum sepii - korovska zajednica starih zita u dolini Zapadne Morave [Srbija, Jugoslavija]. Peti kongres o korovima. Banja Koviljaca (Yugoslavia). 18-21 Jun 1996. *Fifth congress of weeds. Proceedings. Janjic, V. (ed.). Peti kongres o korovima. Zbornik radova p. 284-292*. Herbolosko drustvo Srbije. 3 tables; 16 ref. Serbian. (AGRIS 97-063720).

An association of weed at small grains Galeopsi-Calystegietum sepii Stepic 1984 (= Ass. Galeopsis tetrahit-Calystegia sepium) was ascertained and described. Its floristic composition have 90 species from 29 families and 15 floristic elements. Its character of vital spectrum is terophytic. This association is similar with other weeds associations of small grains having the same name found in other regions of Yugoslavia.

4183 Pawlowska, J. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Cultivation); Makarska, E. (Agricultural



University, Lublin (Poland). Dept. of Chemistry); Kukula, S. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Cultivation) (1995) [Evaluation of some herbicides activity in winter triticale varieties cultivation]. *Ocena dzialania preparatow herbicydowych w uprawie kilku odmian pszenzyta ozimego. Fragmenta Agronomica (Poland) v. 12(3) p. 79-86. 4 tables; 14 ref. Polish. (AGRIS 97-078502).*

In 3-years experiment conducted on the soil of very good rye complex the response of a few winter triticale varieties on some herbicides was studied. The influence of the herbicides on grain yield, number of weeds and the mineral content of grain was determined. The differentiation in yield cultivars was rather small. The changes of the content of mineral components in grain applied by herbicides were less than those caused by weather conditions during the years of investigation.

4184 Price, W.J. (University of Idaho, Moscow, ID.); Shafii, B.; Thill, D.C. (1996) Quantifying competition between spring barley and wild oat with an individual-plant simulation model. *Western Society of Weed Science (USA) v. 49 p. 110-112. references. Meeting held March 11-14, 1996, Albuquerque, New Mexico. English. (AGRIS 97-063554).*

4185 Salehi, L.; Saeedi, Sh. (1993) Partial list of weeds in Guilan. Guilan Univ., Rasht (Iran Islamic Republic). College of Agriculture. *Proceedings of the 11th Plant Protection Congress of the 28 Aug.- 2 Sep. 1993 Rasht (Iran Islamic Republic) p. 291. Persian. (AGRIS 97-078531).*

4186 Serre, I.; Cabanne, F.; Gauvrit, C. (Phytopharmacie, INRA BV 1540, 21034 Dijon Cedex (France)) (1996) Behaviour of alkyl oleates on leaf surfaces in relation to their influence on herbicide penetration. *Brighton Crop Protection Conference: Pests and Diseases - 1996: Volume 3: Proceedings of an International Conference, Brighton, UK, 18-21 November 1996. p. 807-812. British Crop Protection Council. 12 ref. English. (AGRIS 97-063653).*

4187 Stojanovic, J.; Stojanovic, S.; Ognjanovic, R. (Institut za istrazivanja u poljoprivredi Srbija, Kragujevac (Yugoslavia). Centar za strna zita) (1996) [The influence of weeds on wheat grain yield losses]. *Uticaj korova na smanjenje prinosa zrna pšenice. Peti kongres o korovima. Banja Koviljaca (Yugoslavia). 18-21 Jun 1996. Fifth congress of weeds. Proceedings. Janjic, V. (ed.). Peti kongres o korovima. Zbornik radova p. 293-300. Herbolosko drustvo Srbije. 3 tables; 16 ref. Serbian. (AGRIS 97-063721).*

The influence of weeds on wheat grain yield losses at different crop density and nitrogen nutrition was investigated. Obtained results showed that wheat yield was increased by the increase of crop density and nitrogen rate both in the control crops (hand weeded and herbicide treated) and in the crops with two densities of wild oat and broadleaved weeds. Yield reductions due to weed competition were the most in the variant with broadleaved weeds, and than in the variant with higher wild oat density. The increase of crop density and rate of applied nitrogen were reduced weeds aboveground mass and wheat grain yield losses. Treatment with herbicide Granstar 75-DF was influenced the increase of grain yield in the relation of hand weeded control.

4188 Stojanovic, S. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita); Stojanovic, J.; Jerkovic, Z.; Milijic, S.; Jevtic, R. (1996) [The quitch grass as a source of resistant genes to wheat rusts]. *Pirevina kao izvor gena otpornosti prema rdjama pšenice. Peti kongres o korovima. Banja Koviljaca (Yugoslavia). 18-21 Jun 1996. Fifth congress of weeds. Proceedings. Janjic, V. (ed.). Peti kongres o korovima. Zbornik radova p. 403-409. Herbolosko drustvo Srbije. 3 tables; 25 ref. Serbian. (AGRIS 97-063722).*

In the paper showed effectiveness of Sr24, Sr25, Sr26 and Lr19, Lr24 and Lr29 resistance genes from the quitch grass to wheat stem and leaf rust. It is pointed out on high effectiveness Sr24 and Sr26 genes to different pathotypes of Puccinia graminis tritici in the seedling stage, as a theirs low effectiveness at adult stage in the locations Kragujevac and Zajecar (Serbia, Yugoslavia). Very effective to Puccinia recondita tritici were Lr19 and Lr24 genes. In our population of parasites there is no virulence allele to Lr19 gene. Genes from the quitch grass (especially Agropyron elongatum) are very important in breeding program of wheat, as donors Sr and Lr genes of resistance to rusts.

4189 Uludag, A.; Lyon, D.J.; Nissen, S.J.; Kachman, S.D. (1997) PROSE MILLET (PANICUM MILIACEUM) RESPONSE TO CGA-152005, METSULFURON, AND TRIASULFURON. *Weed Technology. 11(1):138-*

143. English. [UNIV NEBRASKA DEPT AGRON SCOTTSBLUFF, NE 69361 USA].

Prose millet is a short-season summer annual grass that is well adapted to the central Great Plains. Prose millet is commonly planted as a summer crop when winter wheat stands are lost due to adverse conditions, Sulfonyleurea herbicides labeled for use in winter wheat prohibit planting prose millet for intervals up to 10 mo following application. A series of greenhouse and field studies determined prose millet tolerance to CGA-152005, metsulfuron, and triasulfuron soil residue. In the greenhouse, prose millet was not affected by soil-applied CGA-152005 at doses up to 160 g ai/ha, while metsulfuron and triasulfuron doses of 4 and 15 g ai/ha, respectively, inhibited prose millet biomass accumulation. In the field, metsulfuron and triasulfuron caused early season stunting and chlorosis at doses two to four times those recommended; however, grain yields were not affected. Organic matter and clay content were highly correlated with prose millet growth response to the herbicides under greenhouse conditions, but in the field, soil pH may have influenced herbicide bioavailability. [References: 15].

4190 Veljkovic, B. (Institut za zastitu bilja i zivotnu sredinu, Beograd (Yugoslavia)); Zivanovic, M. (Poljoprivredni fakultet, Novi Sad (Yugoslavia)) (1996) [Estimation of adsorption degree for herbicides fluazifop-p-buthyl and haloxyfop-ethoxyethyl]. *Utvrdjivanje stupnja adsorpcije za herbicide fluazifop-p-butil i haloksifop-etoksietil. Peti kongres o korovima. Banja Koviljaca (Yugoslavia). 18-21 Jun 1996. Fifth congress of weeds. Proceedings. Janjic, V. (ed.). Peti kongres o korovima. Zbornik radova p. 596-602. Herbolosko drustvo Srbije. 3 graphs; 2 tables; 8 ref. Serbian. (AGRIS 97-063654).*

Investigation were carried out with the aim to estimate the constant of adsorption for herbicides fluazifop-p-buthyl and haloxyfop-ethoxyethyl in soil of the following structure: organic material 3.6, sand 85 and mud 8-10. The constant of adsorption for fluazifop-p-buthyl is 10, and for haloxyfop-ethoxyethyl is 11. On the basis of the obtained values it can be concluded that both herbicides belong to the group of relative strong adsorbents. The total work was based on bioassay and barley was test plant.

4191 Wicks, G.A. (1997) SURVIVAL OF DOWNY BROME (BROMUS TECTORUM) SEED IN FOUR ENVIRONMENTS. *Weed Science. 45(2):225-228. English. [UNIV NEBRASKA DEPT AGRON N PLATTE, NE 69101 USA].*

Downy brome is one of the most troublesome winter annual weeds in winter wheat-fallow rotations in the central Great Plains. A 3-yr seed burial study was initiated to determine how long downy brome seed remained germinable when placed on the soil surface or 2.5 cm deep at four different times in four environments. Only 1 to 7% of the downy brome seed survived after 1 yr on the soil surface in chemical fallow and stubble mulch when deposited in August, but survival varied in September, October, and November. In 1970, a year with low fall and winter precipitation, 36 to 46% of the seed placed on the soil surface of chemical fallow in September, October, and November survived, compared with 1 to 8% for stubble mulch tillage. Early spring tillage covered more seed with soil, and downy brome seed survival decreased. When fall and winter precipitation was normal, stubble mulch and chemical fallow had 1 to 20% germinable seed remaining. Induced dormancy existed in some years. More downy brome seed survived when placed on the soil surface of crested wheatgrass sod (14 to 50%) than on smooth brome sod (0 to 36%). No differences existed among environments when downy brome seed was buried 2.5 cm deep. Only 0.4% of downy brome seed buried 2.5 cm survived after 1 yr when averaged across all environments. [References: 22].

## J11 HANDLING, TRANSPORT, STORAGE AND PROTECTION OF PLANT PRODUCT

4192 Ahmed, M. (Karachi Univ. (Pakistan). Grain Storage Research Lab.); Shaikat, S.S. (Karachi Univ. (Pakistan). Dept. of Botany); Alam, M.S.; Iqbal, S.; Ahmed, A.; Khan, J. (1993) Comparative cost effectiveness of four integrated pest management methods for storage of bagged wheat in Lahore and Multan [Pakistan]. *Sarhad Journal of Agriculture (Pakistan) v. 9(5) p. 403-414. 1 ill., 4 tables, 8 ref. English. (AGRIS 97-078663).*

Four Integrated Pest Management Protocols for the protection of stored wheat in bags were tested in Lahore and Multan for evaluating their cost effectiveness. These IPM protocols included the laid down practice of

Punjab Food Department (P-1); Multiple dose fumigation with spraying of peripheral bags (P-2); phosphine Fumigation under Polyethylene Enclosure (PEPF) (P-3) and control or monitoring of actual agency routine practice (P-4). In Multan, storage loss during treatment period was highest in control (P-4) followed by PEPF (P-3), Multiple dose fumigation (P-2) and the recommended practice (P-1). The total insect load at despatch and the quantity lost and its value also showed the same pattern. Net cost (total expenditure + value of loss) was highest for agency controlled followed by Multiple dose fumigation, PEPF and the recommended practice followed by the maximum percent increase in number of insects at issue over arrival was found in control followed by Multiple dose fumigation, PEPF and the recommended practice. Net cost was highest in Multiple dose fumigation followed by the recommended practice, control, probably due to development of resistance in stored grain insect pests against phosphine. However, the one which provided for the under sheet phosphine fumigation (PEPF) appeared to be comparatively most qualified for use by public sector agencies.

4193 Alam, M.S.; Ahmed, M.; Ahmed, A. (Grain Storage Research Lab., PARC, Karachi (Pakistan)) (1993) A survey of resistance to phosphine and contact insecticides in major pests of stored wheat and rice in Pakistan. *Sarhad Journal of Agriculture (Pakistan) v. 9(6) p. 562-575. 7 ills., 19 ref. English. (AGRIS 97-078664).*

Forty strains of *R. dominica*, forty three of *T. castaneum*, eight of *T. granarium* and four of *S. oryzae* collected from various parts of Pakistan were tested for their resistance to phosphine. Fifty five and 46.5 percent of the tested strains of *R. dominica* and *T. granarium* were found resistant. The resistant factor in *R. dominica* ranged between 2 and 85, in *T. castaneum* 2 and 162, in *T. granarium* 11 and 36 and *S. oryzae* against malathion 16, 14 and 8 strains respectively were tested. None of the strain was found susceptible. The RF value in these species ranged between 8 and 240, 4 and 350 and 8 and 31 in that order. Sixteen strains of stored grain pests were tested against fenitrothion, all of them were found resistant. The maximum RF value recorded was that of 138 for *R. dominica*. Out of 34 strains of stored grain pests tested against Actellic 7 were found susceptible whereas other exhibited the RF value ranging between 2 and 91.

4194 Dominguez Sepulveda, Hugo (1995) [Chemical control of *Sitophilus granarius* L. (Coleoptera: curculionidae) effect of stored barley fumigated in relation of humidity content in Chapingo, Mexico State]. *Control quimico de Sitophilus granarius L. (Coleoptera:Curculionidae) y efecto de la fumigacion en semilla de cebada maltera almacenada en relacion a su contenido de humedad en Chapingo, Mex. Universidad Autonoma Chapingo, Chapingo, Mex. (Mexico). Departamento de Parasitologia Agricola. 55 p. Spanish. (AGRIS 97-078592).*

4195 Flinn, PW.; Hagstrum, DW.; Muir, WE. (1997) EFFECTS OF TIME OF AERATION, BIN SIZE, AND LATITUDE ON INSECT POPULATIONS IN STORED WHEAT - A SIMULATION STUDY. *Journal of Economic Entomology. 90(2):646-651. English. [USDA ARS US GRAIN MKT RES LAB MANHATTAN, KS 66502 USA].*

A spatial model of *Cryptolestes ferrugineus* (Stephens) population dynamics and bin temperature was used to simulate effects of time of aeration, bin size, and latitude on *C. ferrugineus* density in stored wheat. In unaerated grain, densities of *C. ferrugineus* were predicted to be much greater in wheat stored in Oklahoma than in Kansas or South Dakota and reach greater densities in 272.2-T (10, 000 bu) than in 81.6-T (3, 000 bu) bins. Automatic aeration controllers (fans turned on when outside air was 10 degrees C lower than grain temperature) suppressed *C. ferrugineus* population growth better than manual aeration starting in November. Automatic aeration also worked better when started at grain harvest rather than waiting until 1 September. In Oklahoma, automatic aeration starting at harvest was the only aeration strategy that prevented *C. ferrugineus* from exceeding 2/kg. Average fan hours to cool the grain to 10 degrees C using automatic control starting at harvest was 270 h for 272.2-T bins and 220 h for 81.6-T bins. Starting automatic aeration at harvest added an additional 30 h. This small increase in fan hours resulted in much greater *C. ferrugineus* suppression, especially in latitudes similar to those of Oklahoma and Kansas. In temperate climates, automatic aeration controllers should greatly reduce the need for chemical control. [References: 14].

4196 Hoersten, D. von (1995) [Use of microwave energy and other heating sources to eradicate *Fusarium culmorum* in wheat seed]. *Einsatz von Mikrowellenenergie und anderen thermischen Verfahren zur Abtoetung von Fusarium culmorum im Weizensaatgut. Georg-August-Universitaet Goettingen (Germany). Inst. fuer Tierzucht und Haustiergenetik. Forschungsbericht Agrartechnik des Arbeitskreises Forschung und Lehre der Max-Eyth-Gesellschaft Agrartechnik im VDI (VDI-MEG) (Germany); no. 269 134 p. German. (AGRIS 97-063865).*

Die Grundlagen fuer die thermische Abtoetung von Krankheitserregern in Saatgut werden anhand von kuenstlich mit *Fusarium culmorum* infiziertem Weizensaatgut ermittelt. Neben der Heisswasser- und Heissluftbehandlung werden insbesondere Versuche zur Mikrowellenbehandlung mit einer messtechnisch vollstaendig ausgestatteten Versuchsanlage durchgefuehrt. Mit allen untersuchten Methoden ist eine Abtoetung des Krankheitserregers *Fusarium culmorum* bei gleichzeitigem Erhalt der Keimfaehigkeit moeglich. Mit der Heisswasserbeizung sind hierfuer Behandlungszeiten von mindestens 60 Minuten notwendig, wobei eine anschliessende Nachtroeknung unumgaenglich ist. Eine Heissluftbehandlung von trockenem Saatgut in geschlossenen Behaeltern (unter Luftabschluss) mit Zeiten von mindestens 30 Minuten ermoeglicht ebenfalls eine Abtoetung des Erregers bei Erhalt der Keimfaehigkeit. Durch eine Mikrowellenerwaermung in Kombination mit Dampfzufuhr kann das untersuchte Saatgut mit einem Feuchtegehalt von 15 % bei sehr kurzen Behandlungszeiten von 3 Minuten und Temperaturen von 70 bis 75 C vollstaendig vom Erreger befreit werden, ohne dass die Keimfaehigkeit geschaedigt wird und eine Befeuchtung des Saatguts eintritt. Bei allen untersuchten Verfahren muss ein Austrocknen des Saatguts verhindert werden, so dass die Letaltemperatur des Pilzes nicht erhoehet wird. Bei der Mikrowellenbehandlung unter gleichzeitigem Dampfzusatz wird weiterhin der positive Effekt einer deutlichen Vergleichmaessigung des elektrischen Feldes im Behandlungsraum und einer deutlich verbesserten Temperaturverteilung im Behandlungsgut erzielt. Insbesondere die kombinierte Mikrowellen-Dampf-Behandlung stellt aufgrund der sehr kurzen Behandlungszeit und der entfallenden Nachtroeknung eine verfahrenstechnisch interessante Alternative zur Abtoetung von samenbuertigen Krankheitserregern dar.

4197 Iqbal, J.; Irshad (National Agricultural Research Centre, Islamabad (Pakistan). Entomological Research Labs.); Khalil, S.K. (NWFP Agricultural Univ., Peshawar (Pakistan)) (1993) Sack fumigation of wheat under polythene sheets. *Sarhad Journal of Agriculture (Pakistan) v. 9(5) p. 399-402. 2 tables, 8 ref. English. (AGRIS 97-078662).*

Losses caused by insects are reduced by fumigation. The commonly used fumigant in stores is phosphine. Wheat grain fumigation under polythene sheet was tested at Islamabad. Phosphine concentration measured by Harris conductivemeter was higher in the stacks fumigated with Detia tablets at the rate of 3 gram per ton than Phostoxin pellets at the same dose indicating that in Detia tablets more phosphine was generated. Effective fumigation was also achieved at 1 gram/ton dose. This shows that recommended phosphine dose can be reduced from 3 gram to 1 gram per tone. This dose for exposure period of 10 days also caused mortality in a resistant strain of *Tribolium castaneum* (Hbst.), red flour beetle (TC-33). Sealing of the stacks was variable, therefore, different level of leakage was obtained.

4198 Khalil, S.K. (NWFP Agricultural Univ., Peshawar (Pakistan)); Irshad, M. (National Agricultural Research Centre, Islamabad (Pakistan)) (1994) Field estimates of population growth rate of some important grain pests in wheat stored at farm level in Northern Pakistan. *Sarhad Journal of Agriculture (Pakistan) v. 10(3) p. 273-278. 2 tables, 7 ref. English. (AGRIS 97-078656).*

Population of five species of stored grain pests was monitored in four villages of Mansehra district. Among *Sitophilus oryzae*, *Tribolium castaneum*, *Rhyzopertha dominica*, *Oryzaephilus surinamensis* and *Sitotroga cerealella* encountered, the *S. oryzae* was most abundant. Its number continuously increased in each month; and maximum number was found in November. Its highest rate of growth was in village Butkarar followed by Jabbori; and was low and almost equal in village Shahoter and Kanoge. The highest rate of increase (r) was obtained in July-September in different villages. *T. castaneum* was not found in July and afterwards there was no specific trend. Similarly its rate of increase was low. *R. dominica* was not found in village Shahoter and Butkarar. In other two villages its population fluctuated without any specific trend. Rate of increase of *O. surinamensis* was identical in village Shahoter, Butkarar and Jabbori. *S.*

cerealella was first encountered in August and continuously increased in village Butkarar, Shahoter and Jabbari.

4199 Kljajic, P.; Peric, Z.; Peric, I. (Institut za istrazivanja u poljoprivredi "Srbija", Beograd Zemun (Yugoslavia). Centar za pesticide i zastitu zivotne sredine) (1996) [Lethal effects of extreme temperatures on granary weevil adults, *Sitophilus granarius* L. (Coleoptera: Curculionidae)]. Letalni efekti ekstremnih temperatura na adulte zitnog ziaka, *Sitophilus granarius* L. (Coleoptera: Curculionidae). *Pesticidi (Yugoslavia)* v. 11(3) p. 195-202. 5 tables; 21 ref. Serbian. (AGRI 97-063858).

Effects of extreme temperatures (-25, -5, 45, 50, 55 and 60 deg C) on granary weevil adults, *Sitophilus granarius* L. were studied. The paralysis speed varied significantly at different temperatures. With 10 degrees temperature increase, the paralysis speed over 100. At level LT50 the action speed at 60 deg C was about 3.5 times greater than at 45 deg C. Variations in the speed of action of low temperatures were much greater than those of high temperatures. The LT50 level for insects exposed to -5 deg C was 5.69 days, while at -25 deg C it was 33.45 minutes. Granary weevil adults from populations characterized by different density reacted differently to extreme temperatures. However, based on calculated confidence limit, effect variations in three population densities were statistically insignificant at -5 deg C, and mutual differences at -25 deg C were also irrelevant.

4200 Longstaff, B.C. (1997) DECISION TOOLS FOR GRAIN STORAGE PEST MANAGEMENT [Review]. *Journal of Stored Products Research*. 33(2):99-114. English. [CSIRO DIV ENTOMOL GPO BOX 1700 CANBERRA ACT 2601 AUSTRALIA].

The application of a range of decision tools to the management of pests in stored grain is discussed. Included in this review are: Knowledge Acquisition and Surveys, Decision Analysis, Modelling and Expert Systems. A project integrating a number of these techniques, to provide a coherent training system, is also described. Improving understanding of underlying issues by all levels within a management hierarchy is seen as a key to enhancing the effectiveness of pest management. Improvements in decision-making procedures available to managers and pest control staff should lead to greater application of effective storage procedures and thus to reductions in overall storage losses and improved efficiency of pesticide usage. (C) 1997 Elsevier Science Ltd. [References: 43].

4201 Scholler, M.; Hassan, S.A.; Reichmuth, C. (1996) EFFICACY ASSESSMENT OF TRICHOGRAMMA EVANESCENS AND T-EMBRYOPHAGUM (HYM, TRICHOGRAMMATIDAE), FOR CONTROL OF STORED PRODUCTS MOTH PESTS IN BULK WHEAT. *Entomophaga*. 41(1):125-132. English. [FED BIOL RES CTR AGR & FORESTRY INST STORED PROD PROTECT KONIGIN LUISE STR 19 D-14195 BERLIN GERMANY].

The potential of *Trichogramma evanescens* Westwood and *T. embryophagum* Quednau to control *Ephestia kuehniella* and *E. elutella* was evaluated under laboratory conditions. Both *Trichogramma* species parasitised eggs of the two *Ephestia* spp. in bulk wheat at 1, 2 and 5 cm depth. The release of *T. evanescens* was more effective than that of *T. embryophagum* resulting in higher rates of parasitism, predation and parasitoid induced mortality. At 17 degrees C and 26 degrees C, the mortality of *Ephestia* due to the release of *T. evanescens* was 67, 78% and of *T. embryophagum* 27 and 38%, respectively. The difference in host finding efficiency between the two species was large, at 5 cm depth and 26 degrees C, *T. evanescens* parasitised about four times more host eggs compared to *T. embryophagum*. [References: 19].

4202 Svihus, B.; Newman, C.W.; Newman, R.K.; Selmerolsen, I. (1997) CHANGES IN EXTRACT VISCOSITY, AMINO ACID CONTENT, AND SOLUBLE AND INSOLUBLE BETA-GLUCAN AND DIETARY FIBRE CONTENT OF BARLEY DURING DIFFERENT HIGH MOISTURE STORAGE CONDITIONS. *Animal Feed Science & Technology*. 64(2-4):257-272. English. [AGR UNIV NORWAY DEPT ANIM SCI POB 5025 N-1432 AS NORWAY].

Two experiments were conducted to investigate changes in barley during anaerobic high moisture storage of whole barley. To study the effect of micro-organisms and enzymes present in the grain, samples were irradiated or steamed prior to storage. The effects of enzyme addition and gibberellic acid addition were also investigated. When micro-organisms were not inhibited, considerable lactic acid, acetic acid, and ethanol production occurred, and the numbers of lactic acid bacteria were high.

Soluble beta-glucan content was lower ( $P < 0.05$ ) and dietary fibre content was reduced in the high moisture barley stored for 35 or 90 days compared with the dry control barley, regardless of pretreatments or additives. Correspondingly acid extract viscosity was also greatly ( $P < 0.05$ ) reduced. Insoluble beta-glucan content was higher ( $P < 0.05$ ) in high moisture barley than in dry barley, other than when enzymes with beta-glucanase activity were added to the samples. Enzyme addition enhanced fibre breakdown and reduction in acid extract viscosity, while gibberellic acid addition had no effect. Regardless of additives or pretreatments, the reduction in beta-glucan content and acid extract viscosity was largest in the first days of storage, and generally only small changes occurred after the sixth day. A correlation of 0.55 to 0.81 ( $P < 0.05$ ) was found between soluble beta-glucan content and acid extract viscosity, while a significant ( $P < 0.05$ ) negative correlation (-0.74 to -0.90) was found between soluble and insoluble beta-glucan content. The correlation between total beta-glucan content and acid extract viscosity was of the order of 0.51 to 0.63 ( $P < 0.05$ ), while the correlation between dietary fibre content and acid extract viscosity was low (0.23 to 0.33) and not significant ( $P > 0.05$ ). Amino acid content was only slightly affected by high moisture storage. These results demonstrate that high moisture storage of barley results in a rapid change in the fibre content, and that viscosity is reduced due to a reduction in soluble beta-glucan content. It appears that this process is not related to activity of enzymes in the grain, or activity of lactic acid bacteria during storage. [References: 37].

4203 Tennyson, L.K. (SDSU.) (1994) Wheat first must pass SDSU taste test before it's grown on the moon. *South Dakota farm and home research (USA)* v. 45(2) p. 10-11. English. (AGRI 97-063859).

4204 Trewin, B.; Reichmuth, C. (1997) EFFICACY OF THE DIATOMACEOUS EARTH DRYACIDE(R) AGAINST STORED PRODUCT PEST INSECTS. *Anzeiger fur Schadlingskunde Pflanzenschutz Umweltschutz*. 70(3):51-54. German. [BIOL BUNDESANSTALT LAND & FORSTWIRTSCHAFT INST VORRATSSCHUTZ KONIGIN LUISE STR D-14195 BERLIN GERMANY].

Efficacy of the diatomaceous earth Dryacide(R) against stored product pest insects The diatomaceous earth (DE) Dryacide(R) was tested under laboratory conditions on surfaces (2 g DE/m<sup>2</sup>) and in wheat grain (3 kg DE/t wheat) at a relative humidity of 70 +/- 5% and a temperature of 22 +/- 1 degrees C. The wheat had a moisture content of 14.5%. The effect of surface treatments was tested on *Ephestia kuehniella*, *Oryzaephilus surinamensis*, *Tenebrio molitor* and *Tribolium castaneum*. The efficacy of grain treatments was determined using *Ephestia elutella*, *O. surinamensis*, *Sitophilus granarius* and *Tribolium confusum*. In both treatments adult and larval stages were included. 100% mortality were reached with the surface treatments in adults and larvae of *O. surinamensis* and the adults of *T. molitor* and *E. kuehniella* after an exposition time of 3-9 days. Against *T. castaneum* and the larvae of *T. molitor* and *E. kuehniella* no complete control could be achieved. In the grain treatments the dosage of 3 kg DE/t wheat reached 100% mortality in all tested pests except *S. granarius*. Most sensitive were *O. surinamensis* and *E. elutella*. In *T. confusum* the adults died within 13 days of treatment, but for complete control of the larvae 13 weeks were necessary. Against *S. granarius* the silica dust showed no satisfactory efficacy, because 49 days after beginning of the examinations beetles of the progeny hatched. Dryacide(R) could not prevent the reproduction of the granary weevil, but there was a lower number of progeny compared to the untreated control. [References: 16].

4205 Velacoffier, E.L.; Fargo, W.S.; Bonjour, E.L.; Cuperus, G.W.; Warde, W.D. (1997) IMMIGRATION OF INSECTS INTO ON-FARM STORED WHEAT AND RELATIONSHIPS AMONG TRAPPING METHODS. *Journal of Stored Products Research*. 33(2):157-166. English. [OKLAHOMA STATE UNIV DEPT ENTOMOL STILLWATER, OK 74078 USA].

Relationships among numbers of insects trapped by unbaited flight and probe traps, and grain trier and deep bin cup samples were studied in 1991 in three farm bins in North Central Oklahoma. Placement of flight traps at the eaves of bins resulted in higher insect catches than at other positions. In the grain mass, insects were more likely to be in the central core during the first weeks of storage. Insects favored the center of the grain mass, but no significant differences were found among temperatures and moisture contents at the different regions sampled. Increasing numbers of insects with depth and length of storage time combined with the capture pattern of grain insects by flight traps indicated that infestation occurred after grain binning. The most abundant species were *Cryptolestes* spp.,



*Tribolium* spp., *Rhyzopertha dominica* (F.), *Ahasverus advena* (Waltl) and *Typhaea stercora* (L.). Action thresholds (the insect densities at which managers need to control insect populations) for the number of insects in weekly probe trap catches were 7.35 for *R. dominica*, 720.14 for *Cryptolestes* spp., and 101.34 for *Tribolium* spp. when compared with estimates from grain trier samples, and 8.04, 749.03, and 68.14 insects per probe trap, respectively, when compared with estimates from cup samples. (C) 1997 Published by Elsevier Science Ltd. [References: 25].

4206 White, N.D.G. (Agriculture and Agri Food Canada, Winnipeg, Canada.); Demianyk, C.J. (1996) Deterioration in stored wheat infested with *Tribolium audax* or *Tribolium confusum* (Coleoptera: Tenebrionidae). *Environmental entomology (USA)* v. 25(5) p. 1109-1112. English. (AGRIS 97-063856).

Adults of *Tribolium audax* Halstead or *Tribolium confusum* Jacquelin du Val were placed in bottles of wheat plus ground wheat (23:1, wt:wt) to determine effects of the insects on grain deterioration over 20 wk at 30 degrees C and 70% RH. *T. audax* increased in numbers to approximately 25 insects per 130 g wheat compared with 500 insects per 130 g wheat for *T. confusum* by 20 wk. Seed germination decreased to 5% in the *T. confusum* treatment, 15% in the *T. audax* treatment, and 25% in the whole wheat controls by 20 wk. *T. confusum* damaged up to 39% of the wheat germs and 18% of the endosperm during the study, whereas *T. audax* damaged approximately 15 and 7% of the germs and endosperm, respectively. Seed moisture content remained between 13.8 and 14.8% in all treatments. Fat acidity values of the wheat in all treatments at 30 degrees C increased with time, but there were no significant differences between treatments. The field fungus *Alternaria* sp. decreased in all treatments and virtually disappeared by 5 wk. The storage fungi *Penicillium* spp. and *Aspergillus glaucus* group generally infected fewer seeds in insect treatments than in wheat controls, the lower infection rate probably resulted from insect consumption of molds and the release of quinones by the *Tribolium*. *T. audax* is unlikely to cause severe damage to wheat in granaries because of its slow rate of development and low rate of increase compared with that of *T. confusum*.

4207 White, NDG.; Jayas, DS.; Demianyk, C.J. (1997) DEGRADATION AND BIOLOGICAL IMPACT OF CHLORPYRIFOS-METHYL ON STORED WHEAT AND PIRIMIPHOS-METHYL ON STORED MAIZE IN WESTERN CANADA. *Journal of Stored Products Research*. 33(2):125-135. English. [AGR CANADA CEREAL RES CTR 195 DAFOE RD WINNIPEG MB R3T 2M9 CANADA].

Insecticide degradation and pest survival were monitored in treated stored wheat and maize in southern Manitoba. Wheat stored in two wooden bins each holding 2.4 tonnes of grain was treated with the insecticide chlorpyrifos-methyl at calculated levels of 5 ppm; untreated wheat was placed in two other identical bins in the same granary. Maize was simultaneously stored in four identical bins each holding 2.3 tonnes of grain in another granary and the maize in two of these bins was treated with the insecticide pirimiphos-methyl at calculated levels of 6 ppm. Monthly samples were taken from the top and at 1 m depths of the grain bulks for 18 months. Grain surface temperatures fluctuated with ambient air conditions, but at 1 m depth lagged behind top temperatures. Moisture content of the wheat ranged from 12.2 to 15.1% and the maize from 12.1 to 15.3% over 18 months. Chlorpyrifos-methyl residues on wheat declined 51 and 38% at the top and 1 m depths, respectively. Pirimiphos-methyl residues on maize did not decrease; however, after 8 months, pirimiphos-methyl began to appreciably lose effectiveness against the insect *Tribolium castaneum* (Herbst) in 24 h laboratory bioassays, and after a year against *T. castaneum* and the mite *Tarsonemus granarius* Lindquist within the granaries. Fat acidity values increased in both wheat and maize and insecticide treatments were not directly related to the increases. Under western Canadian conditions chlorpyrifos-methyl applied on wheat degraded with time, but at 4.6 ppm, offered effective insect control (>90%) for 10 months. Pirimiphos-methyl (5.6 ppm) on maize killed > 90% of insects for 8 months. It did not degrade at either the surface or 1 m depth, but became less effective with time, based on short-term exposure of adults, possibly because of translocation into the seed. (C) 1997 Published by Elsevier Science Ltd. [References: 31].

