

Literature Update on Wheat, Barley, and Triticale



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CIMMYT



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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.

**Roger Rowe
Acting Director General, CIMMYT**

**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 ← 4
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* ← 6
Science. 123(Part 2):175-183. English [CIMMYT WHEAT PROGRAM ← 8
7 —→ 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 ← 8
Investigaciones en Granos y Semillas); Sterling, F.; Herrera, J. (1992) ← 3
4 —→ [Evaluation of the vigor in maize seeds and its relationship with the
behaviour in the field]. *Evaluacion del vigor en semillas de maiz y su* ← 5
relacion con el comportamiento en el campo. *Agroñomia Costarricense* ← 6
7 —→ (Costa Rica) v. 16(2) p. 203-210. 20 ref.; graf. Spanish. (AGRIS 94- ← 9
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, ← 8
Chapingo, Mex. 56230 (Mexico)), (1992) [Economic aspects of agricultural ← 4
3 —→ research in relation to the production of wheat in Mexico]. Aspectos ← 5
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.)
6 —→ (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
9 —→ 94-114649). ← 7

- | | |
|--|---|
| 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 |
| 5 Original title (only in entries
retrieved from AGRIS) | for entries 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. 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

2361 [CIMMYT in 1993: Helping the poor through innovative agricultural research]. CIMMYT in 1993 (CIMMYT) (1994) Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). CIMMYT in... (CIMMYT) 24 p. CIMMYT. 2 tables; 3 graphs., 15 ill. English. (AGRI 95-061416).

A non-technical annual report presenting a cross-section of innovative agricultural research by the International Maize and Wheat Improvement Center (CIMMYT). The report contains an overview by the Director General, 12 brief articles about CIMMYT's work, 8 highlights of other Center activities, financial highlights from 1993, a list of principal staff and trustees, and a complete list of the Center's outreach offices.

2362 Kang, Y.S. (Rural Development Administration, Suwon (Korea Republic). Crop Experiment Station) (1993) Wheat researches in China. *Journal of the Korean Society of International Agriculture (Korea Republic)* v. 5(2) p.99-113. 3 illus.; 6 tables; 9 ref. Korean. (AGRI 95-061433).

B50 HISTORY

2363 Miskelly, D.; Trumper, A. (Goodman Fielder Mills, Summer Hill (Australia)) (1994) Some historical perspectives of [wheat] flour milling in NSW [New South Wales]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 511. English. (AGRI 95-045968).

C10 EDUCATION

2364 Hides Pearson, K. (1992) From soil to satisfaction: the bread we eat. New South Wales Agriculture. Illus., fig., tables. vp. English. (AGRI 95-061546).

Comprises a kit designed as a teaching resource for junior secondary students. Included are a teacher's manual, student workbook and videotape presentation. The programme looks at all aspects of farming and cereal growing from the point of view of bread production.

C20 EXTENSION

2365 Hartley, R. (New South Wales Agriculture, Tamworth (Australia)) (1993) Encourage wheatgrowers to adopt wiser practices to benefit themselves, their community and the wider community. New South Wales Agriculture. 2 tables. 13 p. English. (AGRI 95-061581).

Details the origin, strategies and outcomes of a particular extension program designed to assist wheat farmers to improve the quality and yield of their wheat crops while minimising soil degradation. All aspects of the conception, advertising and marketing of the program and the collection of data and the results and assessment of its effectiveness are included.

2366 Suge, H. (Tohoku Univ., Sendai (Japan). Inst. of Genetic Ecology) (1993) Use of gravitropic mutants in barley (*Hordeum vulgare*) and pea (*Pisum sativum*) for the study of space botany. *Gamma Field Symposia (Japan)* (no.31) p. 85-95. 1 table; 7 fig.; 10 ref. English. (AGRI 95-046043).

E10 AGRICULTURAL ECONOMICS AND POLICIES

2367 Byerlee, D.; Traxler, G. (1995) NATIONAL AND INTERNATIONAL WHEAT IMPROVEMENT RESEARCH IN THE POST-GREEN REVOLUTION PERIOD - EVOLUTION AND IMPACTS. *American Journal of Agricultural Economics*. 77(2):268-278. English. [WORLD BANK DEPT AGR & NAT RESOURCES WASHINGTON, DC 20433 USA].

The role of IARC-generated technology in the global system of spring wheat improvement is examined for the period, 1977-90. Nine of the thirty-eight developing countries that produce spring wheat demonstrate the capacity to develop varieties from their own crosses; the other countries focus on screening CIMMYT germplasm for direct release. Over 40% of spring wheat area is sown to "direct transfer" CIMMYT varieties, indicating that CIMMYT research remains an important complement to NARS research. An ex post rate of return above 50% is estimated for wheat

research investments in developing countries, with the highest returns occurring in the South Asia region and in irrigated and high-rainfall environments. Future returns above 35% are projected. [References: 38].

2368 Kang, TH.; Brorsen, BW. (1995) VALUING TARGET PRICE SUPPORT PROGRAMS WITH AVERAGE OPTION PRICING. *American Journal of Agricultural Economics*. 77(1):106-118. English. [OKLAHOMA STATE UNIV DEPT AGR ECON STILLWATER, OK 74078 USA].

The U.S. government deficiency payment program supplements farm income by transferring income from taxpayers to farmers. When revenue lost due to the acreage restriction exceeds revenue gained from participating in the program, farmers lose money by participating. Therefore, measuring expected revenue from the government program is important so that farmers can decide whether to participate in the program. This study uses a GARCH average-option pricing model and the Black average-option pricing model to predict the implicit premium of the U.S. government deficiency payment program. The average-option pricing model considers the average price of the underlying asset over a fixed period. A regression model based on the simulation results is provided so that the average-option models can be easily used to project deficiency payments. The results can be used by extension economists to help producers decide whether to participate in the program. [References: 46].

2369 Mehier, C. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Consequences of the Common Agricultural Policy reform and devaluation in Italy: the plain of Po river]. *Reforme de la PAC et devaluation (en Italie). Perspectives Agricoles (France)* (no 184) p. 6-9. 5 tableaux. French. (AGRI 95-046379).

2370 Paarlberg, PL. (1995) AGRICULTURAL EXPORT SUBSIDIES AND INTERMEDIATE GOODS TRADE. *American Journal of Agricultural Economics*. 77(1):119-128. English. [PURDUE UNIV W LAFAYETTE, IN 47907 USA].

In this paper I examine the effects of export subsidies when a bulk commodity is an intermediate good which is either exported or processed into a higher-value agricultural good for domestic or export sale. The analysis shows that while the industry producing the subsidized good benefits, the industry producing the other good may not. A bulk commodity export subsidy may lower the price of the higher value agricultural commodity. An export subsidy on the higher-value agricultural commodity may lower the bulk commodity's price. The outcome depends on the relative excess supply and excess demand elasticities and on the market structure. [References: 14].

2371 Traxler, G.; Falckzepeda, J.; Ortizmonasterio, J.; Sayre, K. (1995) PRODUCTION RISK AND THE EVOLUTION OF VARIETAL TECHNOLOGY. *American Journal of Agricultural Economics*. 77(1):1-7. English. [AUBURN UNIV DEPT AGR ECON & RURAL SOCIOL AUBURN, AL 36849 USA].

A just-Pope production function is used to estimate the effect of genetic improvement on the first two moments of wheat yield for the period 1950-86. The model characterizes the green revolution as the culmination of an era in which wheat breeders achieved rapid increases in yield potential accompanied by higher yield variances. To date, the post-green revolution has been an era of slower mean yield growth, but of relatively rapid improvement in yield stability. Overall, the analysis indicates steady progress in producing "better" varieties; successive releases have improved either stability, mean yield, or both. [References: 38].

E16 PRODUCTION ECONOMICS

2372 Ansard, C. (Unigrains (France)); Camaret, D.; Perrot, D. (1993) [Production of all cereal crops in East Europe]. *Quel est le potentiel cerealier des pays de l'Est ? Perspectives Agricoles (France)* (no 177) p. 10-21. 12 ref., 11 tableaux. French. (AGRI 95-046793).

2373 Bonnemort, C. (Institut Technique des Cereales et des Fourrages, Paris (France)); Drieu, Y.; Mangin, M. (1993) [Wheat crops in Rhone-Alpes and Saone-et-Loire areas (France)]. *Coûts de production: la culture du ble en Rhone-Alpes et Saone-et-Loire. Perspectives Agricoles (France)* (no 186) p. 40-55. 11 tableaux. French. (AGRI 95-046801).

2374 Melo Filho, G.A. de; Richetti, A.; Kruker, J.M. (1994) [Wheat production costs valuation, 1994 harvest]. *Estimativa de custo de producao de trigo, safra 1994*. Centro de Pesquisa Agropecuaria do Oeste, Dourados, MS (Brazil). *Comunicado Tecnico - Centro de Pesquisa Agropecuaria do Oeste (Brazil)*; no. 3 2 p. Portuguese. (AGRIS 95-046727).

2375 Moynier, J.L. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Production costs of wheat crop (France)]. *Les charges du ble passees au scanner (France)*. *Perspectives Agricoles (France)* (no 179) p. 11-19. 7 tableaux, 14 graph. French. (AGRIS 95-046798).

2376 Popovic, Lj. (Poljoprivredni fakultet, Novi Sad (Yugoslavia)) (1994) [Some characteristics of wheat and maize production in Vojvodina (Yugoslavia) (1956-1990)]. *Obelezja proizvodnje pšenice i kukuruza u Vojvodini [Jugoslavija] (1956-1990)*. *Savremena poljoprivreda (Yugoslavia) v. 42(1-2)* p. 129-134. 2 graphs; 4 tables; 7 ref. Serbian. (AGRIS 95-046753).

In Vojvodina (Yugoslavia), the acreage under wheat averages around 400,000 ha, showing the tendency of falling. The average wheat yield is around 3.7 t/ha, growing at the rate of 3.60. Total annual wheat production averages over 1.4 million tons, the rate of growth being 2.78. The social sector is more important in this production, than the private one. Maize is grown on nearly 650,000 ha and this acreage is in stagnation. Annual yield averages 4.73 t/ha, growing at the average rate of 2.00 per year. The yield growth is faster in the private sector (2.9) than in the social sector. Total annual maize production is over 3 million tons (of maize kernel). The private sector is the major subject of this production. The genetic potential of wheat and maize in Vojvodina is not sufficiently used.

2377 Singh, A.J.; Harrington, L. (Punjab Agricultural Univ., Ludhiana 141004 (India). Dept. of Economics and Sociology) (1994) Trends in total factor productivity in Indian agriculture implications for farming systems research. 3. Asian Farming Systems Symposium; Manila (Philippines); 7-10 Nov 1994. *Abstracts of papers presented at the third asian farming systems symposium; theme: conservation and equitable growth: the challenge for farming systems*. Department of Agriculture, Diliman, Quezon City (Philippines). Asian Farming Systems Association; Dept. of Science and Technology, Bicutan, Taguig, Metro Manila (Philippines) p. 11. DA; DOST. Received Dec 1994. English. (AGRIS 95-061941).

The present study examines the trends in total factor productivity for crop sector across states and overtime for India. It shows that total factor productivity for crop sector has declined consistently for all the states overtime. Thus, viewed from the economic standpoint crop production has become unsustainable. However, trends in partial productivity indicate that land and labour productivity have been increasing over time whereas capital productivity has been declining. The trends in total factor productivity are found to be increasing for the two cereal crops- wheat and paddy which have experienced technological breakthroughs. From the standpoint of ecological security, trends in land productivity are of critical importance. These trends need to be interpreted on the basis of trends in productivity per unit area in conjunction with the trends in soil degradation and water depletion.

2378 Wehland, W. (1993) [To cultivate winter barley instead of rape? Cultivation programme of 1993/94]. *Wintergerste statt Raps anbauen? Anbauplan 1993/94*. *Top agrar (Germany)* (no.8) p. 22-24. 1 ill., 1 table. German. (AGRIS 95-046759).

2379 Workneh Negatu; Mwangi, W.; Tesfaye Tesema (1992) Farmers' varietal preferences for durum wheat in Ada, Lume and Gimbiu Woredas. *Ethiopian Journal of Agricultural Science (Ethiopia) v. 13(1-2)* p. 88-100. 10 tables; 7 ref. English. (AGRIS 95-061926).

A survey of 144 farmers was undertaken in Ada, Lume and Gimbiu woredas to identify the durum wheat varieties grown by farmers and the quality characteristics they seek in them. Sixty-four percent of the sample farmers had formerly grown 27 durum wheat local varieties. By 1990/91 only 5 percent were growing local varieties. Aphid attack, lack of seed and susceptibility to rust diseases were identified as the main reasons for abandoning the traditional varieties. In the 1990/91 season, 94 percent of the sample farmers grew five improved wheat varieties: Boohai, Cocorit, Gerardo, Enkoy and Israel. The first three are durums while Enkoy and Israel are bread wheats though farmers do not differentiate them from durum wheat. Israel was rated highly because of its high yield, desirable grain color, bread quality, strong and long straw, disease tolerance,

performance in light soil, frost tolerance and marketability. Although farmers' varietal preferences clearly show regional differences, there are varietal characteristics that transcend all the three woredas. These are grain size (big), good grain color (amber), early maturity, strong and long straw, straw palatability, food quality (mainly injera, kunche and kolo) and marketability. In most cases, farmers' actual allocation of the land reflected their varietal preferences. The main implication from this study is that for durum wheat breeders to succeed, they will have to pay special attention to those characteristics that are important to farmers.

2380 Zapata, H.O.; Frank, D. (1993) Agricultural statistics and prices for Louisiana, 1986-1992. *A.E.A. information series (USA)*; no. 116 73 p. English. (AGRIS 95-046719).

E20 ORGANIZATION, ADMINISTRATION AND MANAGEMENT OF AGRICULTURAL ENTERPRISES OR FARMS

2381 Briffaux, G. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1994) [Wheat crops in Champagne chalks]. *Ble en Champagne crayeuse*. *Perspectives Agricoles (France)* (no 190) p. 25-34. 11 graph. French. (AGRIS 95-062073).

2382 Choi, J.S.; Helmberger, P.G. (1993) How sensitive are crop yields to price changes and farm programs? *Journal of agricultural and applied economics (USA) v. 25(1)* p. 237-244. references. English. (AGRIS 95-062012).

A two-stage approach is used to estimate sensitivity of corn, wheat, and soybean yields to changes in prices and land idled. Estimated elasticity of demand for fertilizer per acre with respect to expected output price equals 0.47, 0.10, and 0.82 for corn, wheat, and soybeans. Upper estimates of the elasticity of yield with respect to fertilizer equals 0.58, 0.29, and 0.16 for corn, wheat, and soybeans. Yields are found to be quite insensitive to price changes. Fertilizer demands and yields are insensitive to land idled under farm programs.

2383 Murphy, M.C. (Agricultural Economics Unit, Department of Land Economy, 16 21 Silver Street, Cambridge CB3 9EL, UK) (1993) Report on farming in the eastern counties of England 1992/93. Agricultural Economics Unit, Department of Land Economy, University of Cambridge. 211 p. English. (AGRIS 95-062061).

2384 Sourie, J.C. (Institut National de la Recherche Agronomique, Thiverval Grignon (France). Centre de Grignon Massy Paris, Economie et Sociologie Rurales); Hautcolas, J.C.; Brayot, D. (1994) [Opportunity cost method for energy crops]. *Cultures energetiques: incidences sur le revenu agricole des exploitations*. *Perspectives Agricoles (France)* (no 190) p. 17-24. 6 ref., 8 tableaux. French. (AGRIS 95-062072).

E70 TRADE, MARKETING AND DISTRIBUTION

2385 Adam, B.D.; Anderson, K.; Olbert, E. (1994) The effects of government storage programs on profitability of storage hedges. *Current farm economics (USA) v. 67(1)* p. 3-13. references. English. (AGRIS 95-047320).

2386 Bangsund, D.A.; Sell, R.S.; Leistritz, F.L. (1994) Economic contribution of the wheat industry to the Minnesota economy. *Agricultural economics report (USA)*; no. 312 81 p. Dept. of Agricultural Economics, Agricultural Experiment Station, North Dakota State University. ill., maps. bibliographical ref.(p. 43-46). Cover title. "February 1994.". English. (AGRIS 95-062352).

2387 Hoffmann, J. (1994) [Onions instead of winter barley?]. *Zwiebeln statt Wintergerste? Speisewiebeln fuehrend im Verbrauch. dlz. Die landwirtschaftliche Zeitschrift fuer Produktion - Technik - Management (Germany) v. 45(5)* p. 97-99. 2 ill., 1 table. German. (AGRIS 95-062412).

2388 Lindloff, V. (1994) [Brewer's barley: price poker when making contracts]. *Braugerste: Preis poker bei Vorvertraegen*. *Top agrar (Germany) (no.3)* p. 153-154. 1 ill., 1 table. German. (AGRIS 95-047437).

2389 Lindloff, V. (1993) [More money by exact supervision of protein [barley]]. Mehr Geld durch genaue Kontrollen beim Eiweiss. *Top agrar (Germany)* (no.8) p. 26-28. 1 ill., 1 graph, 1 table. German. (AGRI 95-047436).

2390 Martin, G. (1993) [Quality and outlet of wheat in Germany]. Qualite et debouches du ble en Allemagne. Institut Technique des Cereales et des Fourrages, Paris (France). *Perspectives Agricoles (France)* (no 182) p. 27-32. 6 graph. French. (AGRI 95-047319).

2391 Martin, G. (Institut Technique des Cereales et des Fourrages, Paris (France)); Bar, C. (1993) [Wheat for biscuit industry]. Les bles biscuitiers: une notion complexe de la qualite. *Perspectives Agricoles (France)* (no 178) p. 19-22. 5 ref. French. (AGRI 95-047438).

E71 INTERNATIONAL TRADE

2392 Anon. (1994) [Smaller world wheat production predicted]. Kleinere Welt-Weizenproduktion wahrscheinlich. *Agra-Europe (Germany); Markt und Meinung* v. 35(36) p. 17-21. 2 tables. German. (AGRI 95-047542).

2393 Hui, J.; McLean Meynsse, P.E. (1994) A price analysis of U.S. agricultural exports in east Asian markets. *Journal of international food and agribusiness marketing (USA)* v. 6(1) p. 17-31. references. English. (AGRI 95-062458).

2394 Lelong, C. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Italy: the largest client for French grain]. L'Italie: le premier marche pour les cereales francaises. *Perspectives Agricoles (France)* (no 177) p. 22-26. 7 tableaux, 5 graph. French. (AGRI 95-047540).

2395 Oishi, A. (Nihon Univ., Tokyo (Japan)) (1994) An analysis on the relationships of imports of wheat and wheat products to Japanese industries. *Journal of Agricultural Development Studies (Japan)* v. 4(2) p. 72-80. 4 tables; 11 ref. Japanese. (AGRI 95-062457).

2396 Yang, S.R.; Wilson, W.W. (1994) Impacts of wheat export strategies on market shares. *Agricultural economics report (USA)*; no. 313 25 p. Dept. of Agricultural Economics, Agricultural Experiment Station, North Dakota State University. ill. bibliographical ref.(p. 21-23). Cover title. "January 1994". English. (AGRI 95-062460).

F01 CROP HUSBANDRY

2397 [Areas of cereals and oleiferous plants sown in the autumn of 1994 [objective crop yield surveys]]. Hoestsadda arealer 1994. Rapport fraan de objektiva skoerdeuppskattingarna (1994) Statistiska Centralbyraan, Stockholm (Sweden). *Statistiska Meddelanden. Serie J, Jordbruk, Skogsbruk och Fiske (Sweden)*; no. 12.8 4 p. SCB. Chiefly tables. Swedish. (AGRI 95-047852).

2398 [Conference about wheat production in Serbia (Yugoslavia) in the 1994-1995 period: [Proceedings]]. Savetovanje o proizvodnji pšenice u Srbiji (Jugoslavija) u 1994/95. godini: [Zbornik radova] (1994) Savetovanje o proizvodnji pšenice; Beograd (Yugoslavia); 16 Sep 1994. Institut za primenu nauke u poljoprivredi, Beograd (Yugoslavia). Institut za primenu nauke u poljoprivredi. Graphs; Tables; Bibliography at every paper. 90 p. Serbian. (AGRI 95-047839).

2399 [Crop yields per hectare and total yields in 1994]. Hektarskoerda och totalskoerda 1994. Rapport fraan de objektiva skoerdeuppskattingarna. Definitiva resultat (1995) Statistiska Centralbyraan, Stockholm (Sweden). *Statistiska Meddelanden. Serie J, Jordbruk, Skogsbruk och Fiske (Sweden)*; no. 12.1 22 p. SCB. Chiefly tables. Swedish. (AGRI 95-047851).

2400 Wheat: production, relative importance in the region and per capita production levels (1993) Working Document (CIAT); no. 128 p. 203-208. CIAT. ill. p. 203-208. English. (AGRI 95-062646).

2401 [Plant growth substances cards]. Fiches regulateurs de croissance [pour cereales] (1994) Institut Technique des Cereales et des Fourrages,

Paris (France). *Perspectives Agricoles (France)* (no 188) p. 75-78. 3 p. p. seulement. French. (AGRI 95-062727).

Studied products: Arvest (chlormequat chloride + ethephon), Moddus (trinexapac - ethyl), Sonis (trinexapac - ethyl + ethephon).

2402 [Triticale cultivation in different areas]. Triticale: region par region, les conduites de culture (1994) Institut Technique des Cereales et des Fourrages, Paris (France). *Perspectives Agricoles (France)* (no 188) p. 22-32. 11 illus., 5 tableaux. French. (AGRI 95-062659).

2403 Amanuel Gorfu (IAR, Addis Abeba (Ethiopia)) (1994) An Analysis of Long-term Constraints to Wheat Production in Ethiopia. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (ed.) p. 35-40. CIMMYT. 8 ref. English. (AGRI 95-062602).

Ethiopia produces wheat on an area of about 750,000 ha. UP to 60 percent of this area is occupied by durum wheat, while bread wheat covers the remaining 40 percent. The average national wheat yield for peasant farmers is about 1.1 t/ha, whereas that of the state farms is about 2 t/ha. Low yields are attributable to certain technical and socio-economic constraints such as low soil fertility, weeds, diseases and pests, varieties, moisture stress, unavailability of inputs, seasonal labor shortages, draft power shortage, inadequate credit systems, and the weak linkage between research and extension.

2404 Andersen, B. (1995) [Survey 1994, D: Soil treatment]. Oversigt 1994, D: Kulturteknik. Landsudvalget for Planteavl, Aarhus (Denmark). *Oversigt over Landsforsogene (Denmark)* (no.1994) p. 75-79. 4 tables. Suppl. tables in Markforsog (Denmark) 1994, part D, p. 278-285. Danish. (AGRI 95-048066).

2405 Antapa, P.L. (Hanang Wheat Complex, Katesh (Tanzania)) (1994) An Analysis of Research Required to Address Constraints to Rainfed, Large-scale, Mechanized Wheat Production in Northern Tanzania. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (ed.) p. 47-61. CIMMYT. 7 tables; 12 ref. English. (AGRI 95-062645).

Wheat production under rainfed conditions at the Hanang Wheat Complex (HWC) farms in Northern Tanzania started during the mid-seventies under the sponsorship of the Governments of Canada and Tanzania. The objective of the project is for Tanzania to attain Self-sufficiency in wheat production (Nielsen, 1982). In total there are seven farms, namely Basotu, Setchet, Mulbadow, Murjanda, Gawal, Gidagnmowed and Waret, with the goal of each reaching 4,000 ha per farm. Average grain yield for the past 10 years is approximately 1.64 t/ha. Major soils of the area include Vertisols and vertic intergrades which occupy nearly 50 percent of the cultivated land. Among other agronomic problems, soil erosion as well as decreasing amounts of precipitation over current years have been the major limitations to wheat production in the area. Current efforts to control soil erosion include the introduction and evaluation of broad based terraces and an emphasis on the use of minimum tillage. Availability of suitable wheat cultivars and poor weed control techniques are among the major production constraints at the area. Another constraint is the availability of an efficient and reliable market for the produced wheat. Efforts to control most of these problems are being made through collaborative research by SARI and the HWC Agronomy department.

2406 Beese, G. (Saechsische Landesanstalt (Germany)); Kasper, W. (1994) [Variety tests of winter barley: four-rowed varieties were the better ones in 1994]. Landessortenversuche Wintergerste: Vierzeilige Sorten waren '94 ueberlegen. *Top agrar / Spezial fuer Mecklenburg-Vorpommern, Brandenburg, Sachsen-Anhalt, Sachsen, Thuringen (Germany)* (no.8) p. 20-22. 1 table. German. (AGRI 95-047872).

2407 Boisgontier, D. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Wheat sowing: crop establishment]. Semis: assurer des le depart [l'implantation du ble]. *Perspectives Agricoles (France)* (no 183) p. 19-23. 5 ref. French. (AGRI 95-047850).

2408 Briffaux, G. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Attempt to obtain high protein levels in wheat grain in the chalky soils of Champagne area]. *Champagne crayeuse. Faire des proteines: le grand ecart. Perspectives Agricoles (France) (no 182) p. 64-72. 9 graph. French. (AGRI 95-048020).*

2409 Burt, OR. (1995) **POOLING EXPERIMENTS OVER TIME TO QUANTIFY THE DYNAMICS OF DRYLAND WINTER WHEAT YIELD RESPONSE.** *Agronomy Journal. 87(2):156-164. English. [UNIV CALIF DAVIS DEPT AGR ECON DAVIS, CA 95616 USA].*

This research had a dual purpose: (i) statistical estimation of winter wheat (*Triticum aestivum* L.) yield response as a function of plant available water and applied N fertilizer from an 8-yr experiment in northcentral Montana and (ii) illustration of the modeling methods that are appropriate in this type of research. Summer-fallowed and re-cropped treatments were pooled to obtain an indirect estimate of the extra amount of N made available by summer fallow, as well as to improve the implicit experimental design by providing the necessary variation in plant available water, particularly soil water at seeding. The statistical model was nonlinear regression with an error components disturbance term entering multiplicatively. A new flexible functional form is presented for crop response; it is a polynomial generalization of the Mitscherlich single-factor equation. A major task was to validate the regression model by considering various types of specification errors, such as accounting for all concomitant factors associated with pooling the experiments over time. Mineralized N during summer fallow was found to be a negatively sloped linear function of precipitation during the fallow period; the average amount was 24.5 kg ha⁻¹. Nitrogen and water have strong interactions in shaping the yield response surface, and at high levels of both factors, more of either depresses yield. The depressing effect of N on yield at very low levels of water was clearly discerned. [References: 21].

2410 Butler, J.H.A.; Spouncer, L.; Reuter, D. (Commonwealth Scientific and Industrial Research Organisation, Glen Osmond (Australia). Div. of Soils); Correll, R.L. (Commonwealth Scientific and Industrial Research Organisation, Glen Osmond (Australia). INRE Biometrics Unit); Dyson, C. (South Australian Research and Development Inst., Adelaide. Northfield Research Lab.) (1994) **Factors affecting grain protein - a survey approach [wheat: South Australia].** [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 501. English. (AGRI 95-048025).*

2411 Chen Yongjie; Duan Yutian; Jia Wenlan (Shanxi Provincial Academy of Agricultural Sciences, Linfen (China). Inst. of Wheat) (1994) **Main limiting factors of high yield on late sowing wheat.** *Journal of Shanxi Agricultural Sciences (China) v. 22(2) p. 9-12. 3 tables, 5 ref. Chinese. (AGRI 95-047831).*

2412 Couvreur, F. (Institut Technique des Cereales et des Fourrages, Paris (France)); Robert, D. (1993) [Wheat: time of sowing and sowing rate]. *L'epoque de semis [du ble] conditionne la densite. Perspectives Agricoles (France) (no 183) p. 8-12. French. (AGRI 95-048021).*

2413 Du Guijuan; Wang Weigang; Li Liming (Liaoning Provincial Academy of Agricultural Sciences, Shenyang (China). Inst. of Crop Cultivation) (1994) **Morphological and yield-increasing effect of paclobutrazol on spring wheat.** *Liaoning Agricultural Sciences (China) (no. 2) p. 27-29. 7 tables. Chinese. (AGRI 95-047830).*

2414 Femic, V.; Lomovic, S.; Micanovic, D.; Ciric, D. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita "Kragujevac") (1994) [The effect of wheat grain mass from different maturity stages on seedling vigor]. *Uticaj mase zrna pšenice razlicitog ontogenetskog razvika na vitalnost ponika. Savremena poljoprivreda (Yugoslavia) v. 42(3) p. 183-186. 3 tables; 11 ref. Serbian. (AGRI 95-047838).*

Ten Yugoslav winter wheat cultivars were investigated. The seeds from four maturity stages had been grown in microtrial experiment and were sown in pots quartz with sand. The seeds of later maturity stages gave more vigorous seedlings with larger dry matter. The yield of seedling dry matter was in high correlation with grain mass. Efficiency of grain mass (dry matter of seedling/dry mass of grain) decreased from milky stage to full physiological maturity stage. Cultivar KG-56 had the highest 1000 kernel weight (41.14 g) and the highest seedling dry matter (52.93 mg/pl.). The

least 1000 kernel weight was registered on cultivar Zagrepčanka (29.08 g), but the highest efficiency of grain mass (1.53).

2415 Gammie, R. (New South Wales Agriculture, Orange (Australia)) (1993) **Winter cereal variety sowing guide 1994.** *Winter Cereal Variety Sowing Guide (Australia) 48 p. New South Wales Agriculture. Fig., tables. English. (AGRI 95-062664).*

Gives information on crop management, variety selection for different climatic areas and soil types, disease control, tillage management and grain quality assessment, receival standards and marketing.

2416 Gate, P. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Wheat sowing date according to variety and environment]. *La variete et le milieu imposent la date de semis [du ble]. Perspectives Agricoles (France) (no 183) p. 13-18. French. (AGRI 95-047849).*

2417 Gate, P. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Wheat: yield forecasting models]. *Pilotage des cultures. Ble: des modeles pour prevoir le rendement. Perspectives Agricoles (France) (no 178) p. 56-58. French. (AGRI 95-047846).*

2418 Gill, MS.; Verma, HN.; Singh, S. (1994) **RESPONSE OF WHEAT (TRITICUM AESTIVUM) TO IMPROVED PRACTICE UNDER RAINFED CONDITION.** *Indian Journal of Agronomy. 39(4):557-559. English. [PUNJAB AGR UNIV OPERAT RES PROJECT DRYLAND AGR GARH SHANKAR 144527 INDIA].*

A field experiment was conducted with rainfed wheat (*Triticum aestivum* L. mend. Fiori and Paol.) during the winter season of 1989-90, 1990-91 and 1991-92 to study the contribution of improved practices, viz. fertilizer, spacing and seed treatment against termites. The crop responded significantly to 80 kg N + 40 kg P₂O₅/ha in all the years and gave 17.0 q/ha more yield than the control on pooled basis, with contribution of 72%. Aldrin seed treatment and wide row spacing also increased the grain yield significantly over untreated and narrow row spacing, with their relative contribution of 19 and 9% respectively.

2419 Gillet, J.P. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Four crosscheck processes: prevision model of the ear at 1cm stage, prevision of yield, prevision of nitrates in the sap and prevision of the appearance of brown rust in wheat crops]. *Pilotage des cultures. L'epreuve du terrain. Perspectives Agricoles (France) (no 178) p. 73-75. French. (AGRI 95-048019).*

2420 Gruzdev, G.S.; Dejkov, K.V. (1994) [Dynamics in the amount of nitrates in barley plants with different methods of applying Granstar, Tilt and nitrogen fertilizer]. *Dinamika soderzhaniya nitratov v vegetativnykh organakh yachmenya pri raznykh sposobakh primeneniya granstara, tilta i karbamid-ammiachnoy selitry. Izvestiya Timiryazevskoy sel'skokhozyajstvennoj akademii (Russian Federation) (no.1) p. 139-145. 9 ref. Russian. (AGRI 95-047878).*

The effect of combinations and methods of applying herbicide, fungicide and nitrogen fertilizer on the amount of nitrates in barley plants that was established experimentally is of short-term nature and cannot exert a long-term effect on nitrogenous metabolism and, consequently, on the level and quality of yield. The results of studying physicochemical compatibility of the mentioned above and other agents of chemicalization are also presented in the paper.

2421 Kasimov, I. (Institut po Pshenitsata i Sl'nchogleda "Dobrudzha", General Toshevo (Bulgaria)) (1994) [Effect of the sowing norm on the canopy density and productivity of triticale cultivars]. *Vliyanie na posevnite normi v'rkh g'stotata na poseva i produktivnostta na sortove tritcale. Selskostopanska Akademiya, Sofia (Bulgaria). Rastenier "dni Nauki (Bulgaria); Plant Science v. 31(1-2) p. 42-44. 3 tables; 8 ref. Bulgarian. (AGRI 95-062618).*

2422 Kim, J.K.; Han, M.S.; Kim, K.Y. (Rural Development Administration, Suwon (Korea Republic). Livestock Experiment Station) (1994) **Study on the fodder utilization of barley cultivated on paddy land after rice-(1)-Pattern of dry matter accumulation and silage yield of barley as affected by morphological growth stage.** *RDA Journal of Agricultural Science (Korea Republic) v. 36(2) p. 536-541. 5 tables; 25 ref. Korean. (AGRI 95-047871).*

2423 Kolev, T.; Lalev, Ts. (Institut po Pamuka i Tv'rdata Pshenitsa, Chirpan (Bulgaria)); Belcheva, S.; Terziev, Zh. (1994) [Effect of some growth regulators on durum wheat yield and grain quality]. *Vliyanie na nyakoi rastezhni regulatori v'rkhu dobiva i kachestvoto na z'moto ot tv'rdata pshenitsa. Selskостopanska Akademiya, Sofia (Bulgaria). Rasteniev'dni Nauki (Bulgaria); Plant Science v. 31(1-2) p. 9-11. 4 tables; 7 ref. Bulgarian. (AGRI 95-062731).*

2424 Koptsik, I.K.; Trompel, G.F.; Koptsik, N.I. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1994) [The role of variety in the increase of winter wheat yield in Belarus conditions]. *Rolya sortu w pavyshennii vradzhajnosti azimaj pshenitsy va wmovakh Belarusi. Vestsi Akademiі Agrarnykh Nauk Belarusi (Belarus) v. 1 p. 41-45. 2 tables; 1 fig.; 5 ref. Byelo Russian. (AGRI 95-047829).*

The efficiency of winter wheat cultivation in Belarus conditions depends considerably on technologic factors, however the role of variety is also great in the increase of productivity. The effect of negative environmental factors may be lowered by strict observance of technology elements. The introduction of new varieties of winter wheat promotes the increase of productivity and yields stabilization.

2425 Laconde, J.P. (Institut Technique des Cereales et des Fourrages, Paris (France)); Cochet, J.C.; Castillon, P.; Roques, F.; Verdier, J.L.; Deumier, J.M. (1993) [How to succeed in hard wheat in South West France]. *Comment reussir le ble dur dans le Sud [de la France]. Perspectives Agricoles (France) (no 184) p. 52-72. 14 tableaux, 9 graph. French. (AGRI 95-048022).*

2426 Matsue, Y. (Fukuoka ken. Agricultural Research Center, Chikushino (Japan)); Yano, M.; Hiramatsu, M.; Odahara, K. (1993) Effects of seeding time, seeding rate and ridge height on quality of malting barley [*Hordeum vulgare*] mild winter years in Buzen area of Fukuoka prefecture (Japan). *Bulletin of the Fukuoka Agricultural Research Center. Series A. Crop (Japan) (no.12) p. 29-32. 4 tables; 2 fig.; 8 ref. Japanese. (AGRI 95-047876).*

2427 McKenzie, E.A. (New South Wales Agriculture, Tamworth (Australia)) (1994) Environmental effects on wheat gluten quality. *New South Wales Agriculture. 9 fig., 7 tables. 29 p. English. (AGRI 95-062633).*

Gives results of studies to assess the variation in wheat gluten quality across a range of environments and the analysis of the genotype by environment interaction, and to analyse the specific effects on wheat gluten quality of high temperatures during grain filling. The investigators also wished to develop reliable and quantitative chemical-biochemical predictors of changes in gluten quality, to facilitate the objective testing of wheat quality and the genetic selection of new cultivars.

2428 Micanovic, D. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita "Kragujevac") (1994) [Effect of sowing date on the length of growing stages of wheat]. *Utica vremena setve na duzinu trajanja pojedinih faza razvoja pšenice. Savremena poljoprivreda (Yugoslavia) v. 42(3) p. 165-169. 2 tables; 11 ref. Serbian. (AGRI 95-047837).*

Effect of sowing date on start and length of growing stages (sowing-emergence, tillering, booting, heading, maturing) and the total vegetation period were investigated. The field experiment designed as a complete randomized block system in four repetitions, was carried out at two wheat genotypes (Srbijanka and L 11/35) and four sowing dates (October 20, November 5, November 20, December 5). Everyday phenological observations in the field and fibroscoping of plant material were done in order to notice the beginning and length of each growing stage of wheat. Sowing date significantly affected morphological phases especially the length of sowing-emergence and tillering phase.

2429 Micanovic, D.; Femic, V.; Knezevic, D. (Institut za poljoprivredna istrazivanja "Srbija", Kragujevac (Yugoslavia). Centar za strna zita "Kragujevac") (1994) [Effect of sowing date on some components of wheat grain yield]. *Utica vremena setve na neke elemente prinosa pšenice. Savremena poljoprivreda (Yugoslavia) v. 42(1-2) p. 109-114. 6 tables; 25 ref. Serbian. (AGRI 95-047836).*

Effect of sowing date on seed number per spike, seed weight per spike, 1000 seed weight and hectoliter weight was investigated. Field experiment designed as a complete randomized block in four repetitions, was carried out with two wheat genotypes (Srbijanka, L11/35) and four sowing dates on vertisol soil. The standard methods were used for analyzing the

investigated parameters. The data was analyzed by the standard analysis of variance. Delaying of sowing date increased the seed number per spike, seed weight per spike, while 1000 seed weight and hectoliter weight slightly varied. Delaying of sowing date decreased grain yield for both genotypes. This decrease was 19 for both genotypes and years.

2430 Moga, I.; Raducanu, C.; Dihoru, A.; Veverca, D.; Flueraşu, V. (Research Institute for Cereals and Industrial Crops, Fundulea (Romania)) (1994) Utilization of thermic resources disposable after various winter crops, in the Danube plain, by silo maize. *Romanian Agricultural Research (Romania) (no.1) p. 53-55. 4 tables; 2 graphs; 4 ref. English. (AGRI 95-047915).*

During 1988-1990, on the cambic chernozem at Fundulea, under irrigation, intensive cropping systems made up of two Italian ryegrass harvests, wheat or winter barley, followed by silo maize, as second crop were studied in comparison with silo maize seeded in its own field. It was noticed that under these conditions silo maize seeded in its own field used only 60-62 percent from the thermic supply of the respective zone. The optimum alternative is that made up of two Italian ryegrass harvests followed by late (Fundulea 420) or semi-late (Fundulea 320) maize hybrids, as second crop, which obtain yields equal to those achieved in its own field, a 60-65 t green mass/ha or 10-12 thousand nutritive units/ha being additionally obtained. After winter barley, the semilate maize silo hybrids (Fundulea 320) achieve only 85-87 percent from the yield in its own field, a 6-7 t grains/ha being obtained additionally. After winter wheat, the semilate Fundulea 320 or semiearly (Fundulea 270) silo maize hybrids achieve up to 75 percent from the yield in its own field, a 6-7 t grains/ha being obtained additionally.

2431 Murphy, D.P.L.; Knight, S.; Evans, E.J. (Department of Agriculture, University of Newcastle upon Tyne, Newcastle upon Tyne NE1 7RU (United Kingdom)) (1992) Spikelet sterility and grain yield in five cultivars of winter wheat (*Triticum aestivum*). *Tests of Agrochemicals and Cultivars (United Kingdom) (no.13) p. 132-133. 3 ref. English. (AGRI 95-048023).*

2432 Nasr, H.M.; Selles, F. (1995) SEEDLING EMERGENCE AS INFLUENCED BY AGGREGATE SIZE, BULK DENSITY, AND PENETRATION RESISTANCE OF THE SEEDBED. *Soil & Tillage Research. 34(1):61-76. English. [AGR & AGRI FOOD CANADA RES STN RES BRANCH POB 1030 SWIFT CURRENT SK S9H 3X2 CANADA].*

Producers in western Canada are concerned with producing good seedbeds in conservation tillage systems. A thorough understanding of how seedlings interact with the soil surrounding them is required to develop criteria for designing effective furrow openers and packing devices suitable for use in conservation tillage systems. To facilitate interpretation of field evaluations of furrow openers for zero tillage seeders, we conducted a greenhouse experiment designed to assess the impact of bulk density and aggregate size distribution of the seedbed on the emergence of Hard Red Spring Wheat (*Triticum aestivum* L.). Seeds of wheat (c.v. Lancer) were germinated in seedbeds with five aggregate size distributions with geometric mean diameter ranging from 0.44-12.67 mm, and four bulk densities ranging from 1.0-1.6 Mg m⁻³ arranged in a factorial design. The soil used in this study was taken from the Ap horizon of a Swinton silt loam (Orthic Brown Chernozemic). A logistic model including bulk density, geometric mean diameter and time since initiation of the experiment explained 90% of the variation observed during the course of emergence, and a logistic model that used penetration resistance and time explained 86% of this variability. Number of seedlings emerged and speed of emergence were affected by bulk density and aggregate size of the seedbed, and by the interaction of both variables. In general, increasing bulk density or aggregate size delayed emergence and reduced total emergence. However, the effect of bulk density was small in seedbeds with large aggregates, and the effect of aggregate size was negligible in compacted seedbeds. Increased bulk density delayed emergence mainly by decreasing the volume of voids in the soil. This elevated the interfacial stress to the elongating coleoptile. The detrimental effect of increased aggregate size was mainly due to increase in the length of the path the coleoptile had to traverse to reach the soil surface, as it elongated through the interaggregate voids. Compaction of the seedbed, necessary to achieve the higher bulk densities in the coarser-aggregate seedbeds, resulted in substantial breakdown of larger aggregates. Consequently, as the interfacial stress was increased by compaction, the path length was decreased, and both effects cancelled each other. [References: 26].

2433 Nielsen, K.A.; Mikkelsen, M. (1995) [Survey 1994, K: Production of roughage]. Oversigt 1994, K: Grovfoderproduktion. Landsudvalget for Planteavl, Aarhus (Denmark). *Oversigt over Landsforsøegene (Denmark)* (no.1994) p. 230-278. 4 ill., 69 tables. Suppl. tables in Markforsøeg (Denmark), part K, p. 717-766. Danish. (AGRI 95-048514).

2434 Nishibe, Y. (Tohoku National Agricultural Experiment Station, Morioka (Japan)) (1992) Wheat production and technology in Michinoku district (Japan): From production to consumption. *Miscellaneous Publication of the Tohoku National Agricultural Experiment Station (Japan)* (no.13) p. 1-158. 20 plates; 109 tables; 40 fig.; Appendix. Japanese. (AGRI 95-047834).

2435 Obenaud, U. (Chambre d'Agriculture du Schleswig Holstein (Allemagne)) (1993) [Germany. Wheat cultivation in Schleswig-Holstein]. *Allemagne. Comment cultiver-t-on le ble dans le Schleswig-Holstein? Perspectives Agricoles (France)* (no 180) p. 15-18. 7 graph. French. (AGRI 95-047848).

2436 Parent, G.; Tessier, S.; Allard, G.; Angers, D.A. (1995) NO-TILLAGE SEEDING OF FORAGE CROPS IN QUEBEC - A REVIEW [Review]. *Canadian Agricultural Engineering*. 37(1):29-39. French. [UNIV LAVAL DEPT PHYTO ST FOY PQ G1K 7P4 CANADA].

No-tillage seeding of forage crops has drawn considerable interest over the last few years, principally because of the obvious savings associated with the reduced energy and labor requirements for soil preparation and rock picking on many typical dairy or beef cattle farms. However, this technique is yet seen to often result in less than satisfactory stand establishment of forage crops. A review of the current information on the changes in soil edaphic factors brought about by no-tillage seeding was deemed necessary to guide no-tillage seeder design or modifications to better meet the soil-seed environment needs of these generally very small seeded crops. Increased shading and decreased soil evaporation and heating are likely consequences of the sometimes important residue mass retained at the surface with no-tillage. However, neither grass nor legume forage species are greatly affected by incoming light. While increased soil water availability near the soil surface may contribute to better emergence, establishment of these plant species should not be significantly slowed by the range of reported temperature differences between no-tillage and conventional seeding. Because of the low seed energy reserves of many forage species, it is imperative that no-tillage seeding be as shallow (few millimetres) and as uniform as possible. Seed row firming is recommended to both close the furrow and increase soil-seed contact, but should be fairly light. Ideally, the press wheel should compact the soil around the seed and leave loose soil above it. Starter fertilisers should be placed differently according to the primary root development patterns of the forage species, to insure fast availability to these relatively slow growing plants. Fertiliser placement under the residue mass as well as under the seed seems most advantageous for no-tillage seeding. Finally, a no-tillage seeder should be able to place seed very near the surface, compact soil around the seed, and close the furrow without applying excessive pressure at the surface of the furrow, and place starter fertilisers under the seed to maximize forage crops emergence. [References: 118].

2437 Pedersen, J.B. (1995) [Survey 1994, B: Cultivars and species of cereals]. Oversigt 1994, B: Kornsorter og komdyrkning. Landsudvalget for Planteavl, Aarhus (Denmark). *Oversigt over Landsforsøegene (Denmark)* (no.1994) p. 17-60. 3 ill., 63 tables. Suppl. tables in Markforsøeg (Denmark) 1994, part B, p. 11-254. Danish. (AGRI 95-047873).

2438 Prevot, J.P. (Institut Technique des Cereales et des Fourrages, Paris (France)); Pellot, P.; Verhaeghe, V. (1993) [Wheat cropping methods for Nord Picardy area (France)]. *La culture du ble en Nord-Picardie. Perspectives Agricoles (France)* (no 178) p. 29-48. 23 tableaux, 17 graph. French. (AGRI 95-048018).

2439 Quinche, J. P. (1995) [Cereal grains: cadmium content observed in the French and Italian part of Switzerland]. Le cadmium des grains de cereales cultivees en Suisse romande et au Tessin. Station federale de recherches agronomiques, Changins (Switzerland). *Revue suisse d'agriculture (Switzerland)* v. 27(1) p. 23-27. 7 tables, 2 graphs, various formula, 17 ref. French. (AGRI 95-048013).

The cadmium contamination of wheat grains does not seem alarming. But, with the aim to avoid cadmium accumulation, especially on acid soils, there shouldn't be any slurry spreading containing cadmium.

2440 Relave, F. (TOP Semence, La Batie Rolland (France)) (1993) [Chickpea, an alternative to pea or durum wheat in south of France]. Le pois chiche, une alternative au pois ou au ble dur pour le sud de la France. *Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France)* (no 124) p. 45-47. French. (AGRI 95-062889).

2441 Repka, J.; Danko, J. (Vysoka Skola Polnohospodarska, Nitra (Slovak Republic). Katedra Fyziologie Rastlin) (1994) [Energy efficiency of winter wheat cultivation system using large-scale production technologies]. Energeticka efektivnost pestovania ozimnej pšenice pri veľkovýrobných technológiach. *Polnohospodárstvo (Slovak Republic)* v. 40(6) p. 410-419. 4 tables; 12 ref. Slovak. (AGRI 95-048032).

Inputs of supplemental energy and energy efficiency of winter wheat cultivation system using large-scale production technologies were evaluated. Supplemental energy in 1986-1989 represented 27.693 GJ per ha (fertilizers 45.06 %, fuels 19.28 % and seeds 17.46 %). At the average grain yield 4.75 t per ha, a 56.17 GJ per ha net energy output was obtained and an efficiency coefficient was $rE=3.02$. At the total yield 10.29 t per ha a 153.78 GJ per ha net energy output was reached and $r=6.55$. Winter wheat stands used on the average 0.80 % of photosynthetically active radiation for main crop and 1.73 % for total biomass.

2442 Robert, D. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Wheat: forecasting development stages]. Pilotage des cultures: prevision du developpement. *Perspectives Agricoles (France)* (no 178) p. 59-62. French. (AGRI 95-047847).

2443 Savoie, J.M. (Institut National de la Recherche Agronomique, Villenave d'Ornon (France). Centre de Bordeaux, Champignon); Chalaux, N. (1994) [Determination of wheat straw quality for production of substrates in mushroom growing]. Estimation de la qualite des pailles de ble pour leur utilisation dans la production de substrats pour la culture du champignon de couche. *Bulletin de la Federation Nationale des Syndicats Agricoles de Cultivateurs de Champignons (France)* (no 64) p. 131-135. 5 ref., 3 p. p. seulement. French. (AGRI 95-048283).

2444 Savoie, J.M. (Institut National de la Recherche Agronomique, Villenave d'Ornon (France). Centre de Bordeaux, Champignon); Chalaux, N. (1994) [Some data on wheat straw used for substrate in mushroom growing: composition and degradation]. Quelques notions sur les pailles de ble utilisees pour la production de substrats de culture de champignon: composition et biodegradation. *Bulletin de la Federation Nationale des Syndicats Agricoles de Cultivateurs de Champignons (France)* (no 63) p. 103-107. 3 p. p. seulement. French. (AGRI 95-048430).

2445 Schuhmacher, K. (Halle Univ. (Germany). Landwirtschaftliche Fakultät. Inst. fuer Pflanzenzüchtung und Saatgutwirtschaft); Hartmann, G. (1993) [Two-year studies with mixtures of winter wheat varieties for their yield and quality]. Zweijährige Untersuchungen an Sorten-Mischungen hinsichtlich Ertrag und Qualität bei Winterweizen. *Kuehn-Archiv (Germany)* v. 87(2) p. 177-186. 2 ill., 2 tables; 20 ref. German. (AGRI 95-062639).

2446 Selamyeihun Kidanu; Demisie Mitiku; Negusie Tadesse (Debre Zeit Agricultural Research Center (Ethiopia)) (1994) Soil-related Constraints to the production of Durum Wheat in the Central Highlands of Ethiopia. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. *A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa*. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (ed.) p. 62-72. CIMMYT. 11 tables; 7 ref. English. (AGRI 95-062728).

2447 Shang Zhenqing; Shi Jiping; Han Jianmin (Hebei Agricultural Univ., Baoding (China). Dept. of Agronomy) (1994) Research on the mechanism of the drought resistance increased by using plant growth regulator '891' in wheat. *Journal of Hebei Agricultural University (China)* v. 17(2) p. 10-14. 4 ill., 1 table, 10 ref. Chinese. (AGRI 95-048027).

2448 Shi Jilin (Zhejiang Provincial Academy of Agricultural Sciences, Hangzhou (China). Inst. of Crops); Qiu Chuanyou (1994) Studies on optimization in main measures combination for cultivating early indica rice as subsequent crop of barley for high yielding and high benefit. *Journal of Zhejiang Agricultural Sciences (China)* (no. 2) p. 51-55. 1 ill., 6 tables. Chinese. (AGRI 95-047954).

2449 Stobbe, Elmer (University of Manitoba (Canada)) (1994) External Assessor's Report: Long-term Trial Working Group, Feb 7-18, 1994. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. *A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa*. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (ed.) p. 5-14. CIMMYT. 1 table. English. (AGRI 95-062642).

2450 Sun Benpu; Wang Yong; Li Xiuyun (Binzhou Regional Inst. of Agricultural Sciences, Binzhou, Shandong (China)) (1994) Research on suitable seeding time and seeding rate of late sowing winter wheat under plastic covering. *Journal of Laiyang Agricultural College (China)* v. 11(1) p. 29-34. 5 tables. Chinese. (AGRI 95-047832).

2451 Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (1994) A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa. *Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia)*; 7-18 Feb 1994. CIMMYT. 99 leaves. English. (AGRI 95-062640).

2452 Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (1994) Report on the Travelling Workshop of the Long-term Trial Working Group to Ethiopia, Tanzania (and Kenya), Feb. 7-18, 1994. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. *A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa*. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (eds.) p. 1-4. CIMMYT. English. (AGRI 95-062641).

2453 Wang Jianping; Wang Gaowu; Zhou Qiuping (Institute of Agricultural Sciences of the Taihu Lake District, Suzhou (China)) (1994) An approach to increasing wet resistance of wheat I. Effect of plant growth regulators in the increase of wet resistance of wheat. *Jiangsu Agricultural Sciences (China)* (no. 1) p. 5-8. 5 tables, 5 ref. Chinese. (AGRI 95-048028).

2454 Weng Huiyu (Shanxi Provincial Academy of Agricultural Sciences, Taiyuan (China). Inst. of Crop Genetics); Wu Zongxin (1994) Effect of ethylene on yield of winter wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(2) p. 55-58. 1 ill., 3 tables, 4 ref. Chinese. (AGRI 95-047833).

2455 Yeshanew Ashagrie (Adet Research Center, Bahir Dar (Ethiopia)) (1994) An Analysis of Long-term Wheat Production Constraints in Northwestern Ethiopia. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. *A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa*. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (ed.) p. 41-43. CIMMYT. 3 ref. English. (AGRI 95-062643).

2456 Yoshida, M. (Hokkaido National Agricultural Experiment Station, Sapporo (Japan)); Abe, J.; Moriyama, M.; Takaya, T. (1994) Low-temperature germination and winter survival in spring wheat [*Triticum aestivum*] sown in early winter. *Research Bulletin of the Hokkaido National Agricultural Experiment Station (Japan)* (no.159) p. 59-66. 2 plates; 3 tables; 4 fig.; 12 ref. Japanese. (AGRI 95-048031).

The acreage and production of spring wheat have not increased for years, since spring wheat cultivation has two difficulties: a short growing period and difficulties in sowing at the optimum seeding time in spring. Recently, Sasaki et al. (1991) reported new techniques to extend growing period by means of sowing spring wheat seeds in early winter prior to snow cover. In order to establish this technique, we investigated germination and seedling growth at low temperatures and field survival of spring wheat cultivars, Haruyutaka, Haruhikari and Manitou, together with winter wheat cultivar, Horoshirikomugi. Most of the spring wheat plants sown before late October could not overwinter. The later the spring wheat seeds were sown in autumn to early winter, the higher the overwintering survival was. Percent survival of spring wheat cultivars sown late in November was as high as

74.2%, 60.6% and 84.8% for Haruyutaka, Haruhikari and Manitou, respectively. This indicates we should discriminate suitable cultivars to use the cultivation of spring wheat sown in early winter. As regards winter wheat, the minimum value observed late in October in the V-shaped curve of overwintering percent coincided with the turning point of the change in dry weight of plant.

2457 Zewdu Yilma (IAR, Addis Abeba (Ethiopia)) (1994) An Analysis of Constraints to Wheat production in the Rainfed Farming Systems of Sinana Area, Bale Region. Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa; Addis Abeba (Ethiopia); 7-18 Feb 1994. *A Regional Travelling Workshop on Long-term Wheat-based Sustainability Trials in East Africa*. Tanner, Douglas G. (CIMMYT, Addis Abeba (Ethiopia)) (ed.) p. 44-46. CIMMYT. English. (AGRI 95-062644).

2458 Zhang Liming (Shandong Provincial Academy of Agricultural Sciences, Jinan (China). Inst. of Crops); Liang Zhenxing; Mei Nan (1993) The effects of epibrassinolide on the yield and yield structure of wheat. *Journal of Laiyang Agricultural College (China)* v. 10(4) p. 244-247. 5 tables, 9 ref. Chinese. (AGRI 95-048026).

F02 PLANT PROPAGATION

2459 Chen Yaofeng; Zhu Qinglin (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Dept. of Agronomy) (1993) Effect of the ratio of sucrose to maltose in the frequency of induction and differentiation of pollen callus in wheat. *Acta Agronomica Sinica (China)* v. 19(2) p. 145-148. 2 tables, 11 ref. Chinese. (AGRI 95-048650).

2460 Hou Bingkai; Teng Shiyun (Shandong Univ., Jinan (China). Dept. of Biology) (1994) Effect of low temperature treatment on differentiation of long-term culture calli of wheat. *Plant Physiology Communications (China)* v. 30(2) p. 108-110. 1 ill., 1 table, 12 ref. Chinese. (AGRI 95-048649).

2461 Liu Bao; Wu Qinsheng; Liu Dajun (Nanjing Agricultural Univ. (China). Lab. of Cytogenetics) (1993) Barley protoplast culture: embryogenic callus formation and albino plantlet regeneration. *Acta Agronomica Sinica (China)* v. 19(6) p. 520-522. 6 ill., 8 ref. Chinese. (AGRI 95-048630).

2462 Nie Daotai; Zhuang Jiajun (Academia Sinica, Beijing (China). Inst. of Genetics) (1993) Rapid development of new wheat germplasm resistant to stripe rust and barley yellow dwarf virus via anther culture. *Acta Genetica Sinica (China)* v. 20(6) p. 514-523. 5 tables, 11 ref. Chinese. (AGRI 95-048626).

2463 Tang Fenglan; Wang Guangjin; Li Zhongjie (Heilongjiang Provincial Academy of Agricultural Science, Harbin (China). Inst. Crop Breeding) (1994) A study on increasing in vitro culture efficiency of wheat immature embryo. *Heilongjiang Agricultural Sciences (China)* (no. 4) p. 36-39. 4 tables, 2 ref. Chinese. (AGRI 95-048647).

2464 Yun Yue; Hu Daofen (Beijing Municipal Plant Cell Bioengineering Lab. (China)); Liu Min (1994) Callus inducing frequency from the anther of different genotypes winter wheat and the electrophoretic analysis of proteins in calli. *Acta Agriculturae Boreali-Sinica (China)* v. 9(3) p. 34-38. 3 ill., 1 table, 10 ref. Chinese. (AGRI 95-048625).

The high frequencies of callus induction were obtained from anthers of different genotypes winter wheat on the W142 medium (a modified W14 medium). Different genotypes showed significant differences in the frequency of callus induction, IEF and SDS-PAGE analysis on the proteins of wheat anthers and calli there were performed with the Phast System Electrophoresis apparatus made by the Pharmacia Company. Differences were observed in proteins from the anthers of different genotypes and relationship was considered to exist between the difference and the frequencies of callus induction. No obvious difference was observed in band patterns of anther calli among different genotypes. It was found that there some new protein bands in calli when compared with those of the anthers. This phenomenon probably resulted from the biochemical changes in the process of callus induction.

2465 Zhao Ruitang; Gao Shuguo; Qiao Yake (Hebei Agrotechnical teachers Coll., Changli (China)) (1994) A new approach of screening salt-tolerance variants by anther culture to cultivate salt-tolerance wheat variety. *Acta*

F03-SEED PRODUCTION

2466 Cejudo, F.J.; Cubo, M.T.; Baulcombe, D.C. (1995) AMYL EXPRESSION DURING WHEAT SEED GERMINATION. *Plant Science*. 106(2):207-213. English. [UNIV SEVILLA FAC QUIM INST BIOQUIM VEGETAL & FOTOSINTESIS APARTADO 553 E-41080 SEVILLE SPAIN].

The expression pattern of alpha-Amyl, a gene coding for high-pi alpha-amylase, has been studied during wheat (*Triticum aestivum*) seed germination using both Northern-blot and in situ hybridisation. At early stages of germination (24 h after imbibition) this gene was exclusively expressed in the scutellar epithelium. The expression in this tissue was transient and independent of GA(3). At later stages of germination, after 48 h of imbibition, expression in the epithelium decreased while alpha-Amyl mRNA accumulated in the aleurone layer. In this tissue, where alpha-Amyl expression is regulated by GA(3), a gradient could be detected with the embryo-proximal aleurone cells showing a higher level of expression than distal cells. These results show temporal and spatial expression of alpha-Amyl during germination of the wheat grain. [References: 32].

2467 Drobny, J.; Drobna, J. (1995) THE EFFECT OF PROPAGATION DEGREE ON SEED-PRODUCTION VALUE OF SPRING BARLEY. *Rostlinna Vyroba*. 41(4):189-196. English. [VYSKUMNY USTAV RASTLINNE] VYROBY BRATISLAVSKA CESTA 122 PIESTANY 92168 SLOVENIA].

In the years 1989 to 1992 we studied the effect of propagation degree on the seed production values in the varieties Orbit and Novum. Eight propagation degrees (S1, S2, S3, elite, original, reseeded, second reseeded, third reseeded) and 14 sorts of seeds (basic and reseeded ones) of various storage period (zero to three years) were compared. The seed was stored in the cooling box at 5 degrees C. Examined characteristics were: 1,000-kernel weight, grain balance (portions of grains on individual mesh sieves) and germination capacity. Statistically highly significant differences were found out at 1,000-kernel weight among individual propagation degrees (Tab. I), at which the highest average value of 1,000-kernel weight (37.7 g) was reached by the degree S1. Statistically highly significant differences were observed also among the seeds and years. Evaluating the germination capacity (Tab. II), no statistically significant differences were found out among the propagation degrees, as well as among seed sorts. Highly significant differences between the varieties were observed in advantage for the variety Novum, as well as among the years, with the same results. Remarkable differences were noticed at kernel balance (portions of grains on mesh sieves) among the individual propagation degrees, seed sorts, varieties, as well as individual years. Regarding portion of grains on 2.8 mm mesh sieve (Tab. III) we have found out statistically highly significant differences among the degrees of propagation, seeds, varieties and years. Concerning portion of grains on 2.5 mm (Tab. IV), 2.2 mm mesh sieve (Tab. V) and of undersized grains (Tab. VI) we have observed statistically significant differences among propagation degrees and highly significant ones among seeds, varieties and years. Classification of the individual degrees of propagation at 1,000-kernel weight, portion of grains on 2.8 mm; 2.5 mm and 2.2 mm mesh sieves, respectively, was approximately the same; it means, from increasing to falling degrees. In view of evaluation of germination capacity values, we have obtained the contrary order as to 1,000-kernel weight and grain balance. Statistically significant and highly significant differences among the values of assessed characteristics confirm, that seed value of spring barley, varieties Orbit and Novum, depends on propagation degree. In order to eliminate the influence of propagation degree it is necessary to obtain high quality seeds for sowing, good crop management, careful control of stands and health state, timely harvest, careful postharvest during storage.

2468 Gilbert, J.; Tekauz, A.; Woods, S.M. (1995) EFFECT OF PHAEOSPHERIA NODORUM-INDUCED SEED SHRIVELLING ON SUBSEQUENT WHEAT EMERGENCE AND PLANT GROWTH. *Euphytica*. 82(1):9-16. English. [AGR & AGRIFOOD CANADA WINNIPEG RES CTR 195 DAFOE RD WINNIPEG MB R3T 2M9 CANADA].

The bread wheat cultivars Pasqua and Katepwa, and durum wheat cultivars Kyle and D8257 were used to test the effects of sowing *Phaeosphaeria nodorum*-shrivelled seed. In a controlled environment, emergence, tillering, and dry weight of seedlings were compared at two

sowing depths. Emergence, tillering and plant dry weights were also determined in field plots in 1992 and 1993, as were yield and thousand kernel weight (TKW) in plants inoculated with *P. nodorum*. Under controlled conditions the level of shrivelling did not affect emergence at depths of 25 mm and, except for Katepwa, 50 mm. Deeper seeding reduced emergence regardless of the level of shrivelling. Seeding depth did not affect dry weight of roots and shoots and the effect on tillering was inconsistent in the two years. Dry root weight was positively correlated with original seed size and decreased with level of shrivelling. In the field, seedling emergence of severely shrivelled seed was significantly lower in Katepwa and Pasqua. Tillers per plant appeared to increase with increased level of shrivelling, but was significant only for D8257 in one year. Dry tiller weight was inversely related to tillering and decreased consistently with level of shrivelling. Excepting Pasqua, in one year, yield and TKW did not differ between plots originating from plump or shrivelled seed. Inoculation with *P. nodorum* caused a significant reduction in TKW and yield in all cultivars but Kyle. Seed shrivelled due to *P. nodorum* was in general found to be as suitable as plump seed for growing a wheat crop. [References: 19].

2469 Minard, D. (Service Officiel de Controle et de Certification, Paris (France)) (1993) [Visual appearance of cereal seeds]. L'aspect visuel des semences de cereales. *Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France)* (no 124) p. 52-54. French. (AGRIS 95-063149).

2470 Muller, M.; Muth, J.R.; Gallusci, P.; Knudsen, S.; Maddaloni, M.; Motto, M.; Schmitz, D.; Sorensen, M.B.; Salamini, F.; Von Wettstein, D.; Thompson, R.D. (1995) REGULATION OF STORAGE PROTEIN SYNTHESIS IN CEREAL SEEDS - DEVELOPMENTAL AND NUTRITIONAL ASPECTS. *Journal of Plant Physiology*. 145(5-6):606-613. English. [MAX PLANCK INST ZUCHTUNGSFORSCH CARL VON LINNE WEG 10 D-50829 COLOGNE GERMANY].

The major seed storage proteins of cereals are deposited in the maturation phase of endosperm development, starting at 12 days after pollination (dap) in maize and continuing up to around 30 dap. Cell type-specific expression in the endosperm is conferred by a multicomponent promoter motif, the endosperm box sequence. Proteins interacting at this motif include the gene product of the regulatory gene Opaque-2 (O2). O2 encodes a bZIP transcription factor, which is capable of activating its target promoters, 22 kD alpha-zein and b-35 in a number of experimental systems. Storage protein accumulation, and storage protein promoter activity, are modulated according to available levels of nitrogen (N). In barley, nitrogen regulation is mediated by the endosperm box via interaction of the endosperm and GCN4 motifs. The nitrogen-responsive components of the 22 kD zein promoter have been shown to include the O2-binding sites Z1-Z3 but to display N-responsiveness even in the absence of O2 protein. [References: 53].

2471 Patschke, K. (Lehr und Versuchsanstalt fuer Integrierten Pflanzenbau e.V., Gueterfelde (Germany)) (1994) [Seed dressing of cereal seed with fungicides is very effective]. Durch Beizen auf der sicheren Seite. Auf Saatgutbehandlung, auch bei Nachbau, sollten Sie keinesfalls verzichten. *Pflanzenschutz-Praxis (Germany)* (no.3) p. 38-39. German. (AGRIS 95-063151).

2472 Roques, F. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Production of malting barley seeds]. Produire des semences d'orge de brasserie. *Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France)* (no 123) p. 51-52. French. (AGRIS 95-063144).

2473 Sun Shulan; Shui Guomin; Yang Tingfu (Liaoning Provincial Academy of Agricultural Sciences, Shenyang (China). Inst. of Crop Breeding) (1994) A preliminary experiments on the dormancy breaking of spring wheat seed. *Liaoning Agricultural Sciences (China)* (no. 3) p. 48-50. 4 tables. Chinese. (AGRIS 95-048825).

2474 Wang Guirong (Shandong Agricultural Univ., Taian (China). Center Lab.); Zhang Deshui (1994) Storage effect of dry barley seeds irradiated with Co60 gamma rays. *Journal of Shandong Agricultural University (China)* v. 25(1) p. 21-26. 1 ill., 3 tables, 15 ref. Chinese. (AGRIS 95-048829).

2475 Yan Xudong; Lu Shaoyuan; Li Zongzhi (Hebei Agricultural Univ., Baoding (China). Dept. of Agronomy) (1994) A practical APAGE method of wheat gliadin analysis in China [APAGE: Acid Polyacrylamide Gel Electrophoresis]. *Journal of Hebei Agricultural University (China)* v. 17(1) p. 7-10. 1 ill., 1 table, 8 ref. Chinese. (AGRS 95-048839).

2476 Zhong Huaxin; Dong Hong; Zhou Juhua (Hangzhou Univ., Zhejiang (China). Dept. of Biology) (1993) Effects of Tween-80 on the germination and some physiological and biochemical characters of barley seeds. *Acta Agronomica Sinica (China)* v. 19(4) p. 376-379. 3 ill., 4 tables. Chinese. (AGRS 95-048830).

F04 FERTILIZING

2477 [Updated technical recommendations for wheat culture in the state of Mato Grosso do Sul]. Atualizacao das recomendacoes tecnicas para a cultura do trigo no Mato Grosso do Sul, safra 1994 (1994) Centro de Pesquisa Agropecuaria do Oeste, Dourados, MS (Brazil). *Comunicado Tecnico - Centro de Pesquisa Agropecuaria do Oeste (Brazil)*; no. 4 16 p. Portuguese. (AGRS 95-049041).

2478 Aassveen, M. (SFL Apelsvoll Forskingsstasjon, Kapp (Norway)) (1994) [Split application of N fertilizer in some barley varieties]. Delt nitrogengoedsling til ulike byggsorter. *Norsk Landbruksforskning (Norway)*; *Norwegian Agricultural Research* v. 8(3-4) p. 293-304. 6 tables, 2 figures; 11 ref. Norwegian. (AGRS 95-063295).

2479 Alimov, K.G. (1993) [Efficiency of fluid inorganic fertilizers depending on terms and methods of their application (spring wheat intensive management)]. *Ehffektivnost' zhidkikh mineral'nykh udobrenij v zavisimosti ot srokov i sposobov ikh vneseniya. Sibirskij vestnik sel'skokhozyajstvennoj nauki (Russian Federation) (no.3)* p. 76-79. 5 ref. Russian. (AGRS 95-049051).

Results of production experiments, testifying to a high efficiency of fluid inorganic fertilizers in comparison with the solid ones in case of intensive technology of growing spring wheat in conditions of Novosibirsk Region are presented. It has been shown that spring local application of fluid fertilizers gives the greatest increase in yield.

2480 Brar, B.S.; Dhillon, N.S.; Chand, M. (1995) EFFECT OF FARMYARD MANURE APPLICATION ON GRAIN YIELD AND UPTAKE AND AVAILABILITY OF NUTRIENTS IN RICE (ORYZA SATIVA)-WHEAT (TRITICUM AESTIVUM) ROTATION. *Indian Journal of Agricultural Sciences*. 65(5):350-353. English. [PUNJAB AGR UNIV DEPT SOILS LUDHIANA 141004 PUNJAB INDIA].

2481 Braun, P. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1994) [Hard wheat quality: good results by a later nitrogen supply]. *Qualite du ble dur: bons resultats pour l'apport tardif d'azote. Perspectives Agricoles (France) (no 188)* p. 30-34. 5 illus., 7 graph. French. (AGRS 95-063327).

2482 Cugnet, O. (Ecole Superieure d'Agriculture Purpan, Toulouse (France)); Mathieu, C.; Maruejols, B.; Baril, C. (1993) [Sowing sugar beet over mulch and management of intercrop period by catch crops]. *Betteraves sur mulch en Champagne crayeuse. Un moyen de gestion des ressources en azote du sol. Perspectives Agricoles (France) (no 177)* p. 28-34. French. (AGRS 95-049112).

2483 Dinev, N.; Stancheva, I. (1995) RESPONSE OF WHEAT AND MAIZE TO DIFFERENT NITROGEN SOURCES .1. PLANT GROWTH AND BIOMASS ACCUMULATION. *Journal of Plant Nutrition*. 18(6):1273-1280. English. [N Poushkarov Inst Soil Sci & Agroecol Dept Mineral Nutr POB 13699 BU-1080 Sofia Bulgaria].

Maize (Zea mays L., hybrid Pioneer 3737) and wheat (Triticum aestivum L., cultivar Jantar) were grown hydroponically in nutrient solutions containing 10 mM nitrogen (N) as either the nitrate (NO₃) anion or the ammonium (NH₄) cation or in a 1:1 combination of both. Maize and wheat plants had different responses to the N sources. Maize growth and biomass accumulation were greatest with the equal combination of NO₃ and NH₄, while NO₃ only was more favourable for wheat. The effects of the different N sources were detected on the 14th and 21st day for maize and wheat plants, respectively. [References: 12].

2484 Dou, Z. (Pennsylvania State University, University Park (Etats Unis). Department of Agronomy); Fox, R.H. (1994) [The contribution of nitrogen from legume cover crops double-cropped with winter wheat to tilled and non-tilled maize]. [Apport d'azote par un engrais vert, legumineuse installee dans un ble d'hiver, a une culture de maïs implantee soit apres labour soit par semis direct]. *European Journal of Agronomy (France)* v. 3(2) p. 93-100. 21 ref., 5 tableaux. English. (AGRS 95-048980).

2485 Fathi, G.; McDonald, G.K.; Lance, R.C.M. (Adelaide Univ., Glen Osmond (Australia). Waite Inst.) (1994) Grain yield and protein responses to nitrogen fertilizer in six cultivars of barley. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 502. English. (AGRS 95-048971).

2486 Gordon, R.; De Gracia, N.; Gonzalez, A.; Franco, J.; Herrera, A.P. de (Instituto de Investigacion Agropecuaria de Panama (IDIAP), Azuero (Panama)); Raun, W. (Oklahoma State University, Stillwater KO (USA). Profesor asistente) (1993) [Response of the maize crop to P and S application in the Azuero region of Panama, 1989-1992]. *Respuesta del cultivo de maiz a la aplicacion de fosforo y azufre en la region de Azuero, Panama 1989-1992. [Synthesis of the experimental results of the Regional Maize Program (PRM) 1992]. Sintesis de resultados experimentales del Programa Regional de Maiz para Centro America y el Caribe (PRM) 1992. Bolanos, J. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Ciudad de Guatemala (Guatemala). Programa de Maiz); Sain, G. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), San Jose (Costa Rica). Programa de Maiz); Barreto, H.J. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Programa de Maiz); Urbina, R. (Programa Regional de Maiz para Centro p. 124-136. Programa Regional de Maiz (PRM). 5 tables; 6 graphs., 15 ref. Spanish. (AGRS 95-063298).*

2487 Jelic, M.; Kostic, M.A. (Institut za istrazivanja u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita "Kragujevac") (1994) [Nitrogen, phosphorus and potassium utilization and balance in long-term fertilization experiment]. *Iskoriscavanje i bilans azota, fosfora i kalijuma na visegodisnjem ogledu sa djubrenjem. Savremena poljoprivreda (Yugoslavia)* v. 42(1-2) p. 27-31. 3 tables; 5 ref. Serbian. (AGRS 95-048960).

The long-term stationary field experiment was performed on the soil type, smonitza (vertisol). It comprised eight fertilizations and a control plot. Winter wheat cultivar used was Kragujevacka 56. Utilization percentage for each fertilizer was 60 of nitrogen, about 24 of phosphorus and 50-70 of potassium used in a long-term. The highest utilization coefficient was obtained with regular application of NPK-fertilizers. On the average, for a long-term period, wheat crop used 2.35 kg of nitrogen, 0.88 kg of phosphorus and 1.69 of potassium for 100 kg of grain formation. During the 17 year-period, the unused part of nitrogen was between 8 and 12, phosphorus 52-56 and potassium 20-30 from the total amounts of nitrogen, phosphorus and potassium fertilizers.

2488 Kaerner, E. (Estonian Agricultural Univ., Tartu (Estonia)) (1994) [The effect of ammonium nitrate on the yield of early barley]. *Ammoniumsalpeetri mojust odra saagile. Transactions of Estonian Agricultural University (Estonia); Agronomy (no.178)* p. 49-52. 11 ref. Estonian. (AGRS 95-063294).

An influence of rate of ammonium nitrate and previous crop on the yield of early barley was studied. Previous crops included potato and barley. Before the sowing of barley seeds P₂O₅ and K₂O both 60 kg ha⁻¹ and 0,50,75,100 and 125 kg of nitrogen (N) per hectare were applied to the soil. At the stage tillering an additional top-dressing of 50 kg N ha⁻¹ was additionally done as fertilization during the growing period against the background 75...125 kg N ha⁻¹. The sowing rate of early barley was 600 germinating seeds per 1 m². According to our data in 1984...1985 the yield of early barley depended more on nitrogen fertilizer, but also on year and previous crop. Without an application of a nitrogen fertilizer, depending on a previous crop, the yield of early barley was 2.04...2.72 (on the average 2.37) tons of grains per hectare. Under the influence of 50...175 kg N ha⁻¹ the grain yield was increased by 0.63...0.98 (on the average 0.82) t ha⁻¹ or 26.6...41.4 per cent.

2489 Knudsen, L.; Oestergaard, H.S. (1995) [Survey 1994, E: Fertilization and liming]. *Oversigt 1994, E: Goedskning og kalkning. Landsudvalget*

for Planteavl, Aarhus (Denmark). *Oversigt over Landsforsøgene (Denmark)* (no.1994) p. 80-126. 14 ill., 60 tables. Suppl. tables in Markforsøeg (Denmark) 1994, part E, p. 286-387. Danish. (AGRS 95-048978).

2490 Konno, K. (Hokkaido. Kitami Agricultural Experiment Station, Kunneppu (Japan)); Kikuchi, K.; Hirai, Y. (1992) Decomposition processes of green manures and wheat straw incorporated into upland field in Abashiri district (Japan). *Bulletin of Hokkaido Prefectural Agricultural Experiment Stations (Japan)* (no.64) p. 13-23. 7 tables; 4 fig.; 24 ref. Japanese. (AGRS 95-048958).

2491 Krstic, B.; Pajevic, S.; Kraljevic Balalic, M. (Poljoprivredni fakultet, Novi Sad (Yugoslavia)) (1994) [Photosynthetic differences between wheat cultivars in dependence on mineral nutrition]. *Fotosintetska heterogenost sorata pšenice u zavisnosti od mineralne ishrane. Savremena poljoprivreda (Yugoslavia)* v. 42(1-2) p. 21-25. 3 tables; 17 ref. Serbian. (AGRS 95-048959).

In this paper the attention is paid to the study of the rate of photosynthesis and dark respiration, as physiological processes which affect plant production to a great extent. Different genotypes of wheat were taken as experimental objects. The plant were cultivated under greenhouse conditions by using the water culture method. Nutrient solution contained three different levels of mineral nutrients. Significant differences were found between the individual cultivars in net photosynthesis and respiration rates under given experimental conditions. Regardless of cultivars, photosynthetic activity, on the average increased as the concentration of nutrients in solution increased. The respiration rate varied mostly not depending on the concentration of nutrients in solution.