4208 Zelij, D.; Demin, M. (Poljoprivredni fakultet, Beograd Zemun (Yugoslavia)) (1996) [The investigation of the effects of active ventilation of wheat in big silo bins]. Ispitivanje efekata aktivne ventilacije pšenice u velikim silosnim celijama. 12. savetovanje "Zito-hleb". Novi Sad

(Yugoslavia). 24-26 Apr 1996. *Cereal and flour production and processing: domestic [Yugoslav] potentials - international quality. Monograph, [proceedings of a conference].* Vukobratovic, R. (ed.). Proizvodnja i prerada zita i brasna: domaci [jugoslovenski] potencijali - svetski kvalitet. Monografija, [zbornik radova sa savetovanja] p. 149-160. Tehnoloski fakultet, Zavod za tehnologiju zita i brasna. 11 graphs; 7 ref. Serbian. (AGRIS 97-063867).

The investigations of effect of active ventilation were performed in various wheather conditions in order to realize the possibilities of the application of this measure for wheat keeping in big silo bins. The investigations were performed immediately after harvest, the usual period for the second elevation and in the conditions of negative outer temperatures when the positive cooling effect was expected. By the analysis of the results of investigations it was observed that active ventilation was possible to apply even in silo bins of great volume and height and in order to achieve both prophylaxis and cooling, but fulfilling the following conditions: 1. The system of active ventilation must be correctly projected and performed; 2. The time choice for active ventilation must be adequate.

## K50 PROCESSING OF FOREST PRODUCTS

4209 Nimz, H.H.; Schoene, M.; Pilz, A. (1995) [Utilization and chances of ligno-cellulose plants for papermaking]. *Landwirtschaftlicher Hochschultag. Stuttgart (Germany)*. 11 May 1995. Hohenheim Univ., Stuttgart (Germany). Agrarfakultaeten. *Nutzung und Chancen von Ligno-Cellulose-Pflanzen zur Papierherstellung* 16 p. 1 graph, 9 tables; 7 ref. German. (AGRIS 97-079158).

## L01 ANIMAL HUSBANDRY

4210 Marquardt, R.R. (Manitoba Univ., Winnipeg, Man. (Canada). Dept. of Animal Science); Brenes, A.; Zhang, Z.; Boros, D. (1996) Use of enzymes to improve nutrient availability in poultry feedstuffs. *Animal Feed Science Technology (Netherlands)* v. 60(3-4) p. 321-330. 15 ref. English. (AGRIS 97-079458).

4211 Rajcevic, M.; Ponikvar, M. (Poslovni sistem Mercator, Ljubljana (Slovenia)); Froehlich, A. (Ljubljana Univ. (Slovenia). Biotechnical Fac., Zootechnical Dept.) (1996) [The effect of barley in the final stage of fattening on some carcass traits of Friesian bulls]. [Vpliv jecmena v sklepni fazi pitanja na nekatere klavne lastnosti crno-belih bikov]. *Zbornik Biotehniske fakultete Univerze v Ljubljani (Slovenia). Kmetijstvo (Zootehnika) (no.68)* p. 33-38. 2 tables; 13 ref. English. (AGRIS 97-064594).

The most important carcass traits of Friesian bulls fattened on higher body mass have been dealt with in the present research. The basic ration was grass silage and hay with the addition of two isoenergetically equal but differently composed feed mixture. In the first mixture the basic component was maize while barley was in the second one. Dissection of halves showed a statistically highly significant difference in the share of tallow per half between the group with maize and the group with barley ( $p=0.001$ ) while no statistically significant differences were determined in LD meat composition, in the treated parameters i.e. protein content and intramuscular tallow content between the groups.

## L02 ANIMAL FEEDING

4212 Al Asghar, N.A.; Ali, A. (King Saud Univ., Riyadh (Saudi Arabia). Zoology Dept. Coll. of Science) (1996) [Effect of feeding different levels of wheat bran on the growth performance and body composition of *Oreochromis niloticus*]. *Einfluss der Fuetterung unterschiedlicher Anteile von Weizenkleie auf Wachstumsrate und Koerperzusammensetzung bei Oreochromis niloticus. Agribiological research (Germany)* v. 49(2-3) p. 193-202. 4 tables; 42 ref. English. (AGRIS 97-079795).

4213 Ayarza, N.; Cook, F. (Universidad Nacional San Cristobal de Huamanga, Ayacucho (Peru)) (1994) [Guinea-pigs feeding improved with chicken excrements - barley]. *Alimentacion de cuyes mejorados con gallinaza - cebada*. 11. Reunion Cientifica Anual [de la] Asociacion Peruana de Produccion Animal. Piura (Peru). 6-9 Nov 1988. [Research on guinea-pigs: summaries]. Investigaciones en cuyes: resúmenes. Chauca de Zaldivar, L. (comp.). *Informe Tecnico - Instituto Nacional de Investigacion Agraria (Peru)*; no. 6 p. 96. Instituto Nacional de Investigacion Agraria, Lima



(Peru). *Direccion General de Investigacion Agraria; Centro Internacional de Investigaciones para el Desarrollo, Ottawa (Canada); Asociacion Peruana de Produccion Animal, Lima (Peru)*. Spanish. (AGRIC 97-079625).

4214 Boros, D. (Institute of Plant Breeding, Warsaw, Poland.); Marquardt, R.R.; Guenter, W. (1995) Rye as an alternative grain in commercial broiler feeding. *The Journal of applied poultry research (USA)* v. 4(4) p. 341-351. references. English. (AGRIC 97-079668).

4215 Fitzgerald, J.J. (1996) GRASS SILAGE AS A BASIC FEED FOR STORE LAMBS .3. EFFECT OF BARLEY SUPPLEMENTATION OF SILAGES VARYING IN CHOP LENGTH ON SILAGE INTAKE AND LAMB PERFORMANCE. *Grass & Forage Science*. 51(4):389-402. English. [TEAGASC MOOREPARK RES CTR FERMOY CORK IRELAND].

An experiment was carried out to study the effect of silage chop length and barley supplementation on silage intake and the performance of store lambs. The silages were cut from a perennial ryegrass regrowth at a relatively mature stage of growth in early July. Different types of harvester were used to produce a long silage (L), single-chopped (S), double-chopped (D), medium precision-chopped (MP) or a short precision-chopped (SP) silage. The chop length of the silages averaged 37.4, 12.4, 8.4, 7.0 and 2.9 cm respectively. All silages were treated with formic acid at 2.51 t(-1) grass. They were well preserved and of a good quality with a dry-matter (DM) digestibility of 720-760 g kg(-1) DM. The silages were fed ad libitum to Suffolk crossbred store lambs over a period of 10 weeks. Each silage was fed either alone or was supplemented with whole barley at 400 g lamb(-1) d(-1). When offered silage alone, intakes were 738, 679, 773, 980 and 910 (+/-30) g DM d(-1) for silages L, S, D, MP and SP respectively. Similar relative differences in intakes between the silages were evident when supplemented with barley. Liveweight gain on silage alone was higher on the precision-chopped silages (85-93 g d(-1)) than the long or flail-chopped silages (28-49 g d(-1)). Liveweight gain on the precision-chopped silages was also better when supplemented with barley (150 vs. 90-112 (+/-9.0) g d(-1)). Silage intake and lamb performance were similar for the MP and SP silages, despite the difference in chop length. Barley supplementation reduced silage intake to a similar extent for all silages (-9%) and increased total DM intake (+30%) and metabolizable energy intake (+37%). The substitution rates of silage for barley were similar for all silages and averaged 0.24 g silage DM g(-1) barley DM. The response in weight gain per 100 g of barley fed was similar for all silages and averaged 20.0 g liveweight gain and 13.4 g carcass gain. Feed conversion efficiency of the total diet was similar for the flail-chopped and precision-chopped silages but was less for the long silage. The results of this study show that the benefit in weight gain due to the higher intake of precision-chopped silage was maintained when the silage was supplemented with a moderate level of barley. Such silage required supplementation with barley (400 g d(-1)) to achieve a rate of liveweight gain of 150 g d(-1). [References: 19].

4216 Han, Y.M.; Yang, F.; Zhou, A.G.; Miller, E.R.; Ku, P.K.; Hogberg, M.G.; Lei, X.G. (1997) SUPPLEMENTAL PHYTASES OF MICROBIAL AND CEREAL SOURCES IMPROVE DIETARY PHYTATE PHOSPHORUS UTILIZATION BY PIGS FROM WEANING THROUGH FINISHING. *Journal of Animal Science*. 75(4):1017-1025. English. [CORNELL UNIV DEPT ANIM SCI ITHACA, NY 14853 USA].

This experiment was conducted to measure the nutritional and metabolic responses of pigs fed diets with continuous supplementation of microbial and cereal phytase from weaning to finishing, and to determine the feasibility of complete replacement of inorganic P addition by supplemental phytase in swine diets. Forty-eight Landrace x Hampshire x Meishan pigs were divided into four groups. In phase 1 (10 to 50 kg BW), pigs in Groups 1, 2, 3, and 4 were fed a low-P, corn-soybean meal basal diet (ED), the ED plus microbial phytase (*A. ficuum*) at 1, 200 units/kg, the ED plus 10% wheat bran (230 units of cereal phytase/kg), and the ED + .24% inorganic P (calcium phosphate), respectively. In phase 2 (51 to 90 kg BW), these pigs were fed a similar ED or the ED plus 1, 000 microbial phytase units/kg, 20% wheat bran, or .20% inorganic P, respectively. Repeated measures included growth performance, P, Ca, and N balance, metatarsal and metacarpal bone strength, serum concentration of inorganic P, Ca, and 1, 25-dihydroxycholecalciferol, and serum alkaline phosphatase activity. Pigs fed the ED supplemented with microbial phytase and pigs fed the ED supplemented with inorganic P showed almost identical responses for all variables. Pigs fed the ED supplemented with cereal phytase also had responses for various measures that were similar to those of pigs fed microbial phytase or inorganic P, except for

some differences in serum inorganic P concentrations and bone strength in phase 1. Because of improvements in apparent digestibility of dietary P and N, fecal excretion of these two nutrients was reduced by 31 to 62% (P < .05) in pigs fed the ED supplemented with phytase compared with pigs fed inorganic P. It is physiologically feasible and environmentally advantageous to replace inorganic P with microbial or cereal phytase in corn-soybean meal diets for this type of pig through the entire growing-finishing period. [References: 42].

4217 Hill, T.M. (University of Maine, Orono, ME.); Christen, S.D.; Davis Dentici, K. (1995) Effect of supplementing late gestation and lactating ewes receiving low protein grass hay with barley of soybean meal. *Journal of sustainable agriculture (USA)* v. 7(2/3) p. 41-51. references. English. (AGRIC 97-064901).

4218 Mandell, I.B.; Gullett, E.A.; Wilton, J.W.; Allen, O.B.; Osborne, V.R. (1997) EFFECTS OF DIET, BREED AND SLAUGHTER ENDPOINT ON GROWTH PERFORMANCE, CARCASS COMPOSITION AND BEEF QUALITY TRAITS IN LIMOUSIN AND CHAROLAIS STEERS. *Canadian Journal of Animal Science*. 77(1):23-32. English. [UNIV GUELPH DEPT ANIM & POULTRY SCI GUELPH ON N1G 2W1 CANADA].

Ninety-six Charolais and Limousin steers were used to evaluate 75% grain (whole barley or corn) diets and two slaughter endpoints (7 mm backfat or 568 kg liveweight) in an experiment designed to constrain carcass weights to under approximately 341 kg yet produce optimal beef quality. Each breed was represented by eight progeny from each of six sires. The trial was terminated after 281 d feeding regardless of individual steers attaining designated slaughter endpoints. Limited availability of dietary energy in whole-barley diets resulted in decreased (P < 0.01) average daily gain and increased (P < 0.01) dry matter intake, feed/gain and days on feed for barley- vs. corn-fed cattle. Charolais outgained (P < 0.05) Limousin but dry matter intake was similar on a g BW(0.75) basis. Feeding to 568 kg liveweight was associated with high (P < 0.10) ADG and decreased (P < 0.05) feed/gain compared with feeding to 7 mm. Corn feeding increased (P < 0.001) carcass weights, fat deposition and longissimus muscle area. Lean deposition was greater (P < 0.01) in Limousin than Charolais. Taste panel assessment of tenderness, flavour and juiciness in longissimus muscle was generally not affected (P > 0.10) by diet, breed or slaughter endpoint. Twelve primal ribs from each of Agriculture Canada's marbling classifications (A, AA, AAA) were purchased and processed identically to ribs from the test cattle. Shear and tenderness scores were similar (P > 0.10) across test cattle and purchased ribs, despite intramuscular fat contents of 20.2, 27.1, 35.6 and 49.7 g kg(-1), respectively, for test cattle and trace, slight and small marbled ribs. Slight and small marbled ribs did have higher (P < 0.05) taste panel scores for initial juiciness and flavour than ribs from the test cattle. While 26% of carcasses from test cattle graded Canada B1 due to either inadequate finish or marbling, similar tenderness and shear scores were probably due to age of test cattle at slaughter which averaged 481 +/- 45 d plus the fact that all roasts were aged 7 d prior to freezing. [References: 39].

4219 Mohammed, A. (IPA Agric. Res. Center, Baghdad, Iraq.) (1995) Barley varieties, enzyme supplementation, and broiler performance. *The Journal of applied poultry research (USA)* v. 4(3) p. 230-234. references. English. (AGRIC 97-079663).

4220 Santos, D.; Cook, F. (Universidad Nacional San Cristobal de Huamanga, Ayacucho (Peru)) (1994) [Guinea-pigs fattening improved with green alfalfa, commercial concentrate, soaked barley and ralgro]. *Engorde de cuyes mejorados con alfalfa verde, concentrado comercial, cebada remojada y ralgro*. 11. Reunion Cientifica Anual [de la] Asociacion Peruana de Produccion Animal. Piura (Peru). 6-9 Nov 1988. [Research on guinea-pigs: summaries]. *Investigaciones en cuyes: resúmenes*. Chauca de Zaldivar, L. (comp.). *Informe Técnico - Instituto Nacional de Investigación Agraria (Peru)*; no. 6 p. 93-94. *Instituto Nacional de Investigación Agraria, Lima (Peru)*. *Direccion General de Investigación Agraria; Centro Internacional de Investigaciones para el Desarrollo, Ottawa (Canada); Asociacion Peruana de Produccion Animal, Lima (Peru)*. Spanish. (AGRIC 97-079621).

4221 Sosulski, K.; Wang, S.M.; Ingledew, W.M.; Sosulski, F.W.; Tang, J.M. (1997) PREPROCESSED BARLEY, RYE, AND TRITICALE AS A FEEDSTOCK FOR AN INTEGRATED FUEL ETHANOL FEEDLOT PLANT. *Applied Biochemistry & Biotechnology*. 63-5:59-70. English.

Rye, triticale, and barley were evaluated as starch feedstock to replace wheat for ethanol production. Preprocessing of grain by abrasion on a Satake mill reduced fiber and increased starch concentrations in feedstock for fermentations. Higher concentrations of starch in flours from preprocessed cereal grains would increase plant throughput by 8-23% since more starch is processed in the same weight of feedstock. Increased concentrations of starch for fermentation resulted in higher concentrations of ethanol in beer. Energy requirements to produce one L of ethanol from preprocessed grains were reduced, the natural gas by 3.5-11.4%, whereas power consumption was reduced by 5.2-15.6%. [References: 7].

4222 Ueberschaer, K.H.; Vogt, H. (1995) [Influence of rations with high fiber content on egg-cholesterol]. Einfluss rohfaserreicher Rationen auf den Cholesteringehalt von Hühnereiern. 3. Tagung Schweine- und Geflügelernaehrung. Halle/Saale (Germany). 29 Nov - 1 Dec 1994. [Enlightenment and revival. 300 years University of Halle (1694-1994)]. Aufklärung und Erneuerung. 300 Jahre Universität in Halle (1694-1994). Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany) p. 270-273. Wissenschaftl. Fachverlag. German. (AGRIS 97-079774).

Eine Erhoehung des Rohfasergehaltes durch Weizenkleie und Haferschrot auf 7 bzw. 11% (von 4% in der Kontrollration) hatte keinen sign. Einfluss auf den Cholesteringehalt des Eidotters. Mit dem Alter der Tiere nahm er jedoch hochsign. zu.

4223 Vieira, S.L. (Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil.); Penz, A.M. Jr.; Kessler, A.M.; Catellan, E.V. Jr. (1995) A nutritional evaluation of triticale in broiler diets. *The Journal of applied poultry research (USA)* v. 4(4) p. 352-355. references. English. (AGRIS 97-079669).

## L20 ANIMAL ECOLOGY

4224 Covasa, M. (Leeds Univ. (United Kingdom). Dept. of Animal Physiology and Nutrition); Forbes, J.M. (1996) Effects of prior experience and training on diet selection of broiler chickens using wheat. *Applied Animal Behaviour Science (Netherlands)* v. 46(3-4) p. 229-242. 23 ref. English. (AGRIS 97-080160).

## L51 ANIMAL PHYSIOLOGY-NUTRITION

4225 Bekendorf, T.; Abel, H. (Goettingen Univ. (Germany). Inst. fuer Tierphysiologie und Tierernaehrung) (1996) [In vivo and in vitro (RUSITEC)-investigations on lactate metabolism in the rumen of sheep]. Untersuchungen zur Laktateliminierung aus dem Pansen von Schafen durch Pansenmikroben in vitro (RUSITEC). *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 75(3) p. 133-141. 3 ill., 5 tables; 26 ref. English. (AGRIS 97-065740).

Innerhalb einer Adaptationszeit von 4-5 Tagen wurden die Laktatkonz. im Pansen bzw. Inkubationsmilieu des RUSITEC zunehmend schneller gesenkt. Die Adaptation an die Laktateliminierung wurde durch Pufferzulagen u. durch Weizen anstelle von Mais gefoerdert. Die Konz. an kurzkettigen Fettsaeuren des Pansensaftes wurde durch Laktat- und/oder Pufferinfusion (I) nicht beeinflusst. Laktatinfusion fuehrte zu deutlich engerem C2/C3-Verhaeltnis. I hatte einen hoeheren Wasserverbrauch der Tiere sowie hoehere Volumen u. laengere Retentionszeiten der Pansenflussigkeit zur Folge.

4226 Bernard, J.K. (1997) MILK PRODUCTION AND COMPOSITION RESPONSES TO THE SOURCE OF PROTEIN SUPPLEMENTS IN DIETS CONTAINING WHEAT MIDDINGS. *Journal of Dairy Science*. 80(5):938-942. English. [UNIV TENNESSEE DEPT ANIM SCI JACKSON, TN 38301 USA].

Two 3 x 3 Latin square trials were conducted to determine the effect of the source of supplemental protein in diets containing wheat middlings on milk production and composition. Cottonseed meal or meat and bone meal was substituted for a portion of the soybean meal and provided 24.5% of the total dietary crude protein. Trial 1 was conducted during fall 1989, and trial 2 was conducted during summer 1993. During trial 1, no differences in production or composition of milk were found for primiparous cows fed the various protein supplements. Multiparous cows tended to have higher dry matter intakes and produced more milk with lower milk fat percentages when fed meat and bone meal than when fed soybean meal or

cottonseed meal. No differences were found among supplements for other milk components or for the production of energy-corrected milk. In trial 2, primiparous cows tended to produce more milk, and multiparous cows tended to produce less milk, when fed meat and bone meal than when fed soybean meal. No differences were found for dry matter intake, milk composition, or production of energy-corrected milk. Cottonseed meal was equal to soybean meal in supporting milk production. Meat and bone meal tended to support higher productions of milk than did soybean meal, but production of energy-corrected milk was similar for both. [References: 18].

4227 Bluemmel, M.; Paul, C.; Goodchild, A.; Becker, K. (Hohenheim Univ., Stuttgart (Germany). Inst. fuer Tierproduktion in den Tropen und Subtropen) (1996) Grinding energy and in vitro gas technique for the assessment of Syrian barley straws: physical and microbial degradation and voluntary feed intake by sheep. *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 76(2-3) p. 132-140. 2 ill., 2 tables; 27 ref. English. (AGRIS 97-080584).

Mit multiplen Regressionsgleichungen konnten 83.4% der Varianz der freiwilligen Futteraufnahme (FFA) durch den Logarithmus der Mahlwiderstandsmessungen (LogGER) und 2.9% durch in vitro Gasproduktions-Parameter erklart werden. Die Hoehe und Rate der Gasproduktion alleine erklarten zusammen 84% der Varianz der FFA, wobei die Rate 80% der Varianz erklarte. LogGER war negativ mit der Rate ( $r=-0.93$ ) und der Hoehe ( $r=-0.78$ ) der Gasproduktion korreliert.

4228 Boila, R.J. (Manitoba Univ., Winnipeg, Man. (Canada). Dept. of Animal Science); Ingalls, J.R. (1994) The ruminal degradation of dry matter, nitrogen and amino acids in wheat-based distillers' dried grains in sacco. *Animal Feed Science and Technology (Netherlands)* v. 48(1-2) p. 57-72. 21 ref. English. (AGRIS 97-080450).

4229 Buraczewska, L. (Polish Academy of Sciences, Jablonna, Warsaw (Poland). Kielanowski Inst. of Animal Physiology and Nutrition); Valaja, J.; Buraczewski, S.; Naesi, M.; Gdala, J. (1996) Digestibility and availability of protein and phosphorus in pigs fed wet barley protein and wet distillers solids from integrated starch-ethanol production. *Animal Feed Science Technology (Netherlands)* v. 58(3-4) p. 201-212. 36 ref. English. (AGRIS 97-080599).

4230 Dusel, G.; Kluge, H.; Glaeser, K.; Simon, O.; Jeroch, H. (1996) [Investigation on the variability of in-vitro-extract-viscosity and pentosan contents of wheat and their effect on the apparant metabolizable energy (AME) in broiler chickens]. Untersuchungen zur Variabilitaet der In-vitro-Extrakt-Viskositaet und dem Pentosangehalt von Weizen und deren Einfluss auf die Umsetzbare Energie (AME) bei Broilerkueken. 50. Tagung der Gesellschaft fuer Ernaehrungsphysiologie. Goettingen (Germany) 27-29 Feb 1996. *Proceedings of the Society of Nutrition Physiology*. Giesecke, D. (ed.). Berichte der Gesellschaft fuer Ernaehrungsphysiologie/Proceedings of the Society of Nutrition Physiology (Germany); no. 5. Halle-Wittenberg Univ., Halle (Germany). Inst. fuer Tierernaehrung und Vorratshaltung p. 131. DLG. 1 table; 2 ref. German. (AGRIS 97-065589).

Zwischen umsetzbarer Energie (ME) und Extraktviskositaet von Weizen ( $r=-0.85$ ) sowie Futtermischung ( $r=-0.87$ ) bestanden negative Korrelationen. Die Weizensorten unterschieden sich sign. in der ME (14.0-14.6 MJ/kg TS).

4231 Escobar, F.; Blas, C. (Universidad Nacional San Cristobal de Huamanga, Ayacucho (Peru)) (1994) [Nutritive value of alfalfa, maize and barley for guinea-pigs]. Valor nutritivo de alfalfa, maiz y cebada para cuyes. 12. Reunion Cientifica Anual [de la] Asociacion Peruana de Produccion Animal. Lima (Peru). 23-29 Oct 1990. [Research on guinea-pigs: summaries]. Investigaciones en cuyes: resúmenes. Chauca de Zaldivar, L. (comp.). Informe Tecnico - Instituto Nacional de Investigacion Agraria (Peru); no. 6 p. 108. Instituto Nacional de Investigacion Agraria, Lima (Peru). Direccion General de Investigacion Agraria; Centro Internacional de Investigaciones para el Desarrollo, Ottawa (Canada); Asociacion Peruana de Produccion Animal, Lima (Peru). Spanish. (AGRIS 97-080462).

4232 Fondevila, M. (Zaragoza Univ. (Spain). Dept. de Produccion Animal y Ciencia de los Alimentos); Castrillo, C.; Guada, J.A.; Balcells, J. (1994) Effect of ammonia treatment and carbohydrate supplementation of barley straw on rumen liquid characteristics and substrate degradation

4233 Hadorn, R.; Gloor, A.; Wiedmer, H. (1997) EFFECT OF A CARBOHYDRASE IN AN ENERGY-REDUCED AND WHEAT-BASED DIET FOR LAYING HENS. *Archiv für Geflügelkunde*. 61(2):82-87. German.

In a trial with 8 x 180 laying hens (LSL white), the effect of 450 ppm Biofeed Plus CT (diet B) was tested in a wheat-based and energy-reduced diet (diet C) and compared with a standard diet (diet A). Diet A was given to two units and diets B and C to three units each. The diets were fed ad libitum as crumbs and tested in three phases (21-48., 49-64., 65-80. week). Nutrient contents of phase-1 diets were increased, whereas diets of phase 2 and 3 should only differing in components, but not in nutrient content. No differences could be seen in egg production (83, 5%) and egg weight (64, 7 g). Effects in food consumption (118, 0-121, 4g/Tag) were not significant. Reduction of dietary ME content by 0, 4-0, 5 MJ per kg feed was followed by a negative effect in feed efficiency (3, 5%), which could be partly compensated by the enzyme (about 50%). Due to the enzyme supplementation, ME consumption per kg egg mass was significantly improved from week 21 to 48 (0, 55 MJ). No more enzyme effect could be seen for phase 2, whereas a higher dietary ME content seemed to increase ME consumption per kg egg mass. In phase 3, neither an enzyme nor a ME-effect could be seen on ME utilization. Animal weights of the enzyme diet were significantly higher at the end of the trial (+ 54 g). Increasing dietary ME content led to more normal eggs (53-65 g) instead of large ones (> 65 g). Only a small reduction in the sum of dirty, broken and small eggs could be observed due to the enzyme supplementation. [References: 20].

4234 Hsu, J.C. (National Chung Hsing Univ., Taichung (Taiwan). Dept. of Animal Science); Lu, T.W.; Chiou, P.W.S.; Yu, B. (1996) Effects of different sources of dietary fibre on growth performance and apparent digestibility in geese. *Animal Feed Science Technology (Netherlands)* v. 60(1-2) p. 93-102. 32 ref. English. (AGRIS 97-080524).

4235 Hullar, I.; Fekete, S.; Meleg, I. (1996) [Determination of the digestibility and metabolizable energy content of the most important pigeon's feeds]. *Berichte der Gesellschaft fuer Ernährungsphysiologie*. 50. Tagung der Gesellschaft fuer Ernährungsphysiologie. Goettingen (Germany) 27-29 Feb 1996. *Proceedings of the Society of Nutrition Physiology*. Giesecke, D. (ed.). *Proceedings of the Society of Nutrition Physiology (Germany)*; no. 5. Budapest Univ. (Hungary). *Dept. of Animal Nutrition* p. 126. DLG. 1 table. English. (AGRIS 97-065656).

Die Verdaulichkeit von Rohprotein der Futtermittel unterschied sich nicht sign. von den Werten fuer Huehner, die von NfE war niedriger und die von Rohfett hoeher. Die Werte fuer umsetzb. Energie waren etwas hoeher.

4236 Jamroz, D.; Orda, J.; Wiliczekiewicz, A.; Skorupinska, J. (1996) [The apparent digestibility of structural carbohydrates, the intestinal fermentation of different kinds of grain in three poultry species]. *Die scheinbare Verdaulichkeit der Geruestkohlenhydrate und Dammfermentation verschiedener Getreidearten bei drei Gefluogelspezies*. 50. Tagung der Gesellschaft fuer Ernährungsphysiologie. Goettingen (Germany) 27-29 Feb 1996. *Proceedings of the Society of Nutrition Physiology*. Giesecke, D. (ed.). *Berichte der Gesellschaft fuer Ernährungsphysiologie* *Proceedings of the Society of Nutrition Physiology (Germany)*; no. 5. Landwirtschaftliche Univ., Wroclaw (Poland). *Inst. fuer Tierernaehrung und Futtermittelkunde* p. 130. DLG. German. (AGRIS 97-065588).

Die Gefluogelart uebte einen deutlicheren, teilweise sign. Einfluss auf Verdaulichkeit u. Fermentationsverlauf aus als die eingesetzten Getreidearten. Enten verdauten Nahrungsfaser am schlechtesten. Die FFS-Bildung im Darminhalt war bei Enten u. Gaensen am hoechsten.

4237 Jamroz, D.; Wiliczekiewicz, A.; Orda, J.; Skorupinska, J. (1996) [Parameters of digesta tract, the N and P utilization in broilers, ducks and geese fed with different kinds of grain]. *Parameter des Verdauungstrakts der N- und P-Verwertung bei Broiler, Enten und Gaensen bei Verfuetterung verschiedener Getreidearten*. 50. Tagung der Gesellschaft fuer Ernährungsphysiologie. Goettingen (Germany) 27-29 Feb 1996. *Proceedings of the Society of Nutrition Physiology*. Giesecke, D. (ed.). *Berichte der Gesellschaft fuer Ernährungsphysiologie* *Proceedings of the Society of Nutrition Physiology (Germany)*; no. 5. Landwirtschaftliche Univ., Wroclaw

(Poland). *Inst. fuer Tierernaehrung und Futtermittelkunde* p. 96. DLG. German. (AGRIS 97-065587).

Darmlaenge je nach Gefluogelart 170-227 cm. Getreideart war ohne Einfluss auf Parameter des Verdauungstraktes und Organe (Ausnahme Muskelmagengewicht). Geringster N- und P-Ansatz bei Enten (32 u. 35%), bei Kueken und Gaensen betrug die Verwertung fuer N 46 u. 37%, fuer P 44 u. 40%.

4238 Jensen, M.S.; Thaela, M.J.; Pierzynowski, S.G.; Jakobsen, K. (Danish Inst. of Animal Science, Tjele (Denmark). Dept. of Nutrition. Research Centre Foulum) (1996) Exocrine pancreatic secretion in young pigs fed barley-based diets supplemented with beta-glucanase. *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 75(4-5) p. 231-241. 4 ill., 2 tables; 39 ref. English. (AGRIS 97-065732).

Vier am Pankreasgang fistulierte 6 Wochen alte Schweine erhielten eine auf Gerste basierende Ration (75,8% mit vollem Schalenanteil) ohne und mit Zusatz von Beta-Glukanase (0,25 g/kg Futter). Der Tagesverlauf des Sekretionsvolumens und der Gehalt an Enzymen war unabhangig vom Glukanase-Zusatz. Der Enzymzusatz hatte keinen Einfluss auf das ausgeschiedene Gesamtvolumen, fuehrte aber ueber 24 Stunden zu einer geringeren Proteinsekretion, die Gesamtaktivitaet von Chymotrypsin lag bei diesen Tieren hoeher und war sign. hoeher nach den Mahlzeiten am Morgen und am Nachmittag. Die erhoehte Chymotrypsinsekretion koennte darauf hindeuten, dass eine verbesserte enzymatische Spaltung von Beta-Glukan eine bessere Verfuegbarkeit des Futterproteins zur Folge hat.

4239 Komprda, T.; Dolezal, P. (Mendel Univ. of Agriculture and Forestry, Brno (Czech Republic). Dept. of Food Technology) (1996) Crude protein degradability, protein digestible in the intestine and net energy for lactation of whole crop barley in various vegetative stages. *Archives of Animal Nutrition (Germany)* v. 49(4) p. 325-333. 1 ill., 3 tables; 15 ref. English. (AGRIS 97-080475).

Gerste wurde in 5 Vegetationsstadien geschnitten und siliert. Rohprotein-Abbaubarkeit (I), verdauliches Protein im Duenndarm (II) und Nettoenergie Laktation (III) wurden durch das Wachstumsstadium sign. beeinflusst. Im Vergleich mit der Trocknung bei 60 C erhoehte das Silieren I und III, II wurde nicht beeinflusst.

4240 Lebzien, P.; Daenicke, R.; Aulrich, K. (Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany). Inst. fuer Tierernaehrung) (1996) [Influence of NaOH-treated versus crushed wheat on the digestive processes in dairy cows]. *Vergleich von unzerkleinertem NaOH-behandeltem und geschrotetem Weizen hinsichtlich des Einflusses auf die Umsetzungen im Verdauungstrakt von Milchkuehen*. *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 75(2) p. 96-104. 2 ill., 4 tables; 21 ref. German. (AGRIS 97-065621).

Der Austausch von Weizenschrot (I) gegen Sodagrain (II) (mit 3% NaOH behandelt) fuehrte bei unveraenderter Gesamtverdaulichkeit der OS u. der Staerke zu einer Zunahme der Rohfaserverdauung von 71,8 auf 83,6%. Der intraruminale Abbau der Staerke u. der OS nahm von 88,8 auf 55,1% bzw. von 46,7 auf 35,9% ab. Bei II blieb der pH-Wert im Pansensaft deutlich stabiler als bei I, das C2:C3-Verhaeltnis war weiter u. die NH<sub>3</sub>-Konz. lag sign. hoeher. Nettoenergiegehalt fuer die I-Ration lag bei 7,3 MJ NEL/kg TS, fuer die II-Ration bei 7,0 MJ.