2492 Kummerova, M.; Hladilova, M.; Brandejsova, R. (1995) ACID PHOSPHATASE ACTIVITY OF SPRING BARLEY IN DEPENDENCE ON PHOSPHATE NUTRITION. *Rostlinna Vyroba*. 41(5):197-200. Czech. [MASARYKOVA UNIV FAK PRIRODOVEDECKA KOTLARSKA 2 CR-61137 BRNO CZECH REPUBLIC].

Rational utilization of nutrients as one of the ways of obtaining economically justified yields also assumes the knowledge of the character of the genotype specificity of mineral nutrition of plants (Wieneke, 1990). The use of biochemical parameters, particularly enzymes, as markers for the assessment of metabolic potentials and their heredity is a modern trend of testing the potential productivity of genotypes. When studying a number of factors connected with the ability of plant adaptation to conditions of low phosphorus level an important role was also ascribed to the activity of non-specific phosphatases (Mc Lachlan et al., 1987). In view of the above problems and linking up to our earlier papers (Kummerova, Buresova, 1990) the effect of exogenous phosphate deficiency on the activity of acid phosphatase, Pi (inorganic phosphate) content and the formation of biomass were studied. The results obtained document significant differences in enzymatic activity and Pi content between the genotypes of spring barley KM 743 and Rubin in dry and imbibed grains (Fig. 1) and in acid phosphatase activity of the third leaf of plants growing for 21 and 28 days in solutions with decreasing phosphate content (Fig. 2). Reduced phosphate content (P-0.5) and, in particular, its complete exclusion (P-0) evoked a demonstrable drop in Pi content in the root and in the third leaf in two genotypes (Fig. 3). The absence of phosphorus in the nutrient solution (P-0) for the whole time of cultivation induced an unambiguous increase in acid phosphatase activity of the root and the third leaf of plants of the two genotypes (Fig. 2). Negative correlation between enzymatic activity and the Pi content in tissue, induced by its exogenous deficiency, was also demonstrated in other plant species (Garcia, Ascencio, 1992). Differences between the genotypes in the formation of biomass were significant for the whole time of plant cultivation in nutrient solutions with 1, and 0.5 mM KH₂PO₄ (Fig. 4). Whereas in spring barley plants of the genotype KM 743 after 21 and, particularly, after 28 days of culture a significant growth inhibition was recorded in comparison with the plants of the variant P-1, the formation of dry matter weight of the whole plant of the genotype Rubin with half the content of phosphorus (P-0.5) in the culture medium was not affected. The results obtained support the justification of the view (Furlani et al., 1984) of utilizing genotype differences in the absorption or utilization of phosphorus as a criterion for economic utilization of the fertilizers used or for obtaining higher productivity in soils with lack of phosphorus. Such an approach to the field of improvement can also fulfil required conditions for the quality of production and environment as well.

2493 Lapa, V.V.; Ivakhnenka, N.M. (Belaruski Navukova Dasledchy Instytut Glebaznawstva i Agrakhimii, Minsk (Belarus)) (1993) [The influence of doses and correlations of mineral fertilizers on productivity and quality of barley grain on demo-podzolic sandy soil]. *Uplyw doz i suadnosin mineral'nykh ugnayennaw na praduksyjnasts' i yakasts' yachmenyu na dzyamova-podzolistaj supyaschanaj glebe. Vesti Akademi Agrarnykh Navuk Belarusi (Belarus)* (no.4) p. 34-38. 4 tables. Byelo Russian. (AGRS 95-048972).

The data about the change in yield and quality of barley grain and straw under the influence of mineral fertilizers, the utilization coefficient of reproduction of nutrient leaching by fertilizers are presented in the article.

2494 Laurent, F. (Institut Technique des Cereales et des Fourrages, Paris (France)); Justes, E. (1994) [Nitrogen fertilization of winter wheat: Jubil, a management tool]. *Fertilisation azotee du ble d'hiver. Un nouvel outil de pilotage Jubil. Perspectives Agricoles (France)* (no 190) p. 62-69. French. (AGRS 95-063325).

2495 Le Souder, C. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Adjustment of nitrogen fertilization program to winter soft wheat crop needs]. *Pilotage des cultures. Conduite de la fertilisation azotee du ble tendre d'hiver. Perspectives Agricoles (France)* (no 178) p. 69-72. French. (AGRS 95-049039).

2496 Le Souder, C. (Institut Technique des Cereales et des Fourrages, Paris (France)); Bernicot, M.H. (1993) [Nitrogen fertilisation for soft wheat crops, problem of cultivars]. *Ble tendre et bilan azote. Faut-il fertiliser de la meme facon toutes les varietes ? Perspectives Agricoles (France)* (no 179) p. 67-73. 10 graph. French. (AGRS 95-049040).

2497 Le Souder, C. (Institut Technique des Cereales et des Fourrages, Paris (France)); Martin, G.; Briffaux, G.; Drieu, Y. (1994) [Nitrogen fertilization of soft wheat by split dressings]. *Fertilisation azotee du ble tendre: les "plus" du fractionnement. Perspectives Agricoles (France)* (no 188) p. 24-28. 8 graph. French. (AGRS 95-063326).

2498 Limaux, F. (Chambre d'Agriculture de Lorraine, Nancy (France)); Aubry, C.; Bourzeix, A.; Constant, J.B. (1993) [Nitrogen fertilization of maize crops in Lorraine area (France)]. *Fertilisation azotee du ble en Lorraine. Constats et propositions pour de nouvelles pratiques (France). Perspectives Agricoles (France)* (no 179) p. 58-66. 7 ref., 9 tableaux. French. (AGRS 95-048964).

2499 Lin Qi; Wei Dongbin; Liu Peili (Laiyang Agricultural Coll., Shandong (China). Dept. of Agronomy) (1993) Influence of late stage application of nitrogen fertilizer upon quality of wheat gluten. *Journal of Laiyang Agricultural College (China)* v. 10(4) p. 248-252. 8 tables, 6 ref. Chinese. (AGRS 95-049043).

2500 Lind, AM.; Debosz, KK.; Maag, M. (1995) N-BALANCE FOR MINERAL-N ON SPRING BARLEY CROPPED SANDY LOAM AND COARSE SANDY SOIL WITH MINERAL AND ORGANIC FERTILIZERS. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 45(1):39-50. English. [DANISH INST PLANT & SOIL SCI RES CTR FOULUM DEPT SOIL BIOL & CHEM BOX 23 DK-8830 TJELE DENMARK].

N-balance for mineral N was calculated for growing season and autumn-winter periods during a three-year field experiment on two Danish soils, a sandy loam and a coarse sand. Both soils were grown with spring barley and on the coarse sandy soil a catch crop was undersown in one treatment. The soils were fertilized with inorganic N (NPK) and organic N (pig slurry) applied in the spring and also in autumn (on the coarse sand). On the sandy loam soil the differences in N-leaching, N-uptake and net N-mineralization between the fertilized treatments were small. On the coarse sandy soil the autumn-applied slurry caused a strongly increased N-leaching, while the undersown catch crop reduced the leaching. The unfertilized soil differed from the fertilized treatments with a lower N-uptake and a decreased N-leaching, especially on the sandy loam soil. The type of fertilization did not influence the net N-mineralization very much. The N-balances were based on the store of mineral nitrogen in spring and at harvest, as well on the N-input and N-output, which included N fertilization, net N mineralization, and N-uptake, N-leaching and N-denitrification. The deviations in N-balance were strongly influenced by the high variations found for the N-

- pools included in the N-balance and only to a minor extent by the climatic conditions and the type of soil. [References: 27].
- 2501 Liu Dianying; Shi Liyan; Dong Qingyu (Shandong Agricultural Univ., Taian (China). Dept. of Agronomy) (1993) The effect of top-dressing and irrigation time on the root system, root activities and plant characters in winter wheat. *Acta Agronomica Sinica (China)* v. 19(2) p. 149-155. 1 ill., 8 tables, 7 ref. Chinese. (AGRIS 95-048954).
- 2502 Mohr, RM.; Flaten, DN.; Bernier, CC.; Racz, GJ. (1995) EFFECT OF CHLORIDE FERTILIZATION ON BEDFORD BARLEY AND KATEPWA WHEAT. *Canadian Journal of Soil Science*. 75(1):15-24. French. [UNIV MANITOBA DEPT PLANT SCI WINNIPEG MB R3T 2N2 CANADA].
- Recent studies in the northern Great Plains have confirmed that the chloride (Cl-) component of fertilizers can reduce disease severity and increase grain yield for wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*). Field studies were conducted in Manitoba in 1989 and 1990 to determine the effect of rates of 25 and 50 kg Cl- ha(-1) (applied as KCl or NaCl) applied with or without *Cochliobolus sativus* inoculum on plant nutrient status, disease severity and grain yield for Katepwa wheat and Bedford barley. Chloride application, regardless of placement or source, increased the Cl- concentration in plant tissue sampled at the boot to heading stages. Rates of 25 and 50 kg Cl- ha(-1) resulted in significant reductions in the severity of common root rot for barley in two of six experiments and for wheat in one of four experiments. Chloride applications did not reduce spot blotch severity on barley in either of two experiments conducted. Inoculum did not have a consistent effect on any of the parameters measured. The application of 50 kg Cl- ha(-1) significantly increased grain yield for barley by an average 393 kg ha(-1) in two of eight experiments, but did not increase grain yield for wheat in any of eight experiments. Yield responses to Cl- were not related to soil Cl- content, Cl- concentration in plant tissue or observed reductions in disease. [References: 27].
- 2503 Mohr, RM.; Flaten, DN.; Bernier, CC.; Racz, GJ. (1995) EFFECT OF CULTIVAR ON RESPONSE OF WHEAT AND BARLEY TO CHLORIDE FERTILIZATION. *Canadian Journal of Soil Science*. 75(1):25-34. French. [UNIV MANITOBA DEPT PLANT SCI WINNIPEG MB R3T 2N2 CANADA].
- Crop cultivar has been shown to affect the frequency and magnitude of yield responses to chloride (Cl-) fertilizer applications. Information regarding the Cl- responsiveness of cereal cultivars commonly grown in western Canada is limited, however. Field experiments were conducted in Manitoba in 1990 and 1991 to determine the effect of Cl- fertilization on plant nutrient status, grain yield and grain quality of Katepwa, Roblin, Biggar and Marshall wheat (*Triticum aestivum* L.) and of Bedford, Frier, Argyle and Heartland barley (*Hordeum vulgare* L.). Chloride fertilization increased the concentration of Cl- in plant tissue of all cultivars. Increased grain yield and improved grain quality due to Cl- fertilization occurred more frequently in wheat than in barley; however, cultivars within a species differed in Cl- responsiveness. The application of 50 kg Cl- ha(-1) significantly increased grain yield for Heartland barley by 905 kg ha(-1) in one of four experiments, for Roblin wheat by 492 kg ha(-1) in one of four experiments, for Biggar wheat by an average 333 kg ha(-1) in two of four experiments and for Marshall wheat by an average 363 kg ha(-1) in two of four experiments. However, the application of 50 kg Cl- ha(-1) resulted in significant reduction in grain yield for Bedford in one of four experiments and for Marshall in one of four experiments. Yield responses to Cl- were not related to soil Cl- content or Cl- concentration in plant tissue. [References: 22].
- 2504 Orphanos, P.I. (Agricultural Research Institute, Nicosia (Chypre)) (1994) [Performance of grain and hay barley in different rotations and nitrogen and phosphorus fertilization in a Mediterranean environment]. [Rendement en grain et en foin de l'orge selon différentes rotations et différents apports de phosphore et d'azote dans le milieu méditerranéen]. *European Journal of Agronomy (France)* v. 3(3) p. 227-233. 20 ref., 7 graph. English. (AGRIS 95-048970).
- 2505 Palta, J.A.; Fillery, I.R.P. (Commonwealth Scientific and Industrial Research Organisation, Wembley (Australia). Div. of Plant Industry) (1994) Nitrogen management, post-anthesis water deficits and grain protein in spring wheat. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 502. English. (AGRIS 95-048949).
- 2506 Palta, J.A.; Fillery, I.R.P. (1995) N APPLICATION ENHANCES REMOBILIZATION AND REDUCES LOSSES OF PRE-ANTHESIS N IN WHEAT GROWN ON A DUPLEX SOIL. *Australian Journal of Agricultural Research*. 46(3):519-531. English. [CSIRO DIV PLANT IND DRYLAND CROPS & SOIL RES UNIT PO WEMBLEY PERTH WA 6014 AUSTRALIA].
- The effect of fertilizer N on the remobilization of N to the grain in wheat was evaluated on a duplex soil at East Beverley, Western Australia. Remobilization of N to the grain was determined using the stable isotope, N-15, which was fed to wheat plants during the vegetative growth phase. Nitrogen was applied at 15, 30 and 60 kg N ha(-1) with half being applied at seeding and the remainder at 35 days after sowing (DAS), before the onset of tillering. The high N treatment increased N uptake between stem elongation and anthesis and grain protein concentration by 2.9% relative to the low N treatment. Both the nitrogen harvest index (NHI) and the nitrogen utilization efficiency (NUE) declined as the rate of N application was increased; the decline was more pronounced when the rate of N application was increased from 30 to 60 kg N ha(-1). Total grain N at 60 kg N ha(-1) was increased by 54%, relative to that at 15 kg N ha(-1), due to a 2.3 fold increase in remobilization of pre-anthesis accumulated N and despite a 5 fold reduction in post-anthesis uptake. The application of 60 kg N ha(-1) reduced the losses of pre-anthesis N from 19% to 6%. The absolute contribution of the N taken up early in the growth of the crop (before the second node stage) to grain N was 0.9, 1.4 and 3.2 g m(-2) at 15, 30 and 60 kg N ha(-1) respectively. The contribution of pre-anthesis N to the grain was 2.2, 3.7 and 5.1 g m(-2) when 15, 30 and 60 kg N ha(-1) were applied respectively. This contribution accounted for 60, 82 and 95% of the total grain N respectively. Results indicated that with greater amounts of N accumulated before anthesis, there was higher remobilization to the grain and less risk of net N losses at maturity, because post-anthesis water deficits developed more rapidly. [References: 33].
- 2507 Palta, J.A.; Fillery, I.R.P. (1995) N APPLICATION INCREASES PRE-ANTHESIS CONTRIBUTION OF DRY MATTER TO GRAIN YIELD IN WHEAT GROWN ON A DUPLEX SOIL. *Australian Journal of Agricultural Research*. 46(3):507-518. English. [CSIRO DIV PLANT IND DRYLAND CROPS & SOIL RES UNIT PO WEMBLEY PERTH WA 6014 AUSTRALIA].
- The effect of fertilizer N on the growth, post-anthesis water deficits and remobilization of dry matter in spring wheat was measured on a duplex soil at East Beverley, Western Australia. Nitrogen was applied at 15, 30 and 60 kg N ha(-1) with half being applied at seeding and the remainder at 35 days after sowing (DAS), immediately before the onset of tillering. The applied N generated differences in early growth (76-117 g m(-2)) and dry matter at anthesis (410-693 g m(-2)), mainly through the effect of N on tiller number (120-171 m(-2)) and tiller size. It also generated differences in the water deficit, particularly after flowering. During the first 21 days after anthesis, midday flag leaf water potential fell at rates of 0.04, 0.07 and 0.13 MPa day(-1) at 15, 30 and 60 kg N ha(-1) respectively. Grain yield at 60 kg N ha(-1) was increased by 20% relative to that of 15 kg N ha(-1). The increase in grain yield resulted from an increase in the number of ears and grain number per ear. The high N treatment probably induced the increase in the number of fertile tillers (tillers with an ear), but reduced the grain size by 16% relative to the low N treatment. Contribution of pre-anthesis dry matter to grain yield was 193 g m(-2) for the wheat receiving 60 kg N ha(-1), 71 g m(-2) for wheat which received 30 kg N ha(-1) and only 16 g m(-2) for wheat which received 15 kg N ha(-1). This indicates that at high N supply, grain growth was substantially supported by pre-anthesis stored assimilates. [References: 23].
- 2508 Patel, NR.; Thaker, KR.; Bavevadia, TN. (1994) INFLUENCE OF DIFFERENT PROPORTIONS OF ORGANIC AND INORGANIC NITROGEN ON IRRIGATED WHEAT (TRITICUM AESTIVUM). *Indian Journal of Agronomy*. 39(4):641-643. English. [GUJARAT AGR UNIV DEPT AGRON SARDAR KRUSHINAGAR 385506 INDIA].
- 2509 Peltonen, J. (1995) GRAIN YIELD AND QUALITY OF WHEAT AS AFFECTED BY NITROGEN FERTILIZER APPLICATION TIMED ACCORDING TO APICAL DEVELOPMENT [Review]. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 45(1):2-14. English. [UNIV HELSINKI DEPT PLANT PROD BOX 27 SF-00014 HELSINKI FINLAND].

Optimal yield and quality of wheat (*Triticum aestivum* L.) depend to a large extent on the rate of nitrogen (N) fertilizer application, which may often be inadequate. Uptake and utilization of N by wheat plants are influenced by environment and variety, and consequently supplementary N may be needed during the growing season according to variations in these factors. Additional N can be applied at specific stages of plant development (phenology) for maximum effect. However, timing supplemental N application according to growth stage scales may not result in maximum yield as the scales do not provide sufficiently precise indication of spikelet and floret formation, which critically affect the sink capacity of the plant. In this review it is proposed that knowledge of apical development offers a means to identify the initiation and formation of those plant organs that are indicators of specific stages of plant development. Aspects of the general usage of apical development stages in timing N, and how they vary according to growing conditions, are discussed. [References: 118].

2510 Puponin, A.I.; Platonov, I.G.; Mazalov, S.K. (1994) [Effect of tillage, liming and fertilizers on potassium regime of sod-podzolic loamy soil and grain crop yield]. *Vliyanie obrabotki, izvestkovaniya i udobrenij na kalijnyj rezhim dernovo-podzolistoj suglinistoj pochvy i urozhajnost' zernovykh kul'tur. Agrokimiya (Russian Federation) (no.3) p. 31-38. 8 ref. Russian. (AGRIS 95-048976).*

2511 Raznikiewicz, H.; Carlgren, K.; Martensson, A. (1994) IMPACT OF PHOSPHORUS FERTILIZATION AND LIMING ON THE PRESENCE OF ARBUSCULAR MYCORRHIZAL SPORES IN A SWEDISH LONG-TERM FIELD EXPERIMENT. *Swedish Journal of Agricultural Research. 24(4):157-164. English. [SWEDISH UNIV AGR SCI DEPT SOIL SCI POB 7014 S-75007 UPPSALA SWEDEN].*

Occurrence of arbuscular mycorrhizal fungal (AMF) spores was investigated in a long-term field experiment located at two separate sites. In addition to treatments with no liming or phosphorus application, the original experimental design included liming to 75% of base saturation, a basal dressing with 540 kg P/ha, and annual additions of 0, 15 and 45 kg P/ha. The number of AMF spores decreased in the 540 kg P/ha treatment as well as in those plots given annual additions of 45 kg P/ha over a 9-year period. Indices suggest a negative relationship between a decrease of AMF spores and elevated levels of readily available soil phosphorus. Liming to 75% degree of base saturation at one of the field sites, i.e. increasing soil pH from 6.3 to 6.7, did not affect the presence of AMF spores. On the other hand, in the second soil, liming increased pH from 5.1 to 6.3, which significantly decreased the number of AMF spores. This may be explained by an increasing level of readily available soil phosphorus becoming soluble when pH was raised more than one unit by liming, which also has a negative effect on the occurrence of AMF spores. Presence of AMF spores did not affect harvest yields. Yield differences are mainly explained as being due to changes in chemical soil parameters, such as pH and amounts of readily available soil phosphorus. [References: 20].

2512 Saroka, V.I.; San'ko, T.V.; Shkel', M.P.; Bulavin, L.A.; Kulyashova, S.I. (Belaruski Navukova Dasledchy Instytut Glebaznavstva i Agrakhimii, Minsk (Belarus)) (1994) [Effect of urea in phosphate capsule on the crop and quality of field cultures and cereal plants]. *Uplyv machaviny v fasfatnaj abalontsy na vradzhaj i yakasto' palyavykh kul'tur i zlakavykh traw. Vestsi Akadehmii Agrarnykh Navuk Belarusi (Belarus) v. 1 p. 27-31. 5 tables; 7 ref. Byelo Russian. (AGRIS 95-049038).*

2513 Scharf, P.C.; Alley, M.M. (1995) NITROGEN LOSS INHIBITORS EVALUATED FOR HUMID-REGION WHEAT PRODUCTION. *Journal of Production Agriculture. 8(2):269-275. English. [USDA ARS SOIL PLANT NUTR RES UNIT POB E FT COLLINS, CO 80522 USA].*

Applied N fertilizer can be lost from the crop root zone by several pathways, reducing agronomic efficiency and causing environmental problems. One approach that has been suggested to reduce N losses is to mix compounds with the N fertilizer that inhibit some steps in the loss pathway. Our objective was to evaluate the effectiveness of five potential inhibitors (ammonium polyphosphate [APP], ammonium thiosulfate [ATS], dicyandiamide [DCD], monoammonium phosphate [MAP], and KCl), singly and in combinations, on yield and N uptake of winter wheat (*Triticum aestivum* L.) in a humid climate. A total of four experiments were established over 2 yr in which spring N topdress applications were made either as urea-ammonium nitrate (UAN) solution or as UAN solution mixed with inhibitors. All treatments gave a total spring application rate of 60 lb

N/acre. Yields exceeded 90 bu/acre in three of the experiments and reached 70 bu/acre in the fourth. Nitrogen rate treatments were also applied in each experiment to determine the N-responsiveness of each site. Large yield responses to applied N occurred at three of the experimental locations. Treatments that reduced fertilizer N losses would thus be expected to translate into increased yield at those three locations. However, none of the inhibitors tested increased yield or N uptake in any experiment despite ideal conditions for N loss (ammonia volatilization the first year, leaching and denitrification loss the second year), good uniformity in our experiments, and our use of eight replications for selected treatments in the second year. In one experiment with 100 bu/acre yields, we could have detected a 3.3 bu/acre yield increase, which would have required only 8 lb/acre additional N to achieve. This implies that no inhibitor reduced N loss by as much as 8 lb/acre in this experiment, which was conducted on a sandy soil and received 8 in. of rain within 4 wk of treatment application. While it is possible that some treatments gave yield increases below our limits of detection, even if this happened it would be cheaper in almost all cases to achieve this yield increase by applying a small amount of additional N than by using an inhibitor.

2514 Singh, H.; Sharma, K.N.; Arora, B.S. (1995) INFLUENCE OF CONTINUOUS FERTILIZATION TO A MAIZE-WHEAT SYSTEM ON THE CHANGES IN SOIL FERTILITY. *Fertilizer Research. 40(1):7-19. English. [CENT AGR RES INST PORT BLAIR INDIA].*

The effect of continuous application of rates of N (40, 80 and 120 kg N ha⁻¹), P (0, 17.5, and 35 kg P ha⁻¹) and K (0 and 33.2 kg K ha⁻¹) to a maize-wheat annual sequence on the changes in soil fertility after harvest of maize and wheat in their 11th cycle are reported. The organic carbon (O.C.), available nutrients and micronutrients tended to decline with cropping. Application of N or P significantly increased O.C. status of the soil both after harvest of maize and wheat. Potassium addition also increased the O.C. status but significant differences were observed only after wheat harvest (22nd crop). The available N status of the soil increased significantly with N application whereas a declining trend occurred with P dressings. Potassium application did not affect the soil available N content. The maximum decline in available P status was observed under N-120 P-0 K-33.2 treatment whereas a significant increase occurred in P treated plots. The available K status continued to decline in plots receiving increasing rates of N and NP fertilizers. The soil available K status was maintained to its initial content in plots receiving fertilizer K with increasing rates of N with or without P. Continuous application of increasing levels of N (averaged over PK) depleted the soil of DTPA-extractable Fe, Mn, Zn and Cu content. The addition of P also resulted in a decline in the status of Mn and Cu whereas the Fe and Mn content of the soil was increased. The available micronutrients content was least affected by K additions. The contents of organic carbon, available N and K in differentially fertilized plots were higher after harvest of 22 crops (wheat) than 21 crops (maize) while the reverse occurred in respect of available P and micronutrients.

2515 Sleeswijk, A.W. (Leiden Univ. (Netherlands)) (1993) Life cycle assessment of wheat fertilization: Methodological aspects and results. *Life Cycle Assessments of Food Products; Lyngby (Denmark): 22-23 Nov 1993. Proceedings of the 1st European invitational expert seminar on life cycle assessments of food products. Weidema, P.P., Danmarks Tekniske Univ., Lyngby (Denmark) p. 43-56. DTU. 2 tables; 13 ref. English. (AGRIS 95-048956).*

2516 Soegaard, K. (1994) [Application of slurry in fodder crop rotations]. *Styring og tildeling af husdyrgoedning i grovfoderaedskifter. Statens Planteavlssforsoeg, Lyngby (Denmark). SP. Rapport (Denmark); no. 37 40 p. SP. 8 ill., 16 tables; 23 ref. Danish. (AGRIS 95-048973).*

2517 Sparrow, L.A. (1993) A REVIEW OF FERTILISER ADVICE IN AUSTRALIA. *Australian Journal of Experimental Agriculture. 33(8):1067-1077. English. [DEPT PRIMARY IND & FISHERIES POB 46 KINGS MEADOWS TAS 7249 AUSTRALIA].*

Fertiliser advice is provided in many ways in Australia today. There has been a move away from blanket recommendations to recommendations for particular paddock-crop-farmer combinations. Emphasis has been on phosphorus for pastures and on nitrogen and phosphorus for cereals because of the importance of these elements and production systems in Australian agriculture. Soil tests are a major tool used in formulating recommendations, but plant tissue testing and nutrient budgets are playing increasing roles both in addition, and as alternatives, to soil tests.

Variability within our agricultural systems places limits on the capacity of any or all of these techniques to predict precise fertilizer needs. We know very little about farmer attitudes to fertilizer advice, both for the minority of farmers who use advisory services and, more so, for the majority who do not. Farmers have not been questioned enough about why they have, or have not, adopted available technology. If better fertilizer management is to be more widely practised, the needs of our clients must direct future research and extension in soil fertility more than they have in the past. Resources for research will be increasingly difficult to justify unless serious consideration is given to the application of that research in agriculture and its adoption by farmers. [References: 81].

2518 Sun Peng (Zibo Municipal Station of Soil and Fertilizers, Shandong (China)); Sui Fangong; Wei Yuanxiu (1994) Studies on the application technology for N, P, K fertilizers in the succession system of winter wheat-cotton. *Journal of Linyang Agricultural College (China)* v. 11(3) p. 181-185. 4 tables, 4 ref. Chinese. (AGRS 95-049075).

2519 Sun Yongfei; Wu Xujiang (Agricultural Bureau of Xinchang County, Zhejiang (China)); Xu Baijuan (1994) [An approach to the techniques of fertilizer application with low nitrogen in the early developmental stages of wheat]. *Journal of Zhejiang Agricultural Sciences (China)* (no. 1) p. 35-36. 2 tables. Chinese. (AGRS 95-049044).

2520 Tanacs, L.; Matuz, J.; Gero, L.; Csentes, J.N. (1994) EFFECT OF NPK FERTILIZATION AND YEAR ON THE FLOUR-EXTRACTIONS AND BRAN-EXTRACTIONS OF WHEAT VARIETIES. *Novenytermeles*. 43(6):513-520. Hungarian. [KEE ELELMISZERIPARI FOISKOLAI KAR MARS TER 7 H-6724 SZEGED HUNGARY].

In the tests the flour and bran extractions of two wheat varieties were evaluated over two years at different fertilizer levels. Concerning the two mill-industrial characteristics it can be stated that the effect of variety and year significantly influenced the parameters tested, while the effect of the different fertilizer treatments was not so marked. The year x variety x fertilizer interaction was strong. The year 1991 resulted in a higher flour extraction % in both wheat varieties at the 16 different fertilizer levels. The flour extraction % in variety GK Csuros was in every treatment during the two years significantly higher than that of variety GK Kata. The rate of the flour and bran extractions in the two wheat varieties was decisively controlled by the genotype. The variety GK Csuros showed at increasing N doses at 0 P and 0 K levels a growing flour extraction % in both years, while in variety GK Kata this was contradictory at similar treatment levels. The increasing P, K dosings at 0 N level in GK Csuros gave in the most combinations reliable flour extraction %, while in GK Kata the development of this parameter during the two years partly rose, and partly decreased. The combined P, K and N fertilizations strengthened in GK Csuros the increase of flour extraction, while in GK Kata this effect was not as marked. The year had a strong influence on the improving effect of combined fertilizers on flour extraction %. The rate of bran extraction showed always an inverse tendency with the flour extraction %.

2521 Thomsen, I.K. (1994) [Nitrogen uptake and nitrate leaching after application of straw, catch crops and animal slurry: Effects of soil type, crop rotation and cropping history]. *Kvalitetsforbedring og nitratnedvaskning efter tilførsel af halm, efterafgroede og gylle til jord: effekt af jordtype, afgroedevalg og dyrkningshistorie*. Statens Planteavlssorsoeg, Lyngby (Denmark). SP. Rapport (Denmark); no. 29 20 p. SP. 8 ill., 5 tables; 10 ref. Danish. (AGRS 95-048974).

2522 Tomar, RKS.; Namdeo, KN.; Raghu, JS.; Tiwari, KP. (1995) EFFICACY OF AZOTOBACTER AND PLANT GROWTH-REGULATORS ON PRODUCTIVITY OF WHEAT (TRITICUM AESTIVUM) IN RELATION TO FERTILIZER APPLICATION. *Indian Journal of Agricultural Sciences*. 65(4):256-259. English. [JAWAHARLAL NEHRU CTR ADV SCI RES ZONAL AGR RES STN TIKAMGARH 472001 MADHYA PRADESH INDIA].

A field experiment was conducted during the winter season of 1991-92 and 1992-93 to evaluate the efficacy of Azotobacter and plant growth-regulators on the yield of wheat (*Triticum aestivum* L. emend. Fiori and Paol.) in relation to N, P and K application. Yield and yield attributes of 'H1 1077' wheat increased significantly with application of N, P and K 120, 26.20 and 33.33 kg/ha respectively. Azotobacter resulted in maximum dry matter/plant (16.02 g) and 1 000-seed weight (48 g), whereas cytokinin (250

ml/ha at 30 and 45 days after sowing) gave the maximum grain weight/plant (8 g), harvest index (41.17%) and grain yield (3.053 tonnes/ha). The highest straw (4.626 tonnes/ha) was recorded with Azotobacter. Application of N, P and K 120, 26.20 and 33.33 kg/ha respectively + Azotobacter gave the highest grain yield (4.261 tonnes/ha).

2523 Wang Ren; Zhang Baolie; Qiu Weiwen (Liaoning Provincial Academy of Agricultural Sciences, Shenyang (China). Inst. of Soil and Fertilizers) (1994) Influence of combined application of green manures and mineral fertilizers on soil fertility and wheat yield. *Liaoning Agricultural Sciences (China)* (no. 3) p. 9-12. 4 tables. Chinese. (AGRS 95-049042).

2524 Wang Zhengfang (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Application of Atomic Energy in Agriculture); Chen Xianglong (1994) [Effect of boron on cotton transplanting after wheat harvest]. *Jiangsu Agricultural Sciences (China)* (no. 3) p. 44-46. 1 ill., 4 tables, 3 ref. Chinese. (AGRS 95-049072).

2525 Wang Zhenlin; Shen Chengguo; Yu Songlie (Shandong Agricultural Univ., Taian (China)) (1993) The effect of zinc nutrition on leaf structure and chloroplast ultrastructure in winter wheat (*Triticum aestivum* L.). *Acta Agronomica Sinica (China)* v. 19(6) p. 553-557. 13 ill., 1 table, 12 ref. Chinese. (AGRS 95-048955).

2526 Wojnowska, T.; Sienkiewicz, S.; Wojtas, A. (Akademia Rolniczo Techniczna, Olsztyn (Poland). Katedra Chemii Rolnej) (1993) [Dynamics of CO₂ emanation from soil according to FYM and NPK fertilization and cultivated crops]. *Dynamika wydzielania CO₂ z gleby w zaleznosci od nawozenia obornikiem i NPK oraz uprawianych roslin*. Zeszyty Problemowe Postepow Nauk Rolniczych (Poland); no. 411 p. 101-106. Komitet Gleboznawstwa i Chemii Rolnej PAN. 1 fig., 3 tables; 12 ref.. Distributed 1994. p. 101-106. Polish. (AGRS 95-048965).

It was noted that in the 14 weeks period of plant vegetation in the series with farmyard manure (FYM) fertilization intensity of CO₂ emanation increased about 18 percent as compared to series without FYM. Intensity of CO₂ emanation was highest in the second half of June and the first decade of July, what was more visible in cereals cultivation than in root crops. The effect of air temperature was positive and their increasing about 1 degree C increased CO₂ emanation about 0.269 g/24 h per sq. m. The highest correlations between CO₂ emanation and precipitation was noted in years with low rainfall.

2527 Xiao Ling; Li Gang; Hao Weiping (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Dept. of Soil Science and Agrochemistry) (1994) The effects of applying sewage sludge to manural loess soil on wheat growth. *Acta Universitatis Agriculturae Boreali-Occidentalis (China)* v. 22(1) p. 89-93. 4 tables, 9 ref. Chinese. (AGRS 95-049045).

2528 Yadav, PK.; Kurchania, SP.; Tiwari, JP. (1995) HERBICIDE AND FERTILIZER COMPATIBILITY UNDER NORMAL AND STALE SEEDBED SOWING OF WHEAT (TRITICUM AESTIVUM) AT DIFFERENT LEVELS OF NITROGEN. *Indian Journal of Agricultural Sciences*. 65(4):265-270. English. [JAWAHARLAL NEHRU CTR ADV SCI RES DEPT AGRON JABALPUR 482004 MADHYA PRADESH INDIA].

An experiment was conducted during the winter season of 1988-89 and 1989-90 to study herbicide and fertilizer compatibility for weed control in wheat (*Triticum aestivum* L. emend. Fiori & Paol.) under different levels of nitrogen and methods of seedbed preparation. Four methods of isoproturon (1.0 kg/ha) application were spray pre-emergence, post-emergence, broadcast as mixture with superphosphate basal at pre-emergence stage and with urea top-dressed at post-emergence stage; and 3 levels of N were 60, 90 and 120 kg/ha. Isoproturon 1.0 kg/ha as pre-emergence spray effectively controlled small canarygrass (*Phalaris minor* Retz.) and annual broad-leaf weeds, viz scarlet pimpernel (*Anagallis arvensis* L.), lambsquarters (*Chenopodium album* L.), toothed medick (*Medicago hispida* Gaertn.), sweet clover (*Melilotus alba* Medikus), common purslane (*Portulaca oleracea* L.) and corn spurry (*Spergula arvensis* L.). It showed weed-control efficiency 64%, followed by isoproturon post-emergence spray (57%), isoproturon + urea top-dressed (49%) and isoproturon + superphosphate (41%). The weed-control efficiency increased under stale seedbed (34%) compared with normal seedbed. An increase in N level (60-120 kg/ha) also increased the weed-control efficiency (11-21%) and reduced the weed biomass (11-21%). The grain yield (4 270 kg/ha) and net profit (Rs

7 369) were higher under stale seedbed and with increase in N level. The mean yield under different isoproturon treatments (4 252-4 321 kg/ha) was at par with that under hand-weeding (4 222 kg/ha) but significantly superior to weedy control (3 667 kg/ha), and hence proved economical. The benefit : cost ratio with isoproturon was higher (2.53-2.58) than that with hand-weeding (2.19) and weedy control (2.44).

2529 Yamane, T. (Ibaraki ken. Agricultural Experiment Inst., Mito (Japan)); Ogawa, Y.; Sakai, K. (1992) Studies on the rate of nitrogen fertilizer application on field crops in the rotational paddy field, 1: Determination on the rate of nitrogen fertilizer application to wheat (*Triticum aestivum*) crop in the rotational paddy field. *Bulletin of the Ibaraki-ken Agricultural Experiment Institute (Japan)* (no.31) p. 87-99. 7 tables; 5 fig.; 24 ref. Japanese. (AGRIS 95-049046).

2530 Yue Shousong; Yu Zhenwen (Shandong Agricultural Univ., Taian (China). Dept. of Agronomy) (1994) Effect of phosphorus on growth at late stages and yield of winter wheat. *Journal of Shandong Agricultural Sciences (China)* (no. 1) p. 13-15. 1 ill., 5 tables, 5 ref. Chinese. (AGRIS 95-048950).

2531 Zaborin, A.V.; Nikitishen, V.I. (1994) [Soil moisture consumption by winter wheat under various mineral nutrition conditions]. *Ispol'zovanie pochvennoj vlagi posevami ozimoi pshenitsy v razlichnykh usloviyakh mineral'nogo pitaniya. Pochvoedenie (Russian Federation)* (no.3) p. 77-82. 32 ref. Russian. (AGRIS 95-049050).

The optimization of winter wheat mineral nutrition level by fertilizers application favours the development of plants, which are able to completely utilize soil moisture pool from 1 m layer. In this way they get adapted to the stress impact of droughts and have minimum losses in yield.

2532 Zhang Guilan; Sun Kegang; Li Guibao (Henan Provincial Academy of Agricultural Sciences, Zhengzhou (China). Inst. of Soil and Fertilizers) (1994) Optimized fertilization practice and mathematical model for high-yielding winter wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(3) p. 92-99. 3 ill., 6 tables, 3 ref. Chinese. (AGRIS 95-048951).

2533 Zhang Jianping; Zhang Lifeng; Zang Shiguo (Hebei Agricultural Univ., Baoding (China). Dept. of Agronomy) (1994) Studies on the fertilizer application for higher yield of winter wheat in high productivity field. *Journal of Hebei Agricultural University (China)* v. 17(3) p. 57-61. 1 ill., 3 tables, 5 ref. Chinese. (AGRIS 95-048953).

2534 Zhang Wenying; Zhang Qingjiang (Hebei Provincial Academy of Agriculture and Forestry Sciences, Shijiazhuang (China). Inst. of Grain and Oil Crops) (1994) Nitrogen balance of soil-crops system in wheat-corn double cropping. *Acta Agriculturae Boreali-Sinica (China)* v. 9(Suppl.) p. 109-114. 3 ill., 4 tables, 11 ref. Chinese. (AGRIS 95-048986).

2535 Zhou Jun (Beijing Agricultural Engineering Univ. (China)); Yang Rongquan; Chen Haijun (1994) Interaction and economic effect of irrigation and fertilizer application on yield increase of winter wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(3) p. 100-106. 10 tables, 2 ref. Chinese. (AGRIS 95-048952).

F06 IRRIGATION

2536 Chauhan, C.P.S. (Raja Balwant Singh Coll. (India)); Singh, S.P. (1993) Wheat (*Triticum aestivum*) cultivation under saline irrigation. *Wheat Information Service (Japan)* (no.77) p. 33-38. 4 tables; 1 fig.; 6 ref. English. (AGRIS 95-063491).

2537 Duan Yutian; Chen Yongjie; Jia Wenlan (Shanxi Provincial Academy of Agricultural Sciences, Linfen (China). Inst. of Wheats) (1994) Effects of water-limiting irrigation on winter wheat production and its production efficiency of irrigation water. *Journal of Shanxi Agricultural Sciences (China)* v. 22(1) p. 16-19. 4 tables, 3 ref. Chinese. (AGRIS 95-049226).

2538 Mishra, R.K.; Pandey, N.; Bajpai, R.P. (1994) INFLUENCE OF IRRIGATION AND NITROGEN ON YIELD AND WATER-USE PATTERN OF WHEAT (*TRITICUM AESTIVUM*). *Indian Journal of Agronomy*. 39(4):560-564. English. [ZONAL AGR RES STN AMBIKAPUR 497001 MADHYA PRADESH INDIA].

A field experiment was conducted during the winter season of 1986-87 and 1987-88 to study the effect of 6 irrigation and 4 nitrogen levels on wheat (*Triticum aestivum* L. emend. Fiori and Paol.) at Ambikapur. Irrigation of the crop at 0.75 irrigation water : cumulative pan evaporation (IW : CPE) ratio gave the grain yield and yield components similar to that at 5 critical growth stages of wheat. However, at 0.75 IW : CPE ratio 32% irrigation water could be saved because 9 cm winter rains was effectively utilized during both the years. The crop extracted more moisture at 0-60 cm depth than that of deeper layers. The response of grain yield and yield components to N was significant up to 90 kg/ha.

2539 Wang Dianzhang; Ye Chunsheng; Sun Chunzhu (Haiyang County Station of Seed, Shandong (China)) (1994) Effects of water control on growth and development of winter wheat. *Journal of Linyang Agricultural College (China)* v. 11(3) p. 186-190. 1 ill., 4 tables, 6 ref. Chinese. (AGRIS 95-049227).

2540 Yu Zhenwen; Yue Shousong; Shen Chengguo (Shandong Agricultural Univ., Taian (China). Lab. of Wheat Cultivation and Physiology) (1994) Study on irrigation schemes for winter wheat to get high yield and benefit. *Journal of Shandong Agricultural Sciences (China)* (no. 2) p. 3-6. 7 tables, 2 ref. Chinese. (AGRIS 95-049225).

F07 SOIL CULTIVATION

2541 Chen Houde; Wang Zhangming (Jiangsu Agricultural Coll., Yangzhou (China). Dept. of Plant Protection) (1993) Studies on the occurrence of wheat sharp eyespot in the fields with no and minimum tillage in Jiangsu [China]. *Acta Phytologica Sinica (China)* v. 20(4) p. 295-300. 7 tables, 5 ref. Chinese. (AGRIS 95-049309).

2542 Franzluebbers, A.J.; Hons, F.M.; Zuberer, D.A. (1995) TILLAGE-INDUCED SEASONAL CHANGES IN SOIL PHYSICAL PROPERTIES AFFECTING SOIL CO₂ EVOLUTION UNDER INTENSIVE CROPPING. *Soil & Tillage Research*. 34(1):41-60. English. [TEXAS A&M UNIV TEXAS AGR EXPT STN DEPT SOIL & CROP SCI COLLEGE STN, TX 77843 USA].

Crop management practices impact soil productivity by altering the soil environment, which in turn affects microbial growth and decomposition processes that transform plant-produced C to soil organic matter (SOM) or CO₂. Reduced tillage increases SOM in the long term, but there is limited information on the in situ seasonal changes in soil physical and biological properties that affect SOM dynamics. Our objectives were to: (i) determine the effect of tillage (conventionally disked (CT) and no tillage (NT) in a sorghum (*Sorghum bicolor* (L.) Moench)-wheat (*Triticum aestivum* L.) / soybean (*Glycine max* (L.) Merr.) 2-year rotation sequence and a wheat/soybean double-cropping sequence on the seasonal dynamics and soil depth distribution of gravimetric soil water content (SWC), soil temperature, bulk density (BD) and water-filled pore space (WFPS); and (ii) relate soil CO₂ evolution to changes in these physical properties. Treatments had been in place for 9 years at the beginning of sampling. The soil was a Weswood silty clay loam (fine, mixed, thermic Fluventic Ustochrept) located in southcentral Texas. Soil CO₂ evolution, using the static chamber method with alkali absorption, and physical properties were measured 57 times during a 2-year period. Soil water content with NT was greater than with CT at the 0-50 mm depth during the fallow period of sorghum-wheat/soybean. In contrast to the surface, SWC at the 50-125 mm depth with CT was greater than or equal to that with NT in all crop sequences. Tillage reduced soil BD, especially at the 50-125 mm depth in all crop sequences, but exhibited large seasonal dynamics at the 0-50 mm depth. Greater temporal variation in SWC and BD occurred due to tillage effects. Soil temperature at 50 mm depth at sunrise averaged 1.2-degrees-C greater with NT than with CT during May, September and November, perhaps due to reduced heat loss with residue cover. The mean rate of soil CO₂ evolution with CT was 1.55, 1.95 and 2.45 g CO₂-C m⁻² d⁻¹ in sorghum-wheat/soybean, sorghum-wheat/soybean and wheat/soybean, respectively. The corresponding soil CO₂ evolution with NT was 9% greater, 12% greater, and not different compared with CT, respectively. Large seasonal differences in soil CO₂ evolution occurred with respect to tillage regime. Soil CO₂ evolution was highly related to soil temperature, moisture and temperature-moisture interactions. Regression models of soil CO₂ evolution on soil temperature, moisture and day of the season explained from 65 to 98% of the temporal variation, depending upon crop sequence, tillage regime and season. Day of the season was related to non-

linear residue decomposition and a polynomial function that expressed crop root respiration and microbial respiration due to rhizodeposition. There were significant tillage and crop sequence interactions with soil temperature and moisture, suggesting that C budgets of agroecosystems derived from climatic data alone could be misleading. Conversion from CT to NT increased C sequestration in soil, but soil under NT released the same or more C as CO₂, depending upon crop sequence, suggesting that the dynamics of C sequestration/mineralization had changed during the 10-year period. [References: 34].

2543 Hofmann, B. (Halle Univ. (Germany). Landwirtschaftliche Fakultät. Inst. fuer Acker und Pflanzenbau); Raebiger, H.; Dunkel, J. (1993) [The influence of structure-supporting tillage methods on selected soil properties and yields of a loamy sand site in Central Germany]. *Der Einfluss gefuegueschonender Bearbeitung auf ausgewaehlte Bodeneigenschaften und Ertraege eines lehmigen Sandbodens in Mitteldeutschland. Kuehn-Archiv (Germany) v. 87(2) p. 137-145. 1 ill., 5 tables; 18 ref. German. (AGRI 95-063539).*

2544 Jenkyn, J.F.; Gutteridge, R.J.; Todd, A.D. (1995) EFFECTS OF INCORPORATING STRAW, USING DIFFERENT CULTIVATION SYSTEMS, AND OF BURNING IT, ON DISEASES OF WINTER BARLEY. *Journal of Agricultural Science, 124(Part 2):195-204. English. [ROTHAMSTED EXPTL STN INST ARABLE CROPS RES HARPENDEN AL5 2JQ HERTS ENGLAND].*

An experiment at Rothamsted in 1985-89 and another at Whaddon in 1986 studied the effects of incorporating straw on diseases of winter barley. Net blotch (*Pyrenophora teres*) and leaf blotch (*Rhynchosporium secalis*) were initially less severe where straw was burnt or incorporated by ploughing than where cultivations only partially buried it. However, by summer both diseases were usually more severe where straw had been burnt than where it had been incorporated. At Whaddon, eyespot (*Pseudocercospora heliophila*) tended to be less severe in tine-cultivated plots where straw was incorporated than where it was burnt, but at Rothamsted, where the straw treatments were confounded with cultivations, there was no consistent effect. The disease was usually more severe where straw was incorporated by ploughing than where it was incorporated using other methods. In contrast, the severity of take-all was generally decreased by ploughing. Seedlings usually grew better where straw had been burnt rather than incorporated and grain yields were often larger. However, yields at Rothamsted in 1987 were unusually, and inexplicably, smaller after burning the straw so that the 5-year mean yields showed no significant differences between treatments. [References: 9].

2545 Li Yane; Xie Honge; Ren Pinghe (Shanxi Provincial Academy of Agricultural Sciences, Yuncheng (China). Inst. of Cotton Research) (1994) Study on subsoiling with residue mulching for wheat production in semi-arid regions. *Journal of Shanxi Agricultural Sciences (China) v. 22(3) p. 53-56. 3 ill., 4 tables. Chinese. (AGRI 95-049307).*

2546 Prew, R.D.; Ashby, J.E.; Bacon, E.T.G.; Christian, D.G.; Gutteridge, R.J.; Jenkyn, J.F.; Powell, W.; Todd, A.D. (1995) EFFECTS OF INCORPORATING OR BURNING STRAW, AND OF DIFFERENT CULTIVATION SYSTEMS, ON WINTER WHEAT GROWN ON TWO SOIL TYPES, 1985-91. *Journal of Agricultural Science, 124(Part 2):173-194. English. [ROTHAMSTED EXPTL STN INST ARABLE CROPS RES HARPENDEN AL5 2JQ HERTS ENGLAND].*

Disposal methods for straw from continuous winter wheat were tested on two soil types, a flinty silty clay loam and a sandy loam, over 7 years (1985-91). The methods tested were burnt or chopped straw in full factorial combination with four cultivation methods (tined to 10 cm, tined to 10 cm then to 20 cm; ploughed to 20 cm; tined to 10 cm then ploughed to 20 cm). Measurements were taken to determine the effects on crop establishment and growth, pest and disease incidence, and the consequent effects on yield. Another experiment (1985-91) on the flinty silty clay loam site, investigated the interactions between straw treatments (burnt, baled or chopped in plots that were all shallow cultivated to 10 cm) and five other factors; namely, time of cultivation, insecticides, molluscicides, fungicides and autumn nitrogen. All the straw x cultivation systems allowed satisfactory crops to be established but repeated incorporation of straw using shallow, non-inversion cultivations resulted in very severe grass-weed problems. Early crop growth, as measured by aboveground dry matter production, was frequently decreased by straw residues, but the effect rarely persisted

beyond anthesis. Pests were not a problem and their numbers were not greatly affected either by straw or cultivation treatments, apart from yellow cereal fly which, especially on the heavier soil, was decreased by treatments which left much straw debris on the soil surface. Incorporating straw also caused no serious increases in the incidence of diseases. Indeed, averaged over all sites and years, eyespot and sharp eyespot were both slightly but significantly less severe where straw was incorporated than where it was burnt. Eyespot, and even more consistently sharp eyespot, were often more severe after ploughing than after shallow, non-inversion cultivations. Effects on take-all were complex but straw residues had much smaller effects than cultivations. Initially the disease increased most rapidly in the shallow cultivated plots but these also tended to go into the decline phase more quickly so that in the fourth year (fifth cereal crop) take-all was greater in the ploughed than in the shallow cultivated plots. On average, yields did not differ greatly with straw or cultivation systems, although there were clear effects of take-all in those years when the disease was most severe. In the last 2 years, yields were limited by the presence of grass weeds in the plots testing chopped straw incorporated by tining to 10 cm. [References: 49].

2547 Shusharina, L.T.; Shusharin, A.N.; Chichkan', T.N. (1992) [Erodibility of soil surface depending on methods of its tillage in conditions of Northern Kulunda (Russian Federation)]. *Ehrodiruemost' poverkhnosti pochvy v zavisimosti ot sposobov ee obrabotki v usloviyakh Severnoj Kulundy. Sibirskij vestnik sel'skokhozyajstvennoj nauki (Russian Federation) (no.1) p. 6-9. 7 ref. Russian. (AGRI 95-049288).*

Results of field experiments on studying the effect of methods of primary soil cultivation on the resistance of its surface to wind erosion and yield of cereal crops are presented. It has been stated that the danger of appearing dust storms in a fallow field is preserved not only after ploughing, but also after tillage with a subsurface cultivator. With the increase in the quantity of stubble on the soil surface the probability of appearing deflation decreases. The use of surface tillage with a subsurface cultivator and retaining a stubble background without cultivating with straw mulching at harvesting under the second and third culture after fallow ensures a minimum erodibility of the soil surface and obtaining stable yields of wheat and barley according to years.

2548 Watanabe, J. (National Grassland Research Inst., Miyota, Nagano (Japan). Alpine Region Branch); Takaya, T.; Takahashi, M. (1994) Effect of chisel plow on the yield of spring wheat [*Triticum aestivum*] seeded early winter. *Soil Physical Conditions and Plant Growth (Japan) (no.69) p. 31-37. 6 tables; 5 fig.; 6 ref. Japanese. (AGRI 95-063543).*

2549 Xie Deti; Wei Chaofu; Chen Shaolan (Southwest Agricultural Univ., Chongqing (China). Dept. of Soil and Agrochemistry) (1993) Effect of no-tilled paddy soil on growth and yield of wheat and rice. *Southwest China Journal of Agricultural Sciences (China) v. 6(1) p. 47-54. 2 ill., 9 tables, 15 ref. Chinese. (AGRI 95-049305).*

F08 CROPPING PATTERNS AND SYSTEMS

2550 Report. Regional Expert Consultation on the Sustainability of the Rice-Wheat Production System in Different Agro-Ecological Setting in Asia (1993) Regional Expert Consultation on the Sustainability of the Rice-Wheat Production System in Different Agro-Ecological Setting in Asia; Bangkok (Thailand); 6-9 Jul 1993. FAO, Bangkok (Thailand). Regional Office for Asia and the Pacific. *RAPA Report (FAO); no. 1993/20 42 p. English. (AGRI 95-049401).*

2551 Andersen, A.; Olsen, C.C. (1994) [Catch crops after spring barley]. *Efterafgroeder efter vaerbyg. Statens Planteavlsforsog. Lyngby (Denmark). SP. Rapport (Denmark); no. 24 15 p. SP. 3 ill., 6 tables; 4 ref. Danish. (AGRI 95-049385).*

2552 Andersen, A.; Olsen, C.C. (1994) [Different sorts of plants used as green manure in barley growing [Chinese cabbage X turnip, *Brassica chinensis* X *Brassica rapa*, Tyfon]]. *Forskellige kulturplanter anvendt som groengodning i bygdyrkingen. Statens Planteavlsforsog. Lyngby (Denmark). SP. Rapport (Denmark); no. 23 22 p. SP. 12 tables; 3 ref. Danish. (AGRI 95-049386).*

2553 Andersen, A.; Olsen, C.C. (1994) [Winter cereal growing after different preceding crops and different sowing dates]. Dyrkning af overvintrende kornarter efter forskellige forfrugter og med forskellig saatid. Statens Planteavlssforsoeg, Lyngby (Denmark). SP. Rapport (Denmark); no. 22 26 p. SP. 12 ill., 11 ref. Danish. (AGRI 95-049410).

2554 Augustinussen, E. (1994) [Uptake of nitrogen in winter rape in the autumn]. Kvalitetsoptagelse hos vinterraps i efteraarsperioden. Statens Planteavlssforsoeg, Lyngby (Denmark). SP. Rapport (Denmark); no. 21 16 p. SP. 2 ill., 6 tables; 9 ref. Danish. (AGRI 95-049387).

2555 Cheng Yannian (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Agrometeorology) (1994) The influence of climatic variation on the double cropping system of winter wheat and maize in Beijing Region, China. *Acta Agriculturae Boreali-Sinica (China)* v. 9(1) p. 18-24. 6 tables, 3 ref. Chinese. (AGRI 95-049393).

2556 Das, S.; Singh, T.A. (1994) RESIDUAL EFFECT OF UREA SUPERGRANULES APPLICATION IN RICE (ORYZA SATIVA)-WHEAT (TRITICUM AESTIVUM) CROPPING SYSTEM. *Indian Journal of Agronomy*. 39(4):604-605. English. [GOVIND BALLABH PANT UNIV AGR & TECHNOL PANTNAGAR 263145 UTTAR PRADESH INDIA].

2557 Derylo, S. (Akademia Rolnicza, Lublin. (Poland). Katedra Ogolnej Uprawy Roli i Roslin) (1994) [Influence of stubble intercrops on the creation of structure and quality of winter wheat and spring barley yields in cereal crop rotation]. Wplyw miedzyplonow scierniskowych na ksztaltowanie sie struktury i jakosci plonu pszenicy ozimej i jeczmenia jarego w plodozmianach zbozowych. *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland)* v. 35(187) p. 103-111. 4 tables; 4 ref. Polish. (AGRI 95-049425).

In the four-year field experiment carried out on a fallow soil, created of loess, the influence of stubble intercrops on the structure of crop and chemical composition of winter wheat and spring barley, cultivated in crop rotation of varying cereal shares (50, 75 and 100 percent of cereal) was studied. Significantly positive influence of stubble intercrops on the yield of grain shapeliness in both studied cereals were stated. The positive influence of intercrops was also revealed by the increase of protein content in winter wheat and spring barley by 2.4 and 7.3, respectively.

2558 Ding Tonghua; Wang Hao; Cui Shihong (Dongtai Municipal Bureau of Agriculture, Jiangsu (China)) (1994) [Intensive intercropping of barley, watermelon, cotton and radish]. *Shanghai Agricultural Science and Technology (China)* (no. 1) p. 10, 28. 1 ill. Chinese. (AGRI 95-049384).

2559 Dossantos, HP.; Reis, EM. (1995) CROP ROTATION IN GUARAPUAVA, PR BRAZIL. 16. ENERGETIC EFFICIENCY OF ROTATION SYSTEMS FOR WHEAT, UNDER NO-TILLAGE. *Pesquisa Agropecuaria Brasileira*. 30(2):215-222. Portuguese. [EMBRAPA CTR NACL PESQUISA TRIGO CAIXA POSTAL 569 BR-99001970 PASSO FUNDO RS BRAZIL].

From 1984 to 1989, at the Cooperativa Agraria Mista Entre Rios Ltda., in Guarapuava, PR, Brazil, plant species composing rotation systems for wheat on energetic efficiency were assessed. Four rotation systems for wheat were studied: 1) monoculture; 2) one winter without wheat; 3) two winters without wheat; 4) three winters without wheat. Both winter (white oat, barley, common vetch, flax, wheat, and lupin) and summer (corn and soybean) crops were seeded under no-tillage. The energetic efficiency is calculated by dividing the grain yield of each crop by cropping energy, represented by the commodities and labor employed in the cropping systems. Energetic efficiency of crops studied was affected by the period. White oat, barley, and wheat crops showed higher energetic efficiency compared to other winter crops. The best energetic efficiency was obtained by corn.

2560 Dossantos, HP.; Reis, EM. (1995) WHEAT CROPPING SYSTEMS WITH WHITE AND BLACK OATS FOR GRAIN PRODUCTION. *Pesquisa Agropecuaria Brasileira*. 30(1):69-73. Portuguese. [EMBRAPA CTR NACL PESQUISA TRIGO CAIXA POSTAL 569 BR-99001970 PASSO FUNDO RS BRAZIL].

During the period from 1985 to 1989, at the National Wheat Research Center (CNPT-EMBRAPA), Passo Fundo, Rio Grande do Sul, Brazil, the effects of crop rotation systems with white (*Avena sativa*) and black oats

(*Avena strigosa*) on wheat (*Triticum aestivum*) yield and root disease severity were assessed. The cropping systems comprised: 1) monoculture of wheat; 2) one winter with wheat, and one with black oat; 3) one winter with wheat, and two with black oats; 4) one winter with wheat, and three with black oats; 5) one winter with wheat, and two with white oats; 6) one winter with wheat, and three with white oats. Root disease severity was higher under monoculture than under rotation, even in seasons with normal precipitation. Grain yield was not influenced by cropping systems, in the mean of years. Root disease severity and grain yield of wheat in rotation systems were influenced by the year.

2561 Evans, J. (New South Wales Agriculture, Wagga Wagga (Australia)) (1993) Travel to Canada and U.S.A. [nitrogen fixation]. New South Wales Agriculture. 9 p. English. (AGRI 95-063638).

Gives an overview of research being conducted in Canada and U.S.A. of the effects of crop rotations on nitrogen fixation by legumes. Also studied were methods of measuring and testing nitrogen fixation in pastures and crops.

2562 Gill, M.S.; Singh, T.; Rana, D.S. (1994) INTEGRATED NUTRIENT MANAGEMENT IN RICE (ORYZA SATIVA)-WHEAT (TRITICUM AESTIVUM) CROPPING SEQUENCE IN SEMI-ARID TROPIC. *Indian Journal of Agronomy*. 39(4):606-608. English. [PUNJAB AGR UNIV DEPT AGRON LUDHIANA 141004 PUNJAB INDIA].

2563 He Yuannong; Huang Jianbing; Wang Qinghua (Guizhou Provincial Academy of Agricultural Sciences, Guiyang (China). Inst. of Crops) (1993) Balance relationship between multiple cropping of wheat, maize and soybean with level of supplying nitrogen and its distribution stress in a year. *Southwest China Journal of Agricultural Sciences (China)* v. 6(3) p. 56-61. 1 ill., 3 tables, 4 ref. Chinese. (AGRI 95-049417).

2564 Hostrup, S.B. (1994) [Winter wheat for green and whole crop: Leys of autumn-sown ryegrass or spring-sown clover grass]. Vinterhvede som groenaefgroede og helsaedsfoder. Statens Planteavlssforsoeg, Lyngby (Denmark). SP. Rapport (Denmark); no. 12 23 p. SP. 9 tables; 12 ref. Danish. (AGRI 95-049420).

2565 Jiang Jianping; Zhu Jianjun; Liu Tingzhi (Henan Agricultural Univ., Zhengzhou (China)) (1994) Related changes of wheat yield and photosynthetically active radiation in paulownia/wheat intercropping system. *Acta Agriculturae Boreali-Sinica (China)* v. 9(Suppl.) p. 133-137. 6 ill., 3 tables, 3 ref. Chinese. (AGRI 95-049414).

2566 Johnston, A.M.; Larney, F.J.; Lindwall, C.W. (1995) SPRING WHEAT AND BARLEY RESPONSE TO LONG-TERM FALLOW MANAGEMENT. *Journal of Production Agriculture*. 8(2):264-268. English. [AGR & AGRI FOOD CANADA LAND RESOURCE SCI SECT POB 3000 MAIN LETHBRIDGE AB T1J 4B1 CANADA].

Crop rotations with a high frequency of fallow remain the dominant cropping practice in the semiarid northern Great Plains. Tillage to control weeds during fallow periods increases soil exposure to erosion by wind. A fallow management study, initiated on a clay loam soil in 1955, has been used to compare tillage alone, herbicides alone, and combinations of tillage and herbicides on the yield and quality of wheat (*Triticum aestivum* L.) and barley (*Hordeum vulgare* L.). From 1977 to 1991, average spring wheat and barley yields were similar regardless of fallow treatment, with a 3.1 bu/acre difference between highest (31.4 bu/acre) and lowest yielding (28.3 bu/acre) treatments for wheat, and a 4.1 bu/acre difference for barley (54.4-58.5 bu/acre). Fallow with summer herbicides and cultivation with wide blade in fall resulted in the highest grain and grain N yields for wheat and barley, and highest soil nitrate-N concentration. The use of herbicides alone resulted in the highest level of crop residue conservation and plant-available water (PAW) at seeding. When tillage was used alone, only the wide blade cultivator maintained sufficient crop residue cover to protect against wind erosion. Grain yields on fallow increased with precipitation in May and June, the period of tiller formation and stem elongation, and decreased with increasing evaporative demand in June and July, during grain filling. Environmental conditions prevailing from May to July explained 67% of the yield variability observed in spring wheat and 83% in barley. Producers using a cereal-fallow rotation are encouraged to explore herbicide-tillage combinations for fallow as a means of ensuring erosion protection and optimizing grain yield potential.

2567 Komatsuzaki, M. (Ibaraki Univ., Ami (Japan). Faculty of Agriculture); Osaki, K. (1992) Studies on the relation between persistence of volunteer cereals and cropping system in upland, 2: A case study of volunteer wheat [*Triticum aestivum*] in barley [*Hordeum vulgare*] field and a field experiment on the control of volunteer wheat by tillage. *Japanese Journal of Farm Work Research (Japan)* (no.75) p. 95-102. 1 plate; 6 tables; 4 fig.; 17 ref. Japanese. (AGRI 95-049388).

2568 Konno, K. (Hokkaido. Kitami Agricultural Experiment Station, Kunneppu (Japan)); Kikuchi, K.; Miyawaki, T. (1993) Possibilities for short-term rotation systems of sugar beets [*Beta vulgaris*] including spring wheat [*Triticum aestivum*] crop. *Bulletin of Hokkaido Prefectural Agricultural Experiment Stations (Japan)* (no.65) p. 21-28. 4 tables; 5 fig.; 14 ref. Japanese. (AGRI 95-049455).

2569 Li Daxiang; Yang Wenyuan (Sichuan Provincial Academy of Agricultural Sciences, Chengdu (China). Inst. of Soil and Fertilizers) (1993) Study on patterns and comprehensive techniques for utilizing gaps of wheat/corn/sweet potato cropping pattern. *Southwest China Journal of Agricultural Sciences (China)* v. 6(1) p. 55-63. 1 ill., 8 tables, 4 ref. Chinese. (AGRI 95-049416).

2570 Lyon, D.J.; Boa, F.; Arkebauer, T.J. (1995) WATER-YIELD RELATIONS OF SEVERAL SPRING-PLANTED DRYLAND CROPS FOLLOWING WINTER WHEAT. *Journal of Production Agriculture*. 8(2):281-286. English. [UNIV NEBRASKA PANHANDLE RES & EXT CTR 4502 AVE 1 SCOTTSBLUFF, NE 69361 USA].

A winter wheat (*Triticum aestivum* L.)-fallow cropping system has developed in the central Great Plains as a means to stabilize crop production in a highly variable climate. As an alternative, a flexible cropping system partially based on soil water at planting may allow producers to minimize risk while allowing some additional crop production during wetter climate cycles. Water-yield relations are critical in the development of flexible cropping systems. The experiment was conducted near Sidney, NE, on a Keith silt loam (fine silty, mixed mesic Aridic Argiustoll) to determine the response of five spring-planted crops (corn (*Zea mays* L.), grain sorghum [*Sorghum bicolor* (L.) Moench], pinto bean (*Phaseolus vulgaris* L.), proso millet (*Panicum miliaceum* L.), and sunflower (*Helianthus annuus* L.)) to three different soil water levels the year following winter wheat harvest. Water use of all crops increased with increasing soil water at planting. The grain yield of pinto bean and proso millet responded positively to soil water at planting. Soil water at planting accounted for less than half of the total variability in grain yield for corn, grain sorghum, and sunflower. Soil water at planting appears to be useful in determining the success of planting the two short duration crops (pinto bean and proso millet) the year after winter wheat harvest. For the long duration crops (corn, grain sorghum, and sunflower) other factors, such as precipitation near the time of flowering, may be more important in determining success.

2571 Majda, J.; Radomska, M. (Akademia Rolnicza w Krakowie, Rzeszow (Poland). Katedra Technologii Produkcji Rolniczej) (1994) [Weed dynamics in monocultures of winter wheat and triticale]. *Dynamika zachwaszczenia pszenicy ozimej i pszenizyta uprawianych w monokulturze. Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland)* v. 35(187) p. 87-95. 4 tables; 6 ref. Polish. (AGRI 95-049423).

The field experiment was carried out in the years 1988-90. As summer wheat was the forecrop, the first year of growing winter corn can be treated as the beginning of the monocultures. It has been observed that floristic composition, intensity and weight of weeds per 1 sq. m were greater in winter wheat than in triticale. On the subsequent years of monoculture the number of species of weeds decreased in both kinds of corn while their intensity increased more rapidly in the wheat than in triticale. The applied criteria lead to the conclusion that weed dynamics in the monoculture of wheat is greater than in triticale.

2572 Malecka, I.; Rozalski, K. (Akademia Rolnicza, Poznan (Poland). Katedra Uprawy Roli i Roslin) (1994) [Weed infestation of winter wheat in the crop rotations with different concentrations of cereals under conditions of sprinkling and diversified nitrogen fertilization]. *Zachwaszczenie pszenicy ozimej w zmianowaniach z roznym udzialem*

zboz w warunkach deszczowania i zroznicowanego nawożenia azotowego. *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland)* v. 35(187) p. 97-101. 3 tables; 4 ref. Polish. (AGRI 95-049424).

The number and fresh matter of weeds as well as the number of diaspores in soil increased as the concentration of cereals in crop rotation increased. Sprinkling increased the number and fresh matter of weeds in wheat canopy: the highest was found at the nitrogen dose of 60 kg/ha, and the fresh matter was the heaviest at 120 kg N/ha. The weed species composition in canopy was modified by sprinkling and concentration of cereals in crop rotation. This feature was modified in soil by crop rotation only.

2573 Mao Kai; Zhou Shourong (Sichuan Agricultural Univ., Yaan (China)) (1993) A preliminary study on the ecological and economic benefits of intercropping three forages with winter wheat in Sichuan Basin, China. *Grassland of China (China)* (no. 4) p. 31-34. 4 ill., 5 tables, 5 ref. Chinese. (AGRI 95-049471).

2574 Moga, I.; Raducanu, C.; Veverca, D.; Fluerasu, V.; Dihoru, A.; Jinga, E. (Institutul de Cercetari pentru Cereale si Plante Tehnice Fundulea (Romania)) (1992) [Valorification of thermal factor through winter crop followed by maize for silo, in the irrigated zones in the Danube Plain]. *Valorificarea factorului termic prin culturi de toamna urmate de porumb pentru siloz, in zonele irigate din Cimpia Dunarii. Analele Institutului de Cercetari pentru Cereale si Plante Tehnice Fundulea (Romania)* v. 59 p. 167-177. 5 tables; 2 graphs; 3 ref. Romanian. (AGRI 95-049396).

During 1988-1990, on the cambic chernozem at Fundulea under irrigation, intensive systems made up of 2 crops of Italian ryegrass, wheat or winter barley, followed by maize for silo, as second crop were studied in comparison with maize for silo, cultivated on crop's own field. It was noticed that under these conditions maize for silo cultivated on crop's own field uses only 60-62 percent from thermal source of the respective zone. The optimum alternative is that of two harvests of Italian ryegrass followed by late (Fundulea 420) or semilate (Fundulea 320) maize hybrids for silo, which give yields equal to those obtained on crop's own field, an additional quantity of 60-65 t/ha green mass or 10-12 thousand nutritive units/ha being obtained. After winter barley, the semilate maize hybrids for silo (Fundulea 320) produce 85-87 percent from the yield obtained in crop's own field, a yield of 6-8 t/ha grains resulting. After winter wheat, semilate hybrids or semiearly maize hybrids for silo (F 270) produce up to 75 percent from the yield on crop's own field, a yield of 6-7 t grains/ha being obtained.

2575 Nandal, D.P.; Singh, C.M. (1994) WEED MANAGEMENT IN TRANSPLANTED RICE (ORYZA SATIVA)-WHEAT (TRITICUM AESTIVUM) CROPPING SYSTEM. *Indian Journal of Agronomy*. 39(4):517-521. English. [CCS HAU RICE RES STN KAUL 132021 INDIA].

A field experiment was conducted during 1989-1991 in transplanted rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L. emend. Fiori and Paol.) cropping system, to find out the influence of practices followed in one crop on the weed flora of the other. For transplanted rice, anilofos 0.45 kg/ha and 0.60 kg/ha applied 5 or 10 days after transplanting as well as oxadiazon 0.50 kg/ha, butachlor 1.0 kg/ha and pretilachlor 0.75 kg/ha were found equally effective in suppressing weed growth and resulted in higher grain yield of rice. These treatments had no effect on weeds or the crop performance in succeeding wheat crop. Isoproturon 1.5 kg/ha and 2 hand-weedings proved equally effective for weed management in wheat.

2576 Porter, P.M. (1995) DOUBLECROPPING SOYBEAN AFTER CANOLA AND WHEAT. *Journal of Production Agriculture*. 8(2):222-226. English. [SW EXP STN BOX 428 LAMBERTON, MN 56152 USA].

Canola (*Brassica napus* L.) can be planted as a winter crop and doublecropped with soybean [*Glycine max* (L.) Merr.] in the southeastern Coastal Plain of the USA, but little information is available about canola's effect on subsequent crops in the rotation. A 2-yr study was conducted to determine the effect of deep tillage on both canola and wheat (*Triticum aestivum* L.), the subsequent response of doublecropped soybean, and response of wheat grown following the soybean crop when controlled traffic and minimum tillage practices were used. The study was initiated in autumn of 1990 and repeated in 1991 on an Orangeburg loamy sand (fine-loamy, siliceous, thermic Typic Paleudults) near Blackville, SC. Canola yields averaged 37.8 bu/acre in 1991 and 43.2 bu/acre in 1992, whereas wheat yields were 58.0 and 72.5 bu/acre, respectively. In both years, deep

tillage (chiseling to 11 in.) had no effect on wheat yields when compared with dishing. Deep tillage increased canola yields by 12.5% in the drier of the two growing seasons. Soybean yields were not significantly affected by the tillage used for the previous crops. Subsoiled soybean yielded 33.7 vs. 31.9 bu/acre for no-till soybean in 1991, and 22.6 vs. 19.4 bu/acre in 1992. The difference was significant ($P = 0.05$) in 1992, and that year soybean tillage following wheat did not affect soybean yield but following canola, in-row subsoiling resulted in greater soybean yields than no-till. Wheat following soybean was not affected by the tillage practice used for the previous winter crops, and the 1992 wheat yields were unaffected by previous winter crop or soybean tillage. In 1993, soybean tillage did not affect subsequent wheat yield but following canola, in-row subsoiling resulted in greater wheat yields than no-till. These results suggest canola has no adverse effect on either soybean or wheat when grown in sequence on a Coastal Plain soil.

2577 Reents, H.J. (Technische Univ. Muenchen, Freising (Germany). Koordinator fuer oekologischen Land und Gartenbau); Meyer, J. (1994) [Profiles of nitrate in rotational cropping: "clovergrass - wheat - grain" of some ecologically managed farms in the tertiary hill country]. Nitratprofil in dem Fruchtfolgeglied Klee-grass - Weizen - Getreide in einigen oekologische bewirtschafteten Betrieben des tertiaeren Huegellandes. *Schule und Beratung (Germany)* (no.5,pt.4) p. 9-13. 3 graphs, ref. German. (AGRI5 95-049472).

2578 Reszel, R.S.; Kopaczewski, J. (Akademia Rolnicza w Lublinie, Zamosc (Poland). Instytut Nauk Rolniczych) (1994) [State of weeds in plant canopies cultivated in rotated crops with increased addition of potatoes]. Zachwaszczenie lanow roslin uprawianych w zmianowaniach z narastajacym udzialem ziemniaka. *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland)* v. 35(187) p. 79-86. 1 fig., 5 tables; 8 ref. Polish. (AGRI5 95-049433).

The field experiment was conducted on typical brown soil complex. The experiment was conducted using the split plot method. The amount of weeds in plant canopy cultivated in crop rotations: 25, 50, 75 and 100 percent of potato monoculture, was compared. It has been shown that increasing of the amount of correctly cultivated potato in appropriate sowing structure, brings about decreased amount of weeds in the plant canopy and also makes it poorer in botanical composition connected with increase of few short-lived species of weeds.

2579 Rudnicki, F.; Rajs, T.; Urbanowski, S. (Akademia Techniczno Rolnicza, Bydgoszcz (Poland). Katedra Ogolnej Uprawy Roli i Roslin) (1994) [Effect of precipitation on the results of cultivation of plants in many year monocultures. Pt. 3. Spring barley]. Wplyw ilosci opadow na efekty uprawy roslin w wieloletnich monokulturach. Cz. 3. Jeczmienn jary. *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland)* v. 35(187) p. 21-26. 1 fig., 3 tables; 8 ref. Polish. (AGRI5 95-049390).

Results of 18 years field experiments showed a significant increase of the yield of spring barley with time. The dynamic of this phenomena was higher for a 6-field rotation of crops than in case of a monoculture. Higher rainfall attenuated negative effects of cultivation of spring barley after itself for the first couple of years of such a cultivation. Cultivation of spring barley after itself prolonged for more than 3-4 years caused a considerable decrease of crops when compared to crops obtained in rotation of crops. In such a case, a profuse rainfall deepened differences between the yields of spring barely occurring for both kinds of cultivation.

2580 Satake, Y. (Hokkaido. Shintoku Animal Husbandry Experiment Station (Japan)); Sawada, Y.; Takeda, Y. (1992) The culture and management of a feed barley [*Hordeum vulgare*] companion crop with timothy [*Phleum pratense*] and red clover [*Trifolium pratense*] in the Tokachi [Japan] district. *Bulletin of the Hokkaido Prefectural Shintoku Animal Husbandry Experiment Station (Japan)* (no.19) p. 19-27. 6 tables; 10 ref. Japanese. (AGRI5 95-049389).

2581 Simmelsgaard, S.E.; Moeller, E.; Ohlsson, C.; Skovborg, E.B. (1994) [Nutrient uptake and nitrogen-leaching in 2 crop rotations at Silstrup in 1988-92 [whole crop, clover-grass]]. Naeringsoptagelse og kvaelstofudvaskning i 2 saedskifter ved Silstrup i 1988-92. *Statens Planteavlslorsog, Lyngby (Denmark). SP. Rapport (Denmark)*; no. 18 23 p. SP. 1 ill., 16 tables; 10 ref. Danish. (AGRI5 95-049382).

2582 Simmons, SR.; Sheaffer, CC.; Rasmussen, DC.; Stuthman, DD.; Nickel, SE. (1995) ALFALFA ESTABLISHMENT WITH BARLEY AND OAT COMPANION CROPS DIFFERING IN STATURE. *Agronomy Journal*. 87(2):268-272. English. [UNIV MINNESOTA DEPT AGRON & PLANT GENET 1991 UPPER BUFORD CIRCLE ST PAUL, MN 55108 USA].

Small-grain companion crops are commonly used for establishing forage legumes in the north-central USA. Semidwarf-stature barley (*Hordeum vulgare* L.) and oat (*Avena sativa* L.) show promise as less competitive and more lodging-resistant companion crops. This study compared forage production and agronomic characteristics of companion-cropped semidwarf and conventional-stature genotypes of barley and oat. Alfalfa (*Medicago sativa* L.) was seeded both with and without companion crops in experiments conducted at St. Paul, MN, from 1987 through 1989 on a Waukegan silt loam soil (fine-silty over sandy or sandy-skeletal, mixed, mesic Typic Hapludoll). Both semidwarf and conventional-stature barley and oat genotypes were evaluated. Small-grain and alfalfa forage harvests were made at the boot and soft dough stages of the small grain. Subsequent alfalfa harvests also were made later in the establishment season and at first flower in the following spring. Light penetration through the canopies of the various companion crops was monitored in all years. Weed biomass was measured in 1989, to estimate weed suppression by the companion crops. Light intensity at the level of the alfalfa within the semidwarf companion crop canopy was consistently higher than within the conventional-stature companion crops. Averaged over all small-grain genotypes, companion crop treatments produced from 202 to 2355 kg ha⁻¹ more forage dry matter than direct-seeded alfalfa (no companion crop). Alfalfa dry matter production during establishment was suppressed by all companion crops, especially those with conventional stature. Weeds were greatly suppressed by all companion crops. Companion crops increased mortality of alfalfa plants during establishment, but did not lower production of the alfalfa at subsequent harvests in the establishment season or in the following spring. Overall, semidwarf and conventional barley and oat were comparable in performance as companion crops in these studies, but semidwarf genotypes should prove particularly advantageous under conditions where lodging is likely to occur. [References: 18].

2583 Sinsinwar, BS. (1994) PRODUCTION POTENTIAL AND NITROGEN ECONOMY IN WHEAT (TRITICUM AESTIVUM)-BASED FORAGE CROPPING SYSTEM. *Indian Journal of Agronomy*. 39(4):522-527. English. [INDIAN GRASSLAND & FODDER RES INST DIV AGRON JHANSI 284003 UTTAR PRADESH INDIA].

A field experiment was conducted during 1987-88 and 1988-89 to study the effect of 6 fodder crops on yield and nitrogen economy of succeeding wheat (*Triticum aestivum* L. emend. Fiori and Paol.). Six fodder crops were: cowpea [*Vigna unguiculata* (L.) Walp.], clusterbean [*Cymopsis tetragonoloba* (L.) Taubert], field bean [*Dolichos lablab* L. var. *lignosus* Prain], pearl-millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz], sorghum [*Sorghum bicolor* (L.) Moench] and maize [*Zea mays* L.], along with grain sorghum. The loamy soil was low in nitrogen. Wheat grown after cowpea gave significantly higher grain yield (4.2 tonnes/ha), followed by wheat, after field bean and economized fertilizer N to the extent of 40 kg N/ha. Wheat yield in grain sorghum-wheat sequence remained significantly lower (2.3 tonnes/ha), as both the crops are exhaustive in nature. Though preceding gramineous crops, i.e. maize and sorghum, gave higher yields than leguminous ones, the latter crops produced more crude protein per unit area. Economic analysis revealed that maximum net return of Rs 11,550/ha was also obtained with cowpea-wheat sequence. Grain sorghum-wheat rotation resulted in the lowest net return of Rs 3,681.80/ha. Thus cowpea-wheat sequence produced nutritive forage, higher wheat grain, and economized fertilizer nitrogen and proved a remunerative fodder-food system.

2584 Suwara, I.; Gawronska Kulesza, A. (Szkola Glowna Gospodarstwa Wiejskiego, Warszawa (Poland). Katedra Ogolnej Uprawy Roli i Roslin) (1994) [Effect of forecrops and nitrogen on grain yield of winter wheat]. Wplyw przedplonow i nawozenia azotem na plony pszenicy ozimej. *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland)* v. 35(187) p. 113-119. 2 fig., 4 tables; 6 ref. Polish. (AGRI5 95-049426).

This paper presents grain yields of winter wheat in 3-field crop rotations in relation to forecrops (winter rape and pea) and doses of nitrogen (60, 100 and 140 kg/ha). The experiment was carried out since 1986 on black soil with the granulometric composition of light loam. Results obtained in 1987-

91 prove a more favourable effect of pea as forecrop than winter rape on grain yield of winter wheat. N fertilization can be reduced on fertile soil without reducing the yields of winter wheat, when forecrop is pea.

2585 Tersboel, M. (1995) [Survey 1994, H: Organic and biodynamic farming]. *Oversigt 1994, H: Oekologisk og biodynamisk dyrkning. Landsudvalget for Planteavl, Aarhus (Denmark). Oversigt over Landsforsøgene (Denmark) (no.1994) p. 209-213. 13 tables. Suppl. tables in Markforsøge (Denmark) 1994, part H.p. 682-689. Danish. (AGRI 95-049391).*

2586 Thompson, A.J.; Gooding, M.J.; Davies, W.P. (Royal Agricultural College, Cirencester GL7 6JS (United Kingdom)) (1992) Shading ability, grain yield and grain quality of organically grown cultivars of winter wheat. *Tests of Agrochemicals and Cultivars (United Kingdom) (no.13) p. 86-87. 4 ref. English. (AGRI 95-049411).*

2587 Thorup Kristensen, K. (1994) [Nitrogen catch crops in vegetable production]. *Efterafgrøder efter frilandsgroensager. Statens Planteavlsskole, Lyngby (Denmark). SP. Rapport (Denmark); no. 27 18 p. SP. 5 ill., 3 tables; 19 ref. Danish. (AGRI 95-049459).*

2588 Tonev, T. (Institut po Pshenitsata i Sl'nchogleda "Dobrudzha", General Toshevo (Bulgaria)) (1994) [Wheat and other crops in the rotation]. *Pshenitsata i drugite kulturi v seitoobrazhenieto. Selskostopanska Akademiyata, Sofia (Bulgaria). Zemedeleye (Bulgaria); Agriculture v. 92(8) p. 7-8. 1 tables. Bulgarian. (AGRI 95-063604).*

2589 Urbanowski, S.; Rajs, T.; Kaszkowiak, E. (Akademia Techniczna Rolnicza, Bydgoszcz (Poland). Katedra Ogólnej Uprawy Roli i Roslin) (1994) [Effect of precipitation on the results of cultivation of plants in many year monocultures. Pt. 6. Winter wheat]. *Wpływ ilości opadów na efekty uprawy roślin w wieloletnich monokulturach. Cz. 6. Pszenica ozima. Zeszyty Naukowe Akademii Technicznej w Bydgoszczy. Rolnictwo (Poland) v. 35(187) p. 39-44. 1 fig., 3 tables; 10 ref. Polish. (AGRI 95-049422).*

A response of winter wheat to cultivation in a monoculture in comparison to a cultivation in a 6-field crop rotation was studied during 1974-91. A high susceptibility of winter wheat cultivated continuously on a light soil to this kind of cultivation was found. Seed yield was decreasing up to the 15th year of cultivation, but during sequent years the yields were similar. Mean month sums of rainfall from April to June caused smaller differences between the yields found for both kinds of cultivation than higher and smaller rainfall.

2590 Wang Houzhen (Shandong Provincial Station of Plant Protection, Jinan (China)); Zhao Hongliang (1993) The ecological effects of cotton interplanted in wheat field on cotton pests. *Acta Phytophylacica Sinica (China) v. 20(2) p. 163-167. 5 tables. Chinese. (AGRI 95-049419).*

2591 Xie Zhengrong; Yin Yaobang; Zhao Youlong (Kunshan Municipal Bureau of Agriculture, Jiangsu (China)); Wu Bonian (1993) [Techniques of evenly interplanting wheat seed to rice field by machine sputing]. *Shanghai Agricultural Science and Technology (China) (no. 5) p. 16-17. 2 tables. Chinese. (AGRI 95-049415).*

2592 Zawislak, K.; Rzesutek, I. (Akademia Rolniczo Techniczna, Olsztyn (Poland). Katedra Ogólnej Uprawy Roli i Roslin) (1994) [Studies on the critical proportion in crop rotation of two potato cultivars with different resistance to *Globodera rostochiensis* Woll]. *Badania nad dopuszczalnym udziałem w plodozmianie dwóch odmian ziemniaka o różnej odporności na *Globodera rostochiensis* Woll. Zeszyty Naukowe Akademii Technicznej Rolniczej w Bydgoszczy. Rolnictwo (Poland) v. 35(187) p. 67-77. 4 fig., 2 tables; 13 ref. Polish. (AGRI 95-049432).*

Two potato cultivars, Sowa, non-resistant, and Tarpan, resistant to *Globodera rostochiensis* were grown in crop rotations with proportions of 20, 40 and 60 percent of potato. The non-resistant cv. Sowa increased the population of *Globodera rostochiensis* in the soil, especially when the proportion of potato in rotation was 60 percent. The proportion of non-resistant potato cultivars in a crop rotation should not be higher than 20-25 percent and of resistant cultivar even to 35 percent and in shorter periods to 40 percent.

2593 [Genetic control of the type and speed of development of spring wheat in Western Siberia (Russian Federation). Information 3. Reaction on the photoperiod]. *Geneticheskij kontrol' tipa i skorosti razvitiya yarovoj pshenitsy Zapadnoj Sibiri (1993) Sibirskij vestnik sel'skokhozyajstvennoj nauki (Russian Federation) (no.3) p. 42-48. 16 ref. Russian. (AGRI 95-050015).*

Results of studying more than 60 varieties and selection lines of Western Siberian region under conditions of phytotron of photoperiodical sensibility are presented. 91% of genotypes are found to be sensible to the photoperiod and there are no varieties with a weak photoperiodical sensibility among samples of the studied set. Possible causes of observed distinctions in the frequency of meeting genotypes are being discussed, ways for creating middle-ripening varieties adapted to conditions of Western Siberia, which combine in their genotype the presence of concrete dominant alleles of loci Vrn 1-3 with a definite degree of sensibility to the photoperiod.

2594 [Bulletin of cereal varieties 1994: small grain cereals. Descriptive sheets of varieties registered from December 1993 up to March 1994, agricultural and technical traits of varieties appearing in the French catalogue in 1994]. *Bulletin des varietes cereales 1994: cereales a paille. Fiches descriptives des varietes inscrites de decembre 1993 a mars 1994, caracteristiques agronomiques et technologiques des varietes figurant au Catalogue francais en 1994 (1994) Groupe d'Etude et de Controle des Varietes et des Semences, Guyancourt (France). Bulletin des Varietes Cereales (France) 403 p. GEVES. Tableaux. French. (AGRI 95-063947).*

2595 [Hard wheat varieties: 1992, pluriannual and regional results, new varieties, descriptive cards]. *Ble dur (varietes, resultats 1992, pluriannuels et par region, nouvelles varietes, fiches descriptives) (1993) Institut Technique des Cereales et des Fourrages, Paris (France). Perspectives Agricoles (France) (no 180) p. 72-89. French. (AGRI 95-049936).*

2596 [Soft wheat varieties, 1992, pluriannual and regional results, new varieties, descriptive cards]. *Ble tendre (varietes, resultats 1992, pluriannuels et par region, nouvelles varietes, fiches descriptives) (1993) Institut Technique des Cereales et des Fourrages, Paris (France). Perspectives Agricoles (France) (no 180) p. 23-70. French. (AGRI 95-049935).*

2597 [Spring barley and oat, new varieties]. *Orge et avoine de printemps, les nouveautes (nouvelles varietes) (1993) Institut Technique des Cereales et des Fourrages, Paris (France). Perspectives Agricoles (France) (no 180) p. 113-114. French. (AGRI 95-049642).*

2598 [Winter barley varieties: 1992 and regional results, new varieties]. *Orge d'hiver (varietes, resultats en 1992 et par region, nouvelles varietes) (1993) Institut Technique des Cereales et des Fourrages, Paris (France). Perspectives Agricoles (France) (no 180) p. 101-109. French. (AGRI 95-049641).*

2599 Albrecht, J.C.; Deandrade, J.M.V.; Desousa, C.N.A. (1995) WHEAT CULTIVARS BR 33-GUARA AND BR 39-PARAUNA RECOMMENDED TO CENTRAL BRAZIL. *Pesquisa Agropecuaria Brasileira. 30(1):135-142. Portuguese. [EMBRAPA CTR PESQUISA AGROPECUARIA CERRADOS CAIXA POSTAL 08223 BR-73301970 PLANALTIMA DF BRAZIL].*

Wheat Triticum sp. cultivars BR 33 - Guara and BR 39 - Parauna were selected in Planaltina, DF, Brazil, from varietal introductions of CIMMYT, Mexico in 1983. After being tested in regional variety trials between 1989 and 1991, they were recommended at the National Commission for Wheat Research for irrigated cultivation in the dry season. BR 33 - Guara and BR 39 - Parauna, evaluated as CPAC 841222 and CPAC 841244, are recommended for cultivation in Goias, Minas Gerais and Federal District, respectively. Their performance was superior to the standard, cultivars BR 10 - Formosa and Anahuac, for grain yield, resistance to some diseases, and other desirable agronomic characteristics.

2600 Andrews, J.L. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Skerritt, J.H.; Gupta, R.B.; Howes, N.K. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry); Stoddard, F.L. (Sydney Univ. (Australia). Dept. of Crop Sciences); Howes, N.K. (Agriculture Canada, Winnipeg) (1994) Rapid screening for

chromosomal translocations of 2RS, associated with high protein in bread wheat. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 509. English. (AGRI 95-049608).

2601 Anon. (1993) [United Kingdom: cereal varieties evaluation]. Royaume Uni: le système d'évaluation des variétés (de céréales). *Perspectives Agricoles (France)* (no 180) p. 11-14. 5 tableaux. French. (AGRI 95-049933).

2602 Aryan, A.P. (Adelaide Univ., Glen Osmond (Australia). Waite Agricultural Research Inst.) (1994) Expression of the alpha and beta gliadin genes of wheat in response to heat shock. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 500-501. English. (AGRI 95-049605).

2603 Baenziger, PS.; Morensevilla, B.; Peterson, C.J.; Schmidt, J.W.; Shelton, D.R.; Baltensperger, D.D.; Nelson, L.A.; Mcvey, D.V.; Watkins, J.E.; Hatchett, J.H. (1995) REGISTRATION OF ALLIANCE WHEAT. *Crop Science*. 35(3):938. English. [UNIV NEBRASKA DEPT AGRON LINCOLN, NE 68583 USA].

2604 Bailey, K.L.; Wolfe, R.I. (1994) GENETIC RELATIONSHIPS BETWEEN REACTION TO COMMON ROOT ROT AND YIELD IN THE PROGENY OF A BARLEY CROSS. *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie*. 16(3):163-169. English. [AGR CANADA RES STN 107 SCI PL SASKATOON SK S7N 0X2 CANADA].

The heritability of resistance to common root rot, caused by *Cochliobolus sativus*, in 125 progeny (F6-F8) of a cross between barley cultivars Argyle (resistant) and Melvin (tolerant) was 56.7% $\pm$ 4.1 and the minimum number of genes by which the two parents differed for the expression of disease severity was three. The heritability of yield for the same population was 35.3% $\pm$ 3.8, and the number of loci estimated was at least three. There was a greater range in yield and disease expression in the Peace region of Alberta than at Saskatoon, Saskatchewan. At sites in the Peace from 1988 to 1990, the means of some progeny exceeded those of the parents; this did not occur at Saskatoon. Cluster analysis grouped the progeny into three classes; 45% of the lines were resistant (similar to Argyle), 45% tolerant (similar to Melvin), and 10% were susceptible. The rank of lines for disease reaction was generally similar for most resistant and tolerant progeny at both locations. The regression of grain yield on disease severity with all progeny was negative ($y = -4.9 X + 1625$ at $P = 0.01$) but the correlation was weak ($R = -0.24$). This relationship was stronger when the tolerant group of lines was removed from the regression ($R = -0.53$, $P < 0.001$). The relationship between yield and disease among the resistant and tolerant lines was positive ($y = 5.7 X + 1136$, $R = 0.28$, $P < 0.01$), yet a within-class correlation between yield and disease in the tolerant group indicated a negative association ($R = -0.34$, $P < 0.01$). This study suggests that a breeding strategy for developing lines resistant to common root rot, while maintaining high yield should involve screening to eliminate the highly susceptible lines from crosses and then selecting the best yielding lines with the lowest disease.

2605 Banks, P.M.; Larkin, P.J.; Bariana, H.S.; Lagudah, E.S.; Appels, R.; Waterhouse, P.M.; Brettell, R.S.; Chen, X.; Xu, H.J.; Xin, Z.Y.; Qian, Y.T.; Zhou, X.M.; Cheng, Z.M.; Zhou, G.H. (1995) THE USE OF CELL CULTURE FOR SUBCHROMOSOMAL INTROGRESSIONS OF BARLEY YELLOW DWARF VIRUS RESISTANCE FROM THINOPYRUM INTERMEDIUM TO WHEAT. *Genome*. 38(2):395-405. English. [CSIRO DIV PLANT IND POB 1600 CANBERRA ACT 2601 AUSTRALIA].

Barley yellow dwarf virus (BYDV) resistance has been transferred to wheat from a group 7 chromosome of *Thinopyrum* (Agropyron) intermedium. The source of the resistance gene was the L1 disomic addition line, which carries the 7Ai-1 chromosome. The resistance locus is on the long arm of this chromosome. BYDV resistant recombinant lines were identified after three or more generations of selection against a group 7 Th. intermedium short arm marker (red coleoptile) and selection for the presence of BYDV resistance. One recombinant line produced by ph mutant induced homoeologous pairing and 14 recombinant lines induced by cell culture have been identified. Resistance in seven of the cell culture induced recombinants has been inherited via pollen according to Mendelian segregation ratios for up to eight generations. Meiotic analysis of

heterozygotes indicates that the alien chromatin in the cell culture induced recombinants is small enough to allow regular meiotic behaviour. The ph-induced recombinant was less regular in meiosis. A probe, pE1Acc2, originally isolated from Th. elongatum and that hybridizes to dispersed repeated DNA sequences, was utilised to detect Th. intermedium chromatin, which confers resistance to BYDV, in wheat backgrounds. Quantification of these hybridization signals indicated that the translocations involved a portion of alien chromatin that was smaller than the complete long arm of 7Ai-1. Restriction fragment length polymorphism analysis confirmed the loss of the short arm of 7Ai-1 and indicated the retention of segments of the long arm of 7Ai-1. Two 7Ai-1L DNA markers always assorted with the BYDV resistance. A third 7Ai-1L DNA marker was also present in seven of eight recombinants. In all recombinants except TC7, the 7Ai-1L markers replaced the 7DL markers. None of the wheat group 7 markers was missing from TC7. It is concluded that all the resistant lines are the result of recombination with wheat chromosome 7D, except line TC7, which is the result of recombination with an unidentified nongroup 7 chromosome. [References: 43].

2606 Bao Xiaoming (Northeast Normal Univ., Changchun (China). Inst. of Genetics and Cytology) (1993) The identification of two Agropyron intermedium translocation lines in wheat by RAPD (Randomly Amplified Polymorphic DNA) analysis. *Acta Genetica Sinica (China)* v. 20(1) p. 81-87. 7 ill., 16 ref. Chinese. (AGRI 95-049994).

2607 Barnardin, J.E. (United States Dept. of Agriculture, Albany (USA). ARS WRRRC) (1994) Genetic modification of the wheat genome to allow growth in hot climates. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 500. English. (AGRI 95-049603).

2608 Becker, J.; Heun, M. (1995) BARLEY MICROSATELLITES - ALLELE VARIATION AND MAPPING. *Plant Molecular Biology*. 27(4):835-845. English. [MAX PLANCK INST ZUCHTUNGSFORSCH CARL VONLINNE WEG 10 D-50829 COLOGNE GERMANY].

Microsatellites have developed into a powerful tool for mapping mammalian genomes and first reports about their use in plants have been published. A database search of 228 barley sequences from GenBank and EMBL was made to determine which simple sequence repeat (SSR) motif prevails in barley. Nearly all types of SSRs were found. The (A)_n and (T)_n SSRs occurred more often than (C)_n and (G)_n for n greater than or equal to 10. Among the dinucleotide repeats, the (CG)_n SSRs occurred least often. Trinucleotide repeats did not occur with n>7 and there is no correlation between the GC content in the trinucleotide motifs and the number of observed SSRs. Analysing 15 different microsatellites with 11 barleys yielded 2.1 alleles per microsatellite. Sequencing 25 putative microsatellites showed that the resolution capacity of high-quality agarose gels was sufficient to determine differences of only three base pairs. Five microsatellites were mapped on three different chromosomes of a barley RFLP map. [References: 53].

2609 Berthaud, J.; Savidan, Y. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) (1994) Wild relatives of maize. *The CIMMYT maize germplasm bank: Genetic resource preservation, regeneration, maintenance, and use*. Tabo, S. (ed.) (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). *Maize Program*) p. 47-49. CIMMYT. 1 map; 1 table. English. (AGRI 95-063995).

2610 Blumenthal, C.S.; Wrigley, C.W.; Gras, P.W.; Batey, I.L. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry; Barlow, E.W.R. (Western Sydney Univ., Richmond (Australia)) (1994) Genetic sources of tolerance to quality variation due to growth environment [wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 500. English. (AGRI 95-049604).

2611 Boubaker, M.; Yamada, T. (1995) YIELDING ABILITY OF AN INTRODUCED GERMPASM OF DURUM WHEAT IN A SEMI-ARID ENVIRONMENT OF TUNISIA. *Breeding Science*. 45(1):121-123. English.

[ECOLE SUPER AGR KEF DEPT PLANT BREEDING LE KEF 7119 TUNISIA].

Fifty-eight durum wheat cultivars were selected from the introduced germplasm from the National Institute of Agrobiological Resources (Japan) in 1990. The selected cultivars were grown in Tunisia under rainfed conditions and investigated on yield potential, number of seeds/spike and thousand kernel weight for evaluation of their genetic variations and breeding potential during the 1992/93 growing season. All characters showed relatively large standard deviations and coefficients of variations. Thus, this breeding material may be successfully used in Tunisian breeding programs targeting specific goals. Some cultivars performed similar to the most commonly grown local cultivars which were included in the experiment as checks. Selection was applied in order to select the best genotypes. Compared to the checks and based on yielding ability, 17 promising lines were identified.

2612 Bouchet, Y. (Federation Nationale des Agriculteurs Multiplicateurs de Semences, Brain sur l'Authion (France). Centre Technique des Semences) (1993) [Breeding of hybrid wheats]. Les bles hybrides a marche raisonnee. *Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France) (no 125)* p. 49-50. French. (AGRI 95-064051).

2613 Cambron, SE.; Patterson, FL.; Ohm, HW.; Ratcliffe, RH.; Safranski, GG. (1995) GENETIC ANALYSIS OF HESSIAN FLY RESISTANCE IN EIGHT DURUM WHEAT INTRODUCTIONS. *Crop Science*. 35(3):708-714. English. [PURDUE UNIV USDA ARS INSECT & WEED CONTROL RES UNIT W LAFAYETTE, IN 47907 USA].

Breeding for resistance in wheat, *Triticum spp L.*, to Hessian fly, *Mayetiola destructor* (Say), has been the most successful method of controlling damage from this pest. New genes for resistance are needed because virulence evolves in Hessian fly populations. Progenies of selected plants of eight durum wheat, *Triticum durum* Desf., introductions were compared for expression of resistance to Hessian fly Biotype L at temperatures of 19, 23, and 26 degrees C. Biotype L is currently the most virulent biotype identified. The eight introductions had been shown previously to be resistant to Biotypes C, D, E, and L. Ad tested plants of the eight introductions were resistant to Biotype L at 19 degrees C. At 23 degrees C, all plants of four of the introductions were resistant, and four had from 88 to 98% resistant plants. At 26 degrees C, all plants of three introductions were resistant, whereas five introductions had from 78 to 95% resistant plants. From testcross analyses, resistance in seven of the introductions appeared to be conferred by one, two, or three dominant or partially dominant independent genes. Resistances of CI3146-6, CI3241-2, and CI7335-10 were different from genes H5, H9, H14, and H16 of tester stocks. The single gene resistance of CI3146-6 was different from genes for resistance in CI3241-2 and CI3984-12. The two genes for resistance of CI7066-1 were different from H9 and the two genes of CI7041-3. Two lines, CI3170-2 and CI3146-6, appeared to base one gene in common. [References: 20].

2614 Canevara, M.G. (Istituto Sperimentale per la Cerealicoltura, Lodigiano (Italia). Sezione di S. Angelo); Romani, M.; Corbellini, M.; Perenzin, M.; Borghi, B. (1994) [Evolutionary trends in morphological, physiological, agronomical and qualitative traits of *Triticum aestivum L.* cultivars bred in Italy since 1900]. [Evolution des caracteristiques morphologiques, physiologiques, agronomiques et de qualite, chez les varietes de ble tendre (*Triticum aestivum L.*) obtenues en Italie, depuis 1900]. *European Journal of Agronomy (France)* v. 3(3) p. 175-185. 36 ref., 6 tableaux, 8 graph. English. (AGRI 95-049937).

2615 Cattaneo, M.; Mascheroni, S.; Borghi, B. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)); Perrino, P. (Consiglio Nazionale delle Ricerche, Bari (Italy). Istituto del Germoplasma) (1994) [Classification and maintenance of the bread wheat (*Triticum aestivum*) accessions of the Italian breeders]. Classificazione e conservazione delle accessioni di frumento tenero (*Triticum aestivum*) presenti nelle collezioni dei costitutori italiani. *Sementi Elette (Italy)* v. 40(6) p. 3-6. 3 tables; 3 graphs; 9 ref. Italian. (AGRI 95-049996).

About 3,000 accessions obtained from eight Italian breeders were classified and described with 11 descriptors. A sample of the 312 cultivars obtained in Italy since the beginning of this century were clustered in 7 groups, and characterized for several agronomic and quality characteristics.

The seed samples were sent to the Institute of germplasm for a long term storage.

2616 Chee, PW.; Lavin, M.; Talbert, LE. (1995) MOLECULAR ANALYSIS OF EVOLUTIONARY PATTERNS IN U GENOME WILD WHEATS. *Genome*. 38(2):290-297. English. [MONTANA STATE UNIV DEPT PLANT SOIL & ENVIRONM SCI BOZEMAN, MT 59717 USA].

The theory of pivotal-differential evolution states that one genome of polyploid wheats remains stable (i.e., pivotal) during evolution, while the other genome or genomes may become modified (i.e., differential). A proposed mechanism for apparent modification of the differential genome is that different polyploid species with only one genome in common may exchange genetic material. In this study, we analyzed a set of sympatric and allopatric accessions of tetraploid wheats with the genomic constitutions UM and UC. The U genome of these species is from *Triticum umbellulatum* and is considered to be the pivotal genome. The M and C genomes, from *T. comosum* and *T. dichasians*, respectively, are considered to be the differential genomes. Low copy DNA was analyzed using "sequence tagged site" primer sets in the polymerase chain reaction, followed by digestion with restriction enzymes. Genetic similarity matrices based on shared restriction fragments showed that sympatric accessions of different U genome tetraploid species did not tend to share more restriction fragments than did allopatric accessions. Thus, no evidence for introgression was found. Analysis of the diploid progenitor species showed that the U genome was less variable than the M and C genomes. Additionally, comparison of diploid and polyploid species using genome-specific primer sets suggests a possible polyphyletic origin for *T. triunciale* and *T. machrochaetum*. Thus, our results suggest that the differential nature of the M and C genomes may be the result of variability introduced by the diploid progenitors and not the result of frequent introgression events after formation of the polyploid. [References: 21].

2617 Chen Huabang; Zeng Baiyan; Li Qingqi (Shandong Agricultural Univ., Taian (China). Dept. of Agronomy) (1993) A tentative study on model breeding of wheat cultivars with high yield potential. *Acta Agronomica Sinica (China)* v. 19(2) p. 165-172. 3 tables, 23 ref. Chinese. (AGRI 95-049982).

2618 Chen Wanquan; Hu Changcheng (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1993) Postulation of genes for leaf rust resistance in 28 Chinese wheat. *Acta Agronomica Sinica (China)* v. 19(3) p. 268-275. 3 tables, 20 ref. Chinese. (AGRI 95-049984).

2619 Chen Zhide; Yao Guocai; Zhou Chaofei (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Food Crops) (1994) Identification of exotic and domestic spring wheat varieties and their utilization. *Jiangsu Agricultural Sciences (China)* (no. 3) p. 10-12. 4 tables. Chinese. (AGRI 95-049618).

2620 Chi Guotong; Zhang Xuesong; Zhang Liyan (Hebei Agricultural Univ., Baoding (China). Dept. of Plant Protection) (1994) Identification of slowing powdery varieties of wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(3) p. 63-66. 3 tables, 4 ref. Chinese. (AGRI 95-049957).

2621 Cooper, M.; Woodruff, DR.; Eisemann, RL.; Brennan, PS.; Delacy, IH. (1995) A SELECTION STRATEGY TO ACCOMMODATE GENOTYPE-BY-ENVIRONMENT INTERACTION FOR GRAIN YIELD OF WHEAT-MANAGED-ENVIRONMENTS FOR SELECTION AMONG GENOTYPES. *Theoretical & Applied Genetics*. 90(3-4):492-502. English. [UNIV QUEENSLAND DEPT AGR BRISBANE QLD 4072 AUSTRALIA].

Selection for grain yield among wheat lines is complicated by large line-by-environment (L x E) interactions in Queensland, Australia. Early generation selection is based on an evaluation of many lines in a few environments. The small sample of environments, together with the large L x E interaction, reduces the realised response to selection. Definition of a series of managed-environments which provides discrimination among lines, which is relevant to the target production-environments, and can be repeated over years, would facilitate early generation selection. Two series of managed-environments were conducted. Eighteen managed-environments were generated in Series-1 by manipulating nitrogen and water availability, together with the sowing date, at three locations. Nine managed-environments based on those from Series-1 were generated in Series-2. Line discrimination for grain yield in the managed-environments

was compared to that in a series of 16 random production-environments. The genetic correlation between line discrimination in the managed-environments and that in the production-environments was influenced by the number and combination of managed-environments. Two managed-environment selection regimes, which gave a high genetic correlation in both Series-1 and 2, were identified. The first used three managed-environments, a high input (low water and nitrogen stress) environment with early sowing at three locations. The second used six managed-environments, a combination of a high input (low water and nitrogen stress) and medium input (water and nitrogen stress) with early sowing at three locations. The opportunities for using managed-environments to provide more reliable selection among lines in the Queensland wheat breeding programme and its potential limitations are discussed. [References: 31].

2622 Cordova, H.S. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) (1994) Early-maturing maize for the tropics. *The CIMMYT maize germplasm bank: Genetic resource preservation, regeneration, maintenance, and use. Tabla, S. (ed.) (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) p. 25-26. CIMMYT. 2 tables. English. (AGRI 95-063991).*

2623 Cuvreur, F. (Institut Technique des Cereales et des Fourrages, Paris (France)); Boyer, S. (1993) [Performances of cereal crops: soft wheat varieties]. *Varietes de ble tendre: ne pas rater le train de la rentabilite. Perspectives Agricoles (France) (no 177) p. 15-19. 6 graph. French. (AGRI 95-049932).*

2624 Cox, TS.; Sears, RG.; Bequette, RK. (1995) USE OF WINTER WHEAT X TRITICUM TAUSCHII BACKCROSS POPULATIONS FOR GERMLASM EVALUATION. *Theoretical & Applied Genetics. 90(3-4):571-577. English. [KANSAS STATE UNIV AGR & APPL SCI USDA ARS DEPT AGRON THROCKMORTON HALL MANHATTAN, KS 66506 USA].*

The wild diploid goatgrass, *Triticum tauschii* (Coss.) Schmal., is an important source of genes for resistance to both diseases and insects in common wheat (*Triticum aestivum* L.) We have evaluated grain yield, kernel weight, protein concentration, and kernel hardness of 641 BC2 F-1-derived families from direct crosses involving four *T. aestivum* cultivars and 13 *T. tauschii* accessions over 2 years and at two Kansas, USA, locations. On average, *T. tauschii* germplasm depressed grain yield and increased protein concentration, whereas kernel weight was affected either positively or negatively, depending on the *T. tauschii* parent. Three *T. tauschii* parents produced a large proportion of families with very soft endosperm. Some variation among progeny of different *T. tauschii* parents resulted from the segregation of genes for resistance to leaf rust (caused by *Puccinia recondita* Rob. ex Desm.). This study confirmed that random BC2-derived families can be used to evaluate the effects of *T. tauschii* genes in the field. This methodology, although laborious, can provide useful information which is not obtainable by the screening of *T. tauschii* accessions themselves. [References: 32].

2625 Cox, TS.; Sears, RG.; Bequette, RK.; Martin, TJ. (1995) GERMLASM ENHANCEMENT IN WINTER WHEAT X TRITICUM TAUSCHII BACKCROSS POPULATIONS. *Crop Science. 35(3):913-919. English. [KANSAS STATE UNIV AGR & APPL SCI USDA ARS DEPT AGRON THROCKMORTON HALL MANHATTAN, KS 66506 USA].*

Backcross populations derived from direct hybrids between common wheat (*Triticum aestivum* L.) and the wild diploid *T. tauschii* (Coss.) Schmal. have utility for germplasm evaluation, but also can furnish genetic material directly into a germplasm-enhancement program. Three hundred ninety-one BC2F2-derived lines from winter wheat x *T. tauschii* crosses were selected on the basis of disease resistance and general phenotype from populations undergoing field evaluation to determine whether resistant lines agronomically similar or superior to their recurrent parents could be developed. The selected backcross lines were evaluated for yield and grain-quality traits under light to moderate infection by leaf rust (caused by *Puccinia recondita* f. sp. *tritici* Rob. ex Desm.) and heavy infection by wheat soilborne mosaic and spindle-streak mosaic viruses at two locations in 1991. Approximately 50% of the lines were selected for further field evaluation at two locations in 1992, and three lines were entered in advanced yield trials in a total of eight environments in 1992 and 1993. At all stages of selection, BC2F2-derived Lines were identified with disease resistance, grain yield, and grain quality superior to those of their recurrent parents. Lines differing from their recurrent parents in grain yield, either positively or negatively,

occurred in both the disease-resistant and disease-susceptible classes. In advanced yield trials where leaf rust did not affect grain yield, leaf rust-resistant BC2F2-derived lines yielded similarly to their recurrent parents and to cultivars currently grown commercially over large areas. Despite the wide differences in phenotype between common wheat and *T. tauschii*, two backcrosses were sufficient to transfer resistance genes while almost the wheat parent's phenotype. [References: 17].

2626 Crosbie, G.B.; Barclay, I.R.; Wilson, R.E. (Western Australian Dept. of Agriculture, South Perth) (1994) Advanced wheat crossbreds showing potential for Japanese noodles. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 511. English. (AGRI 95-049611).*

2627 Crossa, J. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) (1994) Statistical genetics in genetic resource conservation. *The CIMMYT maize germplasm bank: Genetic resource preservation, regeneration, maintenance, and use. Tabla, S. (ed.) (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) p. 50-51. CIMMYT. 7 ref. English. (AGRI 95-063996).*

2628 Da Longzhou (Henan Provincial Academy of Agricultural Sciences, Zhengzhou (China). Inst. of Wheat) (1994) Comparison study on Tai F1 and normal F1 of wheat in material effects. *Acta Agriculturae Boreali-Sinica (China) v. 9(Suppl.) p. 24-28. 4 tables, 5 ref. Chinese. (AGRI 95-049958).*

2629 Dai Qingyang; Tang Zesheng; Su Xuehui (Sichuan Normal Coll., Nanchong (China). Dept. of Biology) (1993) A comparative study comparison on chloroplast ultrastructure between hybrid wheat and its parents. *Southwest China Journal of Agricultural Sciences (China) v. 6(4) p. 32-35. 6 ill., 5 ref. Chinese. (AGRI 95-049976).*

2630 David, H. (Institut Technique des Cereales et des Fourrages, Paris (France)); Bernicot, M.H. (1993) [Spring barley varieties]. *Orge de printemps: les varietes au banc d'essai. Perspectives Agricoles (France) (no 186) p. 84-90. 7 graph. French. (AGRI 95-049643).*

2631 Delzer, BW.; Busch, RH.; Hareland, GA. (1995) RECURRENT SELECTION FOR GRAIN PROTEIN IN HARD RED SPRING WHEAT. *Crop Science. 35(3):730-735. English. [UNIV MINNESOTA USDA ARS PLANT SCI RES UNIT 411 BORLAUG HALL ST PAUL, MN 55108 USA].*

Grain protein concentration (GPC) of bread wheat (*Triticum aestivum* L.) is important because it partially determines bread-making properties and nutritional value of wheat flour. Ten hard red spring wheats selected for high GPC and other traits were intermated to form the initial population. Twenty to 25 F-3 lines were selected and recombined to initiate each successive cycle. Selection intensity for the parents of each cycle ranged from 3.5 to 8%. Four cycles of recurrent selection for increased GPC were evaluated. Direct response to selection for GPC and indirect responses of agronomic and breadmaking quality traits were determined. About 50 random F-3-derived lines from Cycles 0, 2, and 4 were evaluated at two locations for 2 yr to provide an estimate of gain from selection. The average realized gain for GPC was 2.7% per cycle of selection. Flour protein concentration, mixogram water absorption, and kernel hardness increased linearly with selection for GPC. Although recurrent selection effectively increased GPC linearly over cycles, this gain was associated with lower grain yield. We observed a linear decrease in grain yield of 3.2% per cycle at the target location, but no linear trend was detected at the other location. Lines which combine high GPC and high grain yield may be useful as germplasm sources. [References: 32].

2632 Dong Keqin; Zhu Dehui; Zhao Changping (Beijing Municipal Academy of Agriculture and Forestry Sciences (China)) (1994) Effects of varieties of winter wheat and accumulated temperature in the vegetative growth period on ear characteristics. *Acta Agriculturae Boreali-Sinica (China) v. 9(3) p. 39-43. 3 tables, 5 ref. Chinese. (AGRI 95-049615).*

2633 Dong, HS.; Quick, JS. (1995) DETECTION OF A 2.6 KB SINGLE LOW COPY DNA SEQUENCE ON CHROMOSOMES OF WHEAT (TRITICUM AESTIVUM) AND RYE (SECALE CEREALE) BY FLUORESCENCE IN

SITU HYBRIDIZATION. *Genome*. 38(2):246-249. English. [COLORADO STATE UNIV DEPT AGRON FT COLLINS, CO 80523 USA].

A fluorescence in situ hybridization procedure was developed to detect a 2.6 kb single/low copy DNA sequence on chromosomes of wheat (*Triticum aestivum*) and rye (*Secale cereale*). The probe, pTksul26, was from the wheat genomic library generated at Kansas State University and was labeled with Bio-11-dUTP by nick translation. The signal was amplified by a protocol of avidin-FITC (fluorescein isothiocyanate), biotinylated goat anti-avidin antibody, avidin-FITC. Two rye chromosomes and several wheat chromosomes showed the hybridization sites. The multiple sites in wheat are probably the result of the homoeologous nature of the three genomes in wheat. The ability to detect the hybridization signal of a small single/low copy DNA sequence is a very important step towards the physical mapping of plant genomes. This procedure might also be useful for studying the genomic relationship among wheat relative species. [References: 13].

2634 Dong, HS.; Quick, JS. (1995) INHERITANCE AND ALLELISM OF RESISTANCES TO THE RUSSIAN WHEAT APHID IN SEVEN WHEAT LINES. *Euphytica*. 81(3):299-303. English. [COLORADO STATE UNIV DEPT AGRON FT COLLINS, CO 80523 USA].

Studies were conducted to determine the inheritance and allelic relationships of genes controlling resistance to the Russian wheat aphid (RWA), *Diuraphis noxia* (Mordvilko), in seven wheat germplasm lines previously identified as resistant to RWA. The seven resistant lines were crossed to a susceptible wheat cultivar Carson, and three resistant wheats, CORWA1, PI294994 and PI243781, lines carrying the resistance genes Dn4, Dn5 and Dn6, respectively. Seedlings of the parents, F-1 and F-2 were screened for RWA resistance in the greenhouse by artificial infestation. Seedling reactions were evaluated 21 to 28 days after the infestation using a 1 to 9 scale. All the F-1 hybrids had equal or near equal levels of resistance to the resistant parent indicating dominant gene control. Only two distinctive classes were present and no intermediate types were observed in the F-2 segregation suggesting major gene actions. The resistance in PI225262 was controlled by two dominant genes. Resistance in all other lines was controlled by a single dominant gene. KS92WGRC24 appeared to have the same resistance gene as PI243781 and STARS-9302W-sib had a common allele with PI294994. The other lines had genes different from the three known genes. [References: 22].

2635 Fang Zheng (Yantai Municipal Inst. of Agricultural Sciences, Shandong (China)) (1994) Breeding of winter wheat variety Lumai 13 with drought-resistance and high-yield. *Acta Agriculturae Boreali-Sinica (China)* v. 9(3) p. 12-15. 1 ill., 5 ref. Chinese. (AGRI5 95-049614).

2636 Farooq, S.; Asghar, M.; Askari, E.; Shah, TM. (1994) PRODUCTION AND EVALUATION OF SALT TOLERANT WHEAT GERMPLASM DERIVED THROUGH CROSSES BETWEEN WHEAT (*TRITICUM-AESTIVUM* L) AND *AEGILOPS-CYLINDRICA*. 1. PRODUCTION OF SALT TOLERANT WHEAT GERMPLASM. *Pakistan Journal of Botany*. 26(2):283-292. English. [NIAB FAISALABAD PAKISTAN].

To produce salt-tolerant wheat germplasm through wide hybridization, 8 different salt-tolerant accessions of *Ae. cylindrica* were crossed with 3 hexaploid wheat cultivars: Pak-81, LU-26, and Shalimar-88. Frequency of seed set ranged between 1.72% (Shalimar-88 x *Ae. cylindrica* acc. 38-53) and 52.6% (Pak-81 x *Ae. cylindrica* acc. G.). The performance of wheat cultivars LU-26 and Shalimar-88 as female parent for F hybrid production was poor. Frequency of BC1 seed production ranged between 0.53% (Pak-81 x *Ae. cylindrica* // LU-26) and 8.92% (Shalimar-88 x *Ae. cylindrica* // LU-26). BC1 plants with different chromosome numbers were selfed to produce BC1F1 derivatives. Seven BC1 combinations produced selfed seeds ranging between 1 and 200. Six BC1 combinations did not produce selfed seeds and were backcrossed again with LU-26 to produce BC2 seeds, which ranged between 1 and 12 seeds per BC1 combination. Of the 30 different BC2 seeds produced in different combinations, only 19 produced BC2F1 selfed seeds. All the BC2F1 and BC1F2 seeds were tested for germination under saline solutions of EC 2.5 (control) 15, 20, and 25 dS/m. Salinity induced reduction and delay in seed germination; reduction in shoot and root length and in seedling fresh weight was observed with considerable variation among different salinity levels and among different genotypes at one salinity level. The results have been discussed with reference to the wide hybridization approach and its potential use in the production of genetic variability for polygenically controlled characters such as salt-tolerance.

2637 Farooq, S.; Shah, TM.; Askari, E.; Zaidi, AA.; Arif, M.; Iqbal, N. (1994) IDENTIFICATION OF DIFFERENT WHEAT GENOTYPES THROUGH POLYMORPHISM BASED ON RANDOM AMPLIFIED POLYMORPHIC DNA (RAPD). *Pakistan Journal of Botany*. 26(2):373-382. English. [NIAB FAISALABAD PAKISTAN].

Polymerase chain reaction was used to detect polymorphism in 10 different salt-tolerant wheat introgression lines produced through wide hybridization, 2 cultivated hexaploid wheat varieties, a tetraploid wheat variety and salt-tolerant accession D of *Aegilops cylindrica*. DNAs extracted from fresh leaves by the CTAB method were amplified using 25 µL reaction volume in a Perkin Elmer Thermal Cycler and randomly sequenced 10 mer synthetic primers. Based on amplification reactions, all the primers were divided into 4 categories. Category A primers reacted with all the wheat lines, category B with none, category C with 10-14, and category D with 3-7 wheat lines. Of the 18 reactive primers, 11(61%) detected polymorphism in all the test material. The level of polymorphism was low and ranged from 1.2 to 22.8%. Most of the primers produced monomorphic bands including very intense, easily visible and less visible bands. Of the 9 salt-tolerant introgression wheat lines, 6 were identified on the basis of polymorphic bands. Our study indicated possibilities for using Random Amplified Polymorphic DNA (RAPD) markers to detect specific variations in the genome that could be used for varietal finger printing.

2638 Feng Qingming; Liu Runtang; Zhang Cuixiang (Shanxi Provincial Academy of Agricultural Sciences, Taiyuan (China). Inst. of Crop Genetics) (1994) High yield and yield stability of new dry land wheat varieties in the middle area of Shanxi Province, China. *Acta Agriculturae Boreali-Sinica (China)* v. 9(2) p. 46-48. 2 tables, 7 ref. Chinese. (AGRI5 95-049954).

2639 Ferrero, C.; Ferrero, M. (ASPROCER Piemonte, Turin (Italy)); Grignani, C. (Turin Univ. (Italy). Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio); Bersani, L. (Camera di Commercio, Industria, Artigianato ed Agricoltura, Turin (Italy)) (1994) [Synthesis of the varietal trials carried out on *Triticum aestivum* and barley in Piedmont in 1994]. Sintesi delle prove varietali su frumento tenero e orzo in Piemonte per il 1994. *Piemonte Agricoltura (Italy)* v. 18(4) p. 28-30. Italian. (AGRI5 95-049997).

2640 Francis, HA.; Leitch, AR.; Koebner, RMD. (1995) CONVERSION OF A RAPD-GENERATED PCR PRODUCT, CONTAINING A NOVEL DISPERSED REPETITIVE ELEMENT, INTO A FAST AND ROBUST ASSAY FOR THE PRESENCE OF RYE CHROMATIN IN WHEAT. *Theoretical & Applied Genetics*. 90(5):636-642. English. [JOHN INNES CTR PLANT SCI RES NORWICH RES PK NORWICH NR4 7UJ NORFOLK ENGLAND].

Bulk segregant analysis was used to obtain a random amplified polymorphic DNA (RAPD) marker specific for the rye chromosome arm of the 1BL.1RS translocation, which is common in many high-yielding bread wheat varieties. The RAPD-generated band was cloned and end-sequenced to allow the construction of a pair of oligonucleotide primers that PCR-amplify a DNA sequence only in the presence of rye chromatin. The amplified sequence shares a low level of homology to wheat and barley, as judged by the low strength of hybridization of the sequence to restriction digests of genomic DNA. Genetic analysis showed that the amplified sequence was present on every rye chromosome and not restricted to either the proximal or distal part of the 1RS arm. In situ hybridization studies using the amplified product as probe also showed that the sequence was dispersed throughout the rye genome, but that the copy number was greatly reduced, or the sequence was absent at both the centromere and the major sites of heterochromatin (telomere and nucleolar organizing region). The probe, using both Southern blot and in situ hybridization analyses, hybridized at a low level to wheat chromosomes, and no hybridizing restriction fragments could be located to individual wheat chromosomes from the restriction fragment length polymorphism (RFLP) profiles of wheat aneuploids. The disomic addition lines of rye chromosomes to wheat shared a similar RFLP profile to one another. The amplified sequence does not contain the RIS 1 sequence acid therefore represents an as yet undescribed dispersed repetitive sequence. The specificity of the amplification primers is such that they will provide a useful tool for the rapid detection of rye chromatin in a wheat background. Additionally, the relatively low level of cross-hybridization to wheat chromatin should allow the sequence to be used to analyse the organization of rye euchromatin in interphase nuclei of wheat lines carrying

chromosomes, chromosome segments or whole genomes derived from rye. [References: 32].

2641 Fu Daxiong; Ruan Renwu; Pi Wei (Chongqing Municipal Inst. of Agricultural Sciences, Sichuan (China)) (1992) Problems and ponderations in breeding of hybrid wheat. *Southwest China Journal of Agricultural Sciences (China)* v. 5(1) p. 108-114. 9 ref. Chinese. (AGRI 95-049968).

2642 Furusho, M. (1995) BREEDING OF MALTING BARLEY USING THE HAPLOID METHOD. *JARQ-Japan Agricultural Research Quarterly*. 29(1):9-15. English. [NATL AGR RES CTR DEPT CROP BREEDING TSUKUBA IBARAKI 305 JAPAN].

Production of haploid plants followed by chromosome doubling can shorten the duration of plant breeding programs. Barley haploid plants can be obtained by interspecific crossing between barley (*Hordeum vulgare* L.) and *Hordeum bulbosum* L. This paper describes the haploid breeding method applied for malting barley. There were varietal differences in embryo formation and haploid production among the barley genotypes. The varietal differences in embryo formation were due to the difference in the pollen tube growth and the rate of chromosome elimination 3 to 5 days after pollination. To improve the efficiency of haploid production, superior clones of *H. bulbosum* were selected. Haploid production method using intergeneric crossing was newly developed. F1 plants derived from two cross-combinations of barley cultivars were crossed with *H. bulbosum*. As a result, 209 doubled haploid plants were obtained and 4 elite lines of malting barley were selected. These lines were superior to the check cultivar in agronomic performance and malting quality.

2643 Genlous, S. (Sichuan Agricultural Univ. (China)); Yen, C.; Yang, J. (1993) Intermeiocyte connections and cytotoxicity in intergeneric hybrids, 2: *Triticum aestivum* x *Psathyrostachys huashanica* Keng. *Wheat Information Service (Japan)* (no. 77) p. 13-18. 2 tables; 1 fig.; 11 ref. English. (AGRI 95-064072).

2644 Gibson, C.E.; Evans, D.E.; Dalton, M.R.; Lance, R.C.M.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia). Waite Campus); Symons, M.H.; Arends, A.; Marschke, R.J.; Henry, R.J. (Queensland Dept. of Primary Industries, Hamilton (Australia)) (1994) Cloning of the thermostable alpha-amylase for genetic transformation of barley. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 504. English. (AGRI 95-049651).

2645 Giura, A. (Research Institute for Cereals and Industrial Crops, Fundulea (Romania)) (1994) Preliminary results of wheat polyhaploid production using wheat x maize crosses. *Romanian Agricultural Research (Romania)* (no. 1) p. 1-4. 4 tables; 2 ill.; 17 ref. English. (AGRI 95-049691).

Nine winter wheat F1 hybrids were used to produce wheat polyhaploids through intergeneric crosses with maize. Out of 6,230 pollinated florets, 75.0 percent formed seeds with a genotype variation of 64.3 to 86.8 percent. 66.9 percent of these were plump, well developed seeds ranged from 10.1 to 22.8 percent, indicating a genotype influence. The extracted embryos showed various shapes, sizes and degree of differentiation with great influence on the success of embryo culture. Out of 509 cultured embryos 233 germinated (45.8 percent) and 186 (36.5 percent) developed into plants. All cytological analysed plants had the polyhaploid chromosome complement of $2n = 21$. After colchicine treatment 86 percent of plants survived and are being in the process of clones multiplication. With further improvement we hope that the intergeneric crosses wheat x maize may become a current procedure for a wheat polyhaploids production.

2646 Gland Zwerger, A. (University of Hohenheim, Stuttgart (Germany). State Plant Breeding Institute) (1994) Production of doubled haploid lines through anther culture in barley and triticale. International Colloquium on Impact of Plant Biotechnology on Agriculture; Rogla (Slovenia); 5-7 Jun 1994. *Proceedings of the International Colloquium on Impact of Plant Biotechnology on Agriculture*. Javornik, B.; Bohanec, B.; Kreft, J. (eds.). Biotechnical Faculty, University of Ljubljana, Ljubljana (Slovenia). Agronomy Dept., Centre for Plant Biotechnology and Breeding p. 9-14. 2 tables; 16 ref. English. (AGRI 95-049680).

The influence of carbon source in induction medium and pretreatment on anther culture response was investigated using 13 F1-lines of crossed from 6 spring barley genotypes and strains of winter triticale line '101'. Anthers

were cultured on modified MS, Ficoll-containing medium, supplemented with either maltose or melezitose and barley malt. The use of maltose and the pretreatment with 0.35 M mannitol at 2 Deg C resulted in higher anther response, calli and/or embryoid production and plant regeneration compared to the incubation of anthers either on a medium containing melezitose or pretreated with mannitol or maltose at 4 Deg C.

2647 Gustafsson, M.; Bothmer, R. von (Sveriges Lantbruksuniversitet, Svalöv (Sweden). Inst. för Växtförädlings) (1994) Present research projects in barley at the Institute of Plant Breeding, Svalöv [Swedish University of Agricultural Sciences]. Seminar; Svalöv (Sweden); 9 May 1994. *Sveriges Utsädesförenings Tidskrift (Sweden)* v. 104(4) p. 211-216. 17 ref. English. (AGRI 95-049647).

2648 Hagberg, A. (1994) [Induced chromosome structural mutations in barley. The history of a fifty-year-old research project]. Inducerade kromosomstrukturella mutationer i korn. Historien om ett snart femtioårigt forskningsprojekt. Seminar; Svalöv (Sweden); 9 May 1994. *Sveriges Utsädesförenings Tidskrift (Sweden)* v. 104(4) p. 162-194. 64 ref. Swedish. (AGRI 95-049646).

2649 Han Fangpu; Li Jilin (Harbin Normal Univ. (China). Dept. of Biology) (1993) Morphology and cytogenetics of intergeneric hybrids of crossing *Triticum durum* and *T. timophevi* with tetraploid *Elytrigia elongata*. *Acta Genetica Sinica (China)* v. 20(1) p. 44-49. 1 ill., 3 tables, 12 ref. Chinese. (AGRI 95-050394).

2650 Hartl, L.; Weiss, H.; Stephan, U.; Zeller, F.J.; Jahoor, A. (1995) MOLECULAR IDENTIFICATION OF POWDERY MILDEW RESISTANCE GENES IN COMMON WHEAT (*TRITICUM AESTIVUM* L.). *Theoretical & Applied Genetics*. 90(5):601-606. English. [TECH UNIV MUNICH LEHRSTUHL PFLANZENBAU & PFLANZENZÜCHTUNG D-85350 FREISING GERMANY].

RFLP markers for the wheat powdery mildew resistance genes *Pm1* and *Pm2* were tagged by means of near-isogenic lines. The probe *Whs178* is located 3 cM from the *Pm1* gene. For the powdery mildew resistance gene *Pm2*, two markers were identified. The linkage between the *Pm2* resistance locus and one of these two probes was estimated to be 3 cM with a F-2 population. Both markers can be used to detect the presence of the corresponding resistance gene in commercial cultivars. "Bulked segregant analysis" was applied to identify linkage disequilibrium between the resistance gene *Pm18* and the above-mentioned marker, which was linked to this locus at a distance of 4 cM. Furthermore, the RAPD marker OPH-11(1900) (5'-CTTCCGAGT-3') was selected with pools created from a population segregating for the resistance of Trigo BR 34'. The RAPD marker was mapped about 13 cM from this resistance locus. [References: 44].

2651 Hentrich, W.; Schreiber, H. (1993) [Improvement of the tendency to allogamy in spring barley by means of mutation breeding]. Verbesserung der Allogamie neigung mit Hilfe der Mutationszüchtung bei Sommergerste. *Kuehn-Archiv (Germany)* v. 87(2) p. 187-194. 1 ill., 5 tables; 12 ref. German. (AGRI 95-063963).

2652 Hirai, T.; Gocho, H.; Kashio, T. (1993) A new method for testing scab resistance by controlling heading time of standard wheat [*Triticum aestivum*] varieties. *Bulletin of the Kyushu National Agricultural Experiment Station (Japan)* v. 28(1) p. 1-15. 2 tables; 9 fig.; 12 ref. Japanese. (AGRI 95-050000).

Scab caused by *Gibberella zeae* (Schw.) Petch is one of the most important diseases of wheat in Japan. Breeding for scab resistance is therefore being conducted but a practical scab resistance variety has not yet been released. It is difficult to accurately evaluate scab resistance because wheat varieties differ in heading time and a method for standardizing heading time has not been available. In the present paper, the heading time of standard varieties was controlled to evaluate varieties with unknown degrees of scab resistance. A series of experiments were conducted to obtain information on the effects of sowing time, long day treatment and vernalization on heading time of standard varieties and the effects of these treatments on scab resistance during August 1982 to July 1986.

2653 Hoshino, T. (Tohoku National Agricultural Experiment Station, Morioka (Japan)); Ito, S.; Sato, A.; Watanabe, M.; Tanosaki, S.; Taniguchi, Y.; Gotoh, T.; Fujiwara, H.; Kitahara, S.; Ueda, K.; Nakajima, H. (1993) The new

wheat [*Triticum aestivum*] cultivar "Akitakko". *Bulletin of the Tohoku National Agricultural Experiment Station (Japan)* (no.87) p. 33-53. 2 plates; 16 tables; 6 fig. Japanese. (AGRI 95-050003).

The new wheat cultivar "Akitakko" was released in 1992 by Tohoku National Agricultural Experiment Station, Morioka, Japan. This cultivar was selected by the pedigree method from the cross of Tohoku 143 (later registered as Wakamatsukomugi)/Tohoku 144 in 1976, and was registered as Komugi Norin 137 to the Ministry of Agriculture, Forestry and Fisheries in 1992. Main characteristics of Akitakko are as follows: 1. Akitakko is a tillering type with slightly short culm and awned spikes, and the kernel is glassy and reddish brown. 2. Akitakko is a winter type and maturity is about 3 days earlier than Kitakamikomugi. 3. Akitakko is moderately resistant to cold and snow endurance and is susceptible to leaf rust, powdery mildew and pre-harvest sprouting. 4. The yield is slightly higher under various cultivation practices than Kitakamikomugi, especially in the case of cultivation with top dressing at the meiosis stage. 5. The flour-milling percentage is higher and grain ash content is lower, and the protein content of the flour is the same as Kitakamikomugi. 6. the water-absorption of farinogram is high but the area of extensogram is not large, and the resistance of extensogram is not strong compared with Kitakamikomugi. 7. Akitakko is well suited for use in noodles among Japanese cultivars, similar to Kitakamikomugi.

2654 Howard, K.A.; Gayler, K.R. (Melbourne Univ., Parkville (Australia). Biochemistry Dept.) (1994) Genetic variation in D hordein in barley. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 507. English. (AGRI 95-049656).

2655 Hraska, S.; Rychtarik, J. (Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic)) (1994) [The aleuronic layer variability in winter wheat hybrids in relation to selection of the higher protein content]. *Premenlivost aleuronovej vrstvy hybridov ozimnej pšenice vo vzťahu k selekcii na vyšší obsah bielkovín. Poľnohospodárstvo (Slovak Republic)* v. 40(6) p. 401-409. 4 tables; 3 ref. Slovak. (AGRI 95-050018).

The width of aleuronic layer in winter wheat grains (4 parent varieties and their hybrid F1 and F2 generations) were analysed by secondary fluorescence using a fluorescence microscope. The heterosis effect manifested itself in 50 % of F1 generation hybrids. The value in other hybrids was intermediate or close to the mother variety value. The variability in the followed characteristics was higher in the F2 generation. Besides the intermediate values, some of the hybrids were close to parent varieties, others were above the parents average. The heredity of the wheat aleuronic layer shows hereditary character of quantitative characteristics. The large aleuronic layer lobes length in the central cut can be used in the indirect higher gluten and protein content detection ($r=0.771+*$) in the early phases of breeding.

2656 Hsam, S.L.K.; Cermeno, M.C.; Friebe, B.; Zeller, F.J. (1995) TRANSFER OF AMIGO WHEAT POWDERY MILDEW RESISTANCE GENE PM17 FROM T1AL-CENTER-DOT-1RS TO THE T1BL-CENTER-DOT-1RS WHEAT-RYE TRANSLOCATED CHROMOSOME. *Heredity*. 74(Part 5):497-501. English. [TECH UNIV MUNICH INST PFLANZENBAU & PFLANZENZUCHTUNG D-85350 FREISING GERMANY].

Powdery mildew resistance gene Pm17 located on chromosome arm 1RS of the T1AL . 1RS translocation in the common wheat cultivar 'Amigo' was transferred to a T1BL . 1RS translocated chromosome through selection from a cross with a T1BL . 1RS cultivar 'Helios'. In addition to gene Pm17, the resistant recombinant derivative designated 'Helami-105' also possesses gene pm5 inherited from cultivar 'Helios'. A-PAGE and SDS-PAGE show that in line 'Helami-105' chromosome 1A is derived from 'Helios' and chromosome arms 1BL and 1RS in T1BL . 1RS from 'Amigo'. [References: 18].

2657 Hsiao, C.; Chatterton, N.J.; Asay, K.H.; Jensen, K.B. (1995) PHYLOGENETIC RELATIONSHIPS OF THE MONOGENOMIC SPECIES OF THE WHEAT TRIBE, TRITICEAE (POACEAE), INFERRED FROM NUCLEAR rDNA (INTERNAL TRANSCRIBED SPACER) SEQUENCES. *Genome*. 38(2):211-223. English. [UTAH STATE UNIV USDA ARS FORAGE & RANGE RES LAB LOGAN, UT 84322 USA].

Phylogenetic relationships of 30 diploid species of Triticeae (Poaceae) representing 19 genomes were estimated from the sequences of the internal transcribed spacer (ITS) region of nuclear ribosomal DNA. The ITS sequence

phylogeny indicated that: (i) each genome group of species is monophyletic, concordant with cytogenetic evidence; (ii) *Hordeum* (L) and *Critonia* (H) are basal; (iii) *Australopyrum* (W) is closely related to *Agropyron* (P); (iv) *Peridictyon* (G), *Heteranthelium* (Q), and *Dasypyrum* (V) are closely related to *Pseudoraegneria* (S); (v) most of the annuals, *Triticum* s.l. (A, B, D), *Critopsis* (K), *Taeniatherum* (T), *Eremopyrum* (F), *Henrardia* (O), *Secale* (R), and two perennials, *Thinopyrum* (J) and *Lophopyrum* (E), all of Mediterranean origin, are a monophyletic group. However, phylogenetic trees based on morphology group these Mediterranean species with various perennial lineages of the Arctic-temperate region. The molecular data and biogeography of the tribe suggest that the Mediterranean lineage is derived from the Arctic-temperate lineage and that the two lineages have evolved in parallel. Extensive morphological parallelism apparently obscures the true genealogical history of the tribe when only morphology is considered. [References: 49].

2658 Huang Chengyan; Yang Pingping; Yin Yufen (Shandong Provincial Academy of Agricultural Sciences, Jinan (China). Inst. of Crops) (1993) Study on introducing DNA of *Agropyron elongatum* and *Haynaldia villosa* into common wheat. *Journal of Shandong Agricultural Sciences (China)* (no. 5) p. 3-5. 1 ill., 2 tables, 5 ref. Chinese. (AGRI 95-049944).

2659 Huang Yuanjiang; Li Longye (Southwest Agricultural Univ., Chongqing (China). Dept. of Plant Protection) (1993) Studies on the gene allelism of wheat resistance to powdery mildew. *Journal of Yunnan Agricultural University (China)* v. 8(3) p. 214-215. Chinese. (AGRI 95-049978).

2660 Iriki, N. (Hokkaido National Agricultural Experiment Station, Sapporo (Japan)); Kuwabara, T. (1994) Heritability of amylose content in wheat [*Triticum aestivum*] and its selection effectiveness by near-infrared reflectance analysis with inframatic 8120. *Research Bulletin of the Hokkaido National Agricultural Experiment Station (Japan)* (no.159) p. 39-47. 6 tables; 5 fig.; 17 ref. Japanese. (AGRI 95-050004).

Amylose content is one of the most important traits in quality breeding of wheat in Japan, because it is a valuable criterion for the selection of genotypes suitable for Japanese noodles. But there are few reports on its heritability, though the information is important to carry out the breeding efficiently. Furthermore, only a few reports have been issued on the application of near-infrared reflectance (NIR) analysis to amylose content, even though the NIR analysis may be a very useful selection method in early generations of large populations because the method is more rapid and easier than Autoanalyzer which is a very popular method at many breeding stations. In this report, heritability of amylose content in two hybrid populations was estimated by selection experiment, and the selection effectiveness of NIR analysis was evaluated using the same populations.

2661 Islamfaridi, M.N.; Mujeebkazi, A. (1995) VISUALIZATION OF SECALE CEREALE DNA IN WHEAT GERM PLASM BY FLUORESCENT IN SITU HYBRIDIZATION. *Theoretical & Applied Genetics*. 90(5):595-600. English. [CIMMYT LISBOA 27 APARTADO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

Homozygous wheat/rye (1BL/1RS or 1AS/1RL) translocation lines have significantly contributed to wheat production, and several other wheat/rye translocation lines show a potential promise against biotic and abiotic stresses. Detecting the presence of rye at the chromosome level is feasible by C-banding and isozyme protocols, but the diagnostic strength of genomic in situ hybridization for eventually analyzing smaller DNA introgressions has greater significance. As a first step we have applied the genomic in situ hybridization technique to detect rye chromosomes in a wheat background using germ plasm of agricultural significance. By this method rye contributions to the translocations 1BL/1RS, 1AL/1RS, 5AS/5RL and 6BS/6RL could be identified. Differential labelling has further enabled the detection of rye and *Thinopyrum bessarabicum* chromosomes in a trigenic hybrid of *Triticum aestivum*/Th. *bessarabicum*/Secale cereale. [References: 20].

2662 Iltu, M.; Saulescu, N.N.; Iltu, G.; Moldovan, M.; Tican, C.; Blebea, I. (Academia de Stiinte Agricole si Silvice "Gheorghe Ionescu Sisest", Fundulea (Romania). Institutul de Cercetari pentru Cereale si Plante Tehnice) (1993) [Genotype - isolate - cultivate interaction for resistance to Fusarium scab in wheat and triticale]. *Interactiunea genotip x izolat x*

localitate pentru rezistentă la furioza spicului la griu și triticale. *Analele Institutului de Cercetări pentru Cereale și Plante Tehnice Fundulea (Romania)* v. 60 p. 9-17. 1 table; 7 graphs; 12 ref. Romanian. (AGRI 95-049619).

In field trials carried out at Fundulea, Turda and Brasov in 1991, the study of relationship between genotype, isolate and location was designed to improve the experimental methods of breeding for Fusarium resistance. 10 genotypes of winter wheat and triticale with different degrees of resistance were investigated for the visual score of infection, the weight of ear and seeds, the number of whitened and whitened + shrivelled seeds with 3 Fusarium isolates obtained from each of the mentioned locations. It was concluded that for a better characterisation of the winter wheat and triticale genotypes for Fusarium scab resistance multilocal artificial tests are necessary in which at least one local Fusarium pathogenic isolate is included. The genotype/isolate interaction was not significant so that an acceptable level of stability of resistance in our sources is expected. ANOVA revealed significant influence of genotypes, locations and isolates and of genotype x location and isolate x location interactions.

2663 Jeffries, S.P.; Frensham, A.B. (South Australian Research and Development Inst., Adelaide); MacLeod, L.C.; Logue, S.J. (Adelaide Univ., Glen Osmond (Australia). Dept. of Plant Science) (1994) Genotype by environment interactions for malting quality parameters in advanced barley variety trials. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 507. English. (AGRI 95-049657).

2664 Jerkovic, Z. (Institut za ratarstvo i povrtarstvo, Novi Sad (Yugoslavia)); Jevtic, R.; Stojanovic, S. (1994) [Complete resistance of wheat and barley to rusts and breeding possibilities]. *Nekompletna otpornost pšenice i jecma prema prouzrokovacima rdje i mogućnosti selekcije na to svojstvo. Savremena poljoprivreda (Yugoslavia)* v. 42(3) p. 87-96. 1 table; 68 ref. Serbian. (AGRI 95-049684).

Results of the investigation connected with incomplete resistance to Puccinia spp. in wheat and barley are presented in this paper. There are conditions for efficient breeding on that character. Heritability is high, environmental influence on gene expression in the field can be eliminated with investigations in the controlled conditions. Selection of parents which carry genes for the resistance is possible after only one year of estimation of AUDPC (area under disease progress curve) values, latent period 50 and infection efficiency. Inheritance of the character in the investigated field conditions is mostly partially dominant. That fact makes the selection of genotypes from the progenies with other desirable characters besides incomplete resistance easier.

2665 Jewell, D.C. (Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) (1994) Using wild relatives to improve maize: Wide crosses. *The CIMMYT maize germplasm bank: Genetic resource preservation, regeneration, maintenance, and use. Tabo, S. (ed.) (Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program* p. 41. CIMMYT. English. (AGRI 95-063994).

2666 Jiang Guoliang; Wu Zhaosu (Nanjing Agricultural Univ. (China). Inst. of Wheat Breeding) (1993) Studies on the development of scab resistant gene pool in wheat III. Exploration of the establishment of base populations and their recurrent selection. *Acta Agronomica Sinica (China)* v. 19(5) p. 441-451. 6 tables, 25 ref. Chinese. (AGRI 95-049988).

2667 Jin Zhengxun; Li Zhuofu; Sun Yanli (Northeast Agricultural Univ., Harbin (China). Dept. of Agronomy) (1994) An analysis of possibility and ways in combining high protein with high yield in spring wheat. *Heilongjiang Agricultural Sciences (China)* (no. 4) p. 8-11. 3 tables, 4 ref. Chinese. (AGRI 95-049588).

2668 Johansson, E.; Brismar, K.; Heneen, W.K. (Swedish Univ. of Agricultural Sciences, Svalov. Dept. of Plant Breeding); Joensson, J.O.; Henriksson, P. (1994) [Comparison of electrophoretic methods for identification of the 1BL/1RS rye translocation in wheat - simultaneous screening for high-molecular-weight glutenins - and detection of chromosome deletions]. *Confronto di metodi elettroforetici per l'identificazione della traslocazione della segale 1BL/1RS nel grano. Analisi simultanea di glutenine ad elevato peso molecolare e*

individuazione di delezioni dei cromosomi. Journal of Genetics and Breeding (Italy) v. 48(3) p. 291-300. 1 table; 2 graphs; 45 ref. English. (AGRI 95-049995).

2669 Jovanovic, B. (Poljoprivredni fakultet, Beograd (Yugoslavia)); Prodanovic, S.; Maletic, R.; Gojkovic, Z. (1994) [Relation between cluster determined on the grain quality and pedigree of wheat varieties]. *Povezanost klastera dobijenih na osnovu kvaliteta zrna i pedigre sorata pšenice. Savremena poljoprivreda (Yugoslavia)* v. 42(1-2) p. 81-85. 2 graphs; 1 table; 5 ref. Serbian. (AGRI 95-049623).

Have been measured six characteristics of grain quality for 17 wheat varieties selected in different institutes. On cluster analysis of these characteristics, three groups of wheat varieties with similar grain quality were determined. The varieties in same cluster share some same parents in pedigree. That indicates the relation between obtained clusters and coefficients of percentage for wheat cultivars. The institutes that select often use the same tested varieties. The reason for that could be that the institutes use small number of varieties as gene donors for grain quality.

2670 Kalyada, K.U. (Grodzenski Sel'skagospadarchy Instytut, Grodna (Belarus)) (1994) [Winter soft wheat selection by precocity and productivity in the conditions of western regions of the Republic of Belarus]. *Selektsyya azimaj myakaj pshanitsy na khutkaspelasts' i praduksyjnasts' va wmovakh zakhodnikh raenaw Rehspubliki Belarus'. Vestsi Akademiі Agrarnykh Navuk Belarusi (Belarus)* v. 2 p. 14-18. 2 tables; 3 ref. Byelo Russian. (AGRI 95-049943).

2671 Katupitiya, S.; Millet, J.; Vesik, M.; Vickers, L.; Zeman, A.; Zhao, L.D.; Elmerich, C.; Kennedy, I.R. (1995) A MUTANT OF AZOSPIRILLUM BRASILENSE Sp7 IMPAIRED IN FLOCCULATION WITH A MODIFIED COLONIZATION PATTERN AND SUPERIOR NITROGEN FIXATION IN ASSOCIATION WITH WHEAT. *Applied & Environmental Microbiology*. 61(5):1987-1995. English. [UNIV SYDNEY DEPT AGR CHEM & SOIL SCI SYDNEY NSW 2006 AUSTRALIA].

We report here significant phenotypic and genetic differences between Azospirillum brasilense Sp7 and spontaneous mutant Sp7-S and their related properties in association with wheat. In contrast to the wild-type strain of Sp7, colonies of Sp7-S stained weakly with Congo red when grown on agar media containing the dye and did not flocculate in the presence of fructose and nitrate. Scanning and transmission electron micrographs showed clearly that the Sp7-S strain lacked surface materials present as a thick layer on the surface of the wild-type Sp7 strain. Different patterns of colonization on wheat roots between Sp7 and Sp7-S, revealed by *in situ* studies using *nifA-lacZ* as a reporter gene, were related to a large increase in nitrogenase activity (acetylene reduction) with Sp7-S in association with normal and 2,4-dichlorophenoxyacetic acid-treated wheat for assays conducted under conditions in which the nitrogenase activity of free-living Azospirillum organisms was inhibited by an excess of oxygen. Randomly amplified polymorphic DNA analysis indicated the close genetic relationship of Sp7-S to several other sources of Sp7, by comparison to other recognized strains of A. brasilense. Genetic complementation of Sp7-S was achieved with a 9.4-kb fragment of DNA cloned from wild-type Sp7, restoring Congo red staining and flocculation. [References: 55].

2672 Kehlenbeck, H. (1993) [Induced resistance and yields of winter barley and peas after infection by Erysiphe graminis]. *Zur Ertragsbildung induziert resistenter Wintergerste und Erbsen nach Mehltaubefall. Hannover Univ. (Germany). Fachbereich Gartenbau. Selbstverlag.* 16 ill., 18 tables. Bibliography p. 89-100. 100 p. German. (AGRI 95-063962).

2673 Keller, B.; Messmer, M.; Feuillet, C.; Winzeler, H.; Winzeler, M.; Schachermayr, G. (Eidg. Forschungsanstalt fuer landwirtschaftlichen Pflanzenbau, Reckenholz (Switzerland)) (1995) [Genetic markers in wheat breeding]. *Molekulare Marker in der Weizenzüchtung. Agrar Forschung (Switzerland)* v. 2(1) p. 17-20. 4 graphs, 6 ref. German. (AGRI 95-050022).

Genetic markers are used in wheat breeding in backcrossing programs, for the analysis of genetic diversity, for the identification of varieties and for pyramiding resistance genes. The genetic markers will facilitate pyramiding them and thus improve breeding for durable resistance against leaf rust.

2674 Kellogg, E.A.; Appels, R. (1995) INTRASPECIFIC AND INTERSPECIFIC VARIATION IN 5S RNA GENES ARE DECOUPLED IN DIPLOID WHEAT RELATIVES. *Genetics*. 140(1):325-343. English.

[HARVARD UNIV HERBARIUM 22 DIVIN AVE CAMBRIDGE, MA 02138 USA].

5S RNAs form part of the ribosome in most organisms. In some, e.g., prokaryotes and some fungi, the genes are part of the ribosomal operon, but in most eukaryotes they are in tandem arrays of hundreds to thousands of copies separate from the main ribosomal array. 5S RNA genes can be aligned across kingdoms. We were therefore surprised to find that, for 28 diploid species of the wheat tribe (Triticeae), nucleotide diversity within an array is up to 6.2% in the genes, not significantly different from that of the nontranscribed spacers. Rates of concerted evolution must therefore be insufficient to homogenize the entire array. Between species, there are significantly fewer fixed differences in the gene than would be expected, given the high within-species variation. In contrast, the amount of variation between species in the spacer is the same as or greater than that within individuals. This leads to a paradox. High variation within an individual suggests that there is little selection on any particular gene within an array. But conservation of the gene across species implies that polymorphisms are periodically eliminated at a rate approximately equal to or greater than that of speciation. Levels of intraspecific polymorphism and interspecific divergence are thus decoupled. This implies that selective mechanisms exist to eliminate mutations in the gene without also affecting the spacer. [References: 54].

2675 Koba, T. (Ishikawa Prefecture Coll. of Agriculture, Nonoichi (Japan)); Shimada, T. (1993) Crossability of common wheat [*Triticum aestivum*] with *Aegilops squarrosa*. *Wheat Information Service (Japan)* (no.77) p. 7-12. 2 tables; 14 ref. English. (AGRI 95-064071).

2676 Koebner, RMD. (1995) GENERATION OF PCR-BASED MARKERS FOR THE DETECTION OF RYE CHROMATIN IN A WHEAT BACKGROUND. *Theoretical & Applied Genetics*. 90(5):740-745. English. [JOHN INNES CTR PLANT SCI RES CEREALS RES DEPT NORWICH RES PK COLNEY NR4 7UJ NORFOLK ENGLAND].

Oligonucleotide primers were developed to detect the presence of four rye sequences using a PCR assay. These assays give a rye-specific signal from wheat DNA template which contains various rye chromosomes or chromosome segments. The sequences identified were associated with the nucleolar organiser region, the 5s-Rna-R1 locus, the telomere, and a widely dispersed, rye-specific repetitive element Ris-1. The primers amplified from the well-established loci Nor-R1 and 5s-Rna-R1 on rye chromosome arm 1RS, and also located a 5s-Rna locus on chromosome 3R. The telomere-associated sequence was present on every rye chromosome, and was also present, at a low copy number, in both wheat and barley. These assays will be particularly useful for introgression programmes aimed at reducing the rye content of the 1BL.1RS wheat-rye translocation. When multiplexed, the primers will enable a rapid, simultaneous assay for a number of distinct rye loci, which can be derived from a small portion of mature endosperm tissue. [References: 27].

2677 Kuburovic, M.; Pavlovic, M.; Knezevic, D. (Institut za istrazivanje u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita "Kragujevac") (1994) [Combining ability of number of primary roots in wheat]. *Analiza kombinacionih sposobnosti za broj primarnih korenova pšenice. Savremena poljoprivreda (Yugoslavia)* v. 42(1-2) p. 87-90. 4 tables; 9 ref. Serbian. (AGRI 95-049624).

Four divergent wheat cultivars were involved in diallel crosses. The cultivars and F1 and F2 hybrids differed significantly in number of primary roots. Highly significant general combining ability (GCA) and specific combining ability (SCA) effects were obtained for the number of primary roots indicating the presence of both additive and non-additive components of genetic variance. The ratio of GCA/SCA shows preponderance of additive gene effects in both hybrid generation (F1 and F2). The Sava cultivar was the best combiner and the best cross combination for this trait was Sava x Libellula.