4241 Lebzien, P.; Engling, F.P. (Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany). Inst. fuer Tierernaehrung) (1995) [On the influence of two rations of grass-silage and concentrate mixtures with different sources of carbohydrates on rumen fermentation and nutrient digestibility in dairy cows]. *Zum Einfluss von Kraftfuttermischungen mit unterschiedlichen Kohlenhydrattraegern auf die Pansenfermentation und Rohnaehrstoffverdaulichkeit bei Milchkuehen*. *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 74(4-5) p. 208-218. 8 tables; 38 ref. German. (AGRIS 97-065618).

Es koennen auch hoehere Anteile Kohlenhydrate (17% Trockenschnitzel, 48% Gerste, 36% Weizen, 40% Mais, 40% Tapioka, 28% Zucker) ohne negative Effekte auf die Verdauungsvorgaenge eingesetzt werden, wenn sich die Rohprotein- (16,3-17,4%) und Rohfasergehalte (18,4-22,2% in TS) der Rationen im angegebenen Rahmen bewegen.

4242 McGoogan, B.B. (Louisiana State Univ., Baton Rouge, LA (USA). School of Forestry, Wildlife and Fisheries); Reigh, R.C. (1996) Apparent digestibility of selected ingredients in red drum (*Sciaenops ocellatus*)

diets. *Aquaculture (Netherlands)* v. 141(3-4) p. 233-244. 40 ref. English. (AGRIS 97-080581).

4243 Moloney, A.P. (Teagasc, Dunsany, Co. Meath (Ireland). Grange Research Centre); Almiladi, A.A.; Drennan, M.J.; Caffrey, P.J. (1994) Rumen and blood variables in steers fed grass silage and rolled barley or sugar cane molasses-based supplements. *Animal Feed Science and Technology (Netherlands)* v. 50(1-2) p. 37-54. 40 ref. English. (AGRIS 97-080478).

4244 Okine, E.K.; Arthur, P.F. (1997) EFFECTS OF ISOENERGETIC BARLEY GRAIN AND ALFALFA PELLET DIETS ON IN VITRO LIPOGENESIS AND LIPOGENIC ENZYME ACTIVITIES IN SUBCUTANEOUS ADIPOSE TISSUE FROM SHEEP. *Canadian Journal of Animal Science*. 77(1):173-175. English. [ALBERTA AGR FOOD & RURAL DEV BEEF & DAIRY GRP EDMONTON AB T6G 4P2 CANADA].

The effects of feeding isoenergetic barley grain or alfalfa pellets on in vitro lipogenesis, palmitate esterification, and lipogenic enzymes activities in biopsy samples of subcutaneous adipose tissue in 10 ewes were studied. Acetyl CoA carboxylase and FAS activities and rate of esterification were 52, 38, and 88%, respectively, higher ( $P < 0.05$ ) in subcutaneous adipose of ewes fed the concentrate versus those fed the roughage diet. [References: 8].

4245 Osuji, P.O. (International Livestock Centre for Africa, Addis Ababa (Ethiopia)); Khalili, H. (1994) The effect of replacement of wheat bran by graded levels of molasses on feed intake, organic matter digestion, rumen fermentation and nitrogen utilization in crossbred (*Bos taurus* x *Bos indicus*) steers fed native grass hay. *Animal Feed Science and Technology (Netherlands)* v. 48(1-2) p. 153-163. 39 ref. English. (AGRIS 97-080488).

4246 Rodehutsord, M.; Faust, M.; Lorenz, H. (Bonn Univ. (Germany). Inst. fuer Tierernaehrung) (1996) Digestibility of phosphorus contained in soybean meal, barley and different varieties of wheat, without and with supplemental phytase fed to pigs and additivity of digestibility in a wheat-soybean-meal diet. *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 75(1) p. 40-48. 5 tables; 27 ref. English. (AGRIS 97-065583).

Die Verdaulichkeit des P aus Gerste und Sojaextraktionsschrot betrug 45 bzw. 31%, sie wurde durch Phytase-Zusatz (550 U/kg) sign. auf 66 bzw. 73% erhoeht. Die Verdaulichkeit des P aus 4 Sorten Weizen schwankte zwischen 61 u. 74%. In einer Mischung aus Weizen u. Sojaschrot waren die Verdaulichkeiten des P additiv, solange keine mikrobielle Phytase zugesetzt wurde.

4247 Roth Maier, D.A.; Kirchgessner, M.; Henke, J.; Metak, G.; Erhardt, W. (Technische Univ. Muenchen, Freising (Germany). Inst. fuer Ernaehrungsphysiologie) (1996) [Method for the in vivo determination of the precaecal digestibility of vitamins]. Methodik zur in-vivo-Bestimmung der praecaecalen Verdaulichkeit von Vitaminen. *Journal of Animal Physiology and Animal Nutrition (Germany)* v. 75(4-5) p. 250-256. 3 tables; 16 ref. German. (AGRIS 97-065733).

Mit sechs wachsenden DL-Schweinen wurde geprueft, ob die Verwendung von Ileorectalanastomosen fuer die in-vivo Bestimmung der praecaecalen Verdaulichkeiten als Massstab der Verfuegbarkeit von B-Vitaminen angewendet werden kann. Beschrieben wird die Vorbereitung der Tiere, die Durchfuehrung der Operation und die postoperative Phase. Die praecaecale Verdaulichkeit fuer Vitamin B-6 betrug aus Magermilchpulver, Mais, Weizenkleie 90, 71 und 61%, fuer Pyridoxin, Pyridoxal und Pyridoxamin wurden 69, 81 und 63% ermittelt.

4248 Schwarz, F.J.; Pex, E.J.; Kirchgessner, M. (Technische Univ. Muenchen, Freising (Germany). Inst. fuer Ernaehrungsphysiologie) (1996) [Influence of starch-rich feedstuffs on digestibility and energy content of maize silage in cattle and sheep]. Zum Einfluss staerkereicher Einzelfuttermittel auf die Verdaulichkeit und den Energiegehalt von Maissilage bei Rind und Schaf. *Archives of Animal Nutrition (Germany)* v. 49(4) p. 349-362. 8 tables; 43 ref. German. (AGRIS 97-080611).

Zum Grundfutter Maissilage wurden 33% Koermernais (I), Weizen (II), Gerste (III), Hafer (IV), Maniok (V) oder Kartoffelstaerke (VI) in gemahlener sowie Weizen zusaetzlich in gequetschter u. extrudierter Form zugelegt. Die Ergaenzung der Maissilage (MS) mit den Staerketraegern erhoehte ueber alle Rationen die Verdaulichkeit der organischen Substanz (VOS) bei Rindern nur gering von 77 auf 78%, bei Schafen staerker von 74

auf 79%. Zulagen an II, III u. IV verschlechterten die Verdaulichkeit der Geruestsubstanzen (VGS) in der Gesamtration bzw. der MS, so dass sich die VOS minderte u. die Energiebereitstellung aus der MS um ca. 6% fiel. Zulagen an I, V oder VI verminderten nicht die VGS und den Energiegehalt von MS, II in gemahlener, gequetschter oder extrudierter Form erniedrigte gleichermassen die VGS der Maissilage.

4249 Suedekum, K.H.; Thordsen, J.P.; Stangassinger, M. (1996) [Influence of wheat maturity on ruminal degradation of starch and cell-wall constituents of whole plant wheat silages]. Einfluss des Entwicklungsstadiums von Weizen auf den ruminalen Abbau von Staerke und Zellwandbestandteilen bei Winterweizen-Ganzpflanzensilagen. 50. Tagung der Gesellschaft fuer Ernaehrungsphysiologie. Goettingen (Germany) 27-29 Feb 1996. *Proceedings of the Society of Nutrition Physiology. Giesecke, D. (ed.). Berichte der Gesellschaft fuer Ernaehrungsphysiologie Proceedings of the Society of Nutrition Physiology (Germany); no. 5. Kiel Univ. (Germany). Inst. fuer Tierernaehrung und Stoffwechselphysiologie* p. 113. DLG. 2 ref. German. (AGRIS 97-065595).

4250 Toppo, S.; Verma, A.K.; Dass, R.S.; Mehra, U.R. (1997) NUTRIENT UTILIZATION AND RUMEN FERMENTATION PATTERN IN CROSSBRED CATTLE FED DIFFERENT PLANES OF NUTRITION SUPPLEMENTED WITH UREA MOLASSES MINERAL BLOCK. *Animal Feed Science & Technology*. 64(2-4):101-112. English. [INDIAN VET RES INST NUCL RES LAB IZATNAGAR 243122 UTTAR PRADESH INDIA].

In order to investigate the effect of the plane of nutrition on intake and nutrient utilization from urea molasses mineral blocks (UMMB) and rumen fermentation pattern, sixteen adult crossbred cattle were divided into four equal groups following, a completely randomised design and fed individually for 60 days ad libitum with either wheat straw alone (Group I) or with wheat straw with UMBB (Group II) or with wheat straw and UMBB with 50% of energy requirements provided by crushed barley fortified with mineral mixture and common salt (Group III) or with wheat straw and UMBB with 100% of energy requirements provided by fortified crushed barley (Group IV). At the termination of the feeding trial, a metabolism trial of six days duration was also conducted. A fermentation study was carried out on four rumen fistulated adult cattle following a 4x4 latin square design. Results showed that intake (except for ether extract) and digestibility of all the nutrients increased significantly ( $P < 0.01$ ) in the block-fed groups which was further enhanced by energy (barley) supplementation except for digestibility of neutral detergent fibre (NDF) and acid detergent fibre (ADF) which decreased owing to concentrate supplementation. Total digestible nutrients and digestible protein contents of UMBB were 56.6 and 42.5%, respectively. Significantly increased ( $P < 0.01$ ) concentrations of total nitrogen and its fractions, except TCA-precipitable-N owing to block feeding were observed. However, it did not influence the TVFA concentration in rumen liquor of fistulated animals. Rumen pH, rumen fluid volume and digesta flow rate were also unaffected. This clearly indicated that supplementing 50% of energy requirements through concentrate on a straw based diet along with UMBB resulted in increased intake of UMBB and better utilization of dietary nutrients in adult crossbred cattle. [References: 44].

4251 Zhao, Y. (Hiroshima Univ., Higashi Hiroshima (Japan). Faculty of Applied Biological Science); Taniguchi, K.; Obitsu, T. (1996) Effects of different processing procedures for rice bran on dietary nutrient digestion in each segment of the digestive tract of steers. *Animal Feed Science Technology (Netherlands)* v. 59(4) p. 265-277. 33 ref. English. (AGRIS 97-080477).

4252 Zinn, R.A.; Barajas, R. (1997) INFLUENCE OF FLAKE DENSITY ON THE COMPARATIVE FEEDING VALUE OF A BARLEY-CORN BLEND FOR FEEDLOT CATTLE. *Journal of Animal Science*. 75(4):904-909. English. [UNIV CALIF IMPERIAL VALLEY AGR CTR DEPT ANIM SCI EL CENTRO, CA 92243 USA].

Ninety-six medium-frame crossbred steers (209 kg) were used in an 86-d feeding trial. Dietary treatments consisted of a 92% concentrate diet containing 76.15% (DM basis) grain as 1) steam-flaked barley (SFB), flake density (FD) = .26 kg/L; 2) blend of 2/3 barley and 1/3 corn steam-flaked (SFBLEND), FD = .36 kg/L; 3) SFBLEND, FD = .31 kg/L; 4) SFBLEND, FD = .26 kg/L. There were no treatment effects ( $P > .10$ ) on growth performance of feedlot steers or NE value of the diet. Weight gain averaged 1.46 kg/d. Feed efficiency was in close agreement (101%) with expected values based on observed DMI and tabular dietary NE values.



Treatment effects on characteristics of ruminal and total tract digestion were evaluated using four Holstein steers (280 kg) with cannulas in the rumen and proximal duodenum in a 4 x 4 Latin square design. Ruminal digestibility of OM ( $P < .01$ ), starch ( $P < .01$ ), and feed N ( $P < .10$ ) increased, and ruminal N efficiency (duodenal nonammonia N/N intake,  $P < .01$ ) decreased (linear component) with decreasing FD. Net microbial N flow to the small intestine was greater ( $P < .05$ ) for SFB than for the SFBLEND. Total tract digestion of OM ( $P < .01$ ), starch ( $P < .05$ ), and DE ( $P < .05$ ) was greater for the SFBLEND than for SFB. There were no treatment effects ( $P > .10$ ) on postprandial and total tract digestibility of N. We conclude that blending barley and corn before flaking will have very little impact on the feeding value of the grains compared with flaking the grains separately. [References: 14].

## L70 VETERINARY SCIENCE AND HYGIENE

4253 Vescina, C.M. (Universidad Nacional de La Plata, La Plata, Argentina.); Salice, V.C.; Cortizo, A.M.; Etcheverry, S.B. (1996) Effect of vanadium compounds on acid phosphatase activity. *Biological trace element research (USA)* v. 53(1/3) p. 185-191. references. English. (AGRIC 97-066243).

## N20 AGRICULTURAL MACHINERY AND EQUIPMENT

4254 Anon. (1995) [Harvest technology]. *Erntetechnik: keine Frage der Aehre. Agrartechnik (Germany)* (no.11) p. 62-63. German. (AGRIC 97-067821).

4255 Dickson, J.W. (Scottish Agricultural Coll., Penicuik (United Kingdom). Dept. of Soils); Ritchie, R.M. (1996) Zero and reduced ground pressure traffic systems in an arable rotation. 1. Cultivation power requirement. *Soil and Tillage Research (Netherlands)* v. 38(1-2) p. 71-88. 24 ref. English. (AGRIC 97-082818).

4256 Nada, A.A. (1994) Comparative study on locally manufactured threshing machines for different crops. *Zagazig Univ. (Egypt). Faculty of Agriculture. tables; Bibliography:* p. 79-100. 100 p. English. (AGRIC 97-082822).

4257 Reusch, S.; Heege, H.J. (Institut fuer landwirtschaftliche Verfahrenstechnik, Kiel (Germany)) (1996) [Optical sensors control nitrogen fertilization]. *Optische Sensoren steuern die Stickstoffduengung. Landtechnik (Germany)* v. 51(2) p. 68-69. German. (AGRIC 97-067869).

Reducing nitrate leaching requires precise adaption of nitrogen fertilization to plant needs. A site-specific, need oriented fertilizer application can be realized with a sensor, which registers the nitrogen status of the plants, quickly and contactless while driving over the plot. Since oversupplied and undersupplied plants differ in the colour of their leaves and in their biomass production, spectral analysis of reflected daylight can determine the nitrogen level in the plants.

## P06 RENEWABLE ENERGY RESOURCES

4258 Stridsberg, S.; Segerud, K. (1996) [Combustion of coal/grass/grain powder]. *Pulvereldning kol/roerflen/mald braenslekaerna.. Vaermeforsk (Sweden); no. 566 68 p. Stiftelsen foer Vaermetekniksk Forskning. Swedish.* (AGRIC 97-068143).

## P10 WATER RESOURCES AND MANAGEMENT

4259 Wood, W.W. (U.S. Geological Survey, Reston, VA.); Sanford, W.E. (1995) Chemical and isotopic methods for quantifying ground-water recharge in a regional semiarid environment. *Ground water (USA)* v. 33(3) p. 458-468. references. English. (AGRIC 97-068349).

The High Plains aquifer underlying the semiarid Southern High Plains of Texas and New Mexico, USA was used to illustrate solute and isotopic methods for evaluating recharge fluxes, runoff, and spatial and temporal distribution of recharge. The chloride mass-balance method can provide, under certain conditions, a time-integrated technique for evaluation of recharge flux to regional aquifers that is independent of physical

parameters. Applying this method to the High Plains aquifer of the Southern High Plains suggests that recharge flux is approximately 2% of precipitation, or approximately 11 +/- 2 mm/y, consistent with previous estimates based on a variety of physically based measurements. The method is useful because long-term average precipitation and chloride concentrations in rain and ground water have less uncertainty and are generally less expensive to acquire than physically based parameters commonly used in analyzing recharge. Spatial and temporal distribution of recharge was evaluated by use of alpha 2H, 18O, and tritium concentrations in both ground water and the unsaturated zone. Analyses suggest that nearly half of the recharge to the Southern High Plains occurs as piston flow through playa basin floors that occupy approximately 6% of the area, and that macropore recharge may be important in the remaining recharge. Tritium and chloride concentrations in the unsaturated zone were used in a new equation developed to quantify runoff. Using this equation and data from a representative basin, runoff was found to be 24 +/- 3 mm/y; that is in close agreement with values obtained from water-balance measurements on experimental watersheds in the area. Such geochemical estimates are possible because tritium is used to calculate a recharge flux that is independent of precipitation and runoff, whereas recharge flux based on chloride concentration in the unsaturated zone is dependent upon the amount of runoff.

## P33 SOIL CHEMISTRY AND PHYSICS

4260 Brunet, Y. (Station de Bioclimatologie INRA, Villenave d'Ornon (France)); Itier, B.; McAneney, J.; Lagouarde, J.P. (1994) Downwind evolution of scalar fluxes and surface resistance under conditions of local advection. Part 2. Measurements over barley. *Agricultural and Forest Meteorology (Netherlands)* v. 71(3-4) p. 227-245. 21 ref. English. (AGRIC 97-083602).

4261 Dickson, J.W. (Scottish Agricultural Coll., Penicuik (United Kingdom). Dept. of Soils); Ritchie, R.M. (1996) Zero and reduced ground pressure traffic systems in an arable rotation. 2. Soil and crop responses. *Soil and Tillage Research (Netherlands)* v. 38(1-2) p. 89-113. 25 ref. English. (AGRIC 97-083723).

4262 Domzal, H.; Slowinska Jurkiewicz, A. (Agricultural University, Lublin (Poland). Inst. of Soil Science and Formation of Natural Environment) (1995) [Effect of different tillage systems for winter wheat cultivation on morphological structure of soil arable layer]. *Wplyw roznych sposobow uprawy roli pod pszenice ozima na budowe morfologiczna uprawnej warstwy gleby. Fragmenta Agronomica (Poland)* v. 12(4) p. 18-33. 4 fig.; 19 ref. Polish. (AGRIC 97-083743).

The paper comprises morphological study of soil structure of arable layer of four soils: soil lessive (Haplic Luvisol) developed from loess, rendzina (Rendzic Leptosol) from cretaceous marl, rusty soil (Cambic Podsol) from postglacial sand and brown soil (Eutric Cambisol) from boulder clay which has been carried out. Three different tillage systems were used for winter wheat (*Triticum aestivum* L.) pre-seeding cultivation: conventional-ploughing, non-ploughing and direct drilling. It has been found that in case of soils developed from loess, cretaceous marl and sand the best for structure was ploughing system used, whereas in soil developed from boulder loam the differences resulting from tillage systems were not clear.

4263 Faria, R.T. de (Instituto Agronomico do Parana, Londrina, PR (Brazil)); Madramootoo, C.A. (1996) Simulation of soil moisture profiles for wheat in Brazil. *Agricultural Water Management (Netherlands)* v. 31(1-2) p. 35-49. 20 ref. English. (AGRIC 97-083742).

4264 Flores Sanchez, Diego; Navarro Garza, Hermilo (1995) [Particles size in soil breaking 'tepate' on dry matter production and wheat yield wheat]. *Efecto del tamano de particula en tepate roturado sobre la produccion de materia seca y componentes de rendimiento en trigo. 26. Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas. (Mexico). 1995. [Soil research in Mexico 1992-1995. Proceedings of 26 National meeting of Soil Science. Cd. Victoria, Tamaulipas, 1995]. La investigacion edafologica en Mexico 1992-1995. Memorias del 26 Congreso Nacional de la Ciencia del Suelo. Cd. Victoria, Tamaulipas, 1995. Tovar Salinas, Jorge Leonardo; Ordaz Chaparro, Victor; Quintero Lizaola, Roberto (Eds.) p. 183. Sociedad Mexicana de la Ciencia del Suelo. 1 cuadro; 1 fig.; 2 ref. Spanish. (AGRIC 97-083518).*

4265 Hansen, E.M.; Djurhuus, J. (Danish Institute of Plant and Soil Science (DIPS), Department of Soil Science, Research Centre Foulum, P.O. Box 23, DK 8830 Tjele (Denmark)) (1996) Nitrate leaching as affected by long-term N fertilization on a coarse sand. *Soil Use and Management (United Kingdom)* v. 12(4) p. 199-204. 36 ref. English. (AGRS 97-068469).

4266 Hulme, P.J. (New England Univ., Armidale, N.S.W. (Australia). Dept. of Agronomy and Soil Science); McKenzie, D.C.; MacLeod, D.A.; Anthony, D.T.W. (1996) An evaluation of controlled traffic with reduced tillage for irrigated cotton on a Vertisol. *Soil and Tillage Research (Netherlands)* v. 38(3-4) p. 217-237. 42 ref. English. (AGRS 97-083591).

4267 Ismail, I.E.; Abd El Gawad, H.; El Sissy, L. (Ministry of Agriculture, Cairo (Egypt). Soil and Water Research Inst.) (1993) Salt tolerance of some wheat cultivars at various growth stages. *Al-Azhar Journal of Agricultural Research (Egypt)* v. 17 p. 73-89. 7 tables; 13 ref. English. (AGRS 97-083741).

4268 Nievergelt, J. (Eidg. Forschungsanstalt fuer Agrarökologie und Landbau (FAL), Zuerich Reckenholz (Switzerland)) (1997) [Lysimeter results from 1st April 1995 to 31 March 1996 [Switzerland]]. *Lysimeter-Ergebnisse* 1. April 1995 bis 31. Maerz 1996 [Schweiz]. *Agrarforschung (Switzerland)* v. 4(2) p. 87-88. 3 tables, 1 graph, 1 photo. German. (AGRS 97-068624).

### P34 SOIL BIOLOGY

4269 Bashan, Y.; Holguin, G. (1997) AZOSPIRILLUM-PLANT RELATIONSHIPS - ENVIRONMENTAL AND PHYSIOLOGICAL ADVANCES (1990-1996) [Review]. *Canadian Journal of Microbiology*. 43(2):103-121. English. [CTR BIOL RES NW DEPT MICROBIOL POB 128 LA PAZ 23000 BAJA CALIFORNIA MEXICO].

This review presents a critical and comprehensive analysis of the developments in environmental and physiological studies related to Azospirillum interactions with plants based on information published between 1990 and 1996. It was designed as an update of a previous review with a similar scope. Apart from an update, this review emphasizes the central issues of Azospirillum research today, such as coinoculation with other microorganisms and hormonal studies, shows the less researched areas, and proposes possible avenues for the exploitation of this bacterium in areas other than agriculture. [References: 228].

4270 Degens, BP. (1997) MACRO-AGGREGATION OF SOILS BY BIOLOGICAL BONDING AND BINDING MECHANISMS AND THE FACTORS AFFECTING THESE - A REVIEW [Review]. *Australian Journal of Soil Research*. 35(3):431-459. English. [UNIV E LONDON DEPT ENVIRONM SCI ROMFORD RD LONDON E15 4LZ ENGLAND].

This review presents an analysis of the labile bonding (organic compounds) and binding (hyphae and roots) mechanisms involved in stabilising soil into macro-aggregates in soils (aggregates >0.25 mm diameter). The main emphasis is on the approaches used to study these mechanisms and the factors that affect the aggregating mechanisms at the micro-scale (<100 µm) level in soils. Much of the understanding of the stabilisation of soil into macro-aggregates in field soils by labile organic C is derived primarily from the interpretations of studies where soils were incubated under artificial conditions. In addition, many recent studies have assessed the importance of labile organic C in macro-aggregation based only on whole soils analyses of hyphal length, extractable carbohydrate C, microbial biomass C, or aliphatic C. These approaches have contributed little to understanding fundamental factors that can influence the biological mechanisms of macro-aggregation under field conditions. It is proposed that greater consideration of bonding and binding aggregation mechanisms and the factors affecting the mechanisms at the micro-scale level will facilitate development of field management practices that benefit macro-aggregation. Factors influencing the location and persistence of bonding and binding mechanisms in the soil matrix are discussed. [References: 119].

4271 Govedarica, M. (Poljoprivredni fakultet, Novi Sad (Yugoslavia)); Milosevic, N.; Jarak, M. (1997) [Biological N2 fixation in agriculture: possibilities, application and perspectives]. *Biološka azotifikacija u poljoprivredi: mogućnosti primene i perspektive*. 31. seminar agronoma. Zlatibor (Yugoslavia). 26 Jan - 2 Feb 1997. *Zbornik radova - Naučni institut za*

*ratarstvo i povrtarstvo (Yugoslavia)* (no.29) p. 35-43. 4 tables. Serbian. (AGRS 97-083943).

It was investigated the efficiency of various symbiotic N2 - fixing organisms in wheat, sunflower, maize and sugar beet grown under semi-controlled field conditions. Prior to sowing, the seed of these crop species was inoculated with different N - fixing organisms. The efficiency of these organisms proved to be dependent on the microbial species applied as well as the crop species with which they were used. The amount of pure N fixed was as follows: maize - 90 kg/ha, wheat - 60 kg/ha, sunflower - 70 kg/ha, and sugar beet - 60 kg/ha. The most efficient species were *Azotobacter chroococcum*, *Beijerinckia Derx*, and *Azotospirillum lipoferum*. The selection of N2 - fixing organisms should be done at the level of plant genotype, i.e. each plant genotype should be mated with the most suitable species and strain.

4272 Ruppel, S.; Merbach, W. (1995) [Share of bacterial associative atmospheric nitrogen fixation on nitrogen nutrition of wheat in dependence on nitrogen fertilization]. *Anteil der bakteriellen assoziativen Luftstickstoffbindung an der N-Ernaehrung von Weizen in Abhaengigkeit von der N-Duengung*. [Carbon and nitrogen turnover in the system plant - soil]. Merbach, W.; Bork, H.-R. (eds.). *Kohlenstoff- und Stickstoffumsatz im System Pflanze - Boden ZALF-Berichte (Germany)*; no. 23. *Institut fuer Gemuesebau und Zierrpflanzenbau Grossbeeren/Erfurt, Grossbeeren (Germany)* p. 35-41. Selbstverlag. German. (AGRS 97-068865).

4273 Schlöter, M.; Wiehe, W.; Assmus, B.; Steindl, H.; Becke, H.; Hoflich, G.; Hartmann, A. (1997) ROOT COLONIZATION OF DIFFERENT PLANTS BY PLANT-GROWTH-PROMOTING RHIZOBIUM LEGUMINOSARUM BV TRIFOLII R39 STUDIED WITH MONOSPECIFIC POLYCLONAL ANTISERA. *Applied & Environmental Microbiology*. 63(5):2038-2046. English. [GSF MUNICH NATL RES CTR ENVIRONM & HLTH INST SOIL ECOL INGOLSTADTER LANDSTR 1 D-85764 MUNICH GERMANY].

Monospecific polyclonal antisera raised against *Rhizobium leguminosarum* bv. *trifolii* R39, a bacterium which was isolated originally from red clover nodules, were used to study the colonization of roots of leguminous and nonleguminous plants (*Pisum sativum*, *Lupinus albus*, *Triticum aestivum*, and *Zea mays*) after inoculation. Eight weeks after inoculation of soil-grown plants, between 0.1 and 1% of the total bacterial population in the rhizospheres of all inoculated plants were identified as *R. leguminosarum* bv. *trifolii* R39. To characterize the associative colonization of the nonleguminous plants by *R. leguminosarum* bv. *trifolii* R39 in more detail, a time course study was performed with inoculated roots of *Z. mays*. *R. leguminosarum* bv. *trifolii* R39 was found almost exclusively in the rhizosphere soil and on the rhizoplane 4 weeks after inoculation. Colonization of inner root tissues was detected only occasionally at this time. During the process of attachment of *R. leguminosarum* bv. *trifolii* R39 to the rhizoplane, bacterial lipopolysaccharides were overexpressed, and this may be important for plant-microbe interaction. Fourteen weeks after inoculation, microcolonies of *R. leguminosarum* bv. *trifolii* R39 were detected in lysed cells of the root cortex as well as in intracellular spaces of central root cylinder cells. At the beginning of flowering (18 weeks after inoculation), the number of *R. leguminosarum* bv. *trifolii* R39 organisms decreased in the rhizosphere soil, rhizoplane, and inner root tissue. [References: 37].

4274 Skiba, U. (Institute of Terrestrial Ecology, Penicuik, Midlothian (United Kingdom)); Hargreaves, K.J.; Beverland, I.J.; O'Neill, D.H.; Fowler, D.; Moncrieff, J.B. (1996) Measurement of field scale N(2)O emission fluxes from a wheat crop using micrometeorological techniques. *Plant and Soil (Netherlands)* v. 181(1) p. 139-144. 15 ref. English. (AGRS 97-083945).

4275 Stamboliev, M. (Kompleksna Opitna Stantsiya, Lom (Bulgaria)) (1996) [Factors influencing phosphorus lability in soil upon growing wheat on calcareous chernozem]. *Faktori, vliyaeshchi v'rkhlu podvizhnostta na fosfora v pochvata pri otglezhdane na pshenitsa na karbonaten chernozem*. *Selskostopanska Akademiya, Sofia (Bulgaria). Pochvoznanie, Agrokhimiya i Ekologiya (Bulgaria). Soil Science, Agrochemistry and Ecology* v. 31(3) p. 7-9. 4 tables; 7 ref. Bulgarian. (AGRS 97-068707).

4276 Stevenson, FC.; Vankessel, C. (1997) NITROGEN CONTRIBUTION OF PEA RESIDUE IN A HUMMOCKY TERRAIN. *Soil Science Society of*



America Journal. 61(2):494-503. English. [UNIV SASKATCHEWAN DEPT SOIL SCI 51 CAMPUS DR SASKATOON SK S7N 5A8 CANADA].

Topography influences the distribution of soil water and inorganic N, which could affect the availability of N from legume residue to the subsequent crop. A study assessed the landscape-scale variability of the N contribution by pea (*Pisum sativum* L.) to the soil (N<sub>2</sub> fixation in residue minus seed N derived from the soil) and the subsequent wheat (*Triticum aestivum* L.) crop. In situ N-15-labeled pea residue was used to monitor the contribution of pea residue to the succeeding crop. A 100-point sampling grid, with 10-m spacings, was established in a field with hummocky terrain. Each sampling point was classified as a shoulder or a low-catchment or high-catchment footslope. The N contribution by pea to the soil was 45 kg ha<sup>-1</sup> in the shoulders and 63 kg ha<sup>-1</sup> in the footslopes. Recovery of N-15 in the microbial biomass was greater in the footslopes (71%) vs. the shoulders (51%), and related to greater soil water content in the footslopes. The N contribution by pea to wheat, as assessed by the N-15 that wheat derived from the residue of the preceding wheat crop, was 11% and similar among landform complexes. Therefore, the N contribution of pea to wheat did not explain the greater N accumulation by wheat in the high-catchment areas than the other landform complexes. The N contribution of pea to a succeeding wheat crop apparently will be a small component of the rotation benefit by pea in a hummocky terrain. [References: 40].

4277 Walley, FL.; Germida, JJ. (1997) RESPONSE OF SPRING WHEAT (*TRITICUM AESTIVUM*) TO INTERACTIONS BETWEEN *PSEUDOMONAS* SPECIES AND *GLOMUS CLARUM* NT4. *Biology & Fertility of Soils*. 24(4):365-371. English. [UNIV SASKATCHEWAN DEPT SOIL SCI 51 CAMPUS DR SASKATOON SK S7N 5A8 CANADA].

The effects of interactions between pseudomonads (*Pseudomonas* cepacia strains R55 and R85, *P. aeruginosa* strain R80, *P. fluorescens* strain R92, and *P. putida* strain R104) and the arbuscular mycorrhizal fungus *Glomus clarum* (Nicol. and Schenck) isolate NT4, on spring wheat (*Triticum aestivum* L. cv. Laura), grown under gnotobiotic and nonsterile conditions, were investigated. Although plant growth responses varied, positive responses to pseudomonad inoculants generally were obtained under gnotobiotic conditions. Shoot dry weight enhancement ranged from 16 to 48%, whereas root enhancement ranged from 82 to 137%. Shoot growth in nonsterile soil, however, was unaffected by pseudomonad inoculants, or reduced by as much as 24%. Shoot growth was unaffected or depressed by *G. clarum* NT4 whereas early root growth was enhanced by 38%. Significant interactions between the pseudomonad inoculants and *G. clarum* NT4 were detected. Typically, dual inoculation influenced the magnitude of response associated with any organism applied alone. The effect of these pseudomonads on *G. clarum* NT4 spore germination was investigated. Germination was inhibited when spores were incubated either on membranes placed directly on bacterial lawns of strains R85 and R104 (i.e., direct assay), or on agarose blocks separated from the bacteria by membranes (i.e., diffusion assay). When the agarose blocks were physically separated from the pseudomonad (i.e., volatile assay), there was no evidence of inhibition, suggesting that a nonvolatile, diffusible substance(s) produced by both strains R85 and R104 may inhibit *G. clarum* NT4 spore germination. [References: 39].

4278 Wang, JG.; Bakken, LR. (1997) COMPETITION FOR NITROGEN DURING MINERALIZATION OF PLANT RESIDUES IN SOIL - MICROBIAL RESPONSE TO C AND N AVAILABILITY. *Soil Biology & Biochemistry*. 29(2):163-170. English. [BEIJING AGR UNIV DEPT PLANT NUTR BEIJING 100094 PEOPLES REPUBLIC OF CHINA].