2678 Kuburovic, M.; Pavlovic, M.; Knezevic, D. (Institut za istrazivanje u poljoprivredi "Srbija", Kragujevac (Yugoslavia). Centar za strna zita "Kragujevac") (1994) [Genetic analysis of number of kernels per wheat spike]. *Geneticka analiza broja zrna po klasu pšenice. Savremena poljoprivreda (Yugoslavia)* v. 42(1-2) p. 91-94. 4 tables; 11 ref. Serbian. (AGRI 95-049625).

Four genetically divergent cultivars: KG-75, Jugoslavija, Baranjka and NS-322 were used to make diallel crosses excluding reciprocals and they

produced F1 and F2 hybrids. Obtained results indicated that those components of yield were determined by additive and nonadditive gene effects. Significant high value of special combining ability (SCA) for F1 and F2 generation indicated preponderance nonadditive gene action. The value of special combining ability (SCA) variance was higher than general combining ability (GCA) for 1.5 (F1) and 4.4 times in F2 generation. The wheat line NS-322 had the highest value of GCA variance in F1 and F2 generation. The best cross combination was KG-75 x NS-322.

2679 Lafarga, A. (Instituto Tecnico y de Gestion del Cereal (Espagne)); Leazaun, J.A.; Rodriguez, A.; Salas, L. (1993) [Cereal varieties in Spain]. *Espagne: les varietes cultivees (de cereales). Perspectives Agricoles (France)* (no 180) p. 19-22. 6 graph. French. (AGRI 95-049934).

2680 Lafitte, H.R. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) (1994) Use of germplasm bank accessions in breeding for tolerance to low fertility conditions. *The CIMMYT maize germplasm bank: Genetic resource preservation, regeneration, maintenance, and use. Tabo, S. (ed.) (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program)* p. 35-36. CIMMYT. English. (AGRI 95-063993).

2681 Lance, R.C.M.; Logue, S.J.; MacLeod, L.C.; Langridge, P.J. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) Utilization of anther culture derived doubled haploids and molecular mapping for barley malting quality improvement. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 505. English. (AGRI 95-049655).

2682 Lance, R.C.M.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) Prediction of the [barley] malting quality performance of new cross combinations by utilizing cross experiments. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 505. English. (AGRI 95-049654).

2683 Laroche, G. (Institut Technique des Cereales et des Fourrages, Paris (France)); Masson, E.; Cottet, C.; David, H. (1993) [Triticale varieties, new varieties, descriptive cards]. *Le triticale [varietes, nouvelles varietes, fiches descriptives]. Perspectives Agricoles (France)* (no 180) p. 90-100. French. (AGRI 95-049628).

2684 Lashermers, P. (Office de Recherche Scientifique et Technique Outre Mer, Paris (France)); Blake, T. (Montana State Univ., Bozeman (USA). Dept. of Plant Science); Ceccarelli, S. (International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo (Syria)) (1994) [Identification of polymorphisms in reference barley genotypes based on the polymerase chain reaction]. *Identificazione di polimorfismi in genotipi di orzo di riferimento basata sulla reazione a catena della polimerasi. Journal of Genetics and Breeding (Italy)* v. 48(3) p. 207-210. 3 tables; 14 ref. English. (AGRI 95-049667).

The polymerase chain reaction (PCR) can be used to detect DNA polymorphism. Four reference barley genotypes were evaluated for variability using primers designed to amplify specific segments of genomic DNA. Segregation of such PCR-based markers in F5 SSD progeny was also analysed. Suitability of PCR-based markers for use as genetic marker in barley germplasm is discussed.

2685 Legouis, J.; Erdogan, M.; Friedt, W.; Ordon, F. (1995) POTENTIAL AND LIMITATIONS OF ISOZYMES FOR CHROMOSOMAL LOCALIZATION OF RESISTANCE GENES AGAINST BARLEY MILD MOSAIC VIRUS (BAMMV). *Euphytica*. 82(1):25-30. English. [INRA GENET & AMELIORAT PLANTES LAB DOMAINE BRUNEAUT F-80200 ESTREES MONS FRANCE].

To assess the possibilities offered by isozymes to locate resistance genes against barley mild mosaic virus (BaMMV), the isozyme patterns of 19 barley (*Hordeum vulgare* L.) genotypes carrying genes different from ym4 were determined. Of the 15 isozyme systems tested, only three were polymorphic, namely aconitate hydratase, esterase, phosphoglucanase dehydrogenase, providing markers on four of the seven barley chromosomes. Studies of F-2 progenies derived from three crosses between

resistant genotypes and susceptible varieties failed to reveal linkage between resistance genes and isozymes. Another goal of the experiment was to study the linkage relationships between ym4 and the esterase locus (Est1-Est2-Est4). Our estimates of the recombination rate between these two loci (3.41 and 8.32%) were in the range of those reported between these esterases and one of the resistance genes of the Chinese variety Mokusekko 3. [References: 26].

2686 Lelley, T.; Kazman, E.; Devos, K.M.; Gale, M.D. (1995) USE OF RFLPS TO DETERMINE THE CHROMOSOME COMPOSITION OF TETRAPLOID TRITICALE (A/B)(A/B)RR. *Genome*. 38(2):250-254. English. [AGR UNIV VIENNA INST AGRON & PLANT BREEDING GREGOR MENDEL STR 33 A-1180 VIENNA AUSTRIA].

Tetraploid triticale, (A/B)(A/B)RR (2n = 28), is a botanical novelty, an amphiploid composed of a diploid rye and a 14 chromosome wheat genome made up of chromosomes of the A and B genomes of tetraploid wheat. Restriction fragment length polymorphism (RFLP) markers were used to elucidate the chromosome composition of the mixed wheat genome of 35 different tetraploid triticale lines. Of 128 possible A/B chromosome pair combinations, only 6 were found among these lines, with a prevalence of the 1A, 2A, 3B, 4B, 5B, 6B, and 7B karyotype. In most triticale lines stable wheat genomes made up of only homologous A or B genome chromosome pairs were identified, however, in some lines homoeologous chromosome pairs were found. In this paper we demonstrate that RFLPs can be used successfully as an alternative to C-banding for the identification of the chromosome composition of tetraploid triticale and discuss the possible selective advantage of specific chromosome composition. [References: 13].

2687 Li Lirong (Academia Sinica, Chengdu (China). Chengdu Inst. of Biology) (1993) Gene effects in anther cultural breeding of wheat. *Southwest China Journal of Agricultural Sciences (China)* v. 6(4) p. 105-107. 2 tables, 4 ref. Chinese. (AGRI 95-049977).

2688 Li Suoping (Nanjing Agricultural Univ. (China). Dept. of Agronomy) (1993) Cytological analysis on mechanisms of functional gametes formation in hybrids between *Aegilops tauschii* and *Triticum durum*-*Haynaldia villosa* amphidiploid. *Acta Genetica Sinica (China)* v. 20(1) p. 68-73. 1 ill., 2 tables, 12 ref. Chinese. (AGRI 95-049639).

2689 Li Weiming; Wu Weiren; Lu Haolan (Fujian Agricultural Coll., Fuzhou (China). Inst. of Crop Genetics and Breeding) (1993) A method of detecting linkage between quantitative trait loci and genetic marker and its application in wheat. *Acta Agronomica Sinica (China)* v. 19(2) p. 97-102. 3 tables, 19 ref. Chinese. (AGRI 95-049981).

2690 Li Zhan; Wang Luying; Tang Guiying (Anhui Agricultural Univ., Hefei (China)); Huang Richu (1993) Biological effects of the radiation field in the 200 Mev electron linac tunnel on barley and wheat seeds. *Journal of Anhui Agricultural University (China) (suppl.)* p. 31-33. 2 tables, 3 ref. Chinese. (AGRI 95-049661).

2691 Lin Yufu; Feng Xiuying; Wang Jirong (Shandong Provincial Academy of Agricultural Sciences, Jinan (China). Inst. of Crops) (1994) Preliminary report on selection of new beer barley varieties and determination of quality. *Journal of Shandong Agricultural Sciences (China) (no. 3)* p. 10-12. 7 tables. Chinese. (AGRI 95-049660).

2692 Liu Binghua; Yang Li; Wang Shanhong (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Crop Breeding and Cultivation) (1994) Dwarfing sterile wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(1) p. 12-17. 2 tables, 10 ref. Chinese. (AGRI 95-049952).

2693 Liu Qingfa (Northwestern Agricultural Univ., Yangling, Shaanxi (China)) (1993) Studies on the mechanism and application of wheat haploids induced by alien cytoplasm II. A primary study on the expression of ptg gene and its utilization in wheat haploid breeding. *Acta Agronomica Sinica (China)* v. 19(3) p. 227-232. 3 tables, 24 ref. Chinese. (AGRI 95-049983).

2694 Liu Zhaoye; Yu Jingchuan (Yantai Municipal Inst. of Agricultural Sciences, Shandong (China)); Gong Qinan (1994) Estimations of genetic distance and cluster analysis on quantitative characters in wheat

germplasm. *Journal of Laiyang Agricultural College (China)* v. 11(2) p. 91-95. 1 ill., 6 tables, 3 ref. Chinese. (AGRI 95-049950).

2695 Liu Zhongqi; Li Yuchun (Sichuan Provincial Academy of Agricultural Sciences, Chengdu (China). Inst. of Crop Breeding and Cultivation) (1993) Study on grain filling characteristics of hybrid wheats with *Triticum timopheevi* cytoplasm. *Southwest China Journal of Agricultural Sciences (China)* v. 6(2) p. 26-31. 4 tables, 10 ref. Chinese. (AGRI 95-049973).

2696 Lothrop, J.E. (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) (1994) Breeding for cold tolerance in highland germplasm development. *The CIMMYT maize germplasm bank: Genetic resource preservation, regeneration, maintenance, and use*. Tabo, S. (ed.) (Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), Mexico, DF (Mexico). Maize Program) p. 30-32. CIMMYT. 8 ref. English. (AGRI 95-063992).

2697 Lu Xiangcai; Ma Chunyan (Hebei Provincial Academy of Agriculture and Forestry Sciences, Shijiazhuang (China). Inst. of Cereal and Oil Crops) (1994) Discussions on some problems of regional testing method of winter wheat varieties. *Journal of Hebei Agricultural University (China)* v. 17(1) p. 28-31. 3 tables, 3 ref. Chinese. (AGRI 95-049616).

2698 Lu Yongmei; Zhang Zuofang; Chen Jiuyue (Luan Prefectural Inst. of Agricultural Sciences, Anhui (China)) (1993) [Genetic influence of plant height on plant yield in wheat I. Correlation between plant height and plant yield]. *Journal of Anhui Agricultural University (China) (suppl.)* p. 77-80. 2 ill., 3 tables. Chinese. (AGRI 95-049964).

2699 Lukaszewski, A.J. (1995) PHYSICAL DISTRIBUTION OF TRANSLOCATION BREAKPOINTS IN HOMOELOGOUS RECOMBINANTS INDUCED BY THE ABSENCE OF THE PH1 GENE IN WHEAT AND TRITICALE. *Theoretical & Applied Genetics*. 90(5):714-719. English. [UNIV CALIF RIVERSIDE DEPT BOT & PLANT SCI RIVERSIDE, CA 92521 USA].

The physical distribution of translocation breakpoints was analyzed in homoeologous recombinants involving chromosomes 1A, 1B, 1D of wheat and 1R of rye, and the long arms of chromosome 7S of *Aegilops speltoides* and 7A of wheat. Recombination between homoeologues was induced by removal of the Ph1 gene. In all instances, translocation breakpoints were concentrated in the distal ends of the chromosome arms and were absent in the proximal halves of the arms. The relationship between the relative distance from the centromere and the relative homoeologous recombination frequency was best explained by the function $f(x)=0.0091e^{(0.0592x)}$. The pattern of recombination in homoeologous chromosomes was essentially the same as in homologues except that there were practically no double exchanges. Among 313 recombinant chromosomes, only one resulted from a double crossing-over. The distribution of translocation breakpoints in translocated arms indicated that positive chiasma interference operated in homoeologous recombination. This implies that the reduction of the length of alien chromosome segments present in translocations with wheat chromosomes may be more difficult than the production of the original recombinants. [References: 17].

2700 Luo, M.C. (Sichuan Agricultural Univ. (China)); Yen, C.; Yang, J.L. (1994) Crossability percentages of bread wheat (*Triticum aestivum*) land races from Hunan and Hubei provinces, China with rye [*Secale cereale*]. *Wheat Information Service (Japan) (no.78)* p. 34-38. 2 tables; 2 fig. English. (AGRI 95-064076).

2701 Ma, H.; Hughes, G.R. (1995) GENETIC CONTROL AND CHROMOSOMAL LOCATION OF TRITICUM TIMOPHEEVII-DERIVED RESISTANCE TO SEPTORIA NODORUM BLOTCH IN DURUM WHEAT. *Genome*. 38(2):332-338. English. [UNIV SASKATCHEWAN DEPT CROP SCI & PLANT ECOL SASKATOON SK S7N 0W0 CANADA].

The genetic control of resistance, expressed as restricted lesion development in seedling plants, to septoria nodorum blotch of wheat was studied under controlled environmental conditions, using the parental, F-1, F-2, F-3, BC1F2, and BC1F2 generations of crosses of *Triticum timopheevii*-derived resistant durum lines S3-6, S9-10, and S12-1 with the susceptible durum cv. Sceptre. The seedling resistance of these three resistant sources, derived from *T. timopheevii* (PI 290518), was monogenically controlled. The

chromosomal location of the resistance gene identified was determined by crossing the complete set of 'Langdon' - 'Chinese Spring' D-genome disomic substitution lines with S12-1. Tests of the F-1 and F-2 generations of each cross indicated that only chromosome 3A was associated with resistance. Therefore, the resistance gene is considered to be located on chromosome 3A and has been designated temporarily as SnbTM. [References: 34].

2702 Maroof, MAS.; Zhang, QF.; Biyashev, R. (1995) COMPARISON OF RESTRICTION FRAGMENT LENGTH POLYMORPHISMS IN WILD AND CULTIVATED BARLEY. *Genome*. 38(2):298-306. English. [VIRGINIA POLYTECH INST & STATE UNIV DEPT CROP & SOIL ENVIRONM SCI BLACKSBURG, VA 24061 USA].

This study was undertaken to assess the relative level of molecular diversity between cultivated barley, *Hordeum vulgare* ssp. *vulgare* (HV), and one of its wild relatives, *H. vulgare* ssp. *spontaneum* (HS), and to identify possible restriction fragment length polymorphism (RFLP) patterns that may provide information concerning the phylogenetic relationship between these two barley groups. A total of 363 barley accessions were assayed, including 95 entries of HV collected from 36 major barley growing countries of the world and 268 entries of HS from 25 natural populations in Israel and Iran. The 26 RFLP marker loci used in the survey represent single-copy, low-copy, and repetitive DNA sequences and mark all of the chromosome arms. A randomization test, on the basis of equal sample sizes, showed that HS is more polymorphic than HV, as evaluated by the number of alleles and diversity indices. The analysis also indicated extensive RFLP differentiation between these two barley groups; highly significant differences of allele frequencies were detected at the majority of the loci. The HV sample can be subdivided according to winter or spring growth habits, and two- or six-rowed spikes. Analysis of genetic polymorphisms in these subgroups showed that levels of diversity were about equal in spring and winter groups and also in the groups with two- and six-rowed spikes. However, significant differences of allelic frequencies were detected between subgroups of the two divisions. [References: 30].

2703 May, C.E. (New South Wales Agriculture, Wagga Wagga (Australia)) (1994) Attendance of Dr C. E. May at the 8th International Wheat Genetics Symposium, Beijing, China, July 1993. New South Wales Agriculture. Illus. 10 p. English. (AGRIS 95-063925).

A copy of the paper presented at the wheat genetics symposium, titled 'A directed search for DNA markers linked to agronomic traits' is included with this report.

2704 McCormick, K.M.; Panozzo, J.F.; Eagles, H.A. (Victorian Dept. of Agriculture, Horsham (Australia). Inst. for Dryland Agriculture) (1994) Association between pasting properties and pedigrees of wheat cultivars (1880-1992). [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 508. English. (AGRIS 95-049607).

2705 Meng Huiying (Yantai Municipal Inst. of Agricultural Sciences, Shandong (China)); Zhang Jinqiu; Gong Qinan (1994) Preliminary study on the ecological classification of wheat cultivars in Shandong Province, China. *Journal of Laiyang Agricultural College (China)* v. 11(2) p. 103-108. 1 ill., 2 tables, 6 ref. Chinese. (AGRIS 95-049951).

2706 Menke Milczarek, I.; Zimny, J. (Plant Breeding and Acclimatization Institute, Radzikow (Poland). Dept. of Tissue Culture) (1992) Efficiency of somatic embryogenesis of wheat (*Triticum aestivum* L.). Pt. 1. Embryogenic Reaction of young inflorescences. *Bulletin of the Polish Academy of Sciences. Biological Sciences (Poland)* v. 40(3) p. 183-188. 4 fig., table; 17 ref. English. (AGRIS 95-050010).

Somatic embryogenesis and plant regeneration from young inflorescences of two wheat cultivars have been obtained. Statistical analysis showed that both genotypes, namely Grana and Jawa, a higher efficiency was noticed when immature inflorescence of length 5-10 mm and auxin Dicamba at any concentration between 5-30 microM was used. Thus, young inflorescence at the proper developmental stage can be used as explant for high frequency of somatic embryogenesis and plant regeneration of commercial wheat cultivars.

2707 Menke Mikczarek, I.; Zimny, J. (Plant Breeding and Acclimatization Institute, Radzikow (Poland). Dept. of Tissue Culture) (1992) Efficiency of somatic embryogenesis of wheat (*Triticum aestivum* L.). Pt. 2.

Embryogenic response of immature embryo depending on genotype and medium. *Bulletin of the Polish Academy of Sciences. Biological Sciences (Poland)* v. 40(3) p. 189-195. 3 fig.; 18 ref. English. (AGRIS 95-050011).

Somatic embryogenesis and plant regeneration from immature embryos of 25 genotypes of wheat have been obtained. Efficiency of somatic embryogenesis of all genotypes was examined and four genotypes characterized by, respectively high, middle and low capacities to form somatic embryos were selected and tested on 10 different commonly used media. Among investigated genotypes the CHD 283 line presented the highest ability to form embryogenic calli on each the tested media.

2708 Mogensen, HL.; Holm, PB. (1995) DYNAMICS OF NUCLEAR DNA QUANTITIES DURING ZYGOTE DEVELOPMENT IN BARLEY. *Plant Cell*. 7(4):487-494. English. [NO ARIZONA UNIV DEPT BIOL SCI BOX 5640 FLAGSTAFF, AZ 86011 USA].

Quantities of DNA were estimated in the nuclei of mechanically isolated egg and zygote protoplasts in two cultivars of barley using 4,6-diamidino-2-phenylindole staining and microfluorometry. Unlike many previous studies on DNA amounts within the sex cells of flowering plants, we obtained consistent and unambiguous results indicating that the egg and sperm nuclei are at the 1C DNA level (basic haploid amount) at the time of karyogamy. Karyogamy was initiated within 60 min postpollination, and the male chromatin became completely integrated into the egg nucleus within 6 to 7 hr postpollination (hpp). Zygotic nuclear DNA levels began to increase at similar to 9 to 12 hpp in cultivar Alexis and at 12 to 15 hpp in cultivar Igri. The 4C DNA complement was reached in most zygotes by 22 to 26 hpp in cultivar Alexis and by 23 to 29 hpp in cultivar Ign. These data are fundamental to a better understanding of fertilization and zygote maturation in flowering plants. They are also relevant to studies in which the timing of zygotic DNA replication is of interest, such as ongoing investigations on genetic transformations in barley using the microinjection technique. [References: 25].

2709 Mouritzen, P. (1994) Towards establishing a gene targeting system in barley (*Hordeum vulgare* L.) [plant regeneration]. Carlsberg Research Lab., Copenhagen (Denmark); Kongelige Veterinaer- og Landbohøjskole, Copenhagen (Denmark). KVL. 6 ill. 80 p. English. (AGRIS 95-049666).

2710 Mujeebkazi, A.; Cortes, A.; Rieralzarazu, O. (1995) THE CYTOGENETICS OF A TRITICUM TURGIDUM X PSATHYROSTACHYS JUNCEA HYBRID AND ITS BACKCROSS DERIVATIVES. *Theoretical & Applied Genetics*. 90(3-4):430-437. English. [CIMMYT LISBOA 27 APARTADO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

Psathyrostachys juncea (2n = 2x = 14, NN), a source of barley yellow dwarf (BYDV) virus resistance with tolerance to drought and salinity, has been successfully hybridized in its autotetraploid form (2n = 4x = 28, NNNN) as the pollen parent to durum wheat (*Triticum turgidum* L.). The 2n = 4x = 28 (ABNN) F-1 hybrid has a mean meiotic metaphase-I configuration of 20.29 univalents + 0.29 ring bivalents + 3.36 rod bivalents + 0.14 trivalents. Spike length, internode length, glume awn length and lemma awn length, as well as the general spike morphology of the F-1 hybrid, are intermediate with those of the two parents. Pollinating the ABNN F-1 hybrid has given backcross (BC)-I derivatives of an amphiploid (AABNNN) that expresses limited self-fertility. BC-2 derivatives have been obtained from these plants. Direct transfers of useful genes from *Ps. juncea* to wheat would require substantial genetic manipulation strategies. Both conventional and novel methodologies, which may complement each other, and so facilitate reaching an agricultural objective end point, are addressed. [References: 25].

2711 Musalitin, G.M.; Kozlovskaya, V.F. (1993) [Fertility of gametes and plants F1B1 (*Triticum aestivum* x *T. timopheevii* Zhuk.). Fertil'nost' gamet i rastenij F1B1 (*Triticum aestivum* L. x *T. timopheevii* Zhuk.). *Sibirskij vestnik sel'skokhozyajstvennoj nauki (Russian Federation)* (no.3) p. 29-34. 20 ref. Russian. (AGRIS 95-050013).

The fertility of gametes and plants of nine interspecific hybrids F1B1 (*T. aestivum* x *T. timopheevii*) in conditions of three various vegetations has been studied. It has been demonstrated that the pollen fertility amounted 11, but the frequency of fertile female gametes - 15% at the average on the set of hybrids and conditions on the basis of the result B2. The quantity of the painted pollen (%) does not determine the level of selffertility of the plants F1B1 and simply can not serve as a reliable criterion of prognosis of

their fertility. The result B2 does not reflect the frequency of functionally capable female gametes in the case of self-pollination. The level of fertility of plants F1B1 is probably determined by the frequency of favourable interactions of functionally capable male and female gametes.

2712 Nagashima, H.; Ishikawa, H. (1995) GENOTYPIC VARIATION OF HORDEIN IN JAPANESE BARLEY CULTIVARS (Japanese). *Breeding Science*. 45(1):87-90. Japanese. [NATL FOOD RES INST TSUKUBA IBARAKI 305 JAPAN].

There is great polymorphism in the polypeptides specified by Hor 1 and Hor 2, and to determine the genotypes of hordein is considered to be important for breeding. At present, the hordein genotypes have been investigated by several researchers. But so far, little has been reported about the hordein genotypes in Japanese cultivars. Thus, we investigated and determined the hordein genotypes in Japanese cultivars. Our conclusions are as follows: 1) Three novel types of Hor 1 (Ch, Ta, Ka), and two of Hor 2 (Sa, Ta) were identified. 2) Most of the naked barley and the six-rowed uzu-type covered barley cultivars have alleles which are not found in European barley cultivars. On the other hand, two-rowed barley and six-rowed normal-type covered barley cultivars have alleles which are found in European barley cultivars. 3) Many of the naked barley cultivars have identical alleles. Therefore, identification of the naked barley cultivars based on hordein genotypes is not practical.

2713 Natsuga, M. (Hokkaido Univ., Sapporo (Japan). Faculty of Agriculture); Kawamura, S.; Itoh, K.; Itoh, K. (1992) Statistical differences among varieties in the wheat [*Triticum aestivum*] calibrations using near-infrared reflectance spectroscopy. *Memoirs of the Faculty of Agriculture - Hokkaido University (Japan)* v. 18(1) p. 53-58. 4 tables; 6 fig. Japanese. (AGRIS 95-050008).

Near-Infrared Reflectance Spectroscopy has its advantages in accuracy and precision compared with the usual chemical analytical methods. It will be widely adopted in the future, but we do not have an accumulation of fundamental information about domestic agricultural products. We carried out investigations regarding accuracy and precision of Near-Infrared Reflectance Analyzer in determining moisture and protein content of Hokkaido-grown wheat. The results were as follows: 1) the SEC of moisture calibrations were less than 0.18, and they were adequate to convert the protein content into its standard moisture base value. 2) The r and SEC of protein calibrations were greater than 0.92 and less than 0.18 respectively, and they were adequate. 3) There were significant differences among calibrations obtained for each wheat variety. Therefore, it was difficult to apply the calibration for a certain variety among other varieties. 4) The calibrations obtained for all wheat samples were applicable to all varieties to a good degree. 5) It was advantageous to use the calibrations obtained for each wheat variety in experiments and researches where a higher accuracy was required, but it was somewhat better to use the calibrations obtained for all samples in the farming stage where simplicity was required.

2714 Nishikawa, K. (Gifu Univ. (Japan). Faculty of Agriculture); Ban, T.; Furuta, Y. (1993) Telocentric mapping of alpha-amylase loci in wheat [*Triticum aestivum*]. *Wheat Information Service (Japan)* (no.77) p. 39-45. 4 tables; 3 fig.; 8 ref. English. (AGRIS 95-064073).

2715 Noshin, B.; IMTIAZULHAQ.; Shah, P. (1994) PARTITIONING OF ASSIMILATES DURING VEGETATIVE STAGES OF THE 4 VARIETIES OF WHEAT. *Pakistan Journal of Botany*. 26(2):311-320. English. [UNIV PESHAWAR DEPT BOT PESHAWAR PAKISTAN].

Four varieties of wheat viz., C591, C273, Pak-81 and Pirsabak-85 partitioned different proportions of assimilates to the different organs having different functions. Varieties C591 and C273 grew taller, reached anthesis stage earlier and partitioned more assimilates to stem and less to spike and leaves resulting in smaller spikes, while Pak-81 and Pirsabak-85 partitioned more assimilates to spikes and leaves and thus they had larger spikes than the tall varieties. Up to anthesis the 4 varieties produced about the same total biomass indicating that Pak-81 and Pirsabak-85 had lower net assimilation rate since their total green leaf areas were greater than C591 and C273.

2716 O'Brien, L. (Sydney Univ., Narrabri (Australia). Plant Breeding Inst.); Panozzo, J.F. (Victorian Dept. of Agriculture, Horsham (Australia). Inst. for Dryland Agriculture) (1994) Heritability of lipid content and other grain quality [wheat]. [Conference abstract]. 44. Royal Australian Chemical

Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 510. English. (AGRIS 95-049610).

2717 Oliver, J.R.; Allen, H.M. (New South Wales Agriculture, Wagga Wagga (Australia)) (1993) Quality assessment of central and southern NSW breeding programs [New South Wales; wheat]. New South Wales Agriculture. 1 table, 5 ref. 27 p. English. (AGRIS 95-063922).

Provides the results of projects undertaken over 3 years in New South Wales to evaluate the quality and end-use potential of early generation crossbred wheats between harvest and the following sowing, and to evaluate the environmental stability of the quality of the most promising crossbreds and ensure crossbreds with market-desired quality traits are retained within the program.

2718 Olmedoarcega, OB.; Elias, EM.; Cantrell, RG. (1995) RECURRENT SELECTION FOR GRAIN YIELD IN DURUM WHEAT. *Crop Science*. 35(3):714-719. English. [N DAKOTA STATE UNIV DEPT CROP & WEED SCI FARGO, ND 58105 USA].

Considerable improvements of durum wheat (*Triticum turgidum* L. var. durum) genotypes with better yield have been achieved with different breeding methods. Because of several constraints in its application in small cereals, recurrent selection in durum wheat has not been used extensively. The objectives of this research were to evaluate two cycles of recurrent selection for grain yield and to assess effects of selection on other agronomic and yield-component traits. Nineteen semidwarf durum wheat genotypes selected for high yield and broad genetic diversity, were intercrossed to form the base population. Fifty-five randomly selected St lines from three cycles of selection and a set of four checks were planted in two 1989 and three 1990 environments, respectively. Genotype x environment interactions were generally of magnitude rather than of rank order changes for traits evaluated and therefore a combined analysis across environments was performed. Regression analysis indicated an average increase in yield of 0.25 ± 0.03 Mg ha⁻¹ per cycle of selection. Cycle 2 (C2) produced lines with grain yield higher than any line in Cycles 0 (C0) or 1 (C1). Test weight and plant height increased 8.39 ± 2.01 Kg m⁻³ and 2.62 ± 0.3 cm per cycle, respectively. Recurrent selection for grain yield did not affect spikelets per spike and kernels per spike. Kernel weight increased 2.8 mg from C0 to C2. When calculated as a percentage of the total variance, the genetic variance of most of the evaluated traits decreased slightly. Genotype x environment variance was the most important component of variances of five of the evaluated traits. The efficiency of recurrent selection for yield was demonstrated. Indications are that recurrent selection solely for yield did not have any negative correlated response to unselected traits. [References: 18].

2719 Penrose, L.D.J. (New South Wales Agriculture, Wagga Wagga (Australia)) (1993) Technical assistance to the wheat breeding program at Temora [New South Wales]. New South Wales Agriculture. Fig., ref. 29 p. English. (AGRIS 95-063923).

Provides details of the wheat breeding program at Temora, which is attempting to enhance adaptivity of winter wheats in south-central New South Wales and to maintain disease resistance as pathogens overcome existing resistances. The program is attempting to provide new wheats to meet changes in market requirements, both directly and indirectly, with emphasis on meeting the demand for noodle flour. Included are copies of papers published as a result of the project.

2720 Petroff, M.; Marschke, R.K. (Queensland Dept. of Primary Industries, Hamilton (Australia)); Henry, R.J. (Queensland Dept. of Primary Industries (Australia)); Brennan, P.S. (Queensland Dept. of Primary Industries, Toowoomba (Australia)) (1994) Detection of DNA polymorphisms associated with grain quality in wheat. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 508. English. (AGRIS 95-049606).

2721 Petrovic, S.; Dimitrijevic, M.; Kraljevic Balalic, M. (Poljoprivredni fakultet, Novi Sad (Yugoslavia). Institut za ratarstvo i povrtarstvo) (1994) [The influence of stem height on harvest index of different wheat genotypes [*Triticum aestivum* ssp. vulgare]]. Utiца visine stabljike na zetveni index razlicitih genotipova pšenice (*Triticum aestivum* ssp.

vulgare). *Savremena poljoprivreda* (Yugoslavia) v. 42(1-2) p. 95-98. 2 tables; 10 ref. Serbian. (AGRI 95-050020).

The relation between harvest index and stem height in nine wheat genotypes is examined in this paper. Five characters were analyzed: stem height, number of spikelets per ear, number of grains per ear, grain weight per plant and harvest index. The negative correlation (-0.346) between the stem height and harvest index has been found. This proves that the decrease of vegetative mass gives more successful translocation of substances into the generative organs. There has been a positive correlation (0.398) between the stem height and plant mass.

2722 Piao Tiefu; Xu Yaokui; Zhang Zhicai (Jilin Agricultural Univ., Changchun (China). Dept. of Agronomy) (1994) A study on the mutagenic effects of mitomycin C on barley. *Journal of Jilin Agricultural University* (China) v. 16(3) p. 18-21. 4 tables, 6 ref. Chinese. (AGRI 95-049659).

2723 Pillay, M. (1995) CHLOROPLAST DNA SIMILARITY OF SMOOTH BROMEGRASS WITH OTHER POOID CEREALS - IMPLICATIONS FOR PLANT BREEDING. *Crop Science*. 35(3):869-875. English. [WASHINGTON STATE UNIV CTR IRRIGATED AGR RES & EXTENS CTR DEPT CROP & SOIL SCI RT2 BOX 2953 A PROSSER, WA 99350 USA].

Restriction site (RS) variation in the chloroplast genome has been useful in discerning evolutionary relationships. This information enables plant breeders to determine the primary, secondary, and tertiary gene pools of crop plants. In this study, chloroplast DNA (cpDNA) RS maps of smooth brome grass (*Bromus inermis* Leyss.) were compared with those of wheat (*Triticum aestivum* L.), rye (*Secale cereale* L.), barley (*Hordeum vulgare* L.), and oat (*Avena sativa* L.). The number of common RS for the enzymes KpnI, PstI, PvuII, SalI and XhoI was scored, providing data to calculate the genetic distance (p) among the taxa. Clustering analysis showed that smooth brome grass (tribe Bromeae) is very closely related to wheat, rye and barley of the tribe Triticeae and more distantly related to oat (tribe Aveneae). It was of interest to find that smooth brome grass was more closely related than barley to wheat and rye. The cpDNA relationships suggest that brome grasses are a potentially important component of the gene pool in the breeding of pooid cereals. Brome grasses are a useful source of genes for disease resistance, agronomic properties, and nutritional value that could be introgressed into their close relatives. [References: 31].

2724 Pogna, NE.; Redaelli, R.; Vaccino, P.; Biancardi, AM.; Peruffo, ADB.; Curioni, A.; Metakovsky, EV.; Pagliaricci, S. (1995) PRODUCTION AND GENETIC CHARACTERIZATION OF NEAR-ISOGENTIC LINES IN THE BREAD-WHEAT CULTIVAR ALPE. *Theoretical & Applied Genetics*. 90(5):650-658. English. [IST SPERIMENTALE CEREALICOLTURA APPL GENET SECT VIA CASSIA 176 I-00191 ROME ITALY].

Two biotypes of the bread-wheat cultivar Alpe were shown to possess contrasting alleles at each of the glutenin (Glu-B1, Glu-D1, Glu-B3 and Glu-D3) and gliadin (Gli-B1 and Gli-D1) loci on chromosomes 1B and 1D. Fourteen near-isogenic lines (NILs) were produced by crossing these biotypes and used to determine the genetic control of both low-molecular-weight (LMW) glutenin subunits and gliadins by means of one-dimensional or two-dimensional electrophoresis. Genes coding for the B, C and D groups of LMW subunits were found to be inherited in clusters tightly linked with those controlling gliadins. Southern-blot analysis of total genomic DNAs hybridized to a gamma-gliadin-specific cDNA clone revealed that seven NILs lack both the Gli-D1 and Glu-D3 loci on chromosome 1D. Segregation data indicated that these "null" alleles are normally inherited. Comparison of the "null" NILs with those possessing allele b at the Glu-D3 locus showed one B subunit, seven C subunits and two D subunits, as fractionated by two-dimensional A-PAGE/SDS-PAGE, to be encoded by this allele. Alleles b and k at Glu-B3 were found to code for two C subunits plus eight and six B subunits respectively, whereas alleles b and k at Gli-B1 each controlled the synthesis of two beta-gliadins, one gamma- and two omega-gliadins. The novel Gli-B5 locus coding for two omega-gliadins was shown to recombine with the Gli-B1 locus on chromosome 1B. The two-dimensional map of glutenin subunits showed alpha-gliadins encoded at the Gli-A2 locus on chromosome 6A. The use of Alpe NILs in the study of the individual and combined effects of glutenin subunits on dough properties is discussed. [References: 49].

2725 Pyl'nev, V.V. (1993) [Formation of gliadin spectra while growing wheat hybrid (*Triticum aestivum*) populations in differing ecological conditions]. *Formirovanie spektrov gliadina pri vyrashchivanii*

gibridnykh populyatsij pshenitsy v razlichnykh ehkologicheskikh usloviyakh. *Doklady Rossijskoj akademii sel'skokhozyajstvennykh nauk* (Russian Federation) (no.6) p. 4-6. 8 ref. Russian. (AGRI 95-050017).

Under effect of environmental conditions, genotypes with gliadin formulas typical for the given zone predominated in some progenies of wheat hybrid population. There is a shift of gliadin electrophoretic spectra towards higher frequency of gliadin-loci coding assuring better adaptive properties of the given genotype in new conditions. Forms with gliadin blocs typical for the probable cropping zone should be used to increase efficiency of selection of lines with improved adaptation.

2726 Qian Youting; Zhou Guanghe; Zhou Ximing (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1993) Screening for the sources of resistance to barley yellow dwarf virus. *Acta Phytophylacica Sinica* (China) v. 20(1) p. 71-75. 3 tables, 6 ref. Chinese. (AGRI 95-049979).

2727 Qiao Ruiqing; Wei Yunzong; Xie Fulai (Shanxi Provincial Academy of Agricultural Sciences, Linfen (China). Inst. of Wheat) (1994) An analysis on varietal characteristics of wheat with wide adaptation and high yield. *Journal of Shanxi Agricultural Sciences* (China) v. 22(1) p. 1-5. 2 tables, 7 ref. Chinese. (AGRI 95-049947).

2728 Qiu Dunlian (Sichuan Provincial Academy of Agricultural Sciences, Chengdu (China). Inst. of Sciencetech Information) (1992) Analysis of esterase isozyme on barley. *Southwest China Journal of Agricultural Sciences* (China) v. 5(4) p. 29-35. 2 ill., 1 table, 7 ref. Chinese. (AGRI 95-049662).

2729 Raho, G.; Lupotto, E.; Dellatorre, A.; Hartings, H.; Perrotta, C.; Marmiroli, N. (1995) FUNCTIONAL ANALYSIS OF THE TEMPERATURE-DEPENDENT EXPRESSION OF THE BARLEY HVHSP17 GENE PROMOTER IN MONOCOT AND DICOT CELL SYSTEMS. *Plant Science*. 106(1):63-69. English. [IST SPERIMENTALE CEREALICOLTURA SEZ BERGAMO VIA STEZZANO 24 I-24126 BERGAMO ITALY].

The regulation of a barley heat shock gene (Hvhsp17) has been investigated by means of transient expression assays with monocot and dicot protoplast systems. The complete 1700-bp 5' region of Hvhsp17, and the deletions of 600 and 170 bp, respectively, were fused with the bacterial beta-glucuronidase (beta-GUS) marker gene, to give the following expression vectors: pHSGUS1 (-1700 pH/GUS fusion), pHSGD1 (-600 pH/GUS fusion) and pHSGD2 (-170 pH/GUS fusion). pHSGUS1 and pHSGD1 contain two heat shock elements (HSEs) located in position -238 and -168, respectively, while pHSGD2 contains only one HSE located near the TATA box. As control expression vector, plasmid pBI221 (Clontech) was used, in which the beta-GUS gene is under the control of the CaMV 35S constitutive promoter. All expression vectors were transfected into protoplasts derived from leaf mesophyll cells of tobacco (dicot) and some cereal species (monocots). beta-GUS activity was determined after a heat shock treatment of 1 h at 40 degrees C. Transient expression assays showed that the promoter of Hvhsp17 was active and regulated by thermal induction only in monocot cell systems, while not expressed in tobacco cells. Analyses performed with the deletion constructs, indicated that thermal activation of beta-GUS was obtained only when both the HSEs were present in the promoter region. [References: 30].

2730 Roberts, G.L.; Marchant, M.R. (New South Wales Agriculture, Temora (Australia)) (1994) Southern wheat variety evaluation project. New South Wales Agriculture. 11 p. English. (AGRI 95-063924).

The project provides data on yield and agronomic characteristics and collects grain samples for quality assessment. Agronomic observations which are collected include plant establishment, maturity, disease reaction, lodging, weed infestation and shattering. Any other relevant information is noted. Results are used by breeders to achieve the earliest possible release of new varieties.

2731 Sasaki, A. (Tochigi ken. Agricultural Experiment Station, Utsunomiya (Japan)); Kiryu, M.; Kato, T.; Kaminaga, A. (1992) Construction and use of data base from malted barley (*Hordeum vulgare*) breeding records. *Bulletin of the Tochigi Prefectural Agricultural Experiment Station* (Japan) (no.39) p. 75-86. 5 tables; 1 fig.; 14 ref. Japanese. (AGRI 95-049674).

2732 Sasek, A.; Bradova, J. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyne (Czech Republic); Cerny, J. (1995) [Hordein signal genes of certified Czech and Slovak varieties of barley (*Hordeum vulgare*)]. Hordeinove signalni geny v povolenych ceskych a slovenskych odrudach jecmene seteho (*Hordeum vulgare*). *Potravinarske Vedy - UZPI (Czech Republic) v. 13(1) p. 57-69. 2 graphs, 2 tables; 15 ref. English. (AGRS 95-063959).*

Model electrophoretic hordein spectra of 25 certified varieties of spring barley and 10 certified varieties of winter barley have been compiled. Twenty-five grains of each variety were separately assessed by the method of hordein vertical electrophoresis in columns of starch gel with Al-lactate buffer. Hordein allelic blocks were singled out of the electrophoretic spectra of hordeins and they were characterized by the number of zones, their relative mobility (REM) and staining intensity. The catalogue of hordein electrophoretic spectra and/or catalogue of singled out sets of allelic hordein blocks of zones enable to identify the varieties in a grain sample of seed and mercantile lots.

2733 Saulescu, N.N.; Ittu, G. (Research Institute for Cereals and Industrial Crops, Fundulea (Romania)) (1994) Costs and returns of the wheat breeding program at the Research Institute for Cereals and Industrial Crops - Fundulea. *Romanian Agricultural Research (Romania) (no.1) p. 73-76. 2 tables; 6 ref. English. (AGRS 95-049620).*

It has been used two approaches to estimate the profitability of resources invested in the wheat breeding program: a long-term estimation for the 30 years since the initiation of the program in 1961, in which an estimation of additional production due to growing all Fundulea cultivars (over the Russian cultivar Bezostia 1 dominating during 1965-1976) was compared with all period aggregated expenditures for breeding and short-term estimation in which an estimation of additional production of four most recently released cultivars Flamura 80, Fundulea 133, Fundulea 4 and Flamura 85 (over Fundulea 29, the dominating cultivar during 1983-1990) was compared with an estimation of expenditures for breeding those four cultivars. Both the long-term and short-term estimations of the benefit cost ratios for the wheat breeding program developed at the Research Institute for Cereals and Industrial Crops-Fundulea show rates of returns higher than 10 to 1 for the public investments made in creating new wheat cultivars. Such high benefits are explained by the rapid adoption of most of the 14 released cultivars.

2734 Schmalz, H. (Halle Univ. (Germany). Landwirtschaftliche Fakultät. Inst. fuer Pflanzenzuechtung und Saatgutwirtschaft) (1994) [Genetical and breeding investigations with wheat in Hohenthurm under special consideration of the physiological requirements of plant development in Egypt]. Genetisch-zuechterische Untersuchungen beim Weizen in Hohenthurm unter besonderer Beruecksichtigung der entwicklungsphysiologischen Erfordernisse in Aegypten. *Kuehn-Archiv (Germany) v. 88(1) p. 19-31. 3 tables; 4 ref. German. (AGRS 95-063875).*

2735 Senchanka, V.R.; Senchanka, N.A. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1993) [The problem and results of spring multirow barley breeding in Belarus]. Nekatoryya vyniki i problemy selektsyi yaravoga shmatradkovaga yachmenyu va wmovakh Belarusi. *Vesti Akademi Agramykh Navuk Belarusi (Belarus) (no.4) p. 42-47. 2 tables; 10 ref. Byelo Russian. (AGRS 95-049658).*

The problem of spring multirow barley breeding, the ways of realization and the results of selection work are discussed. The characteristic of the original material and a new variety of spring multirow barley "Selyanin" is given.

2736 Shahriari, F.; Rathjen, A.J.; Shepherd, K.W. (Adelaide Univ., Glen Osmond (Australia). Waite Inst.) (1994) Contributions of Glu-1 and Glu-3 loci to prediction of dough strength by use of SDS-sedimentation test [wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 509. English. (AGRS 95-049609).*

2737 Sharma, H.; Ohm, H.; Goulart, L.; Lister, R.; Appels, R.; Benhabib, O. (1995) INTROGRESSION AND CHARACTERIZATION OF BARLEY YELLOW DWARF VIRUS RESISTANCE FROM THINOPYRUM INTERMEDIUM INTO WHEAT. *Genome. 38(2):406-413. English. [PURDUE UNIV DEPT AGRON W LAFAYETTE, IN 47907 USA].*

Wheatgrasses (species of *Agropyron* complex) have previously been reported to be resistant to barley yellow dwarf virus (BYDV). To introgress this resistance into wheat, *Triticum aestivum* X *Thinopyrum* (*Agropyron*) intermedium hybrids were advanced through a backcrossing program and reaction to BYDV, as determined by enzyme-linked immunosorbent assay (ELISA), is reported for the first time in backcross populations of wide hybrids between wheat and wheatgrasses. ELISA values revealed highly resistant to highly susceptible segregants in backcrosses. BYDV resistance was expressed in some backcross derivatives. Continued selection, based on cytology and ELISA in each generation, eliminated most of the unwanted wheatgrass chromosomes and produced self-fertile BYDV resistant wheat lines. The BYDV resistant lines with $2n = 42$ had normal chromosome pairing similar to wheat, and their F-1 hybrids with wheat had two univalents. DNA analyses showed that the source of alien chromatin in these BYDV resistant wheat lines is distinguishable from that in other Th, intermedium derived BYDV resistant wheat lines. Chromosome pairing and restriction fragment length polymorphism analyses indicated that the 42 chromosome resistant Purdue wheat lines are substitution lines in which chromosome 7D was replaced by a chromosome from Th, intermedium that was carrying gene(s) for BYDV resistance. [References: 34].

2738 Sharma, H.C. (1995) HOW WIDE CAN A WIDE CROSS BE [Review]. *Euphytica. 82(1):43-64. English. [PURDUE UNIV DEPT AGRON W LAFAYETTE, IN 47907 USA].*

Wide crosses in wheat are reviewed in relation to various factors that facilitate wide crossing to show that wide crosses can be as wide as one can make them. Included in this review is a particular reference to wheat-wheatgrass (*Agropyron* complex) crosses and an update on wide crosses of wheat with various genera of *Agropyron* complex. Hybrid seed set is too variable to predict whether a wide hybrid, where no seed was obtained in one attempt, will not be possible. High crossability genes seem to facilitate not only fertilization but also seed development, enabling embryo rescue. Variability for crossability occurs not only in wheat but also in alien species. Contrary to conventional thinking, several wide hybrids with wheat can be produced when species with lower chromosome numbers are used as female parents. Pre- and post-fertilization barriers to wide crosses do not appear to be equally strong, and can be overcome by the development and application of various technologies. Considering these aspects of wide hybridization, and based on recent successes in producing previously unsuccessful and very wide hybrids, it is concluded that how wide cross between plant species can be made is an open question and that many new and wider hybrids can be produced in future. [References: 184].

2739 Sharma, R.; Joshi, B.C.; Tomar, S.M. (1995) LOCATION OF GENES FOR AWNEDNESS ON SPECIFIC CHROMOSOMES OF A WHEAT (*TRITICUM AESTIVUM*)-RYE (*SECALE CEREALE*) RECOMBINANT THROUGH MONOSOMIC ANALYSIS. *Indian Journal of Agricultural Sciences. 65(4):290-292. English. [RAJASTHAN AGR UNIV NATL AGR RES PROJECT SCHEME BIKANER 334002 RAJASTHAN INDIA].*

2740 Shaw, A.L.; Vickers, J.E.; Hamilton, S.E. (Melbourne Univ., Parkville (Australia). Biochemistry Dept.); Weining, S.H.; Henry, R.J. (Queensland Univ., St Lucia (Australia). Queensland Agricultural Biotechnology Centre); Inkerman, A. (Queensland Dept. of Primary Industries, Toowoomba (Australia). Wheat Research Inst.) (1994) A thermostable beta-amylase as a candidate for the genetic engineering of malting barley. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 504. English. (AGRS 95-049653).*

2741 Shu Shide; Den Qiying (Guizhou Provincial Academy of Agricultural Sciences, Guiyang (China). Inst. of Crops) (1994) Local cultivars of barley and their distribution in Guizhou [China]. *Southwest China Journal of Agricultural Sciences (China) v. 7(1) p. 23-29. 5 tables, 5 ref. Chinese. (AGRS 95-049664).*

2742 Sibikeev, S.N.; Voronina, S.A.; Krupnov, V.A. (1995) GENETIC CONTROL FOR RESISTANCE TO LEAF RUST IN WHEAT-AGROPYRON LINES - AGRO 139 AND AGRO 58. *Theoretical & Applied Genetics. 90(5):618-620. English. [AGR RES INST SE REG GENET & CYTOL LAB TULA KOV ST 7 SARATOV 410020 RUSSIA].*

Leaf rust resistance lines of *Triticum aestivum* carry highly effective Lr genes from *Agropyron* intermedium (Host) Beauv. This Agro 58 and Agro

139 resistance segregated independently of Agropyron leaf-rust resistance genes Lr-19, Lr-24 and Lr-9 from *Ae. umbellulata*. Monosomic analysis showed that the Lr gene in Agro 139 was incorporated into wheat chromosome 6D. C-banding analysis could not determine the C-banding pattern of A. intermedium in wheat-Agropyron lines Agro 58 and Agro 139. It is assumed that the transfers occurred from the euchromatin regions of the Agropyron chromosomes to the euchromatin regions of the wheat chromosomes. It is suggested that the Lr gene from Agro 139 be designated LrAg1-1 and the Lr gene from Agro 58 designated LrAg1-2. [References: 5].

2743 Singh, D. (Indian Agricultural Research Inst., New Delhi (India)) (1994) Identification of chlorophyll synthetic genes in three hexaploid wheat [*Triticum aestivum*] varieties. *Wheat Information Service (Japan)* (no.78) p. 21-23. 2 tables; 6 ref. English. (AGRIS 95-064075).

2744 Singh, D. (Indian Agricultural Research Inst., New Delhi (India)); Rajlakshmy, C. (1994) Breeding behaviour of monosomics in hexaploid wheat [*Triticum aestivum*]. *Wheat Information Service (Japan)* (no.78) p. 18-20. 2 tables; 9 ref. English. (AGRIS 95-064074).

2745 Singh, R.; Brown, J.; Kemp, J.; Kollmorgen, J. (Victorian Dept. of Agriculture, Horsham (Australia). Inst. for Dryland Agriculture); Fincher, G. (Waite Agricultural Research Inst., Glen Osmond (Australia)); Mirabile, T. (Melbourne Univ., Parkville (Australia). School of Botany) (1994) The development of gene transfer techniques for cultivated barley (*H. vulgare*). [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 504. English. (AGRIS 95-049652).

2746 Singh, R.P.; Morgunov, A.; Huertaespino, J. (1995) GENES CONFERRING LOW SEEDLING REACTION TO MEXICAN PATHOTYPES OF PUCCINIA RECONDITA F SP TRITICI, AND ADULT-PLANT RESPONSES OF RECENT WHEAT CULTIVARS FROM THE FORMER USSR. *Euphytica*. 81(3):225-234. English. [CIMMYT INT MAIZE & WHEAT IMPROVEMENT CTR LISBOA 27 APDO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

Fifty-five spring bread wheat (*Triticum aestivum* L.) cultivars, mostly released between 1975 and 1991 in eight leaf rust-prone spring wheat growing regions of the former USSR, were tested in the seedling growth stage for reaction to 15 Mexican pathotypes of *Puccinia recondita* f. sp. tritici. In total, seven known and at least two unknown genes were identified, either singly or in combinations: Lr3 (7 cultivars), Lr10 (14), Lr13 (5), Lr14a (1), Lr16 (1), Lr23 (3); the unknown genes were identified in 14 cultivars. The first unknown gene could be either Lr9, Lr19, or Lr25; however, the second unknown gene in 9 cultivars was different from any named gene. Twelve of the 15 pathotypes are virulent for this gene, hence its use in breeding for resistance will be limited. The cultivars were also evaluated at two field locations in Mexico with two pathotypes in separate experiments. The area under the disease progress curve and the final disease rating of the cultivars indicated genetic diversity for genes conferring adult plant resistance. Based on the symptoms of the leaf tip necrosis in adult plants, resistance gene Lr34 could be present in at least 20 cultivars. More than half of the cultivars carry high to moderate levels of adult plant resistance and were distributed in each region. [References: 19].

2747 Stoeva, I.; Stavreva, N.; Penchev, E. (Institut po Pshenitsa i Sl'nchogleda "Dobrudzha", General Toshevo (Bulgaria)) (1994) [Investigation of local and foreign winter soft wheat cultivars in relation to their application in selection]. Prouchvane na nashi i chuzhdi sortove zimna meka pshenitsa v vrzka s izpolzvaneto im v selektsiyata. Selskостопанска Академия, Sofia (Bulgaria). *Rasteniovedni Nauki (Bulgaria); Plant Science* v. 31(1-2) p. 5-8. 3 ill., 2 tables; 9 ref. Bulgarian. (AGRIS 95-064057).

2748 Suenaga, K. (National Inst. of Agrobiological Resources, Tsukuba, Ibaraki (Japan)) (1994) Doubled haploid system using the intergeneric crosses between wheat (*Triticum aestivum*) and maize (*Zea mays*). *Bulletin of the National Institute of Agrobiological Resources (Japan)* (no.9) p. 83-139. 28 tables; 12 fig.; 79 ref. English. (AGRIS 95-050005).

An efficient method for the production of wheat doubled haploid (DH) plants through wheat x maize crosses was developed. The treatment of auxins was considered to be essential to the development of wheat haploid embryos. Time of pollination and age of the embryos appeared to be critical

for the efficiency of the production of wheat DH lines. All the wheat varieties examined produced haploid embryos which is considered to be superior to other DH systems, like anther culture and the *Hordeum bulbosum* system. Although spontaneous variation was detected in a certain number of DH lines derived from the system developed, the extent of the variation was negligible for the practical application. The DH lines did not show any distorted segregation for the marker traits, except glume pubescence. DH lines with desirable characteristics were successfully selected through the system. These results indicate that the system developed in this study is effective for the application of wheat breeding.

2749 Sun Guichen; Xu Huancheng (Shanxi Provincial Academy of Agricultural Sciences, Taiyuan (China). Inst. of Crop Germplasm Research) (1993) Genetical study on the resistance of coldness in wheat varieties. *Journal of Shanxi Agricultural Sciences (China)* v. 21(4) p. 4-7. 5 tables, 3 ref. Chinese. (AGRIS 95-049613).

2750 Sun Lanzhen; Zhang Yanchuan; Gao Qingrong (Shandong Agricultural Univ., Taian (China)) (1994) Breeding of winter wheat variety Lumei 15 by using Taigu nuclear sterile wheat. *Journal of Shandong Agricultural Sciences (China)* (no. 4) p. 6-8. 1 ill. Chinese. (AGRIS 95-049612).

2751 Sun Shangying; Yang Tianzhang (Northwestern Agricultural Univ., Yangling, Shaanxi (China)) (1994) Studies on the cytology of the synergid apogamy by *Ae. Kotschy* male-sterile cytoplasm in common wheat. *Acta Universitatis Agriculturae Boreali-Occidentalis (China)* v. 22(1) p. 29-34. 18 ill., 15 ref. Chinese. (AGRIS 95-049992).

2752 Tada, S. (Kagawa ken. Agricultural Experiment Station, Takamatsu (Japan)); Fujita, K.; Mabuchi, S.; Takahashi, H.; Hagimori, Y. (1992) A new wheat [*Triticum aestivum*] recommended variety "Daichinomori" in Kagawa prefecture. *Bulletin of the Kagawa Agricultural Experiment Station (Japan)* (no.43) p. 1-9. 10 tables; 4 fig.; 13 ref. Japanese. (AGRIS 95-049998).

2753 Tahir, M. (International Center for Agricultural Research in the Dry Areas, Aleppo (Syria)); Valkoun, J. (1994) Genetic diversity in wheat [*Triticum* spp.]: An international approach in its evaluation and utilization. *Wheat Information Service (Japan)* (no.78) p. 1-12. 4 tables; 8 fig.; 11 ref. English. (AGRIS 95-063931).

2754 Tan Changhua; Yu Guodong; Yang Peifeng (Chongqing Municipal Inst. of Crops, Sichuan (China)) (1992) Sterility of thermo-photo sensitive genic male sterile wheat in Chongqing [China]. *Southwest China Journal of Agricultural Sciences (China)* v. 5(4) p. 1-6. 4 tables, 6 ref. Chinese. (AGRIS 95-049969).

2755 Tang Yulan; Liu Qunqiao; Zhang Baisong (Shandong Provincial Academy of Agricultural Sciences, Jinan (China). Inst. of Plant Protection) (1994) Identification of disease resistance in wheat varieties of Shandong Province, China. *Journal of Shandong Agricultural Sciences (China)* (no. 1) p. 19-21. 1 table, 3 ref. Chinese. (AGRIS 95-049946).

2756 Tantsova, O.I.; Cheremisev, B.M. (1993) [Inter- and intracultivar variability of nitrogen fixation activity in spring barley (*Hordeum vulgare*)]. Mezhsortovaya i vnutrisortovaya izmenchivost' aktivnosti azotifikatsii u yarovogo yachmenya. *Doklady Rossijskoj akademii sel'skokhozyajstvennykh nauk (Russian Federation)* (no.6) p. 6-8. 11 ref. Russian. (AGRIS 95-049679).

Of 19 spring barley cultivars and breeding samples evaluated in vegetational experiment, five cultivars with increased nitrogen fixation have been revealed. Samples differed in the index of acetylene reduction by 24 times. Analysis of intracultivar variability showed a 3 - 18-fold spread of the nitrogen fixation in all tested cultivars and samples.

2757 Taya, S. (Kyushu National Agricultural Experiment Station, Chikugo, Fukuoka (Japan)) (1993) Breeding of early maturing wheat [*Triticum aestivum*] varieties with higher grain yield in southwestern regions of Japan. *Bulletin of the Kyushu National Agricultural Experiment Station (Japan)* v. 27(4) p. 333-398. 23 tables; 34 fig.; 76 ref. Japanese. (AGRIS 95-049999).

For the breeding of early maturing and higher yielding wheat varieties well adapted to southwestern regions of Japan, the relations among heading date, grain yield, yield components and dry matter production were investigated for the varieties developed at Kyushu National Agricultural

Experiment Station. The effects of climatic factors on heading date, grain yield, yield components and dry matter production were also investigated. Then, a scheme for the breeding of early maturing wheat varieties with higher grain yield was proposed on the basis of the results obtained in these investigations.

2758 Ternovskaya, T.K.; Zhirov, E.G. (1993) [Genome analysis of wheat frost resistance]. *Genomnyi analiz morozoustojchivosti pshenitsy. Doklady Rossijskoj akademii sel'skokhozyajstvennykh nauk (Russian Federation) (no.6) p. 3-4. 10 ref. Russian. (AGRI 95-050016).*

Analysis of frost resistance of wheat synthetic hexaploids differing only by subgenome D as well as wheat cultivars, samples of *Ae. tauschii* (donors of various subgenomes for synthetics) and all possible F1 hybrids of them has been cited. Influence of subgenomes AB and D on expression of the mentioned property has been found.

2759 Tosa, Y.; Nakamura, T.; Kusaba, M. (1995) DISTRIBUTION OF GENES FOR RESISTANCE TO THE WHEATGRASS MILDEW FUNGUS IN JAPANESE WHEAT CULTIVARS AND OF THEIR CORRESPONDING GENES IN THE WHEAT MILDEW FUNGUS. *Japanese Journal of Genetics. 70(1):119-126. English. [KOCHI UNIV FAC AGR NANKOKU KOCHI 783 JAPAN].*

Genotypes of Japanese wheat cultivars at loci for resistance to the wheatgrass mildew fungus, *Erysiphe graminis f. sp. agropyri*, were examined using the gene-for-gene relationship. Most cultivars carried two genes, Pm10 and Pm15 for resistance to the wheatgrass mildew fungus. Almost all cultivars were non-carriers of Pm11 and Pm14. On the other hand, all isolates of the wheat mildew fungus, *E. graminis f. sp. tritici*, collected from various areas in Japan were non-carriers of Ppm10, Ppm11, Ppm14, and Ppm15, avirulence genes corresponding to Pm10, Pm11, Pm14, and Pm15, respectively. From these results we suggest that the population of the wheat mildew fungus had lost Ppm11 and Ppm14 before its migration to Japan. [References: 12].

2760 Tsujimoto, H. (1995) GAMETOCIDAL GENES IN WHEAT AND ITS RELATIVES. 4. FUNCTIONAL RELATIONSHIPS BETWEEN SIX GAMETOCIDAL GENES. *Genome. 38(2):283-289. English. [YOKOHAMA CITY UNIV KIHARA INST BIOL RES MINAMI KU MUTSUKAWA 3-122-20 YOKOHAMA KANAGAWA 232 JAPAN].*

Gametocidal (Gc) genes in *Aegilops* species are known to cause gamete abortion and chromosome breakage when they are introduced into the wheat genetic background. Interactions of five Gc genes so far identified were investigated by analysis of wheat hybrids among lines carrying different gametocidal genes. As a result, the genes were classified into three functional groups. The first group includes two Gc genes of *Ae. speloides* (Gc1a and Gc1b) and one gene (Gc-S(1)3) on chromosome 2S(1) of *Ae. sharonensis*. These genes were hypostatic to the genes (Gc-S(1)1, Gc-S(1)2) on chromosome 4S(1) of *Ae. longissima* and *Ae. sharonensis*, which constitute the second group. In addition, plants carrying Gc genes of both the first and the second group produced progeny with higher frequencies of chromosome breakage than those found in the progeny of single gene carriers. It was concluded that there were specific interactions between these genes to enhance chromosome breakage. On the other hand, there was no interaction between the Gc gene (Gc-C) of *Ae. triuncialis*, the third group, and Gc genes belonging to the former two groups. These functional groups might be a reflection of the mechanisms by which Gc genes induce gamete abortion and chromosome breakage. Based on functional and local relationships, the symbols of the Gc genes were systematically redesignated. [References: 21].

2761 Ujihara, K. (Kyushu National Agricultural Experiment Station, Chikugo, Fukuoka (Japan)); Nonaka, S.; Taya, S.; Fujita, M.; Araki, H.; Yoshikawa, R.; Kitahara, S.; Yoshida, Y.; Yamaguchi, I.; Kashio, T.; Taniguchi, Y.; Shimoto, E.; Tsuru, M. (1994) A new wheat [*Triticum aestivum*] cultivar "Abukumawase". *Bulletin of the Kyushu National Agricultural Experiment Station (Japan) v. 28(2) p. 53-78. 3 plates; 17 tables; 3 fig.; 14 ref. Japanese. (AGRI 95-050001).*

1. A new wheat cultivar "Abukumawase" developed by Kyushu National Agricultural Experiment Station, Chugoku, Fukuoka, Japan, was selected from the cross Chugoku 114 x Saikai 120 (later registered as Norin 117 "Shirogane-komugi") made in 1972 by the derived line method, and registered as Norin 138 in 1992. 2. Main characteristics of Abukumawase are as follows. Plant type: panicle number type with short culm and short

ear. Lodging resistance: strong. Maturity class: extremely early class, about 8 days earlier than Norin 61. Yielding ability: lower than Norin 61. Grain quality: relatively better than Norin 61, and suitable for Japanese noodles. Resistance to disease: resistant to yellow mosaic and green mosaic, relatively resistant to scab as is Norin 61 and more susceptible to leaf rust and powdery mildew. Sprouting: relatively easily germinating class, germination class similar to shirogane-komugi. Milling characteristics: relatively better than Norin 61. Flour quality: almost as good as Norin 61. Japanese noodle quality: relatively better than Norin 61. 3. Abukumawase is well adapted to flat areas of Kyushu, Shikoku and Honshu except for northern Tohoku districts in Japan. This cultivar has been registered as a recommended cultivar in Fukushima Prefecture since 1993.

2762 Upelnik, V.P.; Novoselskaya, A.Y.; Sutka, J.; Galiba, G.; Metakovsky, E.V. (1995) GENETIC VARIATION AT STORAGE PROTEIN-CODING LOCI OF COMMON WHEAT (CV CHINESE SPRING) INDUCED BY NITROSOETHYLUREA AND BY THE CULTIVATION OF IMMATURE EMBRYOS IN VITRO. *Theoretical & Applied Genetics. 90(3-4):372-379. English. [IST SPERIMENTALE CEREALICOLTURA VIA MULINO 3 I-20079 SAN ANGELO LODIGIANO ITALY].*

Electrophoretic patterns of seed storage proteins, the high-molecular-weight glutenins and gliadins, were studied in 468 plants of the common wheat cultivar 'Chinese Spring' regenerated from callus culture of immature embryos, in 115 plants grown from seeds treated with nitrosoethylurea and in 260 control plants. From 5 to 21 single grains were analysed from each plant. In these three groups, the frequency of inherited mutations causing the loss of all proteins controlled by a locus (null-mutations, probably caused by a chromosomal deficiency) was 0.69%, 2.07%, and 0.05% per locus (the differences were statistically significant), respectively, while that of mutations causing the loss of a single protein band was 0.11%, 0.33%, and 0.05%, respectively. The loss of all of the gliadins controlled by Gli-B1 or Gli-B2 (mutations were probably caused by a deletion of satellites of the corresponding chromosomes), was significantly higher than the loss of gliadins controlled by genomes A and D. Gene mutations altering the electrophoretic mobility of a single protein band in the pattern were found only in the second group of plants (0.44%). Therefore, chemical mutagenesis which produced not only more mutations than cultivation of immature wheat embryos in vitro, but also a higher ratio of mutations that altered DNA sequences, can be considered as an easier and comparatively more promising way for obtaining new improved variants of loci controlling biochemical characteristics in wheat. Somaclonal variation, on the other hand, was probably mainly caused by chromosomal abnormalities and could therefore hardly be considered as a useful tool in wheat breeding. [References: 24].

2763 Vanlill, D.; Purchase, J.L. (1995) DIRECTIONS IN BREEDING FOR WINTER WHEAT YIELD AND QUALITY IN SOUTH AFRICA FROM 1930 TO 1990. *Euphytica. 82(1):79-87. English. [TECHNIKON ORANGE FREE STATE PRIVATE BAG X20539 BLOEMFONTEIN 9300 SOUTH AFRICA].*

Changes in the genetic yield and quality potential of South African winter wheat cultivars since 1930 were investigated by means of canonical variate analysis. Yield potential improved by 87%, while test weight and protein percentage changed marginally. Flour colour improved mostly since 1965, but advancement of flour yield declined after 1984. Dough strength increased since 1930, yet current levels of dough strength should not be exceeded. When compared to farinograph assessment of dough strength, mixograph dough development time appears to be a less sensitive indicator of variation in dough strength. Selection on the basis of mixograph dough development time only, could influence a breeder's perception of the dough quality profile of his breeding programme. Protein efficiency was maintained despite improvement in yield potential. Baking quality improved by 20%. The genetic winter wheat potential advanced significantly since 1930 in meeting the increased nutritional demands of the South African population. [References: 17].

2764 Wang Meiyun; Zhao Ming (Zhangjiakou Agricultural Training School, Hebei (China)); Zhao Shongshan (1993) The thermo-duration of high temperature emasculation in wheat. *Acta Agronomica Sinica (China) v. 19(5) p. 429-435. 3 ill., 1 table, 5 ref. Chinese. (AGRI 95-049987).*

2765 Wang Yongji; Su Xiaojing; Wang Peihong (Northwest Agricultural Univ., Yangling, Shaanxi (China). Lab. of Plant Biochemistry); Li Peigao

(1994) Some physiological changes of the mutant line of wheat with early albinism in the late growth period. *Acta Phytophysiological Sinica (China)* v. 20(1) p. 39-45. 8 ill., 1 table, 14 ref. Chinese. (AGRI 95-049960).

2766 Wang Zonghua (Tibet Autonomous Region Inst. of Agricultural Sciences, Lhasa (China)) (1992) Analysis on varietal variability of resistance to wheat stripe rust in Tibet during 1986-1992 [China]. *Southwest China Journal of Agricultural Sciences (China)* v. 5(4) p. 88-93. 3 tables, 5 ref. Chinese. (AGRI 95-049970).

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Random amplified polymorphic DNA (RAPD) analyses were performed with DNA extracted from a complete set of Langdon durum wheat (*Triticum turgidum* L. var. durum) disomic substitution lines and their parents (Langdon and 'Chinese Spring') with the objective of assigning chromosomal locations for RAPD markers. Seven out of 12 arbitrary decamer primers yielded 11 products that could be assigned to a specific chromosome of the A- or B-genome from Langdon durum or to a D-genome chromosome of Chinese Spring. The 11 RAPD markers were assigned to three A-genome, five B-genome, and one D-genome chromosome. Chinese Spring ditelosomic lines were used to assign four RAPD markers to specific chromosome arms. Most of the markers were present in both Chinese Spring and Langdon, but one was genotype specific (e.g., J11c was present on Langdon chromosome 1B only). These reproducible RAPD markers of specific wheat chromosomes are additional tools for genome mapping. [References: 15].

2768 Wang, YB.; Hu, H.; Snape, J.W. (1995) SPONTANEOUS WHEAT RYE TRANSLOCATIONS FROM FEMALE MEIOTIC PRODUCTS OF HYBRIDS BETWEEN OCTOPOID TRITICALE AND WHEAT. *Euphytica*. 81(3):265-270. English. [DE MONTFORT UNIV DEPT APPL BIOL & BIOTECHNOL SCRAPTOFT CAMPUS LEICESTER LE7 9SU LEICS ENGLAND].

Heptaploid hybrids between octoploid tritcale and wheat were backcrossed as female parents with wheat to examine the rye chromosome distribution in the resultant progenies using genomic in situ hybridization (GISH). One hundred and one backcross (BC) seeds were examined and whole rye chromosome additions and substitutions, wheat/rye centric and noncentric translocations and rye telocentric chromosomes were detected. Dicentric wheat/rye translocated chromosomes were also observed. Comparisons were made with previous results on the rye chromosome distribution from male gametes of the same cross and differences were found, where in the female derived population a deficit of plants with more than two rye chromosomes was apparent relative to the anther derived population. [References: 18].

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2776 Xie Lingqin; Lu Shaoyuan (Hebei Agricultural Univ., Baoding (China). Research Center of Crop Germplasm) (1994) Preliminary studies on the ratio of grain yield to leaf area as an alternative item in the early progeny of wheat breeding. *Journal of Hebei Agricultural University (China)* v. 17(3) p. 43-47. 6 tables, 6 ref. Chinese. (AGRI 95-049617).

2777 Yamaguchi, I. (Agricultural Research Center, Tsukuba, Ibaraki (Japan)); Hosoda, K.; Mukade, K.; Yamamori, M. (1993) A new wheat [*Triticum aestivum*] parental line "Norin PL No.6" with yellowish flour and leaf rust [*Puccinia recondita*] resistance. *Bulletin of the Tohoku National Agricultural Experiment Station (Japan)* (no.87) p. 21-31. 2 plates; 14 tables; 1 fig.; 8 ref. Japanese. (AGRI 95-050002).

"Norin PL 6", a leaf rust resistant wheat parental line, was developed from a cross between "AS-1" and "AS-2" at the tohoku National Agricultural Experiment Station. "AS-1" is a substitution line in which a pair of Agropyron chromosomes replace 7D wheat chromosome. "AS-1" was developed from repeated backcrossed with "Aoba-komugi" to "Agris" and selection by rust resistance and chromosome observation, resulting in a genetic background which is the same as "Aoba-komugi" without the 7D chromosome. "AS-2" is also a substitution line with the genetic background of "Miyagino-komugi" in the same way. "Norin PL 6", carrying resistance gene Lr19 on the Agropyron chromosome, shows resistance in nursery to leaf rust strains 6A, 37B and 21B which predominate in northern Japan, and high resistance has also been observed in field tests. "Norin PL 6" has distinctly yellow flour, also due to a gene or genes on the Agropyron chromosome. Lutein in "Norin PL 6", the yellow pigments of the flour, was more than 2 times greater than other varieties. "Norin PL 6" is a winter wheat having a winter habit class of IV. It is early in heading and maturing time, slightly tall in height, similar to "Nanbu-komugi". The spike is awnless and oblong; the glume is glabrous and brown; the kernels are red, glassy and mid-sized. "Norin PL 6" is moderately resistant to cold damage, slightly weaker than "Nanbu-komugi". The yield is slightly lower and milling quality is superior to those of "Nanbu-komugi".

2778 Yan Xinfu; Liu Wenxuan (Henan Provincial Academy of Agricultural Sciences, Zhengzhou (China). Inst. of Wheat); Lin Qiuping (1994) A study on the esterase isoenzyme of the variants derived from barley DNA introduction into common wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(1) p. 39-43. 2 ill., 1 table, 10 ref. Chinese. (AGRI 95-049953).

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2793 Zou Minglie; Zhao Yinhuai; Wang Su (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Food Crops) (1994) **Selection**

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2795 Cao Guangcai; Wu Dongbing (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Crop Breeding and Cultivation) (1993) **Effect of latitude and altitude on growth and development of wheat**. *Southwest China Journal of Agricultural Sciences (China)* v. 6(2) p. 1-11. 2 ill., 7 tables, 6 ref. Chinese. (AGRI 95-050613).

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2797 Gryb, V.M.; Karaka, M.S. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1994) **[Ecological variability of barley varieties by the protein accumulation in grains on variety plots of Belarus]**. *Ehkalagichnaya zmenlivasts' sarrow yachmenyu pa nazapashvanni byalku w zerni na sortowchastkakh Belarusi. Vestsi Akademii Agrarnykh Navuk Belarusi (Belarus)* v. 1 p. 50-56. 6 tables; 10 ref. Byelo Russian. (AGRI 95-050606).

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2800 Logue, S.J.; Long, N.R.; Macleod, L.C.; Jenner, C.F. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) **Environmental effects on the biochemical and structural bases of malting quality in barley grown in SE [south-eastern] Australia**. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 499. English. (AGRI 95-050605).

2801 Mares, D.J. (Sydney Univ., Narrabri (Australia). Plant Breeding Inst.) (1994) **Environmental and genetic factors which condition the response of wheat to preharvest rain**. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 501. English. (AGRI 95-050593).

2802 Miao Guoyuan; Zhang Yunting; Hou Yaosheng (Shanxi Agricultural Univ., Taigu (China)) (1993) **A study on the combined effects of temperature and light on development of wheat cultivars I. Analysis of maximum and minimum seedling-heading stages and sensitivity of temperature and light**. *Acta Agronomica Sinica (China)* v. 19(6) p. 489-496. 3 tables, 4 ref. Chinese. (AGRI 95-050614).

2803 Millard, M.M.; Veisz, O.B.; Krizek, D.T.; Line, M. (1995) **MAGNETIC RESONANCE IMAGING (MRI) OF WATER DURING COLD ACCLIMATION AND FREEZING IN WINTER WHEAT.** *Plant Cell & Environment*. 18(5):535-544. English. [USDA ARS NAT RESOURCES INST ENVIRONM CHEM LAB BELTSVILLE, MD 20705 USA].

Nuclear magnetic resonance (NMR) spectroscopy and magnetic resonance imaging (MRI) were used to analyse changes in the physical state of water in wheat crowns during cold acclimation and during the freezing/thawing cycle. Spectroscopically measured average spin-spin relaxation times (T-2) decreased during cold acclimation and increased when plants were grown at normal temperatures. Spin-spin relaxation times were accurately approximated by mono-exponential rates for water relaxation on a pixel basis in images. Spin-spin relaxation images whose contrast is proportional to T-2 times were calculated allowing association of water relaxation with regions of tissue in spin-echo images during acclimation and freezing. Images taken during freezing revealed nonuniform freezing of tissue in crowns and roots. Acclimated and non-acclimated wheat crowns were imaged during freezing and after thawing. Spin-echo image signal intensity and T-2 times decreased dramatically between -4 degrees C and -8 degrees C as a result of a decrease in water mobility during freezing. Images collected during thawing were diffuse with less structure and relaxation times were longer, consistent with water redistribution in tissue after membrane damage. [References: 25].

2804 Mvra, K.; Mares, D.J. (Sydney Univ., Narrabri (Australia). Plant Breeding Inst.) (1994) **Environmental and genetic factors which control late maturity alpha-amylase in wheat.** [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 501. English. (AGRI 95-050594).

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2806 Sarandon, S.J.; Sarandon, R. (1995) **MIXTURE OF CULTIVARS - PILOT FIELD TRIAL OF AN ECOLOGICAL ALTERNATIVE TO IMPROVE PRODUCTION OR QUALITY OF WHEAT (TRITICUM AESTIVUM).** *Journal of Applied Ecology*. 32(2):288-294. English. [NATL UNIV LA PLATA FAC CIENCIAS AGR & FORESTALES DEPT PROD VEGETAL CC 31 RA-1900 LA PLATA ARGENTINA].

1. Mixtures of wheat cultivars were tested as an ecological alternative to pure culture, for producing either a higher grain yield and/or a better grain quality (higher protein content). Two cultivars of bread wheat (*Triticum aestivum*) were selected: Buck Pucara (BP) a modern high yielding cultivar, and Buck Cencerro (BC), an old low yielding cultivar, but with higher grain protein content. They were grown in the field in a replacement series at two nitrogen levels and at a fixed density of 300 viable seeds m⁻² for 5 different combinations (mixtures). 2. Nitrogen application influenced total aerial biomass production, number of ears m⁻² and grain yield, but not the harvest index. 3. Total aerial biomass production after ripening was similar in both cultivars, but BP had a greater grain yield. 4. The mixture of 67% BP and 33% BC produced significantly more total aerial biomass than pure stands of either of the component cultivars. 5. It also produced a grain yield similar to the best yielding cultivar (BP), with an improved grain quality (grain protein content) when no N fertilizer was applied. 6. The mixtures showed a lower harvest index with a higher proportion of resources allocated to competitive structures (stems and leaves). Because of their lower harvest index none of the mixtures had a grain yield greater than that of BP. 7. Without fertilizer the percentage of grain protein of all mixtures was higher than that of BP and similar to BC under pure stands. With nitrogen fertilization, all mixtures showed a similar grain protein content. 8. The results of this study suggests that the use of mixtures of contrasting cultivars could be an ecological alternative to optimize crop production in a low input agriculture. [References: 31].

2807 Savin, R.; Nicolas, M.E. (Melbourne Univ., Parkville (Australia). Centre for Crop Improvement) (1994) **High temperature and drought effects on grain growth and quality in two barley cultivars.** [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat,

Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 507. English. (AGRI 95-050603).

2808 Savin, R.; Stone, P.J.; Nicolas, M.E. (Melbourne Univ., Parkville (Australia). Dept. of Agriculture) (1994) **Effects of brief periods of high temperature under field conditions on grain growth and malting quality of barley.** [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 500. English. (AGRI 95-050601).

2809 Stone, P.J.; Nicolas, M.E. (Melbourne Univ., Parkville (Australia). Dept. of Agriculture) (1994) **The effects of short periods of high temperature, during grain filling, on (wheat) grain yield and quality.** [Conference abstract]. 44. Royal Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 500. English. (AGRI 95-050591).

2810 Sun Cunhua (Xuzhou Normal Coll., Jiangsu (China). Dept. of Biology) (1994) **Effect of diurnal temperature variation on growth of wheat seedlings.** *Plant Physiology Communications (China)* v. 30(3) p. 192-194. 3 ill., 8 ref. Chinese. (AGRI 95-050612).

2811 Tahmasebi, Z.; Jenner, C.F.; McDonald, G. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) **Effect of water stress on mobilization of nitrogen and dry matter from the shoot to the grain of wheat during grain filling.** [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 507. English. (AGRI 95-050595).

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2813 Andersen, B. (1994) **Structure and function of photosystem I [including 5 articles].** Kongelige Veterinaer- og Landbohøjskole, Copenhagen (Denmark). Plant Biochemistry Lab. KVL. 16 ill., 3 tables; 108 ref. 50 p. English. (AGRI 95-050722).

2814 Benghedalia, D.; Kabala, A.; Miron, J. (1995) **COMPOSITION AND IN-VITRO DIGESTIBILITY OF CARBOHYDRATES OF WHEAT PLANTS HARVESTED AT BLOOM AND SOFT-DOUGH STAGES.** *Journal of the Science of Food & Agriculture*. 68(1):111-116. English. [AGR RES ORG VOLCANI CTR IL-50250 BET DAGAN ISRAEL].

Wheat plants (*Triticum aestivum*) were harvested at the bloom and soft-dough stages, separated into leaves + sheaths, stems and spikes, and the effect of stage of maturity on neutral detergent fibre (NDF) composition and degradability was studied. The accumulation of starch in the spikes compensated for the decrease in the degradability of NDF polysaccharides so that the in-vitro digestibility of the organic matter (OM) was not changed between the bloom and soft-dough stages. Minor compositional changes occurred in the NDF of the various botanical fractions which can hardly explain the drop in NDF degradability with maturity. There was a decline in the ratio of hemicellulose to lignin, and the changes in NDF-monosaccharide degradability were probably related to the extension of covalent bonding between those matrix components during maturation. Irrespective of botanical fraction and maturity stage, NDF xylose was less digestible than NDF glucose. Between bloom and soft-dough stages there was an increase of 36% in the yield of digestible OM. [References: 24].

2815 Berzonsky, W.A. (Ohio State Univ., Columbus (USA)) (1993) **Detection of quadrivalents in the Brazilian wheat [*Triticum aestivum*] "Fronoso".** *Wheat Information Service (Japan)* (no.77) p. 19-22. 1 table; 1 fig.; 10 ref. English. (AGRI 95-064692).

2816 Ding Hongjian; Guo Yuyuan (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1993) **Studies on the relationship between the morphology of wheat ear and the resistance to**

wheat midge. *Acta Phytophylacica Sinica (China)* v. 20(1) p. 19-24. 3 ill., 4 tables, 12 ref. Chinese. (AGRI 95-050730).

2817 Gu Yunjie; Wang Zhong; Wu Yueping (Jiangsu Agricultural Coll., Yangzhou (China). Dept. of Agronomy) (1994) Isolation of endosperm cells and calculation of their starch grains in wheat plants. *Plant Physiology Communications (China)* v. 30(3) p. 210-213. 2 ill., 1 table, 9 ref. Chinese. (AGRI 95-050729).

2818 Hu Ling; Xu Weigang; Zhao Xiangke (Northwestern Agricultural Univ., Yangling, Shaanxi (China)) (1993) A study on the effect of IB/IR translocation on anther culture in wheat. *Acta Agronomica Sinica (China)* v. 19(2) p. 139-144. 1 ill., 3 tables, 17 ref. Chinese. (AGRI 95-050731).

2819 Kang, YS.; Spillman, CK.; Steele, J.L.; Chung, D.S. (1995) MECHANICAL PROPERTIES OF WHEAT. *Transactions of the ASAE*. 38(2):573-578. English. [KANSAS STATE UNIV AGR & APPL SCI DEPT BIOL & AGR ENGN MANHATTAN, KS 66506 USA].

Fundamental mechanical properties of the wheat kernel were characterized for five different wheat classes. An Instron testing machine was used to perform a compression test on wheat slices. Wheat slices were prepared by cutting off both ends of the wheat kernel. A cross-sectional area of the wheat slices was measured using a commercial image processing system. An offset yield of 0.2 % was introduced for determining the yield point for wheat and used to determine yield stress, yield strain, modulus of deformability, and energy to yield point. To determine the effect of sample location, each kernel of hard red spring and soft red winter wheats was cut into two slices (germ end and brush end). No significant differences, $\alpha = 0.05$, were found in values of the physical properties for germ-end and brush-end samples. In general, the four properties increased as loading rate increased up to a 100 mm/min and decreased thereafter. The mean values of yield stress for all five wheat classes decreased as moisture content increased. Soft wheat samples had generally lower modulus of deformability values. [References: 12].

2820 Lazar, MD.; Simmons, JE. (1995) IDENTIFICATION OF A WHEAT (TRITICUM AESTIVUM) CELL LINE LACKING A SPECIFIC DIVALENT CATION REQUIREMENT. *Plant Cell Reports*. 14(7):418-422. English. [TEXAS A&M UNIV TEXAS AGR EXPT STN AMARILLO, TX 79106 USA].

A wheat (*Triticum aestivum* L.) cell line, derived from anther culture of an F-1 hybrid, has exogenous Ca^{2+} , to that of calcium-dependent cells grown on complete medium. The calcium-independent cell line has been grown in the absence of Ca^{2+} for more than 1.5 years. The cell line grew at a rate similar to that on complete medium for up to 12 weeks if supplied with any one of the divalent cations, Ca^{2+} , Mg^{2+} , Mn^{2+} , Zn^{2+} , Cu^{2+} or Co^{2+} , but declined and appeared necrotic when all 6 of these were removed from the medium. The calcium-independence trait, while identified in tissue culture, was also observed in germinated immature embryos of the same hybrid and one of its parental inbred lines. [References: 17].

2821 Mansour, MMF. (1995) CHANGES IN CELL MEMBRANE PERMEABILITY AND LIPID CONTENT OF WHEAT ROOT CORTEX CELLS INDUCED BY NaCl. *Biologia Plantarum*. 37(1):143-145. English. [AIN SHAMS UNIV FAC SCI DEPT BOT CAIRO 11566 EGYPT].

Wheat seedlings were grown hydroponically in absence and presence of 100 mM NaCl for 7 d. Cell membrane permeability to nonelectrolytes and water was determined by the plasmometric method for individual intact cells. NaCl increased membrane permeability to urea, methylurea and ethylurea and decreased permeability to water. Membrane lipid partiality was decreased by NaCl. The effects of NaCl on cell permeability parallel changes in the lipid composition of the plasma membranes induced by NaCl stress suggesting that nonelectrolyte permeability is a useful tool to probe alterations in the lipid matrix of the membrane.

2822 Vahidy, A.A. (University of Karachi (Pakistan)); Jahan, Q.; Mujeeb Kazi, A. (1994) Intervarietal polymorphism of heterochromatin in bread wheat, *Triticum aestivum* L. *Wheat Information Service (Japan)* (no.78) p. 13-17. 1 table; 2 fig.; 17 ref. English. (AGRI 95-064694).

2823 Wang Fahong; Zhao Junshi (Shandong Provincial Academy of Agricultural Sciences, Jinan (China). Inst. of Crops) (1994) The histological study on the stalk and flag epicuticle of winter wheat varieties with

compact-type and larger ear. *Journal of Laiyang Agricultural College (China)* v. 11(1) p. 11-16. 18 ill., 2 tables, 10 ref. Chinese. (AGRI 95-050717).

2824 Zheng, Y.L. (Sichuan Agricultural Univ. (China)); Yen, C.; Yang, J.L. (1993) Monosomic analysis for total and sterile floret number per spike in the multispikelet line 10-A of common wheat [*Triticum aestivum*]. *Wheat Information Service (Japan)* (no.77) p. 25-28. 2 tables. English. (AGRI 95-064693).

2825 Zhou Liren; Cheng Beijiu; Wang Gongming (Anhui Agricultural Univ., Hefei (China)); Yu Zengliang (1993) Cytological effects of N⁺ ion implanted barley seed. *Journal of Anhui Agricultural University (China)* (suppl.) p. 27-30. 3 tables, 5 ref. Chinese. (AGRI 95-050721).

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2826 [Triticale physiology]. *Triticale: physiologie. Un comportement agronomique original* (1994) Institut Technique des Cereales et des Fourrages, Paris (France). *Perspectives Agricoles (France)* (no 188) p. 7-10. 5 illus. French. (AGRI 95-064967).

2827 Acquistucci, R.; Degidio, MG.; Vallega, V. (1995) AMINO ACID COMPOSITION OF SELECTED STRAINS OF DIPLOID WHEAT, TRITICUM MONOCOCCUM L. *Cereal Chemistry*. 72(2):213-216. English. [IST NAZL NUTR VIA ARDEATINA 546 I-00179 ROME ITALY].

Diploid wheat (*Triticum monococtum* L., einkorn) is of interest both as a crop and as a source of genes unavailable in the more widely grown wheat species, *T. aestivum* L. (common wheat) and *T. durum* Desf. (durum wheat). The biochemical constituents of its seeds, however, have been investigated very little. In this study, 15 strains of T. monococtum and two modern cultivars of common wheat and durum wheat were compared with regard to grain protein content and amino acid composition of seed proteins. Differences in amino acid composition between these three species of wheat and among diploid wheat strains were minimal, especially after amino acid values were adjusted to a common protein level. One of the einkorn accessions examined, however, presented a deviant amino acid profile. This strain may be of use for investigating the biosynthetic pathway of wheat proteins. Among einkorns, correlations between grain protein content and amino acid values were positive for glutamine and proline and negative for threonine, 1/2 cystine, valine, isoleucine, leucine, asparagine, serine, glycine, and alanine. [References: 27].

2828 Ahmad, M.; Arain, MA.; Siddiqui, KA. (1994) EFFECT OF CONTEMPORARY ROTATION SIMULATION ON THE GRAIN WEIGHT, PROTEIN AND LYSINE CONTENT OF BREAD WHEAT (TRITICUM-AESTIVUM L.). *Pakistan Journal of Botany*. 26(2):331-339. English. [ATOM ENERGY AGR RES CTR SINDH PAKISTAN].

Effect of contemporary rotation simulation on grain weight, protein and lysine content of four commercial cultivars (Pavon, Sarsabz, Mehran 89 and T.J. 83) and 21 new promising strains of bread wheat was studied. Late sowing decreased ($P < 0.05$) grain weight, but protein and lysine contents were significantly ($P < 0.05$) enhanced. Correlation between grain weight and development period of grain was positive ($r = 0.581$), whereas, development period and protein ($r = -0.463$) and protein and grain weight ($r = -0.263$) was negative. Higher temperature in the post-anthesis period of late sown wheats probably shortened the grain filling period, which resulted in the reduced endosperm. The reduction in endosperm due to late sowing may be responsible for lower grain weight and enhanced protein content.

2829 Allen, H.M.; Oliver, J.R. (New South Wales Agriculture, Wagga Wagga (Australia). Agricultural Research Inst.); Blakeney, A.B. (New South Wales Agriculture, Yanco (Australia). Yanco Agricultural Inst.) (1994) Early generation quality selection using NIT [near infrared transmission; wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 510. English. (AGRI 95-050960).

2830 Bariana, H.S.; Blundell, M.J.; MacRitchie, F. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Hare, M.J. (New South Wales Agriculture, Tamworth (Australia). Agricultural Research Centre) (1994) Biochemical and technological analyses of some plainsman V-derivatives [wheat]. [Conference abstract].

44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)*. 9 v. 61(9) p. 510. English. (AGRIS 95-050959).

2831 Bracey, M.H.; Bartlett, S.G. (1995) SEQUENCE OF A CDNA ENCODING CARBONIC ANHYDRASE FROM BARLEY. *Plant Physiology*. 108(1):433-434. English. [LOUISIANA STATE UNIV DEPT BIOCHEM BATON ROUGE, LA 70803 USA].

2832 Castagnaro, A.; Segura, A.; Garciaolmedo, F. (1995) HIGH CONSERVATION AMONG SEQUENCES ENCODING TYPE-V THIONINS IN WHEAT AND AEGILOPS. *Plant Physiology*. 107(4):1475-1476. English. [UNIV POLITECN MADRID ETS INGENIEROS AGRON BIOQUIM & BIOL MOLEC LAB E-28040 MADRID SPAIN].

2833 Chhipa, B.R.; Lal, P. (1995) NA/K RATIOS AS THE BASIS OF SALT TOLERANCE IN WHEAT. *Australian Journal of Agricultural Research*. 46(3):533-539. English. [SKN COLL AGR DEPT AGR CHEM & SOIL SCI JOBNER 303329 RAJASTHAN INDIA].

Na/K ratios of salt tolerant and susceptible varieties of wheat were measured. The Na/K ratio in wheat grain and straw above or below a particular level indicate the tolerance of wheat to salinity. This fact was confirmed by applying presoaking treatments of plant hormones to test susceptibility of varieties. On the basis of the results obtained in two pot experiments, the limit of the Na/K ratio of grain and straw of wheat for designating a variety as tolerant is <0.15 and <0.4 respectively, while this ratio at the tillering stage is 0.5. [References: 16].

2834 Cochrane, M.P. (Scottish Agricultural College, Edinburgh, Scotland (United Kingdom)) (1994) The role of the crease region in the control of barley grain maturation. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 504. English. (AGRIS 95-050975).

2835 Cochrane, M.P.; Duffus, C.M. (Scottish Agricultural College, Edinburgh, Scotland (United Kingdom)) (1994) The effect of ambient temperature on grain filling, starch quality and endosperm morphology in barley. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 500. English. (AGRIS 95-050974).

2836 Denyer, K.; Hylton, C.M.; Jenner, C.F.; Smith, A.M. (1995) IDENTIFICATION OF MULTIPLE ISOFORMS OF SOLUBLE AND GRANULE-BOUND STARCH SYNTHASE IN DEVELOPING WHEAT ENDOSPERM. *Planta*. 196(2):256-265. English. [JOHN INNES CTR COLNEY LANE NORWICH NR4 7UH NORFOLK ENGLAND].

We have investigated the nature and locations of isoforms of starch synthase in the developing endosperm of wheat (*Triticum aestivum* L.). There are three distinct granule-bound isoforms of 60 kDa (the Waxy gene product), 77 kDa and 100-105 kDa. One of these isoforms, the 77-kDa protein, is also present in the soluble fraction of the endosperm but it contributes only a small proportion of the total soluble activity. Most of the soluble activity is contributed by isoforms which are apparently not also granule-bound. The 60-kDa and 77-kDa isoforms of wheat are antigenically related to isoforms of very similar size in the developing pea embryo, but the other isoforms in the endosperm appear to have no counterparts in the pea embryo. The significance of these results in terms of the diversity of isoforms of starch synthase and their locations is discussed. [References: 26].

2837 Domon, J.M.; Dumas, B.; Laine, E.; Meyer, Y.; David, A.; David, H. (1995) THREE GLYCOSYLATED POLYPEPTIDES SECRETED BY SEVERAL EMBRYONIC CELL CULTURES OF PINE SHOW HIGHLY SPECIFIC SEROLOGICAL AFFINITY TO ANTIBODIES DIRECTED AGAINST THE WHEAT GERMIN APOPROTEIN MONOMER. *Plant Physiology*. 108(1):141-148. English. [UNIV PICARDIE JULES VERNE BIOTECHNOL & PHYSIOL VEGETALES LAB EA 908 33 RUE ST LEU F-80039 AMIENS FRANCE].

Embryonic tissues of *Pinus caribaea* Morelet var *hondurensis* produce extracellular proteins; among them germins have been identified. Two-dimensional electrophoresis followed by electroblotting onto a polyvinylidene difluoride membrane allowed isolation and N-terminal amino acid sequencing of extracellular GP111, which is present within the

five embryonic cell lines studied. The amino acid sequence showed strong homologies with the sequences of germins deduced from cDNA sequencing, starting at the same amino acid position but one, compared with other sequences of mature germins deduced from protein sequencing. Immunoblots of embryonic and nonembryonic extracellular proteins indicated that the polypeptide GP111 plus two others with similar relative molecular mass values are present in embryonic cell lines but not in nonembryonic ones. They were recognized by an antiserum raised against the nonglycosylated monomer of wheat germin. The cross-reaction between pine and wheat apoproteins was highly specific. An antiserum against the glycosylated pentameric germin-like protein (an oxalate oxidase) of barley crossreacted with all three, as well as with several other glycosylated polypeptides. [References: 32].

2838 Evans, D.E.; Lance, R.C.M.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) Importance of protein Z in barley, malt and finally beer quality. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 505. English. (AGRIS 95-050976).

2839 Flasiński, S.; Dzionot, A.; Pratt, S.; Bujarski, J.J. (1995) MUTATIONAL ANALYSIS OF THE COAT PROTEIN GENE OF BROME MOSAIC VIRUS - EFFECTS ON REPLICATION AND MOVEMENT IN BARLEY AND IN CHENOPODIUM HYBRIDUM. *Molecular Plant-Microbe Interactions*. 8(1):23-31. English. [SAMUEL ROBERTS NOBLE FDN INC POB 2180 ARDMORE, OK 73402 USA].

The coat protein (CP) open reading frame (ORF) of brome mosaic virus (BMV) has been mutated to study host-related CP functions in barley, a systemic host, and in *Chenopodium hybridum* L., which supports both local lesion formation and systemic spread of BMV. To test the role of the N-terminal region of CP, mutants C1 to C3, which synthesized the CP lacking first seven amino acids, and mutant D1, which had Trp 22 and Thr 23 replaced with Phe-Gly-Ser, were generated. C1 to C3 inhibited virus systemic spread in C. hybridum but not in barley while D1 only reduced virus accumulation in noninoculated leaves of C. hybridum. More internal CP regions were tested by mutation of Lys 63 to Leu (mutant SP3) and Lys 129 to Arg (mutant SP1). SP1 behaved similarly to C1 to C3 while SP3 similarly to D1. In addition, SP3 reduced concentrations of RNA3 and RNA4 in both hosts. Apparently, various CP regions differentially affect, either directly or indirectly, virus translocation in different hosts, suggesting both the CP and host factors to be important for virus spread. Larger deletions in the CP ORF (mutants BB4 and SX1) or a decrease of CP production by using a frameshift mutant C, inhibited virus systemic spread in both hosts, and delayed the appearance of smaller local lesions on C. hybridum. Thus, the CP is not required for cell-to-cell movement but is required for systemic translocation of BMV. [References: 44].

2840 Fricke, W.; Hinde, P.S.; Leigh, R.A.; Tomos, A.D. (1995) VACUOLAR SOLUTES IN THE UPPER EPIDERMIS OF BARLEY LEAVES - INTERCELLULAR DIFFERENCES FOLLOW PATTERNS. *Planta*. 196(1):40-49. English. [SWEDISH UNIV AGR SCI DEPT ECOL & ENVIRON RES POB 7072 S-75007 UPPSALA SWEDEN].

The concentrations of vacuolar solutes in different cells of the upper epidermis of the third leaf of barley (*Hordeum vulgare* L.) were studied in leaves of different ages grown under different irradiances (120 or 400 $\mu\text{mol photons} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$). Vacuolar saps were extracted from individual cells located at various positions between adjacent veins and were analysed for their osmolality and the concentrations of K^+ , Ca^{2+} , Cl^- , NO_3^- and malate. Each ion showed a cell-specific distribution within the epidermis that was both quantitatively and qualitatively dependent on the leaf developmental stage and on the light level. During leaf ageing, Ca^{2+} accumulated preferentially in interstomatal cells (i.e. those located between longitudinally adjacent stomata) at concentrations up to 180 mM. Under low light conditions, this was accompanied by a more or less equal decrease in K^+ concentration. Epidermal malate was found only in plants grown continuously or transiently under the high irradiance and reached highest concentrations in trough and interstomatal cells (60 to 150 mM). Chloride concentration was highest in cells overlying the veins (designated as ridge cells) and lowest in cells located between the veins (trough cells), while NO_3^- exhibited the reverse distribution, although the precise patterns were age-dependent. Epidermal osmolality increased with age, but the intercellular differences in the osmolalities were small compared to

differences in vacuolar solute composition. A cell-to-cell analysis of the region surrounding the stomata showed that the steepest changes in the vacuolar solute composition of epidermal cells occurred at the boundary between ridge or trough cells and the adjacent near-stomatal cells. [References: 36].

2841 Gianibelli, M.C.; Arriaga, H. (Univ. Nacional de La Plata, La Plata (Argentina). Catedra de Cerealicultra); Carillo, J.M. (Univ. Politecnica de Madrid, Madrid (Spain). Departamento de Genetica) (1994) High molecular weight glutenin subunit composition of Argentinian bread wheats. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 509. English. (AGRI 95-050956).

2842 Gianibelli, M.C.; Bariana, H.S.; MacRitchie, F. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Arriaga, H.O. (Univ. Nacional de La Plata, La Plata (Argentina). Catedra de Genetica) (1994) Relationships between biochemical and technological properties of Argentinian wheats. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 509. English. (AGRI 95-050958).

2843 Gibson, C.E.; Evans, D.E.; Dalton, M.R.; Lance, R.C.M.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia). Waite Campus); Symons, M.H.; Arends, A.; Marschke, R.J. (Queensland Dept. of Primary Industries, Hamilton (Australia)) (1994) The rapid detection of quality barley enzymes using and enzyme linked immunosorbent assay (ELISA). [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 504. English. (AGRI 95-050978).

2844 Gibson, C.E.; Evans, D.E.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia)); Skerrett, J.H. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry); Symons, M.H. (Queensland Dept. of Primary Industries, Hamilton (Australia)) (1994) The application of enzyme linked immunosorbent assays (ELISA) for the assessment of malt quality enzymes and proteins [barley]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 509. English. (AGRI 95-050977).

2845 Iacobazzi, V.; Palmieri, F. (1995) NUCLEOTIDE SEQUENCE OF A CDNA ENCODING THE ADP/ATP CARRIER FROM WHEAT (TRITICUM TURGIDUM). *Plant Physiology*. 107(4):1473. English. [UNIV BARI DEPT PHARMACOBIOLOGICAL & MOLECULAR BIOLOGY LAB VIA ORABONA 4 I-70125 BARI ITALY].

2846 Ivanova, E.A.; Vafina, G.K.; Kudoyarova, G.R. (1995) APPLICATION OF IMMUNOASSAY FOR IDENTIFICATION OF ENDOGENOUS AUXIN IN THE CELL NUCLEI OF WHEAT SEEDLINGS. *Izvestia Akademii Nauk SSSR. Seriya Biologicheskaya*. (2):252-253. Russian. [RUSSIAN ACADEMY OF SCIENCES INSTITUTE OF BIOLOGY 69 UFA 450001 RUSSIA].

Endogenous auxin was found in the nuclear structures (nucleoplasm, chromatin, and nuclear matrix) of the wheat seedlings using the immunoassay developed by Kudoyarova et al. (1990). The content of endogenous nuclear auxin was shown to correlate with the physiological activity of growing organs and tissues of the seedlings. [References: 7].

2847 Jones, P.G.; Raines, C.A.; Lloyd, J.C. (1995) NUCLEOTIDE SEQUENCE OF A WHEAT CHLOROPLASTIC PHOSPHOGLYCERATE KINASE GENE. *Plant Physiology*. 107(4):1483-1484. English. [UNIV ESSEX DEPT BIOL WIVENHOE PK COLCHESTER CO4 3SQ ESSEX ENGLAND].

2848 Jordan, N.D.; Barber, M.S. (1995) MULTIPLE FORMS OF WHEAT LEAF N-ACETYL-BETA-D-HEXOSAMINIDASE. *Plant Science*. 107(1):41-48. English. [UNIV SOUTHAMPTON SCH BIOL SCI DEPT BIOL SOUTHAMPTON SO16 7PX HANTS ENGLAND].

We have identified two distinct forms of wheat leaf N-acetyl-beta-D-hexosaminidase, N-Hex-A and N-Hex-B, which preferentially hydrolyse pNP-GlcNAc and (GlcNAc)(n), respectively. Both forms were detected in all wheat cultivars examined. In leaves of increasing maturity, the specific activity of N-Hex-A gradually declined, whilst the specific activity of N-

Hex-B remained relatively constant. Affinity chromatography on Con A-Sepharose resulted in a 772-fold purification of N-Hex-A and a 441-fold purification of N-Hex-B. N-Hex-A and N-Hex-B had similar native molecular weights (167 +/- 23 kDa) as estimated by gel filtration. A near-baseline separation of N-Hex-A and N-Hex-B was achieved by anion exchange chromatography. Polyclonal antibody, raised against homologous N-Hex-A, also showed a strong cross-reaction with N-Hex-B. Chitinase-free, semi-purified extracts, containing both N-Hex-A and N-Hex-B activities, preferentially hydrolysed (GlcNAc)(3-5) in comparison to (GlcNAc)(2). Two compounds, PUGNAC and PUCIB had no inhibitory effect on N-Hex-A activity but specifically reduced N-Hex-B activity (PUGNAC, K_i = 1.45 x 10⁻⁷ M; PUCIB, K_i = 6.5 x 10⁻⁶ M). [References: 23].

2849 Jost, M. (JOST Seeds Research, Krizevci (Croatia)); Fister, R. (Podravka Research and Development, Koprivnica (Croatia)); Vapa, L. (University of Novi Sad, Novi Sad (Yugoslavia). Institute of Biology); Javornik, B. (University of Ljubljana, Biotechnical Faculty, Ljubljana (Slovenia). Agronomy Dept.) (1994) Variation of breadmaking quality traits within wheat sister lines having the same HMW glutenin subunits composition. International Colloquium on Impact of Plant Biotechnology on Agriculture; Rogla (Slovenia); 5-7 Jun 1994. *Proceedings of the International Colloquium on Impact of Plant Biotechnology on Agriculture*. Javornik, B.; Bohanec, B.; Kreft, J. (eds.). Biotechnical Faculty, University of Ljubljana, Ljubljana (Slovenia). Agronomy Dept., Centre for Plant Biotechnology and Breeding p. 273-280. 1 table; 2 ill., 16 ref. English. (AGRI 95-051023).

Twenty one (F10-F12) wheat sister lines and female parent, all with the same HMW glutenin subunits composition 2*,7+9,5+10 were tested on yield and breadmaking traits. All of 21 selected progeny lines had much better yielding ability (7.13-8.33 t/ha) than female parent (6.21 t/ha), but remained behind in protein concentration (12.0-14.5 versus 17.7 of female parent), and all other quality traits. A number of wheat lines had protein yield (t/ha) value higher than female parent, indicating acceptable improvement in combined traits: grain yield and grain protein concentration. Significant difference in grain protein concentration as well as in protein yield was determined in wheat sister lines having the same HMW glutenin subunits composition, which indicates that grain proteins are coded by some other loci too. Significant variation for rheological traits within wheat sister lines having the same HMW glutenin subunits composition indicates that after fixation of the most convenient HMW glutenin subunits, sufficient variation for all traits still remains available to the breeder. Selection based solely on average effects of glutenin alleles would exploit only a main partition of the available genetic variation. Remaining variability should be further improved by phenotypically based selection.

2850 Katupitiya, S.; New, P.B.; Elmerich, C.; Kennedy, I.R. (1995) IMPROVED N-2 FIXATION IN 2,4-D TREATED WHEAT ROOTS ASSOCIATED WITH AZOSPIRILLUM LIPOFERUM - STUDIES OF COLONIZATION USING REPORTER GENES. *Soil Biology & Biochemistry*. 27(4-5):447-452. English. [UNIV SYDNEY DEPT AGRICULTURE & SOIL SCI SYDNEY NSW 2006 AUSTRALIA].

Among several Azospirillum strains tested for N-2 fixation in association with wheat in a model system, 2 A. lipoferum strains (SpBr17 and 596) were found to be more efficient than the 8 other A. lipoferum and A. brasilense strains tested. Plants treated with low concentrations (0.7 µg ml⁻¹) of 2,4-dichlorophenoxyacetic acid (2,4-D) followed by inoculation supported larger acetylene reduction activity than plants treated only with bacteria. Three broad host range plasmids carrying lacZ, as a reporter gene, controlled by nifA, nodG and ntrC promoters were transferred to A. lipoferum SpBr17 and strain 596 by conjugation. All the transconjugants showed high beta-galactosidase activity in the free-living condition. Studies on colonization of wheat roots using the SpBr17 nodC-lacZ gene fusion, which expressed the lacZ gene at the highest level, indicated the localization of bacteria on the young parts of roots as a thick coat. Counts of azospirilla on plant roots showed increased association of bacteria in 2,4-D treated plants. [References: 24].

2851 Kraic, J.; Horvath, L.; Gregova, E.; Zak, I. (1995) THE STANDARD METHODS OF ELECTROPHORETIC SEPARATION OF GLUTENINS AND GLIADINS OF WHEAT BY SDS-PAGE AND A-PAGE. *Rostlinna Vyroba*. 41(5):219-223. Czech. [VYSKUMNY USTAV RASLINNE] VYROBY BRATISLAVSKA CESTA 122 PIESTANY 92168 SLOVAKIA].

Acidic polyacrylamide gel electrophoresis (A-PAGE) and SDS-PAGE were used for separation, detection and evaluation of gliadin and glutenin patterns in wheat (*Triticum aestivum* L.). All analytical methods used are tested or adopted, as a standard reference methods by ISTA or UPOV organizations, for identification and characterization of wheat varieties. ISTA A-PAGE method in our modification is very convenient for identification purposes of wheat varieties. The stained gels with gliadin profiles can be further evaluated for the presence of gliadin alleles and other genetic studies. There are only slight differences in concentration of soluble gels in ISTA and UPOV SDS-PAGE methods. Both methods are very simple, the separation of glutenin subunits detected in the gels with different concentration of acrylamide were reproducible and usable for variety distinguishing and recognition of an alleles corresponding to HMW glutenin subunits. Gliadin and glutenin banding patterns were obtained from several wheat varieties and protein polymorphism in gliadins and glutenins was presented in this paper. The electrophoretic spectra obtained by described methods can be evaluated subsequently by densitometry for preparation of digitalised electrophoretic spectra of cultivars.

2852 Liu Dianying; Shi Liyan; Huang Bingru (Shandong Agricultural Univ., Taian (China). Dept. of Agronomy) (1993) Root system in relation to characteristics of top in winter wheat. *Journal of Shandong Agricultural University (China)* v. 24(4) p. 359-364. 3 ill., 3 tables, 4 ref. Chinese. (AGRIS 95-050961).

2853 Ma Ruikun; Jian Jiali; Jia Xiuling (Hebei Provincial Academy of Agriculture and Forestry Sciences, Shijiazhuang (China). Inst. of Cereal and Oil Crops) (1994) Characteristics of changes in leaf water potential and water saving regulation in high-yielding winter wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(2) p. 14-19. 4 ill., 4 tables, 11 ref. Chinese. (AGRIS 95-050962).

2854 McCormick, K.M.; Panozzo, J.F. (Victorian Dept. of Agriculture, Horsham (Australia). Inst. for Dryland Agriculture) (1994) Screening for late maturity alpha-amylase using the swelling power test [wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 508. English. (AGRIS 95-050955).

2855 Muzzarelli, RAA.; Xia, WS.; Tomasetti, M.; Ilari, P. (1995) DEPOLYMERIZATION OF CHITOSAN AND SUBSTITUTED CHITOSANS WITH THE AID OF A WHEAT GERM LIPASE PREPARATION. *Enzyme & Microbial Technology*. 17(6):541-545. English. [UNIV ANCONA FAC MED I-60100 ANCONA ITALY].

Chitosan was readily depolymerized by a wheat germ lipase preparation, from approximately 700,000 to 13,000 D, as shown by the viscosity decrease of its lactate solutions, gel permeation chromatography, electrophoresis, and titration of the reducing sugars. Typically, the viscosity was lowered to 35% of the initial value upon 10-min contact with lipase at 25 degrees C. Measurements taken in the lipase concentration range 4.5 10(-3) to 9 10(-1) g/l(-1) showed a logarithmic dependence of the initial velocity on the enzyme concentration. N-Carboxymethyl chitosan was an even better substrate, with the initial velocity over double that for chitosan. This work indicates for the first time the possible involvement of lipases in the dietary significance of chitosans, and in the resorption of chitosan-based medical items. [References: 16].

2856 Nishikawa, N.; Shida, A.; Toyama, S. (1995) METABOLISM OF C-14-LABELED EPIBRASSINOLIDE IN INTACT SEEDLINGS OF CUCUMBER AND WHEAT. *Journal of Plant Research*. 108(1089):65-69. English. [OCHANOMIZU UNIV FAC SCI DEPT BIOL TOKYO 112 JAPAN].

The metabolism of exogenously applied C-14-24-epibrassinolide (C-14-EBR) in seedlings of cucumber and wheat was examined. Total lipids were extracted with isopropanol and chloroform, and then partitioned with water. More than 80% of radioactivity was distributed to chloroform-phase. Concentrated chloroform-phase was applied to silica gel plate and was developed with chloroform-ethanol (5:1 v/v). Rf value of original C-14-EBR was about 0.6. In cucumber leaves harvested after 2 day-culture, three peaks were detected at Rf 0.11, 0.47 and 0.84. In cucumber petioles of 2 day-culture, however, a major peak was detected at Rf 0.90. But C-14-EBR was hardly metabolized in hypocotyls and roots after 2 days. In wheat leaves harvested just after pulse labeling, a peak was detected at Rf 0.63. By further

analysis of this peak using ODS-HPLC, however, an original peak of C-14-EBR and two metabolites having higher polarity were detected. In wheat leaves harvested after 2 day-culture, the profile of TLC scanning was similar to that just after pulse labeling, although, an original peak of C-14-EBR was no longer detected by ODS-HPLC. In wheat roots, C-14-EBR was hardly metabolized. These results indicate that C-14-EBR occurring in leaves and petioles is metabolized to produce several kinds of metabolites. [References: 13].

2857 Ohba, R.; Kitaoka, S.; Ohda, S.; Ueda, S. (1995) STORAGE STABILITY AND THERMAL STABILITY OF HORDEUMIN, AN ANTHOCYANIN PIGMENT FROM BARLEY. *Bioscience Biotechnology & Biochemistry*. 59(4):746-748. English. [KUMAMOTO INST TECHNOL FAC ENGN DEPT APPL MICROBIAL TECHNOL IKEDA 4-22 KUMAMOTO 860 JAPAN].

Hordeumin stored at -40 to -80 degrees C in 1% HCl-methanol suffered neither from color reduction nor discoloration. After heating at 80 degrees C for 60 min, hordeumin showed a pigment retention rate of 100%. This characteristic is because the pigment is a composite high-molecular weight compound consisting of anthocyanins and polyphenols. It was determined, however, that discoloration and browning occurred more rapidly than color reduction during storage and heating of the pigment. [References: 19].

2858 Quiles, M.J.; Garcia, C.; Cuello, J. (1995) DIFFERENTIAL EFFECTS OF ABSCISIC ACID AND METHYL JASMONATE ON ENDOPROTEINASES IN SENESCING BARLEY LEAVES. *Plant Growth Regulation*. 16(2):197-204. English. [UNIV MURCIA FAC BIOL DEPT BIOL VEGETAL E-30001 MURCIA SPAIN].

Endoproteinase activity was analyzed in chloroplasts isolated from barley leaf segments incubated in the dark with various hormonal senescence effecters. As a control, the endoproteinase activity of the supernatant fraction obtained during chloroplast preparation was also analyzed. Measured against azocaseine as substrate, the endoproteinase activity in chloroplasts increased 18 fold during the induction of senescence. This rise in activity was inhibited by kinetin (the activity increased only 10 fold) and very strongly stimulated by abscisic acid (ABA) (117 fold) and methyl jasmonate (Me-JA) (57 fold). Although less so, the endoproteinase activity of the supernatant fraction, mainly vacuolar and with acid pH optimum, was affected in the same way by all three effecters. Among the five endoproteinases (EC) found in chloroplasts, EC2 and EC4 were induced after incubation in water. ABA increased the levels of EC2 and EC4 (5 fold), and induced the development of EC3 and EC5, while Me-JA totally inhibited EC2 and EC4, and induced the development of EC1. At least one of the endoproteinases, EC2, is synthesized in chloroplasts. Among the six endoproteinases found in the supernatant fraction (E), E1, E2, E3 and E5, which are very probably extrachloroplastic endoproteinases, are stimulated by ABA to varying degrees. However, Me-JA stimulates E1 to a greater extent and totally inhibits E3. The differential effects of ABA and Me-JA on chloroplast and supernatant fraction endoproteinases suggest different action mechanisms for both senescence promoters. [References: 36].

2859 Shimoni, Y.; Zhu, XZ.; Levanony, H.; Segal, G.; Galili, G. (1995) PURIFICATION, CHARACTERIZATION, AND INTRACELLULAR LOCALIZATION OF GLYCOSYLATED PROTEIN DISULFIDE ISOMERASE FROM WHEAT GRAINS. *Plant Physiology*. 108(1):327-335. English. [WEIZMANN INST SCI DEPT PLANT GENET IL-76100 REHOVOT ISRAEL].

Wheat (*Triticum aestivum*) storage proteins fold and assemble into complexes that are linked by intra- and intermolecular disulfide bonds, but it is not yet clear whether these processes are spontaneous or require the assistance of endoplasmic reticulum (ER)-resident enzymes and molecular chaperones. Aiming to unravel these processes, we have purified and characterized the enzyme protein disulfide isomerase (PDI) from wheat endosperm, as well as studied its developmental expression and intracellular localization. This ER-resident enzyme was previously shown to be involved in the formation of disulfide bonds in secretory proteins. Wheat PDI appears as a 60-kD glycoprotein and is among the most abundant proteins within the ER of developing grains. PDI is notably upregulated in developing endosperm in comparison to embryos, leaves, and roots. In addition, the increase in PDI expression in grains appears at relatively early stages of development, preceding the onset of storage protein accumulation by several days. Subcellular localization analysis and immunogold labeling of electron micrographs showed that PDI is not only present in the lumen of the ER but is also co-localized with the storage

proteins in the dense protein bodies. These observations are consistent with the hypothesis that PDI is involved in the assembly of wheat storage proteins within the ER. [References: 30].

2860 Speulman, E.; Salamini, F. (1995) **A BARLEY CDNA CLONE WITH HOMOLOGY TO THE DNA-BINDING DOMAIN OF THE STEROID HORMONE RECEPTORS**. *Plant Science*. 106(1):91-98. English. [MAX PLANCK INST ZUCHTUNGSFORSCH CARL VON LINNWEIG 10 D-50829 COLOGNE GERMANY].

The steroid hormone receptors are members of a superfamily of nuclear receptors that regulate gene expression in response to a ligand in mammals and insects. A cDNA library from barley (*Hordeum vulgare*) was screened with highly degenerated oligonucleotides corresponding to 11 and 6 amino acids of the highly conserved DNA-binding domain of the steroid hormone receptors. A full length cDNA clone (ES43) was isolated. The sequence of ES43 shows homology to the DNA-binding domain of the estrogen receptor, including three amino acids (Glu(191), Gly(192) and Ala(195)) at conserved positions, which determine the binding specificity of the estrogen receptor to its hormone response element. Additional homologies concerning critical amino acid positions with all members of the nuclear receptor superfamily are also evident. [References: 31].

2861 Sun Qun; Jing Jiahai; Gao Junfeng (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Dept. of Basic Course) (1994) **Effects of the flag leaves and water status on grain filling of winter wheat**. *Acta Universitatis Agriculturae Boreali-Occidentalis (China)* v. 22(1) p. 61-66. 5 ill., 1 table, 12 ref. Chinese. (AGRI 95-051027).

2862 Swinnen, J.; Vanveen, J.A.; Merckx, R. (1995) **CARBON FLUXES IN THE RHIZOSPHERE OF WINTER WHEAT AND SPRING BARLEY WITH CONVENTIONAL VS INTEGRATED FARMING**. *Soil Biology & Biochemistry*. 27(6):811-820. English. [DLO AGROBIOL & SOIL FERTIL RES INST AB POB 14 6700 AA WAGENINGEN NETHERLANDS].

Estimates of rhizosphere C budgets for winter wheat and spring barley under conventional (CONV) or integrated (INT) management were obtained using a combination of crop growth measurements, C-14 pulse-labelling and a model rhizodeposition technique. In both crops the proportion of C-14 allocated to shoots 3 wk after labelling increased with the developmental stage, which resulted in maximum belowground C fluxes at tillering. At this stage C-14 released from the roots was relatively more in organic form in wheat and more as CO₂ in barley, and this was reflected in the C fluxes accumulated over the growing season. In wheat no significant effect of management on C-14 allocation was found. In barley relatively more C-14 tended to be transferred to roots in CONV than in INT, and this was reflected in considerably higher calculated root growth, root respiration and rhizodeposition fluxes in CONV than in INT. Therefore, the hypothesis that plants invest more in roots and rhizodeposition in the system with lower nutrient input (INT) was rejected. Total rhizodeposition, including root decay, amounted to 450-990 kg C ha⁻¹ y⁻¹ (7-15% of net assimilation) which was twice the quantity of roots left at crop harvest. The relevance for microbe-mediated processes in relation to soil fertility is pointed out. [References: 41].

2863 Tchan, Y.T.; Zeman, AMM. (1995) **N-2 FIXATION (C2H2 REDUCTION) IN 2,4-DICHLORO-PHENOXYACETIC ACID (2,4-D) TREATED WHEAT INOCULATED WITH FREE-LIVING DIAZOTROPHS**. *Soil Biology & Biochemistry*. 27(4-5):453-457. English. [UNIV SYDNEY DEPT CHEM ENGN SYDNEY NSW 2006 AUSTRALIA].

N fixation associated with 2,4-D-treated wheat seedlings was investigated using a number of free-living, non-associative, O-2- and acid-tolerant diazotrophs. Not all diazotrophs tested formed an N-2-fixing association. Even strains within one species behaved differently. *Azospirillum* was found to have a narrow pH and pO₂ range for nitrogenase activity (C₂H₂ reduction) in 2,4-D-treated wheat seedlings, whereas *Derxia gummosa* was capable of forming an effective N-2-fixing association under a wide range of pH and pO₂. [References: 20].

2864 Wang, M.; Heimovaaradijkstra, S.; Vandermeulen, RM.; Knox, J.P.; Neill, S.J. (1995) **THE MONOCLONAL ANTIBODY JIM19 MODULATES ABSCISIC ACID ACTION IN BARLEY ALEURONE PROTOPLASTS**. *Planta*. 196(2):271-276. English. [UNIV W ENGLAND DEPT BIOL SCI COLDHARBOUR LANE BRISTOL BS16 1QY AVON ENGLAND].

A panel of hybridoma products generated against pea (*Pisum sativum* L.) guard-cell protoplasts has been assayed for anti-abscisic acid (ABA) biological activity in barley (*Hordeum vulgare* L.) aleurone protoplasts. The effects of the antibodies on ABA-induced accumulation of mRNA transcribed from RAB-16, a gene responsive to ABA, were determined. Most of the antibodies, and culture medium, had no effect, but five monoclonal antibodies (MAbs) were found to inhibit ABA-induced RAB-16 gene expression and one MAb enhanced it. The effects of one inhibitory MAb, JIM19, were studied in some detail. These effects were specific to ABA-induced events, as incubation with JIM19 had no effect on the expression of a constitutively-expressed gene, GAPDH, encoding glyceraldehyde-3-phosphate dehydrogenase, and only a slight effect on the production of α-amylase induced by gibberellic acid. Increasing concentrations of ABA in the incubation medium partly overcame the inhibitory effect of JIM19. Immunolabelling and biological activity remained together during immunopurification of JIM19 from hybridoma culture supernatant. Immunoblotting of JIM19 to membrane preparations from barley aleurone protoplasts revealed that JIM19 recognised a number of proteins. [References: 29].

2865 Yu, D.; Kennedy, IR. (1995) **NITROGENASE ACTIVITY (C2H2 REDUCTION) OF AZORHIZOBIUM IN 2,4-D-INDUCED ROOT STRUCTURES OF WHEAT**. *Soil Biology & Biochemistry*. 27(4-5):459-462. English. [UNIV SYDNEY DEPT AGR CHEM & SOIL SCI SYDNEY NSW 2006 AUSTRALIA].

The characteristics of C₂H₄ formation from C₂H₂ associated with 2,4-D-induced root structures on wheat seedlings inoculated with *Azorhizobium caulinodans* ORS571 have been investigated. Wheat seedlings treated with *Azorhizobium* plus 2,4-D were more tolerant in their C₂H₂ reduction activity to pO₂ 0.02 and 0.04 atm in the gas phase than wheat seedlings inoculated with *Azorhizobium* alone. C₂H₃ production was C₂H₂ dependent and was strongly inhibited by ammonia and nitrite. The nitrogenase activity of *A. caulinodans* associated with the 2,4-D-induced root structures of wheat seedlings was also confirmed by the fixation of N-15(2). [References: 16].

2866 Zhao Huijie; Lin Xuewu; Wu Yueting (Henan Agricultural Univ., Zhengzhou (China). Dept. of Agronomy) (1994) **A study on isozyme patterns of superoxide dismutase and lipid peroxidation in anthers of cytoplasmic male-sterile lines and the corresponding maintainer line of wheat**. *Acta Agriculturae Boreali-Sinica (China)* v. 9(1) p. 25-29. 3 ill., 1 table, 7 ref. Chinese. (AGRI 95-051021).

2867 Zhen, Z.; Moss, R. (Bread Research Inst. of Australia, North Ryde) (1994) **High molecular weight glutenin composition in relation to Asian end-product quality [wheat]**. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 509. English. (AGRI 95-050957).

2868 Zou Yunding; Meng Qinglei; Ma Fei (Anhui Agricultural Univ., Hefei (China)) (1994) **Relationship between chemical compositions of "8455" wheat plant and population dynamics of *Schizaphis graminum* and *Macrosiphum avenae***. *Chinese Journal of Applied Ecology (China)* v. 5(3) p. 276-280. 2 tables, 12 ref. Chinese. (AGRI 95-051020).

F61 PLANT PHYSIOLOGY-NUTRITION

2869 Belyankevich, A.A.; Shashko, K.G. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1994) **[Expressiveness of barley genotypes responses to the conditions of plants nutrition]. *Ehksprehsivnasts' rehaktysi genatypaw yachmenyu na wmovy zhywleniya raslinaw*. *Vesti Akademiі Agrarnykh Nauk Belarusi (Belarus)* v. 2 p. 18-27. 5 tables; 10 ref. Byelo Russian. (AGRI 95-051371).**

The expressiveness of barley genotypes responses to the nutrition conditions was determined by the extension of ontogenesis interphase periods and the compensatory effect of grain productivity. The results of investigation are adduced, as well as the methods and formulae of compensatory effects calculation as the criterion for quantitative evaluation of the barley genotypes responses to environmental factors.

2870 Bityutskij, N.P.; Kashchenko, A.S. (1993) **[Phosphorus-containing complexes as effective measure to regulate iron absorption by plant roots [in hydroponics]]. *Fosforsoderzhashchie kompleksy* -**

ehfektivnoe sredstvo regulyatsii kornevogo pitaniya rastenij zhelezom. *Doklady Rossijskoj akademii sel'skokhozyajstvennykh nauk (Russian Federation)* (no.6) p. 15-17. 8 ref. Russian. (AGRS 95-051458).

Theoretical and practical problems of the use of iron complexonates to optimize the mineral nutrition of farm crops in conditions of hydroponics have been studied. It has been shown for the first time that in low-acidic media, phosphorus-containing complexons which formed mid-resistant Fe-complexes were most effective measures to regulate iron absorption by plant roots.

2871 Brennan, RF. (1995) EFFECT OF LEVELS OF TAKE-ALL AND PHOSPHORUS FERTILISER ON THE DRY MATTER AND GRAIN YIELD OF WHEAT. *Journal of Plant Nutrition*. 18(6):1159-1176. English. [DEPT AGR ALBANY HIGHWAY ALBANY WA 6330 AUSTRALIA].

In a field experiment with wheat (*Triticum aestivum* L.), the effect of the percentage severity of take-all on the production of dried tops and grain and the kernel weight (mg/seed) was measured when different amounts of phosphorus (P) fertiliser were applied. The soil was severely P deficient. The amounts of P fertiliser varied from nil P (deficient) to 40 kg P/ha (adequate) applied annually. The levels of *Gaeumannomyces graminis tritici* (Ggt) were generated by four cropping sequences. The levels of percent severity of Ggt on plant roots ranged from low (<10% of wheat plant roots infected) to high (70% of roots infected by Ggt). Yield of dried tops, grain, and kernel weight, all increased as the level of P applied increased, but the amount of Ggt infection decreased. No grain was produced where no P was applied. The percentage increase in yield due to declines in the severity of take-all was greater as the level of P applied increased. Increasing levels of P fertiliser help control the severity of Ggt (%) only where; the initial level of Ggt with nil P fertiliser are moderate to low. Where the levels of Ggt severity are >65% the effectiveness of P in reducing the levels of Ggt severity rapidly declined. The percentage severity of Ggt affected the efficiency of plants to use P fertilisers. For each cropping sequence, a Mitscherlich function described the grain yield response to P fertiliser. The maximum grain yield (A coefficient) and the curvature coefficient (C) both declined with increases in the level of Ggt severity (%). For example, the C was significantly reduced from 0.134+/-0.03 for the least Ggt severity (%) to 0.00446+/-0.001 where Ggt was not controlled. The kernel weight (mg/seed) was increased by P application and decreased by Ggt infection. [References: 32].

2872 Justes, E. (Institut National de la Recherche Agronomique, Fagnieres (France). Centre de Nancy, Agronomie) (1994) [Nitrogen nutrition of wheat: a new tool for diagnosis [nitrate determination in juice at the base of stem]]. *Nutrition azotée du blé: un nouvel outil de diagnostic [détermination de la teneur en nitrate du jus de base de tige de blé]. Perspectives Agricoles (France)* (no 188) p. 17-21. French. (AGRS 95-065412).

2873 Kelly, JT.; Bacon, RK.; Wells, BR. (1995) GENETIC VARIABILITY IN NITROGEN UTILIZATION AT FOUR GROWTH STAGES IN SOFT RED WINTER WHEAT. *Journal of Plant Nutrition*. 18(5):969-982. English. [UNIV ARKANSAS DEPT AGRON FAYETTEVILLE, AR 72701 USA].

Studies were conducted to determine relationships among nitrate reductase activity (NRA), dry weight (DW), nitrogen (N) uptake, and N concentration in soft red winter wheat (*Triticum aestivum* L.). Data were collected for three growing seasons from field plots grown on a silt loam and one growing season on a sandy loam. Ten cultivars were measured under field conditions with plant samples taken at Feekes Growth Stages 6, 10, 10.5, and 11.1. NRA was measured using an in vivo assay method on fully expanded leaves representing the upper most part of the canopy. Results indicated that N uptake was highest during Stages 10.5 to 11.1, although not significantly different for all cultivars. Few differences were found among cultivars for N concentration. The NRA measured under field conditions was more stable at Growth Stage 6. Path coefficients between NRA and DW, N uptake, and N concentration varied considerably depending on the growth stage, indicating that selection for N utilization using one or more of the measurements evaluated in this study should consider the stage of growth. [References: 27].

2874 Kimos, SV.; Mironenko, TG.; Nikiforova, TA.; Kaplan, IB.; Talyanskii, ME.; Atabekov, IG.; Izmailov, SF. (1995) EFFECT OF HUMAN INTERFERON ON NITRATE REDUCTASE ACTIVITY AND PRODUCTIVITY IN BARLEY. *Russian Journal of Plant Physiology*. 42(2):213-

216. English. [RUSSIAN ACAD SCI INST PLANT PHYSIOL UL BOTANICHESKAYA 35 MOSCOW 127276 RUSSIA].

A treatment of spring barley (*Hordeum vulgare* L.) with human alpha-2 interferon enhances the potential activity of nitrate reductase in leaves, induces the accumulation of reduced nitrogen in plants, and increases grain yield without decreasing grain protein content. Possible mechanisms of interferon action on the nitrate reductase activity and plant productivity are discussed. [References: 21].

2875 Mack, G. (1995) ORGAN-SPECIFIC CHANGES IN THE ACTIVITY AND SUBUNIT COMPOSITION OF GLUTAMINE-SYNTHETASE ISOFORMS OF BARLEY (*HORDEUM VULGARE* L.) AFTER GROWTH ON DIFFERENT LEVELS OF NH₄⁺. *Planta*. 196(2):231-238. English. [UNIV GOTTINGEN INST PFLANZENPHYSIOL UNTERE KARSPULE 2 D-37073 GOTTINGEN GERMANY].

One cytosolic glutamine synthetase (GS, EC 6.3.1.2) isoform (GS 1a) was active in the germinating seeds of barley (*Hordeum vulgare* L.). A second cytosolic GS isoform (GS 1b) was separated from the leaves as well as the roots of 10-d-old seedlings. The chloroplastic isoform (GS 2) was present and active only in the leaves. The three GS isoforms were active in N-supplied (NH₄⁺ or NO₃⁻) as well as in N-free-grown seedlings. This indicates (i) that a supply of nitrogen to the germinating seeds was not necessary for the induction of the GS isoforms and (ii) that no nitrogen-specific isoforms appeared during growth of seedlings with different nitrogen sources. The activity of GS, however, depended on the seedlings' nitrogen source: the specific activity was much higher in the leaves and much lower in the roots of NH₄⁺-grown barley than in the respective organs of NO₃⁻-fed or N-free-grown plants. With increasing concentrations of NH₄⁺ (supplied hydroponically during growth), the specific activity of GS 1b increased in the leaves, but decreased in the roots. The activity of GS 2 (leaf) also increased with increasing NH₄⁺ supply, whereas GS 1a activity (leaf and root) was not affected. The changes in the activities of GS 1b and GS 2 were correlated with changes in the subunit compositions of the active holoenzymes: growth at increased levels of external NH₄⁺ resulted in an increased abundance of one of the four GS 2 subunits, and of two of the five GS 1b subunits in the leaves. In the roots, however, the abundance of these two GS 1b subunits was decreased under the same growth conditions, indicating an organ-specific difference either in the expression of the genes coding for the respective GS 1b subunits or in the assembly of the GS 1b holoenzymes. Furthermore, growth at different levels of NH₄⁺ resulted in changes in the substrate affinities of the isoforms GS 1b (root and leaf) and GS 2 (leaf), presumably due to the changes in the subunit compositions of the active holoenzymes. [References: 46].

2876 Paplowskaya, R.S.; Yakimovich, N.A. (Akadehmiya Navuk Belarusi, Minsk (Belarus). Instytut Ehksperymental'nej Botaniki) (1994) [Effect of nitrate and ammonium nutrition on the flavonoids content in barley leaves in different illumination conditions]. *Uplyw nitrata na i amaniynaga zhyvleniya na kol'kasts' flavanoidaw u listakh yachmenyu va wmovakh roznaga asvyatlennya. Vestsi Akadehmii Navuk Belarusi. Seryya Byalagichnykh Navuk (Belarus)* v. 1 p. 18-21. 1 fig.; 13 ref. Byelo Russian. (AGRS 95-051370).

2877 Robson, AD.; Osborne, LD.; Snowball, K.; Simmons, WJ. (1995) ASSESSING SULFUR STATUS IN LUPINS AND WHEAT. *Australian Journal of Experimental Agriculture*. 35(1):79-86. English. [UNIV WESTERN AUSTRALIA FAC AGR NEDLANDS WA 6009 AUSTRALIA].

The effect of sulfur (S) supply on growth and S distribution within lupin and wheat plants was studied in a glasshouse experiment using pots containing 11 lupin or 15 wheat plants in 6 kg soil. Shoot growth and grain yield increased with increasing S supply, and both species produced maximum grain yield at 60 mg S/pot. Wheat yielded a lower percentage of maximum grain yield than lupin where no S was applied. Sulfur concentrations in all shoot parts increased with increasing S supply in both wheat and lupins. In wheat, S concentrations decreased with increasing plant age. At all rates of S, concentrations in old leaves were higher than in the youngest leaves. In lupins, S accumulated in stems when supply was adequate but decreased markedly with S deficiency and plant age. Concentrations in other parts of lupins generally did not change with plant age. Sulfur concentrations in the youngest open leaf blades were higher than those in old leaves at all rates of S. For lupins, critical S concentrations in the young leaves (0.28%), stems (0.07%), and whole shoots (0.15%), and the critical nitrogen (N) to S ratio in young leaves (22), are likely to be valid as

diagnostic indices for S deficiency as they do not appear to be affected by plant maturity. In contrast, critical S concentrations (0.14-0.31% S) and N to S ratio (9-19) in young leaves of wheat plants changed sharply with plant age; neither is useful as a diagnostic aid unless the maturity of the plant is known. Field surveys were conducted in the agricultural regions of Geraldton and Dowerin in Western Australia to investigate the incidence of S deficiency in lupin and wheat crops. Sulfur concentrations in lupins and wheat from Dowerin were higher than those sampled at Geraldton. Lupin crops from both regions and wheat from Dowerin had an adequate S supply. Of the wheat sampled at Geraldton, 36% was deficient or marginal in S. [References: 22].

2878 Roy, SK.; Pradhan, AC. (1994) EFFECT OF METHOD AND TIME OF BORON APPLICATION ON WHEAT (TRITICUM AESTIVUM) PRODUCTION IN TARAI REGION OF WEST BENGAL. *Indian Journal of Agronomy*. 39(4):643-645. English. [DEPT AGRON N BENGAL CAMPUS PUNDIBARI 736165 W BENGAL INDIA].

2879 Sikka, R.; Kansal, BD. (1995) EFFECT OF FLY-ASH APPLICATION ON YIELD AND NUTRIENT COMPOSITION OF RICE, WHEAT AND ON PH AND AVAILABLE NUTRIENT STATUS OF SOILS. *Bioresource Technology*. 51(2-3):199-203. English. [PUNJAB AGR UNIV DEPT AGRON LUDHIANA 141004 PUNJAB INDIA].

A greenhouse experiment was conducted to evaluate the effect of fly-ash application on dry-matter yield and nutrient composition of 60 day-old rice and wheat plants and on pH and available nutrient status of soils. Fly-ash was collected from an old deposit of a thermal power plant and was mixed with seven soils (varying in texture and CaCO₃) each at 0, 2, 4 and 8% (w/w) levels. Moderate rates of fly-ash application (2-4% w/w) had a beneficial effect on the dry-matter yield of paddy, but a higher level (8% w/w) had a significant depressing effect. Addition of fly ash resulted in a significant increase in the contents of N, S, Ca, Na and Fe and a significant decrease in P and Zn contents of rice. The residual effect of fly ash on dry-matter yield and nutrient composition of a subsequent wheat crop was non-significant, except for the Fe content of the wheat plants which increased significantly from 138 ppm in the control to 161 ppm at 8% level of fly-ash addition. The pH and available nutrient status of soils after harvest of the rice and wheat crops were not affected by the application of fly-ash. However, the mean DTPA-extractable Fe content in soils increased significantly from 12 ppm in the control to 18.1 ppm in soils amended with 8% fly-ash. [References: 20].

2880 Stancheva, I.; Dinev, N. (1995) RESPONSE OF WHEAT AND MAIZE TO DIFFERENT NITROGEN SOURCES 2. NITRATE REDUCTASE AND GLUTAMINE SYNTHETASE ENZYME ACTIVITIES, AND PLASTID PIGMENT CONTENT. *Journal of Plant Nutrition*. 18(6):1281-1290. English. [N POUCHKAROV INST SOIL SCI & AGROECOL DEPT MINERAL NUTR POB 1369 BU-1080 SOFIA BULGARIA].

Glutamine synthetase and nitrate reductase enzyme activities occurred both in roots and leaves of maize (*Zea mays* L., hybrid Pioneer 3737) and wheat (*Triticum aestivum* L., cultivar Jantar) plants grown on different nitrogen (N) sources. Enzyme activities and plastid pigment content in maize plants were higher in the treatments with a mixture of nitrate (NO₃) and ammonium (NH₄) than with either N source alone. In wheat plants, plastid pigment content, nitrate reductase activity, and root glutamine synthetase activity were higher in the treatments where NO₃ alone was applied to the nutrient medium. [References: 16].

2881 Sueyoshi, K.; Kleinhofs, A.; Warner, RL. (1995) EXPRESSION OF NADH-SPECIFIC AND NAD(P)H-BISPECIFIC NITRATE REDUCTASE GENES IN RESPONSE TO NITRATE IN BARLEY. *Plant Physiology*. 107(4):1303-1311. English. [WASHINGTON STATE UNIV DEPT CROP & SOIL SCI PULLMAN, WA 99164 USA].

Barley (*Hordeum vulgare* L.) has two, differentially regulated, nitrate reductase (NR) genes, one encoding the NADH-specific NR (Nar1) and the other encoding the NAD(P)H-bispecific NR (Nar7). Regulation of the two NR genes by nitrate was investigated in wild-type Steptoe and in an NADH-specific NR structural gene mutant (Az12). Gene-specific probes were used to estimate NADH and NAD(P)H NR mRNAs. The kinetics of induction by nitrate were similar for the two NR genes; expression was generally below the limits of detection prior to induction, reached maximum levels after 1 to 2 h of induction in roots and 4 to 8 h of induction in leaves, and then declined to steady-state levels. Derepression of the

NAD(P)H NR gene in leaves of the NADH-specific NR gene mutant Az12 did not appear to be associated with changes in nitrate assimilation products or nitrate flux. Nitrate deprivation resulted in rapid decreases in NADH and NAD(P)H NR mRNAs in seedling roots and leaves and equally rapid decreases in the concentration of nitrate in the xylem sap. These results indicate that factors affecting nitrate uptake and transport could have a direct influence on NR expression in barley leaves. [References: 55].

2882 Takahashi, T. (Hokkaido Univ., Sapporo (Japan). Faculty of Agriculture) (1994) Growth phases based on dry matter partitioning and evaluation of productivity in spring wheat [*Triticum aestivum*]. *Memoirs of the Faculty of Agriculture - Hokkaido University (Japan)* v. 19(1) p. 1-56. 12 tables; 45 fig.; 142 ref. Japanese. (AGRIS 95-051405).

2883 Tuori, RP.; Wolpert, TJ.; Ciuffetti, LM. (1995) PURIFICATION AND IMMUNOLOGICAL CHARACTERIZATION OF TOXIC COMPONENTS FROM CULTURES OF PYRENOPHORA TRITICI-REPENTIS. *Molecular Plant-Microbe Interactions*. 8(1):41-48. English. [OREGON STATE UNIV DEPT BOT & PLANT PATHOL CORVALLIS, OR 97331 USA].

To facilitate the genetic analysis of pathogenicity in the wheat-Pyrenophora tritici-repentis interaction, a host-selective toxic protein, designated ToxA, was purified from culture filtrates of this fungus. ToxA was shown to be a 13.2-kDa heat-stable protein which induced visible necrosis in sensitive wheat cultivars at an average minimum concentration of 60 nM. Polyclonal antibodies raised against ToxA were shown by Western analysis and indirect immunoprecipitation to be specific for this protein. Bioassays of immunoprecipitated protein and ToxA protein eluted from polyacrylamide gels indicated that ToxA protein is the toxic agent. Other less abundant necrosis-inducing components that are chromatographically and immunologically distinct from ToxA were also detected in culture filtrates of *P. tritici-repentis*. These components were found in cationic and anionic protein fractions and, like ToxA, induced cultivar-specific necrosis. [References: 15].

2884 Weber, P.; Nussbaum, S.; Fuhrer, J.; Gfeller, H.; Schlunegger, UP.; Brunold, C.; Rennenberg, H. (1995) UPTAKE OF ATMOSPHERIC (NO₂)-N-15 AND ITS INCORPORATION INTO FREE AMINO ACIDS IN WHEAT (TRITICUM AESTIVUM). *Physiologia Plantarum*. 94(1):71-77. English. [FRAUNHOFER INST ATMOSPHER UMWELTFORSCH D-82467 GARMISCH PARTENKIRCHEN GERMANY].

Five-week-old wheat plants were exposed, under controlled environmental conditions, to 60 nl l⁻¹ (NO₂)-N-15 or to purified air. After 48 and 96 h of exposure, leaves, stalks and roots were analysed for N-15-enrichment in alpha-amino nitrogen of soluble, free amino acids. In addition, the in vitro nitrate reductase (NR, EC 1.6.6.1) and nitrite reductase (NiR, EC 1.7.7.1) activities were determined in the leaves. NR activity in the leaves decreased continuously during the 96-h exposure to purified air. In the leaves exposed to (NO₂)-N-15, NR activity increased within the first 24 h, then decreased, and reached the level of controls after 96 h. NiR activity in leaves exposed to purified air was almost constant during the 96-h exposure. In leaves exposed to (NO₂)-N-15, NiR activity increased within the first 48 h, then decreased, and reached the level of controls after 72 h. Exposure to (NO₂)-N-15 enhanced the total content of soluble, free amino acids in all tissues analysed. Most of this increase was attributed to Glu in the leaves and to Asn plus Gin in the stalks and the roots. After 48 h exposure to (NO₂)-N-15 the highest N-15-enrichment in the a-amino group of soluble, free amino acids was observed in the leaves, the lowest enrichment in the roots. The main labelled amino compounds were Glu (with 8.0% N-15 enrichment compared to the control), gamma-aminobutyric acid (GABA; 7.9%), Ala (7.2%), Ser (6.8%), Asp (5.5%) and Gin (4.6%). Appreciable incorporation of N-15 into Asn was not found. After 96 h exposure to (NO₂)-N-15 the N-15 enrichment in the a-amino group of soluble, free amino acids in the leaves declined as compared to the values obtained after 48 h fumigation. The possible pathway and the time course of N-15 incorporation into soluble, free amino acids from the (NO₂)-N-15 absorbed are discussed. [References: 41].

2885 Xu Hengyong; Zhao Junshi (Shandong Provincial Academy of Agricultural Sciences, Jinan (China). Inst. of Crops); Xu Maozhen (1994) Studies on utilization efficiency of solar energy of high-yielding winter wheat. *Journal of Laiyang Agricultural College (China)* v. 11(1) p. 6-10. 3 tables, 5 ref. Chinese. (AGRIS 95-051366).

F62 PLANT PHYSIOLOGY-GROWTH AND DEVELOPMENT

2886 Aggarwal, PK. (1995) UNCERTAINTIES IN CROP, SOIL AND WEATHER INPUTS USED IN GROWTH MODELS - IMPLICATIONS FOR SIMULATED OUTPUTS AND THEIR APPLICATIONS. *Agricultural Systems*. 48(3):361-384. English. [INT RICE RES INST APPA DIV AGROECOL UNIT POB 933 MANILA 1099 PHILIPPINES].

Deterministic crop growth models require several inputs relating to crop/variety, soil physical properties, weather and crop management. The input values used could be significantly uncertain due to random and systematic measurement errors and spatial and temporal variation observed in many of these inputs. Often soil and weather data are approximated using GIS and/or weather generators. In this paper total uncertainty in simulated yield, evapotranspiration and crop N uptake has been quantified considering uncertainties in crop, soil and weather inputs. WTGROWS, a crop model that simulates the effect of genotypic, climatic, edaphic and management factors on productivity of spring wheat was used. The uncertainty in each input was represented by a statistical distribution of values based on literature review, actual measurement and subjective expert judgement. The Monte Carlo simulation technique was used to analyze total uncertainty. The results showed that uncertainties in crop, soil and weather inputs resulted in uncertainty in simulated grain yield, ET and N uptake, which varied depending upon the production environment. Uncertainties in outputs increased as the production system changed from a potential production level to a level where crop growth was constrained by limited availability of water and nitrogen. There was an 80% probability that the bias in the deterministic model outputs was always less than 10% in potential and irrigated production systems. In rainfed environments this bias was larger. The bias in simulated outputs was less than or equal to model error. Most of the uncertainty in outputs caused by variable soil, crop and weather inputs could be represented if the outputs were determined using fixed soil and crop data, and a large series of weather data. In potential and irrigated production systems, inputs relating to crop photosynthesis and leaf area estimation had a large 'uncertainty importance'. Uncertainties in soil N inputs and vapor pressure were also of great importance in irrigated environments. In rainfed environments, uncertainties in soil and weather inputs were dominant and crop parameters had only limited 'uncertainty importance'. The implications of these results in estimates of potential and rainfed productivity, database development and guiding refinement of models are discussed. [References: 33].

2887 Averill, RH.; Apries, T. (1995) THE CONTROL OF RESPIRATION IN WHEAT (*TRITICUM AESTIVUM* L.) LEAVES. *Planta*. 196(2):344-349. English. [UNIV CAMBRIDGE DEPT PLANT SCI DOWNING ST CAMBRIDGE CB2 3EA ENGLAND].

The aim of this work was to discover whether the respiration of wheat (*Triticum aestivum* L. cv. Huntsman) leaves, transferred to darkness after 7 h photosynthesis, showed an initial period of wasteful respiration. For young and old leaves, CO₂ production and O₂, uptake after 7 h photosynthesis were up to 56% higher than at the end of an 8-h night. The maximum catalytic activities of citrate synthase (EC 4.1.3.7), aconitase (EC 4.2.1.3), fumarase (EC 4.2.1.2) and cytochrome-c oxidase (EC 1.9.3.1) at the end of the day did not differ from those at the end of the night. Changes in the contents of glucose 6-phosphate, fructose-1,6-bisphosphate, dihydroxyacetone phosphate, and alpha-ketoglutarate did not as a group parallel the changes in the rate of respiration. The detailed distribution of label from [U-C-14]sucrose supplied to leaves in the dark was similar at the end of the day and the end of the night. No correlation was observed between the rates of leaf respiration and extension growth. It is argued that the higher rate of respiration at the beginning of the night cannot be attributed to wasteful respiration. [References: 23].

2888 Balaguer, L.; Barnes, JD.; Panicucci, A.; Borland, AM. (1995) PRODUCTION AND UTILIZATION OF ASSIMILATES IN WHEAT (*TRITICUM AESTIVUM* L.) LEAVES EXPOSED TO ELEVATED O₃ AND/OR CO₂. *New Phytologist*. 129(4):557-568. English. [UNIV NEWCASTLE UPON TYNE DEPT AGR & ENVIRONM SCI RIDLEY BLDG NEWCASTLE UPON TYNE NE1 7RU TYNE & WEAR ENGLAND].

This study examined the effects of elevated ozone (O₃) and/or carbon dioxide (CO₂) on the diel allocation of photosynthetically fixed carbon in

fully expanded leaves of young (growth stages 4-5) spring wheat (*Triticum aestivum* L. cv. Hanno). Plants were grown in controlled environment chambers and exposed to two O₃ regimes ['non-polluted' air (CF), < 5 nmol mol⁻¹; 'polluted' air, CF + 75 nmol mol⁻¹ 7 h d⁻¹] and two CO₂ treatments ('ambient', 354 μmol mol⁻¹; 'elevated', 700 μmol mol⁻¹) over a 30 d period. Neutral sugars (predominantly sucrose) were found to be the most abundant form of carbohydrate accumulated by leaves during the day, but significant quantities of starch and high degree of polymerization (d.p.) fructans were also present. Elevated concentrations of O₃ and/or CO₂ were found to have marked effects on diel patterns of export, storage and respiration, whilst the proportions of fixed carbon allocated to each of these processes were broadly similar. O₃ depressed the rate of net CO₂ assimilation (-20%) and reduced stomatal conductance (-19%). This was reflected in a reduced amount of carbohydrate accumulated in, and exported by, source tissue during the day. Effects of O₃ on the rate of CO₂ fixation were aggravated by an increased demand for carbon by dark respiratory processes. In contrast, doubling the atmospheric concentration of CO₂ enhanced the rate of net CO₂ assimilation (+47%) and reduced the proportion of fixed carbon retained in the leaf blade, increasing the rate of export. The favourable carbon balance of CO₂ enriched leaves was further enhanced by a decrease in the cost of maintenance respiration, whilst simultaneous measurements of CO₂ efflux and O₂ uptake at night suggested a shift in the substrates metabolized at high CO₂. Effects of elevated CO₂ and O₃ on the carbon balance of individual leaf blades over a single 24 h light/dark cycle were entirely consistent with the cumulative effects of the gases on plant growth over a 30 d period. O₃ reduced the rate of plant growth (-10%), but there were differential effects of O₃ on the growth of root and shoot which exacerbated the decrease in assimilate availability induced by O₃. In contrast the favourable effects of CO₂ enrichment on the carbon balance of individual source leaves was reflected in the enhanced accumulation of dry matter in existing sinks, and the initiation of new sinks (i.e. increased tillering). In the combined treatment (elevated CO₂ + O₃), O₃ counteracted the favourable effects of CO₂ enrichment on the carbon balance of individual leaves, and the combined effects of the individual gases on the diel partitioning of photosynthetically fixed carbon in fully expanded leaf blades was reflected in a decreased rate of plant growth at elevated CO₂, a situation further exacerbated by O₃-induced shifts in the relative partitioning of carbon between root and shoot. There was no evidence that CO₂ enrichment afforded additional protection against O₃ damage: the extent of the O₃-induced reduction in photosynthesis, carbohydrate availability and growth observed at elevated CO₂ was similar to that induced by O₃ in ambient air, despite additive effects of the gases on stomatal conductance that would reduce the effective dose of O₃ by approximate to 30%. The wider ecological significance of interactions between elevated CO₂ and O₃ is discussed in the light of other recent findings. [References: 58].

2889 Balota, M.; Saulescu, N.N. (Research Institute for Cereals and Industrial Crops, Fundulea (Romania)) (1994) Membrane thermostability of some Romanian winter wheat genotypes. *Romanian Agricultural Research (Romania)* (no.1) p. 37-40. 5 tables; 1 graph; 12 ref. English. (AGRS 95-051577).

The membrane thermostability (MT) test on seedlings suggested by SAADALLA et al. (1990) was modified by growing the seedlings at room temperature and changing the hardening duration and heat test temperature and duration, to make it more rapid and convenient. Significant differences in MT were found among tested Romanian wheat genotypes. Genotype ranking for MT corresponded well with the ranking based on previous field observations on grain plumpness under heat.

2890 Bandurska, H.; Gniazdowskaskoczek, H. (1995) CELL MEMBRANE STABILITY IN TWO BARLEY GENOTYPES UNDER WATER STRESS CONDITIONS. *Acta Societatis Botanicorum Poloniae*. 64(1):29-32. English. [ACAD AGR POZNAN DEPT PLANT PHYSIOL WOLYNSKA 35 PL-60637 POZNAN POLAND].

The effect of water stress induced in vitro by polyethylene glycol 6000 (PEG) and under drought stress on cell membrane stability was examined in two barley genotypes, the cultivar Aramir and line R567. The injury of cell membranes was markedly influenced by leaf age, leaf position on the stem, and the degree of drought stress. The differences in percentage of injury to cell membrane between these genotypes were also found. The cv. Aramir exhibited a lower percentage injury value as compared to line R567, measured in vitro by PEG test. Similarly, under drought stress the cv.

Aramir showed higher cell membrane stability than the line R567, even in severe stress. The results indicated also that both genotypes differ in the ability to adjust their cell membranes to water stress.

2891 Bernardin, J.E.; Witt, S.C.; Milenic, J. (United States Dept. of Agriculture, Albany (USA). ARS WRR) (1994) Storage protein synthesis in the wheat endosperm at elevated temperature. [Conference abstract]. 44. Royal Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 499-500. English. (AGRIC 95-051574).

2892 Bietz, J.A.; Schmalzried, E. (1995) CAPILLARY ELECTROPHORESIS OF WHEAT GLIADIN - INITIAL STUDIES AND APPLICATION TO VARIETAL IDENTIFICATION. *Food Science & Technology-Lebensmittel-Wissenschaft & Technologie*. 28(2):174-184. English. [USDA ARS NATL CTR AGR UTILIZAT RES 1815 N UNIV ST PEORIA, IL 61604 USA].

Wheat gluten proteins have important functional properties, and are reliable indicators of genotype. They are also very heterogeneous, demanding use of powerful analytical techniques. Gel electrophoresis methods are widely used for gluten analysis, but they are labor-intensive, and their delta are not easily quantified. Methods of capillary electrophoresis (CE) are now available that promise to overcome these disadvantages. We here report successful application and optimization of two CE procedures for gliadin analysis. The first procedure used 0.06 mol/L sodium borate buffer pH 9.0, containing 200 mL/L acetonitrile + 10 g/L sodium dodecyl sulfate; separations were excellent, but reproducibility was difficult to maintain. The second buffer 0.1 mol/L phosphate, pH 2.5, containing a linear hydrophilic polymer, overcame this problem, providing separations of gliadins that are rapid, high-resolution, automatic, and easily quantified. CE analyses of gliadin also reliably differentiate varieties of all U.S. wheat classes. CE is thus a valuable technique for gliadin analysis, complementary to other methods of electrophoresis and chromatography. CE has much potential to become a routine tool for wheat varietal identification and classification, and for prediction of quality. [References: 32].