In an experiment where N-poor (barley straw) and N-rich (clover leaves) plant residues were placed into soil as separate layers, negative effect of plant roots on microbial growth was observed. The depression effect occurred predominantly in N-poor plant residue layers, which indicated that microbial growth can be limited by N availability in such microsites in soil. More energy substrates were available in the planted straw layer, as indicated by a significantly higher N immobilization potential in the planted soil compared with that in the unplanted soil. However, in the N-rich sites, plant roots stimulated N mineralization during 1 wk incubation of soil slurries. Microbial response to initial growth conditions, including C and N availability, are also discussed. (C) 1997 Elsevier Science Ltd. [References: 30].

4279 Wheatley, RE.; Ritz, K.; Griffiths, BS. (1997) APPLICATION OF AN AUGMENTED NITRIFICATION ASSAY TO ELUCIDATE THE

EFFECTS OF A SPRING BARLEY CROP AND MANURES ON TEMPORAL VARIATIONS IN RATES. *Biology & Fertility of Soils*. 24(4):378-383. English. [SCOTTISH CROP RES INST DEPT CELLULAR & ENVIRONM PHYSIOL UNIT INTERGRAT BIOSCI DUNDEE DD2 5DA SCOTLAND].

The effects of crop plants and farmyard or poultry manure applications on temporal variations in nitrification rates were measured in a field experiment. In order to elucidate factors which may have been governing such rates, an augmented nitrification assay was applied. The basis of the assay was to measure nitrification rates under circumstances where substrate, i.e. ammonium-ion, and water and spatial constraints had been removed. Nitrification rates showed marked temporal variation, of over one order of magnitude, throughout the growing season. Nitrification rates were also similarly increased when substrate and spatial constraints were removed, but distinct temporal variations still persisted. The pattern of such variations varied according to assay conditions in the augmented nitrification assay. Barley plants had a statistically significant effect on nitrification rates, positive early in the growing season and negative at the end. Manures stimulated nitrification, with poultry manure having a greater effect than farmyard manure, and there was evidence for a relationship between heterotrophic and autotrophic activity. Factors other than ammonium-ion concentration and water or spatial restrictions must also regulate nitrification rates in mineral soils; these could include population size or interactions. [References: 23].

4280 Xavier, LJC.; Germida, JJ. (1997) GROWTH RESPONSE OF LENTIL AND WHEAT TO *GLOMUS CLARUM* NT4 OVER A RANGE OF P LEVELS IN A SASKATCHEWAN SOIL CONTAINING INDIGENOUS AM FUNGI. *Mycorrhiza*. 7(1):3-8. English. [UNIV SASKATCHEWAN DEPT SOIL SCI 51 CAMPUS DR SASKATOON SK S7N 5A8 CANADA].

The growth responses of lentil (*Lens esculenta* L. cv. Laird) and two wheat cultivars (*Triticum aestivum* L. cv. Laura and Neepawa) to *Glomus clarum* NT4 in soil containing indigenous arbuscular mycorrhizal fungi (AMF) and fertilized with phosphorus at different (0, 5, 10, 20 ppm) levels was studied in a growth chamber. Soil was inoculated with a monospecific culture of *G. clarum* NT4 to provide an inoculant:indigenous AMF ratio of ca. 1:100. The shoot and root growth, and AMF colonization levels of NT4-inoculated lentil were significantly (*P* less than or equal to 0.05) greater than the appropriate control plants in the unfertilized soil at 48 days after planting (DAP). At 95 DAP, NT4 inoculation had significantly increased the shoot dry weight (*P* less than or equal to 0.08) and AMF colonization (*P* less than or equal to 0.05) of lentil plants receiving 5 mg P kg<sup>-1</sup> soil, whereas 20 mg P kg<sup>-1</sup> soil reduced the shoot growth of NT4-inoculated plants. The NT4 inoculant had no effect (*P* less than or equal to 0.05) on shoot P content, but increased (*P* less than or equal to 0.08) the P-use efficiency of lentil plants receiving 5 mg P kg<sup>-1</sup> soil. In contrast to the inoculant's effect on lentil, NT4 generally had no positive effect on any of the parameters assessed for wheat cv. Laura at any P level at 48 or 95 DAP. Similarly, there was no positive effect of NT4 on shoot or root growth, or AMF colonization of wheat cv. Neepawa plants at any P level at 48 DAP. However, NT4 inoculation increased the grain yield of Neepawa by 20% (*P* less than or equal to 0.05) when fertilized with 20 mg P kg<sup>-1</sup> soil. This yield increase was associated with a significant (*P* less than or equal to 0.05) reduction in root biomass and a significant (*P* less than or equal to 0.05) increase in the grain P content of inoculated plants. Thus, NT4 appears to have a preference for the Neepawa cultivar. Our results show that lentil was more dependent on mycorrhizae than wheat and responded to an AMF inoculant even in soil containing high levels of indigenous AMF. It might, therefore, be possible to develop mixed inoculants containing rhizobia and AMF for field production of legumes. [References: 18].

4281 Zaghloul, R.A. (Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture); Mostafa, M.H.; Amer, A.A. (1996) Influence of wheat inoculation with mycorrhizal fungi, phosphate solubilizing bacteria and *Azospirillum* on its growth and soil fertility. *Annals of Agricultural Science, Moshtohor (Egypt)* v. 34(2) p. 611-626. 10 tables; 28 ref. English. (AGRI 97-083944).

## P35 SOIL FERTILITY

4282 Allam, S.M.M. (1994) Studies on iron deficiency and boron toxicity in some soils of Egypt. Ain-Shams Univ., Cairo (Egypt). Faculty of

Agriculture. 20 graph. 1 ill. 19 tables; Bibliography: p. 151-164. 179 p. English. (AGRIS 97-084003).

4283 Fahmy, F.M. (1995) Effect of some organic wastes on availability of some micronutrients in calcareous soils. Zagazig Univ., Moshtohor (Egypt). Faculty of Agriculture. 8 graph. 11 tables; Bibliography: p. 79-102. 105 p. English. (AGRIS 97-084002).

4284 Richards, I.R. (Levington Agriculture Ltd., Ipswich, Suffolk (United Kingdom)); Wallace, P.A.; Paulson, G.A. (1996) Effects of applied nitrogen on soil nitrate-nitrogen content after harvest of winter barley. *Fertilizer Research (Netherlands)* v. 45(1) p. 61-67. 13 ref. English. (AGRIS 97-084000).

4285 Roxo, M.J.; Cortesao Casimiro, P.; Soeiro de Brito, R. (Departamento de Geografia e Planeamento Regional. Universidade, Nova de Lisboa (Portugal)) (1996) Inner Lower Alentejo field site: cereal cropping, soil degradation and desertification. *Mediterranean desertification and land use*. Brandt, C.J.; Thornes, J.B. (eds.) p. 111-135. John Wiley and Sons Ltd. 12 ref. English. (AGRIS 97-068900).

4286 Wassif, M.M. (Ministry of Agriculture, Cairo (Egypt). Desert Research Centre); Atta, S.K.; Tadros, S.F. (1995) Water erosion of calcareous soil and its productivity under rainfed agriculture of Egypt. *Egyptian Journal of Soil Science (Egypt)* v. 35(1) p. 15-31. 2 graph. 9 tables; 23 ref. English. (AGRIS 97-084001).

### P36 SOIL EROSION, CONSERVATION AND RECLAMATION

4287 Chapman, S.J. (1997) BARLEY STRAW DECOMPOSITION AND S IMMOBILIZATION. *Soil Biology & Biochemistry*. 29(2):109-114. English. [MACAULAY LAND USE RES INST CRAIGIEBUCKLER AB15 8QH ABERDEEN SCOTLAND].

Sulphur deficiencies have become increasingly recognized in both soils and crops. The return of plant residues low in S to low S soils may lead to decomposition processes being limited by S availability. In a laboratory incubation, barley straw that was low in S was added to four low S soils, with or without added sulphate-S. Straw samples with varying concentrations of S were also added to one of the soils. Decomposition was monitored as CO<sub>2</sub> production, and S immobilization was measured by the change in phosphate-extractable-S. Decomposition was limited by S in all four soils, but this was dependent on the straw S content. With sufficient S, approximately 40% of the straw C was respired over 25 days at 25 degrees C, but this was up to 30% less where S was limiting. Mineralization occurred at a straw S content of 0.15% irrespective of any S addition. At 0.11% S, there was a balance where decomposition was not retarded in the absence of added S, but immobilization occurred if S was added. However, at 0.07 and 0.04% S, there was increased immobilization, and decomposition was retarded if S was not added. The critical S content for immobilization was estimated to be 0.13% or a C-to-S ratio in the residue of 340. For potential limitation of residue decomposition, the S content would have to be slightly less than this with a C-to-S ratio in the range 400-650 (0.11-0.07% S). In S-deficient areas and depending upon the soil, the incorporation of plant residues low in S may lead to reduced plant growth and retarded residue decomposition. (C) 1997 Elsevier Science Ltd. [References: 25].

4288 Kosmas, C.S.; Moustakas, N.; Danalatos, N.G.; Yassoglou, N. (Laboratory of Soils and Agricultural Chemistry, Agricultural University of Athens (Greece)) (1996) The Sparta field site: I. The impacts of land use and management on soil properties and erosion. II. The effect of reduced moisture on soil properties and wheat production. *Mediterranean desertification and land use*. Brandt, C.J.; Thornes, J.B. (eds.) p. 207-228. John Wiley and Sons Ltd. 35 ref. English. (AGRIS 97-068950).

4289 Williams, J.R. (Kansas State Univ., Manhattan, KS (USA). Dept. of Agricultural Economics); Tanaka, D.L. (1996) Economic evaluation of topsoil loss in spring wheat production in the northern Great Plains, USA. *Soil and Tillage Research (Netherlands)* v. 37(2-3) p. 95-112. 14 ref. English. (AGRIS 97-084118).

### Q02 FOOD PROCESSING AND PRESERVATION

4290 Abd El Hady, E.A.; Mostafa, G.A. (Suez Canal Univ., Ismaileyah (Egypt). Faculty of Agriculture) (1995) Effect of adding alpha-amylase and alpha-amylase SSL [Sodium Stearoyl-2-Lactylate] mixture for retarding wheat bread staling. *Annals of Agricultural Science, Moshtohor (Egypt)* v. 33(4) p. 1399-1412. 1 photo. 5 tables; 22 ref. English. (AGRIS 97-084346).

4291 Agte, V.V.; Joshi, S.R. (1997) EFFECT OF TRADITIONAL FOOD PROCESSING ON PHYTATE DEGRADATION IN WHEAT AND MILLETS. *Journal of Agricultural & Food Chemistry*. 45(5):1659-1661. English. [MACS AGHARKAR RES INST GG AGARKAR RD PUNE 411004 MAHARASHTRA INDIA].

For cereal-based vegetarian meals, processing such as soaking cereal flour prior to heating can activate native phytases. This activation will result in improving the zinc bioavailability since degraded products of phytate have a lower affinity for zinc. The effect of increasing the time for soaking wheat batter at 10 degrees C for 0-48 h and the effect of roti making with millet and sorghum flour batters was investigated. Phytate (IP<sub>6</sub>) degradation was studied using ion-exchange chromatography on a column of Dowex 1X8 resin (200-400 mesh). A soaking time of 12 h for wheat batter resulted in a 40% decrease in IP<sub>6</sub>. The decreasing trend for wheat with increased soaking time was significant ( $p < 0.01$ ). Soaking also resulted in an increase of zinc solubility by 38.5%. Degradation of IP<sub>6</sub> due to roti making without soaking of batter for all three cereals was 14-19% with a marginal decrease in zinc solubility. [References: 12].

4292 Andreae Jaeckering, M. (Jaeckering Muehlen und Naehrmittelwerke GmbH, Hamm (Germany)) (1996) [Wheat milling in the turbulence with the Ultra-Rotor equipment]. *Weizenvermahlung im Luftwirbel auf dem Ultra-Rotor. Getreide Mehl und Brot (Germany)* v. 50(4) p. 212-213. 1 ill. German. (AGRIS 97-069781).

Die Abkueerzung der Vermahlung durch den Einsatz eines einstufigen Zerkleinerungsaggregates (Ultra-Rotor-Vermahlungsmaschine) fuer die Herstellung von Weizen- und Roggenmehlerzeugnissen wird vorgestellt. Bei der Vermahlung von Weizen koennen nur Mehle mit hoeherem Mineralstoffgehalt hergestellt werden. Der Schwerpunkt des Verfahrens liegt in der Herstellung von Roggenmehlerzeugnissen zu handelsueblichen Endprodukten. Es wird jedoch gezeigt, dass auf den Ultra-Rotor-Luftwirbelmuehlen ein in allen Aspekten konkurrenzfaehiges Mehl fuer die Weiterverarbeitung zu Weizenstaerke und Weizenkleber hergestellt werden kann.

4293 Anon. (1996) [Automated management with computer aided processing management in milling industry]. *Conduite automatisee avec GPAO integree en meunerie. Industries des Cereales (France)* (no 97) p. 41-43. French. (AGRIS 97-069281).

4294 Autran, J.C. (Institut de Recherches Technologiques Agro Alimentaires des Cereales, Paris (France)); Hamer, R.J.; Plijter, J.J.; Pogna, N.E. (1995) [Improvement of processing quality of European wheat. A synthesis of results of the EC programme "ECLAIR" (1991-1994)]. *Ameliorer la qualite d'utilisation industrielle des bles europeens. Synthese des resultats du programme CEE "ECLAIR" (1991-1994). Industries des Cereales (France)* (no 94) p. 11-27. 11 illus., 102 ref., 9 graph. French. (AGRIS 97-069259).

4295 Back, W.; Narziss, L. (1996) [Malt parameters and beer quality]. *Malzparameter und Bierqualitaet. Brauwelt (Germany)* v. 136(5) p. 198-204. 1 ill., 9 tables; 17 ref. German. (AGRIS 97-069364).

4296 Bar, C. (Institut Technique des Cereales et des Fourrages, Paris (France). Laboratoire Qualite des Cereales) (1996) [Interest of chromatographic analysis of wheat proteins for characterizing baking quality]. *Interet de l'analyse chromatographique des proteines du ble pour caracteriser la qualite boulangere*. 46. Journees de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealières]. Paris (France). 15-16 Nov 1995. *Industries des Cereales (France)* (no 96) p. 22. 5 graph. French. (AGRIS 97-069270).

4297 Bourson, Y. (Ecole Nationale Supérieure de Meunerie et des Industries Cerealières, Paris (France)) (1995) [Wheat cleaning: necessary and sufficient equipment]. *Le nettoyage: équipement nécessaire et*



suffisant [nettoyage du blé en meunerie]. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 1994. *Industries des Céréales (France) (no 92) p. 30-35*. French. (AGRI 97-069252).

4298 Chasserau, P. (Ecole Nationale Supérieure de Meunerie et des Industries Céréalières, Paris (France). Sciences Biologiques et Biotechnologie des Céréales) (1995) [Quality of soft wheat of the 1995 crop in France and their biotechnological characteristics of flours]. La qualité des blés tendres de la récolte 1995 en France et les caractéristiques biotechnologiques de leur farine. *Industries des Céréales (France) (no 95) p. 12-19*. 15 graph. French. (AGRI 97-069261).

4299 Chaurand, M. (Inst. National de la Recherche Agronomique, Montpellier (France). Unité de Technologie des Céréales) (1996) [Durum wheat milling]. Vermahlung von Durumweizen. *Getreide Mehl und Brot (Germany) v. 50(3) p. 186-190*. 3 graphs; 11 ref. German. (AGRI 97-069757).

Die Durummüllerei hat in den letzten Jahren beachtliche Fortschritte erreicht, und die Automation konnte durch den Einsatz von Elektronik wesentlich verbessert werden. Es werden die spezifischen Probleme bei der Durumweizenvermahlung und die drei wichtigen Verfahrensschritte - Reinigung, Vorbereitung und Vermahlung bei der Herstellung von Mehl und Grieß beschrieben. Es wird daran gearbeitet, weitere Verbesserungen bei der elektronischen Korngrößenverteilung zu erreichen. Ausserdem wird der Trigotec-Prozess zur Vereinfachung des Mahlverfahrens untersucht. Wichtigste Voraussetzung fuer optimale Griessausbeuten in einer Durummühle ist ein gesunder, einwandfreier Durumweizen mit hoher Glasigkeit und gutem Farbwert, der optimal gereinigt und vorbereitet ist.

4300 Cretois, A. (Ecole Nationale Supérieure de Meunerie et des Industries Céréalières, Paris (France)) (1996) [Milling quality of French and imported wheat]. Valeur meunière des blés de force français et d'importation. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 21-22 Nov 1996. *Industries des Céréales (France) (no 100) p. 15-20*. 15 graph. French. (AGRI 97-069285).

4301 Cretois, A. (Ecole Nationale Supérieure de Meunerie et des Industries Céréalières, Paris (France)); Rio, L. (1995) [Behaviour of major soft wheat cultivars in milling from the 1995 crop in France [Forby, Recital, Sideral, Soissons]]. Comportement en mouture des variétés dominantes de la récolte 1995 [blé tendre: Forby, Recital, Sideral, Soissons]. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 1995. *Industries des Céréales (France) (no 95) p. 20-27*. 9 tableaux, 9 graph. French. (AGRI 97-069262).

4302 De Dios, C.A. (1996) [Grain drying and dryers]. Secado de granos y secadoras. FAO, Santiago (Chile). Oficina Regional para América Latina y el Caribe. *Serie Tecnología Postcosecha (FAO); no. 11 314 p.* Illus. Spanish. (AGRI 97-069573).

4303 Degant, O. (Hosokawa Alpine AG, Augsburg (Germany)) (1996) [New developments with impact grinding and air classification equipment in cereal processing]. Neu entwickelte Prallmühlen und Windsichtanlagen in der Getreideverarbeitung. *Getreide Mehl und Brot (Germany) v. 50(3) p. 164-166*. 2 ill., 2 graphs. German. (AGRI 97-069636).

Eine allgemeine und kurze Beurteilung der Verfahrenssysteme Prallzerkleinerung und Windsichtung im Hinblick auf die Anwendung in der Getreidemüllerei wird gegeben. Neue Sichtermühlen (Zirkoplex, Fließbett-Gegenstrahlmühle) werden beschrieben und ihre technischen Vorteile und Möglichkeiten aufgezeigt. Auf den Energieverbrauch wird eingegangen und mit herkömmlichen Prallmühlen verglichen.

4304 Dubois, M. (1995) [Experimental milling of baking wheat]. La mouture expérimentale du blé tendre. *Industries des Céréales (France) (no 93) p. 2-21*. 8 ref., 13 tableaux. French. (AGRI 97-069255).

4305 Fischer, J. (Institut Technique des Céréales et des Fourrages, Paris (France)) (1995) [Baking capacity of soft wheat of the 1995 harvest. Analysis ... the main cultivars and their complementarity in French and loaf bread making [Soissons, Sideral, Recital, Forby]]. Valeur boulangère des blés de la récolte 1995. Analyse des principales variétés

et de leur complémentarité en panification courante et pain de mie [Soissons, Sideral, Recital, Forby]. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 1995. *Industries des Céréales (France) (no 95) p. 28-34*. 11 graph. French. (AGRI 97-069263).

4306 Fischer, J. (Institut Technique des Céréales et des Fourrages, Paris (France)) (1996) [Baking characteristics of French wheat of the 1996 harvest. Analysis of the main cultivars and their complementarity in French and loaf bread making [Soissons, Sideral, Recital, Texel]]. Valeur boulangère des blés de la récolte 1996 (France). Analyse des principales variétés et de leur complémentarité en panification française et pain de mie [Soissons, Sideral, Recital, Texel]. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 21-22 Nov 1996. *Industries des Céréales (France) (no 100) p. 21-27*. 12 graph. French. (AGRI 97-069286).

4307 Handreck, B.; Poetschke, L. (TU-Berlin, Berlin (Germany). Fachgebiet Aufbereitungs- und Müllereitechnologie) (1996) [Influence of impact grinding on flour yield and quality by grinding middlings from different wheat cultivars]. Einfluss der Prallzerkleinerung und Mehlmehlgüte bei der Vermahlung von Dunsten aus unterschiedlichen Weizensorten. *Getreide Mehl und Brot (Germany) v. 50(3) p. 159-163*. 7 graphs, 4 tables; 4 ref. German. (AGRI 97-069778).

Es wurde Dunst aus den drei Weizensorten Zentos (A 8), Kontrast (A 6) und Contra (B 4) mit einer Stiftmühle bei unterschiedlichen Geschwindigkeiten vermahlen. Untersucht wurden neben müllereischen Kriterien Inhaltsstoffverschiebungen und Qualitätsveränderungen der Mehle, Backeigenschaften und das rheologische Verhalten der Teige. Folgende Ergebnisse wurden erzielt: Der Mehlanfall ist von der Sorteneigenschaft und der Intensität der Zerkleinerung abhängig und liegt zwischen 30 und 87 %. Walzenstuhlmehle (WM) und Prallmehle (PM) unterscheiden sich deutlich in der Korngrößenverteilung; die Feingutmaxima der PM liegen zwischen 20 und 40  $\mu\text{m}$ , die der WM zwischen 120 und 160  $\mu\text{m}$ . In Abhängigkeit von der Zerkleinerung treten neben Veränderungen im Mineralstoffgehalt auch Verschiebungen im Rohprotein- und Staerkegehalt auf. Der Rohproteingehalt der PM liegt stets über dem der WM. Ähnliche Tendenzen ergeben sich fuer den Feuchtglutengehalt. Staerkebeschädigung und Wasseraufnahme der PM sind in Abhängigkeit von den Sorteneigenschaften in der Regel höher als die der WM. WM haben meist grössere Gebäckvolumen als PM. Der Einfluss der unterschiedlichen Zerkleinerungsparameter auf die Volumenausbeute ist jedoch relativ gering. Bei Betrachtung aller Messergebnisse wird auf die Vorteile der Prallzerkleinerung bei der Vermahlung des Dunstes der weichen Sorte B4 gegenüber den härteren Sorten verwiesen.

4308 Huot Marchand, J.M. (Gist Brocades, Roissy (France)); Gricourt, C.; Fischer, J. (1996) [Behaviour in deep freezing of the main wheat cultivars, season 1994 (France) [Soissons, Recital, Sideral, Forby]]. Comportement en surgélation des principales variétés de blé tendre récolte 1994 (France) [Soissons, Sideral, Recital, Forby]. 46. Journées de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Céréalières]. Paris (France). 15-16 Nov 1995. *Industries des Céréales (France) (no 96) p. 25*. French. (AGRI 97-069272).

4309 Ibanoglu, S.; Ainsworth, P. (1997) KINETICS OF STARCH GELATINIZATION DURING EXTRUSION OF TARHANA, A TRADITIONAL TURKISH WHEAT FLOUR-YOGURT MIXTURE. *International Journal of Food Sciences & Nutrition*. 48(3):201-204. English. [DEPT FOOD ENGN TR-27310 GAZIANTEP TURKEY].

Tarhana, a traditional Turkish cereal food, was extruded at different extrusion conditions (product temperature: 60-120 degrees C; screw speed: 100-300 rpm; feed rate: 10-20 kg/h). The mean residence time and corresponding degree of starch gelatinization data were used to estimate the order of reaction, gelatinization rate constants and activation energy for starch gelatinization. Results indicate that starch gelatinization exhibited an apparent first-order reaction kinetics with a reaction order of approximately 0.8. Activation energy for gelatinization was calculated as 3325 kJ/kg mol using the Arrhenius equation. [References: 14].

4310 Icard, C. (Institut National de la Recherche Agronomique, Montpellier (France). Centre de Montpellier, Technologie des Céréales); Feillet, P. (1997) [Oxidoreduction events in durum wheat pasta]. Effets

des phenomenes d'oxydo-reduction au cours de la fabrication des pates alimentaires. *Industries Alimentaires et Agricoles (France)* v. 114(1-2) p. 4-19. 13 illus., 120 ref. French. (AGRI 97-084265).

4311 Kim, S.S. (Korea Catholic University, Buchon (Korea Republic). Department of Food Science and Nutrition); Lee, W.J. (Kangnung National University, Kangnung (Korea Republic). Department of Food Science) (1997) Characteristics of germinated rice as a potential raw material for Sikhe production. *Korean Journal of Food Science and Technology (Korea Republic)* v. 29(1) p. 101-106. 9 illus.; 1 table; 20 ref. Korean. (AGRI 97-084513).

4312 Kim, Y.H. (Daehan Flour Mills Company Limited, Incheon (Korea Republic). Food Research Institute) (1996) Qualities of bread and changes in phytic acid during breadmaking with whole wheat flour. *Journal of the Korean Society of Food Science and Nutrition (Korea Republic)* v. 25(5) p. 779-785. 3 illus.; 8 tables; 27 ref. Korean. (AGRI 97-084564).

4313 Kim, Y.H. (Daehan Flour Mills Company Limited, Incheon (Korea Republic). Food Research Institute); Choi, K.S. (Yeungnam University, Kyungsan (Korea Republic). Department of Food Science and Technology); Son, D.H. (Shinil Junior College, Taegu (Korea Republic). Department of Food Science and Technology); Kim, J.H. (Kyungsan University, Kyungsan (Korea Republic). Department of Environmental Science) (1996) Rheological properties of dough with whole wheat flour. *Journal of the Korean Society of Food Science and Nutrition (Korea Republic)* v. 25(5) p. 817-823. 6 illus.; 6 tables; 20 ref. Korean. (AGRI 97-084565).

4314 Kuenzli, A. (Buehler AG, Uzwil (Switzerland)) (1996) [Grain cleaning and conditioning for the milling process]. *Reinigen und Vorbereiten des Getreides fuer den Mahlprozess. Getreide Mehl und Brot (Germany)* v. 50(3) p. 156-158. 4 ill., 1 graph. German. (AGRI 97-069777).

Neuentwicklungen von Reinigungsmaschinen und -konzepten zum Reinigen und Vorbereiten von Weizen werden beschrieben. Die Vorteile der Kombi-Reinigungsmaschinen werden im Vergleich zu den Maschinen von vor 10 Jahren wie folgt beschrieben: 50 % weniger Energieverbrauch, Reduzierung des Frischluftbedarfs um 90 %, Reduktion der Filterflaeche, Verringerung der Investitionskosten, Vereinfachung der Ueberwachung, reduzierte Bedienung durch wenige Einstellarbeiten, minimale Unterhaltungsarbeiten, wesentlich kleinerer Raumbedarf, reduzierte Montagekosten.

4315 Leon, A.; Duran, E.; Debarber, C.B. (1997) A NEW APPROACH TO STUDY STARCH CHANGES OCCURRING IN THE DOUGH-BAKING PROCESS AND DURING BREAD STORAGE. *Zeitschrift fur Lebensmittel-Untersuchung und-Forschung A-Food Research & Technology*. 204(4):316-320. English. [CSIC INST AGROQUIM & TECNOL ALIMENTOS POLIGONO COMA S-N APARTADO 73 E-46100 BURJASSOT VALENCIA SPAIN].

Wheat starch gelatinization taking place during the baking of different bread dough recipes was studied by differential scanning calorimetry (DSC), simulating the baking conditions in the centre of bread crumb samples. After heating, dough samples were kept in DSC pans to evaluate amylopectin retrogradation at different storage times. Results were compared with those obtained from a calorimetric study of lyophilized bread crumb samples. Both methods showed that similar retrogradation rates occurred. In this work, dough heating methodology was applied in order to study the influence of water content and dough freezing on starch gelatinization and retrogradation. Maximum retrogradation was observed to occur when the water content was between 35 and 50%. Dough freezing had no significant effect on starch gelatinization, but it increased the retrogradation rate when the storage of frozen dough was prolonged to 30 days. Heating wheat flour dough in the calorimeter afforded direct information about the behaviour of starch in the dough system and about its retrogradation during storage. This method appears to be as a simple and reliable way to evaluate the influence of components and processing conditions on the physico-chemical changes of starch. [References: 45].

4316 Magnus, E.M.; Brathen, E.; Sohlstrom, S.; Faergestad, E.M.; Ellekjaer, M.R. (1997) EFFECTS OF WHEAT VARIETY AND PROCESSING CONDITIONS IN EXPERIMENTAL BREAD BAKING STUDIED BY UNIVARIATE AND MULTIVARIATE ANALYSES. *Journal of Cereal Science*. 25(3):289-301. English. [NORWEGIAN FOOD RES INST MATFORSK OSLOVEIEN 1 N-1430 AS NORWAY].

The effects of variety, mixing conditions and fermentation time on bread loaf characteristics were studied by univariate and multivariate statistical methods. Nearly all the measured bread loaf characteristics were significantly affected by variety, fermentation time; and mixing conditions. Significant interactions were also found. Multivariate analysis (principal component analysis; PCA), was used to find the main variation among the bread samples and to identify the bread loaf characteristics that contributed to describe this variation. The characteristics loaf volume and weight described a large part of the main variation among the leaves and these characteristics were studied in more detail by response surface methodology. The loaf volume and weight response surfaces for varieties, which by multivariate analysis were found to have common properties, followed similar general patterns. It was shown that the experimental design used provided information about the baking performance of wheat flours over a wide range of experimental conditions and, thus, can be a useful supplement to standardised and optimised baking tests. (C) 1997 Academic Press Limited. [References: 18].

4317 Mostafa, G.A.; Abd El Hady, E.A. (Suez Canal Univ., Ismaileyah (Egypt). Faculty of Agriculture) (1995) Retarding wheat bread staling by adding Keltrol and SSL [Sodium Stearoyl-2 Lactylate]. *Annals of Agricultural Science, Moshohor (Egypt)* v. 33(4) p. 1383-1397. 1 photo. 5 tables; 24 ref. English. (AGRI 97-084345).

4318 Muenzing, K. (Bundesanstalt fuer Getreide, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Actual aspects in wheat drying]. *Aktuelle Fragen zur Trocknung von Weizen. Muehle + Mischfuettertechnik (Germany)* v. 133(15) p. 233-234. German. (AGRI 97-069779).

Diskutiert werden Teilspekte der Warmlufttrocknung von Weizen wie Luftfeuchtigkeit, Luftgeschwindigkeit und Wasseraktivitaet als Einflussfaktoren fuer eine Optimierung der Getreidetrocknung. Ausserdem werden optimale Korn-Endtemperaturen zur Qualitaetserhaltung von Brotgetreide empfohlen.

4319 Robertson, J.A.; Majsaknewman, G.; Ring, S.G.; Selvendran, R.R. (1997) SOLUBILISATION OF MIXED LINKAGE (1-3), (1-4) BETA-D-GLUCANS FROM BARLEY - EFFECTS OF COOKING AND DIGESTION. *Journal of Cereal Science*. 25(3):275-283. English. [AFRC INST FOOD RES NORWICH LAB DEPT FOOD MOL BIOCHEM NORWICH RES PK NORWICH NR4 7UA NORFOLK ENGLAND].

The extractability behaviour of mixed linkage beta-glucans from barley has been assessed during cooking and under different regimens used for fibre isolation. Whilst beta-glucan extractability increased to around 50% during cooking, from around 30% in the raw flour, methods used for NSP isolation resulted in even greater extractability (>60%). Enzymic rather than chemical treatments were more important in accounting for the increased extractability. Endogenous proteases from the small intestine were shown to be capable of enhancing the extractability of the beta-glucan to a level similar to that found in ileal effluent from patients fed an acute barley-based diet. This is consistent with the presence of mixed linkage beta-glucans as proteoglycan complexes in barley. The extractability of beta-glucans measured in vivo was significantly higher ( $P < 0.001$ ) than that measured in the original barley but without protease treatment. Thus, not only do 'unextractable' beta-glucans from barley have the potential to behave as a source of soluble NSP but the fibre matrix can be modified during transit in the upper gut. Hence the amount of soluble fibre present during gut transit can differ significantly from that measured in foods. This has implications for assessing the mechanism(s) involved in determining the response to fibre in the diet. It is important to take account of modifications to the fibre matrix when assessing the dietary response to a fibre source. (C) 1997 Academic Press Limited. [References: 26].

4320 Rohschenkel, C.; Enders, T. (Boehringer Ingelheim Backmittel GmbH, Bingen (Germany). Forschung und Entwicklung) (1996) [Advice fifty-fifty. New knowledges about "Unterbruch" baking method]. *Empfehlung fifty-fifty. Neue Erkenntnisse zur Unterbruchbackmethode. Brot und Backwaren (Germany)* v. 44(7-8) p. 33-35. 6 graphs, 1 table. German. (AGRI 97-069401).

Durch die Anwendung der Unterbruchbackmethode 50/50 lassen sich roggenghaltige Brote mit mindestens gleicher Qualitaet wie die von direkt ausgebackenen Broten herstellen. Eine Vorbackzeit von ca. 50 Prozent der Gesamtbackzeit und die Erreichung einer Kerntemperatur von 98 Grad C sind guenstige Voraussetzungen fuer hohe Gebaeckqualitaeten. Fuer die

Nachbackphase ist die erneute Erreichung einer Kerntemperatur von 98 Grad C sehr wichtig. Bei einer Zwischenlagerung bei Raumtemperatur ist eine Verpackung (Stikkenhaube) empfehlenswert. Die Lagerdauer sollte wegen der mikrobiologischen Stabilität 24 Stunden nicht ueberschreiten. Bei einer Kuehlagerung (0 Grad C) spielt die Verpackung eine untergeordnete Rolle; es ist eine Lagerung bis zu 72 Stunden ohne Verpackung moeglich. Roggenhaltige Broete, die nach der Unterbruchbackmethode 50/50 hergestellt worden sind, zeigen tendenziell eine bessere Frischhaltung.

4321 Saulnier, L. (Institut National de la Recherche Agronomique, Nantes (France). Centre de Nantes, Biochimie et Technologie des Proteines); Faurot, A.L.; Berot, S.; Petit, M.D.; Rouau, X.; Thibault, J.F. (1996) [Isolation of arabinoxylans from wheat flours at the pilot level [cultivars: Soissons, Thesee, Apollo]]. *Isolement a l'echelle pilote d'arabinoxylanes de farines de ble [varietes: Soissons, Thesee, Apollo]*. 46. Journees de l'ENSMIC [Ecole Nationale Supérieure de Meunerie et des Industries Cerealières]. Paris (France). 15-16 Nov 1995. *Industries des Cereales (France)* (no 96) p. 27. French. (AGRI 97-069274).

4322 Skendzic, M.; Sekulic, R. (Mlinpek zavod, Novi Sad (Yugoslavia)) (1996) [Categorization of phases in milling process]. *Kategorizacija faza u postupku mlevenja*. 12. savetovanje "Zito-hleb". Novi Sad (Yugoslavia). 24-26 Apr 1996. *Cereal and flour production and processing: domestic [Yugoslav] potentials - international quality. Monograph, [proceedings of a conference]*. Vukobratovic, R. (ed.). *Proizvodnja i prerada zita i brasna: domaci [jugoslovenski] potencijali - svetski kvalitet. Monografija, [zbornik radova sa savetovanja]* p. 183-190. Tehnoloski fakultet, Zavod za tehnologiju zita i brasna. 6 graphs; 4 tables; 11 ref. Serbian. (AGRI 97-069784).

4323 Willm, C. (Association Amicale des Anciens Eleves de l'Ecole Nationale Supérieure de Meunerie et des Industries Cerealières, Paris (France)) (1995) [Behaviour of 9 soft wheat cultivars in milling; influence of hardness and nitrogen application (part 1)]. *Comportement en mouture de 9 varietes de ble tendre; influence de la durete et de l'apport d'azote (1. partie)*. *Industries des Cereales (France)* (no 92) p. 18-29. 7 ref., 9 graph. French. (AGRI 97-069251).

4324 Willm, C. (Association Amicale des Anciens Eleves de l'Ecole Nationale Supérieure de Meunerie et des Industries Cerealières, Paris (France)) (1995) [Behaviour of 9 soft wheat cultivars in milling; influence of hardness on flour particle size (part 2)]. *Comportement en mouture de 9 varietes de ble tendre; influence de la durete sur la granulometrie des farines (2. partie)*. *Industries des Cereales (France)* (no 94) p. 2-9. 10 graph. French. (AGRI 97-069258).

4325 Willm, C. (Association Amicale des Anciens Eleves de l'Ecole Nationale Supérieure de Meunerie et des Industries Cerealières, Paris (France)) (1996) [Study of soft wheat milling diagram (part 1)]. *Etude de diagramme ble tendre (1. partie)*. *Industries des Cereales (France)* (no 98) p. 3-12. 6 ref., 11 tableaux. French. (AGRI 97-069282).

4326 Willm, C. (Association Amicale des Anciens Eleves de l'Ecole Nationale Supérieure de Meunerie et des Industries Cerealières, Paris (France)) (1996) [Study of soft wheat milling diagram (part 2)]. *Etude du diagramme ble tendre (2. partie)*. *Industries des Cereales (France)* (no 99) p. 22-26. 9 ref., 5 tableaux. French. (AGRI 97-069284).

4327 Zwingelberg, H.; Fretzdorff, B. (Bundesanstalt fuer Getreide, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Influence of microwave treatment on the shelf life of wheat germs for human nutrition]. *Einfluss der Mikrowellenbehandlung auf die Haltbarkeit von Weizenspeisekeimen. Getreide Mehl und Brot (Germany)* v. 50(4) p. 214-218. 3 graphs, 4 tables; 16 ref. German. (AGRI 97-069780).

Ziel der Arbeit war es, ein Verfahren zu untersuchen, das es erlaubt, Weizenspeisekeime durch Mikrowellenbehandlung kontinuierlich fuer einen laengeren Zeitraum haltbar zu machen, ohne wertvolle Inhaltsstoffe zu schaedigen. Es wurden die Zusammenhaenge zwischen Feuchtigkeitsgehalt und mikrowellenanlagen-spezifischen Prozessparametern wie z.B. Bandgeschwindigkeit und Weizenkeimschichtdicke auf den Stabilisierungsprozess untersucht. Der Einfluss der Mikrowellenbehandlung auf die Qualitaet der Weizenkeime wurde durch folgende Methoden ueberwacht: Feuchtigkeitsgehalt,

Wasseraktivitaetswert, Gehalt an freien Fettsaeuren, Bestimmung der Aktivitaet der Peroxidase, 4-Methylumbelliferyl-Palmitinsaureester-Hydrolase (MUPase) und Tocopherole. Ausserdem wurden die Weizenkeimproben sofort nach der Behandlung in Abstaenden von 4 Wochen ein Jahr lang sensorisch geprueft. Durch die Mikrowellenbehandlung konnte in Abhaengigkeit vom Energieeintrag und der Schichtdicke auf dem Transportband der Feuchtigkeitsgehalt in den Weizenkeimen bis auf 1,6 % Feuchtigkeit gesenkt werden. Bei geringer Schichtdicke und geringem Energieeintrag blieben die Enzyme und Tocopherole weitgehend erhalten. Die Mehrzahl der behandelten Proben zeigte nach einem Jahr Lagerung weder Bitterkeit noch Ranzigkeit. Der bei traditionell behandelten Weizenkeimen sehr haeufig festgestellte nussartige Geschmack kann nicht erreicht werden. Es wird festgestellt, dass durch schonende Mikrowellentrocknung die in einer Muehle anfallenden Weizenkeime kontinuierlich ohne Zwischenlagerung behandelt werden koennen.

## Q03 FOOD CONTAMINATION AND TOXICOLOGY

4328 Aziz, N.H.; Attia, E.S.A.; Farag, S.A. (1997) EFFECT OF GAMMA-IRRADIATION ON THE NATURAL OCCURRENCE OF FUSARIUM MYCOTOXINS IN WHEAT, FLOUR AND BREAD. *Nahrung*. 41(1):34-37. English. [NATL CTR RADIAT RES & TECHNOL POB 29 CAIRO EGYPT].

A survey was carried out to obtain data on the occurrence of Fusarium mycotoxin in wheat and flour samples collected from local markets in Egypt and to study the influence of gamma-irradiation on controlling the occurrence of these mycotoxins in wheat, flour and bread. Deoxynivalenol (DON) was detected in five samples of wheat at levels ranging from 103 to 287 µg/kg and one sample each of flour and bread at concentrations 188 and 170 µg/kg. Zearalenone (ZEN) was detected in ten samples of wheat at levels from 28 to 42 µg/kg and four samples each of flour and bread at concentrations of 95 and 34 µg/kg, respectively. T-2 toxin was detected only in one sample each of wheat, flour and bread at concentrations of 2.9, 2.2 and 2.3 µg/kg, respectively. Gamma-irradiation at dose level of 6 kGy completely eliminated fungal flora in flour and wheat. DON, ZEN and T-2 toxin concentrations are reduced to 85, 20 and 2.0 µg/kg for wheat and to 125, 45, and 1.0 µg/kg for flour after 4 kGy exposure and a sharp drop in Fusarium toxin levels occurred at 6 kGy and was eliminated at 8 kGy. Bread prepared from 6 kGy was contaminated with Fusarium toxin at levels below 5 µg/kg. It was noticed that gamma-irradiation reduce greatly the natural occurrence of Fusarium mycotoxins in bread. [References: 26].

4329 Beuchat, L.R. (Georgia Univ., Griffin, GA (USA). Dept. of Food Science and Technology); Hwang, C.A. (1996) Evaluation of modified dichloran 18 percent glycerol (DG18) agar for enumerating fungi in wheat flour: a collaborative study. *International Journal of Food Microbiology (Netherlands)* v. 29(2-3) p. 161-166. 13 ref. English. (AGRI 97-084786).

4330 Gilbert, J. (Ministry of Agriculture, Fisheries and Food, Norwich, UK.) (1995) Analysis of mycotoxins in food and feed: certification of DON in wheat and maize. *Natural toxins (USA)* v. 3(4) p. 263-268. references. In the special issue: Mycotoxins and toxic plant components / edited by H.P. van Egmond, A. Visconti, A. Boenke, G.J.A. Speijers. Paper presented at an international workshop held October 13-15, 1994, Lisbon, Portugal. English. (AGRI 97-070084).

Worldwide there are either statutory limits or in some instances advisory guidelines for the maximum levels of mycotoxins in foods and feeds. These limits which have been agreed for the protection of human health and as standards for trade are often set at surprisingly low levels in view of both the problems of sampling and the abundant evidence of the difficulties of mycotoxin analysis, particularly so when approaching the limits of detection. Improved methodology for mycotoxins and improvements in performance even of expert laboratories have, however, been achieved through intercomparison exercises organised by the EC Measurement and Testing programme (formerly BCR). On a wider scale, participation in proficiency testing through schemes such as the UK Food Analysis Performance Assessment Scheme (FAPAS) have indicated that between 10 and 40% of laboratories experience difficulties in obtaining satisfactory results in monitoring mycotoxins. Reference materials provide an important means of checking method performance. BCR has made a unique contribution in the production and certification of maize and wheat

reference materials naturally contaminated with the *Fusarium* mycotoxin 4-deoxynivalenol (DON), which has now been available for purchase for some 2 years.

4331 Hajslova, J.; Kosinkova, P.; Kocourek, V.; Poustka, J.; Holadova, K. (Vysoka Skola Chemickotechnologicka, Prague (Czech Republic). *Ustav Chemie a Analýzy Potravin*) (1997) GC/MS procedure for analysis of synthetic pyrethroid residues in treated cereals. *Potravinarske Vedy - UZPI (Czech Republic)* v. 15(1) p. 1-12. 2 graphs, 4 tables; 10 ref. English. (AGRI 97-084787).

Optimization of procedure for determination of 6 widely used pyrethroid residues in cereals was investigated. Grains were extracted with ethyl acetate, gel permeation chromatography was employed for clean-up of crude extracts. High resolution gas chromatography coupled with mass selective detector performed in selected ion monitoring mode was used for isomeric separation of these insecticides and their subsequent quantitation. The recoveries at 0.1 mg/kg spiking level were 90-99 %. The detection limits ranged from 0.0002 to 0.05 mg/kg. Compared to existing methods, the procedure presented in this study is less laborious and highly selective.

4332 Helalia, A.R.; Abd El Lateef, M.F.A. (Azhar Univ., Cairo (Egypt). Faculty of Agriculture); Dogheim, S.M.; Ayoub, M.M. (1995) Monitoring of pesticide residues in wheat, horsebean, rice and egg samples collected from four markets in Greater Cairo [Egypt]. *Zagazig Journal of Agricultural Research (Egypt)* v. 22(3) p. 907-918. 9 tables; 20 ref. English. (AGRI 97-084669).

4333 Mueller, H.M. (Hohenheim Univ., Stuttgart (Germany). Inst. fuer Tierernaehrung) (1996) [Survey on mycotoxin concentration in cereals]. *Erhebung zur Mykotoxinkonzentration in Getreide. LAF-Tagung. Stuttgart-Hohenheim (Germany)*. 26 Oct 1995. *LAF-Infos (Germany)* v. 4(2) p. 82-90. German. (AGRI 97-084620).

Untersuchungen ueber 5 (1987-92) bzw. 4 Jahre (1989-92) fuer das Gebiet der Regierungspraesidien Stuttgart u. Tuebingen. In Gerste, Hafer u. Weizen wurden die Mykotoxine Zearalenon, Deoxynivalenol, T2-Toxin, HT-2 Toxin, Diacetoxyscirpenol, Nivalenol, 3alpha-Acetyl-Deoxynivalenol u. 15alpha-Acetyl-Deoxynivalenol in Abhaengigkeit von Klima u. Jahrgang untersucht.

4334 Pacin, A.M.; Resnik, S.L.; Neira, M.S.; Molto, G.; Martinez, E. (1997) NATURAL OCCURRENCE OF DEOXYNIVALENOL IN WHEAT, WHEAT FLOUR AND BAKERY PRODUCTS IN ARGENTINA. *Food Additives & Contaminants*. 14(4):327-331. English. [UNIV NACL LUJAN CTR INVEST MICOTOXINAS CC 221 RA-6700 LUJAN PCIA DE BUENOS ARGENTINA].

The objective of this study was to evaluate the natural occurrence of deoxynivalenol (DON) in wheat, wheat flour and different kinds of breads and pastries widely consumed by the population in Argentina. Of 60 wheat samples analysed, 93.3% were contaminated. The average DON contamination level over all samples was 1798 µg/kg, and the minimum and maximum values were 100 µg/kg and 9250 µg/kg, respectively. The wheat flour samples (61 samples) were contaminated with DON at levels ranging from 250 µg/kg to 9000 µg/kg with an average of 1309 µg/kg. The frequency of DON contamination over 42 samples of different bakery products was 92.8%, with levels ranging from 200 µg/kg to 2800 µg/kg with an average of 464 µg/kg. These results suggest a high risk for consumers of wheat products and the need to monitor final products before consumption. [References: 19].

4335 Scott, P.M. (1997) MULTI-YEAR MONITORING OF CANADIAN GRAINS AND GRAIN-BASED FOODS FOR TRICOTHECENES AND ZEARELENONE. *Food Additives & Contaminants*. 14(4):333-339. English. [HLTH CANADA HLTH PROTECT BRANCH ADDRESS LOCATOR 2203D OTTAWA ON K1A 0L2 CANADA].

Monitoring of Canadian grain crops and foods by the Health Protection Branch for deoxynivalenol (DON, vomitoxin) has been undertaken every year since 1980, when it was found in Ontario soft wheat for the first time (in the 1979 and 1980 crops). Contamination of this wheat crop has varied, with 22-100% incidences in all but 1 year and up to 0.75 µg/g for the annual means of positive samples. The Canadian guideline for DON is 2 µg/g in uncleaned soft wheat. Western Canadian hard wheat had <10% incidence of DON in 7 crop years but 11-43% of samples analysed in 10 other years were positive. Wheat foods, including imports, have shown 9-

90% incidences with annual mean levels of 0.07-0.58 µg/g in positive samples. Consistently high contamination of Ontario corn has been observed (13-100% annual incidences and annual means of positives 0.16-1.4 µg/g). Other trichothecenes, namely nivalenol and HT-2 toxin, have been found infrequently in Canadian grains. New analyses of Canadian and imported beers showed low ng/ml levels of DON. Grains destined for food use and corn foods have been analysed for zearalenone from 1986 to 1993. The most contaminated crop was Ontario corn; annual mean levels in positive samples ranged from 23 to 215 ng/g. Zearalenone has been detected infrequently in wheat, barley and soybeans (<75 ng/g). [References: 26].

4336 Skrinjar, M.; Saric, M.; Dimic, G.; Matkovic, K. (Tehnoloski fakultet, Novi Sad (Yugoslavia)) (1996) [Presence of fungi and some mycotoxins in wheat]. *Prisustvo gljiva i nekih mikotoksina u pšenici. 12. savetovanje "Zito-hleb". Novi Sad (Yugoslavia)*. 24-26 Apr 1996. *Cereal and flour production and processing: domestic [Yugoslav] potentials - international quality. Monograph, [proceedings of a conference]*. Vukobratovic, R. (ed.). *Proizvodnja i prerada zita i brasna: domaci [jugoslovenski] potencijali - svetski kvalitet. Monografija, [zbornik radova sa savetovanja]* p. 121-130. Tehnoloski fakultet, Zavod za tehnologiju zita i brasna. 2 ill.; 1 graph; 3 tables; 28 ref. Serbian. (AGRI 97-070086).

The presence of fungi, with special attention to toxigenic species, and their metabolites aflatoxin B1 (AB1), ochratoxin A (OA) and zearalenone (F-2 toxin) in wheat kernels was investigated. 20 samples (15 different sorts), harvested in 1994, and originated from two localities, were analyzed. All of wheat samples tested were contaminated with fungi at various degree (1.7 to 4.0/kernel). Moulds from family Dematiaceae, were found to be dominant, zygomycetes had also a very significant share in mycopopulations, as well as species of genera *Aspergillus*, *Fusarium* and *Penicillium*. The most of isolates belonged to the toxigenic species. AB1 was not found in wheat samples. Five samples were contaminated with OA at concentrations from hard detectable (traces) to 40.00 mg/kg. F-2 toxin was established only in one wheat sample (traces).

4337 Usleber, E. (Ludwig Maximilians Universitat Munchen, Munchen, Germany.); Abramson, D.; Gessler, R.; Smith, D.M.; Clear, R.M.; Martlbauer, E. (1996) Natural contamination of Manitoba barley by 3, 15-diacetyldeoxynivalenol and its detection by immunochromatography. *Applied and environmental microbiology (USA)* v. 62(10) p. 3858-3860. references. English. (AGRI 97-069988).

Contamination of Canadian barley samples by 3, 15-diacetyldeoxynivalenol was detected by enzyme immunoassays combined with liquid chromatography and was confirmed by gas chromatography-mass spectrometry. This is the first reported natural occurrence of this mycotoxin. The barley was infected mainly with *Fusarium graminearum*. Deoxynivalenol, 3-acetyldeoxynivalenol, 15-acetyldeoxynivalenol, and zearalenone were also found.

4338 Wirsta, P. (Ecole Nationale Supérieure de Meunerie et des Industries Cerealières, Paris (France)); Lecornu, C.; Lance, C. (1996) [Assessment of a new immuno-assay method for detection of wheat and flour batches contaminated by insects]. *Evaluation d'une nouvelle methode immuno-enzymatique destinee a estimer la contamination de lots de bles et de farines par des insectes. Industries des Cereales (France) (no 96)* p. 29-32. 7 ref. French. (AGRI 97-069830).

4339 Wood, G.M. (Leatherhead Food Research Association, Leatherhead, Surrey, UK.); Entwisle, A.C.; Patel, S.; Hald, B.; Boenke, A. (1995) Ochratoxin A in cereals and the BCR-MandT-projects. *Natural toxins (USA)* v. 3(4) p. 275-279. references. In the special issue: Mycotoxins and toxic plant components / edited by H.P. van Egmond, A. Visconti, A. Boenke, G.J.A. Speijers. Paper presented at an international workshop held October 13-15, 1994, Lisbon, Portugal. English. (AGRI 97-070030).

Reliable analytical procedures and certified reference materials are essential for the establishment and enforcement of tolerance levels for ochratoxin A in foods. The inadequacy of analytical procedures, together with the need for certified reference materials, led the Commission of the European Communities Community Bureau of Reference (BCR) to undertake a project to prepare suitable reference materials for ochratoxin A in wheat, in order to improve methodology and to harmonise agreement of results between member states. The first intercomparison study indicated problems in the analysis due to the influence of co-extractives in the matrix, and demonstrated that further work was necessary to improve



recovery, clean-up and reproducibility. The second intercomparison study, in the EC Measurements and Testing Programme, correlated the performance of the different methods for ochratoxin A measurement in a separate batch of contaminated wheat, and compared novel immunoaffinity column methods with the standard laboratory methods. Results were obtained from 26 laboratories within 11 European countries, which therefore gives a good representation of the scope of methods currently used in Europe. Considerable improvements in the determination of ochratoxin A were noted compared with the first intercomparison study.

## Q04 FOOD COMPOSITION

4340 Ali, Y.; Ghorpade, VM.; Hanna, MA. (1997) PROPERTIES OF THERMALLY-TREATED WHEAT GLUTEN FILMS. *Industrial Crops & Products*. 6(2):177-184. English. [UNIV NEBRASKA DEPT BIOL SYST ENGN IND AGR PROD CTR LINCOLN, NE 68583 USA].

Effects of thermal treatments on selected properties of wheat gluten film were studied. Films were cast from heated alkaline aqueous solutions of wheat gluten, ethanol and glycerin and subsequently heat treated at 65, 80, or 95 degrees C for 2, 4, 6, 12, 18, or 24 h. Water vapor permeability (WVP), Hunter L, a and b values, tensile strength (TS) and elongation at break (E) were determined and compared with untreated film (control). Significant reduction in WVP of film occurred with increasing curing temperature and exposure time. Hunter L value (whiteness) decreased, whereas a (redness) and b (yellowness) values increased with increasing heat treatment temperature and exposure time. Also, an increase in TS and a decrease in E were present with increasing treatment temperature and exposure time. (C) 1997 Elsevier Science B.V. [References: 26].

4341 Amano, T.; Takada, S.; Miura, M.; Ishida, K.; Ohshima, K. (1997) RETARDATION EFFECTS OF SACCHARIDES ON THE HARDENING OF WHEAT STARCH GELS - RETARDATION OF THE HARDENING OF STARCH GELS BY POLYOLS. 2. [Japanese]. *Journal of the Japanese Society for Food Science & Technology-Nippon Shokuhin Kagaku Kogaku Kaishi*. 44(2):93-101. Japanese. [AICHI PREFECTURAL GOVT FOOD RES INST NISHI KU 2-1-1 SHINPUKUJI CHO NAGOYA AICHI 451 JAPAN].

The influences of saccharides on hardening and water mobility of wheat starch gels stored at 2 degrees C have been investigated. Hardening process of saccharides-supplemented gels could be separated into the four regions similarly to the control gel. In the region I, the creep compliance of the gels decreased exponentially with increasing storage period from the beginning of storage to several hours. In the following several hours, the compliance showed approximately a flat or slow increasing or decreasing change (region II). In the region III, the value decreased exponentially on the trend which was assumed the initial value extended. Finally, the compliance continued with decreasing more slowly (region IV). Except for D-ribose-added gel, no great differences were recognized among the initial creep compliance (J(01)) of saccharides-supplemented gels in the region I, and the compliances were smaller than the value of the control gel. However, D-ribose-added gel showed the same strain with the stress of which was about 60% in the other gels. Hardening rate constants (k(I) for the region I, k(III) for the region III) of gels added with D-ribose, maltose, trehalose, sucrose, maltose, and malto-oligosaccharides (major components were maltose and maltotriose, or maltotriose) were smaller than the control gel. On the other hand, D-fructose, D-galactose, melibiose increased the hardening rate compared to the control gel. Gel-stabilizing effect of disaccharides and oligosaccharides would be dependent on both constituent monosaccharides and glucosidic linkages in these molecules. The mobility of water in starch gels was inferred from measurements of apparent transverse relaxation time T-2 using O-17-NMR techniques. The decreasing ratio of T-2 to the initial T-2 with storage was larger in order of maltose-added gel less than or equal to trehalose-added gel < sucrose-added gel < control gel < melibiose-added gel. The saccharides which reduced the hardening rate, resulted in a decrease in water mobility in the non-stored gel, and in an inhibition of progressive decrease in water mobility with the elapse of storage period. [References: 14].

4342 Autran, JC.; Hamer, RJ.; Plijter, JJ.; Pogna, NE. (1997) EXPLORING AND IMPROVING THE INDUSTRIAL USE OF WHEATS [Review]. *Cereal Foods World*. 42(4):216-227. English. [INRA PARIS FRANCE].

4343 Bangur, R.; Batey, IL.; McKenzie, E.; Macritchie, F. (1997) DEPENDENCE OF EXTENSOGRAF PARAMETERS ON WHEAT

PROTEIN COMPOSITION MEASURED BY SE-HPLC. *Journal of Cereal Science*. 25(3):237-241. English. [CSIRO DIV PLANT IND GRAIN QUAL RES LAB POB 7 N RYDE NSW 2113 AUSTRALIA].

Size-exclusion HPLC measurements were made on the total protein from flours of 158 wheat lines grown at five locations (31 at all sites and an extra one at three locations). Closely spaced cuts in the chromatograms were made at elution times differing by 0.4 min. The percentage of the protein that eluted up to each time was correlated With Extensograph dough maximum resistance (R-max) and dough extensibility (Ext). For R-max, maximal correlation ( $r = 0.489^{***}$  for all locations) was obtained for the percentage of protein eluting before 13.2 min, corresponding to estimated molecular weights equal to and greater than 250 000. In the case of Ext, the highest correlation ( $0.859^{***}$  for all locations) was obtained for the percentage of protein in the flour which eluted before 16.8 min, which included essentially all the flour polymeric protein with estimated molecular weights above 52 000. The different dependencies of R-max and Ext provide a basis for manipulating these parameters in predictable ways in breeding programs. (C) 1997 Academic Press Limited. [References: 7].

4344 Bartolome, B.; Faulds, CB.; Williamson, G. (1997) ENZYMIC RELEASE OF FERULIC ACID FROM BARLEY SPENT GRAIN. *Journal of Cereal Science*. 25(3):285-288. English. [AFRC INST FOOD RES DEPT BIOCHEM NORWICH RES PK NORWICH NR4 7UA NORFOLK ENGLAND].

4345 Bechtel, DB.; Wilson, JD. (1997) ULTRASTRUCTURE OF DEVELOPING HARD AND SOFT RED WINTER WHEATS AFTER AIR- AND FREEZE-DRYING AND ITS RELATIONSHIP TO ENDOSPERM TEXTURE. *Cereal Chemistry*. 74(3):235-241. English. [ARS US GRAIN MKT & PROD RES CTR USDA 1515 COLL AVE MANHATTAN, KS 66502 USA].

A transmission electron microscopic study was conducted on air- and freeze-dried developing wheat to determine the effects of drying on the structure of the starchy endosperm. Field-grown hard red winter wheat (Karl) and soft red winter wheat (Clark) were harvested at 15, 18, 21, 23, 25, 28, and 35 days after flowering (DAF). Wheat was dried by either air-drying in the spike at 28 degrees C or freeze-drying following freezing in liquid nitrogen. Dried wheat was prepared for microscopy. Fresh samples of Karl and Clark were also harvested on the same days and prepared immediately for microscopy. The method of drying greatly affected cellular ultrastructure. The most pronounced change upon air-drying of developing samples was disappearance of individual protein bodies and conversion of the cytoplasm into a matrix-like material similar in appearance to storage protein matrix found in mature wheat endosperm. Freeze-dried wheats maintained nearly natural ultrastructure but exhibited various amounts of freeze damage. Conversion of protein bodies to a matrix was not observed in freeze-dried samples. The results suggest that hardness develops as a result of endosperm senescence rather than accumulation of particular grain components. Senescence may cause changes in the starch granule surface such that surrounding components bind tightly in hard wheats, whereas the binding is weaker in soft wheats. Therefore, the surface of starch granules might be more important than components the starch granules bind to in determining hardness. [References: 17].

4346 Boettcher, G.; Freund, W.; Senneke, J. (Universitaet Hannover, Hannover (Germany) Institut fuer Lebensmittelwissenschaft) (1995) [Raw materials for biscuits: To optimize wheat flour]. *Rohstoffe fuer Dauerbackwaren: Optimierung von Weizenmehl. Suesswaren (Germany)* v. 39(4) p. 23-29. 3 ill, 6 tables; 12 ref. German. (AGRI 97-070489).

4347 Cherian, G.; Chinachoti, P. (1997) ACTION OF OXIDANTS ON WATER SORPTION, H-2 NUCLEAR MAGNETIC RESONANCE MOBILITY, AND GLASS TRANSITION BEHAVIOR OF GLUTEN. *Cereal Chemistry*. 74(3):312-317. English. [UNIV MASSACHUSETTS DEPT FOOD SCI AMHERST, MA 01003 USA].

Oxidation of vital wheat gluten with potassium bromate and ascorbic acid significantly extends or broadens glassy-rubber transition to a higher final temperature range or moisture content. Thermomechanical and deuterium nuclear magnetic resonance (NMR) data show that the increased stiffness due to oxidation could be detected from the thermomechanical and deuterium NMR mobility level, indicating increased rigid fractions. The oxidation also resulted in increased water sorption, but no significant change in "freezable" water, and a much

decreased mobile deuterium NMR signal. Room temperature sorption of water resulted in a glassy-rubbery transition over a approximate to 10-20% mc range for the control. For the oxidized sample, it started at approximate to 10%mc, but the transition was gradual and extended into much higher moisture ranges that corresponded to a more rigid fraction of deuterium (NMR) signal. This suggests that the oxidative interactions led to a more rigid gluten fraction, extending the transition to a higher temperature range, perhaps resulting in a more elastic dough. [References: 32].

4348 Cumbee, B.; Hildebrand, DF.; Addo, K. (1997) SOYBEAN FLOUR LIPOXYGENASE ISOZYMES EFFECTS ON WHEAT FLOUR DOUGH RHEOLOGICAL AND BREADMAKING PROPERTIES. *Journal of Food Science*. 62(2):281 ff. English. [UNIV KENTUCKY DEPT NUTR & FOOD SCI LEXINGTON, KY 40506 USA].

The effects of soy flour from LOX null mutant isolines and purified LOX isozymes on the rheological and breadmaking properties of a commercial hard wheat flour were investigated. Wheat flours were fortified with either 3% soy mutant flours alone, or in the presence of 0.2% and 1% linoleic acid. Purified LOX 2 isozyme had the greatest effect among LOX isozymes on dough extensibility and strength. Linoleic acid substrate addition reduced dough extensibility and strength. The L2L3 null isolate mutant for L1 resulted in the largest increase in bread volume. A reduction in bread firmness occurred after 5 day storage for all three single null mutant-containing samples in the presence of 1.0% linoleic acid substrate. [References: 23].

4349 Dahhan, M.; Hafez, A.K. (Aleppo univ. (Syria). faculty of agriculture) (1994) [Effect of production site on technological characters of some bread wheat varieties]. *Research journal of Aleppo university (Syria). Agricultural sciences series (no.22) p. 233-254. 11 tables; 7 ref. Arabic. (AGRIS 97-085006).*

4350 Dejong, G.W.; Vandenberg, C.; Kokelaar, A.J. (1996) WATER VAPOUR SORPTION BEHAVIOUR OF ORIGINAL AND DEFATTED WHEAT GLUTEN. *International Journal of Food Science & Technology*. 31(6):519-526. English. [AGR UNIV WAGENINGEN DEPT FOOD SCI FOOD PHYS GRP BOMENWEG 2 NL-6703 HD WAGENINGEN NETHERLANDS].

The water vapour sorption isotherms of original and defatted gluten samples, prepared from two wheat cultivars (Spring and Taurus) with good and poor baking performance, respectively, were investigated at 25 and 40 degrees C. The GAB isotherm equation described the isotherms well up to a relative humidity of at least 84% at 25 degrees C and up to 75% at 40 degrees C. The GAB constants of Spring gluten indicated an increased number of adsorption sites and a decreased average interaction energy per binding site at increased defatting (petroleum ether, chloroform). This tendency was also observed for Taurus, however, here no significant differences were found between the solvents. When comparing both cultivars the isotherm analysis indicated less available active sites for water adsorption with a stronger interaction energy per site for Taurus gluten. This stronger interaction is in accord with the higher isosteric heat of adsorption (Clausius-Clapeyron analysis) found at low relative humidities. These findings are related to bread baking performance. [References: 16].

4351 Filipovic, N.; Kaludjerski, G.; Saric, M.; Jovicic, D.; Erkcic, M.; Gnip, M. (Tehnoloski fakultet, Novi Sad (Yugoslavia)) (1996) [The choice of wheat variety for making pasta of good quality]. *Izbor sorte pšenice za proizvodnju kvalitetne testenine. 12. savetovanje "Zito-hleb". Novi Sad (Yugoslavia). 24-26 Apr 1996. Cereal and flour production and processing: domestic [Yugoslav] potentials - international quality. Monograph, [proceedings of a conference]. Vukobratovic, R. (ed.). Proizvodnja i prerada zita i brasna: domaci [jugoslovenski] potencijali - svetski kvalitet. Monografija, [zbornik radova sa savetovanja] p. 77-89. Tehnoloski fakultet, Zavod za tehnologiju zita i brasna. 1 graph; 6 tables; 19 ref. Serbian. (AGRIS 97-070354).*

In Yugoslavia, pasta is made of vulgare wheat i.e. of bread wheat varieties. For these investigations 8 varieties from harvest 1994 and 13 varieties from harvest 1995 which represent an average quality in experimental field trials on the whole fertile land under wheat in Vojvodina (Yugoslavia), one sample of durum and 7 samples of commercial farina from different pasta producers in Vojvodina are chosen. Investigations cover wheat quality, milling, quality of farina and pasta. Data show that investigations of specific purpose of wheat for pasta processing is justified and that existing grading system into technological

groups of quality do not define specific purpose of raw material for pasta. It is interesting to point out that pasta made from pure wheat variety, regardless to which technological group of quality it belongs, is always better than pasta made from commercial farina.

4352 Fredriksson, H.; Salomonsson, L.; Salomonsson, AC. (1997) WHEAT CULTIVATED WITH ORGANIC FERTILIZERS AND UREA - BAKING PERFORMANCE AND DOUGH PROPERTIES. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 47(1):35-42. English. [SWEDISH UNIV AGR SCI DEPT FOOD SCI POB 7051 S-75007 UPPSALA SWEDEN].