2893 Bingham, IJ. (1995) A COMPARISON OF THE DYNAMICS OF ROOT GROWTH AND BIOMASS PARTITIONING IN WILD OAT (AVENA FATUA L.) AND SPRING WHEAT. *Weed Research*. 35(1):57-66. English. [SCOTTISH AGRICULTURAL COLLEGE CROFT BUIOIL 581 KING ST ABERDEEN AB9 1UD SCOTLAND].

The dynamics of early root growth and dry matter partitioning were compared in spring wheat (*Triticum aestivum* L.) and wild oat (*Avena fatua* L.) grown in solution culture. Total root length was greater in wheat than wild oat throughout the experiment; a result of a greater number of seminal axes and greater production of lateral root length per axis. The final number of adventitious roots was greater in wheat than in wild oat, but their length was similar. Relative growth rates were also similar as was shoot:root dry weight ratio and rate of root respiration. However, wheat used the dry matter partitioned to its roots more efficiently, producing a greater specific root length (SRL, length per unit weight). Caution must be exercised when relating these results to plants growing and competing in the field, but three general points are raised. First, the initial number of seminal axes can have a profound effect on the rate of early root development; second, the adventitious root system of wild oat is not inherently more vigorous than that of wheat; and third, future studies should compare SRL of wheat and wild oat in the field. If differences similar to those in the present study are found they may contribute to the greater competitive ability of wheat. [References: 32].

2894 Brady, D.J.; Wenzel, C.L.; Fillery, I.R.P.; Gregory, P.J. (1995) ROOT GROWTH AND NITRATE UPTAKE BY WHEAT (TRITICUM AESTIVUM L.) FOLLOWING WETTING OF DRY SURFACE SOIL. *Journal of Experimental Botany*. 46(286):557-564. English. [CORNELL UNIV US PLANT SOIL & NUTR LAB TOWER RD ITHACA, NY 14853 USA].

The nitrate uptake capacity of surface roots of spring wheat (*Triticum aestivum* L. cv. Kulini) was investigated following wetting of dry surface soil. Plants were grown to stem elongation stage with adequate watering at depth while the surface soil was allowed to dry. Eight weeks after sowing, water or a N-15-nitrate solution was added to the surface soil to simulate rainfall. Root growth and nitrate uptake were measured up to 4 d after wetting on plants with unconfined nodal root growth and on plants with the majority of nodal roots confined within small vials. Prior to wetting,

plants from both nodal treatments had seminal roots with collapsed cortices along the upper 10 cm and many short, viable lateral roots. Nodal roots, where present, were only a few cm long and unbranched. Only plants with unconfined nodal roots were able to take up nitrate within the 24 h before any new root growth. By 2 d after wetting there was significant growth of the seminal lateral roots, and rapid growth and branching of nodal roots. From 2 d after wetting, plants with confined nodal roots also took up nitrate, presumably due to the growth of the seminal lateral roots. Hence it appears as though the nodal roots in the unconfined treatment could immediately take up nitrate, but the seminal roots required new lateral root growth to become active in nitrate uptake. The plants with confined nodal roots had a lower nitrate uptake than those with unconfined nodal roots 4 d after wetting, indicating that the seminal root system was not able to compensate for lack of nodal roots. Insufficient nitrate was taken up after 4 d, by plants from either nodal root treatment, to increase the shoot N concentration significantly. [References: 25].

2895 Briggs, D.E. (School of Biochemistry, University of Birmingham, Birmingham B15 2TT (United Kingdom)) (1992) Overcoming dormancy in malting barley. *HGCA Project Report (United Kingdom)*; no. 61 54 p. Home Grown Cereals Authority. 26 ref. English. (AGRIC 95-065562).

2896 Briggs, D.E.; Woods, J.L. (Birmingham Malting and Brewing Group, School of Biochemistry, University of Birmingham, Birmingham B15 2TT (United Kingdom)) (1993) Dormancy in malting barley: studies on drying, storage, biochemistry and physiology. *HGCA Project Report (United Kingdom)*; no. 84 148 p. Home Grown Cereals Authority. 60 ref. English. (AGRIC 95-065527).

2897 Bukhov, NG.; Bondar, V.V.; Drozdova, IS. (1995) LONG-TERM EFFECTS OF BLUE OR RED LIGHT ON ATP AND ADP CONTENTS IN PRIMARY BARLEY LEAVES. *Planta*. 196(2):211-216. English. [RUSSIAN ACADEMY OF SCIENCES INSTITUTE OF BOTANICAL SCIENCES 35 MOSCOW 127276 RUSSIA].

Levels of ATP and ADP were studied in primary leaves of barley (*Hordeum vulgare* L. cv. Viner) seedlings grown under blue (BL) or red light (RL) of various irradiances. In mature leaf segments, BL stimulated a greater accumulation of adenylates than RL. Transfer of barley seedlings from RL to BL for 48 h caused about a twofold increase in the content of adenylates, probably due to de-novo synthesis of adenine nucleotides. Weak BL was found to stimulate an increase in the adenylate content and a higher irradiance enhanced the stimulatory effect. The adenylate content increased markedly from the base towards the tip of barley leaves grown under BL but not in those grown under RL. However, the adenylate content was higher in the basalmost segment of barley leaves grown under RL, indicating that the action of RL on adenylate content proceeded more rapidly than that of BL. The same conclusion could be drawn from the results of experiments with de-etiolated leaves. A linear relationship was established between the maximum rate of CO₂ fixation and the ATP or ADP content in mature segments of primary barley leaves. The possible involvement of two photoreceptors, phytochrome and cryptochrome, in the long-term light regulation of the total content of adenylates in primary barley leaves is discussed. [References: 28].

2898 Caycedo Arias, Rodolfo; Morales Rodriguez, B. (1993) [Evaluation of the physiological quality of five genotypes of wheat (*Triticum aestivum* L.) produced in four localities of Boyaca and Cundinamarca, Colombia]. Evaluacion de la calidad fisiologica de cinco genotipos de trigo (*Triticum aestivum* L.) producidas en cuatro localidades de Boyaca y Cundinamarca. Universidad Nacional de Colombia. Facultad de Agronomia, Santa Fe de Bogota (Colombia). il., tabs., fotos. 96 p. Spanish. (AGRIC 95-051622).

2899 Chi, L.Q.; Tessier, S. (1995) A PORTABLE MICRO-PENETROMETER FOR MEASURING SEED ROW COMPACTION. *Soil & Tillage Research*. 34(1):27-39. English. [UNIV LAVAL DEPT GENIE RURAL QUEBEC CITY PQ G1K 7P4 CANADA].

The soil mechanical properties of a seedbed have significant influence on the emergence and early root growth of crops. A portable micro-penetrometer unit was designed and built at Universite Laval for field studies of soil resistance to coleoptile and radicle growth. The unit consists of 11 sleeve-type probes placed 10 mm apart and fitted with 2.5 mm diameter cone tips. An electronically controlled hydraulic system can push the probes into the soil at five different speeds. A datalogger is used to

control the operation and to sample penetration resistance and depth. Satisfactory performance was observed during field experiments. The designed probe load sensor showed a high accuracy of penetration resistance measurement with a relative error of less than 0.6%. No interaction between adjacent probes was detected during the experiments. The effect of penetration rate seems negligible with these sleeve-type probes. [References: 24].

2900 Couvreur, F. (Institut Technique des Cereales et des Fourrages, Paris (France)); Gate, P. (1993) [Small grain cereals. Studying plant hormones]. *Cereales a paille. Les hormones vegetales a l'etude. Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France) (no 125) p. 45-48. 7 ref. French. (AGRIS 95-065586).*

2901 Duchateau, N.; Bortlik, K.; Simmen, U.; Wiemken, A.; Bancal, P. (1995) SUCROSE-FRUCTAN 6-FRUCTOSYLTRANSFERASE, A KEY ENZYME FOR DIVERTING CARBON FROM SUCROSE TO FRUCTAN IN BARLEY LEAVES. *Plant Physiology*. 107(4):1249-1255. English. [INRA CTR RECH GRIGNON AGRON STN F-78850 THIVERVAL GRIGNON FRANCE].

Sucrose:sucrose 6-fructosyltransferase, an enzyme activity recently identified in fructan-accumulating barley (*Hordeum vulgare*) leaves, was further characterized. The purified enzyme catalyzed the transfer of a fructosyl group from sucrose to various accepters. It displayed some beta-fructosidase (invertase) activity, indicating that water could act as fructosyl acceptor. Moreover, it transferred the fructosyl residue of unlabeled sucrose to [U-C-14]Glc, producing [U-C-14]sucrose and unlabeled glucose. Most significantly for fructan synthesis, the enzyme used as accepters but not as donors a variety of oligofructans containing beta(2->1)- and beta(2->6)-linked fructosyl moieties. Thus, it acted as a general sucrose:fructan fructosyltransferase. The products formed by the enzyme from sucrose and various purified, structurally characterized oligofructans were analyzed by liquid chromatography and identified by comparison with structurally characterized standards. The results showed that the enzyme formed exclusively beta(2->6) fructosyl-fructose linkages, either initiating or elongating a fructan chain of the phlein type. We propose, therefore, to rename the purified enzyme sucrose:fructan 6-fructosyltransferase. [References: 28].

2902 Dumas, B.; Freyssinet, G.; Pallett, KE. (1995) TISSUE-SPECIFIC EXPRESSION OF GERMIN-LIKE OXALATE OXIDASE DURING DEVELOPMENT AND FUNGAL INFECTION OF BARLEY SEEDLINGS. *Plant Physiology*. 107(4):1091-1096. English. [RHONE-POULENC AGRO DEPT BIOTECHNOL BP 9163 F-69263 LYON 09 FRANCE].

Oxalate oxidase activity was detected in situ during the development of barley seedlings. The presence of germin-like oxalate oxidase was confirmed by immunoblotting using an antibody directed against wheat germin produced in *Escherichia coli*, which is shown to cross-react with barley (*Hordeum vulgare*) oxalate oxidase and by enzymatic assay after electrophoresis of the protein extracts on polyacrylamide gels. In 3-d-old barley seedlings, oxalate oxidase is localized in the epidermal cells of the mature region of primary roots and in the coleorhiza. After 10 d of growth, the activity is detectable only in the coleorhiza. Moreover, we show that oxalate oxidase is induced in barley leaves during infection by the fungus *Erysiphe graminis* f. sp. *hordei* but not by wounding. Thus, oxalate oxidase is a new class of proteins that responds to pathogen attack. We propose that oxalate oxidase could have a role in plant defense through the production of H₂O₂. [References: 35].

2903 Fujita, M. (Kyushu National Agricultural Experiment Station, Chikugo, Fukuoka (Japan)); Ujihara, K. (1993) Some traits correlated with high yielding ability of wheat (*Triticum aestivum*) in the south-western area of Japan. *Bulletin of the Kyushu National Agricultural Experiment Station (Japan) v. 28(1) p. 29-43. 10 tables; 1 fig.; 15 ref. Japanese. (AGRIS 95-051626).*

For breeding high yielding wheat cultivars in the south-western area of Japan, some traits correlated with high yielding ability were investigated based on growth analysis using 16 genotypes of Japanese and foreign wheat cultivars. 1. Among the genotypes used, the recently developed south-western Japanese cultivars were early-maturing and showed high yield, because they had short-strong culms, and high harvest indexes (HI). On the other hand, foreign cultivars had large grains, large ears, erect leaves and high dry matter production. Some of them yielded more than Nishikaze-Komugi, which was the high yielding cultivar in the south-western area of

Japan, because of their high dry matter production in spite of low HI. 2. Yield was correlated with the leaf area duration, crop growth ratio (CGR) and the increase in ear weight except for the period of translocation from stem and leaf sheath during grain filling, and was not correlated with HI. Therefore, in order to increase yield, high CGR must be maintained until maturing. 3. High photosynthetic cultivars had dense leaf color and erect leaves. It seems that the thickness of the leaf affected leaf photo-synthesis. 4. For breeding of high yielding cultivars, foreign cultivars can be used as cross parent for gene sources of some traits correlated with high yielding ability, such as high dry matter production, large grains and erect leaves.

2904 Fujita, M.; Taniguchi, Y.; Ujihara, K.; Sasaki, A. (1995) EAR PRIMORDIA DEVELOPMENT AND STEM ELONGATION OF NEAR-ISOGENIC LINES FOR VERNALIZATION REQUIREMENT IN EXTREMELY-EARLY MATURING WHEAT CULTIVARS (*TRITICUM AESTIVUM* L.) [Japanese]. *Breeding Science*. 45(1):97-104. Japanese. [MAFF KYUSHU NATL AGR EXPT STN CHIKUGO FUKUOKA 833 JAPAN].

Early maturity has been one of the important breeding objectives in wheat (*Triticum aestivum* L.) in the southwestern part of Japan, because this trait is suitable for double cropping with summer crops such as rice, and for avoiding pre-harvest sprouting which often occurs in the rainy season. However, early maturing cultivars are usually spring type cultivars which are prone to sustain frost damage in early spring because of their earliness in ear primordia initiation and stem elongation. To develop early maturing wheat cultivars with tillers that can avoid frost damage, winter type near-isogenic lines were bred for the extremely early maturing spring cultivars Asakazekomugi and Saikai 157 (later registered as "Abukumawase") by backcrossing to a winter type cultivar Ebisukomugi (Fig. 1). Compared with the recurrent spring cultivars, ear primordia initiation and stem elongation were clearly late in the winter type near-isogenic lines (BC5F4 or BC5F5). These differences were distinct in warm winter (Tables 2, 3, 4, Fig. 3), and thus winter types are considered to be able to avoid late frost in early spring. Heading date of the winter types was 6 or 2 days later than that of recurrent spring cultivars in warm winter (1992/93) (Table 3). However, this difference was 2 or 0 days in standard winter weather (1993/94) (Table 4). The values of grain yield, 1,000 grain weight, test weight, spike number and spikelet number per spike in the winter types (BC4F4) were almost the same as those of the recurrent parent (Table 5). These results indicated that early heading and maturing wheat cultivars with tillers that can avoid frost could be developed by genetic improvement of the vernalization requirement.

2905 Galili, G.; Altschuler, Y.; Levanony, H.; Giorinisilfen, S.; Shimoni, Y.; Shani, N.; Karchi, H. (1995) ASSEMBLY AND TRANSPORT OF WHEAT STORAGE PROTEINS. *Journal of Plant Physiology*. 145(5-6):626-631. English. [WEIZMANN INST SCI DEPT PLANT GENET IL-76100 REHOVOT ISRAEL].

Following sequestration into the endoplasmic reticulum (ER), the storage proteins of wheat (*Triticum aestivum* L.) may either be retained and packaged into protein bodies (PB) inside the organelle or be exported to the Golgi complex. To unravel the signals and mechanisms regulating the assembly and sorting of these proteins within the ER, we expressed wild type and mutant forms of a gamma type gliadin in *Xenopus* oocytes. A considerable amount of the wild type gamma-gliadin was secreted via the Golgi into the medium, while still a significant proportion was retained within the ER of the oocytes where it assembled into dense PB. A deletion mutant of the gamma-gliadin, encoding only the N-terminal region, which is composed of tandem repeats of a consensus PQQPFQ sequence, was entirely retained within the oocytes, while another deletion mutant encoding only the C-terminal unique-sequence region of this protein was entirely secreted. Retention of the gamma-gliadin within the ER could not be explained by rapid precipitation or assembly into insoluble deposits inasmuch as protein could diffuse rather efficiently within the organelle for several hours. In contrast, mutants of the gamma-gliadin, lacking specific conserved cysteines in the C-terminal region, were entirely retained within the oocytes and were unable to diffuse within the ER. We thus hypothesize that the assembly and sorting of wheat gliadins within the ER are determined by concerted interactions between the N and C-terminal regions of these proteins with ER resident proteins. [References: 22].

2906 Guerra, AF. (1995) SOIL-WATER TENSION - EFFECT ON YIELD AND GRAIN QUALITY OF BARLEY. *Pesquisa Agropecuaria Brasileira*. 30(2):245-254. Portuguese. [CTR PESQUISAS AGROPECUARIA

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The objective of this work was to study the effect of three levels of soil-water tension (187, 824 and 1.000 kPa) in three stages of development of barley (*Hordeum vulgare*, L.) (stage I = emergency to initial tillering, stage II = initial tillering to complete flowering and stage III = complete flowering to hard dough grain) on the crop development, yield, and grain quality. During stage I, all treatments were irrigated at 187 kPa. Due to plant lodging in earlier studies, a well-irrigated treatment (187 kPa) in which cycocel was applied. The crop was irrigated when the soil-water tension at 10 cm depth reached the values of each treatment. The amount of water applied in each irrigation was calculated to bring the soil profile 1 m depth to the field capacity (6 kPa). Irrigation at 187 kPa in all the crop cycle resulted in higher yield independently of cycocel application. Irrigation at 824 kPa in at least one developmental stage resulted in a significative reduction in yield. Nevertheless, the grain protein content was adequate for malting. Irrigation at 1.000 kPa caused a drastic reduction in yield and grain quality. Irrigation at 824 kPa in stage II caused a reduction of plant height similar to cycocel application.

2907 Gusakovskaya, M.A.; Mokhammad Ali Nadzhar (1994) [Gynogenesis in culture of unfertilized ovary and ovule in wheat]. *Ginogenez v kul'ture neoplodotvorennykh zavyazej i semyapochek pshenitsy. Botanicheskij zhurnal (Russian Federation) v. 79(1) p. 70-79. Bibliography p. 78-79. Russian. (AGRS 95-065591).*

2908 Hay, RKM. (1995) HARVEST INDEX - A REVIEW OF ITS USE IN PLANT BREEDING AND CROP PHYSIOLOGY [Review]. *Annals of Applied Biology*. 126(1):197-216. English. [SCOTTISH AGR SCI AGCY E CRAIGS EDINBURGH EH12 8NJ MIDLOTHIAN SCOTLAND].

This review charts the use of the concept of harvest index in crop improvement and physiology, concentrating on the literature from the last 20 years. Evidence from abstract journals indicates that the term has been applied most to small grain cereal crops and pulses, in India, Western Europe and the USA, and that it has been less useful for maize and tuber crops. Standard methods of measuring harvest index, the associated problems of measurement and interpretation, and representative values for a range of world species are reviewed. The values for modern varieties of most intensively-cultivated grain crops fall within the range 0.4 to 0.6. Variation between varieties of the same species is illustrated by trends in the harvest indices of old, outclassed and recent varieties of temperate and mediterranean wheat and barley (compared under uniform conditions); this shows a progressive increase throughout the present century, although improve ment has been much slower in Australia and Canada than in the UK. In most cases, the improvement in harvest index has been a consequence of increased grain population density coupled with stable individual grain weight. The high heritability of harvest index is explored by examining its (rather weak) response to variation in environmental factors (fertilisation, population density, application of growth regulators) in the absence of severe stress. A fuller perspective is gained by reviewing aspects of the harvest index of rice, maize and tropical pulses. With rice, attention must be paid to the fact that the adhering lemma and palea (not primarily part of economic yield) can make up 20% of grain weight; and there are important interactions among biomass, grain yield and season length. Maize differs from most small grain crops in that harvest index (in N. American varieties) was already high at the start of this century, and increases in yield potential have been largely the consequence of increased biomass production. The harvest index of many pulse species and varieties tends to be low because selection has been for some yield in all seasons. Extension of the harvest index concept to express the partitioning of mineral nutrients as well as dry matter (e.g. the nitrogen harvest index) has provided a range of responses whose implications for production and breeding remain to be explored. It is concluded that even though the principal cereal crops appear to be approaching the upper limit of harvest index, and future yield gains will have to be sought by increased biomass production, there will still be a need for the concept of harvest index as a tool in interpreting crop response to different environments and climatic change. [References: 118].

2909 He, JX.; Wang, J.; Liang, HG. (1995) EFFECTS OF WATER STRESS ON PHOTOCHEMICAL FUNCTION AND PROTEIN METABOLISM OF PHOTOSYSTEM II IN WHEAT LEAVES. *Physiologia Plantarum*. 93(4):771-

777. English. [LANZHOU UNIV DEPT BIOL LANZHOU 730000 PEOPLES REPUBLIC OF CHINA].

The effects of osmotic dehydration in wheat leaves (*Triticum aestivum* L. cv. Long chun No. 10) on the photochemical function and protein metabolism of PSII were studied with isolated thylakoid and PSII membranes. The results indicated that PSII was rather resistant to water stress as mild water deficit in leaves did not significantly affect its activity. However, extreme stress conditions such as 40% decrease in relative water content (RWC) or 1.8 MPa in water potential ($\Psi(w)$) caused ca 50% reduction in O-2 evolution and ca 25% inhibition of DCIP (2,6-dichlorophenol indophenol) photoreduction of PSII. In addition, it was found that the inhibited DCIP photoreduction of PSII could not be reversed by DPC (2,2-diphenylcarbazide), a typical electron donor to PSII, suggesting that water stress did not affect electron donation to PSII. Urea-SDS-PAGE and western blot analysis showed that the steady state levels of major PSII proteins, including the D1 and D2 proteins in the PSII reaction center, declined on a chlorophyll basis with increasing water stress, possibly as a result of increased degradation. In vitro translation experiments and quantitative analysis of chloroplast RNAs indicated that the potential synthesis of chloroplast proteins from their mRNAs was impaired by water stress. From the results it is concluded that the effects of water stress on PSII protein metabolism, especially on the reaction center proteins, may account for the damage to PSII photochemistry. [References: 26].

2910 Huang, BR.; Johnson, JW. (1995) ROOT RESPIRATION AND CARBOHYDRATE STATUS OF TWO WHEAT GENOTYPES IN RESPONSE TO HYPOXIA. *Annals of Botany*. 75(4):427-432. English. [UNIV GEORGIA DEPT CROP & SOIL SCI GEORGIA STN GRIFFIN, GA 30223 USA].

To investigate root respiration and carbohydrate status in relation to waterlogging or hypoxia tolerance, root respiration rate and concentrations of soluble sugars in leaves and roots were determined for two wheat (*Triticum aestivum* L.) genotypes differing in waterlogging-tolerance under hypoxia (5% O-2) and subsequent resumption of full aeration. Root and shoot growth were reduced by hypoxia to a larger extent for waterlogging-sensitive Coker 9835. Root respiration or oxygen consumption rate declined with hypoxia, but recovered after 7 d of resumption of aeration. Respiration rate was greater for sensitive Coker 9835 than for tolerant Jackson within 8 d after hypoxia. The concentrations of sucrose, glucose and fructose decreased in leaves for both genotypes under hypoxia. The concentrations of these sugars in roots, however, increased under hypoxia, to a greater degree for Jackson. An increase in the ratio of root sugar concentration to shoot sugar concentration was found for Jackson under hypoxic conditions, suggesting that a large amount of carbohydrate was partitioned to roots under hypoxia. The results indicated that root carbohydrate supply was not a limiting factor for root growth and respiration under hypoxia. Plant tolerance to waterlogging or hypoxia appeared to be associated with low root respiration or oxygen consumption rate and high sugar accumulation under hypoxic conditions. [References: 21].

2911 Jamieson, PD.; Brooking, IR.; Porter, JR.; Wilson, DR. (1995) PREDICTION OF LEAF APPEARANCE IN WHEAT - A QUESTION OF TEMPERATURE. *Field Crops Research*. 41(1):35-44. English. [NEW ZEALAND INST CROP & FOOD RES LTD PRIVATE BAG 4704 CHRISTCHURCH NEW ZEALAND].

The rate of leaf appearance in wheat depends on temperature. When the rate is expressed in thermal time based on air temperature, a marked contrast is apparent between autumn and spring sowings. This variation has often been attributed to a preconditioning response that determines the thermal phyllochron at about the time of emergence, either directly through an effect of daylength or its rate of change. However, in this paper we show that invoking such a response is unnecessary. Leaf appearance rate was found to be well predicted based only on temperature near the apical meristem (near-surface soil temperature until stem extension began, then canopy temperature) and leaf number. It was not necessary to include a response to daylength or its rate of change. A model of leaf appearance based on estimates of near-surface soil temperature and canopy temperature gave superior predictions than others based on air temperature alone or modified by rate of change of daylength. [References: 50].

2912 Jiang Hongming; Li Qingqi (Shandong Agricultural Univ., Taian (China). Dept. of Agronomy) (1993) Comparison of maturing phases of

high yield wheat varieties. *Journal of Shandong Agricultural University (China)* v. 24(4) p. 437-445. 5 ill., 5 tables, 11 ref. Chinese. (AGRIS 95-051623).

2913 Keutgen, N.; Roeb, G.W.; Minchin, P.E.H.; Fuhr, F. (1995) USE OF TRANSFER FUNCTION AND COMPARTMENTAL ANALYSIS TO QUANTIFY C-11-LABELLED PHOTOASSIMILATE EXPORT FROM WHEAT LEAVES. *Journal of Experimental Botany*. 46(286):489-496. English. [KFA JULICH GMBH RES CTR INST RADIOAGRON D-52425 JULICH GERMANY].

Compartmental analysis of tracer loss from a leaf after pulse-labelling with carbon isotopes has often been used to infer the flow of photosynthate through the leaf. Recently, a more general approach has been suggested based upon estimation of the transfer function using data from pulse-labelling as well as continuous-labelling experiments. A comparison of these two approaches shows that with the same data set they give equivalent physiological interpretations. The measured decline of C-11 activity from a wheat leaf after (CO₂)-C-11 pulse-labelling was extrapolated by compartmental as well as transfer function analysis. Both methods estimated a 66.4% loss of the initially fixed C-11 due to export and respiration. The advantage of transfer function analysis, however, is its applicability to continuous-labelling experiments. The model allows the use of the net photosynthetic rate as the reference (100%) value. Data from continuous-labelling experiments with wheat plants indicate diurnal variations in the export of freshly labelled assimilate of between 32.7% and 43.6% of net photosynthesis. [References: 25].

2914 Knight, C.D.; Sehgal, A.; Atwal, K.; Wallace, J.C.; Cove, D.J.; Coates, D.; Quatrano, R.S.; Bahadur, S.; Stockley, P.G.; Cuming, A.C. (1995) MOLECULAR RESPONSES TO ABSCISIC ACID AND STRESS ARE CONSERVED BETWEEN MOSS AND CEREALS. *Plant Cell*. 7(5):499-506. English. [UNIV LEEDS DEPT GENET LEEDS LS2 9JT W YORKSHIRE ENGLAND].

Promoter elements from the wheat *Em* gene have been characterized. These elements are inducible by abscisic acid (ABA) and by osmotic stress. In this study, we demonstrated that the same promoter elements function in a distantly related plant species, the moss *Physcomitrella patens*. Transient and stable expression of the beta-glucuronidase reporter gene was used to determine that the heterologous wheat promoter also responds to osmotic stress and ABA in moss. Mutational analysis of the promoter indicated that the mechanism of gene regulation is conserved in both species. Gel retardation and DNase I footprint analyses were conducted to characterize further the interaction of moss transcription factors with the *Em* promoter. In addition, the synthesis of stress-related polypeptides in moss was observed. The evolutionary significance of these data and the potential for studying the entire ABA perception-response pathway in moss are discussed. [References: 39].

2915 Kumar, A.; Sharma, D.K.; Sharma, H.C. (1995) WATER AND NITROGEN NEEDS OF WHEAT (*TRITICUM AESTIVUM*) IN SODIC SOIL. *Indian Journal of Agricultural Sciences*. 65(5):323-327. [INDIAN AGR RES INST DIV AGRON NEW DELHI 110012 INDIA].

A field experiment was conducted during the winter season of 1990-91 and 1991-92 to evaluate the effect of irrigation and nitrogen on wheat (*Triticum aestivum* L. emend. Fiori & Paol.) grown on sodic soil. Frequent irrigation at 1.2 irrigation water depth : cumulative pan evaporation (IW : CPE) ratio (IW = 50 mm) with 180 kg N/ha gave the highest grain yield of wheat (4 091 kg/ha). The rate of water use per day increased with advance in age, reaching the peak value of 3.58 mm/day during 60-90 days and was higher in irrigated crop (4.97 mm/day) under 1.2 IW : CPE ratio than in the unirrigated (1.89 mm/day). More moisture was extracted from deeper layer (60-120 cm) under unirrigated condition than under irrigated condition. N application increased the moisture depletion from 0-60 cm soil depth. The nitrate-nitrogen content of the soil was more under unirrigated condition than under irrigated one. It decreased with increase in irrigation frequency, but increased with higher level of N. At harvest, it was higher in 15-30 cm than in 0-15 cm soil layer under 0.9 and 1.2 IW : CPE ratios.

2916 Lakatos, L. (1994) ESTIMATION OF WET GLUTEN PROPORTION OF WINTER WHEAT ON THE BASES OF METEOROLOGICAL PARAMETERS. *Novenytermeles*. 43(6):499-511. Hungarian. [AGR EGYETEM DEBRECEN PF 36 H-4015 DEBRECEN HUNGARY].

The dynamic model developed by us helps to describe the dry matter accumulation increase in winter wheat (Jubilejnaja 50) relying on purely meteorological parameters such as air temperature and soil moisture content, taken 5 days examination periods into account. The model is suitable for predicting yield quantity and quality parameters such as wet gluten proportion. The rise of the curve of the ear dry matter accumulation function depends on the thermal and humidity conditions, during the growing season. According to our research, neither fast nor slow dry matter accumulations are favorable for the formation of wet gluten. An optimum accumulation speed, when the wet gluten proportion is at its maximum can be determined. If we know the functions of dry matter accumulation we can calculate the rise of the curves for each year. The relationship between the wet gluten proportion and the steepness of curve can be characterized by the following equation: $N(s)(m) = 55.45 m^2 + 10.78 m - 29.5$ Where *m* is the rise of the curve of ear dry matter accumulation function and *N(s)* is the wet gluten proportion content. By this equation the quality of winter wheat in respect of wet gluten proportion is numerically defined. The differences between the measured and calculated values are not bigger than two percent. The above correlation exists only Jubilejnaja 50 variety. We have to validate our model for winter wheat varieties with different ripening periods.

2917 Liu, L.; Gitz, D.C.; McClure, J.W. (1995) EFFECTS OF UV-B ON FLAVONOIDS, FERULIC ACID, GROWTH AND PHOTOSYNTHESIS IN BARLEY PRIMARY LEAVES. *Physiologia Plantarum*. 93(4):725-733. English. [MIAMI UNIV DEPT BOT OXFORD, OH 45056 USA].

Barley (*Hordeum vulgare* L.) was grown with W-B (280-320 nm) at levels simulating 25 or 5% ozone depletion on the date of the summer solstice at 40 degrees N latitude, with UV-A (320-400 nm), or with no supplemental irradiation. In plant growth chambers providing 300 $\mu\text{mol m}^{-2} \text{s}^{-1}$ photosynthetically active radiation (PAR), UV-B-grown leaves elongated more slowly than controls but reached the same final length 1 day later. Leaf specific fresh weight (mass leaf area⁻¹) was significantly increased by UV-B after the 7th day of growth. UV-B did not significantly affect leaf area, fresh weight, dry weight, total chlorophylls, total carotenoids or photosynthetic quantum efficiency. CO₂ assimilation was decreased by UV-B only at internal CO₂ levels above 250 $\mu\text{mol l}^{-1}$. By the 8th day of growth, UV-B increased flavonoid (saponarin and luteonarin) accumulation in both the lower epidermis and the mesophyll; about 40% of the saponarin and 20% of the luteonarin were in the lower epidermis under all experimental conditions. Glasshouse conditions proved too variable for reproducible determination of growth and photosynthesis but were reliable for determining developmental changes in flavonoid (saponarin and luteonarin) accumulation and provided up to 800 $\mu\text{mol m}^{-2} \text{s}^{-1}$ PAR. In the glasshouse UV-B-grown leaves had more flavonoids than controls at all stages from 5 to 30 days after planting; ca 50% more saponarin and 100% more luteonarin. Levels of soluble (vacuolar) ferulic acid esters were similar under all conditions on day 5, and on day 20 or later, but were significantly higher in W-B-grown plants on days 10 and 15. UV-B decreased insoluble (cell-wall-bound) ferulic acid esters on a whole leaf basis but significantly increased this fraction in the lower epidermis. W-A had no significant effects on growth, photosynthesis or ferulic acid, but it slightly increased flavonoid accumulation. The results are discussed in terms of secondary phenolics as a tissue-specific, developmentally regulated adaptive response to UV-B. [References: 42].

2918 Liu, L.; McClure, J.W. (1995) EFFECTS OF UV-B ON ACTIVITIES OF ENZYMES OF SECONDARY PHENOLIC METABOLISM IN BARLEY PRIMARY LEAVES. *Physiologia Plantarum*. 93(4):734-739. English. [MIAMI UNIV DEPT BOT OXFORD, OH 45056 USA].

Barley (*Hordeum vulgare* L.) was grown in a glasshouse with 13.56 or 8.84 $\mu\text{mol m}^{-2}$ biologically effective UV-B (280-320 nm; UV-B-BE) simulating levels predicted to occur with 25 or 5% ozone depletion at 40 degrees N latitude, with UV-A (320-400 nm), or with no supplemental irradiation. Activities of L-phenylalanine ammonia-lyase (PAL, EC 4.3.1.5), chalcone-flavanone isomerase (CFI, EC 5.5.1.6) and peroxidase (EC 1.11.1.7) were determined from the 5th through the 30th day after planting. PAL regulates diversion of L-phenylalanine into precursors for secondary phenolics, CFI regulates an early step of flavonoid biosynthesis, and peroxidase activates phenolic precursors for cross-linking and rigidifying cell walls. At all ages W-B decreased soluble protein leaf⁻¹ but had little effect on fresh weight or CFI activity. Exposure to UV-B decreased peroxidase activity only slightly in early growth stages but decreased it about 40% by day 30. PAL

activity was highest 5 days after planting under all treatments, decreased thereafter, and was not detectable in control plants after day 10. UV-B prolonged PAL activity through day 15 in plants given the highest level of UV-B. This UV-B prolongation of PAL activity is correlated with, and is a likely underlying mechanism to explain, the UV-B-enhanced accumulation of flavonoids and ferulic acid in barley primary leaves. The results are discussed in terms of barley leaf adaptation to UV-B as a developmental response dependent on conditions of plant growth. [References: 25].

2919 Merbach, W.; Schumann, F.; Romer, W.; Reining, E. (1994) APPARENT CO₂ ASSIMILATION, C-14 INCORPORATION, AND C-14 TRANSLOCATION IN SPRING BARLEY INFLUENCED BY SINK MANIPULATIONS. *Photosynthetica*. 30(4):593-601. English. [ZENTRUM AGRARLANDSCHAFTS & LANDNUTZUNGSFORSCH INST OKOPHYSIOL PRIMARPROD EBERSWALDER STR 84 D-15374 MUNCHEBERG GERMANY].

Pot experiments were conducted with *Hordeum distichon* L. (mutant of the cultivar Plena) and *Hordeum vulgare* L. ssp. *hexastichon* (cv. Certina). At two stages of development (5 and 20 d after the end of flowering), the assimilate demand of the sink organs (ears) was increased by darkening them for 5 d. The influence of this treatment on the apparent CO₂ assimilation (P-N), the (CO₂)-C-14 incorporation of source leaves (flag leaves) and the subsequent C-14 distribution in the plants were investigated using a combination of gas exchange measurements by IRGA and exposure of the plants to (CO₂)-C-14. Darkening of the ear 5 d after the end of flowering produced no change in P-N, C-14 incorporation of the source (flag leaf), or subsequent C-14 distribution to the individual organ fractions in either of the cultivars. Darkening of the ear of cv. Certina 20 d after the end of flowering caused an increased orientation of the C-14 translocation to the ear, while P-N of the flag leaf was not significantly influenced. In the Plena cultivar, the loss of ear photosynthesis caused by the darkening could not be compensated by the increased C-14 translocation, which was already very high in the control plants; P-N of the flag leaf was enhanced. In the course of grain filling (5 d → 20 d after the end of flowering), the absolute P-N, and protein and chlorophyll contents of the flag leaves strongly decreased in both cultivars. Darkening of the ear delayed this process in cv. Plena and partly also in cv. Certina. In the case of an increased assimilate demand of the sink (ear), the CO₂ assimilation of the source leaves was reduced only if the saccharide reserves of the plant were depleted. Differences in source-sink interactions observed between cultivars and developmental stages could be explained by this result. [References: 26].

2920 Morgan, J.M. (1995) GROWTH AND YIELD OF WHEAT LINES WITH DIFFERING OSMOREGULATIVE CAPACITY AT HIGH SOIL WATER DEFICIT IN SEASONS OF VARYING EVAPORATIVE DEMAND. *Field Crops Research*. 40(3):143-152. English. [TAMWORTH CTR CROP IMPROVEMENT RMB 944 TAMWORTH NSW 2340 AUSTRALIA].

Wheat Lines with differing capacities for osmoregulation were grown on a full profile of soil water at sowing in seasons of contrasting evaporative demand. Watered experiments were also included. Across seasons the relative increase in dry weight and yield associated with high osmoregulation was positively correlated with cumulative pan evaporation during the period of most rapid growth before anthesis. In experiments showing the most extreme responses to osmoregulative capacity there was no association with the overall soil water deficit at anthesis or harvest suggesting a direct effect of evaporative demand. This was further confirmed by correlations between vapour pressure deficit and leaf water potential and differences in turgor pressure. Significant differences in turgor were, in turn, associated with significant differences in dry weight. It was therefore concluded that osmoregulative effects on growth were mediated through leaf or shoot responses to leaf water stress rather than through root responses to soil water deficit, and that it was necessary to screen lines specifically for osmoregulation rather than for growth responses to soil water deficit. [References: 23].

2921 Mumtaz, S.; Naqvi, S.S.M.; Shereen, A.; Khan, M.A. (1995) PROLINE ACCUMULATION IN WHEAT SEEDLINGS SUBJECTED TO VARIOUS STRESSES. *Acta Physiologiae Plantarum*. 17(1):17-20. English. [ATOM ENERGY AGR RES CTR DIV PLANT PHYSIOL TANDOJAM PAKISTAN].

Proline accumulates when germinating wheat seeds (*Triticum aestivum* L., cv Mehran-89) are subjected to abiotic or biotic stresses. Seedlings, raised under salinity (NaCl), water (PEG-6000), darkness or herbicide stresses exhibited enhanced proline levels and shoot and root lengths were variably

affected. Proline level was also increased when rust (*Puccinia recondita* f. sp. *tritici*) infected mature leaves were compared with healthy leaves. These observations indicate that proline accumulation, as a physiological trait for salinity/drought tolerance, needs to be viewed with caution.

2922 Murelli, C.; Rizza, F.; Albini, F.M.; Dulio, A.; Terzi, V.; Cattivelli, L. (1995) METABOLIC CHANGES ASSOCIATED WITH COLD-ACCLIMATION IN CONTRASTING CULTIVARS OF BARLEY. *Physiologia Plantarum*. 94(1):87-93. English. [IST SPERIMENTALE CEREALICOLTURA VIA S PROTASO 302 I-29017 FIORENZUOLA D'ARDA ITALY].

Cereal plants become more resistant to freezing when first exposed to a period of cold-acclimation. Many physiological and molecular changes have been shown to occur at low temperatures, but the role and the contribution of each to frost resistance is still poorly understood. Two cultivars of barley (*Hordeum vulgare* L.), the winter barley Onice and the spring barley Gitane, were acclimated under controlled conditions under an 8-h photoperiod at 4 degrees C (light) and 2 degrees C (dark) for 21 days. Changes in free proline, ABA, water-soluble carbohydrates and free fatty acids were measured to assess their involvement in cold-acclimation and to explain the different frost-resistant capacities of the two cultivars. Exposure of barley plants to low temperature resulted in an equal increase in proline in both cultivars. During the first days of cold acclimation, ABA levels showed a peak in the frost-resistant cultivar, lasting about 24 h, followed by a decrease. The water soluble carbohydrates reached their highest content after 3 days of hardening, although after 14 to 21 days of acclimation the carbohydrate content was similar to that of unhardened plants. The frost-resistant Onice had a much higher free fatty acid content than the frost-sensitive Gitane. Furthermore in Onice 86% of free fatty acids was represented by unsaturated molecular species, linolenic acid alone being 71%. In contrast, in the frost-sensitive cultivar only 31% of free fatty acids was unsaturated and a large amount of 9-oxo-nonanoic acid, a product present in the linolenic acid cascade, was also detected. The ABA content after 2 days of hardening and the free fatty acid composition were clearly different between the two cultivars and may explain, at least in part, the different frost-resistant capacities of Onice and Gitane. [References: 33].

2923 Nakagawa, E.; Alano, T.; Hirai, N.; Iwamura, H. (1995) NON-INDUCED CYCLIC HYDROXAMIC ACIDS IN WHEAT DURING JUVENILE STAGE OF GROWTH. *Phytochemistry*. 38(6):1349-1354. English. [KYOTO UNIV FAC AGR DEPT AGR CHEM KYOTO 606 JAPAN].

2,4-Dihydroxy-1,4-benzoxazine-3-one glucoside (DIBOA-G) and its methoxy analogue, 2,4-dihydroxy-7-methoxy-1,4-benzoxazine-3-one glucoside (DIMBOA-G), were present in germinating wheat (*Triticum aestivum*); the corresponding aglycones, DIBOA and DIMBOA, appeared soon after germination. The amounts of these compounds reached a maximum 12-48 hours after germination, and then decreased to undetectable levels as the plants began autotrophic growth. The time of their appearance was little affected by using seeds either sterilized or non-sterilized, by infection with pathogens and wounding with a razor blade. The concentration of DIBOA was found to be 0.2-0.3 nmol mg⁻¹ fr. wt (0.2-0.3 mM if the density of plant tissue is assumed to be uniform and unity) and that of DIMBOA was 0.7-1.0 nmol mg⁻¹ (0.7-1.0 mM). The aglycones retarded the germ tube growth of species of fungi at 0.3 mM. These observations suggest that the appearance of benzoxazinones is as defence compounds in the juvenile stage of growth. [C-14]Anthranilic acid was incorporated into DIBOA-G and DIMBOA-G when administered to embryos isolated from pre-emerging seeds, showing that the series of compounds are generated by de novo synthesis. [References: 21].

2924 Olsen, O.A.; Brown, R.; Kalla, R.; Kleczkowski, L.A.; Lemmon, B.; Linnestad, K.; Nielsen, P.S.; Potter, R.; Shumamoto, K.; Thorbjørnsen, T.; Villand, P. (1995) DEVELOPMENTAL REGULATION OF GENE EXPRESSION DURING BARLEY ENDOSPERM FORMATION. *Journal of Plant Physiology*. 145(5-6):587-591. English. [AGR UNIV NORWAY DEPT BIOTECHNOL SCI PLANT MOLEC BIOL LAB POB 5051 N-1432 AS NORWAY].

This paper reviews recent data from our laboratories on the early phases of endosperm development in barley. First, we provide a description of endosperm morphogenesis based on immunohistochemical studies using the confocal laser scanning microscope. In the second part, the barley Ltp2 gene, which is exclusively expressed in the aleurone layer of developing

grains, is characterized. In the last part, we describe the barley gene encoding the small subunits of the ACPase in the starchy endosperm and leaf tissue. [References: 19].

2925 Oyanagi, A.; Takahashi, H.; Suge, H. (1995) INTERACTIONS BETWEEN HYDROTROPISM AND GRAVITROPISM IN THE PRIMARY SEMINAL ROOTS OF TRITICUM AESTIVUM L. *Annals of Botany*. 75(3):229-235. English. [TOHOKU UNIV INST ECOL GENET SENDAI MIYAGI 98077 JAPAN].

It has been proposed that hydrotropism interacts with gravitropism in seedling roots; that is, roots which are highly gravitropic show less hydrotropism (Takahashi and Suge, 1991 *Physiologia Plantarum* 82: 24-31; Takahashi and Scott, 1993 *Plant, Cell and Environment* 16: 99-103). Here, we examine varietal differences in the hydrotropic response and its interaction with gravitropism in wheat roots. Primary seminal roots of wheat (*Triticum aestivum* L.) were hydrotropically stimulated by different moisture gradients established by placing wet cheesecloth and saturated solutions of different salts in closed chambers. From equations obtained by relative humidity (RH) at different distances from the wet cheesecloth, moisture gradients at the root-lip level were estimated to be 0.03 to 1.84% RH mm(-1), depending upon the salt introduced into the chamber. The roots showed positive hydrotropism in response to 0.67% RH mm(-1), and the response apparently increased as the gradient was strengthened. When the primary seminal roots of 12 cultivars were exposed to a moisture gradient of 1.84% RH mm(-1), hydrotropic response significantly differed depending upon the cultivar tested. Among the cultivars, the roots of Norin 11, Norin 15, Norin 117, and Norin 125 responded hydrotropically more strongly than the others. These roots, with the exception of Norin 11, showed a less vigorous response to gravity compared to the remaining cultivars. However, the roots of Norin 20, Norin 38, and Norin 107 were relatively unresponsive to both a moisture gradient and to gravity. Thus, the primary seminal roots of wheat respond hydrotropically, and the responsiveness differs among cultivars. However, the varietal difference in hydrotropic response cannot be explained solely by converse differences in responsiveness to gravity. [References: 19].

2926 Paradis, R.; Dalpe, Y.; Charest, C. (1995) THE COMBINED EFFECT OF ARBUSCULAR MYCORRHIZAS AND SHORT-TERM COLD EXPOSURE ON WHEAT. *New Phytologist*. 129(4):637-642. English. [UNIV OTTAWA DEPT BIOL 30 MARIE CURIE OTTAWA ON K1N 6N5 CANADA].

In order to investigate the effect of arbuscular mycorrhizal colonization and short-term cold exposure on *Triticum aestivum* L., 7-wk-old seedlings of spring and winter cultivars (Glenlea and AC Ron) were submitted to a 1-wk cold treatment when inoculated with *Glomus mosseae* (Nicol. & Gerd.) Gerd. & Trappe. The combined effect of arbuscular mycorrhizas and low temperature on the two cultivars was determined for several physiological parameters including biomass and chlorophyll, protein, and sugar contents. The dry biomass was higher in Glenlea than AC Ron at week five and did not significantly change at week eight in both cultivars with either the mycorrhizal or the cold treatment. The chlorophyll content was higher in mycorrhizal (M+) than nonmycorrhizal (M-) Glenlea at 5 degrees C but was unaltered in AC Ron or in either cultivar at 25 degrees C. The reducing and total sugar contents were higher in AC Ron than Glenlea. The non-reducing sugar level at 5 degrees C was higher in M+ AC Ron than M+ Glenlea and higher in M- than M+ Glenlea. The protein content was higher in Glenlea than AC Ron at 25 degrees C but remained constant regardless of the mycorrhizal or cold treatment. This study shows that the spring wheat seems to benefit more than the winter wheat from AM association after a short-term exposure to low temperature. [References: 34].

2927 Quartacci, MF.; Pinzino, C.; Sgherri, CLM.; Navariuzzo, F. (1995) LIPID COMPOSITION AND PROTEIN DYNAMICS IN THYLAKOIDS OF TWO WHEAT CULTIVARS DIFFERENTLY SENSITIVE TO DROUGHT. *Plant Physiology*. 108(1):191-197. English. [UNIV PISA IST CHIM AGR I-56124 PISA ITALY].

Two wheat (*Triticum durum* Desf.) cultivars with different sensitivities to drought were either grown under regular irrigation or subjected to water deficit by withholding water for 14 d. Water-stressed plants of both cultivars underwent similar decreases in leaf water potential, but the drought-tolerant cultivar showed higher relative water content and turgor. Neither osmotic nor elastic adjustment mechanisms appeared to be active under the conditions described here. Thylakoids isolated from the stressed,

drought-tolerant wheat showed an increase in lipid-to-protein ratio, in comparison with the control, whereas this ratio remained unchanged in the sensitive wheat. In both cultivars, water deficit determined different rearrangements in the composition of the thylakoid individual polar lipids, but their unsaturation level remained unaffected with the exception of monogalactosyldiacylglycerol. In the drought-sensitive cultivar, an accumulation of free fatty acids together with a reduction in polar lipid amount was observed. Electron paramagnetic resonance measurements of spin-labeled proteins of stressed plants from the sensitive cv Adamello showed a higher spin label rotational correlation time together with lower sulphhydryl group and mobile proteic portion levels, in comparison with the control. In the tolerant cv Ofanto, the first two parameters changed to a lesser extent following water depletion, and the mobile proteic portion was not altered. [References: 35].

2928 Ryan, PR.; Delhaize, E.; Randall, PJ. (1995) CHARACTERISATION OF AL-STIMULATED EFFLUX OF MALATE FROM THE APICES OF AL-TOLERANT WHEAT ROOTS. *Planta*. 196(1):103-110. English. [CSIRO DIV PLANT IND GPO BOX 1600 CANBERRA ACT 2601 AUSTRALIA].

Aluminium (Al) stimulates the efflux of malate from the apices of wheat (*Triticum aestivum* L.) roots (Delhaize et al. 1993, *Plant Physiol.* 103, 695-702). The response was five to tenfold higher in Al-tolerant seedlings than Al-sensitive seedlings and the capacity for Al-stimulated malate efflux was found to co-segregate with Al tolerance in a pair of near-isogenic wheat lines differing in Al-tolerance at a single dominant locus. We have investigated this response further using excised root apices. Half-maximal efflux of malate from apices of Al-tolerant seedlings was measured with 30 μ M Al in 0.2 mM CaCl_2 , pH 4.2, while saturating rates of 2.0 nmol . apex(-1) . h(-1) occurred with concentrations above 100 μ M Al. The stimulation of malate efflux by Al was accompanied by an increase in K+ efflux which appeared to account for electroneutrality. The greater stimulation of malate efflux from Al-tolerant apices compared to Al-sensitive apices could not be explained by differences in the activities of phosphoenolpyruvate carboxylase or NAD-malate dehydrogenase. Several other polyvalent cations, including gallium, indium and the tridecamer Al-13, failed to elicit malate efflux. Aluminium-stimulated efflux of malate was correlated with the measured concentration of total monomeric Al present, and with the predicted concentrations of Al^{3+} and AlOH_2^+ ions in the solution. Several antagonists of anion channels inhibited Al-stimulated efflux of malate with the following order of effectiveness: niflumic acid approximate to NPPB > IAA-94 approximate to A-9-C > ethacrynic acid. Lanthanum, chlorate, perchlorate, zinc and alpha-cyano-4-hydroxycinnamic acid inhibited malate release by less than 30% at 100 μ M while 4,4'-diisothiocyanatostilbene-2,2'-disulphonate (DIDS) had no effect. These results suggest that the Al^{3+} cation stimulates malate efflux via anion channels in apical cells of Al-tolerant wheat roots. [References: 34].

2929 Rybka, Z. (1995) ESTIMATION OF ENERGY EXPENDITURE IN WHEAT CROWNS DURING ACCLIMATION TO FROST USING METABOLIC INHIBITORS. *Acta Physiologiae Plantarum*. 17(1):31-36. English. [PLANT BREEDING & ACCLIMATIZAT INST DEPT PLANT BIOCHEM & PHYSIOL POB 1019 PL-00950 WARSAW POLAND].

The method of calculation of ATP requirements for metabolic processes in animal tissues has been adopted to wheat crowns. The specific inhibitors of RNA and protein syntheses and ion transport involving Ca^{2+} ion channel, Na^+/K^+ -ATPase and P-type ATPase inhibitors were used for calculation of ATP utilization in these processes. Cold acclimation resulted in lowering of ATP requirements for practically all processes in crowns of frost resistant wheat cultivar. In the frost susceptible cultivar acclimation did not affect or increased ATP consumption except processes associated with Ca^{2+} transport. The effect of inhibitor of SH groups indicates importance of these groups in energy management in cells.

2930 Salopelto, J.; Peltonen, J. (1995) IMPACT OF SEED VIGOUR ON THE GRAIN YIELD OF SPRING WHEAT UNDER SHORT AND NORTHERN GROWING SEASON. *Acta Agriculturae Scandinavica Section B-Soil & Plant Science*. 45(1):57-62. English. [UNIV HELSINKI DEPT PLANT PROD BOX 27 SF-00014 HELSINKI FINLAND].

The study was designed to measure the effect of low-vigour and high-vigour spring wheat seeds (Cv. Heta) on grain yield and grain N yield under short season, northern growing conditions. Low vigour seed significantly restricted yield formation and grain N yield under early summer drought. The results indicate that the immediate effect of low

vigour seed on yield reduction can be obviated by grading seed prior to sowing to ensure plump grains and high kernel weight in seeds matured under favourable growing conditions, but by grading smaller kernels in poor-vigour seeds where dormancy has not necessarily broken in large kernels as a consequence of maturing under unfavourable growing conditions. Protein concentration and protein composition were not good indicators of seed vigour. In a good growing season, N fertilization was an efficient way of reducing the negative impact of poor-vigour seed on subsequent wheat grain N yield. [References: 17].

2931 Sasek, A.; Cerny, J. (1995) **ELECTROPHORETIC SPECTRA OF GLIADINS AND SUBUNITS OF GLUTENINS OF HMW OF WHEAT VARIETIES DELETED IN THE YEARS 1982 TO 1993.** *Rostlinna Vyroba*. 41(5):225-231. Czech. [VYZKUMNY USTAV ROSTLINNE VYROBY DRNOVSKA 507 CR-16106 PRAGUE 6 CZECH REPUBLIC].

Wheat varieties, deleted from the List of Certified Varieties in 1982 to 1993, may be used as donors of some requested properties in hybridization programmes. Certification and introduction into circulation of the seed of deleted variety is usually admitted one to several years after its deletion. The use of model electrophoretic spectra and sets of gliadin and glutenin allelic blocks of zones separated from them is a prerequisite of purposeful utilization of deleted wheat varieties as genetic sources, as well as identification of these varieties from seed sample. This study has been aimed at preparation of these model electrophoretic spectra of gliadins and glutenins of high molecular weight (HMW) of wheat varieties deleted in the years 1982 to 1993. In total 22 deleted winter wheat varieties and four deleted spring wheat were assessed. Bulk samples supplied from the State Institute for Agricultural Supervision and Testing - Division of Seeds and Planting Stock were used for electrophoretic analyses. To set up electrophoretic structure of gliadins each bulk sample containing 50 grains was electrophoretically analyzed. Electrophoretic structure of glutenin subunits of HMW was determined by assessment of five random seeds from each bulk sample. Electrophoretic spectra of gliadins were set up by modified method of vertical electrophoresis in columns of starch gel in Al-lactate buffer at pH 3.1 with 2 mol urea per 1 litre (Sasek, Sykorova, 1989). Allelic gliadin blocks were separated from electrophoretic spectra of gliadins as reported by Sobko, Poperejla (1986). Electrophoretic spectra of glutenins of HMW were determined by modified procedure of vertical discontinual electrophoresis in polyacrylamid gel under presence of sodium dodecyl sulfate after Laemmli (1970). Allelic blocks of zones or individual allelic zones of glutenin subunits of HMW were found according to the published catalogue (Payne et al., 1981). Based on the electrophoreograms obtained the degree of protein polymorphism of assessed varieties was tested. Homozygosity of all investigated loci Gld and Glu was confirmed. Relative frequency of gliadin heterogenous varieties is comparatively high, amounts to 62%. Varieties of maximum gliadin heterogeneity, i.e. Super Zlatna and Mironovska zlepsena, are at the same time heterogenous in the structure of glutenins of HMW, consisting of two glutenin lines. Through the allelic gliadin and glutenin blocks properties marked by them were evaluated, such as baking quality, frost hardiness and resistance to stem rust. From the set of assessed deleted varieties or lines having blocks GLD 1B1 and GLU 1A1 or GLU 1A2* and GLU 1B7+8 or GLU 1B7+9 and GLU 1D5+10 can be separated as sources of higher baking quality. Genetic source of frost hardiness are the varieties Branka, Jubilejna, Mironovska 808 and Mironovska zlepsena with both major markers of frost hardiness, i.e. blocks GLD 1D5 and GLD 6A3. Spring wheat Rena, containing a major marker of frost hardiness - block GLD 1D5 in gliadin spectra, or the Sylva variety with the second major marker of frost hardiness - block GLD 6A3, can be considered as donors of frost hardiness genes. Secaline block GLD 1B3, i.e. marker of bad baking quality, but at the same time a marker of resistance to stem rust of grain (Sozinov, 1985; Sasek et al., 1982, 1986), was identified in gliadin spectra of the varieties Amika - line B, Branka, Istra, Roxana, Sabina, Solaris and Butin.

2932 Sasek, A.; Cerny, J. (1995) **THE MODEL ELECTROPHORETIC SPECTRA OF HMW GLIADINS AND GLUTENINS OF COMMON WHEAT VARIETIES CULTIVATED IN THE CZECH REPUBLIC IN 1993.** *Rostlinna Vyroba*. 41(4):163-168. Czech. [VYZKUMNY USTAV ROSTLINNE VYROBY DRNOVSKA 507 CR-16106 PRAGUE 6 CZECH REPUBLIC].

The work is a catalogue of model electrophoretic spectra of HMW gliadins and glutenins of all wheat varieties, approved for cultivation in 1993. The catalogue serves for fast and objective determination of varietal trueness and purity of doses of seeds and merchandizing of wheat; 21 varieties

of winter wheat and five varieties of spring wheat, represented by the seed of grade S1, were assessed in total. To determine electrophoretic composition of gliadins (60 grains) vertical electrophoresis in columns of starch gel Al-lactate buffer at pH 3.1 with 2 mol.l(-1) of urea (Sasek, Sykorova, 1989) was used. Allelic gliadin blocks were separated from electrophoretic spectra of gliadins after Sobko, Poperejla (1986). To determine electrophoretic spectra of HMW glutenins the procedure of vertical discontinual electrophoresis in PAA gel under presence of SDS (Laemmli, 1970) was applied. Allelic blocks of zones or allelic zones of HMW glutenins were determined after Payne et al. (1981). The degree of protein polymorphism was assessed and genetic structure of varieties assessed has been determined; 22 varieties out of 26 assessed varieties are homogenous in the structure of gliadins, hence they are pure lines. The other four varieties are populations composed of two sister lines. In the composition of HMW glutenins only two varieties are heterogenous. Different varieties or their protein lines were assessed according to the occurrence of allelic blocks of gliadins and glutenins of HMW - markers of baking quality and frost-hardiness.

2933 Saulescu, NN.; Kronstad, WE.; Moss, DN. (1995) **DETECTION OF GENOTYPIC DIFFERENCES IN EARLY GROWTH RESPONSE TO WATER STRESS IN WHEAT USING THE SNOW AND TINGEY SYSTEM.** *Crop Science*. 35(3):928-931. English. [OREGON STATE UNIV DEPT CROP & SOIL SCI CORVALLIS, OR 97331 USA].

Early detection of genotypic differences in response to water stress would help in increasing selection intensity in breeding drought tolerant wheat (*Triticum aestivum* L.). However, detection of small differences requires adequate control of the stress level. A system was used to determine if differences among genotypes in growth response to water stress could be detected. Haun stage and shoot dry weight were determined after 20 d in 25 cultivars grown with adequate water supply or with a water deficit imposed by lowering the water table by 8 cm and by interposing a porous ceramic disk, with an air exclusion value of 0.5 MPa, in the conducting medium between the water table and the roots. Significant differences were found among cultivars in the response to the imposed water deficit. Haun stage reduction varied between 13% in the spring wheat 'Klasic' and 36% in 'Apollo', while shoot dry weight reduction was between 21% in Klasic and 67% in the club wheat 'Morro'. The coefficient of correlation between the Haun stage and shoot dry weight response to water stress was highly significant ($r = 0.78$). Although no direct comparison could be made between response of early growth to water deficits and yield response in the field under drought stress, the results of the seedling growth test corresponded well with previous knowledge about the performance of the tested cultivars under water stress. Our results verified that the system could be useful for rapid evaluation of drought response in wheat breeding. [References: 12].

2934 Savin, R.; Hall, A.J.; Sattore, EH. (1995) **TESTING THE ROOT GROWTH SUBROUTINE OF THE CERES-WHEAT MODEL FOR TWO CULTIVARS OF DIFFERENT CYCLE LENGTH (VOL 38, PG 125, 1994).** *Field Crops Research*. 40(3):199. English.

2935 Sayed, OH. (1995) **EFFECTS OF TEMPERATURE ON GROWTH, MORPHOLOGY, AND PHOTOSYNTHESIS IN WHEAT.** *Biologia Plantarum*. 37(1):49-55. English. [UNIV QATAR FAC SCI DEPT BOT POB 2713 DOHA QATAR].

Several morphological characteristics differed when wheat (*Triticum aestivum* L. cv. Doha 88) was grown under a cool (10-degrees-C), warm (20-degrees-C), and hot (30-degrees-C) regime. Development of leaves was linearly related to shoot meristem temperature, and the time between appearance of successive leaves on the main culm was independent of growth temperature. Area and dry mass of leaves and roots increased exponentially with time, and variations between growth temperature regimes were reduced when plants were compared at a similar developmental age. In isolated thylakoids thermal stability of photosystem 2 and of whole electron transport chain was enhanced with the increase in growth temperature. Therefore this cultivar is able to acclimate to contrasting temperature regimes.

2936 Sayre, KD.; Acevedo, E.; Austin, RB. (1995) **CARBON ISOTOPE DISCRIMINATION AND GRAIN YIELD FOR THREE BREAD WHEAT GERMLASM GROUPS GROWN AT DIFFERENT LEVELS OF WATER STRESS.** *Field Crops Research*. 41(1):45-54. English. [INT MAIZE & WHEAT

IMPROVEMENT CTR APDO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

Carbon isotope discrimination (Delta), yield and other characters were determined for 75 spring bread wheat cultivars and advanced breeding lines in which water availability was varied using a line-source irrigation system. The experiment was carried out in 1989/90 at CIMMYT-CIANO, Cd. Obregon, in northwest Mexico. Forty of the cultivars and advanced breeding lines came from CIMMYT-Mexico, twenty from ICARDA-Syria, and fifteen from CIMMYT's International Drought Trial (IDT). Considering all materials together, grain yield and Delta were markedly reduced by drought (yield declined from 4560 to 1090 kg ha⁻¹), Delta from 16.9 to 14.0 parts per thousand, from least to most stressed, respectively). For each group of lines, grain yield was positively correlated with Delta in both the most stressed and least stressed parts of the trial (except for the CIMMYT lines under low stress where the correlation was nonsignificant). In addition, high yield under stress was associated with an early maturity score and with less reduction in mature plant height, Delta may be potentially used to augment selection for high yield based on yield itself, in both low- and high-stressed environments. In the latter environment, early maturity and minimal reduction in plant height should also be considered in a selection program especially under conditions of mid-season to terminal drought and/or heat stress. [References: 7].

2937 Sharma, RC. (1995) TILLER MORTALITY AND ITS RELATIONSHIP TO GRAIN YIELD IN SPRING WHEAT. *Field Crops Research*. 41(1):55-60. English. [INST AGR & ANIM SCI CHITWAN NEPAL].

Spikeless tillers of wheat (*Triticum aestivum* L.) affect grain yield because of less than optimum effective plant population. This study was conducted to examine the genetic variability for tiller mortality, and its relationship to grain yield in diverse wheat lines. Twenty lines were evaluated in replicated field tests in 4 years at Rampur, Nepal. The characters investigated were maximum number of tiller produced, the number of reproductive tillers, tiller mortality, and grain yield. The lines differed significantly for all characters. The tiller mortality ranged from 7 to 30%. There were substantial effects of environment on all four characters. The entry-by-year interactions were significant for all traits, primarily because of changes in the relative genotypic differences for these traits in the four years. However, certain lines consistently ranked low or high for tiller mortality. There was a significant negative correlation between tiller mortality and grain yield in 3 out of 4 years. There was a positive correlation of highest tiller number with reproductive tiller number and with tiller mortality. Grain yield showed a nonsignificant positive correlation with maximum tiller number. The reproductive tiller number was positively correlated with grain yield. Results of this study indicate that spikeless tillers contribute negatively to grain yield and that genetic variation exists for tiller mortality in spring wheat. [References: 14].

2938 Shatadal, P.; Jayas, DS.; Bulley, NR. (1995) DIGITAL IMAGE ANALYSIS FOR SOFTWARE SEPARATION AND CLASSIFICATION OF TOUCHING GRAINS. 1. DISCONNECT ALGORITHM. *Transactions of the ASAE*. 38(2):635-643. English. [UNIV MANITOBA DEPT AGR ENGN WINNIPEG MB R3T 2N2 CANADA].

An algorithm to segment connected grain kernel image regions is described. The algorithm attempts to eliminate the need for well-separated kernels in machine-vision-based grain grading experiments. The algorithm uses image transforms from the discipline of mathematical morphology. The algorithm was tested on 746 connected kernels of hard red spring (HRS) wheat, 391 connected kernels of durum wheat, 376 connected kernels of barley, 286 connected kernels of oats, and 393 connected kernels of rye. The spatial arrangement of the touching kernels was random in all of the images used. The algorithm was successful in disconnecting kernels of HRS wheat, durum wheat, barley, oats, and rye with accuracies of 95, 95, 94, 79, and 89%, respectively. The important limitation of the algorithm was that it failed when the connected kernels formed a relatively long isthmus or bridge between them. [References: 24].

2939 Shatadal, P.; Jayas, DS.; Bulley, NR. (1995) DIGITAL IMAGE ANALYSIS FOR SOFTWARE SEPARATION AND CLASSIFICATION OF TOUCHING GRAINS. 2. CLASSIFICATION. *Transactions of the ASAE*. 38(2):645-649. English. [UNIV MANITOBA DEPT AGR ENGN WINNIPEG MB R3T 2N2 CANADA].

The images containing touching kernels of hard red spring (HRS) wheat, durum wheat, barley, oats, and rye were processed for software-separation

using a disconnect algorithm. The kernels were imaged again after they were manually separated. Geometrical features were extracted from both software-separated and physically separated kernels. Software-separation did not cause appreciable change in the geometrical features of the grains except for the area of oats. An overall classification success of 93.3% was achieved in a five-way classification among HRS wheat, durum wheat, barley, oats, and rye for the software-separated kernels. Classification of physically separated kernels resulted in 95.0% correctly classified kernels. [References: 22].

2940 Shewry, PR.; Sayanova, O.; Tatham, AS.; Tamas, L.; Turner, M.; Richard, G.; Hickman, D.; Fido, R.; Halford, NG.; Greenfield, J.; Grimwade, B.; Thomson, N.; Miles, M.; Freedman, R.; Napier, J. (1995) STRUCTURE, ASSEMBLY AND TARGETING OF WHEAT STORAGE PROTEINS. *Journal of Plant Physiology*. 145(5-6):620-625. English. [UNIV BRISTOL INST ARABLE CROPS RES DEPT AGR SCI LONG ASHTON RES STN BRISTOL BS18 9AF AVON ENGLAND].

The functional properties of wheat flour in various food systems (most notably for breadmaking) are determined largely by the structures and interactions of the prolamin storage proteins, termed gliadins and glutenins. It is therefore important to understand the structures of the individual proteins, their pathways and mechanisms of synthesis and deposition, and their interactions with other flour components (for example, starch and lipids) in order to manipulate the quality of wheat for food and other uses. We are using a range of biophysical and biochemical approaches to determine the structures of individual proteins, using fractions purified from flour or expressed in heterologous systems. We are also isolating cDNAs for proteins involved in protein folding and assembly in the endoplasmic reticulum (protein disulphide isomerase, BiP and peptidyl-prolyl cis-trans isomerase) and studying their interactions with gluten proteins synthesised in *E. coli*. This work is complemented by immunocytochemical studies of gluten protein deposition in the leaves and seeds of transgenic tobacco plants, using wild-type proteins and mutants in which specific transit-targeting sequences have been added or deleted. Taken together these results are giving a detailed picture of the structure, synthesis, assembly and deposition of wheat gluten proteins. [References: 32].

2941 Stone, PJ.; Nicolas, ME. (1995) A SURVEY OF THE EFFECTS OF HIGH TEMPERATURE DURING GRAIN FILLING ON YIELD AND QUALITY OF 75 WHEAT CULTIVARS. *Australian Journal of Agricultural Research*. 46(3):475-492. English. [UNIV MELBOURNE DEPT AGR CTR CROP IMPROVEMENT PARKVILLE VIC 3052 AUSTRALIA].

The responses of 75 cultivars of wheat to a short (3 day) period of very high temperature (40 degrees C max.) applied at either 10 or 30 days after anthesis were examined under controlled conditions. The effect of high temperature on a number of yield (grain number, individual kernel mass and N per kernel) and quality components (protein composition, apparent amylose content and noodle swelling power) is described for the sample population and for a number of varieties which were either particularly heat tolerant or sensitive. Genotypic variation of response to high temperature of the order of 20% was recorded for the majority of yield and quality components. The fact that responses of this magnitude were caused by exposure to high temperatures lasting only 5 to 6% of the grain filling period demonstrates the extent to which short periods of very high temperature may affect wheat yield and quality. [References: 51].

2942 Stuiver, CEE.; Dekok, LJ.; Clement, JMAM.; Kuiper, PJC. (1995) HOW INDICATIVE ARE CHANGES IN MAJOR METABOLITES FOR FREEZING TOLERANCE OF WHEAT. *Botanica Acta*. 108(2):106-110. English. [UNIV GRONINGEN DEPT PLANT BIOL POB 14 9750 AA HAREN NETHERLANDS].

Relative growth rate of winter wheat at low temperature (day/night, 4/2 degrees C) was about 0.02 g g⁻¹ fresh weight day⁻¹. There was a substantial increase in dry matter content of shoots and roots, especially during the first week of low temperature exposure, which for the greater part could be attributed to an accumulation of soluble sugars and starch. The freezing tolerance (LTS₅₀) of the leaf tissue gradually increased with 6 degrees C during the 6 weeks exposure, whereas freezing tolerance of roots was hardly affected. Upon low temperature exposure there was an increase in the content of water-soluble non-protein thiols (mainly glutathione), soluble sugars, starch, amino acids and total nitrogen in both shoots and roots. The most substantial increases in the content of thiols, sugars and

amino acids already occurred within hours or a few days after the onset of the exposure. The nitrate content in shoots showed a rapid and strong decrease during low temperature exposure, however, in roots its content remained unaffected. It is proposed that the observed rapid increases in the content of various metabolites at low temperature are primarily due to an altered balance in their synthesis and their consumption in growth. There was no direct relation between increases in the content of the various metabolites and the degree of freezing tolerance of the tissue. [References: 25].

2943 Trethowan, RM. (1995) EVALUATION AND SELECTION OF BREAD WHEAT (*TRITICUM AESTIVUM* L) FOR PREHARVEST SPROUTING TOLERANCE. *Australian Journal of Agricultural Research*. 46(3):463-474. English. [VICTORIAN INST DRYLAND AGR RMB 260, HORSHAM VIC 3400 AUSTRALIA].

This paper examines the success of selection for preharvest sprouting tolerance in white-grained bread wheat using a standard wetting treatment, germination of hand-threshed seed and falling number measurements. The rain simulator was useful in shifting the population mean of field grown material towards higher levels of tolerance in successive years; however, large genotype x year interactions in material sown under rain protection did not allow accurate assessment of individual genotypes. The most accurate assessments were achieved using falling number measurements ($h(2) = 80.7\%$) and hand-threshed seed germinations ($h(2) = 38.4\%$), where no genotype x year interactions were recorded. Seed dormancy (determined from hand threshed grain) correlated significantly with change in falling number following 3 days' treatment in the rain simulator ($r = -0.56^{**}$). Visual measurements scored in the rain simulator, however, did not correlate significantly with seed dormancy in the first year ($r = 0.20$) but correlated strongly in the second ($r = 0.73^{***}$). In comparisons of the same test between years, falling number (without rain treatment) and seed dormancy were significantly correlated ($r = 0.68^*$ and 0.90^{***} , respectively), whilst visual scores of sprouting showed no association ($r = -0.03$). [References: 15].

2944 Van, NC.; Bielawski, W.; Kaczowski, J. (1995) DISTRIBUTION OF ENDOPEPTIDASES IN GERMINATING TRITICALE GRAINS SUSCEPTIBLE AND RESISTANT TO PRE-HARVEST SPROUTING. *Acta Physiologiae Plantarum*. 17(1):9-16. English. [AGR UNIV WARSAW DEPT BIOCHEM SGGW RAKOWIECKA 26-30 PL-02528 WARSAW POLAND].

The level of non-protein N and the total, aspartyl, cysteine and serine endopeptidase activities were determined in 5 milling fractions (embryonic, seed coat, aleurone layer and two flour subfractions) of resting grains and those subjected to 24, 48 and 72h imbibition of two varieties of Triticale: susceptible and resistant to pre-harvest sprouting. The results show that in the resting grain and during the initial imbibition period the aspartyl proteinase contribution to the total endopeptidase activity was the highest but its increase rates during the first three days of germination were the smallest. At the same time significant increases of cysteine proteinase and about three times smaller of serine proteinase activities were observed in the embryonic fraction and in the aleurone layer. After 24 or 48h germination there was a significant translocation of those two enzymes towards both endosperm fractions. Those phenomena were faster in the susceptible Malno variety than in resistant Lasko. The results confirm the suggestion that aspartyl proteinase may be synthesized mainly in the developing grains and it should initiate grain storage protein degradation. Since the cysteine proteinase contribution to the total proteinase activity became dominant starting of 48h germination it should be regarded as the main enzyme catalysing the breakdown of these proteins. The comparison of the data obtained for grains of different pre-harvest sprouting resistance suggests the faster translocation of endopeptidases through the tissue in the susceptible Triticale variety, than in resistant one.

2945 Vardevanyan, PO.; Tiratsuyan, SG.; Vardevanyan, AO.; Boyadzhyan, BG.; Panosyan, GA. (1995) STUDY OF OLIGONUCLEOSOMES IN GERMINATING WHEAT EMBRYOS ENRICHED IN TRANSCRIPTIONALLY ACTIVE GENES. *Russian Journal of Plant Physiology*. 42(2):258-261. English. [YEREVAN STATE UNIV FAC BIOL UL A MANUKYANA 1 YEREVAN 375049 ARMENIA].

The fractions of oligonucleosomes from the chromatin of dry, germinating, and gibberellin-treated isolated embryos of wheat (*Triticum aestivum* L.) were extracted and investigated. A significant redistribution of chromatin fractions was found in the course of gradient centrifugation after

nuclease treatment. Profiles of chromatin and DNA from isolated dry and germinating wheat embryos, treated and untreated with gibberellin, show differences in the melting temperatures of a highly active fraction of chromatin and DNA. This observation indicates that in the course of germination and gibberellin induction, different regions of chromatin participate in the process of genome activation. [References: 22].

2946 Wang, HL.; Offler, CE.; Patrick, JW. (1995) THE CELLULAR PATHWAY OF PHOTOSYNTHATE TRANSFER IN THE DEVELOPING WHEAT GRAIN .2. A STRUCTURAL ANALYSIS AND HISTOCHEMICAL STUDIES OF THE PATHWAY FROM THE CREASE PHLOEM TO THE ENDOSPERM CAVITY. *Plant Cell & Environment*. 18(4):373-388. English. [UNIV CALIF DAVIS DEPT BOT DAVIS, CA 95616 USA].

In the developing wheat grain, photosynthate is transferred longitudinally along the crease phloem and then laterally into the endosperm cavity through the crease vascular parenchyma, pigment strand and nucellar projection. In order to clarify this cellular pathway of photosynthate unloading, and hence the controlling mechanism of grain filling, the potential for symplastic and apoplastic transfer was examined through structural and histochemical studies on these tissue types. It was found that cells in the crease region from the phloem to the nucellar projection are interconnected by numerous plasmodesmata and have dense cytoplasm with abundant mitochondria. Histochemical studies confirmed that, at the stage of grain development studied, an apoplastic barrier exists in the cell walls of the pigment strand. This barrier is composed of lignin, phenolics and suberin. The potential capacity for symplastic transfer, determined by measuring plasmodesmatal frequencies and computing potential sucrose fluxes through these plasmodesmata, indicated that there is sufficient plasmodesmatal cross-sectional area to support symplastic unloading of photosynthate at the rate required for normal grain growth. The potential capacity for membrane transport of sucrose to the apoplast was assessed by measuring plasma membrane surface areas of the various cell types and computing potential plasma membrane fluxes of sucrose. These fluxes indicated that the combined plasma membrane surface areas of the sieve element-companion cell (se-cc) complexes, vascular parenchyma and pigment strand are not sufficient to allow sucrose transfer to the apoplast at the observed rates. In contrast, the wall ingrowths of the transfer cells in the nucellar projection amplify the membrane surface area up to 22-fold, supporting the observed rates of sucrose transfer into the endosperm cavity. We conclude that photosynthate moves via the symplast from the se-cc complexes to the nucellar projection transfer cells, from where it is transferred across the plasma membrane into the endosperm cavity. The apoplastic barrier in the pigment strand is considered to restrict solute movement to the symplast and block apoplastic solute exchange between maternal and embryonic tissues. The implications of this cellular pathway in relation to the control of photosynthate transfer in the developing grain are discussed. [References: 33].

2947 Wang, HL.; Patrick, JW.; Offler, CE.; Wang, XD. (1995) THE CELLULAR PATHWAY OF PHOTOSYNTHATE TRANSFER IN THE DEVELOPING WHEAT GRAIN .3. A STRUCTURAL ANALYSIS AND PHYSIOLOGICAL STUDIES OF THE PATHWAY FROM THE ENDOSPERM CAVITY TO THE STARCHY ENDOSPERM. *Plant Cell & Environment*. 18(4):389-407. English. [UNIV CALIF DAVIS DEPT BOT DAVIS, CA 95616 USA].

The cellular pathway of sucrose transfer from the endosperm cavity to the starchy endosperm of developing grains of wheat (*Triticum turgidum*) has been elucidated. The modified aleurone and sub-aleurone cells exhibit a dense cytoplasm enriched in mitochondria and endoplasmic reticulum. Significantly, the sub-aleurone cells are characterized by secondary wall ingrowths. Numerous plasmodesmata interconnect all cells between the modified aleurone and starchy endosperm. The protonophore carbonylcyanide-m-chlorophenyl hydrazone (CCCP) slowed [$C-14$]sucrose uptake by grain tissue slices enriched in modified aleurone and sub-aleurone cells but had no effect on uptake by the starchy endosperm. The fluorescent weak acid sulphorhodamine G (SRG) was preferentially accumulated by the modified aleurone and sub-aleurone cells, and this uptake was sensitive to CCCP. The combined plasma membrane surface areas of the modified aleurone and sub-aleurone cells appeared to be sufficient to support the *in vivo* rates of sucrose transfer to the starchy endosperm. Plasmolysis of intact excised grain inhibited [$C-14$]sucrose transfer from the endosperm cavity to the starchy endosperm. The

sulphydryl group modifier p-chloromercuribenzenesulphonic acid (PCMBs) decreased [C-14]sucrose uptake by the modified aleurone and sub-aleurone cells but had little effect on uptake by the starchy endosperm. In contrast, when PCMBs and [C-14]sucrose were supplied to the endosperm cavity of intact excised grain, PCMBs slowed accumulation by all tissues equally. Estimates of potential sucrose fluxes through the interconnecting plasmodesmata were found to be within the published range. It is concluded that the bulk of sucrose is accumulated from the endosperm cavity by the modified aleurone and sub-aleurone cells and subsequently transferred through the symplast to the starchy endosperm. [References: 34].

2948 Wang, X.T.; Below, F.E. (1995) **TILLERING, NUTRIENT ACCUMULATION, AND YIELD OF WINTER WHEAT AS INFLUENCED BY NITROGEN FORM.** *Journal of Plant Nutrition*. 18(6):1177-1189. English. [UNIV ILLINOIS DEPT AGRON 1201 W GREGORY AVE URBANA, IL 61801 USA].

When grown with mixtures of nitrate-nitrogen (NO₃-N) and ammonium-nitrogen (NH₄-N) (mixed N) spring wheat (*Triticum aestivum* L.) plants develop higher order tillers and produce more grain than when grown with only NO₃. Because similar work is lacking for winter wheat, the objective of this study was to examine the effect of N form on tillering, nutrient acquisition, partitioning, and yield of winter wheat. Plants of three cultivars were grown to maturity hydroponically with nutrient solutions containing N as either all NO₃, all NH₄, or an equal mixture of both forms. At maturity, plants were harvested; separated into shoots, roots, and grain; and each part analyzed for dry matter and chemical composition. While the three cultivars varied in all parameters, mixed N plants always produced more tillers (by a range of 16 to 35%), accumulated more N (28 to 61%), phosphorus (P) (22 to 80%), and potassium (K) (11 to 89%) and produced more grain (33 to 60%) than those grown with either form, alone. Although mixed N-induced yield increases were mainly the result of an increase in grain bearing tillers, there was cultivar specific variation in individual yield components (i.e., tiller number, kernels per tiller, and kernel weight) which responded to N form. The presence of NH₄ (either alone or in the mixed N treatment), increased the concentration of reduced N in the shoots, roots, and grain of all cultivars. The effect of NH₄ in either treatment on the concentrations of P and K was variable and depended on the cultivar and plant part. In most cases, partitioning of dry matter, P, and K to the root decreased when NH₄ was present, while partitioning of N was relatively unaffected. Changes in partitioning between the shoot and grain were affected by N treatment, but varied according to cultivar. Based on these data, the changes in partitioning induced by NH₄ and the additional macronutrient accumulation with mixed N are at least partially responsible for mixed-N-induced increases in tillering and yield of winter wheat. [References: 18].

2949 Zhang Xiaorong; Wang Shizhi (Academia Sinica, Beijing (China). Inst. of Botany) (1993) **Studies on the anatomical and physiological factors influencing the unbalanced development of the spikes, spikelets and grains of wheat.** *Acta Agronomica Sinica (China)* v. 19(2) p. 103-110. 11 ill., 3 tables, 20 ref. Chinese. (AGRIC 95-051624).

2950 Zheng Kekuan; Fan Mingshou (Inner Mongolia Inst. of Agriculture and Animal Husbandry, Hohhot (China). Dept. of Agronomy) (1994) **Influence of rhizosphere and nutrition supply on growing and development of spring wheat.** *Acta Agriculturae Boreali-Sinica (China)* v. 9(3) p. 86-91. 7 tables, 2 ref. Chinese. (AGRIC 95-051575).

F63 PLANT PHYSIOLOGY-REPRODUCTION

2951 Ahmed, K.Z.; Sagi, F. (1993) **HIGH-EFFICIENCY PLANT REGENERATION FROM AN EMBRYOGENIC CELL SUSPENSION CULTURE OF WINTER WHEAT (TRITICUM AESTIVUM L.).** *Acta Biologica Hungarica*. 44(4):421-432. English. [CEREAL RES INST POB 391 H-6701 SZEGED HUNGARY].

Highly embryogenic cell suspension cultures were established from immature embryo-derived embryogenic calli of winter wheat (*Triticum aestivum* L., cv. GK Sagvari). Weekly subcultures were made in liquid MS medium supplemented with 2 mg l⁻¹ 2,4-D. An average of twenty-two compact, organized calli were obtained from each 1 ml suspension cells when plated on solid MS medium containing IAA and zeatin under a 16/8 h light/dark cycle, while only 9 calli were produced in the dark. Variation

in the callus inducing ability was correlated to the time elapsed after subculture. Plated cells responded best 9 days after the subculture and 59% of the calli were regenerable, retaining their embryogenic capacity over 6 months. Several hundred green shoots and plants were regenerated on differentiation media supplemented with IAA and BAP, and 300 plants were transferred to the greenhouse. The majority of plants had an abnormal chromosome number and a low viability. [References: 39].

2952 Cheng Zengshu; Gao Zhiqiang; Fang Ren (Hebei Provincial Academy of Agriculture and Forestry Sciences, Shijiazhuang (China). Inst. of Cereal and Oil Crops) (1994) **High frequency cell division and callus formation in the culture of protoplast derived from embryogenic callus of wheat.** *Acta Agriculturae Boreali-Sinica (China)* v. 9(1) p. 1-6. 4 tables, 12 ref. Chinese. (AGRIC 95-051839).

2953 Inagaki, M.; Bohorova, N. (1995) **FACTORS AFFECTING THE FREQUENCIES OF EMBRYO FORMATION AND HAPLOID PLANT REGENERATION IN CROSSES OF HEXAPLOID WHEAT WITH PEARL MILLET.** *Breeding Science*. 45(1):21-24. English. [CIMMYT APARTADO POSTAL 6-641 MEXICO CITY 06600 DF MEXICO].

Factors affecting the frequency of haploid production from the crosses of hexaploid wheat variety Chinese Spring and pearl millet line NEC-7006 were investigated. Wheat florets were pollinated with pearl millet at their developmental stages ranging from one day before anthesis to one day after anthesis. The embryos obtained were incubated on the culture medium with different combinations of hormones (indole-3-acetic acid and 6-benzylaminopurine) and solidifying agents (Gelrite or agar). The effects of developmental stages of immature embryos at the time of embryo rescue were also investigated in relation to plant regeneration. High frequency (25.4 %) of embryo formation was obtained by the pollination earlier than the day of anthesis. Plant regeneration of the embryos was depressed on the culture medium supplemented with hormones. The lowest frequency of plant regeneration was found in the culture medium with combination of hormones and Gelrite. On the agar-solidified culture medium without hormones, immature embryos that were 0.7 mm long at 14 days after pollination regenerated into plants at a frequency of 54.4 %. Frequencies of plant regeneration decreased as the time of embryo rescue was delayed and larger embryos developed. All 118 cytologically examined plants were wheat euploids that carried a complement of 21 chromosomes. These results suggest that the developmental stages of wheat florets and embryos used are critical with respect to production efficiency of wheat haploids from the crosses of hexaploid wheat with pearl millet.

2954 Kihara, M.; Funatsuki, H. (1995) **FERTILE PLANT REGENERATION FROM BARLEY (HORDEUM VULGARE L.) PROTOPLASTS ISOLATED FROM PRIMARY CALLUSES.** *Plant Science*. 106(1):115-120. English. [SAPPORO BREWERIES LTD PLANT BIOENG RES LABS 37-1 KIZAKI GUNPO 37033 JAPAN].

Barley (*Hordeum vulgare* L.) protoplasts were isolated from the immature embryo-derived primary calluses. These protoplasts were cultured with nurse cells, and they then divided to form colonies. After transfer of the colonies to regeneration medium, either green or albino shoots were regenerated from these colonies. A high agarose concentration (2.4% w/v) in the protoplast culture medium promoted protoplast division. The plantlets that developed strong root systems were transferred to the soil. These plants flowered and have set seeds. [References: 15].

2955 Stiff, C.M.; Kilian, A.; Zhou, H.P.; Kudrna, D.A.; Kleinhofs, A. (1995) **STABLE TRANSFORMATION OF BARLEY CALLUS USING BIOLOGISTIC(R) PARTICLE BOMBARDMENT AND THE PHOSPHINOTHRICIN ACETYLTRANSFERASE (BAR) GENE.** *Plant Cell Tissue & Organ Culture*. 40(3):243-248. English. [WASHINGTON STATE UNIV DEPT GENET & CELL BIOL PULLMAN, WA 99164 USA].

Suspension culture cells of barley (*Hordeum vulgare* L. cv. Klages) were collected on filters and bombarded with gold particles carrying the Basta (R) resistance (bar) gene, or both bar and the beta-glucuronidase (uidA) genes in a Biolistic (R) Particle Accelerator. Filters carrying the bombarded tissues were selected on basal medium with increasing concentrations (maximum of 200 mg l⁻¹) of phosphinothricin. Surviving calli were assayed for the presence of phosphinothricin acetyltransferase activity. All positive calli were shown to have the bar gene integrated into their genome. Nine independent stable transformation events have been analyzed with substantial variation in the integration pattern and transgene copy number.

Some albino plantlets were produced, but no mature plants were obtained. [References: 19].

2956 Stirn, S.; Mordhorst, A.P.; Fuchs, S.; Lorz, H. (1995) **MOLECULAR AND BIOCHEMICAL MARKERS FOR EMBRYOGENIC POTENTIAL AND REGENERATIVE CAPACITY OF BARLEY (HORDEUM VULGARE L.) CELL CULTURES**. *Plant Science*. 106(2):195-206. English. [UNIV HAMBURG ZENTRUM ANGEW MOLEK BIOL PFLANZEN INST ALLGEMEINE BOT OHNHORSTSTR 18 D-22609 HAMBURG GERMANY].

The embryogenic potential and regenerative capacity of cereal cell cultures was examined using the expression of two embryo-specific genes (the dormancy-related cDNA-clone B15C, R. Aalen, Norway; the aldose reductase cDNA-clone pG22-69, D. Bartels, Germany) in barley cell cultures. By Northern blotting the expression of both clones was limited to embryogenic cultures and not to non-embryogenic cultures. In situ hybridization showed high gene expression in the shoot and root apex of embryos and in subepidermal cell layers of embryogenic barley cultures. In androgenetic embryos the expression of the embryo-specific clones was detected as early as 2 weeks after isolation of microspores, indicating their usefulness as early markers for embryogenesis. Nevertheless, cell aggregates which were embryogenic but no longer able to regenerate plants, expressed both genes. Cell cultures consisting of embryogenic aggregates unable to regenerate plantlets were used to verify that an embryo-specific marker alone is not sufficient to characterize regenerable cultures. Comparing the protein pattern of embryogenic/regenerable and embryogenic/non-regenerable suspension cultures of barley, we identified a 85-kDa polypeptide (pI 5.8) accumulating only in non-regenerable cultures. Moreover, following the electrophoretic pattern of secreted proteins, two glycoproteins were found correlating with the embryogenic capacity (46 kDa, pI 6.1) and the loss of regenerative potential (17.4 kDa), respectively. The data indicate that at least two levels of control exist in somatic embryogenesis. One is the induction of bipolar embryos and the second the germination of somatic embryos into plantlets. [References: 38].

2957 Vitanova, Z.; Vitanov, V.; Trifonova, A.; Savova, D.; Atanasov, A. (1995) **EFFECT OF 2,4-D PRECULTIVATION ON REGENERATION CAPACITY OF CULTIVATED BARLEY**. *Plant Cell Reports*. 14(7):437-441. English. [INST GENET ENGN BU-2232 KOSTINBROD BULGARIA].

A reliable protocol for regeneration of barley from seedling explants including leaf bases with the complete apical meristem has been developed. Callus induction and shoot regeneration was only achieved when 28 days-old seedlings were grown in the presence of high concentrations of 2,4-D. The Bulgarian barley variety Ruen commercially important for brewery industry was used as a model. The regeneration response of a range of Bulgarian barley genotypes was evaluated. Cytological analyses were performed at the level of callus and regenerants. [References: 26].

2958 Zair, I.; Chlyah, B.; Chlyah, H. (1995) **EFFECT OF TWO BIOLOGICAL EXTRACTS ON SOMATIC EMBRYOGENESIS AND RETENTION OF REGENERATION CAPACITY OF WHEAT CALLUS (TRITICUM AESTIVUM)**. *Canadian Journal of Botany-Revue Canadienne de Botanique*. 73(3):498-504. French. [FAC SCI RABAT DEPT BIOL PHYSIOL VEGETALE LAB AVE IBN BATTOUTA BP 1014 RABAT MOROCCO].

The effect of extracts of potato or immature wheat seeds, polyethylene glycol, or mannitol on the embryogenic capacity of calli derived from half or whole immature embryos of wheat (*Triticum aestivum* L.) has been studied. Calli initiated from embryo halves give the same yield of somatic embryos and regenerated plantlets as calli from whole embryo cultures. Compared to control cultures, calli initiated on potato extract are more embryogenic (>70% embryogenic calli), form bigger embryos in a more reduced number, but that show a higher frequency of plant regeneration and longer retention of the regeneration capacity. The calli initiated on a wheat seed extract form less embryogenic calli and more but smaller somatic embryos; they have a shorter retention of their regeneration capacity. Increase in osmotic potential by addition of polyethylene glycol or mannitol to the culture medium did not improve somatic embryogenesis. [References: 28].

2959 Zhao, F. (Hebei Dry Farming Inst., Hengshui (China)); Li, H.; Bai, Z.; Guo, Z.; Sun, L. (1993) **Studies on the male sterility in wheat (*Triticum aestivum*) induced by two new chemical hybridizing agents; EK and ES**. *Wheat Information Service (Japan)* (no.77) p. 29-32. 6 tables. English. (AGRI 95-065703).

F70 PLANT TAXONOMY AND GEOGRAPHY

2960 Li Longye; Huang Yuanjiang (Southwest Agricultural Univ., Chongqing (China). Dept. of Plant Protection) (1993) **Studies on the resistances to powder mildew and rust of wild relative plants of wheat**. *Journal of Yunnan Agricultural University (China)* v. 8(3) p. 221-222. Chinese. (AGRI 95-051946).

H01 PROTECTION OF PLANTS-GENERAL ASPECTS

2961 Nielsen, G.C.; Haldrup, C. (1995) [Survey 1994, G: Diseases, pests and growth regulation]. *Oversigt 1994, G: Sygdomme, skadedyr og vækstregulering*. Landsudvalget for Planteavl, Aarhus (Denmark). *Oversigt over Landsforsøgene (Denmark)* (no.1994) p. 148-186. 13 ill., 58 tables. Suppl. tables in Markforsøg (Denmark) 1994, part G, p. 416-681. Danish. (AGRI 95-052015).

H10 PESTS OF PLANTS

2962 [Cereal insecticide card, Best (deltamethrine + pyrimicarb)]. *Fiches insecticides cereales [Best (deltamethrine + pyrimicarb)]* (1993) Institut Technique des Cereales et des Fourrages, Paris (France). *Perspectives Agricoles (France)* (no 178) p. 82-86. French. (AGRI 95-052413).

2963 [Cereal insecticide card: Meltop 500 (propiconazole + fenpropidin)]. *Fiches fongicides cereales: Meltop 500 (propiconazole + fenpropidine)* (1993) Institut Technique des Cereales et des Fourrages, Paris (France). *Perspectives Agricoles (France)* (no 178) p. 94. French. (AGRI 95-052414).

2964 Adams, M.J.; Welham, S.J. (1995) **USE OF THE MOST PROBABLE NUMBER TECHNIQUE TO QUANTIFY SOIL-BORNE PLANT PATHOGENS [Review]**. *Annals of Applied Biology*. 126(1):181-196. English. [INST ARABLE CROPS RES DEPT PLANT PATHOL ROTHAMSTED EXPTL STN HARPENDEN AL5 2JQ HERTS ENGLAND].

Bioassays using serial soil dilutions and most probable number (MPN) estimations have been used by various authors to quantify inoculum of soil-borne plant pathogens. The requirements of a reliable bioassay are discussed; they include a good choice of dilution series and reproducible growing conditions. Sources of computer programs for analysis of the data are listed. The importance of testing the fit to the mathematical model used is illustrated and emphasised. Factors affecting the size and stability of the standard errors and of the inherent bias of the most probable number estimate are discussed. Equations are presented for calculating the expected standard errors, approximate confidence limits and least significant differences for different dilution factors and numbers of replicates. The benefits of using uneven replication are illustrated. Mathematical considerations show that the technique should enable differences of an order of magnitude to be detected and MPNs should be quoted with a maximum of two significant figures. Dilution ratios as large as 10 should be avoided. Statistical and biological difficulties, especially in standardising growing conditions when soil moisture is critical, indicate that results should normally be regarded as relative, rather than absolute, measurements of inoculum. [References: 52].

2965 Bhuiyan, M.S.I. (University of Southampton (Royaume Uni). School of Biological Sciences, Department of Biology); Wratten, S.D. (1994) [Grain aphid populations and their fall-off rate on different cultivars of wheat]. [Populations du puceron des cereales et leur diminution selon differents cultivars de ble]. *Bulletin OILB SROP (France)*; v. 17(4) p. 27-35. OILB. 14 ref. p. 27-35. English. (AGRI 95-052404).

2966 Caillaud, C.M. (Institut National de la Recherche Agronomique, Rennes (France). Centre de Rennes, Zoologie); Di Pietro, J.P.; Chaubet, B.; Pierre, J.S. (1994) [Application of discriminant analysis to electrical penetration graphs of the grain aphid (*Sitobion avenae* F.) feeding on resistant and susceptible wheat]. [Application de l'analyse discriminante aux graphes electriques de penetration du puceron des cereales (*Sitobion avenae* F.) s'alimentant sur des bles sensibles et resistants]. *Bulletin OILB SROP (France)*; v. 17(4) p. 36-40. OILB. 12 ref. p. 36-40. English. (AGRI 95-052405).

2967 Caillaud, C.M.; Dipietro, J.P.; Chaubet, B.; Pierre, J.S. (1995) APPLICATION OF DISCRIMINANT ANALYSIS TO ELECTRICAL PENETRATION GRAPHS OF THE APHID SITOBION AVENAE FEEDING ON RESISTANT AND SUSCEPTIBLE WHEAT. *Journal of Applied Entomology-Zeitschrift für Angewandte Entomologie*. 119(2):103-106. English. [ENSA RENNES CHAIRE ZOOLOGIE INRA LAB 65 ROUTE ST BRIEUC F-35043 RENNES FRANCE].

The stylet penetration activities of *Sitobion avenae* F. were followed with an electronic method (DC-EPG) on resistant and susceptible wheat genotypes. Discriminant analysis was therefore applied to data evaluated on each electrical penetration graphs obtained (EPGs). The variables which mostly explained the resistance-susceptibility status of the wheat genotypes appeared to be related to the ingestion sap event (as represented by pattern E2), either to the time preceding first occurrence of a sap ingestion event or to the total time spent by the aphid ingesting sap from the sieve elements of the phloem. On the basis of their stylet penetration activities, individuals were separated into three blocks. The first one was made up of the individuals tested on susceptible or slightly resistant wheat ('susceptible block'). The second one contained the individuals tested on two resistant genotypes ('resistant block 1') and the third one regrouped the individuals tested on another resistant genotype ('resistant block 2'). These results are discussed in relation to the possible mechanisms of wheat resistance to *S. avenae*. [References: 20].

2968 Dasilva, D.B.; Alves, R.T.; Ferreira, P.S.F.; Camargo, A.J.A. (1994) COLLARIA OLEOSA (DISTANT, 1883) (HETEROPTERA, MIRIDAE), A SMALL STINKBUG THREATENING WHEAT CULTIVATION IN THE SAVANNAH REGION OF BRAZIL. *Pesquisa Agropecuária Brasileira*. 29(12):2007-2012. Portuguese. [EMBRAPA CPAC CAIXA POSTAL 08223 BR-73301970 PLANALTINA DF BRAZIL].

During the last 4 years, an increase in population of a small stinkbug was observed on rainfed wheat in farm fields in the Federal District and an intense attack of *Collaria oleosa* (Distant, 1883) in 1994 in the experimental field at EMBRAPA-CPAC, Planaltina, DF. This insect was observed throughout wheat growing period feeding mainly on the epidermal cells presenting typical white specs on the leaf surface. Preliminary observations about its biology revealed that it takes 5 days for middle incubation, 13 days for five nymphal stages and about 14 days for the adult stage. A single female lays up to 28 eggs during its life cycle. This insect mainly attacks gramineous species such as rice, barley, oat, some forage grasses (*Brachiaria decumbens*, *B. brizantha* cv. marandu and *Andropogon gayanus*) besides other native host plants from the savannah region. Hence, this small stinkbug has a great potential as a pest of those gramineous hosts grown intensively in this region.

2969 Drews, F.W. (Universitaet Halle Wittenberg (Allemagne). Landwirtschaftliche Fakultät, Institut fuer Phytopathologie und Pflanzenschutz) (1994) [Setting up and reproduction of *Macrosiphum avenae* (Fabr.) and *Rhopalosiphum padi* L. on healthy and with *Septoria nodorum* Berk. infested wheat plants]. [Installation et reproduction de *Macrosiphum avenae* (Fabr.) et *Rhopalosiphum padi* L. sur des plantes de blé saines et infestées par *Septoria nodorum* Berk.]. *Bulletin OILB SROP* (France); v. 17(4) p. 20-26. OILB. p. 20-26. English. (AGRI 95-052403).

2970 Grover, P. (1995) HYPERSENSITIVE RESPONSE OF WHEAT TO THE HESSIAN FLY. *Entomologia Experimentalis et Applicata*. 74(3):283-294. English. [209 E LUTZ W LAFAYETTE, IN 47906 USA].

Hessian fly *Mayetiola destructor* (Say) larvae are able to obtain food from their host plant without inflicting mechanical damage to the plant surface, apparently by secreting substances which elicit release of nutrients from plant cells surrounding the feeding site. Cells of fully susceptible plants retain their normal appearances, while in resistant plants extensive areas of cellular collapse occur. These responses indicate that hypersensitivity is the basis of wheat's resistance to the Hessian fly. The fly's feeding mechanism more closely resembles that of a pathogen than of a phytophagous insect; correspondingly, both the genetic relationship and resistance mechanism of the host plant to the parasite are of the sorts commonly associated with bacterial and fungal pathogens. [References: 23].

2971 Hasken, K.H. (Universitaet Goettingen (Allemagne). Institut fuer Phytopathologie und Pflanzenschutz); Poehling, H.M. (1994) [Some effects of low input agriculture on cereal aphids and aphid specific predators in

winter wheat]. [Quelques effets d'une agriculture à faibles intrants sur les pucerons des céréales et leurs prédateurs spécifiques sur blé d'hiver]. *Bulletin OILB SROP* (France); v. 17(4) p. 137-147. OILB. 14 ref. p. 137-147. English. (AGRI 95-052409).

2972 Hayhurst, I.M.; Bartlett, D.W. (1995) EXPERIMENTAL FUNGICIDE ICIA0858 (SC-0858) - FOLIAR UPTAKE, TRANSLOCATION AND METABOLISM IN WHEAT AND BARLEY. *Pesticide Science*. 43(4):375-376. English. [ZENACA AGROCHEM JEALOTTS HILL RES STN BRACKNELL RG12 6EY BERKS ENGLAND].

2973 Heitefuss, R. (ed.); Holtschulte, B.; Niemann, M. (1994) [Integrated plant production. Research report. Final report on a priority program "development of an integrated system of crop production with regard to economic and ecological aspects of plant protection in wheat crops"]. *Integrierte Pflanzenproduktion. Forschungsbericht. Abschlussbericht zum Schwerpunktprogramm "Entwicklung eines integrierten Systems der Pflanzenproduktion unter Beachtung ökonomischer und ökologischer Aspekte des Pflanzenschutzes im Weizen"*. Deutsche Forschungsgemeinschaft, Bonn (Germany). VCH. ill., tables. Bibliography Numerous ref. vp. v. 2: 313 p. German. (AGRI 95-066246).

2974 Helenius, J. (University of Helsinki (Finlande). Department of Applied Zoology); Tolonen, T. (1994) [Enhancement of generalist aphid predators in cereals: effect of green manuring on recruitment of ground beetles (Col.: Carabidae)]. [Augmentation des prédateurs généralistes de pucerons en culture de céréales: effet des engrais verts sur le recrutement des carabes (Col., Carabidae)]. *Bulletin OILB SROP* (France); v. 17(4) p. 201-210. OILB. 9 ref. p. 201-210. English. (AGRI 95-052325).

2975 Hill, B.D.; Butts, R.A.; Schaalje, G.B. (1995) MODE OF CONTACT OF CHLORPYRIFOS WITH RUSSIAN WHEAT APHID (HOMOPTERA, APHIDIDAE) IN WHEAT. *Journal of Economic Entomology*. 88(3):725-733. English. [AGR & AGRIFOOD CANADA RES CTR POB 3000 LETHBRIDGE AB T1J 4B1 CANADA].

Laboratory and greenhouse experiments were conducted to determine the mode of contact of chlorpyrifos with Russian wheat aphid, *Diuraphis noxia* (Mordvilko), in wheat, *Triticum aestivum* L. When infested plants were exposed to the vapor only from chlorpyrifos treatments, there was no significant aphid mortality. Apparently, the protective leaf curl surrounding the aphids shields them from toxic vapors generated during the spray operation. When aphids were exposed in vitro to the vapor only from chlorpyrifos-treated leaves, a definite, toxic effect was observed. Different parts of infested, three-leaf stage plants were covered with plastic sleeves during spraying to determine which chlorpyrifos deposits caused a toxic effect. With the aphids located in the bottom of the third leaf, the only deposits causing significant mortality were those on the third leaf itself. Further leaf-cutting and leaf-painting experiments showed that aphid mortality was caused only by deposits on the bottom half of the third leaf. Toxicity from direct contact with dried chlorpyrifos residues on various leaf parts was generally low. A two-step process is postulated for the toxic action of chlorpyrifos against Russian wheat aphid. The initial mode of contact is as a penetrating vapor from the fresh spray deposited on the outside of the protective leaf curl. A secondary, more prolonged toxic action occurs as the dried surface residues on the leaf curl penetrate into the tissue, as a vapor or as dissolved residue, and contact the aphids as they feed. [References: 22].

2976 Hiramoto, T.; Abe, N.; Tobimatsu, R.; Shiraishi, T.; Oku, H.; Yamada, T.; Ichinose, Y. (1995) THE RELATIONSHIP BETWEEN SYSTEMIC RESISTANCE INDUCED BY PRUNING AND ACCUMULATION OF ANTIFUNGAL SUBSTANCES IN BARLEY SEEDLINGS. *Journal of Phytopathology-Phytopathologische Zeitschrift*. 143(1):43-46. English. [OKAYAMA UNIV COLL AGR PLANT PATHOL & GENET ENGN LAB 2-5-1 SHIKATA CHO OKAYAMA 700 JAPAN].

Infection by a compatible race of *Erysiphe graminis* f. sp. *hordei* on barley secondary leaves was significantly suppressed upon pruning of the primary leaves when *E. graminis hordei* was inoculated 3-12 h after the pruning, but it was rather enhanced during 15-21 h. The accumulation of antifungal substances was detected in hot ethanol extracts of barley seedlings from 15-27 h after pruning the primary leaves. Taking the time of the infection process of a challenger (*E. graminis hordei*) into consideration,

ning of systemic resistance induced upon pruning coincided with the accumulation of antifungal substances. [References: 17].

2977 Holz, F. (Universitaet Halle Wittenberg (Allemagne). Institut fuer Phytopathologie und Pflanzenschutz) (1994) [On the occurrence of stenophagous predators of aphids in winter wheat fields nearby Halle (Saxony-Anhalt)]. [Sur la presence des predateurs stenophages de pucerons sur ble d'hiver en Halle (Saxe-Anhalt)]. Bulletin OILB SROP (France); v. 17(4) p. 127-136. OILB. 5 ref. p. 127-136. English. (AGRI 95-052408).

2978 Hussein, I.A.A. (Halle Wittenberg Univ., Halle (Germany). Inst. fuer Phytopathologie und Pflanzenschutz) (1994) [Vertical dispersion of aphids (Aphidae) and cereal leaf beetles (Oulema spp.) on wheat plants and the influence of reduced dose rates of some specific insecticides on these insects]. Vertikale Dispersion von Blattlaeusen (Aphidae) und Getreidehaehnchen (Oulema spp.) auf der Weizenpflanze und ihre Beeinflussung durch reduzierte Aufwandmengen ausgewaehlter Insektizide. Archives of phytopathology and plant protection (Germany) v. 29(1) p. 71-78. 2 ill., 3 tables; 14 ref. German. (AGRI 95-066249).

Investigations on the vertical dispersion of cereal aphids and of cereal leaf beetles (eggs and larvae) were carried out on two winter wheat fields near Halle/S. (Sachsen-Anhalt, Germany). Also reduced dose rates of two insecticides against these insects - Decis (deltamethrine) and Bi 58 EC (dimethoate) - were tested. Sitobion avenae (Fabr.) amount to 80% of the aphid-population of the inspected fields. Nearly 80% of the observed individuals could be found on the upper parts of the wheat plants (ears and flag leaves). With the Oulema spp. 45% of the larvae were staying upon the flag leaves. Down to the lowest leaves the density of both species declined significantly.

2979 Knaust, H.J. (Universitaet Goettingen (Allemagne). Institut fuer Pflanzenpathologie und Pflanzenschutz); Poehling, H.M. (1994) [Studies of the action of imidacloprid on cereal aphids and on their efficiency to transmit the BYD-virus]. [Etude de l'action de l'imidaclopride sur les pucerons des cereales et sur leur capacite a transmettre le virus de la jaunisse nanisante de l'orge]. Bulletin OILB SROP (France); v. 17(4) p. 89-100. OILB. 9 ref., 8 graph. p. 89-100. English. (AGRI 95-052323).

2980 Korcz, A. (Instytut Ochrony Roslin, Poznan (Poland)); Bubniewicz, P.; Paradowska, R. (Rolniczy Zaklad Doswiadczalny IOR, Poznan (Poland)) (1993) [Harmful Heteropteroafauna collected on the triticale and other cereals in the district of Poznan in the years 1988-91]. Szkodliwa heteropteroafauna zebrana na pszenzydzie i innych zbozach w okolicach Poznania w latach 1988-91. 33. Research Session of Institute of Plant Protection; Poznan (Poland); 1993. Materials of the 33rd Research Session of Institute of Plant Protection. Pt. 1. Reports. Pruszyński, J.; Lipa, J.J. (eds.). Instytut Ochrony Roslin, Poznan (Poland) p. 146-155. Państwowe Wydawnictwo Rolnicze i Lesne. 5 fig., 2 tables; 17 ref.. Distributed 1994. Polish. (AGRI 95-052322).

Heteroptera species on triticale, rye and wheat in the years 1988-91 and on their harmfulness 27 species from 6 families (Miridae, Scutelleridae, Pentatomidae, Lygaeidae, Anthoridae, Nabidae) were found. The predatory bugs collected on cereals belonged to Anthoridae and Nabidae family. The most numerous bugs were found on triticale. As phytophagous bugs dominating: Lygus rugulipennis Pop. and L. gemellatus H.-S. They constituted 38-86 percent of all collected specimens from this group. Other species (Stenodema spp., Notostira erratica L., Trigonotylus coelestialis Kirk, Leptoterna dolabrata (L.)) constituted from 2 to 17 percent on the different cereals. The phytophagous bugs were most numerous and most harmful in the milk stage of corn maturity.

2981 Kuang Rongping; Zhu Jianguo; Xiao Ningnian (Academia Sinica, Kunming (China). Kunming Inst. of Zoology) (1993) Biological traits of apple grain aphid (Rhopalosiphum padi L.) reared in different wheat cultivars (Triticum aestivum). Southwest China Journal of Agricultural Sciences (China) v. 6(1) p. 114-116. 4 tables. Chinese. (AGRI 95-052416).

2982 Leszczyński, B. (Wyzsza Szkoła Rolniczo Pedagogiczna, Siedlce (Poland)) (1993) [Biochemical interaction between cereal aphids and winter triticale]. Biochemiczne interakcje mszyce zbozowe - pszenzyto ozime. 32. Research Session: Plant Protection; Poznan (Poland); 1992. Materials of the 32nd Research Session of Institute for Plant Protection. Pt. 2.

Posters. Pruszyński, S.; Lipa, J.J. (eds.). Instytut Ochrony Roslin, Poznan (Poland) p. 249-253. Państwowe Wydawnictwo Rolnicze i Lesne. 3 tables; 13 ref. Polish. (AGRI 95-052304).

The higher activity of the glutathione S-transferase in the aphids fed on studied triticale was observed. The possibility of the hydroxamic acids application in triticale resistance to the grain aphid is discussed.

2983 Loebner, U. (Universitaet Halle Wittenberg (Allemagne). Institut fuer Phytopathologie und Pflanzenschutz); Hartwig, O. (1994) [Soldiers beetles (Col., Cantharidae) and Nabid bugs (Het. Nabidae)- occurrence and importance as aphidophagous predators in winter wheat fields in the surroundings of Halle/Saale (Sachsen-Anhalt) [Cantharis fusca, Cantharis lateralis] (Germany)]. [Les cantharides (Col., Cantharidae) et les punaises Nabidae (Heteroptera): presence et importance en tant que predateurs de pucerons sur ble d'hiver dans les environs de Halle/Saale (Sachsen-Anhalt) [Cantharis fusca, Cantharis lateralis] (Allemagne)]. Bulletin OILB SROP (France); v. 17(4) p. 179-187. OILB. 16 ref. p. 179-187. English. (AGRI 95-052411).

2984 Malschi, D. (Academia de Stiinte Agricole si Silvice "Gheorghe Ionescu Sisesti", Fundulea (Romania). Institutul de Cercetari pentru Cereale si Plante Tehnice) (1993) [Contributions on the study of diptera pests on wheat in Transilvania]. Contributii la studiul diptereilor daunatoare grului in Transilvania. Analele Institutului de Cercetari pentru Cereale si Plante Tehnice Fundulea (Romania) v. 60 p. 199-211. 3 tables; 12 graphs; 21 ref. Romanian. (AGRI 95-052171).

The group of phytophagous Diptera Opomyzidae and Anthomyiidae are one of the important entomological problems on winter wheat crops in Transilvania. They have been present in wheat entomofauna for a long time but the strong attack and heavy damage were registered on early spring in the seventies and eighties of the twentieth century. The data related on the composition of species and biology of phytophagous flies in wheat crops, at the Research Agricultural Station Turda, to the period from 1981 to 1990. Additional investigations were made on ecoclimatic causes for the population abundances and dynamics of species. Sweep net and larval instar examinations of tillers attacked proved the presence of 24 species belonging to 10 Diptera families. The most frequent and numerous species are: Opomyza florum F. (Fam. Opomyzidae), Delia coarctata Fall., Phorbia penicillifera. Jermy, Phorbia securis Tiensuu (Fam. Anthomyiidae) and Oscinella frit L. (Fam. Chloropidae). The attack levels were available and dependent on ecoclimatic and technological conditions. From 1981 to 1990, the most important attack was registered in April, caused by Delia coarctata and opomyza florum (with 10-16 percent tillers attacked), and in May, caused by Phorbia securis and Ph. penicillifera (with 6-7 percent tillers attacked, respectively). The percentage of tillers attacked in April and in May was negatively correlated with yield. Autumn infestation, mainly caused by Oscinella frit and Phorbia securis, was registered only in early wheat crops, in 1981-1983 period (with 5 percent "deadheart" symptoms). The following integrated plant protection measures are suitable to forecast; the late sowing data (in the first-half October); adequate technological measures providing for good tiller; cultivation of winterhardy varieties with productive tillering compensatory capacity.

2985 Mauremootoo, J.R. (University of Southampton (Royaume Uni). School of Biological Sciences, Department of Biology); Wratten, S.D. (1994) [Permeability of field boundaries to predatory carabid beetles]. [Permeabilite des bordures des champs aux carabides predateurs]. Bulletin OILB SROP (France); v. 17(4) p. 188-200. OILB. 6 ref. p. 188-200. English. (AGRI 95-052324).

2986 Mphuru, A.N.; Mushobozy, D.M.K. (1992) Economic importance of termites in some annual crops and their control in Tanzania [millet]. Termite Research and Control; Nairobi (Kenya); 17-19 Aug 1992. Proceedings of the 1st regional workshop on termite research and control. Teknologisk Inst., Copenhagen (Denmark) p. 81-86. DTI. 14 ref. English. (AGRI 95-052461).

2987 Oakley, J.N. (ADAS Bridgents, Martyr Worthy, Winchester, Hampshire SO21 1AP (United Kingdom)) (1994) Orange wheat blossom midge: a literature review and survey of the 1993 outbreak. HGCA Research Review (United Kingdom); no. 28 51 p. Home Grown Cereals Authority. 5 pp. of ref. English. (AGRI 95-066161).

2988 Pons, X.; Tatchell, G.M. (1995) DROUGHT STRESS AND CEREAL APHID PERFORMANCE. *Annals of Applied Biology*. 126(1):19-31. English. [IRTA UDL CTR RES & DEV LLEIDA AREA PROTECCIO CONREUS AVDA ROVIRA ROURE 177 E-25006 LLEIDA SPAIN].

The performance of clones of *Rhopalosiphum padi* and *Sitobion avenae* from England and Spain was examined on drought-stressed tillering winter wheat in an environment chamber at 14 +/- 1 degrees C. Two different levels of drought stress and an unstressed control were established by different watering regimes which resulted in drought-stressed plants being smaller at the end of the experiment. The effect of drought stress to plants on aphid performance was not significantly different between the clones tested. Drought stress had no effect on aphid development time, nymphal mortality, the weight of teneral adults and the number of embryos in teneral adults up to the onset of reproduction in the first F-1 generation. The subsequent reproductive capacity, as measured by the effective and potential fecundity, and the reproductive rate, were much reduced on drought-stressed plants. However, there was only a small decrease in the intrinsic rate of increase ($r(m)$). Overall the clone of *R. padi* from Spain performed better than that from England, the development and prereproductive times being shorter and the fecundity higher in the Spanish clone, giving a higher $r(m)$. There were no differences in the fecundity and the $r(m)$ between the Spanish and the English clones of *S. avenae*. The proportion of the F-2 generation that was alate differed greatly between clones, and only the English *S. avenae* produced significantly more alatae on drought-stressed than on unstressed plants. [References: 36].

2989 Stamenkovic, S. (Poljoprivredni fakultet, Novi Sad (Yugoslavia). Institut za ratarstvo i povrtarstvo); Damjanovic, V. (Zavod za unapredjenje poljoprivrede, Backa Topola (Yugoslavia)) (1994) [Epicometis hirta Poda may severely damage wheat (too)]. *Rutava buba [Epicometis hirta Poda] moze jace ostetiti i pšenicu. Savremena poljoprivreda (Yugoslavia) v. 42(1-2) p. 143-145. 10 ref. Serbian. (AGRIS 95-052307).*

Being a polyphagous insect species, *Epicometis* (=Tropinota) *hirta* Poda attacks a large number of cultivated crops and weed species. It causes extensive damage in pear and apple orchards. The pest has been registered to attack rye and wheat, but in a lesser degree. In the spring of 1992, the pest's imagoes were seen on wheat spikes at the time of flowering on a limited acreage in the vicinity of Backa Topola, Vojvodina (Yugoslavia). The most heavily infested area of 190 ha had to be treated with Sumition E-50 (2 l/ha) in order to prevent the pest from further spreading. Although the occurrence of the pest on small grains is quite rare in these conditions, it is an indication that *Epicometis hirta* Poda imagoes are capable of causing extensive damage in wheat.

2990 Tinline, R.D.; Diehl, J.A.; Spurr, D.T. (1994) ASSESSMENT OF METHODS FOR EVALUATING COMMON ROOT ROT IN SPRING WHEAT AND INFECTION OF SUBTERRANEAN PLANT PARTS BY THE CAUSAL FUNGUS COCHLIOBOLUS SATIVUS. *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie*. 16(3):207-214. English. [AGR CANADA RES STN 107 SCI PL SASKATOON SK S7N 0X2 CANADA].

Some methods of assessing common root rot of spring wheat, caused primarily by *Cochliobolus sativus*, were compared. In field trials in Saskatchewan, disease ratings based on the extent of lesions on crowns did not discriminate among cultivar and line reactions to the disease as consistently as did disease ratings based on lesions on subcrown internodes. Further, reductions in fresh weight and grain yield were associated with disease evaluated on the subcrown internodes but not on the crowns. In Saskatchewan fields many lesions occur on lower leaf sheaths and since some sheaths may disintegrate, considerable variation can occur in ratings based on crowns. Disease incidence and disease rating based on subcrown internode lesions in Brazilian material were highly correlated with those based on lesions on all subterranean plant parts. Since reports show that grain yield per plant declines with increasing disease severity evaluated by the subcrown and all basal part methods, both are deemed appropriate for the evaluation of common root rot and their use is discussed. The frequency of isolation of *C. sativus* was fairly similar from crowns and from subcrown internodes of wheat plants in Saskatchewan. It was lower from crown roots and least from seminal roots. Apparently some isolations from roots represent original infections and do not result from an extension of the fungus from the central axis. *C. sativus* was recovered at moderate frequencies from subcrown internodes that were devoid of lesions. Its isolation frequency from other basal parts of these same plants was

consistently lower than that from parts of plants having subcrown internodes with lesions.

2991 Wang Haiyan; Zhang Zhongshan (Henan Provincial Academy of Agricultural Sciences, Zhengzhou (China). Inst. of Plant Protection) (1994) The effect of dressing with seed coating formulations on controlling of winter wheat diseases and pests. *Acta Agriculturae Boreali-Sinica (China) v. 9(2) p. 115-119. 5 tables, 5 ref. Chinese. (AGRIS 95-052306).*

2992 Weber, A.; Kranz, J. (1994) [Influence of fungicide sprays on the community of pests and diseases in the agroecosystem of winter wheat]. *Einfluss von unterdosierter Fungizidanwendung auf die Komplexität des Befalls im Agroökosystem Winterweizen. [Integrated plant production. Research report. Final report on a priority program "development of an integrated system of crop production with regard to economic and ecological aspects of plant protection in wheat crops"]*. Heitefuss, R. (ed.); Holtschulte, B.; Niemann, M.. *Deutsche Forschungsgemeinschaft, Bonn (Germany) v. 2 p. 2-16. VCH. 4 ill., 6 tables; 31 ref. German. (AGRIS 95-066247).*

The influence of different fungicide applications on the complexity and structure of the disease and pest community on winter wheat was examined in field trials in 1989 and 1990. The broad spectrum fungicides propiconazole and fenpropimorph were applied at a quarter of.

2993 Wellso, S.G.; Hoxie, R.P. (1995) TILLERING RESPONSE OF MONON AND NEWTON WINTER WHEATS INFESTED WITH BIOTYPE L HESSIAN FLY (DIPTERA, CECIDOMYIIDAE) LARVAE. *Great Lakes Entomologist*. 27(4):235-239. English. [1083 KONA LANE BASTROP, TX 78602 USA].

Two wheat, *Triticum aestivum*, cultivars that differed in their ability to tiller were infested by ovipositing Hessian flies, *Mayetiola destructor*, under similar controlled conditions. Since a larva typically stunts and kills the stem where it feeds and develops, tiller development of fly infested-wheat seedlings is an important plant trait relative to grain yield. 'Monon' tillered more than 'Newton' at the 0 infestation level (control). 'Monon' had about the same number of tillers at 0, 1, 2, and 3 puparia (indicative of the number of feeding larvae) per plant; and 'Newton' had fewer tillers at 0 than 1, 2, or 3 puparia per stem. However, tillering of both cultivars was less at 4 or more puparia per stem, perhaps due to the depletion of plant nutrients. In general, for both cultivars there was a decrease in leaf length, number and wet weight as the number of puparia increased per tiller.

2994 Wintgen, A. (Universitaet Goettingen (Allemagne). Institut fuer Pflanzenpathologie und Pflanzenschutz); Bigalke, A.; Buenger, J.; Fiebig, M.; Meyer Zu Brickwedde, W.; Pfaff, K.; Poehling, H.M. (1994) [Barley yellow dwarf virus infestation in winter cereals in Northern Germany 1990-1992]. [Infestation des cereales d'hiver par le virus de la jaunisse nanisante de l'orge dans le nord de l'Allemagne en 1990-1992]. *Bulletin OILB SROP (France) v. 17(4) p. 68-88. OILB. 9 ref., 9 tableaux, 8 graph. p. 68-88. English. (AGRIS 95-052407).*

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2995 [Cereal fungicides cards]. *Fiches fongicides cereales (1993) Institut Technique des Cereales et des Fourrages, Paris (France). Perspectives Agricoles (France) (no 177) p. 70-86. French. (AGRIS 95-053032).*

2996 Ares, M.I.; Melcho, B.; Castro, G. (1994) [Development of a system for rational disease management on wheat in Uruguay]. *Desarrollo de un sistema para el manejo racional de enfermedades en el cultivo de trigo en Uruguay. Fitopatologia Brasileira (Brazil) v. 19(2) p. 154-161. 5 graphs. Spanish. (AGRIS 95-066721).*

2997 Asir, R. (Bharathiar Univ., Coimbatore (India)); Reddy, V.R.K.; Viswanathan, P. (1994) Incorporation of stripe rust resistant specific genes into [Triticum aestivum cultivar] Unnath Kalyansona carrying different gene complexes. *Wheat Information Service (Japan) (no.78) p. 24-27. 2 tables; 6 ref. English. (AGRIS 95-066795).*

2998 Bakardzhieva, N.; Kondakova, V.; Stoev, A. (Institut za Zashchita na Rasteniyata, Kostinbrod (Bulgaria)) (1994) [Detection of the Barley yellow dwarf virus through DAS-ELISA]. *Opredelyane na Barley yellow dwarf virus s pomoshcha na metoda DAS-ELISA. Diagnosis Press Ltd., Sofia (Bulgaria). Biotehnologiya i Biotehnika (Bulgaria); Biotekhnologiya and*

Barley yellow dwarf virus (BYDV) have a world-wide distribution and infect plant species from several different subfamilies of the Gramineae. More than 70 species are known as experimental hosts of these viruses but relatively few of these have been found infected in the field. The disease has been discovered in almost all East and West European countries, as well as in Canada and the USA. The losses caused by it amount to millions of dollars. The present article goes over the results from the DAS-ELISA test of barley samples of various origins. The test proves the presence of BYDV infection of barley plants in two remote regions in Bulgaria.

2999 Balmas, V.; Corazza, L. (Istituto Sperimentale per la Patologia Vegetale, Rome (Italy)) (1994) [Fusarium graminearum Group 2 causal agent of scab (head blight) of Triticum durum in Central Italy]. Fusarium graminearum Gruppo 2 agente causale della scabbia del frumento duro nell'Italia centrale. *Informatore Fitopatologico (Italy)* v. 44(11) p. 59-62. 1 table; 15 ref. Italian. (AGRI 95-053067).

Fusarium graminearum Group 2 caused an epidemic of scab (head blight) on 25 cultivars of Triticum durum in a varietal trial for the evaluation of agronomic traits. The cultivars Doro, Ofanto, Simeto, Tavoliere and Valnova were the most susceptible, while Cresco confirmed the moderate resistance recorded several years ago. The relevance of maize as preceding crop and of the presence of residues of this cereal left on the field for the development of epidemics on durum wheat is stressed.

3000 Baluska, F.; Bacigalova, K.; Oud, J.L.; Hauskrecht, M.; Kubica, S. (1995) RAPID REORGANIZATION OF MICROTUBULAR CYTOSKELETON ACCOMPANIES EARLY CHANGES IN NUCLEAR PLOIDY AND CHROMATIN STRUCTURE IN POSTMITOTIC CELLS OF BARLEY LEAVES INFECTED WITH POWDERY MILDEW. *Protoplasma* 185(3-4):140-151. English. [SLOVAK ACAD SCI INST BOT DUBRAVSKA CESTA 14 BRATISLAVA 84223 SLOVAKIA].

Post-mitotic epidermal cells of barley leaves were found to contain, in addition to cortical microtubules (CMTs), distinct arrays of endoplasmic microtubules (EMTs). These encircle nuclei and continuously merge into the CMT arrays that underlie the plasmalemma. Detailed three-dimensional reconstruction of both types of MTs during fungal infection showed that profound and very rapid MT rearrangements occurred especially in the case of incompatible (resistant) barley-powdery mildew genotype combination. The most early MT responses, followed by their subsequent complete disintegration, were recorded around nuclei. These events might be relevant for the induction of such nuclear processes as onset of DNA synthesis and nuclear chromatin condensation. Observed pattern of early infection events, as well as less prominent responses in the case of compatible (susceptible) barley-powdery mildew genotype combination, both findings suggest that rapid reorganization of the MT cytoskeleton could be involved in recognition of the fungus by host cells and in the initiation of resistance responses in barley leaves. We hypothesize that the integrity and dynamics of the MT cytoskeleton, especially of its perinuclear part, might participate in control mechanisms involved in activation of resistance genes. [References: 42].

3001 Beck, J.J.; Ligon, J.M. (1995) POLYMERASE CHAIN REACTION ASSAYS FOR THE DETECTION OF STAGONOSPORA NODORUM AND SEPTORIA TRITICI IN WHEAT. *Phytopathology* 85(3):319-324. English. [CIBA GEIGY CORP POB 12257 RES TRIANGLE PK, NC 27709 USA].

Polymerase chain reaction (PCR) primers have been developed that can distinguish important wheat pathogenic fungal species and detect their DNA in infected wheat leaf tissues. Septoria tritici (teleomorph Mycosphaerella graminicola) and Stagonospora nodorum = Septoria nodorum (teleomorph Phaeosphaeria nodorum), are agronomically significant pathogens of wheat, causing wheat leaf and glume blotch, respectively. Primers made to conserved sequences of the ribosomal DNA were used to PCR amplify and clone the internal transcribed spacer (ITS) regions from S. nodorum and S. tritici. The ITS regions were sequenced, the sequences were aligned, and species-specific PCR primers were designed to the polymorphic regions. These ITS-derived primers were used to amplify specific fragments from the fungi from which they were designed, thus allowing the detection of the pathogens. The primers also successfully amplified similar-sized fragments from wheat tissues infected with the respective fungi. [References: 16].

3002 Benada, J.; Milotova, J.; Pospisil, A. (1995) VARIETAL SENSITIVITY TO COMMON BUNT IN WHEAT AND TO STRIPE DISEASE AND LOOSE SMUT IN BARLEY. *Rostlinna Vyroba* 41(4):185-188. Czech. [ZEMEDELSKY VYZKUMNY USTAV HAVLICKOVA 2787 CR-76741 KROMERIZ CZECH REPUBLIC].

In the years 1993 and 1994, the sensitivity of wheat varieties to common bunt [Tilletia caries (DC.) Tul.] in the field trials at a seeding rate of 200 kg per hectare and two concentrations of inoculum was investigated. Principally higher infestation was found in 1993, the highest level was found in the variety Sofia with 47% of diseased ears and lowest limit in the variety Livia with only 5% of infested ears. In 1994 the experiments were expanded by three sowing dates and a higher number of varieties applied. Asta was the variety with the highest infestation (in some variants 30% of infested ears), nevertheless, on average the infestation of wheat was low. In other trials carried out in the same year, higher incidence was achieved using space sowing. It is assumed that in the dense wheat crop the growing apex can escape the fungus mycelium. In 1994 a collection of spring barley infested by stripe disease (Helminthosporium gramineum Rab.) and loose smut [Ustilago nuda (Jensen) Rostr.] was assessed. In one case, the varieties were exposed to natural infestation beside a diseased crop in the preceding year, in the other case, the collection was sown several years without seed dressing. There were great differences in the susceptibility of varieties to the above-mentioned diseases. The stripe disease seems to be more dangerous for barley than loose smut. The varietal sensitivity of cereals to smuts and stripe disease can be a part of factors affecting the decision of the necessity of seed dressing.

3003 Bernicot, M.H. (Institut Technique des Cereales et des Fourrages, Paris (France)); David, H. (1993) [Variety behaviour in front of cereal lodging and diseases]. Quel comportement (varietal) face aux maladies et a la verse ? *Perspectives Agricoles (France)* (no 176) p. 48-57. French. (AGRI 95-053030).

3004 Bouchet, Y. (Federation Nationale des Agriculteurs Multiplicateurs de Semences, Brain sur l'Authion Paris (France). Centre Technique des Semences); Collin, F. (1994) [Durum wheat, soft wheat. Effects of Fusarium wilt on seed quality]. Ble dur, ble tendre. L'incidence de la fusariose sur la qualite des semences. *Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France)* (no 127) p. 39-40. French. (AGRI 95-066782).

3005 Braun, P. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1994) [1993 regional strategies for fungicide utilisation in cereal crops (Provence-Languedoc area (France))]. Les strategies regionales fongicides en 1993 [Provence-Languedoc: le recul de dix annees d' experimentation (France)]. *Perspectives Agricoles (France)* (no 189) p. 96-98. French. (AGRI 95-066725).

3006 Braun, P. (1993) [Regional fungicide program, strategy for fungicide use on hard wheat in Provence Languedoc area]. Quelle strategie fongicide sur ble dur en Provence-Languedoc? *Perspectives Agricoles (France)* (no 176) p. 16-17. French. (AGRI 95-053027).

3007 Budzevich, G.V.; Koptsik, I.K. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1993) [Spike fusariose and selection of winter wheat to pathogen]. Fuzaryez kolasa yi selektsyya azimaj pshanitsy da patagena. *Vesti Akademi Ahrarnykh Navuk Belarusi (Belarus)* (no. 4) p. 14-17. 2 tables; 8 ref. Byelo Russian. (AGRI 95-052918).

The identity of agent species composition, causing spike fusariose and root rots of winter wheat as stated. The sources of resistance to this disease are singled out.

3008 Cao Keqiang; Wang Gexin (Hebei Agricultural Univ., Baoding (China). Dept. of Plant Protection); Li Shuangyue (1994) Establishment of the middle-period forecasting model for powdery mildew of wheat. *Journal of Hebei Agricultural University (China)* v. 17(1) p. 57-61. 2 ill., 1 table, 6 ref. Chinese. (AGRI 95-053048).

3009 Caron, D. (1993) [Piloting fungicide treatments in wheat crops]. Pilotage des cultures: le pilotage des traitements fongicides du ble. *Perspectives Agricoles (France)* (no 178) p. 63-68. 7 graph. French. (AGRI 95-053033).

3010 Carroll, JE.; Gray, SM.; Bergstrom, GC. (1995) USE OF ANTISERUM TO A NEW YORK ISOLATE OF WHEAT SPINDLE STREAK MOSAIC VIRUS TO DETECT RELATED BYMOVIRUSES FROM NORTH AMERICA, EUROPE, AND ASIA. *Plant Disease*. 79(4):346-353. English. [CORNELL UNIV USDA ARS ITHACA, NY 14853 USA].

Wheat spindle streak mosaic bymovirus (WSSMV) is a widespread and damaging pathogen of winter wheat in North America. The diagnosis of this viral disease has relied primarily on the observation of transient symptoms that may be confused with other biotic and abiotic stresses. Virus was purified from field-infected wheat plants grown in New York and a polyclonal antiserum was produced that by enzyme-linked immunosorbent assay detected as little as 0.25 ng WSSMV/μL leaf or root sap. The antiserum reacted to bymoviruses from North America, Europe, and Asia, including isolates of WSSMV, wheat yellow mosaic virus, and barley yellow mosaic virus, but did not detect oat mosaic virus or barley mild mosaic virus. This corroborates previous findings on serological relationships within the bymovirus group. The antiserum did not react with other cereal viruses tested, including soilborne wheat mosaic furovirus, wheat streak mosaic rymovirus, and barley yellow dwarf luteovirus. The availability of this antiserum will facilitate detection of bymoviruses and enhance research on biology, epidemiology, and management of the diseases caused by these fungal-vectored viruses. [References: 41].

3011 Chen, JP.; Macfarlane, SA.; Wilson, TMA. (1995) EFFECT OF CULTIVATION TEMPERATURE ON THE SPONTANEOUS DEVELOPMENT OF DELETIONS IN SOILBORNE WHEAT MOSAIC FUROVIRUS RNA 2. *Phytopathology*. 85(3):299-306. English. [SCOTTISH CROP RES INST DEPT VIROL DUNDEE DD2 5DA SCOTLAND].

Intraplant movement of soilborne wheat mosaic virus (SBWMV) and the spontaneous development of sequence deletions in SBWMV RNA 2 were monitored in individual plants of *Triticum aestivum* cultivars Galahad and Vona inoculated mechanically or with viruliferous zoospores of *Polymyxa graminis* and grown at different temperatures. Movement of SBWMV RNAs 1 and 2 (either full-length or deleted forms) from foliage to roots was detected 2 days after mechanical inoculation. Plants infected by *P. graminis* and maintained at high temperatures (25-30°C) showed extensive deletions in the readthrough (RT) domain of the coat protein-RT gene within 4-12 wk. In contrast, plants kept at 17°C over the same period contained only full-length RNA 2 molecules (3,593 nucleotides). Thus, in addition to prolonged cultivation at 15-17°C and/or serial mechanical transfers to healthy plants, higher temperatures resulted in truncated forms of SBWMV RNA 2. Our observations confirm that only full-length SBWMV RNA 2 is transmitted to wheat roots by viruliferous *P. graminis* from field soil and that there is no intraplant barrier to the movement of deleted forms of RNA 2 between roots and leaves. Deleted forms of SBWMV RNA 2 appear to cause more severe symptoms only after mechanical inoculation to young, healthy plants. The significance of these observations for events in fields of winter wheat or barley, especially those expressing a temperature-sensitive host resistance gene against SBWMV, are discussed. These studies may also help elucidate the mechanism of spontaneous RNA deletion. [References: 24].

3012 Chen, XM.; Jones, SS.; Line, RF. (1995) CHROMOSOMAL LOCATION OF GENES FOR STRIPE RUST RESISTANCE IN SPRING WHEAT CULTIVARS COMPAIR, FIELDER, LEE, AND LEMHI AND INTERACTIONS OF ANEUPLOID WHEATS WITH RACES OF *PUCCINIA STRIIFORMIS*. *Phytopathology*. 85(3):375-381. English. [WASHINGTON STATE UNIV DEPT PLANT PATHOL PULLMAN, WA 99164 USA].

The spring wheat (*Triticum aestivum*) cultivar Lemhi has one gene, and cultivars Lee, Compair, and Fielder have two genes each for resistance to stripe rust, caused by *Puccinia striiformis*. To determine the chromosomal locations of the genes, the cultivars were crossed with susceptible disomic Chinese Spring and a set of 21 Chinese Spring aneuploids. Monosomic F1 plants were cytologically determined, grown in a greenhouse, and self pollinated to produce F2 seed. F2 seedlings and their parents were inoculated with selected North American races of *P. striiformis*. The results confirmed that Yr6 in Fielder is on chromosome 7B and Yr8 in Compair is on chromosome 2D; and they show that YrLem in Lemhi is on chromosome 1B, YrLel in Lee is on chromosome 4D, YrLe2 in Lee is on chromosome 6D, YrCom in Compair is on chromosome 5B, and YrFie in Fielder is on chromosome 6D. None of the Lee genes that we detected with North American races is Yr7. We propose official gene designations Yr19 for

YrCom, Yr20 for YrFie, Yr21 for YrLem, Yr22 for YrLel, and Yr23 for YrLe2. [References: 35].

3013 Chen, XM.; Line, RF. (1995) GENE ACTION IN WHEAT CULTIVARS FOR DURABLE, HIGH-TEMPERATURE, ADULT-PLANT RESISTANCE AND INTERACTION WITH RACE-SPECIFIC, SEEDLING RESISTANCE TO *PUCCINIA STRIIFORMIS*. *Phytopathology*. 85(5):567-572. English. [WASHINGTON STATE UNIV DEPT PLANT PATHOL PULLMAN, WA 99164 USA].

Stephens and Druchamp wheat (*Triticum aestivum*) cultivars have both durable, high-temperature, adult-plant (HTAP) resistance and race-specific, seedling resistance to stripe rust caused by *Puccinia striiformis*. Gene action for the HTAP resistance was studied in parental F-1, F-2, and backcross populations from reciprocal crosses among Stephens, Druchamp, Paha (a cultivar with race-specific resistance); and Michigan Amber (a susceptible cultivar) using stripe rust intensity data from the field transformed to area under the disease progress curve (AUDPC). Based on a joint scaling test, the additive component for HTAP resistance was significant for both Stephens and Druchamp. When HTAP resistance was effective and seedling resistance was ineffective in the same parent, the dominant component and the additive-additive, additive-dominant, and dominant-dominant epistatic interactions contributed significantly to HTAP resistance in Druchamp but not in Stephens. When HTAP resistance and seedling resistance were effective in the same parent, the dominant component and additive-additive and dominant-dominant epi-static interactions were significant in both Stephens and Druchamp and the additive-dominant epistatic interaction was significant in Stephens but not in Druchamp. When HTAP resistance was effective in one parent and seedling resistance was effective in the other parent, the dominant component and the additive-additive and dominant-dominant epistatic interactions were significant in the Druchamp crosses but not in the Stephens crosses. When HTAP resistance was effective in both parents, the additive and dominant components were detected at the Mount Vernon, WA, site but not the Pullman, WA, site. A constant cytoplasmic effect and a cytoplasm-dominance interaction were significant in reciprocal crosses of Stephens with Paha inoculated with race CDL-29; HTAP resistance was greater when Stephens was the female parent. A cytoplasm-additive gene interaction was significant in the reciprocal crosses of Druchamp with Paha tested with race CDL-25. Based on the gene action of HTAP resistance and its interactions with seedling resistance, it should be possible to exploit both HTAP and seedling resistances in breeding programs and in crosses; Stephens and Druchamp should be used as female parents to obtain the highest HTAP resistance. [References: 19].

3014 Chen, XM.; Line, RF. (1995) GENE NUMBER AND HERITABILITY OF WHEAT CULTIVARS WITH DURABLE, HIGH-TEMPERATURE, ADULT-PLANT (HTAP) RESISTANCE AND INTERACTION OF HTAP AND RACE-SPECIFIC SEEDLING RESISTANCE TO *PUCCINIA STRIIFORMIS*. *Phytopathology*. 85(5):573-578. English. [WASHINGTON STATE UNIV DEPT PLANT PATHOL PULLMAN, WA 99164 USA].

Wheat cultivars Druchamp and Stephens have durable, non-racespecific, high-temperature, adult-plant (HTAP) resistance to *Puccinia striiformis*, as well as race-specific resistance expressed in both seedling and adult plants. Cultivar Paha has only race-specific seedling resistance. Cultivar Michigan Amber is susceptible to all known North American races of *P. striiformis*. To determine the gene number and heritability of HTAP resistance and the relationship of HTAP resistance to seedling resistance, diallel, reciprocal crosses were made among Druchamp, Stephens, and Paha or Michigan Amber in a greenhouse. Parents and F-1, F-2, B-1, B-2, F-3, and F-5 progeny from all crosses were tested at Pullman, WA, in a plot inoculated with race CDL-25. The same progeny from the crosses of Druchamp and Stephens with Paha were tested at Pullman in a plot inoculated with race CDL-29, and progeny from the crosses of Druchamp with Stephens were tested with naturally occurring race CDL-25 at Mount Vernon, WA. Means and variances of area under disease progress curve based on disease intensity data were used to estimate the number of genes and the heritability of resistance in Stephens and Druchamp. IT data also were analyzed to determine the number of genes in the cultivars. Two to three KTA resistance genes were estimated for both Druchamp and Stephens. The HTAP resistance genes in Druchamp and Stephens were different from one another and different from the race-specific resistance genes in Druchamp, Stephens, and Paha. The HTAP resistances showed no specificity for races CDL-25 and CDL-29. Estimated broad- and narrow-sense heritabilities of the HTAP resistance were high. Broad-sense heritability was 96.8% for

Druchamp and 95.3% for Stephens. Narrow-sense heritability was 86.1-89.1% for Druchamp and 95.4% for Stephens. When HTAP resistance and seedling resistance were combined, estimated broad-sense heritabilities remained high (85.2-98.7%), but estimated narrow-sense heritabilities became low and variable (19.8-60.2) depending on the combination of genes. HTAP genes in both Druchamp and Stephens provided high adult-plant resistance over a range of environmental conditions. Combining these genes for resistance into new commercial cultivars should provide greater stripe rust resistance. [References: 32].

3015 Dal Bello, G.M.; Monaco, C.I.; Sisterna, M.N. (1994) [Trichoderma spp. effect on the control of the wheat seedling blight caused by *Bipolaris sorokiniana* in greenhouse]. Efecto de *Trichoderma* spp. sobre el control del tizon de la plantula em trigo ocasionado por *Bipolaris sorokiniana* bajo condiciones de invernadero. *Fitopatologia Brasileira (Brazil)* v. 19(3) p. 394-400. 5 illus.; 27 ref. Spanish. (AGRIS 95-067086).

3016 Das, M.K.; Griffey, C.A. (1995) GENE ACTION FOR ADULT-PLANT RESISTANCE TO POWDERY MILDEW IN WHEAT. *Genome*. 38(2):277-282. English. [VIRGINIA POLYTECH INST & STATE UNIV DEPT CROP & SOIL ENVIRONM SCI BLACKSBURG, VA 24061 USA].

Gene action for adult-plant resistance to powdery mildew was studied using generation mean analyses of parents and of F-1, F-2, and backcross populations derived from a diallel cross of one susceptible and three adult-plant resistant wheat cultivars. Joint scaling tests showed that an additive-dominance model was sufficient to explain the variability in the expression of adult-plant resistance in one cross, while digenic epistasis was involved in the other five crosses. Additive gene effects were predominant; however, dominance was significant in four crosses, additive X additive interaction was significant in three crosses, additive X dominance interaction was significant in three crosses, and dominance X dominance interaction was significant in one cross. Therefore, selection for adult-plant resistance would likely be most effective in advanced generations derived from crosses among the adult-plant resistant cultivars Redcoat, Houser, and Massey. [References: 30].

3017 Devallavieillepoite, C.; Huber, L.; Leconte, M.; Goyeau, H. (1995) COMPARATIVE EFFECTS OF TEMPERATURE AND INTERRUPTED WET PERIODS ON GERMINATION, PENETRATION, AND INFECTION OF PUCCINIA RECONDITA F SP TRITICI AND P. STRIFORMIS ON WHEAT SEEDLINGS. *Phytopathology*. 85(4):409-415. English. [INRA PATHOL VEGETALE LAB F-78850 THIVERVAL GRIGNON FRANCE].

Under optimal temperature and nonlimiting wetness duration, the infection efficiency (defined as the proportion of inoculated urediniospores causing lesions on wheat seedling leaves) was 12 times greater for *Puccinia recondita* f. sp. *tritici* than for *P. striiformis*. Penetration of both species, however, was similarly affected by a 1-h dry period interrupting a 24-h wet period 1, 2, 4, 6, 8, or 16 h after inoculation at several temperatures between 5 and 30 C. Appressoria from germinated *P. r. tritici* urediniospores prior to penetration were unable to survive the 1-h dry period. An interruption of the wet period by a dry period did not affect ungerminated urediniospores, which were able to infect leaves during a subsequent dew period. The minimal continuous dew period necessary for infection increased from 4 to 6 h at optimal temperatures (8 C for *P. striiformis*, 15 C for *P. r. tritici*) to at least 16 h at suboptimal temperatures. Infection by *P. r. tritici* occurred over a wide range of temperatures (5-25 C), whereas infection by *P. striiformis* was restricted to a narrower range (5-12 C). Percentage of infection as a function of the duration of the continuous dew period was described by a Richards's function with temperature-dependent parameters. For a dry period interrupting the 24-h dew period before the minimal continuous dew period necessary for infection, percentage of infection at specific temperatures was fitted by a negative exponential function of time of interruption. If the dry period occurred after the minimal dew duration for infection, percentage of infection was the same as with a continuous wet period. [References: 30].

3018 Doussinault, G. (Institut National de la Recherche Agronomique, Le Rheu (France). Centre de Rennes, Groupe d'Etudes et de Controle des Varietes et des Semences, Secteur d'Etude des Varietes) (1993) [Wheat: disease resistant and disease tolerant varieties]. Bie: valoriser les resistances et les tolerances varietales. *Perspectives Agricoles (France)* (no 180) p. 7-10. French. (AGRIS 95-053035).

3019 Duan, C.H.; Tsai, W.H.; Tu, C.C. (Taiwan Agricultural Research Institute, Wufeng, Taichung (Taiwan)) (1992) Some host plants of *Bipolaris maydis* in Taiwan. *Plant Pathology Bulletin (United Kingdom)* v. 1(3) p. 156-157. 8 ref. Chinese. (AGRIS 95-066740).

3020 Duveiller, E. (CIMMYT (Centro Internacional de Mejoramiento de Maiz y Trigo), Lisboa 27, Apdo Postal 6 641, 06600 Mexico D.F. (Mexico)) (1994) Bacterial leaf streak or black chaff of cereals. *Bulletin OEPP (United Kingdom)* v. 24(1) p. 135-157. 8 pp. of ref. English. (AGRIS 95-066741).

3021 Dyck, P.L.; Sykes, E.E. (1995) THE INHERITANCE OF STEM RUST AND LEAF RUST RESISTANCE IN SOME ETHIOPIAN WHEAT COLLECTIONS. *Euphytica*. 81(3):291-297. English. [AGRICANADA WINNIPEG RES CTR 195 DAFOE RD WINNIPEG MB R3T 2M9 CANADA].

Common and durum wheat populations obtained from Sweden and originally collected in Ethiopia were screened for resistance to stem rust and leaf rust. Resistant selections of common wheat were crossed and backcrossed with either stem rust susceptible RL6071, or leaf rust susceptible Thatcher. Genetic studies, based largely on tests of backcross F-2 families, showed that four of the selections had in common a recessive gene *SrA*. Plants with this gene were resistant (1-+ infection type) to all stem rust races tested. This gene was neither *Sr26* nor *Sr29*. The resistance of other selections, based on tests with an array of rust isolates, was due to various combinations of *Sr6*, *8a*, *9a*, *9d*, *9e*, *11*, *13*, *30*, and *36*. One of the selections had linked genes, *Lr19/Sr25*. Another selection had a dominant gene for resistance (1 infection type) to all the races of leaf rust. With the possible exception of this gene for leaf rust resistance and *SrA*, no obviously new resistance was found. [References: 7].

3022 Eshetu Bekele (1992) Studies on the Fungicidal Control of Septoria Leaf Blotch of Wheat. *Ethiopian Journal of Agricultural Science (Ethiopia)* v. 13(1-2) p. 37-46. 4 Tables; 10 ref. English. (AGRIS 95-066792).

A number of fungicides were screened for the control of septoria leaf blotch of wheat from 1984 to 1987 at Holetta Research Center. Rate, spray frequency and interaction between promising fungicides and cultivars have been studied. Propiconazole, chlorothalonil, flutriafol and fenitacetate + maneb restricted the disease spread, reduced disease severity and number of pycnidia on flag leaves of susceptible cultivars. Seed weight and yield were increased by more than 50 percent. Two applications at half rate (0.5 lt ha-1) of propiconazole and flutriafol, early (when symptom appeared) and late (3 weeks after the first spray), and one application at full rate (1.0 lt ha-1) of the same products at about heading, and in addition, two application (early and late) of chlorothalonil (1.125 kg a.i. ha-1) have similarly and significantly reduced the disease and increased both seed weight and yield of a susceptible cultivar Laketch-8156. Five fortnightly sprays (starting at the on-set of the disease) of fenitacetate + maneb (0.1 percent) were required to achieve the same level of control. The effect of these fungicides was less when a resistant cultivar (Enkoy) or a moderately susceptible cultivar (Dashen) were sprayed. On the other hand, spraying a susceptible cultivar like Laketch-8156 with the fungicides had significantly controlled the disease and increased seed weight and yield by about 40 and 60 percent, respectively. The result indicates that spraying a cultivar with some moderate or high resistance for the control of septoria leaf blotch per-se may not be necessary. However, if one has to spray wheat fields for the control of stripe and leaf rusts, the broad spectrum fungicides, such as propiconazole and flutriafol, may as well be used for the control of septoria leaf blotch as these diseases often occur together at different severity levels depending upon the cultivar and environmental factors.

3023 Fan Yongjian; Lu Zhenxiao; Wu Shuhua (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Plant Protection); Peng Guangjuan (1993) Some properties of coat proteins and nucleic acids of wheat spindle streak mosaic virus and its cDNA synthesis. *Jiangsu Journal of Agricultural Sciences (China)* (suppl.) p. 1-5. 3 ill., 12 ref. Chinese. (AGRIS 95-053050).

3024 Fehrmann, H. (Goettingen Univ. (Germany). Inst. fuer Pflanzenpathologie und Pflanzenschutz); Allam, A.D.A.; Manthey, R.; Krueger, W. (1994) [Fungal attack on wheat roots and successions of pathogenic fungi in wheat]. Pilzbefall an Weizenwurzeln und Befallssukzessionen weizenpathogener Pilze. [Integrated plant production. Research report. Final research report on a priority program "development of an

integrated system of crop production with regard to economic and ecological aspects of plant protection in wheat crops" J. Hestefuss, R. (ed.); Holtschulte, B.; Niemann, M.. Deutsche Forschungsgemeinschaft. Bonn (Germany) v. 2 p. 17-28. VCH. 2 ill., 7 tables; 8 ref. German. (AGRI 95-066789).

In two winter wheat fields at two different locations and with two different crop rotations each with a different wheat history, during two successive years and at different plant stages a survey was made for fungal attack of wheat roots. Mainly at a more advanced plant stage, damage by root pathogenic fungi may become quite high. From root lesions a number of - usually quite common - fungi was isolated, and their pathogenicity tested under greenhouse conditions. Experimental evidence from former authors and field observations led to the opinion of strong mutual dependence and mutual influence of wheat attack by different wheat pathogenic fungi. In model field experiments with artificial inoculation, this mutual influence was investigated for *Erysiphe graminis*, for *Pseudocercospora herpotrichoides* and for *Septoria nodorum*. The results led to the conclusion that usually such influence should be of minor importance and of shorter duration only. - Statistical analysis of numerous assessment data from a number of field experiments with wheat variety mixtures in many cases revealed highly significant correlations between the attack by powdery mildew, leaf rust, stripe rust and/or *S. nodorum* (unspecific necrotic leaf spots), which support the aforementioned statement. Root attacking fungi were not included in this study.

3025 Fernandez, MR.; Clarke, JM.; Depauw, RM.; Irvine, RB.; Knox, RE. (1994) BLACK POINT AND RED SMUDGE IN IRRIGATED DURUM WHEAT IN SOUTHERN SASKATCHEWAN IN 1990-1992. *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie*. 16(3):221-227. English. [AGR & AGRIFOOD CANADA RES CTR POB 1030 SWIFT CURRENT SK S9H 3X2 CANADA].

The incidence of black point and red smudge was determined in 133-183 durum wheat genotypes (introductions, breeding lines, and registered cultivars), grown under irrigation at two locations, Swift Current and Outlook, Saskatchewan, in 1990-1992. The fungi responsible for these kernel diseases were also identified in 1991 and 1992. Levels of black point were higher at Outlook than at Swift Current, and in 1992 than in the previous years, with the lowest levels being found in 1991. Black point incidence was correlated between locations, and between 1991 and 1992. Mean black point incidence was 14% in 1990, 10% in 1991, and 27% in 1992 at Swift Current, and 27% in 1990, 19% in 1991, and 41% in 1992 at Outlook. Red smudge was less common than black point but was also present at higher levels in 1992 (1.7-2.3%) than in 1990 or 1991 (average incidence less than or equal to 0.2%). Low temperatures, high rainfall, and frosts during seed development, which delayed maturity and ripening of the crop, likely contributed to a greater development of these kernel diseases in 1992 than in previous years. *Pyrenophora tritici-repentis* was isolated from all red smudged durum wheat kernels, and from some of the black pointed kernels. *Alternaria* spp. were the most prevalent fungi in black pointed kernels; *Cochliobolus sativus* was also associated with black point symptoms in durum wheat. Other fungi, mostly saprophytes and bacteria, were more numerous in kernels in 1992 than in 1991. Field conditions in 1990-1992 allowed for the detection of different levels of resistance among genotypes to black point but not to red smudge, except in 1992. Some of these differences were associated with plant height. The semi-dwarf durum wheat genotypes were more susceptible to black point, but more resistant to red smudge, than the conventional height genotypes.

3026 Fetch, TG.; Steffenson, BJ. (1994) IDENTIFICATION OF COCHLIOBOLUS SATIVUS ISOLATES EXPRESSING DIFFERENTIAL VIRULENCE ON TWO-ROW BARLEY GENOTYPES FROM NORTH DAKOTA. *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie*. 16(3):202-206. English. [N DAKOTA STATE UNIV DEPT PLANT PATHOL FARGO, ND 58105 USA].