Data describing white flour composition, dough properties and baking performance of both spring and winter wheat treated with different fertilizer strategies including meat bone meal, slurry manure and urea, were analyzed by principal component analysis and variance analysis. No significant differences in the analyzed variables were found between flour from wheat fertilized with organic fertilizers or urea at different N rates, irrespective of experiment. The differences mainly reflected variation between experiments. Higher N application rates significantly increased flour protein content and dough development time but decreased dough softening. Protein content was positively correlated to wet gluten content and dough stability, development time, resistance, extensibility as well as bread yield. The correlation between protein content and dough softening was negative and the correlation to farinograph water absorption was poor. The bread yield response to increasing protein content, obtained by increasing the N fertilizer rate, was lower in the spring wheat than in the winter wheat. [References: 28].

4353 Fu, J.; Mulvaney, S.J.; Cohen, C. (1997) EFFECT OF ADDED FAT ON THE RHEOLOGICAL PROPERTIES OF WHEAT FLOUR DOUGHS. *Cereal Chemistry*. 74(3):304-311. English. [CORNELL UNIV INST FOOD SCI STOCKING HALL ITHACA, NY 14853 USA].

The effect of added fat content on the rheological properties of wheat flour doughs was determined for three different added fat contents (2.5, 5.0, and 7.5%) at 25 degrees C using dynamic mechanical analysis (DMA) and stress relaxation (SR) tests. Frequency sweeps indicated that added fat had a plasticizing effect on G' and G'' in the rubbery region. SR results were parameterized using a Maxwell model and a Williams-Watts (WW) model. The WW model indicated that each dough could be characterized by just two major relaxation modes, while four elements were needed for the Maxwell model. The average relaxation time for the shorter process was <1 sec and was not affected by added fat. However, the average relaxation time for the longer WW process actually increased from 107 to 261 sec with added fat up to 5%, and then decreased again. Taken together, these results suggest that added fat actually delayed the onset of viscous flow, while simultaneously attenuating the short-time elastic properties of the gluten fraction of the dough. Furthermore, rheological testing over a wide time (frequency) scale was needed to observe the effect of added fat on both the short-time elastic and longer-time viscous behavior of these doughs. [References: 33].

4354 Ghanem, A.M.H. (1993) Biochemical studies on wheat proteins. Zagazig Univ. (Egypt). Faculty of Agriculture. tables; ref. 100 p. English. (AGRIS 97-085024).

4355 Gobbetti, M.; Corsetti, A. (1997) LACTOBACILLUS SANFRANCISCO A KEY SOURDOUGH LACTIC ACID BACTERIUM - A REVIEW [Review]. *Food Microbiology*. 14(2):175-187. English. [AGR FAC PERUGIA INST DAIRY MICROBIOL PERUGIA ITALY].

Sourdough may be considered a traditional product with a great future. Studies on the sourdough microflora have recently been improved. In this paper, research on *Lactobacillus sanfrancisco*, a key sourdough lactic acid bacterium, is reviewed. The physiology, trophic relationships with sourdough related organisms and the genetics are considered in order to explain and improve the biotechnological performances of *Lb. sanfrancisco*. (C) 1997 Academic Press Limited. [References: 106].

4356 Gomez, C.; Navarro, A.; Manzanares, P.; Horta, A.; Carbonell, J.V. (1997) PHYSICAL AND STRUCTURAL PROPERTIES OF BARLEY (1-3), (1-4)-BETA-D-GLUCAN .1. DETERMINATION OF MOLECULAR WEIGHT AND MACROMOLECULAR RADIUS BY LIGHT SCATTERING. *Carbohydrate Polymers*. 32(1):7-15. English. [ASOCIAC INVEST CERVEZA & MALTA INVESCEMA POB 73 BURJASSOT 46100 VALENCIA SPAIN].

(1→3), (1→4)-beta-D-Glucan purified from the 65 degrees C water extract of barley flour, commercial beta-glucans and samples obtained by controlled depolymerisation of the former, covering a range from 9 x 10(3) to 6 x 10(5) dalton, were characterised by size exclusion chromatography and light scattering. The on-line measurement of molecular weight with a multiangle laser-light scattering photometer gave reproducible and consistent values according to: (a) the process followed in sample preparation; (b) their chromatographic elution in terms of hydrodynamic volume; and (c) the kinetics of depolymerization. However, batch light scattering measurements of beta-glucan molecular weights did not give concordant and reproducible results. These last data, together with the study of the very early stages of enzymatic degradation of high molecular weight beta-glucans by barley endo-beta-glucanases as monitored by the Cdcfluor-F.I.A. method, seem to suggest the formation of very labile molecular aggregates. (C) 1997 Elsevier Science Ltd. [References: 25].

4357 Gomez, C.; Navarro, A.; Manzanares, P.; Horta, A.; Carbonell, J.V. (1997) PHYSICAL AND STRUCTURAL PROPERTIES OF BARLEY (1-3), (1-4)-BETA-D-GLUCAN 2. VISCOSITY, CHAIN STIFFNESS AND MACROMOLECULAR DIMENSIONS. *Carbohydrate Polymers*. 32(1):17-22. English. [ASOCIAC INVEST CERVEZA & MALTA INVESCEMA POB 73 BURJASSOT 46100 VALENCIA SPAIN].

Intrinsic viscosities and molecular weights of (1→3), (1→4)-beta-D-glucan samples, covering a range of 9 x 10(3)-6 x 10(5) daltons, have been used to determine their conformational parameters and molecular dimensions. The chain of beta-glucan is satisfactorily modelled by a partially stiff worm-like cylinder, with persistence length 3.5-3.8 nm and cross-section diameter 0.45 nm. This corresponds to an average of about four beta(1→3) links per statistical segments. The characteristic ratio, C-infinity, calculated from this worm-like description of the macromolecule, gave a value of 13-14, in good agreement with the theoretical calculations. (C) 1997 Elsevier Science Ltd. [References: 19].

4358 Graeber, S. (Univ. Hohenheim, Stuttgart (Germany). Inst. fuer Lebensmitteltechnologie) (1996) [Physical properties of triticale during heating]. *Physikalische Eigenschaften von Triticale beim Erhitzen. Getreide Mehl und Brot (Germany) v. 50(4) p. 197-200. 9 graphs, 2 tables; 5 ref. German. (AGRIS 97-070472).*

Die rheologischen und thermischen Eigenschaften verschiedener Triticale Sorten aus den Erntejahren 1993 und 1994 sowohl aus intensivem als auch extensivem Anbau wurden untersucht. Verwendet wurden die Methoden Filzhalt, registrierender Backversuch und DSC-Messung. Die Einflüsse von Sorte, Anbauintensität und Anbaujahr auf die ermittelten Messgrößen wurden statistisch ausgewertet. Mittels Varianzanalyse wurde ein Einfluss der Sorte und des Erntejahres auf die verschiedenen Messgrößen festgestellt. Die Anbauintensität hatte bei den untersuchten Proben keine Auswirkungen auf die Ergebnisse. Die Ergebnisse wurden durch die Backversuche ergänzt. Ziel der Untersuchungen war, von der Witterung unabhängige Informationen über die einzelnen Triticale Sorten hinsichtlich ihrer backtechnologischen Verwendung zu erhalten.

4359 Gupta, T.R. (Central Food Technological Research Institute, Mysore, India.) (1996) Thermal diffusivity measurements of wheat flour and wheat flour dough. *Journal of food process engineering (USA) v. 19(3) p. 343-352. references. English. (AGRIS 97-070493).*

4360 Gyula, V.; Lang, L.; Bedo, Z. (1996) USE OF PRINCIPAL COMPONENT ANALYSIS IN CORRELATION STUDIES BETWEEN ALVEOGRAPH VALUES AND OTHER BREADMAKING QUALITY TRAITS IN WINTER WHEATS. *Novenytermeles. 45(5-6):435-443. Hungarian. [HUNGARIAN ACAD SCI AGR RES INST PF 19 H-2462 MARTONVASAR HUNGARY].*

Studies were made in 1994 and 1995 on the alveograph breadmaking quality traits of 19 advanced lines and winter wheat varieties currently or previously cultivated in Hungary. Correlation analysis was used to compare alveograph characters with thirteen other breadmaking quality traits. A close significant positive correlation could be demonstrated between the "W" and "G" values obtained with the alveograph and the farinograph index, gluten index, area under the mixograph curve and the SDS sedimentation volume. The two alveograph parameters exhibited a moderately strong, significant correlation with protein content, wet and dry gluten content, and the mixograph peak time. The alveograph "P/L" value was only significantly correlated with the SDS sedimentation

volume. The observed variables were grouped according to principal component analysis. When plotting the principal component loadings with the 1st and 2nd principal component variables as the coordinates, the group of traits characteristic of the rheological properties of the dough were found near the +1 and -1 points of the 1st principal component variable, while those related to protein quantity were grouped round the +1 point of the 2nd principal component variable. The SDS sedimentation volume values were located in an intermediate position. The alveograph "P/L" value was placed near the origin, suggesting that there is no correlation with the 1st and 2nd principal component variables. In summary it can be stated that alveograph quality analysis, especially the determination of the "P/L" value, may provide useful additional information on the breadmaking quality of winter wheat varieties and breeding lines. [References: 13].

4361 Hack, A.; Brueggemann, J. (Univ. National de Rosario, Rosario (Argentina). Fac. de Ciencias Agrarias) (1996) [Selenium content in Argentine wheat cultivars]. *Selengehalte in argentinischen Weizenproben. Getreide Mehl und Brot (Germany) v. 50(4) p. 195-196. 1 graph, 2 tables; 5 ref. German. (AGRIS 97-070494).*

In 66 verschiedenen argentinischen Weizenmustern von vier verschiedenen Standorten aus den Erntejahren 1993/94 und 1994/95 wurden Selengehalte im Bereich von 4,3 bis 78,5 Mikrogramm/kg Frischsubstanz gefunden. An den verschiedenen Standorten errechnen sich durchschnittliche Selengehalte, die sich um einen Faktor 2 unterscheiden können (z.B. 21 oder 42 bzw. 50 Mikrogramm/kg Frischsubstanz). In den 21 Sorten konnten keine statistisch gesicherten Unterschiede der Selengehalte nachgewiesen werden.

4362 Handreck, B.; Poetschke, L. (TU Berlin, Berlin (Germany). Fachgeb. Aufbereitungs und Muellertechnologie) (1996) [Grinding results and flour quality of middlings crushed by means of impact milling of different kinds of wheat]. *Mahlergebnisse und Mehlgüte prallzerkleinerter Dunste aus unterschiedlichen Weizensorten. Muehle + Mischfüttertechnik (Germany) v. 133(23) p. 365-366, 369-370. 7 graphs, 3 tables; 4 ref. German. (AGRIS 97-070496).*

Das Mahlverhalten unterschiedlich harter Weizensorten unter Prallbeanspruchung und deren Einfluss auf die erzielten Qualitätseigenschaften war Ziel der Untersuchungen. Es wurden Dunste der Weizensorten Zentos (A 8), Kontrast (A 6) und Contra (B 4) einer Prallvermahlung auf einer Stütmühle mit unterschiedlichen Rotorgeschwindigkeiten unterzogen. Die folgenden Ergebnisse werden diskutiert: Mahlverhalten der Dunste, Mineralstoffgehalt, Staerkebeschädigung und Wasseraufnahme, Gluteneigenschaften der Mehle, Gaer- und Gebaeckeeigenschaften. Die Prallzerkleinerung von Dunsten aus Backweizen hoeherer Qualitätsstufen fuehrt zu Veraenderungen ihrer Verarbeitungseigenschaften durch Erhoehung der Staerkebeschädigung und Schwaechung der Glutengüte. So kann z. B. die Glutenschwaechung zur Verbesserung der Verarbeitungseigenschaften von Mehl aus sehr starkem Weizen und fuer Mehle der Dauerbackwarenindustrie von Vorteil sein. Die geringfuegige Abnahme im Gebaeckevolumen kann beim Zusammenstellen der Typenmehle ausgeglichen werden.

4363 Hussain, A.; Lukow, OM.; Watts, BM.; McKenzie, RH. (1997) RHEOLOGICAL PROPERTIES OF FULL-FORMULA DOUGHS DERIVED FROM NEAR-ISOGENIC 1BL/1RS TRANSLOCATION LINES. *Cereal Chemistry*. 74(3):242-248. English. [AGR & AGRI FOOD CANADA CEREAL RES CTR 195 DAFOE RD WINNIPEG MB R3T 2M9 CANADA].

Four pairs of near-isogenic wheat lines, with and without the 1BL/1RS translocation, and differing at the Glu-1 loci (coding for high molecular weight [HMW] glutenin subunits) were evaluated for their dough mixing properties, dough stickiness, and baking performance. In all 1BL/1RS translocation lines, weakening of the dough consistency occurred within 2 min past peak time. The full-formula dough from every 1BL/1RS translocation line exhibited poor dough mixing characteristics and increased stickiness compared to the corresponding wheat control. The HMW glutenin subunits coded by the Glu-A1 locus had no apparent effect on mixing properties, but did have a slight effect on the dough stickiness at two of the four stages of dough mixing. Glu-B1 and Glu-D1 loci encoded glutenin subunits produced significant changes in dough mixing properties and dough stickiness, respectively. With respect to baking performance, there was no significant difference between loaf volumes of



1BL/1RS versus control wheats for three of four near-isogenic pairs. Within the 1RS-group, the translocation lines containing HMW glutenin subunits 5+10 produced bread with greater loaf volumes than the pairs containing its allelic counterpart 2+12. Loaf volume was not influenced by the subunits associated with the Glu-B1 loci. In general, the breads baked from 1BL/1RS translocation lines had a relatively poor crumb and crust quality and contained larger gas cells than the wheat controls. In comparing isogenic pairs, the magnitude of the difference in loaf volume between the control wheat and the corresponding 1BL/1RS translocation line was greater in the pair unique for HMW subunits 5+10; the difference was primarily due to the stronger mixing properties of the wheat control. [References: 51].

4364 Jia, Y.Q. (Ecole Supérieure d'Agriculture de Purpan, Toulouse (France). Laboratoire de Physiologie Végétale); Aussenac, T.; Fabre, J.L. (1995) [Processing quality of soft wheat]. *La qualité technologique des blés tendres. Purpan (France) (no 176) p. 121-133. 25 ref., 12 graph. French. (AGRIS 97-084810).*

4365 Khatkar, B.S.; Schofield, J.D. (1997) MOLECULAR AND PHYSICO-CHEMICAL BASIS OF BREADMAKING PROPERTIES OF WHEAT GLUTEN PROTEINS - A CRITICAL APPRAISAL [Review]. *Journal of Food Science & Technology-Mysore. 34(2):85-102. English. [PUNJAB AGR UNIV DEPT FOOD SCI & TECHNOL LUDHIANA 141004 PUNJAB INDIA].*

Wheat gluten consists mainly of the storage protein of wheat endosperm, i.e., gliadin and glutenin. Upon hydration and during processing, gliadin and glutenin interact to form a unique viscoelastic gluten network, which is envisaged as being necessary for holding the gases and for producing a light porous crumb textured bread. Recent work has confirmed that the elastic properties of gluten are due to the glutenin fraction, whilst the viscous properties come from the gliadin fraction. An appropriate balance in the amount of these two major protein components of wheat gluten is required for achieving the desired bread quality. Variations in the composition and physical properties of the glutenin polypeptides appear to be largely responsible for the differences in the gluten viscoelasticity and breadmaking potential among wheat cultivars. Recently, exploratory results have indicated an association of gliadin polypeptides with breadmaking quality. Using improved protein separation and purification techniques, physical methods and genetic engineering, a beginning has been made to understand the structure-functional relationship of wheat gluten proteins, but much remains to be explored in the years to come. [References: 115].

4366 Lee, S.Y.; Hur, H.S.; Song, J.C.; Park, N.K.; Chung, W.K.; Nam, J.H. (Rural Development Administration, Suwon (Korea Republic). National Crop Experiment Station); Chang, H.G. (Kyungwon University, Sunnam (Korea Republic)) (1997) Comparison of noodle-related characteristics of domestic and imported wheat. *Korean Journal of Food Science and Technology (Korea Republic) v. 29(1) p. 44-50. 2 illus.; 6 tables; 20 ref. Korean. (AGRIS 97-085025).*

4367 Lee, Y.T. (Sunmoon University, Asan (Korea Republic). Department of Food Resources and Technology) (1996) Beta-glucans in barley and oats and their changes in solubility by processing. *Agricultural Chemistry and Biotechnology (Korea Republic) v. 39(6) p. 482-487. 2 illus.; 6 tables; 26 ref. Korean. (AGRIS 97-084845).*

4368 Li, M. (Rutgers, The State University of New Jersey, New Brunswick, NJ.); Lee, T.C. (1996) Effect of cysteine on the functional properties and microstructures of wheat flour extrudates. *Journal of agricultural and food chemistry (USA) v. 44(7) p. 1871-1880. references. English. (AGRIS 97-070492).*

The effect of the concentration of added cysteine (0, 0.25, 0.5, 0.75, 1.0, and 1.5% (w/w)) on the functional properties and microstructures of wheat flour extrudates was studied in order to elucidate the relationship of the disulfide cross-linking, the extrudate microstructure, and the functional property of proteins through the high-temperature short-time extrusion. The added cysteine markedly affected the functional properties and microstructures of the extrudates during twin-screw extrusion. After extrusion, the disulfide content in the extrudate (including in both protein and cystine) increased by nearly two times. The expansion ratio of the extrudates decreased by 25%. The bulk density of the extrudates first dropped by 50% and then remained constant. The expansion volume of

the extrudates first increased by 25% and then returned back. The water-holding capacity of ground extrudates decreased by 16%. The oil-absorption capacity of ground extrudates first increased by 135% and then remained constant. The "whiteness" value of the extrudates increased by 3.9 color units. The gumminess and cohesiveness of the extrudates increased. For the microstructures of the extrudates, the cell size decreased and the cell wall thinned; also, the cell surface morphology changed. The information generated in this study could be applied to predict and control the functional properties and textural characteristics of extruded products.

4369 Lynn, A.; Cochrane, M.P. (1997) AN EVALUATION OF CONFOCAL MICROSCOPY FOR THE STUDY OF STARCH GRANULE ENZYMIC DIGESTION. *Starch-Starke. 49(3):106-110. English.*

Industrially prepared wheat starch granules were stained with the fluorochrome Nile Blue A, and subjected to digestion with human saliva. Using a confocal microscope, the degradation of two granules was recorded in sets of optical sections gathered over a seven hour period. Each set of these optical sections was digitally processed to produce a reconstructed 3 dimensional image of the starch granules. Using this technique it was therefore possible to follow the internal and external digestion of each wheat starch granule in real time. [References: 16].

4370 Manelius, R.; Qin, Z.; Avall, A.K.; Andtfolk, H.; Bertoft, E. (1997) THE MODE OF ACTION ON GRANULAR WHEAT STARCH BY BACTERIAL ALPHA-AMYLASE. *Starch-Starke. 49(4):142-147. English. [ABO AKAD UNIV DEPT BIOCHEM & PHARM POB 66 SF-20520 TURKU FINLAND].*

Large (A) and small (B) granules from wheat starch were subjected to alpha-amylolysis. The B granules were solubilised faster than the A granules. The solubilised dextrins were separated from the enzyme before a secondary hydrolysis of the products occurred and then characterized. The size-distribution of the hydrolysis products ranged between a degree of polymerization of 2-500. The dextrins solubilised from the B granules contained somewhat more linear fragments and had smaller average chain length than the corresponding dextrins from the A granules. The composition of the residues of the A granules remained practically unchanged, whereas the B granules contained somewhat less amylose. Both granule types possessed extensive fragmentation of some granules, whereas other granules were virtually untouched by the enzyme. [References: 24].

4371 Martinezanaya, M.A.; Rouzaud, O. (1997) INFLUENCE OF WHEAT FLOUR AND LACTOBACILLUS STRAINS ON THE DYNAMICS OF BY-PRODUCTS FROM AMYLOLYTIC ACTIVITIES. *Food Science & Technology International. 3(2):123-136. English. [INST AGROQUIM & TECNOL ALIMENTOS LAB CEREALES APDO POSTAL 73 BURJASSOT 46100 VALENCIA SPAIN].*

Amylolytic activity of six flours from three European wheat cultivars (Obelisk, Camp Remy and Fresco, at 70 and 100% extraction level), and five lactobacilli strains (*Lactobacillus plantarum* B-39, L-73; *L. brevis* 25a, L-62, and *L. sanfrancisco* L-99), as well as the dynamics of by-products from amylolytic degrading action in mixed flour-lactobacilli systems have been investigated. alpha-Amylase activity of flours depended on ash content; whole flours from the three cultivars had similar values, which were of the order of three to ten times that of white flours. *L. sanfrancisco* showed the lowest alpha-amylase activity, and *L. plantarum* the highest. At the concentrations of lactobacilli used in sourdough processes, flour was the main contributor to final alpha-amylase action in flour-lactobacilli mixtures. Production of monosaccharides followed variable trends, depending on the extraction level of the flour and on the *Lactobacillus* strain. The dynamics of monosaccharides, due to their active and variable involvement in metabolic pathways, could not be adjusted to model regression equations. Maltose levels increased during fermentation, although an effective incorporation in *Lactobacillus* metabolism was observed. A second order polynomial could be used to describe changes in maltose. Low molecular weight dextrins (LMWD) with degrees of polymerization (DP) from three to seven, only appeared and accumulated during the late stages of fermentation. LMWD with a DP of three was the only oligosaccharide capable of being incorporated by lactobacilli, and, of the strains tested, only by *L. brevis* (25a). The larger dextrins seemed to be involved in further degrading enzymic reactions yielding smaller size fragments. Dynamics of LMWD followed exponential curves, with highly significant regression coefficients. [References: 69].



4372 Matuz, J.; Beke, B. (1996) GRAIN YIELD AND QUALITY OF DURUM WHEAT (TRITICUM DURUM DESF) FROM SZEGED, HUNGARY [Review]. *Novenytermeles*. 45(5-6):579-582. Hungarian. [CEREAL RES INST PF 391 H-6701 SZEGED HUNGARY].

The main result of the durum research programme of the Cereal Research Institute (CRI) is the successful introduction of durum wheat into Hungary. The acreage of durum wheat in Hungary was about 14000 ha in 1996. The registered durum cultivars of CRI are the following: GK Minaret, GK Basa, GK Tiszadur, GK Novodur. These winter durum varieties generally yield only 15-30% less than the most widely produced winter bread wheat cultivars (*T. aestivum* L). The yield of spring durum varieties is 40-50% less than the yield of winter bread wheats. [References: 5].

4373 McCleary, BV.; Mugford, DC. (1997) DETERMINATION OF BETA-GLUCAN IN BARLEY AND OATS BY STREAMLINED ENZYMATIC METHOD - SUMMARY OF COLLABORATIVE STUDY. *Journal of AOAC International*. 80(3):580-583. English. [MEGAZYME INT IRELAND LTD BRAY BUSINESS PK BRAY WICKLOW IRELAND].

A collaborative study was conducted involving 8 laboratories (including the authors' laboratories) to validate the streamlined enzymatic method for determination of beta-D-glucan in barley and oats. In the method, the flour sample is cooked to hydrate and gelatinize beta-glucan, which is subsequently hydrolyzed to soluble fragments with the lichenase enzyme. After volume and pH adjustments and filtration, the solution is treated with beta-glucosidase, which hydrolyzes beta-glucan-oligosaccharides to D-glucose. D-Glucose is measured with glucose oxidase-peroxidase reagent. Other portions of lichenase hydrolysate are treated directly with glucose oxidase-peroxidase reagent to measure free glucose in test sample. If levels of free glucose are high, the sample is extracted first with 80% ethanol. For all samples analyzed, the repeatability relative standard deviation (RSDr) values ranged from 3.1 to 12.3% and the reproducibility relative standard deviation (RSDR) values ranged from 6.6 to 12.3%. The streamlined enzymatic method for determination of beta-D-glucan in barley and oats has been adopted first action by AOAC INTERNATIONAL. [References: 3].

4374 McMurrough, I. (Guinness Brewing Worldwide Research Centre, Dublin, Ireland.); Madigan, D.; Smyth, M.R. (1996) Semipreparative chromatographic procedure for the isolation of dimeric and trimeric proanthocyanidins from barley. *Journal of agricultural and food chemistry (USA)* v. 44(7) p. 1731-1735. references. English. (AGRIS 97-070166).

A semipreparative chromatographic method for the isolation of small amounts (10-20 micrograms) of dimeric and trimeric proanthocyanidins from barley is described. Concentrated extracts of barley were injected onto a high-performance gel filtration column (Superdex 75 HR), and were eluted with methanol. This procedure resolved the dimeric proanthocyanidins (prodelphinidin B3 and procyanidin B3), as well as the trimeric procyanidin C2 and three other trimeric prodelphinidins. The separated flavanoid peaks were collected and their contents were estimated by UV spectrophotometry, reaction with p-dimethylaminocinnamaldehyde, and reversed phase HPLC with electrochemical detection. This method produced proanthocyanidins in sufficient amounts to calibrate a system for direct injection chromatographic analysis of beers and barley extracts. The method described may be optimized for the isolation of dimeric proanthocyanidins only, in which case the preparation can take as little as 3 h; alternatively, by extending the chromatographic separation to 9 h, the four major trimeric proanthocyanidins of barley can be recovered also in a chromatographically pure state.

4375 Metakovsky, EV.; Annicchiarico, P.; Boggini, G.; Pogna, NE. (1997) RELATIONSHIP BETWEEN GLIADIN ALLELES AND DOUGH STRENGTH IN ITALIAN BREAD WHEAT CULTIVARS. *Journal of Cereal Science*. 25(3):229-236. English. [IST SPERIMENTALE COLTURE FORAGGERE VIALE PLACENZA 29 I-20075 LODI ITALY].

Dough strength, as determined by Alveograph W, was studied in Italian bread wheat cultivars grown at several locations over 21 years of testing. Broad sense heritability of Alveograph W was found to range between 0.40 and 0.82, variation in this parameter being affected by genotype x year interactions. Standardised Alveograph W values (Wst) across 40 environments (location-year combinations) were computed for 54 cultivars with reference to the long-term control (cv. Mec), and a quality score based on the Wst value was given to each gliadin allele occurring in at least four of the 54 cultivars analysed. Significant differences in Wst

values were observed at the Gli-B1, Gli-B2 and Gli-A2 loci. Alleles Gli-B1b, Gli-B2c and Gli-A2b were significantly related to high gluten strength. An overall quality score based on allelic composition at these loci explained 41% of the observed Wst variation in the 54 cultivars used for the score definition, and 23% to 48% of W value variation in three sets of independent data. The combination of this score with a quality score based on Glu-1 alleles coding for high M-r glutenin subunits could explain, on average, about 50% of gluten strength variation. (C) 1997 Academic Press Limited. [References: 34].

4376 Miller, RA.; Hosney, RC. (1997) FACTORS IN HARD WHEAT FLOUR RESPONSIBLE FOR REDUCED COOKIE SPREAD. *Cereal Chemistry*. 74(3):330-336. English. [R&R RES SERV 8831 QUAIL LANE MANHATTAN, KS 66502 USA].

Time-lapse photography showed that, during baking, the diameter of sugar-snap cookies increased linearly then suddenly became fixed. Therefore, cookie diameter was a function of spread rate and set time. Cookies made with soft wheat flour were significantly larger in diameter (184 mm) than those made with hard wheat flour (161 mm). Cookies made with soft wheat flour set later (5.8 min) during baking than those made with hard wheat flour (5.1 min). The differences in set time within cookies made with various hard wheat flours or within cookies made with various soft wheat flours appeared to be affected by flour protein content. However, other factors also affected the difference in set time between cookies made with hard wheat and soft wheat flours. Cookies made with soft wheat flour spread at a faster rate (7.8 mm/min) than those made with hard wheat flour (4.6 mm/min). The level of soluble starch in the flour appeared to cause the difference in spread rate between cookies made with hard wheat and soft wheat flour. The higher level of soluble starch in hard wheat flour (0.352 +/- 0.008%) than in soft wheat flour (0.152 +/- 0.030%) increased dough viscosity, thus the spread rate was slower. However, soluble starch content did not explain the differences in spread rate within cookies made with various hard wheat flours or within cookies made with various soft wheat flours. [References: 31].

4377 Mir Ali, N.; Arabi, M.I.E.; Al Safadi, B. (1995) [Evaluation of wheat gluten strength and its relations to storage proteins fractionated by SDS-PAGE]. Atomic energy commission, Damascus (Syria). AEC. 39 ref.; 20 tables. 57 p. Arabic. (AGRIS 97-085018).

109 bread wheat and 128 durum wheat genotypes were studied for the composition of high molecular weight glutenin subunits (HMWGS) as determined by sodium dodecyl sulfate-poly acrylamide gel electrophoresis (SDS-PAGE). The effects of the different alleles on gluten strength (using SDS-sedimentation test) were analyzed using two statistical approaches. Both bread and durum wheats differed in the allelic compositions at Glu-1 among the different groups as well as from results reported by other workers. In bread wheat, the genotypes showed significant differences in gluten strength. The effects of the different loci were highest at Glu-D1 and lowest at Glu-A1. No significant effect was noticed for Glu-A1 unlike Glu-B1 and Glu-D1. The best allele to indicate for gluten strength at Glu-B1 was 17+18 and at Glu-D1 5+10. In durum wheat unexpected result was realized that the effect of HMWGS at Glu-B1 was larger than LMWGS of Glu-B3 with the interaction between the two loci being highly significant. All durum genotypes under study possessed the null allele at Glu-A1 and the best indicator for good quality were subunits 7+8 of Glu-B1.

4378 Ockenden, I.; Falk, DE.; Lott, JNA. (1997) STABILITY OF PHYTATE IN BARLEY AND BEANS DURING STORAGE. *Journal of Agricultural & Food Chemistry*. 45(5):1673-1677. English. [MCMASTER UNIV DEPT BIOL 1280 MAIN ST W HAMILTON ON L8S 4K1 CANADA].

The purpose of this study was to measure the stability of phytate in barley grains (*Hordeum vulgare*) and beans (*Phaseolus vulgaris*) during storage. Grains of four barley cultivars stored for 8-10 years varied in their phytate content and were either the same as the current value or lower by up to 17.7%. With accelerated dry aging of barley at 41 degrees C for 3 months there was less than 2% decrease in phytate and a slight drop in percent germination. When aged at 41 degrees C and 75% relative humidity (RH), phytate levels decreased 5 to 10%, depending on the cultivar, and no kernels germinated. Beans stored dry at room temperature and ambient humidity for 14 months had no decrease in phytate, but phytate levels in dry beans stored for 4 months at 41 degrees C dropped by 23%. At 41 degrees C and 75% RH the levels of phytate in beans dropped by 27%. Phytate was more stable in barley kernels than in beans. [References: 22].

4379 Park, H.; Seib, P.A.; Chung, O.K. (1997) FORTIFYING BREAD WITH A MIXTURE OF WHEAT FIBER AND PSYLLIUM HUSK FIBER PLUS THREE ANTIOXIDANTS. *Cereal Chemistry*. 74(3):207-211. English. [KANSAS STATE UNIV DEPT GRAIN SCI & IND MANHATTAN, KS 66506 USA].

A 7.3 (w/w) mixture of wheat fiber (WF) and psyllium husk fiber (PHF) was substituted for 10wt% of flour on a 14% mb, and the protein in the blend was restored to 10.3% by incorporating vital wheat gluten. After adding 0.5% sodium stearoyl 2-lactylate, the blend (100 g) was fortified with a combination of fat-coated ascorbic acid (AsA), protein-encased (PE) beta-carotene, and cold-water-dispersible (CWD) all-rac-alpha-tocopheryl acetate (ToAc) at levels of 72, 5.6, and 115 mg, respectively, of active material. Adding the fiber ingredients to the pup loaf formula increased water absorption 25% and mixing time 50% and imparted stickiness to the dough. The fiber and antioxidant bread showed a 10% reduction in loaf volume and a somewhat inferior crumb grain with an off-color caused by small, black specks on a dark gray background. The crumb of the fiber and antioxidant bread remained much softer than control bread during one to seven days of storage at room temperature. Caramel coloring masked the off-color. AsA was lost significantly faster in the fiber and antioxidant bread than in antioxidant bread; the losses of AsA were 97 and 86%, respectively, after three days at 25 degrees C. Approximately 25% of beta-carotene was lost from the fiber and antioxidant bread after three days, and 33% after seven days, but the loss of ToAc was <10%. One serving size (one slice, 28 g) of fiber and antioxidant bread was calculated to provide 2.1 g of dietary fiber, or similar to 8% of daily value, of which similar to 30% was soluble. The three-day-old slice also contained vitamin E and vitamin A (as beta-carotene) at 120-150% and 12-15%, respectively, of the adult recommended daily allowances, but with 16% fewer calories than white pan bread. [References: 24].

4380 Potente, H.; Liu, J.; Ruecker, A. (Univ. GH Paderborn (Germany). Kunststofftechnologie) (1996) [Gelatinization behaviour of wheat starch in a twin screw mixer]. *Gelatinierungsverhalten von Weizenstaerke in einem zueiwelligen Knetgeraet. Starch - Staerke (Germany) v. 48(5) p. 171-174. 7 graphs, 1 table; 11 ref. German. (AGRI 97-070449).*

Native Staerke kann unter der Zugabe von Gelatinierungsmitteln (z.B. dest. Wasser oder Glyzerin) in einem zueiwelligen Knetgeraet gelatinisiert werden. Der Gelatinierungsgrad der Staerke haengt wesentlich von den Parametern Verweilzeit, Temperatur, Druck, Drehzahl und dem Anteil des Gelatinierungsmittels ab. Bei den Versuehen wurden die Proben in einem Plastographen mit verschiedenen Anteilen destillierten Wassers (20%, 30%, 40 %) und unterschiedlichen Knetzeiten hergestellt. Der Gelatinierungsgrad dieser Proben wurde durch ein DSC-Analysengerat bestimmt. Die Ergebnisse zeigen, dass der Gelatinierungsgrad der Staerke mit steigender Verweilzeit und steigender spezifisch-mechanischer Energieeinleitung zu Beginn stark und dann langsam zunimmt, bis der Gelatinierungsgrad der Staerke von 100% erreicht wird. Mit dem steigenden Anteil des destillierten Wassers verzoeiert sich jedoch die Gelatinierung der Staerke. Weiterhin wird eine mathematische Behandlung des Gelatinierungsvorganges durchgefuehrt. Die Uebereinstimmung zwischen dem berechneten und gemessenen Gelatinierungsgrad ist zufriedenstellend.

4381 Ramkumar, D.H.S. (University of Minnesota, St. Paul, MN.); Bhattacharya, M. (1996) Relaxation behavior and the application of integral constitutive equations to wheat dough. *Journal of texture studies (USA) v. 27(5) p. 517-544. references. English. (AGRI 97-070421).*

4382 Randhawa, H.S.; Dhaliwal, H.S.; Singh, H. (1997) DIVERSITY FOR HMW GLUTENIN SUBUNIT COMPOSITION AND THE ORIGIN OF POLYPLOID WHEATS. *Cereal Research Communications*. 25(1):77-84. English. [PUNJAB AGR UNIV CTR BIOTECHNOL LUDHIANA 141004 PUNJAB INDIA].

The phylogenetic relationship between the diploid and polyploid species was investigated on the basis of variability for molecular weight (HMW) glutenin subunit composition in wild di old and tetraploid progenitor species of cultivated wheats. The analysis of diploid progenitor species showed that T. urartu(A(u)) possesses two type of accessions, one expressing only Ax subunit and other expressing both Ax and Ay subunits at Glu A1 locus. All accessions of other diploid species, T. boeoticum (A(b)), possess both the Ax and Ay subunits. The presence of only Ax subunits or null allele at Glu A1 locus in cultivated polyploid species

indicated that T. urartu possessing only Ax subunit is the plausible donor of the A genome to wheat. Observations on HMW glutenin profiles also suggested that Ae. speltioides may have contributed the G genome to T. araraticum (AG) and some other S genome species might have contributed the B genome. [References: 14].

4383 Rao, S.J.; Rao, G.V. (1997) EFFECT OF INCORPORATION OF SORGHUM FLOUR TO WHEAT FLOUR ON CHEMICAL, RHEOLOGICAL AND BREAD CHARACTERISTICS. *Journal of Food Science & Technology-Mysore*. 34(3):251-254. English. [CENT FOOD TECHNOL RES INST MILLING & BAKING TECHNOL DEPT MYSORE 570013 KARNATAKA INDIA].

Sorghum flours (quality grades-25 and 15% perishing) were incorporated into wheat flour at 5, 10, 15 and 20% levels. The water absorption of flour blends and dough strength decreased with the increase in the level of sorghum flour. The bread volume decreased with increasing level of sorghum substitution. The crumb colour changed from creamish white to dull brown and a gradual hardening of crumb texture was observed as the addition of sorghum increased. Replacement of wheat flour upto 15 and 10% with 75 and 85% extraction rate sorghum flours, respectively produced acceptable breads. [References: 21].

4384 Rentel, D. (Bundessortenamt, Hannover (Germany)) (1996) [Quality of wheat]. *Qualitaet von Weizen. Getreide Magazin (Germany) v. 2(4) p. 22-23. German. (AGRI 97-070473).*

4385 Riganakos, K.A.; Kontominas, M.G. (1997) STUDY OF WATER SORPTION OF FLOURS (WHEAT AND SOY) USING A HYGROMETRIC METHOD - EFFECT OF RELATIVE HUMIDITY DURING HEAT TREATMENT. *Zeitschrift fur Lebensmittel-Untersuchung und-Forschung A-Food Research & Technology*. 204(5):369-373. English. [UNIV IOANNINA DEPT CHEM FOOD CHEM & TECHNOL LAB GR-45110 IOANNINA GREECE].

The moisture sorption isotherms of wheat and soy flours at 30 degrees C were constructed using the Novasina hygrometric technique. Wheat flour had a higher sorptive capacity than soy flour, as has previously been demonstrated using a chromatographic sorption technique. Good agreement was found between the Novasina and the static gravimetric methods. The difference between the two methods was of the order of 10.7% for wheat flour and 11.4% for soy flour. Subsequently, the flour samples were heat treated at 100 degrees C for 1 h and 150 degrees C for 2 h at various relative humidity environments (0.32 < a(w) < 0.90). Sorption data showed a reduced sorptive capacity for both flours for all heating conditions which further decreased with increasing relative humidity values during heat treatment. The decrease in wheat flour sorptive capacity upon heating in the presence of moisture ranged between 11.5% and 55.7% (heating for 1 h at 100 degrees C) and between 42.1% and 83.1% (heating for 2 h at 150 degrees C). For soy flour, the decrease in sorptive capacity ranged between 7.8% and 33.8% (heating for 1h at 100 degrees C) and between 45.4% and 60.6% (heating for 2 h at 150 degrees C). Results were correlated with the effect of a specific heat treatment/relative humidity on protein and carbohydrate constituents of the flours. [References: 30].

4386 Riha, W.E. III (Rutgers, The State University of New Jersey, New Brunswick, NJ.); Hwang, C.F.; Karwe, M.V.; Hartman, T.G.; Ho, C.T. (1996) Effect of cysteine addition on the volatiles of extruded wheat flour. *Journal of agricultural and food chemistry (USA) v. 44(7) p. 1847-1850. references. English. (AGRI 97-070491).*

The sulfur-containing amino acid cysteine was added at concentrations ranging from 0% to 1.0% to wheat flour and extruded in a corotating twin screw extruder. A total of 18 sulfur-containing compounds was tentatively identified along with 4 pyrazines and 1 furan. The fact that most of the sulfur-containing compounds were thiazoles indicated that these compounds may be formed due to thermal degradation of cysteine. The increase in concentration of cysteine in the wheat flour did effect the concentration of most volatiles, including non-sulfur-containing volatiles; however, the addition of cysteine over the 0.5% level did not seem to greatly increase volatile production.

4387 Rouzaud, O.; Martinezanaya, M.A. (1997) RELATIONSHIPS BETWEEN BIOCHEMICAL AND QUALITY-RELATED CHARACTERISTICS OF BREADS, RESULTING FROM THE INTERACTION OF FLOUR, MICROBIAL STARTER AND THE TYPE

OF PROCESS. *Zeitschrift für Lebensmittel-Untersuchung und-Forschung A-Food Research & Technology*. 204(4):321-326. English. [AP CORREOS 73 E-46100 BURJASSOT VALENCIA SPAIN].

The possible relationships between biochemical characteristics [total starch, sugars, low-molecular-weight dextrins (LMWD), acetic and lactic acids, soluble solids and crumb-swelling power] and characteristics related to the quality of wheat bread (volume, texture and sensory quality scores) have been investigated. Variables influencing the possible interactions occurring were the type of flour (white and whole-wheat flours), the starter microorganism (*Lactobacillus brevis*, *L. plantarum*) and the type of process used to introduce the lactobacilli inoculum (sourdough, straight). The main factor explaining variability of data was related to sensory quality attributes and physical characteristics of the breads. The second factor was related to LMWD and the third to the acidity and lactic acid content of breads. The first factor permitted separation of the bread samples into two groups on the basis of flour extraction rate, whereas LMWD allowed differentiation between white breads made with sourdough or straight processes. Cluster analysis included the level of acidity and the lactic acid content as additional factors grouping control breads (without starter) together with breads made using a straight process. The best canonical correlation was established between the physical characteristics of breads and carbohydrates, soluble solids and crumb-swelling power. The first pair of canonical variables between two sets of experimental variables showed a squared correlation coefficient of 0.986. [References: 17].

4388 Rychener, M.; Tieche, J. D. (Bundesamt fuer Landwirtschaft, Bern (Switzerland)) (1996) [Quality comparison of conventional and extensive grown wheat: Results of production, milling and baking tests 1992-1994]. Vergleich der Qualitaet von Weizen aus konventionellem und extensivem Anbau: Ergebnisse der Streifenanbau-, Grossmahl- und Backversuche 1992-1994. *Getreide Mehl und Brot (Germany)* v. 50(4) p. 201-208. 1 ill., 15 graphs, 8 tables. German. (AGRIS 97-070495).

Die Untersuchungen wurden an Weizensorten durchgefuehrt, die von 1992 bis 1994 in Streifenanbauversuchen in der Schweiz sowohl konventionell als auch extensiv angebaut wurden. Die wichtigsten Laboranalysen wurden am ganzen Korn (Vollkornschrot) und an Mehlen der Type 550 durchgefuehrt. Die Backversuche wurden mit Mehlen der Type 900 vorgenommen. Aus den Untersuchungsergebnissen wurden Dreijahresdurchschnitte berechnet und diese auf Unterschiede zwischen konventionellem und extensivem Anbau verglichen. Bei keiner der gepueften Sorten wurden gravierende Qualitaetsunterschiede zwischen den extensiv und konventionell angebauten Weizen festgestellt. Die Hektolitergewichte sind zwar beim extensiven Verfahren etwas geringer, in bezug auf Protein- und Staerkequalitaet sowie teigphysikalische, vermahlungs- und backtechnische Eigenschaften sind die Weizen aus beiden Anbauverfahren jedoch ebenbuertig. Fuer den Extensio-Anbau eignet sich hinsichtlich der Qualitaet vor allem die Sorte TAMARO.

4389 Rychlik, M.; Grosch, W. (Deutsche Forschungsanstalt fuer Lebensmittelchemie, Garching (Germany). Kurt Hess Inst. fuer Mehl und Eiweissforschung) (1996) [Flavour of toasted wheat bread]. Aroma von getoastetem Weissbrot. *Getreide Mehl und Brot (Germany)* v. 50(4) p. 219-222. 6 graphs, 7 tables; 5 ref. German. (AGRIS 97-070179).

In geroestetem Weissbrot wurden durch Verduennungsanalysen und Aromawertberechnungen das roestige 2-Acetyl-1-pyrrolin, das gruene-fettig riechende (E)-2-Nonenal, das karamelartige 4-Hydroxy-2, 5-dimethyl-3(2H)-furanon und das kartoffelartig riechende Methional als wichtigste Aromastoffe identifiziert. Mit zunehmender Braeunung nahm 2-Acetyl-1-pyrrolin kontinuierlich zu, waehrend beim 4-Hydroxy-2, 5-dimethyl-3(2H)-furanon ein Konzentrationssprung im mittleren Braeunungsbereich festgestellt wurde. Die Aromaabweichungen einiger Toastbrotvarianten lassen sich auf Konzentrationsunterschiede von Substanzen mit hohen Aromawerten zurueckfuehren. Mit steigender Hefemenge nahmen die Gehalte von 2-Acetyl-1-pyrrolin und 2-Furfurylthiol zu, welche eine roestige, verbrannte Note bewirkten. Beim Vollkorntoast traten Fettoxidationsprodukte in den Vordergrund und erzeugten einen suesslich-fettigen Geruchseindruck. Das schweissige Aroma von geroestetem Weizenkleietoastbrot wurde auf hoehere Gehalte der isomeren Methylbuttersauren zurueckgefuehrt. Fuer die Butternote war in erster Linie Delta-Decalacton verantwortlich.

4390 Sacher, B.; Ketterer, M.; Back, W. (1996) [Investigations into new winter barleys of the 1993 harvest]. Untersuchungen an neuen

Wintergersten der Ernte 1993. *Monatsschrift fuer Brauwissenschaft (Germany)* v. 49(1-2) p. 4-11. 12 tables; 1 ref. German. (AGRIS 97-070340).

4391 Seibel, W.; Sievert, D.; Bruemmer, J. M. (Bundesanstalt fuer Getreide, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Quality of rye and wheat milled products in the grain economic year 1994/95]. Qualitaet der Roggen- und Weizenmahrerzeugnisse im Getreidewirtschaftsjahr 1994/95. *Getreide Mehl und Brot (Germany)* v. 50(3) p. 131-135. 2 graphs, 8 tables; 11 ref. German. (AGRIS 97-070430).

Die mit der Ernte 1974 begonnene Statistik ueber die Qualitaet der Weizen- und Roggenmahrerzeugnisse der Getreidewirtschaftsjahre wurde im Wirtschaftsjahr 1994/95 durch Qualitaetsuntersuchungen an den Roggenmehlen (Typen 997/1150), Weizenmehlen (Typen 550/1050), Backschroten, Vollkornschroten und Vollkommehlen aus Weizen und Roggen fortgesetzt. Insgesamt hatten die Weizen- und Roggenmahrerzeugnisse im Getreidewirtschaftsjahr 1994/95 eine gute bis sehr gute Verarbeitungsqualitaet. Das Qualitaetsniveau spiegelt sich auch in den Ergebnissen bei den DLG-Qualitaetspruefungen fuer Backwaren und bei der CMA-Qualitaetspruefung fuer Backwaren wider. Dem Muehlengewerbe ist es wiederum gelungen, im Wirtschaftsjahr 1994/95 durch den selektiven Einkauf von Roggen und Weizen Mahrerzeugnisse mit guten bis sehr guten Qualitaetseigenschaften fuer das Backgewerbe herzustellen.

4392 Seibel, W.; Zwingelberg, H. (Bundesanstalt fuer Getreide, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Special processing values of winter durum wheats. Part 1: Comparable quality tests]. Besondere Verarbeitungseigenschaften von Winterdurumweizen. 1. Teil: Vergleichende Qualitaetsuntersuchungen. *Getreide Mehl und Brot (Germany)* v. 50(4) p. 243-245. 1 graph, 10 tables; 5 ref. German. (AGRIS 97-070476).

Die im Jahre 1992 begonnenen Qualitaetsuntersuchungen an Winterdurumweizen im Vergleich zu Sommerdurumweizen wurden 1994 abgeschlossen. 1994 stand Probenmaterial aus Deutschland und Oesterreich zur Verfuegung. Die Untersuchungen wurden am Korn, daraus hergestellten Griessen und Teigwaren durchgefuehrt. Zusammenfassend zeigen die Ergebnisse aus den drei Erntejahren, dass die bisher in Anbauversuchen geernteten Winterdurumweizen in ihren Eigenschaften noch grossen Schwankungen unterworfen sind. Besonders grosse Unterschiede zeigten sich im Anteil vollglasiger Koerner und im Anteil dunkelfleckiger Koerner. Sehr starke Schwankungen zeigten sich in der Fallzahl. Die Mineralstoffgehalte im Korn und in den Griessen liegen im Durchschnitt niedriger als bei den bekannten Sommerdurumweizen. Der Winterdurumweizen aus der Bundesrepublik Deutschland erreicht jedoch Proteingehalte, die in vielen Faellen hoeher liegen als bei Sommerdurumpartien aus suedeuropaeischen Laendern. Auch der Pigmentgehalt erreicht mit durchschnittlich 0,51 mg/100 g Beta-Carottingehalt einen vergleichbaren Wert mit vielen Sommerdurumweizen. Die Teigwarenqualitaet liegt im mittleren bis guten Bereich und das Kochpotential der Teigwaren aus Winterdurum ist hoch (Auspraegungsstufen von nahezu 6).

4393 Shewry, P.R.; Tatham, A.S. (1997) DISULPHIDE BONDS IN WHEAT GLUTEN PROTEINS [Review]. *Journal of Cereal Science*. 25(3):207-227. English. [UNIV BRISTOL LONG ASHTON RES STN DEPT AGR SCI IARC BRISTOL BS18 9AF AVON ENGLAND].

Disulphide bonds play a key role in determining the structure and properties of wheat gluten proteins. Comparison of the sequences of monomeric gliadins and polymeric glutenin subunits allows the identification of conserved and variant cysteine residues. Direct disulphide bond determination demonstrates that the conserved cysteine residues present in S-rich prolamins (alpha-type gliadins, gamma-type gliadins and LMW subunits) form intra-chain disulphide bonds while additional cysteines residues present only in the LMW subunits form inter-chain bonds with cysteines in HMW subunits and other LMW subunits. Conserved and variant cysteine residues are also present in the HMW subunits but their patterns of disulphide bond formation are less well understood. Further information on the abilities of individual cysteine residues to form intra- and inter-chain disulphide bonds has also been obtained by heterologous expression of wild type and mutant proteins in *E. coli* and, in the case of the HMW subunits, by examination of the patterns of dimers recovered on partial reduction of glutenin or resulting from the expression of subunits in transgenic tobacco plants. Wheat gluten



proteins are folded and assembled within the lumen of the endoplasmic reticulum of the developing endosperm cells, where disulphide bond formation and exchange may be catalysed by the enzyme protein disulphide isomerase. Similarly, disulphide bond reduction; for example to facilitate mobilisation during germination, may be catalysed by thioredoxin h. Understanding the mechanism and specificity of disulphide bond formation in gluten is crucial for the manipulation of its functional properties by genetic engineering or chemical modification. (C) 1997 Academic Press Limited. [References: 111].

4394 Sinha, NK.; Yamamoto, H.; Ng, PKW. (1997) EFFECTS OF FLOUR CHLORINATION ON SOFT WHEAT GLIADINS ANALYZED BY REVERSED-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY, DIFFERENTIAL SCANNING CALORIMETRY AND FLUORESCENCE SPECTROSCOPY. *Food Chemistry*. 59(3):387-393. English. [MICHIGAN STATE UNIV DEPT FOOD SCI & HUMAN NUTR E LANSING, MI 48824 USA].

Chlorinated soft wheat flours produce better quality cakes. In this study, changes in surface hydrophobicity of gliadins due to flour chlorination were analyzed. Results obtained from RP-HPLC of gliadins showed intervarietal differences, but intravarietal differences in the gliadin patterns of chlorinated and unchlorinated flours were difficult to discern because of the large number of peaks eluted. However, three-dimensional plots of retention time, wavelength and absorbency showed differences among gliadin patterns of unchlorinated and chlorinated flours within a variety, suggesting conformational changes and consequently alteration in hydrophobicity of gliadins due to chlorination. The DSC analyses of gliadins extracted from unchlorinated and chlorinated flours showed higher denaturation peak transition temperatures (T-d) and lower enthalpies of transition ( $\Delta H$ ) in some varieties, indicating hydrophobicity and conformational changes. Fluorescence spectroscopy measurements with an extrinsic probe, 1-anilino-8-naphthalene sulfonic acid (ANS), showed increases in hydrophobicity of gliadins from chlorinated flours, confirming conformational changes in gliadins due to chlorination. (C) 1997 Elsevier Science Ltd. [References: 27].

4395 Skadsen, RW. (1997) INFLUENCE OF THE STARCHY ENDOSPERM ON ALPHA-AMYLASE ISOZYME LEVELS IN BARLEY. *Journal of the American Society of Brewing Chemists*. 55(1):5-10. English. [USDA ARS CEREAL CROPS RES UNIT 501 N WALNUT ST MADISON, WI 53705 USA].

alpha-Amylase activity in malted barley seedlings is composed of the activities of the high-isoelectric point (pI) and low-pI alpha-amylase isozymes. In intact seedlings, the high-pI isozyme activity is roughly 10-fold greater than low-pI activity. However, in isolated aleurones treated with gibberellin (GA), low-pI activity is equal to or greater than high-pI activity. Therefore, alpha-amylase expression during malting must be controlled by factors missing from the isolated aleurone system. The objective of this study was to determine the contribution of GA and the starchy endosperm toward producing the alpha-amylase isozyme levels found in intact seedlings. The possibility that the starchy endosperm could contribute to the prolonged dominance of high-pI expression seen in intact seedlings was explored by incubating isolated aleurones with GA and crude endosperm homogenates from untreated de-embryonated half-seeds. alpha-Amylase isozyme levels were analyzed with isoelectric focusing activity gels. The levels of the messenger RNAs (mRNAs) that encode them were analyzed by RNA blots. This endosperm treatment reproduced aspects of intact seedling expression by prolonging the rise in high-pI mRNA levels and increasing the secretion of high-pI enzyme. This indicates that the starchy endosperm, by virtue of a resident factor or one created during hydrolytic metabolism, contributes to the expression of the high-pI alpha-amylase genes in developing seedlings. [References: 32].

4396 Tafel, A.; Bohm, H.; Flamme, W. (1997) PROTEIN INHIBITORS OF ALPHA-AMYLASE IN MATURE AND GERMINATING GRAIN OF RYE (SECALE CEREALE). *Journal of Cereal Science*. 25(3):267-273. English. [GERMAN INST HUMAN NUTR DEPT FOOD CHEM & PREVENT NUTR ARTHUR SCHEUNERT ALLEE 114-116 D-14558 BERGHOLZ REHRUCKE GERMANY].

The activities of endogenous (R-type) and exogenous acting (D-type) protein inhibitors of alpha-amylase and the activities of alpha- and total amylase were determined in milling fractions of rye. High D-type amylase inhibitor activities were detected in the embryo (255 IU/g) and in the endosperm fraction (64.9 IU/g), low inhibitor activities were found in the

aleurone layer fraction (25.9 IU/g). The highest R-type alpha-amylase inhibitor activity was found in the aleurone layer fraction (32.6 IU/g), and the lowest value in the epidermis containing fraction (5.0 IU/g). The D- and R-type alpha-amylase inhibitor activities varied with growing conditions. D-type amylase inhibitor activities were found to be high in those samples which grew under drought conditions and low in samples cultivated under wet and cool weather. Higher R-type alpha-amylase inhibitor activities were found in rye genotypes cultivated under wet conditions and lower values under dry weather. There were small variations in alpha-amylase inhibitor activities between sprout-stable and sprout-sensitive rye genotypes. The D- and R-type alpha-amylase inhibitor activities of all varieties were stable during 72h of germination. Similar soil conditions will therefore lead to differential alpha-amylase inhibitor activities depending on weather conditions during growth. (C) 1997 Academic Press Limited. [References: 23].

4397 Tolstoguzov, V. (1997) THERMODYNAMIC ASPECTS OF DOUGH FORMATION AND FUNCTIONALITY. *Food Hydrocolloids*. 11(2):181-193. English. [NESTLE RES CTR POB 44 VERS CHEZ LES BLANC CH-1000 LAUSANNE 26 SWITZERLAND].

Thermodynamic and microrheological approaches providing information on mechanisms involved in dough formation and functionality are proposed. The phase behaviour of bipolymer mixtures and excluded volume effects of macromolecules are critical factors influencing the functionality of dough. Milk proteins and flour proteins have similar structures and functionalities, therefore skimmed milk protein-polysaccharide systems can be used to model wheat dough. During mixing of flour with water, albumins, globulins, water-soluble starch (from damaged starch granules) and pentosans form a liquid aqueous phase. This is immiscible with glutelins and gliadins which form a separated gluten phase. Aggregation of the gel particles of the gluten phase minimizes contact with the non-wetted liquid phase and results in the formation of dough structure. At first, bread dough contains two continuous protein phases, a gluten thixotropic gel phase and a liquid phase. Phase equilibrium of the co-existing phases is controlled by mechanical treatment of the dough and by dough additives and ingredients, such as salt, sugars, lipids, surfactants and alcohol produced by fermentation. Mechanical treatment greatly affects the structure-property relationship of doughs by establishing an equilibrium between the co-existing phases; transformation of the continuous liquid protein-polysaccharide phase into the dispersed phase, orientation of polypeptide chains of the gluten phase, intensification of their hydrophobic interactions and formation of hydrophobic structural domains adsorbing lipids. Basic mixing of doughs includes: (i) deformation and breaking down of the liquid and gas dispersed particles; (ii) spinneretless spinning of gluten strips formed between oriented capillary-like particles of the liquid and gas phases; (iii) decreasing the size of liquid gas dispersed particles and the thickness of gluten strips; (iv) revolving starch granules in shear flow providing high fluidity of doughs due to a 'ball-bearing' effect; and (v) migration of starch granules towards a higher shearing gradient providing a decrease in water content of the central layers and the formation of 'starch-empty' surface layers of lower stickiness. Starch gelatinization upon heating results in dewatering of the protein phases and fixation of structure shape and volume of the loaf. A large body of experimental evidence supports the mechanisms of dough formation and functionality proposed here. [References: 66].

4398 Vadlamani, DR.; Seib, PA. (1997) TWO METAL IONS IMPROVE BRIGHTNESS IN WHEAT-DOUGH PRODUCTS AND AFFECT AQUEOUS DISPERSION OF GLUTEN. *Cereal Chemistry*. 74(3):318-325. English. [KANSAS STATE UNIV DEPT GRAIN SCI & IND MANHATTAN, KS 66506 USA].

Zinc and aluminum ions at 0.05% of wheat flour, dry basis (7.4 and 18.5 mmol/100 g, respectively), improved the brightness of raw and dried spaghetti and salt and alkaline noodles. They also retarded bacteria and yeast and mold growth in salt noodles held at 25 degrees C for two days as determined by total plate counts. Neither metal ion caused a change in noodle cooking quality, but they imparted a slight aftertaste in cooked noodles. Wheat flour dough mixed with 0.05% zinc or 0.025% aluminum ion (fwb), when kneaded in aqueous 0.1% calcium chloride, gave gluten with increased brightness. Zinc and aluminum ions appear to complex with enzymic browning chromophores in wheat dough and gluten and change their spectral properties. Zinc and aluminum ions affected the dispersion of gluten in water at pH similar to 5.0 and facilitated its spray-

drying, but they were not detrimental to baking quality, Citric and tartaric acids at 5 mmol/100 g of gluten (db) gave wet gluten with pH similar to 4.5, which improved its brightness and water dispersibility. [References: 46].

4399 Vida, G.; Bedo, Z.; Jolankai, M. (1996) ANALYSIS OF THE EFFECT OF AGRONOMIC TREATMENT COMBINATIONS ON THE BREADMAKING QUALITY OF WINTER WHEAT VARIETIES BY MEANS OF PRINCIPAL COMPONENT ANALYSIS. *Novenytermeles*. 45(5-6):453-462. Hungarian. [HUNGARIAN ACAD SCI AGR RES INST PF 19 H-2462 MARTONVASAR HUNGARY].

It is important when cultivating winter wheat with excellent milling and breadmaking quality not only to choose the best variety, but also to select the optimum combination of agronomic treatments. Principal component analysis was used to group sixteen artificial "microenvironments", formed from the combination of two water supply levels and eight nutrient levels, on the basis of six quality traits measured in the 3-year (1990-1992) yield of three wheat varieties with different qualities. Correlations were calculated between the principal component variables and the mean values of the quality parameters in order to determine the effect of background variables on quality. The 1st principal component variable had a different influence on breadmaking quality in varieties with good and poor quality. Principal component weights and the results of correlations analysis were used to determine the best agronomic treatment combinations for high-quality production. [References: 15].

4400 Wannerberger, L.; Eliasson, AC.; Sindberg, A. (1997) INTERFACIAL BEHAVIOUR OF SECALIN AND RYE FLOUR-MILLING STREAMS IN COMPARISON WITH GLIADIN. *Journal of Cereal Science*. 25(3):243-252. English. [LUND UNIV DEPT FOOD TECHNOL BOX 124 S-22100 LUND SWEDEN].

Secalin was extracted from rye flour and analysed by sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE). The SDS-gel pattern showed that some proteins were composed of disulphide linked polypeptide chains. However, a gliadin sample contained more polymeric protein. The behaviour of gliadin and secalin at the air-water interface was compared using the surface balance technique. It was found that secalin was more surface active than gliadin, spreading faster and to a higher surface pressure. The influence of pH on the interfacial behaviour was also studied. The surface pressure after 15 min equilibrium of both gliadin and secalin decreased with decreasing pH. The effect was independent of the acid (hydrochloric acid, lactic acid or ascorbic acid) when compared at the same pH. The behaviour at the gas-liquid interface of five different rye flour-milling streams together with the whole (straight run) flour was also investigated. The fraction with highest protein content spread fastest and reached the highest surface pressure value. When spread on ascorbic acid at pH 3.7 the surface pressure of the flour stream with lowest protein content decreased to the greatest extent, whereas the fraction with the highest protein content was not affected. It was thus found that, although secalin showed an interfacial behaviour similar to gliadin, this behaviour was not necessarily shown by the total protein mixture in a rye flour. (C) 1997 Academic Press Limited. [References: 23].

4401 Wehrle, K. (1995) [Working for rapid methods for qualitative estimation of durum wheat from German cultivation]. Bundesanstalt fuer Getreide-, Kartoffel- und Fettforschung in Detmold und Muenster, Detmold (Germany). Inst. fuer Muellerei- und Baeckereitechnologie; Univ. Hohenheim (Germany). Inst. fuer Lebensmitteltechnologie, Fachgeb. Getreidetechnologie. *Erarbeitung von Schnellmethoden zur qualitativen Beurteilung von Durumweizen aus deutschem Anbau* 119 p. UH. 32 graphs, 47 tables; 144 ref. German. (AGRIS 97-070474).

Es wurden verschiedene Schnellmethoden auf ihre Eignung beim Einsatz zur Qualitätsbestimmung von Durumweizen aus deutschem Anbau untersucht. Zum Einsatz kamen dabei die industrielle Farbmessung, verschiedene Messsysteme der NIR- und NIT-Spektroskopie, die Röntgenfluoreszenzspektroskopie und mehrere Methoden zur Bestimmung des Gesamt- und Kleberproteins. Mit den eingesetzten Schnellmethoden ist es möglich, alle zur Charakterisierung des Durumweizens eingesetzten Kenngrößen zu ermitteln. Dies ist mit einem erheblichen Zeitvorteil gegenüber den Standardmethoden realisierbar, wobei es zum Teil jedoch zu grösseren Abweichungen von der Vergleichsmethode kommt. Eine korrekte Qualitätseinstufung einzelner Rohstoffpartien ist jedoch bei der Mehrzahl der Proben

moeglich. Eine eindeutige Beziehung der Kenngrößen fuer den Rohstoff Durumweizen und der Endproduktqualitaet konnte fuer das sehr bedeutende Qualitätsmerkmal Farbe gefunden werden. Fuer das komplexe Zusammenspiel beim Zustandekommen der Kocheigenschaften konnten lediglich Tendenzen im Einfluss der Rohstoffqualitaet festgestellt werden.

4402 Wehrle, K.; Seibel, W.; Gerstenkorn, P.; Kuhn, M. (Bundesanstalt fuer Getreide-, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Rapid methods for quality evaluation of durum wheats - 1st part: NIR-investigations]. Schnellmethoden zur qualitativen Beurteilung von Durumweizen. 1. Mitteilung: NIR-Untersuchungen. *Getreide Mehl und Brot (Germany)* v. 50(3) p. 181-185. 10 graphs, 2 tables; 17 ref. German. (AGRIS 97-070475).

Es wurden Durumweizenproben aus deutschem Anbau der Erntejahre 1992 bis 1994 vergleichend mit ICC-Standardmethoden und NIR-Spektroskopie untersucht. Mit der NIR-Spektroskopie koennen an Durumweizen und den daraus hergestellten Griessen die Parameter Protein-, Pigment-, Mineralstoff- und Feuchtigkeitsgehalt in guter Uebereinstimmung mit den nach ICC-Standardmethoden ermittelten Werten bestimmt werden. Diese schnellen Analysemethoden sind zur Rohstoff- und Produktionskontrolle in Muehlen und Teigwarenfabriken geeignet.

4403 Weipert, D. (Bundesanstalt fuer Getreide-, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [100 years triticale]. 100 Jahre Triticale. *Muehle + Mischfuttertechnik (Germany)* v. 133(19) p. 301-304. German. (AGRIS 97-070471).

Allgemeiner Ueberblick ueber Zuechtung, Erzeugung, Qualitaet und Verwendungsmoeglichkeiten von Triticale. Zusammenfassend wird festgestellt, dass Triticale aus technischen, technologischen und wirtschaftlichen Gruenden nicht als Brotgetreide anzusehen ist, jedoch als Futtergetreide sehr geeignet ist. Ausserdem eignet sich Triticale aufgrund seines hohen Biomasse- und Energiegehaltes als nachwachsender Rohstoff.

4404 Weipert, D. (Bundesanstalt fuer Getreide-, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Alveogram and German wheat estimation]. Das Alveogram und der deutsche Weizen. *Muehle + Mischfuttertechnik (Germany)* v. 133(24) p. 387-390, 393. German. (AGRIS 97-070497).

Zusammenfassend wird festgestellt, dass die ICC-Standardmethode zur Anwendung des Alveographen fuer die Qualitätsbeurteilung von deutschem Weizen mit ueberwiegend harter Struktur und hohem Proteingehalt in der jetzt vorliegenden Form nicht geeignet ist. Die Ursachen liegen einmal in der nicht standardisierten Herstellung der Versuchsmehle und zum anderen in der Methode selbst, die eine konstante Wasserzugussmenge und eine wenig intensive Teigbereitung vorschreibt, ohne die spezifischen Eigenschaften der zu untersuchenden Weizenprobe zu beruecksichtigen.

4405 Weipert, D. (Bundesanstalt fuer Getreide-, Kartoffel und Fettforschung in Detmold und Muenster, Detmold (Germany)) (1996) [Extensogram and alveogram in comparison]. Extensogram / Alveogram - ein Vergleich. *Getreide Mehl und Brot (Germany)* v. 50(3) p. 149-155. 15 graphs, 2 tables; 21 ref. German. (AGRIS 97-070246).

Ziel der Arbeit war es, die Anwendung der beiden teigphysikalischen Methoden Alveograph und Extensograph zur Beurteilung der Weizenqualitaet vergleichend darzustellen und die Moeglichkeiten und Grenzen der Methoden aufzuzeigen. Am Beispiel der Mehle von drei Weizensorten von unterschiedlichen Teigbeschaffenheiten und Proteingehalten werden die Messergebnisse sowohl miteinander als auch mit den Backergebnissen verglichen. Waehrend zwischen den Messergebnissen der beiden Methoden untereinander direkte Vergleiche nicht moeglich sind, zeigten sich jedoch Beziehungen beider Methoden jeweils zum Backverhalten. Fuer die Untersuchung von Qualitätsweizen mit harter Kornstruktur und hohem Proteingehalt, wie sie in der Bundesrepublik angebaut werden, ist die Extensograph-Methode besser geeignet. Die Alveograph-Methode ist dagegen fuer den Weizenexport von Bedeutung.

4406 Wicklund, T.; Magnus, EM. (1997) EFFECT OF EXTRUSION COOKING ON EXTRACTABLE LIPIDS AND FATTY ACID COMPOSITION IN SIFTED OAT FLOUR. *Cereal Chemistry*. 74(3):326-

329. English. [REGAL MOLLE AVD MOSS POB 261 N-1502 MOSS NORWAY].

Sifted oat flour was processed at 25.0, 27.5, and 30.0% moisture content in a twin-screw extruder at screw speed 300 rpm. The preset temperatures of the extruder barrel were 120, 150, or 180 degrees C. Raw material and extrudates were analyzed for the content of diethyl ether-extractable lipids, with and without hydrolysis, and the content of chloroform-methanol-water saturated butanol (C/M/WSB) extractable lipids. The lipid extracts were analyzed for fatty acid (FA) composition. Percentage distribution of palmitic, oleic, and linoleic acids were significantly different in the different lipid extracts. Extrusion processing influenced the amounts of extractable lipids, while FA composition was not affected. [References: 23].

4407 Winata, A.; Lorenz, K. (1997) EFFECTS OF FERMENTATION AND BAKING OF WHOLE WHEAT AND WHOLE RYE SOURDOUGH BREADS ON CEREAL ALKYLRESORCINOLS. *Cereal Chemistry*. 74(3):284-287. English. [COLORADO STATE UNIV DEPT FOOD SCI & HUMAN NUTR FT COLLINS, CO 80523 USA].

Alkylresorcinol (AR) content was determined in multiple-stage whole wheat and whole rye flour sours, as well as in whole wheat and whole rye flour doughs and breads. AR content decreased considerably during fermentation and baking. AR content was reduced by 20 and 46%, respectively, at the end of sourdough starter fermentation of whole wheat and whole rye flour sours. AR content, which was 512 and 210  $\mu\text{g/g}$  in whole rye and whole wheat flour doughs, respectively, was 30 and 0  $\mu\text{g/g}$ , respectively, after baking of breads. Synthetic AR added at different levels to doughs was also greatly reduced during fermentation and baking. [References: 30].

4408 Yokoyama, WH.; Hudson, CA.; Knuckles, BE.; Chiu, MCM.; Sayre, RN.; Turnlund, JR.; Schneeman, BO. (1997) EFFECT OF BARLEY BETA-GLUCAN IN DURUM WHEAT PASTA ON HUMAN GLYCEMIC RESPONSE. *Cereal Chemistry*. 74(3):293-296. English. [USDA WESTERN REG RES CTR 800 BUCHANAN ST ALBANY, CA 94710 USA].

High-fiber, high-carbohydrate diets, including foods with low glycemic index, have been associated with prevention and treatment of diseases such as coronary heart disease and diabetes. beta-glucan, a soluble, viscous polymer found in oat and barley endosperm cell wall was incorporated into pasta test meals. Five fasted adult subjects were fed test meals of a barley and durum wheat blend pasta containing 100 g of available carbohydrate, 30 g of total dietary fiber (TDF) and 12 g of beta-glucan, or an all durum wheat pasta containing the same amount of available carbohydrate, 5 g of TDF and negligible beta-glucan. The beta-glucan and durum wheat pasta resulted in a lower glycemic response as measured by average total area and maximum increment of the blood glucose curves. Lower insulin response to the beta-glucan and durum wheat pasta was also indicated by lower average area and increment characteristics of the insulin curves. Barley beta-glucans may be an economical and palatable ingredient for processed food products formulated to modify glycemic and insulin response. [References: 28].

## Q05 FOOD ADDITIVES

4409 Hahn, B.; Kieffer, R.; Grosch, W. (Deutsche Forschungsanstalt fuer Lebensmittelchemie, Garching (Germany). Kurt Hess Inst. fuer Mehl und Eiweissforschung) (1996) [Effect of oxidizing agents on cysteine and glutathione in wheat flour and dough]. *Wirkung von Oxidationsmitteln auf Cystein und Glutathion in Weizenmehl und -teig. Getreide Mehl und Brot (Germany) v. 50(3) p. 136-138. 4 graphs, 2 tables; 2 ref. German. (AGRIS 97-070554).*

Der Redoxzustand von Weizenteigen wird massgeblich von Glutathion (GSH) und Cystein (Cys) bestimmt, deren Konzentration von der Sorte und vom Ausmahlungsgrad abhaengen. Zum besseren Verstaendnis der Vorgaenge im Teig wurde untersucht, in welchem Verhaeltnis das GSH im Mehl und Teig auf die Proteinfractionen verteilt ist. Die Ergebnisse zeigten, dass beim Anteigen ein Teil des im Mehl vorkommenden GSH von der saureloeslichen Gluteninfraktion gebunden wurde. Zugeseetztes GSH ging dagegen in den saureunloeslichen Proteinrueckstand. Der Redoxzustand von Teigen wird auch durch die Hefe beeinflusst. Es wurde ermittelt, dass z.B. Trockenhefen in grossem Umfang GSH abgeben mit entsprechenden Auswirkungen auf die Rheologie, die durch Zusatz von Ascorbinsaure kompensiert werden koennen. Die Wirkungen von Mehlverbesserungsmitteln (Redoxmitteln) auf die Konzentrationen von

GSH und Cys im Mehl und daraus hergestellten Teigen wurde bestimmt. Kaliumbromat, Iodat und Kupfer(II)sulfat verringerten den Gehalt an GSH und Cys in unterschiedlichem Masse. Im Vergleich zum Kaliumbromat (50 g/g) war Ascorbinsaure (30 g/g) wesentlich aktiver.

4410 Hatcher, DW.; Kruger, JE. (1997) SIMPLE PHENOLIC ACIDS IN FLOURS PREPARED FROM CANADIAN WHEAT - RELATIONSHIP TO ASH CONTENT, COLOR, AND POLYPHENOL OXIDASE ACTIVITY. *Cereal Chemistry*. 74(3):337-343. English. [CANADIAN GRAIN COMMISS GRAIN RES LAB 1404-303 MAIN ST WINNIPEG MB R3C 3G8 CANADA].

Simple phenolic acid levels were determined on pooled millstreams of five different classes of Canadian wheat milled to similar to 75, 80, and 85% extraction. Pooled flours and whole grain were analyzed by reversed-phase high-performance liquid chromatography (RP-HPLC) to establish endogenous levels of insoluble bound, soluble esterified, and free phenolic acids. Only ferulic acid was detected in the insoluble bound category, which accounted for >80% of the total phenolic acids present in every flour. The soluble esterified phenolic acids accounted for up to 17% of the overall total phenolic acid content within a flour. The major constituents were sinapic, ferulic, and vanillic acids, with minor amounts of coumaric, caffeic, and syringic acids. Free phenolic acids accounted for a maximum of 6% of the total phenolic content of any prepared flour. Ferulic acid was the major free phenolic acid, while sinapic acid was not detected in any flour. Significant correlations ( $r = 0.64-0.97$ ,  $P < 0.05$ ) were observed between insoluble bound ferulic acid, individual soluble esterified acids, and most free acids with polyphenol oxidase activity, as well as color and ash content for each class. [References: 28].

4411 Sudekum, KH.; Voigt, K.; Monties, B.; Stangassinger, M. (1997) SPECTROPHOTOMETRIC INVESTIGATIONS ON LIGNIN IN WHEAT (TRITICUM AESTIVUM L) - INFLUENCE OF CELL WALL PREPARATION, SOLVENT AND STANDARD. *Journal of Agricultural & Food Chemistry*. 45(4):1220-1228. English. [CHRISTIAN ALBRECHTS UNIV KIEL INST TIERERNAHRUNG & STOFFWECHSELPHYSIOL D-24098 KIEL GERMANY].

Absorbance at 280 nm was used to determine lignin concentrations in solutions of cell walls from winter wheat whole-crop silage, stems, and straw. Three different cell wall preparations (hot water-organic solvent fiber, ethanol-benzene residue, neutral detergent fiber) were prepared and dissolved in either HCl-triethylene glycol or acetyl bromide. Three phenolic standard solutions were used to calculate lignin concentrations in the wheat materials from absorbance readings: mixtures of phenolic monomers based on aldehydes (HIGUCHI), aldehydes and acids (REEVES), and washed Indulin (WIND). Gravimetric Klason lignin determination on the cell wall preparations consistently gave higher values than spectrophotometric lignin analysis. Material recovered as cell wall was slightly greater for hot water-organic solvent fiber than for neutral detergent fiber and was lowest for ethanol-benzene residue, probably due to partial dissolution of cell wall components with the latter procedure. Acetyl bromide shifted UV spectra about 10 nm to lower wavelengths, which complicates quantification of absorbance readings. Additionally, triethylene glycol is easier to handle and less toxic. Lignin concentrations related to the REEVES standard were more consistent across cell wall preparations and solvents than other standards. It appears that the REEVES standard was best suited for winter wheat whole-crop silage, stems, and straw. [References: 41].

## Q51 FEED TECHNOLOGY

4412 Mathot, P. (1996) [Modelling of a simplified reactor for solid state fermentation of agricultural products or byproducts. Use of the fermented feed by pigs]. *Modelisation d'un reacteur simplifie pour la fermentation solide de produits et sous-produits agricoles. Valorisation de l'aliment fermente par le porc. Faculte Universitaire des Sciences Agronomiques, Gembloux (Belgium). Unite de Zootechnie. 18 ill.; 44 tables; Bibliography p. 181-206. 250 p. French. (AGRIS 97-085072).*

In order to increase the crude protein content of agricultural surpluses or residues, solid state fermentation was investigated at laboratory and pilot levels. The barley example was described in detail. A simple and inexpensive process has been developed using a selected strain of *Aspergillus niger* which did not require any heat, acid or alkali pretreatment of the substrate. This process did not need the control of the culture parameters (pH, oxygen, moisture, ...) except for the on-line



temperature measurement which ensured the running of the proposed pilot reactor. This reactor was automated and well adapted to farm applications. The chemical composition of fermented barley showed a crude protein content of 26.5 per cent vs 11.1 per cent for barley at laboratory scale and 23.8 per cent vs 12.3 per cent at pilot scale. The true protein content of fermented barley was 20.0 per cent at laboratory scale and 13.2 per cent at pilot scale. This increase led to starch content reduction. The nutritive value of barley and *Aspergillus niger* fermented barley were determined by digestibility tests with growing pigs. Dry matter fecal digestibility, ileal apparent digestibility of crude proteins and of all the amino acids (except for proline) were increased by the fermentation. The metabolizable energy content of fermented barley was 3125 kcal per kg dry matter. A 70-day trial, involving 30 pigs, was set up to test the use of fermented barley as a substitute for the traditional protein feed. Two diets isonitrogenous and isoenergetic were compared. The former was based on barley and soya bean oil meal and the latter was a mixture of barley, fermented barley, and soya bean oil meal. Animal performances were similar. There was no significant difference in the dry matter or crude protein fecal digestibility, nitrogen balance or metabolisable energy in either diet (in vivo measurements).

## Q52 FEED PROCESSING AND PRESERVATION

4413 Chaudhry, A.S. (Cambridge Univ. (United Kingdom). Dept. of Clinical Veterinary Medicine); Miller, E.L. (1994) *In vitro* digestibility of barley and wheat straws treated with hydrogen peroxide, sodium hydroxide and sodium peroxide under various conditions. *Animal Feed Science and Technology (Netherlands)* v. 50(1-2) p. 1-15. 24 ref. English. (AGRIS 97-085106).

4414 Heidenreich, E.; Loewe, R. (1996) [Suitability of milling by-products as carriers for premixtures]. Eignung von Muehlennachprodukten als Traegerstoff fuer Vormischungen. Workshop "Unkonventionelle Futtermittel". Braunschweig-Voelkenrode (Germany). 10-11 Apr 1996. [Unconventional feedstuffs]. Flachowsky, G.; Kamphues, J. (eds.). *Unkonventionelle Futtermittel Landbauforschung Voelkenrode. Sonderheft (Germany)*; no. 169. Internationale Forschungsgemeinschaft Futtermitteltechnik, Braunschweig (Germany). Forschungsinst. Futtermitteltechnik Frickenmuehle p. 267-274. FAL. 3 ill.; 5 ref. German. (AGRIS 97-085107).

Die Eignung von Traegerstoffen wird danach beurteilt, inwieweit die Kriterien Verteilbarkeit, Mischstabilitaet und Verschleppungsneigung erfuellt werden. Kenngrösse ist der jeweils erreichbare Variationskoeffizient bzw. die Kontamination von Spuelchargen. Weizengrieskleie und Leinextraktionsschrot scheinen am besten geeignet, sofern diese nicht uebertrocknet sind (Feuchtigkeitsgehalte um 10%) und der Partikelanteil < 500 mcm nicht mehr als 40-50% betraegt. Als vorteilhaft erwies sich auch die Abtrennung von Fraktionen > 2000 mcm. Traegerstoffe mit Partikelgrößen unter 500 mcm fuehrten zu instabilen Vormischungen.

## Q53 FEED CONTAMINATION AND TOXICOLOGY

4415 Rode, L.M.; Jakober, K.D.; Kudo, H.; Cheng, K.J. (1997) UTILIZATION OF BARLEY STRAW, CHEMICALLY TREATED WITH AMMONIUM SULFITE, ANHYDROUS AMMONIA OR UREA, BY RUMINANTS. *Canadian Journal of Animal Science*. 77(1):105-109. English. [AGR & AGRI FOOD CANADA RES CTR POB 3000 LETHBRIDGE AB T1J 4B1 CANADA].

Straw treated with anhydrous ammonia, ammonium sulfite, urea or left untreated was examined in a series of feeding experiments to determine the relative efficacy of the treatments to improve the nutritive value of barley straw. In exp. 1, diets containing ammonia- and ammonium sulfite-treated barley straw were more digestible ( $P < 0.05$ ) than diets with untreated straw. In exp. 2, average daily gain (ADG) and voluntary feed intake (VFI) were greatest for heifers fed ammonia-treated straw, followed by heifers fed urea-treated straw, and then by heifers fed ammonium sulfite-treated straw. Heifers fed untreated straw had the lowest ADG and VFI ( $P < 0.05$ ). Although ammonium sulfite treatment improved straw digestibility, the relatively low VFI resulted in ADG lower than for animals fed other treated straw. The low VFI was attributed to the high level of sulfur in the diet. Anhydrous ammonia and urea were found to be the most effective chemicals for improving the nutritive value of barley

straw. Although ammonium sulfite was as effective an anhydrous ammonia in improving digestibility of straw, it cannot be recommended because the application rates, necessary for effective treatment, resulted in depressed feed intake. [References: 30].

4416 Villamide, M.J.; Fuente, J.M.; Deayala, P.P.; Flores, A. (1997) ENERGY EVALUATION OF EIGHT BARLEY CULTIVARS FOR POULTRY - EFFECT OF DIETARY ENZYME ADDITION. *Poultry Science*. 76(6):834-840. English. [UNIV POLITECN MADRID ETSI AGRON DEPT ANIM PROD E-28040 MADRID SPAIN].

Three experiments were conducted to study eight barley cultivars and the effect of enzyme addition on their energy value for poultry. In Experiment 1, the AME(n) of a reference barley (Beka cultivar) was calculated by increasing barley concentrations (30, 40, 50, and 60%) that replaced a high protein basal diet. In Experiment 2, eight barley cultivars (four spring and four winter cultivars) replaced the reference barley in the diet with 50% barley inclusion. Two of the winter cultivars were two-rowed and two were six-rowed cultivars. A commercial enzyme was added to these diets to study the effect of enzyme addition. Diets were consumed ad libitum by 27 and 145 21-d-old Arbor Acres broiler chicks, in Experiments 1 and 2, respectively. In Experiment 3, 66 adult roosters were used to determine the TMEn of the eight cultivars used in Experiment 2. Dietary AME(n) decreased linearly ( $P < 0.05$ ) with increasing barley (Beka cultivar) inclusion. Beka barley AME(n) was calculated by extrapolation of the linear regression equation to be equal to 2,980 kcal/kg DM. Barley energy value was influenced by cultivar ( $P < 0.001$ ); the spring cultivars showed greater energy value than the winter cultivars (2,963 vs 2,852 kcal AME(n)/kg DM; 3,192 vs 2,929 kcal TMEn/kg DM). Two-rowed cultivars showed higher TMEn than six-rowed winter cultivars, although no differences were found for AME(n). The correlation between AME(n) and TMEn values of barley was relatively low ( $r = 0.69$ ); therefore, barley TMEn cannot be extrapolated to AME(n) for young chicks. Enzyme addition produced an average increase of 220 kcal/kg DM in barley AME(n) ( $P < 0.001$ ); there was a significant ( $P < 0.10$ ) interaction between barley cultivar and enzyme supplementation. The increment of barley AME(n) caused by enzyme addition was partly explained (47%) by an increase in barley viscosity. This relationship implies that enzyme supplementation significantly improves the feeding value of high as compared to low viscosity barley samples, which involved a decrease in AME(n) variation among cultivars for enzyme-supplemented barley. No relationship was found between AME(n) of unsupplemented barley cultivars and their chemical composition. Instead, a relationship was detected for enzyme-supplemented barley; therefore two equations were proposed for predicting the AME(n) of enzyme-supplemented barley to be used directly in diet formulation. [References: 30].

## Q54 FEED COMPOSITION

4417 Batterham, E.S. (Wollongbar Agricultural Inst. NSW Agriculture, Wollongbar, N.S.W. (Australia)); Andersen, L.M.; Green, A.G. (1994) Pyridoxine supplementation of Linola(TM) meal for growing pigs. *Animal Feed Science and Technology (Netherlands)* v. 50(1-2) p. 167-174. 12 ref. English. (AGRIS 97-085185).

4418 Bustany, Z.A. (Agricultural Research Center IPA, Baghdad (Iraq)) (1996) The effect of pelleting an enzyme-supplemented barley-based broiler diet. *Animal Feed Science Technology (Netherlands)* v. 58(3-4) p. 283-288. 12 ref. English. (AGRIS 97-085137).

4419 Chaudhry, A.S. (Cambridge Univ. (United Kingdom). Dept. of Clinical Veterinary Medicine); Miller, E.L. (1996) The effect of sodium hydroxide and alkaline hydrogen peroxide on chemical composition of wheat straw and voluntary intake, growth and digesta kinetics in store lambs. *Animal Feed Science Technology (Netherlands)* v. 60(1-2) p. 69-86. 32 ref. English. (AGRIS 97-085160).

4420 El Yassin, F.; Abboud, M.; Al Haj Omar, N. (Aleppo univ. (Syria). Faculty of agriculture) (1994) [The nutritive value of four triticale cultivars, wheat and maize as feed stuff for chickens]. *Research journal of Aleppo university (Syria). Agricultural sciences series (no.22)* p. 43-58. 5 tables; 15 ref. Arabic. (AGRIS 97-085188).

4421 Gao, P.J.; Qu, Y.B.; Zhao, X.; Zhu, M.T.; Duan, Y.C. (1997) SCREENING MICROBIAL STRAIN FOR IMPROVING THE NUTRITIONAL

**VALUE OF WHEAT AND CORN STRAWS AS ANIMAL FEED.** *Enzyme & Microbial Technology*. 20(8):581-584. English. [SHANDONG UNIV INST MICROBIOL STATE KEY LAB MICROBIOL TECHNOL SHANDONG 250100 PEOPLES REPUBLIC OF CHINA].

From 18 strains of cellulolytic microorganisms including bacteria and filamentous fungi, one strain of soft rot fungus identified as *Chaetomium cellulolyticum* was screened with respect to stronger decomposition ability of cellulose and hemicellulose and its ability for protein synthesis. As it grew on raw corn straw in solid layer fermentation (SLF) for 5 days, the amino acid content in the fermentation product attained 19.29% (w/w) from 6.43% while the total cell wall was reduced by 54%. A toxicity test with mice showed that the fermentation product is not poisonous. The two filamentous fungi, *Trichoderma pseudokoningii* S-38 and *Penicillium decumbens* JU-A10 produced large amounts of extracellular cellulase and hemicellulase in the SLF process, but their growth was limited and they sporulated profusely with regard to their value as animal feed products. (C) 1997 by Elsevier Science Inc. [References: 16].

4422 Goto, M. (Mie Univ., Kamihama cho, Tsu (Japan). Faculty of Bioresources); Yokoe, Y. (1996) **Ammoniation of barley straw. Effect on cellulose crystallinity and water-holding capacity.** *Animal Feed Science Technology (Netherlands)* v. 58(3-4) p. 239-247. 40 ref. English. (AGRIS 97-085132).

4423 Montane, D.; Salvado, J.; Farriol, X. (1997) **FRACTIONATION OF WHEAT STRAW VIA STEAM-EXPLOSION PRETREATMENT - CHARACTERISTICS OF THE LIGNIN OBTAINED BY ALKALI DELIGNIFICATION OF THE STEAMED STRAW.** *Holzforschung*. 51(2):135-141. English. [UNIV ROVIRA & VIRGILI ESCOLA TECN SUPER ENGN QUIM DEPT ENGN QUIM AUTOVIA SALOU S-N TARRAGONA 43006 CATALUNYA SPAIN].

Lignin was produced from wheat straw via a fractionation process based on a steam explosion pretreatment followed by an alkali delignification stage. The yield and chemical composition of the resulting lignin samples were related to the conditions of the pretreatment stage. Temperature and time were grouped into a single reaction ordinate, Ro, by using the reaction severity concept. Increasing the severity of the pretreatment causes the lignin yield to increase in the severity range studied, from  $\log(10)R(0) = 3.39$  to 4.13. The methoxyl and aliphatic alcohol contents decreased as the pretreatment became more severe. The apparent molecular weight distribution (polystyrene-equivalent) was bimodal for all the samples. The yield of the alkali-extracted lignin obtained at the optimum severity for hemicellulose and cellulose recovery ( $\log(10)R(0) = 3.80$ ) was 70.5% of the Klason lignin in wheat straw, while the C-9 structure calculated for this material was:  $C_9H_7.08O_2.40N_0.09$  ( $COCH_3$ )(0.81)(OH)(1.05)( $COCH_3$ )(0.005). [References: 36].

4424 Williams, B.A.; Vanderpoel, AFB.; Boer, H.; Tamminga, S. (1997) **THE EFFECT OF EXTRUSION CONDITIONS ON THE FERMENTABILITY OF WHEAT STRAW AND CORN SILAGE.** *Journal of the Science of Food & Agriculture*. 74(1):117-124. English. [AGR UNIV WAGENINGEN DEPT ANIM NUTR WIAS MARIJKEWEG 40 NL-6709 PG WAGENINGEN NETHERLANDS].

Wheat (*Triticum aestivum* L) straw and corn (*Zea mays* L) silage were extruded under variable conditions of temperature and screw speed. The resulting extrudates were then tested for their fermentability according to cumulative production of gas, and compared with each other and with the untreated material. VFA analysis was carried out at the end of fermentation, to assess the pattern of fermentation. Analysis of the cumulative gas curves showed significant differences between substrates. Extrusion treatment also led to significant differences, though the effect of screw speed and temperature were not always consistent. However, most differences in cumulative gas production were negative, particularly for wheat straw, which suggests that, under the conditions used, extrusion actually reduced the fermentability of the fibres. [References: 25].

4425 Yadav, B.S. (Haryana Agricultural Univ., Hisar (India). Dept. of Animal Nutrition); Virk, A.S. (1994) **The fixation of nitrogen using acid, green forage and germinated barley during urea treatment of straws.** *Animal Feed Science and Technology (Netherlands)* v. 50(1-2) p. 123-135. 35 ref. English. (AGRIS 97-085138).

## Q55 FEED ADDITIVES

4426 Crestini, C.; Argyropoulos, D.S. (1997) **STRUCTURAL ANALYSIS OF WHEAT STRAW LIGNIN BY QUANTITATIVE P-31 AND 2D NMR SPECTROSCOPY - THE OCCURRENCE OF ESTER BONDS AND ALPHA-O-4 SUBSTRUCTURES.** *Journal of Agricultural & Food Chemistry*. 45(4):1212-1219. English. [MCGILL UNIV DEPT CHEM MONTREAL PQ H3A 2A7 CANADA].

By combining mild alkaline hydrolysis with quantitative P-31 NMR we have been able to arrive at a protocol for determining the various ester linkages and their relative contributions to the overall structure of wheat straw lignin. Additional information on the identity and location of these bonds was sought by the application of GC/MS and two-dimensional C-13-H-1 heterocorrelation NMR experiments. Milled straw lignin was found to contain about 12 ester units per 100 phenylpropane units. Approximately 77% of the carboxyl fraction of these ester bonds was found to be composed of p-coumaric acid while the rest was other aromatic acids bound to lignin via intra- and/or intermolecular ester bonds. In contrast, the hydroxyl fraction of the ester bonds was found to be almost exclusively aliphatic. A small fraction (about 1.6%) of the milled straw lignin units was found to be esterified through the phenolic hydroxyl groups of C-5 condensed phenolic units. The application of C-13-H-1 correlative NMR experiments revealed that acylation occurs only at the gamma-position of the lignin side chain. Detailed studies of two-dimensional HOHAHA and HMQC experiments failed to show evidence for the presence of alpha-O-4 substructures in milled wheat straw lignin. [References: 48].

## Q60 PROCESSING OF NON-FOOD OR NON-FEED AGRICULTURAL PRODUCTS

4427 Muller, J.J. (Max Delbrück Centre for Molecular Medicine, Berlin, Germany.); Gernat, C.; Schulz, W.; Muller, E.C.; Vorwerk, W.; Damaschun, G. (1995) **Computer simulations of X-ray scattering curves: gelation and crystallization process in amylose solutions.** *Biopolymers (USA)* v. 35(3) p. 271-288. references. English. (AGRIS 97-085212).

Small- and wide-angle X-ray scattering is used for structural characterization of amylose solutions and gels. Recently published coordinates determined by X-ray fiber structure analysis and electron diffraction [A. Imberty and S. Perez (1988) *Biopolymers*, Vol. 27, pp. 1205-1212; H.C. Wu and A. Sarko (1978) *Carbohydrate Research*, Vol. 61, pp. 7-40], X-ray crystallography [W. Hinrichs and W. Saenger (1990) *Journal of the American Chemical Society*, Vol. 112, pp. 2789-2796], and theoretically calculated atomic coordinates for energy-minimized conformers of amylose molecules in solution and crystals served to simulate small- and wide-angle X-ray scattering curves. The simulation of scattering curves renders possible a quick screening and detection of special features in experimental curves and the decision of whether they are significant or not. The scattered intensities of the models were calculated using the atomic scattering factors and van der Waals radii within the framework of the improved cube method [J.J. Muller (1983) *Journal of Applied Crystallography*, Vol. 16, pp. 74-82]. All model data and the scattering curves are stored for a fast information retrieval in the database OBIOSCAT controlled by the ORACLE management system. In the context of a mixture of different structures existing in an amylose solution or gel, the parallel-stranded left-handed B-form double helices (Imberty and Perez) do not scatter in a way that is significantly different from that of the parallel-stranded right-handed duplex proposed by Wu and Sarko. The structure of the energy-minimized left-handed parallel-stranded double helix is very similar to that of the canonical B form, but energy-minimized right-handed duplexes with parallel or antiparallel strands have structures that produce new scattering features. Up to now, such features have not been experimentally detected. Extended or collapsed single helices, too, can be discriminated by their scattering features from double helices.

## Q70 PROCESSING OF AGRICULTURAL WASTES

4428 Rosenwinkel, K.H. (1996) **[Recovery of residues from production and wastewater of the foodstuff industry].** *Rueckgewinnung von Reststoffen aus der Verarbeitung und den Abwässern aus der Lebensmittelindustrie. Workshop "Unkonventionelle Futtermittel". Braunschweig-Voelkenrode (Germany). 10-11 Apr 1996. [Unconventional feedstuffs].* Flachowsky, G.; Kamphues, J. (eds.). *Unkonventionelle*



Futtermittel/Landbauforschung Voelkenrode. Sonderheft (Germany); no. 169. Hannover Univ. (Germany). Inst. fuer Siedlungswasserwirtschaft und Abfalltechnik p. 218-230. FAL. 3 ill., 5 tables; 10 ref. German. (AGRIS 97-085320).

Anfallende Produktverlust- und Reststoffmengen und -frachten aus der Lebensmittelindustrie (Brauerei, Milchindustrie, Staerkeindustrie). Es werden technische Moeglichkeiten und Verfahren der Rueckgewinnung aufgezeigt und praktische Beispiele erwaeht (Biomasse aus Kartoffelfruchtwasser, Abwasserbehandlung u. Ressourcenwiedergewinnung durch Algenproduktion, Reinigung von Abwaessern der Fischindustrie).

## S20 PHYSIOLOGY OF HUMAN NUTRITION

4429 Grusak, M.A. (1997) INTRINSIC STABLE ISOTOPE LABELING OF PLANTS FOR NUTRITIONAL INVESTIGATIONS IN HUMANS [Review]. *Journal of Nutritional Biochemistry*. 8(4):164-171. English. [BAYLOR COLL MED USDA ARS CHILDRENS NUTR RES CTR DEPT PEDIAT 1100 BATES ST HOUSTON, TX 77030 USA].

Although plant foods provide an array of nutrients in the human diet, our knowledge of how efficiently these nutrients are absorbed has been limited by our ability to selectively monitor their absorption from a complex food matrix. Intrinsic labeling of plants with low-abundance stable isotopes can provide a safe, traceable product to investigate absorptive phenomena in the gut. Various techniques, including hydroponic culture, stem injection, and atmospheric labeling, have been used to introduce isotopes of either minerals or carbon to the plant. New, alternative possibilities exist for labeling plants with deuterium through the use of heavy water or for using isolated root cultures. Each labeling situation offers some unique concern, related to the plant, the nutrient, or the isotope expense, that must be addressed to generate a useful and affordable product. Attention to the mechanisms and pathways by which a specific nutrient is transported throughout the plant will aid in the selection of an effective labeling approach that will (1) maximize the recovery of isotope in the edible tissues, and (2) ensure that the isotope is incorporated into endogenous compounds and compartments in the same manner as that of the normal high-abundance isotopes. Intrinsically labeled plants may be used in an unlimited number of human bioavailability investigations focusing on essential nutrients, secondary plant metabolites, or unique phytochemicals. (C) Elsevier Science Inc. 1997. [References: 70].

## S30 DIET AND DIET-RELATED DISEASES

4430 Forssell, F.; Wieser, H. (1995) [Spelt wheat and coeliac disease]. *Dinkel und Zoeliakie. Zeitschrift fuer Lebensmittel-Untersuchung und -Forschung (Germany)* v. 201 p. 35-39. 4 ill., 2 tables; 20 ref. German. (AGRIS 97-071086).

Ueber Dinkel (*Triticum spelta* L.) liegen bezueglich seiner Wirkung auf Zoeliakiekranken keine Untersuchungen vor. Da eine klinische Testung aus ethischen Gruenden nicht in Betracht kommt, wurden Dinkel und Weichweizen (*Triticum aestivum* L.) in den fuer die Zoeliakieausloesung relevanten N-terminalen Sequenzen der alpha-Gliadine verglichen. Uebereinstimmende Retentionszeiten bei der HPLC und Aminosaeurezusammensetzungen der entsprechenden Peptide weisen darauf hin, dass auch in einem laengeren N-terminalen Abschnitt der alpha-Gliadine von Dinkel und Weichweizen, identische Sequenzen

vorliegen. Es muss daher davon ausgegangen werden, dass auch Dinkel Zoeliakie ausloest und von Zoeliakiekranken gemieden werden muss.

## S40 NUTRITION PROGRAMMES

4431 Thienpont, C. (Hartwick College.) (1996) Production yields up, too: corn, soybean, apple, wheat prices head higher. *FoodService director (USA)* v. 9(10) p. 94. English. (AGRIS 97-071430).

## T01 POLLUTION

4432 Addiscott, T.M. (1996) Fertilizers and nitrate leaching. *Issues in Environmental Science and Technology (United Kingdom)* v. 5 p. 1-26. 42 ref. Agricultural chemicals and the environment. English. (AGRIS 97-071568).

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Scanning probe microscopes (SPMs) are a family of related instruments which can produce high-resolution images of structures at the molecular and atomic levels. Their main impact so far has been in surface science, but they also have tremendous potential for the study of biomolecules. In this article we will briefly introduce the properties and principles of these instruments, and then discuss a range of preliminary studies from our laboratories in relation to future applications in cereal science. [References: 29].



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