Severe spot blotch infection was observed in 1990 on several two-row barley breeding lines previously regarded as resistant to *Cochliobolus sativus*. Studies were conducted to compare the virulence pattern of a *C. sativus* isolate (ND90Pr) obtained from this two-row breeding nursery with one (ND85F) used in previous disease screening evaluations. Greenhouse and field experiments were performed in 1991 and 1992 at Fargo, ND, using a split plot design with isolate as the main effect. Isolates ND90Pr and ND85F exhibited distinct differential virulence patterns on barley genotypes ND 5883, ND 12437, ND 12720, ND 12721, and Bowman. Isolate ND90Pr displayed high Virulence on ND 12720, ND 12721, and Bowman, and low

virulence on ND 5883 and ND 12437. In contrast, isolate ND85F was highly virulent on ND 5883 and ND 12437 and weakly virulent on ND 12720, ND 12721, and Bowman. Both isolates expressed low virulence on genotype ND B112, the primary source of resistance to *C. sativus* in commercial six-row barley germplasm. To incorporate adequate levels of resistance into future two-row barley cultivars, disease evaluations should be made with *C. sativus* isolates that express the full spectrum of virulence found in North Dakota.

3027 Fox, SL.; Harder, DE. (1995) A QUANTITATIVE INOCULATOR CAPABLE OF INOCULATING CEREAL PLANTS AT ALL GROWTH STAGES WITH RUST UREDINIOSPORES. *Plant Disease*. 79(4):391-394. English. [AGR & AGRIFOOD CANADA RES CTR 195 DAFOE RD WINNIPEG MB R3T 2M9 CANADA].

An inoculator, designed to quantitatively apply a spore/oil mixture on single stems or leaves of cereal plants, was constructed and tested. The tests consisted of counting urediniospores of *Puccinia graminis* f. sp. tritici applied to a glass slide, or counting uredinia that formed on seedling leaves and adult plant stems of susceptible or several different resistant genotypes of *Hordeum vulgare*, or susceptible *Triticum aestivum*. Using 2-mg spores suspended in 1 ml of light mineral oil, urediniospores were applied to glass slides at the rate of 125-224 spores/cm(2), with coefficients of variation between 7 and 22. In plant tests, distinctions between resistant and susceptible genotypes could be made using quantitative inoculations, when qualitative differences were not detectable. [References: 12].

3028 Gao Shiren; Wu Xunchi (Shandong Agricultural Univ., Taian (China). Dept. of Plant Protection); Zhang Shaobo (1994) Occurrence dynamics of wheat take-all in Shandong Province and comprehensive control techniques, China. *Journal of Shandong Agricultural Sciences (China)* (no. 3) p. 40-42. 3 tables. Chinese. (AGRI 95-053044).

3029 Gatschet, MJ.; Bona, L.; Guenzi, AC. (1994) A STRATEGY FOR THE GENETIC ENGINEERING OF WHEAT FOR RESISTANCE TO WHEAT STREAK MOSAIC VIRUS. *Acta Phytopathologica et Entomologica Hungarica*. 29(1-2):31-37. English. [OKLAHOMA STATE UNIV DEPT AGRON STILLWATER, OK 74078 USA].

Wheat streak mosaic (WSM) has become a disease problem of wheat (*Triticum aestivum* L.) in Eastern Europe, and remains endemic in parts of Asia and North America. Genetic transformation utilizing *Agrobacterium tumefaciens* has advanced investigations of coat protein (CP)-mediated protection against virus disease in dicot crops to field trials of transgenic plants. The use of biolistics to genetically transform wheat with CP sequences from wheat streak mosaic virus (WSMV) is a promising strategy for developing wheat resistant to WSMV.

3030 Germeier, C.U. (1992) [Sclerotium rolfsii of cereal crops - methodical investigations in view of ecological methods for its control]. *Sclerotium rolfsii an Getreide - methodische Untersuchungen im Hinblick auf oekologische Verfahren zur Eindämmung*. Georg-August Univ., Göttingen (Germany). Fachbereich Agrarwissenschaften. Selbstverlag. 29 ill., 71 tables. Bibliography p. 190-225. 225 p. German. (AGRI 95-066791).

3031 Ghannadha, MR.; Gordon, IL.; Crome, MG.; McEwan, JM. (1995) DIALLEL ANALYSIS OF THE LATENT PERIOD OF STRIPE RUST IN WHEAT. *Theoretical & Applied Genetics*. 90(3-4):471-476. English. [MASSEY UNIV DEPT PLANT SCI SEED & CROP GRP PALMERSTON NORTH NEW ZEALAND].

A half diallel was made amongst five wheat (*Triticum aestivum* L.) genotypes of which one was susceptible, while the others had adult-plant resistance, to stripe rust (*Puccinia striiformis* West.). The five parent and ten F-1 progeny were grown in the glasshouse and were inoculated with three rust pathotypes at the seedling stage. The latent period was measured on the first leaf. Two procedures were used to analyze the half diallel. Both methods showed that the average effects of alleles were of much greater importance than was dominance in conditioning resistance in response to two of the pathotypes, while for the third pathotype dominance was important. Resistance was conditioned by partial dominance for two pathotypes whereas for the third it was determined by full dominance. Broad-sense heritabilities range from 60-73% and the number of genes involved was different (from 1 to 4), depending on the pathotype. [References: 27].

3032 Gilmour, J. (Scottish Agriculture College (Royaume Uni)); Burnett, F. (1993) [Reducing application rates and susceptibility of barley mildew to fungicides in Scotland]. *Ecosse: pas de problème avec les doses réduites (de fongicides)*. *Perspectives Agricoles (France)* v. 185 p. 122-124. French. (AGRIS 95-052945).

3033 Gindrat, D.; Frei, P.; Maillard, A. (Station fédérale de recherches agronomiques, Changins (Switzerland)) (1995) [Experiments on the control of diseases of winter wheat in French speaking Switzerland: leaf and ear diseases, development of powdery mildew, leaf rust and Septoria spp (1987-1993)]. *Essais de lutte contre les maladies du blé d'automne en Suisse romande: maladies du feuillage et des épis. Développement de l'oidium, de la rouille brune et des septorioses (1987-1993)*. *Revue suisse d'agriculture (Switzerland)* v. 27(1) p. 41-48. 7 tables, 5 graphs, 16 ref. French. (AGRIS 95-052919).

The development of powdery mildew, brown rust and Septoria diseases on winter wheat has been studied in four regions of French speaking Switzerland. The effect of fungicides on winter wheat diseases and yield in the same field experiment will be discussed in a next article.

3034 Godet, F.; Didelot, D.; Lochon, S. (1993) [Sensitivity of wheat powdery mildew strains to triazoles]. *Fongicides. Oidium du blé: gros plan sur un test de sensibilité (aux triazoles)*. *Perspectives Agricoles (France)* v. 185 p. 109-111. French. (AGRIS 95-052936).

3035 Gryb, S.I.; Batura, S.A. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1993) [Resistance of winter Triticale to diseases]. *Ustojlivasts' azimaga trytsikale da khvarob. Vestsi Akademiï Agrarnykh Navuk Belarusi (Belarus)* (no.4) p. 30-33. 3 tables. Byelo Russian. (AGRIS 95-052916).

The most harmful diseases of winter Triticale have been noticed in Belarus. The species composition of root rot agents has been studied. Among the examined samples, those resistant to Septoria have not been revealed. The samples were evaluated for their hardness to Septoria. Their differentiation at the contagious background by the degree of infection and yield productivity has been noticed. The tolerant samples have been isolated. Those absolutely resistant to Septoria were not revealed.

3036 Hanus, H. (Kiel Univ., (Germany). Inst. fuer Pflanzenbau und Pflanzenzüchtung); Kuehl, A. (1994) [Influence of production systems in winter wheat on the interaction between yield and diseases caused by Septoria spp. and Erysiphe graminis]. *Einfluss der Produktionstechnik in Winterweizen auf die Beziehung zwischen Ertrag und Krankheitsbefall mit Septoria spp. und Erysiphe graminis. [Integrated plant production. Research report. Final report on a priority program "development of an integrated system of crop production with regard to economic and ecological aspects of plant protection in wheat crops"]*. Heitefuss, R. (ed.); Holtschulte, B.; Niemann, M.. *Deutsche Forschungsgemeinschaft, Bonn (Germany)* v. 2 p. 29-41. VCH. 7 tables; 9 ref. German. (AGRIS 95-066790).

In three years of field experiments (1988-1990) the influence of weather and different cropping systems in wheat on yield, disease severity of Septoria spp. and Erysiphe graminis and the relationship between disease and yield was investigated. Disease-loss relationships of Septoria spp. and Erysiphe graminis showed marked differences between years and cropping systems. Yield loss by mildew was about double as high as by Septoria. Septoria nodorum caused higher losses in yield than Septoria tritici. Furthermore it became obvious that in years with favourable conditions for high yield potential (1988) the tolerable disease severity is less than in years with lower yield capacity due to unfavourable weather (1990). The same disease severity leads to higher yield loss when cropping system provides favourable conditions for yield potential than in cropping systems with low expected yield. The conclusion from the results obtained is that thresholds for use in integrated cropping systems cannot be fixed, because of the various influencing relationship between disease and wheat yield.

3037 Hiramoto, T.; Tobimatsu, R.; Abe, N.; Shiraishi, T.; Oku, H.; Yamada, T.; Ichinose, Y. (1995) SIGNAL MOLECULES INDUCING SYSTEMIC RESISTANCE AND SUSCEPTIBILITY IN BARLEY SEEDLINGS. *Journal of Phytopathology-Phytopathologische Zeitschrift*. 143(1):47-51. English. [OKAYAMA UNIV COLL AGR PLANT PATHOL LAB 2-5-1 SHIKATA CHO OKAYAMA 700 JAPAN].

Exudate collected from the cut end of barley seedlings exhibited both activities that induced systemic resistance and susceptibility against

Erysiphe graminis f. sp. hordei race Hh4 depending on the time after pruning. Exudates collected between 3-6 h after pruning showed maximum activity that induced systemic resistance, whereas those during 9-12 h conversely induced susceptibility in barley seedlings. The accumulation of antifungal substances in barley leaves correlates to the timing of induced resistance. The antifungal substances were water-soluble and severely affected the infection of E. graminis f. sp. hordei. [References: 22].

3038 Iltu, M.; Saulescu, N.N.; Iltu, G. (Research Institute for Cereals and Industrial Crops, Fundulea (Romania)) (1994) Criteria for estimation of Fusarium scab resistance in wheat. *Romanian Agricultural Research (Romania)* (no.1) p. 19-21. 1 table; 2 graphs; 11 ref. English. (AGRIS 95-052925).

To appreciate the level of resistance to Fusarium which produces scab in wheat different criteria as: the visual score of Fusarium attack, the weight of heads, the number and the weight of each of the white, shrivelled and white+shrivelled kernel were analysed. Under artificial and natural inoculations 21 winter wheat genotypes with different levels of resistance to this pathogen were investigated. Under artificial inoculation the yield reduction expressed as head weight and kernel weight (percent from nonincluded control) was supplementary calculated. The results indicated that the weight reduction of heads beside the visual score of attack were valuable criteria for estimation of resistance, easy to be applied in the routine screening trials. If more details on the level of resistance are necessary, the utilization of kernel number and kernel weight even more laborious, is recommended. Under natural conditions of Fusarium scab epidemics from 1991, the number and the weight of shrivelled kernels accurately expressed the level of resistance. The regression analyses between the intensity of attack and yield losses allowed the identification of the both resistant and tolerant genotypes. Fundulea 29, Fundulea 549, Fundulea 308 and Fundulea 574 registered low values for yield losses and intensity of attack, while Fundulea 336, Fundulea 132 proved as tolerant with relative low yield losses corresponding to high score of Fusarium attack.

3039 Johnsson, L. (Sveriges Lantbruksuniv., Uppsala (Sweden). Inst. foer Vaextpatologi); Hedene, K.A.; Gustafsson, G. (1995) [Common bunt and dwarf bunt in winter wheat in Sweden in 1994]. *Stinkrot och dvaergstinkrot i hoestvetet 1994 - en oersikt*. 36. Svenska Vaextskyddskonferensen. Jordbruk - Skadedjur, Vaextsjukdomar och Ograes; Uppsala (Sweden); 25-26 Jan 1995. *Svenska Vaextskyddskonferensen (Sweden)* v. 36(1) p. 205-218. 33 ref. Swedish. (AGRIS 95-053063).

3040 Kema, G.H.J.; Lange, W.; Vansilfhout, C.H. (1995) DIFFERENTIAL SUPPRESSION OF STRIPE RUST RESISTANCE IN SYNTHETIC WHEAT HEXAPLOIDS DERIVED FROM TRITICUM TURGIDUM SUBSP DICOCOIDES AND AEGILOPS SQUARROSA. *Phytopathology*. 85(4):425-429. English. [DLO IPO PLANT PROTECT RES INST POB 9060 6700 GW WAGENINGEN NETHERLANDS].

The expression of resistance to stripe rust of wheat, conditioned by four Aegilops squarrosa (DD, 2n = 14) and 11 Triticum turgidum subsp. dicoccoides (AABB, 2n = 28) accessions, was studied by testing 22 synthetic hexaploids (AABBDD, 2n = 42) with five stripe rust races in the seedling stage and two races in the adult plant stage. Resistance in one or both parents was frequently suppressed in the synthetic hexaploids, indicating the presence of suppressor genes on the AB and D genomes. Specificity was apparent because the putative suppressor genes affected the expression of specific resistance genes, although not with all races nor in all growth stages. The results and data from F-1, and F-2 populations derived from crosses between two synthetic hexaploids with the same T. t. dicoccoides parent but with different A. squarrosa parents revealed that several recessively inherited suppressor genes on the D genome seemed to be involved. A possible mechanism explaining these results and the variable mode of action of suppressors are discussed. [References: 44].

3041 Kerber, E.R.; Aung, T. (1995) CONFIRMATION OF NONSUPPRESSOR MUTATION OF STEM RUST RESISTANCE IN CANTHATCH COMMON WHEAT. *Crop Science*. 35(3):743-744. English. [AGR & AGRI FOOD CANADA WINNIPEG RES CTR 195 DAFOE RD WINNIPEG MB R3T 2M9 CANADA].

A mutation induced in the common wheat cultivar Canthatch (Triticum aestivum L.) results in resistance to several races of stem rust (Puccinia graminis Pers.:Pers. f. sp. tritici Eriks. and E. Hem.) to which Canthatch is

susceptible. Previous evidence indicated the mutation behaved as a nonsuppressing allele on chromosome arm 7DL, which permitted the expression of resistance normally inhibited by a suppressor also located on 7DL. However, to eliminate the possibility that the improved resistance resulted from a mutation to a resistance gene, additional experiments were undertaken. Chromosome 7D of the susceptible cultivar Chinese Spring was substituted by the corresponding chromosome of the resistant mutant, Canthatch-NS, and of Canthatch. Also, pentaploids were produced from crosses of susceptible tetraploids 'Pelissier' durum wheat and Tetraprelude with the resistant Canthatch mutant. The 7D substitutions of Canthatch-NS and Canthatch, as well as the pentaploids, were fully susceptible. Consequently, the mutation induced in Canthatch-NS was not of a resistance gene, thus confirming the previous conclusion that it behaves as a nonsuppressing allele. [References: 6].

3042 Koizumi, S. (Agricultural Research Center, Tsukuba, Ibaraki (Japan)); Kato, H.; Yoshino, R.; Komada, H.; Ichino, M.; Umehara, Y.; Hayashi, N. (1993) Studies on the pathogens and epidemiology of wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) scab. *Bulletin of the National Agriculture Research Center (Japan)* (no.23) p. 1-104. 37 plates; 46 tables; 29 fig.; 170 ref. Japanese. (AGRIS 95-053062).

Scab is one of the most serious diseases of wheat and barley in Japan and the infested area with the disease has increased due to the recent promotion of wheat and barley cultivation in the country. Studies were conducted to clarify kinds of the pathogens of wheat and barley scab, including their distribution in Japan, ecology and measures of control.

3043 Kolmer, J.A.; Liu, J.Q.; Sies, M. (1995) VIRULENCE AND MOLECULAR POLYMORPHISM IN PUCCINIA RECONDITA F SP TRITICI IN CANADA. *Phytopathology*. 85(3):276-285. English. [NATL SCI & ENGRS COUNCIL 195 DAFOR RD WINNIPEG MB R3T 2M9 CANADA].

Sixty-four representative single-uredinal isolates of *Puccinia recondita* f. sp. tritici collected from wheat in the eastern (Ontario and Quebec), prairie (Manitoba and Saskatchewan), and Pacific (Alberta and British Columbia) regions of Canada were analyzed for virulence polymorphism on 19 near-isogenic wheat differential lines and for randomly amplified polymorphic DNA (RAPD) using 10 arbitrary decamer primers. Thirty-seven phenotypes of *P. r. tritici* were distinguished by the 19 host differential lines. Fifteen molecular phenotypes were distinguished by the 10 primers in the RAPD analysis. Forty-five unique phenotypes of *P. r. tritici* were distinguished by combined virulence and RAPD data. Molecular variation was greatest between isolates of different virulence phenotypes. There was some molecular variation among isolates with identical virulences. Virulence and RAPD data were used separately and combined in cluster analyses. Two major clusters were distinguished with the combined data sets. The first cluster consisted of isolates virulent or avirulent to both resistance genes Lr2a and Lr2c, and the second cluster consisted of isolates avirulent to Lr2a and virulent to Lr2c. The molecular polymorphisms were more effective in distinguishing between the major clusters of *P. r. tritici* compared to the virulence polymorphisms. However, virulence polymorphisms were more effective in distinguishing between isolates within the major clusters compared to the molecular polymorphisms. There was a correlation of 0.58 between the virulence and molecular dissimilarity matrices. The cluster analyses indicated a general relationship between virulence and molecular polymorphism in *P. r. tritici* in Canada. There are currently two major groups of *P. r. tritici* in Canada. One group consists of isolates found in the prairie and eastern regions. Isolates in this group have limited molecular polymorphisms and consist of many virulence phenotypes that are either virulent or avirulent to both Lr2a and Lr2c. Isolates in the second group are found in eastern Canada and in the Pacific region. These isolates are avirulent to Lr2a and virulent to Lr2c and have molecular phenotypes distinct from isolates in the first group. The molecular data support conclusions from virulence survey data that distinct geographic populations of *P. r. tritici* exist in Canada and that new virulences arise and increase in the prairie population by mutations from preexisting phenotypes. [References: 32].

3044 Kr'steva, Kh. (Institut za Zashchita na Rastenyata, Kostinbrod (Bulgaria)) (1994) [Susceptibility of brewer barley varieties to *Oscinella frit* and *Meromyza nigriventris*]. *Chuvstvitelnost na sortovete pivovaren echemik k'm Oscinella frit i Meromyza nigriventris*. Natsionalna Sluzhba za Rastitelna Zashchita, Karantina i Agrokimiya k'm Ministerstvoto na

Zemedeliето. Sofia (Bulgaria). Institut za Zashchita na Rastenyata. *Rastitelna Zashchita (Bulgaria): Plant Protection v. 35(10)* p. 23-25. 2 ill., 3 tables. Bulgarian. (AGRIS 95-066738).

3045 Lacicowa, B.; Pieta, D.; Kiecana, I. (Akademia Rolnicza, Lublin (Poland)); Kukielka, R. (Stacja Hodowli Roslin, Uhowek (Poland)) (1993) [Protective effect of chemical dressing in naturally infested soil with fungi causing root and stem rot of spring barley (*Hordeum vulgare* L.)]. *Ochronne dzialanie zapraw chemicznych w warunkach zagrozenia jeczmiennia jarego (Hordeum vulgare L.) przez choroby poduszkiowe*. 33 Research Session of Institute of Plant Protection; Poznan (Poland); 1993. *Materials of the 33rd Research Session of Institute of Plant Protection*. Pt. 1. Reports. Pruszyński, S.; Lipa, J.J. (eds.). Instytut Ochrony Roslin, Poznan (Poland) p. 195-201. Państwowe Wydawnictwo Rolnicze i Lesne. 1 fig., 4 tables; 8 ref.. Distributed 1994. Polish. (AGRIS 95-052954).

Investigations were carried out in the years 1990-92 in the soil naturally infested with *Bipolaris sorokiniana* and *Fusarium* spp. Lot and Roland seed dressed with Triflume T WP, Super-Homai 70 WP, Oxafum T, Baytan 17.5 DS and Baytan 19.5 DS was sown in the experimental plots. Field stand, productive tillering, healthiness and yield were examined for determine the protective effect of fungicides. Irrespective of the cultivars and years investigations - Baytan 17.5 DS and Baytan 19.5 DS showed the best protective effect. Investigated fungicides increased the yield by 5 q/ha, while they did not increase the field stand. Productive tillering was increased only insignificantly. Chemical dressing inhibited the infection of spring barley by *Fusarium* spp. and *Bipolaris sorokiniana*.

3046 Lamari, L.; Ballance, G.M.; Orolaza, N.P.; Kowatsch, R. (1995) IN PLANTA PRODUCTION AND ANTIBODY NEUTRALIZATION OF THE PTR NECROSIS TOXIN FROM PYRENOPHORA TRITICI-REPENTIS. *Phytopathology*. 85(3):333-338. English. [UNIV MANITOBA DEPT PLANT SCI WINNIPEG MB R3T 2N2 CANADA].

Pyrenophora tritici-repentis, the causal agent of tan spot of wheat, induces differentially tan necrosis and chlorosis in wheat. There are currently four pathotypes described in *P. tritici-repentis*, based on the ability of the pathogen to induce tan necrosis and chlorosis. Previous studies have demonstrated that a host-selective toxin, produced in culture by nec(+) isolates, will produce tan necrosis in sensitive cultivars. This study shows that a necrosis-producing toxin is present in the intercellular washing fluid (IWF) of leaves infected with nec(+) isolates. Comparison of the toxin in the IWFs with culture filtrate-derived toxin and with purified Ptr necrosis toxin in terms of temperature stability, size, immunological identity, host range of sensitivity, and isolate source led to the conclusion that the toxin found in IWFs is Ptr necrosis toxin, which is produced in planta. This is the first report of in planta production and release of the Ptr necrosis toxin by nec(+) isolates of *P. tritici-repentis*. IWFs containing toxin were produced only from leaves inoculated with nec(+) isolates and never with nec(-) isolates. For cultivars inoculated with nec(+) isolates, regardless of whether the cultivars were susceptible or resistant, toxin was present in the IWF indicating that toxin production by the nec(+) isolates is independent of the host interactions and may be produced constitutively. [References: 23].

3047 Larkin, P.J.; Banks, P.M.; Lagudah, E.S.; Appels, R.; Xiao, C.; Xin, Z.Y.; Ohm, H.W.; McIntosh, R.A. (1995) DISOMIC THINOPYRUM INTERMEDIUM ADDITION LINES IN WHEAT WITH BARLEY YELLOW DWARF VIRUS RESISTANCE AND WITH RUST RESISTANCES. *Genome*. 38(2):385-394. English. [CSIRO DIV PLANT IND POB 1600 CANBERRA ACT 2601 AUSTRALIA].

Zhong 5 is a partial amphiploid (2n = 56) between *Triticum aestivum* (2n = 42) and *Thinopyrum intermedium* (2n = 42) carrying all the chromosomes of wheat and seven pairs of chromosomes from *Th. intermedium*. Following further backcrossing to wheat, six independent stable 2n = 44 lines were obtained representing 4 disomic chromosome addition lines. One chromosome confers barley yellow dwarf virus (BYDV) resistance, whereas two other chromosomes carry leaf and stem rust resistance; one of the latter also confers stripe rust resistance. Using RFLP and isozyme markers we have shown that the extra chromosome in the Zhong 5-derived BYDV resistant disomic addition lines (Z1, Z2, or Z6) belongs to the homoeologous group 2. It therefore carries a different locus to the BYDV resistant group 7 addition. L1, described previously. The leaf, stem, and stripe rust resistant line (Z4) carries an added group 7 chromosome. The line Z3 has neither BYDV nor rust resistance, is not a group 2 or group 7 addition, and is

probably a group 1 addition. The line Z5 is leaf and stem rust resistant, is not stripe rust resistant, and its homoeology remains unknown. [References: 43].

3048 Leclercqlequillec, F.; Tanguy, S.; Dedryver, CA. (1995) AERIAL HOW OF BARLEY YELLOW DWARF VIRUSES AND OF THEIR VECTORS IN WESTERN FRANCE. *Annals of Applied Biology*. 126(1):75-90. English. [INRA ZOOL LAB DOMAINE MOTTE VICOMTE BP 29 F-35650 LE RHEU FRANCE].

During the years 1989-1992 cereal aphids were caught alive in a low level (1.5 m high) suction trap operated in Le Rheu (Brittany, France) and tested for BYDV transmission. In most cases comparisons with data collected simultaneously by a 12.2 m suction trap operating in the same site resulted in good relationships between weekly catches at both heights. Results from transmission tests showed that: (i) the two main BYDV vectors were *Rhopalosiphum padi* and *Metopolophium dirhodum* during the years of experiment; (ii) PAV and MAV were the commonest viruses and RPV was relatively scarce; (iii) during spring *M. dirhodum* appeared to be the most important MAV vector and nearly as good a PAV vector as *R. padi*; (iv) during autumn *R. padi* was the only vector of the three viruses with mixed transmission allowing it to transmit also MAV probably by heteroencapsidation. To give an indication of the risk of infection, infectivity indices were calculated by multiplying the numbers of aphids caught by the 12.2 m suction trap by the proportion that were infective. These infectivity indices agreed with field records of primary infections. [References: 65].

3049 Li Jianshe; Zhang Huijie; Zhang Zhuomin (Shanxi Provincial Academy of Agricultural Sciences, Yuncheng (China). Inst. of Cotton Research) (1994) The fluctuation law of wheat take-all and identify of varieties tolerance to take-all in the producing area of winter wheat, Shanxi (China). *Journal of Shanxi Agricultural Sciences (China)* v. 22(2) p. 36-39. 7 ref. Chinese. (AGRI 95-052920).

3050 Luz, W.C. da (1994) [Effect of seed microbiolization on grain yield and on controlling common root rot and seed-borne pathogens of wheat]. Efeito da microbiolizacão de sementes no rendimento e controle da podridão comum das raízes e de patógenos das sementes de trigo. *Fitopatologia Brasileira (Brazil)* v. 19(2) p. 144-148. 22 ref. Portuguese. (AGRI 95-066720).

3051 Mangin, M. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Regional fungicide programs: the strategy at Rhone-Alpes area (France)]. Programmes fongicides regionaux: quelle strategie en Rhone-Alpes? (France). *Perspectives Agricoles (France)* (no 176) p. 18-22. 8 tableaux. French. (AGRI 95-052935).

3052 Maumene, C. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Fungicides for winter wheat crops: "triazole + morpholines" to fight against Erysiphe graminis downy mildew in 93]. Fongicides sur ble d'hiver: "Triazoles + morpholines" dans la lutte contre l'oidium en 93. *Perspectives Agricoles (France)* (no 179) p. 85-86. 7 graph. French. (AGRI 95-053034).

3053 Maumene, C. (Institut Technique des Cereales et des Fourrages, Paris (France)); Couleaud, G. (1993) [Parasite risks and cereal seed treatments. Bunt, black smut, fusariosis, stripe disease... what protection choice?]. Les risques parasitaires et les traitements des semences de cereales. Carie, charbon, fusarioses, helminthosporiose... quelle protection choisir? *Bulletin de la Federation Nationale des Agriculteurs Multiplicateurs de Semences (France)* (no 124) p. 55-57. French. (AGRI 95-066781).

3054 Maumene, C. (Institut Technique des Cereales et des Fourrages, Paris (France)); Maufas, J.Y. (1993) [Fungicides to protect barley crops]. Fongicides: l'helminthosporiose (et autres maladies) de l'orge. *Perspectives Agricoles (France)* (no 186) p. 56-59. French. (AGRI 95-052946).

3055 Maumene, C. (Institut Technique des Cereales et des Fourrages, Paris (France)); Maufas, J.Y. (1993) [Fungicides to protect wheat crops in 1993]. Les performances des fongicides en 1993. *Perspectives Agricoles (France)* (no 186) p. 60-66. 5 tableaux, 8 graph. French. (AGRI 95-053036).

The studied fungicides are : Caramba (metconazole), Unix (cyprodinil), Tango (epoxiconazole), Opus (epoxiconazole), Opus team (epoxiconazole + fenpropimorph), Halley (hexaconazole + ethirimol).

3056 Messmer, Y. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Regional fungicide program: Lorraine area (France), [triazole, morpholine]]. Programmes fongicides regionaux. En Lorraine: 250 F/ha en deux passages. *Perspectives Agricoles (France)* (no 176) p. 47. French. (AGRI 95-052934).

3057 Miedaner, T.; Beyer, W.; Hoxter, H.; Geiger, HH. (1995) GROWTH STAGE SPECIFIC RESISTANCE OF WINTER RYE TO MICRODOCHIUM NIVALE AND FUSARIUM SPP IN THE FIELD ASSESSED BY IMMUNOLOGICAL METHODS. *Phytopathology*. 85(4):416-421. English. [UNIV HOHENHEIM INST STATE PLANT BREEDING D-70593 STUTTGART GERMANY].

Microdochium nivale and various *Fusarium* spp. cause severe diseases at all cereal growth stages. To investigate the successive colonization of the basal parts of winter rye in the field, 12 inbred lines were inoculated artificially with *M. nivale* and 11 with *F. culmorum* at one location across 2 yr for each pathogen. Arbitrarily sampled shoot or stem bases were assessed for fungal protein content in the host tissue by indirect enzyme-linked immunosorbent assay (ELISA) at seven growth stages from the beginning of tillering (EC 21) to full maturity (EC 91). Foot rot lesions were rated on a 1 to 9 scale at milk ripening. For *M. nivale*, the highest protein content and best genotypic differentiation were found in EC 21 shortly after snow melt. During further growth of the plants, *M. nivale* protein content decreased substantially and increased again between anthesis and full maturity. In contrast, *Fusarium* spp. showed a continuous increase in host tissue colonization from tillering to full maturity. In the early growth stages, fungal protein content was highly variable between years. Genotypic differentiation for resistance was significant at the earliest (EC 21) and a late (EC 75) host growth stage for *M. nivale* and at all growth stages tested for *Fusarium* spp. Heritability estimates reached the highest value at EC 21 for the *M. nivale* ELISA ($h^2 = 0.59$) and at milk ripening for the *Fusarium* spp. ELISA ($h^2 = 0.91$). *Microdochium nivale* and *Fusarium* spp. all caused foot rot symptoms at milk ripening leading to a mean foot rot rating of 3.3 and 3.8, respectively. No significant correlation existed between the resistance at early and adult-plant growth stages. For resistance to *Fusarium* spp., moderate to high genotypic correlations ($r = 0.64-0.86$) were found only among the adult-plant heading, anthesis, and milk ripening stages. Selection for adult plant resistance to *Fusarium* foot rot is not feasible during early host growth stages due to strong host genotype-growth stage interactions. Accordingly, resistance to *M. nivale* at early host growth stages (EC 21 and EC 25) cannot be used to predict resistance to *M. nivale* foot rot at milk ripening. [References: 25].

3058 Niu Yongchun; Li Zhenqi; Shang Hongsheng (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Dept. of Plant Protection) (1994) The host range of *Puccinia striiformis* West. f. sp. hordei. *Acta Universitatis Agriculturae Boreali-Occidentalis (China)* v. 22(1) p. 110-112. 1 table, 4 ref. Chinese. (AGRI 95-052955).

3059 Padchufarava, G.M.; Syarova, Z.Ya.; Karpuk, V.V. (Akadehmiya Navuk Belarusi, Minsk (Belarus). Instytut Ehksperymental'nej Bataruki) (1994) [Pectic enzymes of *Helminthosporium Teres* Sacc.]. Pektalichnyyya fermenty *Helminthosporium Teres* Sacc. *Vestsi Akadehmii Navuk Belarusi. Seryya Biyalagichnykh Navuk (Belarus)* v. 1 p. 15-18. 1 fig.; 5 ref. Byelo Russian. (AGRI 95-052947).

It was supposed that under the effect of pectic enzymes of *Helminthosporium Teres* Sacc., changes take place in the construction of pectic components of cell walls causing cells destruction, fungus expansion in tissues, necrosis and drying of barley leaves. The pectic enzymes activity was studied in the experiments and compared with the pathogenity level. The results show that these parameters not always coincide. The conclusion is made that the pectic enzymes are just one of many factors promoting the disease development.

3060 Pancaldi, D. (Bologna Univ. (Italy). Dipartimento di Protezione e Valorizzazione Agroalimentare); Alberti, I. (Bologna Univ. (Italy)) (1994) [Effectiveness and persistence of E.B.I. (ergosterol biosynthesis inhibitors) fungicides against powdery mildew of wheat (Emilia-Romagna)]. Attivita' e persistenza di fungicidi I.B.S. [inibitori della

biosintesi degli steroli) nei confronti dell'oidio del frumento (Emilia Romagna). *Informatore Fitopatologico (Italy)* v. 44(12) p. 34-38. 6 tables; 12 ref. Italian. (AGRI 95-053061).

The effectiveness and persistence of triadimenol, propiconazole and fenpropimorph against powdery mildew on wheat (*Erysiphe graminis* DC. f.sp. *tritici* Marchal) was assessed in comparison with that of more recent triazole fungicides (tebuconazole, tetraconazole, cyproconazole and flutriafol). In several field trials carried out between 1989 through 1992 on common wheat (cv. Gemini), all fungicides showed a very good effectiveness. Nevertheless, differences could be observed with regard to their persistence, being tebuconazole, cyproconazole and tetraconazole the most persistent (30 days), followed by flutriafol (25-30 days), propiconazole, triadimenol and fenpropimorph (23-25 days). On the whole, for their longer persistence, the new fungicides appear as the most effective tool for the control of the powdery mildew.

3061 Parfenava, T.A.; Alyakseeva, T.P. (Akadehmiya Navuk Belarusi, Minsk (Belarus). Instytut Genetyki i Tsytalogii) (1994) [Response of soft wheat sorts to the infection by *Fusarium* fungi]. *Rehaksyya sartow myakkaj pshanitsy na zarazhehne grybami rodu Fusarium. Vestsi Akadehmii Navuk Belarusi. Seryya Bitylagichnykh Navuk (Belarus)* v. 1 p. 39-44. 1 fig.; 1 table; 10 ref. Byelo Russian. (AGRI 95-053042).

The resistance of three sorts ("Belaruskaya 80", "Leningradka" and "Pyan'yama 62") of spring crops wheat to several *Fusarium* (F.) species was evaluated. The plants' response to the infection by F. was determined by seed sprouting, flowering terms and a number of productivity elements. "Leningradka" turned out the most resistant to F. The authors make the conclusion that this sort contains genes of resistance to certain species of F.

3062 Pellot, P. (Institut Technique des Cereales et des Fourrages, Paris (France)); Prevot, J.P.; Verhaeghe, V. (1994) [1993 regional strategies for fungicide utilisation in cereal crops (Nord-Picardie area (France))]. *Les strategies regionales fongicides en 1993 [Nord-Picardie: prevoir un programme puis l'ajuster (France)]. Perspectives Agricoles (France) (no 189) p. 74-81. 12 graph. French. (AGRI 95-066777).*

3063 Plai, C. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1994) [1993 regional strategies for fungicide utilisation in cereal crops: the Ouest area (France)]. *Les strategies regionales fongicides en 1993. Ouest, trois annees d'essais precisent les couts optimum (France). Perspectives Agricoles (France) (no 189) p. 63-66. 5 tableaux. French. (AGRI 95-066775).*

3064 Plai, C. (1993) [Regional fungicide program. West France area economic impact of fungicides on wheat production]. *Programmes fongicides regionaux. Region Ouest: les fongicides font grimper la marge nette du ble. Perspectives Agricoles (France) (no 177) p. 59-63. 7 tableaux. French. (AGRI 95-053031).*

3065 Polley, R.W.; Turner, J.A. (1995) SURVEYS OF STEM BASE DISEASES AND FUSARIUM EAR DISEASES IN WINTER WHEAT IN ENGLAND, WALES AND SCOTLAND, 1989-1990. *Annals of Applied Biology*. 126(1):45-59. English. [MAFF CENT SCI LAB HATCHING GREEN HARPENDEN AL5 2BD HERTS ENGLAND].

An investigation into the incidence of stem base diseases and the pathogens associated with them was undertaken on winter wheat samples collected at growth stages 31 and 73-75 in 1989 and 1990. Symptoms at growth stage 31 were classified into 10 different types based on visual characteristics. Although *Pseudocercospora herpotrichoides* was associated mainly with eyespot lesions and *Rhizoctonia* spp. with sharp eyespot lesions, a significant number of isolates of each pathogen were taken from lesions classified as fusarium. Different types of fusarium lesion on stem bases at both growth stages were not associated with any one particular *Fusarium* or *Microdochium* species. 98% of *P. herpotrichoides* isolates obtained from eyespot lesions at growth stage 31 in 1989, and 87% of those obtained in 1990 were identified as the sub-species *P. herpotrichoides* var. *acuiformis*. *Microdochium nivale* was more common than any of the *Fusarium* species at both growth stages, and was particularly prevalent in samples from Scotland at the earlier growth stage in 1989. Isolations from the top internodes at growth stage 73-75 indicated that systemic infection by *Fusarium* species, although present in some stems, was of little importance. *Fusarium* ear blight affected 0.4% of ears in

1989 and 0.5% in 1990. Glume spot lesions on the ears in 1990 were predominantly associated with *Fusarium poae*. [References: 25].

3066 Rasmussen, M. (1993) Characterization of repetitive DNA in the barley powdery mildew fungus, *Erysiphe graminis* f.sp. *hordei* (including 2 articles). Kongelige Veterinaer- og Landbohøjskole, Copenhagen (Denmark). Section for Plant Pathology. KVL. 25 ill., 3 tables; 115 ref. 104 p. English. (AGRI 95-052949).

3067 Ravail, J. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1994) [1993 regional strategies for fungicide utilisation in cereal crops (South-West area (France))]. *Les strategies regionales fongicides en 1993 [Sud-Ouest: une application bien positionnee assure le revenu (France)]. Perspectives Agricoles (France) (no 189) p. 93-95. French. (AGRI 95-066780).*

3068 Ravail, J. (Institut Technique des Cereales et des Fourrages, Paris (France)); Chabanel, Y.; Laconde, J.P. (1993) [Regional fungicide programs in South-West France]. *Les programmes fongicides dans le Sud-Ouest. Perspectives Agricoles (France) (no 176) p. 12-15. 5 tableaux. French. (AGRI 95-053026).*

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3070 Sangchote, S. (1994) Infection biology, seed transmission, and epidemiology of spot blotch of barley caused by *Bipolaris sorokiniana* [powdery mildew, disease incidence]. Kongelige Veterinaer- og Landbohøjskole, Copenhagen (Denmark). KVL. 13 ill., 4 tables; 161 ref. 99 p. English. (AGRI 95-052948).

3071 Shah, D.; Bergstrom, G.C.; Ueng, P.P. (1995) INITIATION OF SEPTORIA NODORUM BLOTCH EPIDEMICS IN WINTER WHEAT BY SEEDBORNE STAGONOSPOA NODORUM. *Phytopathology*. 85(4):452-457. English. [CORNELL UNIV DEPT PLANT PATHOL ITHACA, NY 14853 USA].

To determine the potential contribution of seedborne *Stagonospora nodorum* to *Septoria nodorum* blotch epidemics, field plots that were isolated from other wheat plants or residues were sown to winter wheat with seed infection levels by *S. nodorum* of <1, 3, 10, 20, 30, and 40% in 1990-91, and 0.0, 0.5, 3, 11, 14, 19.5, 25.5, and 29% in 1991-92. In 1990-91, a season mildly conducive to *Septoria nodorum* blotch, even plots sown to seed with less than 1% infection by *S. nodorum* developed epidemics. Seed infection level had a significant effect on disease incidence and severity at the main shoot and three tillers growth stage ($P < 0.0001$), on the F-5 leaf position at first node stage ($P < 0.05$), on the F-1 leaf position at late milk stage ($P < 0.1$), and on the percentage of harvested seed infected by *S. nodorum* ($P < 0.05$). The above relationships of disease and seed infection level were nonlinear and asymptotic. In 1991-92, a season more conducive to *Septoria nodorum* blotch, epidemics were initiated in plots with seed infection levels as low as 0.5%. Seed infection level had a significant effect on disease incidence at the two-leaves-unfolded stage ($P < 0.05$), but not later that season. The contribution of seedborne *S. nodorum* to epidemic initiation also was assessed, in 1990-91, by following two isolates (with DNA fingerprints distinguishable from each other and background isolates) of *S. nodorum* from infected seed through the crop canopy. Isolates with DNA fingerprints identical to those of the respective seed isolates were recovered from F-5 leaves and from harvested seed. These results showed that seedborne *S. nodorum* was at least partially responsible for initiation of *Septoria nodorum* blotch on the foliage. Moreover, the presence of the same isolates in the seed used for sowing and the seed harvested gave corroborative evidence that seed populations of *S. nodorum* could initiate epidemics of *Septoria nodorum* blotch in new locations and could provide for year-to-year perpetuation of these populations. [References: 52].

3072 Sharma, S.; Louwers, J.M.; Karki, C.B.; Snijders, C.H.A. (1995) POSTULATION OF RESISTANCE GENES TO YELLOW RUST IN WILD EMMER WHEAT DERIVATIVES AND ADVANCED WHEAT LINES FROM NEPAL. *Euphytica*. 81(3):271-277. English. [NATL AGR RES CTR DIV PLANT PATHOL POB 1126 KATMANDU NEPAL].

Seedlings of 38 wild emmer derivatives, and a total of 53 advanced wheat varieties/lines introduced from the International Maize and Wheat Improvement Centre (CIMMYT) or other sources, Nepalese breeding lines and local cultivars were inoculated with 18 different yellow rust isolates to postulate yellow rust resistance genes (Yr). Many wild emmer wheat derivatives used were resistant to all isolates indicating the presence of undescribed genes. Some derivatives carried Yr9, Yr6 and/or YrSU. Genes Yr1, Yr2, Yr6, Yr7, Yr8, Yr15, YrSU and YrA+ are no longer effective in Nepal; Yr4, Yr5, Yr9, Yr10, YrSP and YrSD are still effective; the effectiveness of Yr3 remains unclear. This study shows that stripe rust resistance in seedling stage of most Nepalese cultivars and advanced materials is based on Yr9 with combinations of Yr2, Yr6, Yr7, and YrA+, of which only Yr9 is still effective in Nepal. In many countries Yr9 has lost its effectiveness. Therefore the introduction of new Yr-genes from wild emmer wheat in Nepalese cultivars is highly important. [References: 25].

3073 Sheng Baoqin; Zhou Yiling; Pean Xiayu (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1993) The host range of wheat powdery mildew (*Erysiphe graminis* f. sp. *tritici*) in Shanxi Province (China). *Acta Phytophylacica Sinica* (China) v. 20(2) p. 105-112. 2 tables, 2 ref. Chinese. (AGRI 95-053059).

3074 Sheng Baoqin; Zhou Yilin; Wang Jianxiong (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1994) The host range of wheat powdery mildew in Hebei Province and Beijing Region, China. *Acta Agriculturae Boreali-Sinica* (China) v. 9(1) p. 101-107. 2 tables, 2 ref. Chinese. (AGRI 95-053045).

62 materials from 12 species of 4 genera relatives to wheat collected from 12 cities and counties of Hebei Province and Beijing Region were inoculated with mixture of 11 races of powdery mildew. Among them, 8 species appeared immune and the others infective. The powdery mildew races isolated from 49 materials were successfully reinoculated to wheat plants. The parasitization of races showed obvious specialization to the relatives of wheat as well as to wheat. Susceptibility in 82.2% susceptible relatives of wheat became lower and lower with the plant development. This paper also dealt with the role of wheat relatives in overwintering of powdery mildew in these regions.

3075 Shu Zhengyi; Xiong Fengqi (Southwest Agricultural Univ., Chongqing (China). Dept. of Plant Protection) (1993) Primary infective resources of wheat snow mold caused by *Monographella nivialis*. *Journal of Yunnan Agricultural University* (China) v. 8(3) p. 220-221. Chinese. (AGRI 95-053058).

3076 Sugiura, Y. (Science Univ. of Tokyo (Japan). Faculty of Pharmaceutical Sciences); Saito, H.; Tanaka, T.; Ichino, M.; Ueno, Y. (1994) *Fusarium crookwellense*, a newly isolated fungus from wheat in Japan: Its mycotoxin production and pathogenicity to wheat and barley. *MYCOSCIENCE* (Japan) v. 35(1) p. 77-82. 7 colour plates; 4 tables; 18 ref. English. (AGRI 95-066796).

3077 Sumner, DR.; Dowler, CC.; Johnson, AW.; Baker, SH. (1995) CONSERVATION TILLAGE AND SEEDLING DISEASES IN COTTON AND SOYBEAN DOUBLE-CROPPED WITH TRITICALE. *Plant Disease*. 79(4):372-375. English. [UNIV GEORGIA DEPT PLANT PATHOL TIFTON, GA 31793 USA].

A double-crop rotation of cotton-triticale-soybean-triticale was grown for 4-5 yr in three experiments on loamy sand soil. Tillage treatments were conventional (moldboard plowing 20-25 cm deep after burning triticale residues), no-till, row-till, and ridge-plant. Triticale residues were managed by burning or cutting the straw short (20 cm) or tall (60 cm) at harvest. Population densities of *Rhizoctonia solani* anastomosis group (AG)-4 in soil after triticale were low to moderate and similar among treatments. Population densities of *Pythium* spp. in soil were high and variable among treatments. Root and hypocotyl disease severity in cotton and soybean seedlings was low to moderate each year. In most years and crops, tillage and residue management treatments did not influence seedling disease or inoculum densities of pathogens. When there were differences, burning triticale residues and moldboard plowing improved seedling health. [References: 24].

3078 Trissler, R. (1993) [Investigations on parameters of *Fusarium* resistance in varieties of winter wheat]. *Untersuchungen zu Parametern*

der Fusarienresistenz von Winterweizensorten. Hohenheim Univ., Stuttgart (Germany). Inst. fuer Tierernaehrung. 29 ill., 23 tables. Bibliography 303 ref. 141 p. German. (AGRI 95-052922).

3079 Wang Dongmei; Wang Zhixin; Yang Xiuping (Hebei Agricultural Univ., Baoding (China). Dept. of Agronomy) (1994) Changes of peroxidase activity and isozymes in the course of leaf rust infection of wheat. *Journal of Hebei Agricultural University* (China) v. 17(1) p. 1-6. 4 ill., 1 table, 9 ref. Chinese. (AGRI 95-053047).

3080 Wang Lixin; Jiang Guangzheng (Shandong Agricultural Univ., Taian (China). Dept. of Plant Protection); Wang Xiangji (1993) Population and distribution of sooty mould on leaf surface of winter wheat. *Journal of Shandong Agricultural University* (China) v. 24(4) p. 370-374. 3 tables, 4 ref. Chinese. (AGRI 95-052921).

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3082 Wang Zonghua (Tibet Autonomous Region Inst. of Agricultural Sciences, Lhasa (China)) (1992) Regional epidemics of stripe rust on barley and wheat in Tibet (China). *Southwest China Journal of Agricultural Sciences* (China) v. 5(2) p. 79-85. 3 ill., 2 tables, 7 ref. Chinese. (AGRI 95-053053).

3083 Weiergang, I. (1994) Marasmines in plant pathogenic fungi and their use in selection of barley cultivars resistant to *Pyrenophora teres* [*Colletotrichum graminicola*, *Pyrenophora teres*, *Pyrenophora graminea*, *Cochliobolus sativus*]. Kongelige Veterinaer- og Landbohøjskole, Copenhagen (Denmark). Kemisk Inst. KVL. 49 ill., 28 tables; 402 ref. 298 p. English. (AGRI 95-052950).

3084 Wen Fujiang (Shandong Agricultural Univ., Taian (China). Inst. of Crop Genetics and Breeding) (1994) Use of ELISA and cDNA dot blot hybridization in detection of barley yellow dwarf virus and strain interactions. *Journal of Shandong Agricultural University* (China) v. 25(2) p. 151-157. 2 ill., 3 tables, 7 ref. Chinese. (AGRI 95-052981).

3085 Wiik, L. (Sveriges Lantbruksuniversitet, Alnarp (Sweden). Inst. foer Vaextskyddsvetenskap); Olofsson, B.; Johnsson, L.; Olvaang, H. (1995) [Spraying with fungicides in cereals - a review]. Kemisk bekampning av svampsjukdomar i straaesad - en oersikt. 36. Svenska Vaextskyddskonferensen. Jordbruk - Skadedjur, Vaextsjukdomar och Ograes; Uppsala (Sweden); 25-26 Jan 1995. *Svenska Vaextskyddskonferensen* (Sweden) v. 36(1) p. 219-228. 8 ref. Swedish. (AGRI 95-053064).

3086 Wu Xunchi; Gao Shiren (Shandong Agricultural Univ., Taian (China). Dept. of Plant Protection); Yang Huakui (1993) Using a commercial agent Duobingning to control wheat take-all. *Journal of Shandong Agricultural Sciences* (China) (no. 6) p. 31-32. 3 tables. Chinese. (AGRI 95-053043).

3087 Xiang Qijun; Sheng Baoqin; Zhou Yilin (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1994) The resistant gene analysis for three differential hosts of wheat powdery mildew race. *Acta Agriculturae Boreali-Sinica* (China) v. 9(2) p. 94-97. 1 table, 6 ref. Chinese. (AGRI 95-053046).

3088 Zhang Chuanfei; Shang Hongsheng; Li Zhenqi (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Dept. of Plant Protection) (1994) Parasitic fitness of the major epidemic races of wheat stripe rust in China. *Acta Universitatis Agriculturae Boreali-Occidentalis* (China) v. 22(2) p. 28-32. 5 tables, 7 ref. Chinese. (AGRI 95-053060).

3089 Zhao Xizeng (Yuxi Prefectural Inst. of Agricultural Sciences, Yunnan (China)) (1993) Investigation and experiment of occurrence of wheat scab. *Journal of Yunnan Agricultural University* (China) v. 8(3) p. 216-217. Chinese. (AGRI 95-053055).

3090 Zhao Yiqian; Hou Shengying; Jiang Zhongying (Qinghai Provincial Academy of Agricultural and Forestry Sciences, Xining (China). Inst. of Plant Protection) (1993) Research on wheat root rot at home and abroad

and its control countermeasure. *Journal of Yunnan Agricultural University (China)* v. 8(3) p. 218-220. Chinese. (AGRI 95-053057).

3091 Zhou Yijun; Hou Qingshu; Cheng Zhaobang (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Plant Protection); Xu Daguang (1993) Particle properties and serology of wheat spindle streak mosaic virus. *Jiangsu Journal of Agricultural Sciences (China) (suppl.)* p. 43-44. 9 ref. Chinese. (AGRI 95-053051).

H50 MISCELLANEOUS PLANT DISORDERS

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3094 Cai Shibin; Cao Yan; Li Lin (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Food Crops) (1994) Effect of high temperature during filling stage on dry matter cumulation in wheat grains under different waterlogging conditions. *Jiangsu Agricultural Sciences (China)* (no. 2) p. 5-8. 3 tables. Chinese. (AGRI 95-053493).

3095 Cedola, M.C.; Scalfati, G.; Soprano, M.; Rascio, A. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)); Iannucci, A. (Istituto Sperimentale per le Colture Foraggere, Lodi (Italy)) (1994) [Leaf morphophysiological parameters as screening techniques for drought stress tolerance in Triticum durum Desf]. Parametri morfo-fisiologici delle foglie come tecniche per l'analisi della tolleranza allo stress da siccita' in Triticum durum Desf. *Journal of Genetics and Breeding (Italy)* v. 48(3) p. 229-236. 5 tables; 2 graphs; 18 ref. English. (AGRI 95-053501).

Six Triticum durum cultivars (Appulo, Adamello, Capeiti 8, Karel, Creso and Latino) were grown under field conditions at two different water regimes, i.e. well watered and water stressed. Drought tolerance measured by drought susceptibility index (S) indicated that Capeiti 8 and Appulo had the highest stress tolerance. Relative Water Content (RWC), stomatal resistance (SR) and leaf area (LA) showed differences between stressed and well watered plants. Genotypic variability was observed for RWC, water potential, osmotic potential at full turgor, turgid weight/dry weight ratio (TW/DW), leaf area, and specific leaf weight (SLW), cv Capeiti showing the lowest RWC, water potential and osmotic potential at full turgor values. Analysis of correlations between leaf water status, morphological parameters and susceptibility index showed that high stress tolerance was associated with reduced water potential, RWC, osmotic potential at full turgor and LTS. These parameters appear to be promising as screening characters for drought tolerance, mainly considering their fast and easy analysis.

3096 Couvreur, F. (Institut Technique des Cereales et des Fourrages, Paris (France)); Crosson, P. (1994) [Use of plant growth substances in control of lodging]. Verse, substances de croissance. Toujours la lutte contre la verse des cereales a paille. *Perspectives Agricoles (France)* (no 188) p. 68-74. 5 illus., 6 p. p. seulement. French. (AGRI 95-067119).

3097 Fu Zhaolin; Li Fengyun; Chu Yunting (Binzhou Regional Inst. of Agricultural Sciences, Binzhou, Shandong (China)) (1994) Studies on utilization of wheat cultivars in saline-alkali soil. *Journal of Laiyang Agricultural College (China)* v. 11(3) p. 170-175. 2 tables, 14 ref. Chinese. (AGRI 95-053490).

3098 Gupta, S. (Punjab Agricultural Univ. (India)); Gupta, A.K. (1993) Characterization of hexaploid derivatives for Ne1 and Ne2 necrotic genes of wheat [Triticum aestivum]. *Wheat Information Service (Japan)* (no.77) p. 23-24. 1 table; 8 ref. English. (AGRI 95-067123).

3099 Hara, T. (Gifu Univ. (Japan). Faculty of Agriculture); Hou, G.M.; Koyama, H.; Sonoda, Y. (1993) Growth response of three plants to different

aluminum ions in culture solution. *Research Bulletin of the Faculty of Agriculture - Gifu University (Japan)* (no.58) p. 93-100. 2 tables; 6 fig.; 11 ref. English. (AGRI 95-053485).

Growth responses of rice, corn and barley plants to monomer and polymer Al ions in culture solution were investigated, and the toxicity of each ion species was evaluated. 1) The ferron method clarified that there were differences in the concentration of Al ion species between the monomer Al treatment and the polymer Al treatment. 2) The growth of all plants decreased with both monomer and polymer Al treatment and the decrease was smaller in rice than in corn and barley. The stronger toxicity of monomer Al ions than polymer Al ions was found in the root growth of rice and the shoot growth of barley. 3) The Al content in roots increased with the Al treatments, and it was higher in the monomer Al treatment than in the polymer Al treatment in rice. On the contrary, in corn and barley the Al content was higher in the polymer Al treatment than in the monomer Al treatment, which was attributed to the great damage of the roots by toxic Al ions. It was considered from these results that monomer Al ions were a little more toxic than polymer Al ions to plant growth.

3100 Karim, M.A. (Kyoto Univ. (Japan). Coll. of Agriculture); Nawata, E.; Shigenaga, S. (1993) Salinity tolerance of hexaploid triticale cultivars at different growth stages. *Japanese Journal of Tropical Agriculture (Japan)* v. 37(4) p. 298-304. 4 tables; 15 ref. English. (AGRI 95-053449).

3101 Karnaukhova, T.V.; Tret'yakov, N.N.; Fattakhova, N.N.; Sinyavin, M.S. (1994) [Morphophysiological response of young wheat plants to overmoistening of root medium]. Morfologicheskie reaktsii molodykh rastenij pshenitsy na zatopleniye komej. *Izvestiya Timiryazevskoy sel'skokhozyajstvennoy akademii (Russian Federation)* (no.1) p. 112-123. 8 ref. Russian. (AGRI 95-053498).

Morphophysiological condition of young plants of 13 winter and spring wheat varieties grown in greenhouse experiments in winter and in spring 1992 was studied. After 2 weeks of root flooding common response to overmoistening of root medium manifested itself in extensive increase of roots in length, higher amount of water in them, lower dry mass in roots and above-ground portion, lower water-holding capacity of the whole plant and smaller total amount of ions in tillering nodes. Unfavourable abiotic and biotic factors aggravated the effect of oxygen stress. Ability to tolerate overmoistening depends to some extent on genotypic specific features of the varieties. The amount of ions in tillering nodes and that of dry matter in roots may be considered the most reliable criteria of resistance to root hypoxia.

3102 Li Dequan; Guo Qinfu; Zhang Yiqin (Shandong Agricultural Univ., Taian (China)) (1993) Studies on the physiological characteristics of drought resistance in winter wheat. *Acta Agronomica Sinica (China)* v. 19(2) p. 125-132. 5 tables, 13 ref. Chinese. (AGRI 95-053446).

3103 Liu Guoxin; Zhang Guiyin (Hebei Agricultural Univ., Baoding (China). Dept. of Agronomy) (1993) Study of mercury accumulation in wheat plant applied with sewage sludge and fly ash. *Agro-Environmental Protection (China)* v. 12(5) p. 201-203. 3 tables, 3 ref. Chinese. (AGRI 95-053489).

3104 Maguhn, J. (Technische Univ. Muenchen, Freising (Germany). Inst. fuer Oekologische Chemie); Selinger, H.; Ziegler Joens, A.; Knoppik, D. (1994) [Effects of photooxidants on spring wheat (Triticum aestivum L. cv. Star) - gas exchange measurements during laboratory fumigation with ozone, PAN, and H2O2]. Die Wirkung von Photooxidantien auf Sommerweizen (Triticum aestivum L. Star) - Gaswechsellmessungen waehrend der Begasung mit Ozon, PAN und H2O2 im Labor. *Umweltwissenschaften und Schadstoff-Forschung (Germany)* v. 6(3) p. 123-130. 4 ill., 5 tables; 30 ref. German. (AGRI 95-067122).

The effect of short-time fumigation with the peroxidic photooxidants ozone, peroxyacetyl nitrate (PAN), and hydrogen peroxide (H2O2) on the gas exchange of wheat leaves was investigated. Two types of experiments are to be distinguished: 1. Fumigation is carried out at atmospheric CO2 partial pressure (350 mibar) and the assimilation and transpiration and rates are followed simultaneously. 2. The alteration of CO2-response curves by fumigation is determined; from this, characteristic photosynthetic parameters can be calculated. With this method, statements about the reaction of both photosynthesis as a whole and specific reaction sites within the most important photosynthetic processes are possible. Ozone in concentrations of 260-280 ppb causes a primary perturbation of the

photosynthetic apparatus, whereby the carboxylation rate is affected to nearly the same extent as the electron-transport rate. PAN (120 ppb) causes a reduction in the assimilation rate, primarily due to the closing of the stomata. H2O2 affects the gas exchange only in concentrations of above 1 ppm, whereby the reduction of the assimilation rate represents an almost pure stomatal effect. All three fumigants cause an increase in the respiration rate, which may point to an activation of detoxification and repair mechanisms.

3105 McKenzie, E.A. (New South Wales Agriculture, Tamworth (Australia)) (1994) US-Australian bilateral science and technology collaboration program workshop on 'Heat tolerance in temperate cereals' Hawaii, February 5-10, 1994. New South Wales Agriculture. 7 p. English. (AGRI 95-067109).

Gives an overview of the workshop which provides an interactive forum where recent progress in the understanding of high temperature and heat shock in relation to limitations on yield and grain quality would be reviewed by workers from a range of disciplines, including molecular biology, plant breeding, plant physiology and cereal chemistry. Long-term, the workshop has established a strategic basis for the improvement of high temperature tolerance of cereals over the next decade.

3106 Md Karim, A. (Kyoto Univ. (Japan). Coll. of Agriculture); Nawata, E.; Shigenaga, S. (1993) Effects of salinity and water stress on the growth, yield and physiological characteristics in hexaploid triticale [Triticum]. *Japanese Journal of Tropical Agriculture (Japan)* v. 37(1) p. 46-52. 3 tables; 18 ref. English. (AGRI 95-053448).

3107 Mogensen, V.O. (Royal Veterinary and Agricultural University, Taastrup (Denmark). Department of Agricultural Sciences, Soil and Water and Plant Nutrition); Mortensen, G.; Jensen, C.R. (1994) [Photosynthesis of flag leaves and ears of field grown barley during drought]. [Photosynthese des dernière feuilles et de l'épi chez l'orge en conditions de sécheresse]. *European Journal of Agronomy (France)* v. 3(2) p. 111-116. 17 ref., 7 graph. English. (AGRI 95-053453).

3108 Orr, J.P.; Canevari, M.; Jackson, L. (1994) Increasing wheat yields and reducing injury risk to postemergence herbicides. *Proceedings - California Weed Conference (USA)* v. 46 p. 186-188. Meeting held January 17-19, 1994, San Jose, California. English. (AGRI 95-067121).

3109 Palmer, G.A.; Burrige, P.M.; Guy, W.J.; Mabarrack, J. (South Australian Research and Development Inst., Adelaide) (1994) Rain damage and wheat quality [South Australia]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 507. English. (AGRI 95-053444).

3110 Pleijel, H.; Danielsson, H. (Institutet för Vatten och Luftvaardsforskning, Goeteborg (Sweden)); Aalenius, C.; Wallin, G.; Sellden, G.; Skaerby, L. (1994) [Effects of ozone and carbon dioxide on spring wheat]. *Ozons och koldioxidens påverkan på våravete. Vaextskyddsnotiser (Sweden)* v. 58(4) p. 105-111. 19 ref. Swedish. (AGRI 95-053499).

3111 Qiu Quansheng; Liang Houguo (Lanzhou Univ., Gansu (China). Lab. of Plant Physiology); Li Lin (1994) Effect of water stress on the redox system of the plasma membrane of wheat roots. *Acta Phytophysiological Sinica (China)* v. 20(2) p. 145-151. 4 ill., 3 tables, 14 ref. Chinese. (AGRI 95-053492).

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Proceeding of optimum conditions for the growth of broad bean and spring barley of 22 degrees C and moderate water supply of soil with 55% water capacity, the stomata state advanced with rising temperature and especially with increasing soil moisture. Heat stress as well as surplus water exercised a greater influence on the ultrastructure of the cell than low temperatures and water deficiency. Thus, especially the structures of

chloroplasts, mitochondria and ribosomes were affected and damaged, respectively. By deviating from growth optimum, the number of plastoglobuli was increased. The results show that the diminished host suitability to the aphids under extreme stress conditions are caused by the destruction of the internal structure of plant tissue.

3113 Shen Bo (Chinese Academy of Agricultural Sciences, Hangzhou (China). Inst. of Rice); Li Yunyun (1994) Effect of different concentration of ABA on drought-induced proteins in winter wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(Suppl.) p. 65-70. 10 ill., 12 ref. Chinese. (AGRI 95-053445).

3114 Shen Zhenguo (Nanjing Agricultural Univ., Jiangsu (China). Dept. of Agronomy); Shen Qirong (1994) Relationship between nitrogen nutrition and growth of barley seedlings as well as ion balance under NaCl stress. *Journal of Nanjing Agricultural University (China)* v. 17(1) p. 22-26. 5 tables, 12 ref. Chinese. (AGRI 95-053456).

3115 Tong Yongzhong; Liu Chao; Zhou Zhiqin (Zhejiang Agricultural Univ., Hangzhou (China). Dept. of Environmental Science) (1994) Studies on the environmental influence of acid rain against soil-plant system: The effects of acid rain spraying on the physiology and development of rice and wheat. *Journal of Zhejiang Agricultural University (China)* v. 20(1) p. 86-91. 2 ill., 3 tables, 6 ref. Chinese. (AGRI 95-053472).

Imitative acid rain, similar to natural rainfall in the research area in ion population and with various acidity, was sprayed separately during vegetative and reproductive stage of rice and wheat. After the spraying of acid rain, especially with high acidity, the external osmotic ration of electrolyte, chlorophyll content, activity of polyphenol oxidase and peroxidase, leaf stomata conductivity, and net photosynthetic ratio of both rice and wheat leaves were restrained. Acid rain resulted in more physiological affect during vegetative stage than during the reproductive stage. Microscopic examination showed that high acidity (pH 2.5) of acid rain gave direct harm to the structure of leaves. The yield of wheat seemed to be promoted effect from acid rain, but rice showed negative effect. The effects of seed protein content of both rice and wheat were not obvious.

3116 Yan Xianxi; Zhao Tanfang; Hu Yanji (Shandong Agricultural Univ., Taian (China)) (1994) Effect of salt stress on cells in root tips of barley. *Acta Agriculturae Boreali-Sinica (China)* v. 9(Suppl.) p. 61-64. 9 ill., 4 ref. Chinese. (AGRI 95-053455).

3117 Zhou Rengang; Fan Zhihe; Li Xiaozhi (Hebei Provincial Academy of Agriculture and Forestry Sciences, Shijiazhuang (China). Inst. of Agro Physics, Plant Physiology and Biochemistry) (1994) Heat-shock protein and acquisition of heat tolerance in wheat. *Acta Agriculturae Boreali-Sinica (China)* v. 9(Suppl.) p. 75-79. 5 ill., 12 ref. Chinese. (AGRI 95-053491).

H60 WEEDS

3118 [Reasoning triticale weed control at the plot level]. *Triticale: mauvaises herbes, raisonner le desherbage a la parcelle* (1994) Institut Technique des Cereales et des Fourrages, Paris (France). *Perspectives Agricoles (France)* (no 188) p. 18-21. French. (AGRI 95-067357).

3119 Black, I.D.; Matic, R.; Dyson, C.B. (South Australian Research and Development Inst., Adelaide. Northfield Research Lab.) (1994) Competitive effects of field bindweed (*Convolvulus arvensis* L.) in wheat, barley and field peas. *Plant Protection Quarterly (Australia)* v. 9(1) p. 12-14. 1 table, 1 fig., 14 ref. English. (AGRI 95-067370).

In the same field, the yields of wheat in 1989, barley in 1990 and field peas in 1991 were related to the density of field bindweed stems, using a quadrat assessment technique. At the highest densities of stems that were recorded in wheat (140 sq m), barley (65 sq m) and field peas (100 sq m) there were yield reductions of approximately 56 percent, 92 percent and 74 percent respectively compared with quadrats where there were no field bindweed stems. Explanations are suggested for these differences. The relationships between field bindweed stem density and yield were equally well described by an exponential decay model, a hyperbolic model or a model combining both.

3120 Black, I.D.; Mayfield, A.; Matic, R. (South Australian Research and Development Inst., Adelaide) (1994) Chemical control of bedstraw (*Galium*

tricomutum Dandy) and bifora (*Bifora testiculata* L.) in wheat, barley and field peas (South Australia). *Plant Protection Quarterly (Australia)* v. 9(1) p. 24-27. 4 tables, 9 ref. English. (AGRI 95-067371).

Field trials were carried out over 5 years to develop recommendations for the chemical control of bedstraw and bifora in wheat, barley and field peas. Results of the herbicidal control achieved and crop tolerance are presented.

3121 Brady, T.E.; Condon, M.E.; Marc, P.A. (1994) 1-(0-(cyclopropylcarbonyl) phenyl) sulfamoyl-3-(4, 6-dimethoxy-2-pyrimidinyl) urea and method for the preparation thereof. American Cyanamid Co., Wayne, New Jersey (USA). BPTI. 19 leaves. English. (AGRI 95-067372).

This invention relates to a crop-selective, herbicidal agent 1-(0-(cyclopropyl carbonyl)-phenyl) sulfamoyl-3-(4, 6-dimethoxy-2-pyrimidinyl) urea, a method for the preparation thereof and a method for selectively controlling undesirable plant species in the presence of crops with said crop-selective sulfamoyl urea derivative.

3122 Bulavin, L.A. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1994) [Influence of sowing rates on weed infestation of barley crops and grounding of early terms of herbicides use]. *Uplyw normaw vysevu nasennya na zasmechanasts' pasevaw yachmenyu pustazellem i abgruntavanne rannikh tehrminaw vykarystannya gerbitsydw. Vestsi Akadehmii Agrarnykh Navuk Belarusi (Belarus)* v. 1 p. 31-37. 5 tables; 8 ref. Byelo Russian. (AGRI 95-053714).

It was determined in the study of barley sowing rates influence on the weed infestation and yield without the herbicides use that the optimal rate is 5 mln/ha of germinated grains taking into consideration the difference in response of separate weed species and the natural conditions of central part of Belarus. The most adequate terms are adduced for the lowered herbicides doses introduction when certain weeds predominate.

3123 Cloutier, D.C.; Marcotte, R.; Leblanc, M.L. (1994) [Use of catch crops and green manure crops or weed control (Quebec)]. *Impiego delle colture intercalari e da sovescio per il controllo delle infestanti (Quebec). Bioagricoltura (Italy)* v. 5(30) p. 19-21. 1 table; 5 ref. Italian. (AGRI 95-053781).

3124 Glusac, D.; Malesevic, M. (Poljoprivredni fakultet, Novi Sad (Yugoslavia). Institut za ratarstvo i povrtarstvo) (1994) [Effect of herbicides and application time on wheat yield]. *Uticaj herbicida i vremena primene na prinos pšenice. Savremena poljoprivreda (Yugoslavia)* v. 42(1-2) p. 115-120. 4 tables; 10 ref. Serbian. (AGRI 95-053651).

Effect of herbicides on wheat yield was examined in a three-year trial (1989-1991) conducted in the locality of Rimski Sancevi (Yugoslavia). The trial was established on the chernozem loess terrace. Herbicides were applied at the stages of tillering and shooting. Seed yield and viability were analyzed. The application of herbicides in a moderately infested wheat crop brought yield reductions with all wheat varieties tested. The reductions were particularly high when the crop was treated at the shooting stage.

3125 Guo Qingyun; Tu Heling; Qiu Xuelin (Qinghai Academy of Agricultural and Forestry Sciences, Xining (China). Inst. of Plant Protection) (1993) Effect of the population complex of wild oats and bastard cress on wheat yield. *Acta Phytophylacica Sinica (China)* v. 20(4) p. 369-374. 2 ill., 4 tables, 6 ref. Chinese. (AGRI 95-053741).

3126 Hallgren, E. (Sveriges Lantbruksuniv., Uppsala (Sweden). Inst. foer Vaextodlingslaera) (1995) [Rolling and chemical control in spring barley]. *Vaeltning och kemisk bekaempning i korn. 36. Svenska Vaextskyddskonferensen. Ograes och Ograesbekaempning: Uppsala (Sweden); 25-26 Jan 1995. Svenska Vaextskyddskonferensen (Sweden)* v. 36(2) p. 101-107. 5 ref. Swedish. (AGRI 95-053715).

3127 Jouy, L. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Weed killing: adjuvants, new possibilities for wheat crops (Celio, Puma S, Vegelix, Actirob B)]. *Desherbage. Adjuvants: de nouvelles possibilites sur ble (Celio, Puma S, Vegelix, Actirob B, huile vegetale). Perspectives Agricoles (France) (no 183)* p. 72-74. French. (AGRI 95-053705).

3128 Khan, R.U.; Rashid, A. (1994) EFFICACY OF HERBICIDES FOR THE CONTROL OF GRASSY AND BROAD LEAF WEEDS IN WHEAT CROP

AT EL-MARJ LIBYA. *Pakistan Journal of Botany*. 26(2):327-330. English. [ARID ZONE RES SUBSTN DERA ISMAIL KHAN PAKISTAN].

Field experiments were conducted at the Australian Demonstration Farm at El-Marj Libya during the winter season 1988-89 and 1989-90 to determine the efficacy of herbicides on grassy and broad leaf weeds and grain yield of Wheat variety Mexicale. Herbicides viz., Illoxan, Brominal, Dicuran and Dosanex alone and in different combinations were tested. Illoxan 36 F.C. 2.2. lit + 2 lit Brominal H/ha and Illoxan 36 F.C. 2.5 lit + 1 lit Brominal H/ha increased the yield significantly over other treatments in 1988-89 while Dicuran 500 F.W 5 lit./ha and Dosanex F.L 6 lit/ha in 1989-90. The herbicide treatments showed varied response on weed control according to prevailing weed infestation in both the years. Dicuran 500 P.W and Dosanex F.L were more phytotoxic than the mixture of Illoxan 36 F.C and Brominal-H.

3129 Kristensen, H. (1995) [Survey 1994, G: Weeds]. *Oversigt 1994, G: Ukrudt. Landsudvalget for Planteavl, Aarhus (Denmark). Oversigt over Landsforsoegene (Denmark) (no.1994)* p. 187-208. 7 ill., 30 tables. Suppl. tables in Markforsoeg (Denmark) 1994, part G, p. 416-681. Danish. (AGRI 95-053742).

3130 Ligneau, LAM.; Watt, T.A. (1995) THE EFFECTS OF DOMESTIC COMPOST UPON THE GERMINATION AND EMERGENCE OF BARLEY AND SIX ARABLE WEEDS. *Annals of Applied Biology*. 126(1):153-162. English. [UNIV LONDON WYE COLL ASHFORD TN25 5AH KENT ENGLAND].

In a bioassay, leachate from composted household waste was found to decrease both cress germination and the germination of barley and six arable weeds, especially in the light. The effect of compost depth upon the emergence of these species was examined in a glasshouse experiment. Compost had no significant effect on barley emergence. However, weed emergence, particularly of those with small seeds, was reduced greatly by the physical effect of compost and, to a lesser extent, by its chemical effect. The emergence of the large-seeded species was relatively unaffected by increasing depths of compost, whereas that of the smaller-seeded weeds steadily decreased, being almost completely prevented by a 3 cm layer. The use of compost to control arable weeds in the field is discussed. [References: 17].

3131 Marquez Monroy, J.; Salas Ardila, J. (1993) [Determination of the impact of the competence of different cohorts of wild oats (*Avena fatua* L.) on the commercial yield of wheat (*Triticum aestivum* L.)]. *Determinacion del impacto de la competencia de diferentes cohortes de avena silvestre (*Avena fatua* L.) sobre los rendimientos en un cultivo comercial de trigo (*Triticum aestivum* L.)*. Universidad Nacional de Colombia. Facultad de Agronomia, Santafe de Bogota (Colombia). il., tabs. 107 p. Spanish. (AGRI 95-053789).

3132 Marshall, G.; Hack, C.M.; Kirkwood, R.C. (1995) VOLUNTEER BARLEY INTERFERENCE IN FIBRE FLAX (*LINUM USITATISSIMUM* L.). *Weed Research*. 35(1):51-56. English. [SCOTTISH AGR COLL DEPT PLANT SCI AUCHINCRAVE KA6 5HW AYR SCOTLAND].

Field experiments were conducted in 1989 and 1990 to determine the relationship between yield loss in fibre flax and the density of volunteer barley. At volunteer densities of 50-100 plants m⁻², plants which emerged 7 days before those emerging synchronously with the flax produced a significantly greater reduction in stem height (1990), stem dry weight (DW) at flowering (1989 and 1990) and seed DW (1990). The relationships between flax stem and bell DW and volunteer density were described at two growth stages (flowering and maturity) using a linear model. The 1990 model indicated that where volunteer tiller densities ranged from 0 to 350 m⁻², interference by 90 volunteer tillers m⁻² (30 plants m⁻²) reduced stem DW by 2-9% at the flowering stage. These losses increased to 9-18% for stem DW plus 7-18% for seed DW when plants were grown to seed maturity. Due to the high value of flax fibres and seed it is concluded that an economic threshold based on the control of volunteer barley can be reached at low volunteer densities (30 plants m⁻²) especially if both fibre and oilseed were to be harvested. [References: 7].

3133 Maxwell, B.D.; Stougaard, R.; Davis, E. (1994) Bioeconomic model for optimizing wild oat management in barley. *Proceedings of the Western Society of Weed Science (USA)* v. 47 p. 74-76. Meeting held March 14-17, 1994, Coeur D'Alene, Idaho. English. (AGRI 95-067369).

3134 Pandey, J.; Singh, R.P. (1994) EFFECT OF SULPHONYL UREA HERBICIDES ON WEED CONTROL IN WHEAT (TRITICUM AESTIVUM). *Indian Journal of Agronomy*. 39(4):565-568. English. [INDIAN AGR RES INST DIV AGRON NEW DELHI 110012 INDIA].

An experiment was conducted during 1990-91 and 1991-92 to study the effect of sulphonyl urea herbicides on weed control in wheat (*Triticum aestivum* L. emend. Fiori and Paol.). Metasulfuron-methyl killed all the plants of creeping thistle [*Cirsium arvense* (L.) Scop.], whereas terbutron methyl proved ineffective against it. Both these herbicides paralysed the growth of grass weed for a month and gave good control of broad-leaf weeds. Their combination with isoproturon did not show any added advantage. Isoproturon was most effective against grass weeds and gave satisfactory control of broad-leaf weeds. 2,4-D gave good control of broad-leaf weeds and arrested the growth of *Cirsium arvense* but encouraged tile growth of grass weeds. Herbicides proved ineffective against deer's foot (*Convolvulus arvensis* L.). In both the years, weed-control treatments significantly increased the grain yield of wheat. Hand-weeding proved statistically superior to herbicide treatments. However, latter treatments resulted in identical increase in grain yield. Isoproturon suspension proved inferior to its wettable powder formulation. Addition of surfactants increased killing activity of herbicides and grain yield.

3135 Pittaway, P.A. (1995) OPPORTUNISTIC ASSOCIATION BETWEEN PYTHIUM SPECIES AND WEED RESIDUES CAUSING SEEDLING EMERGENCE FAILURE IN CEREALS. *Australian Journal of Agricultural Research*. 46(3):655-662. English. [UNIV QUEENSLAND GATTON COLL DEPT PLANT PROD LAWES QLD 4343 AUSTRALIA].

Field trials were conducted to establish the link between weed residue management, Pythium infectivity and cereal seedling emergence failure. The herbicide glyphosate was used to manage weed-free and weed residue treatments, and the systemic fungicide metalaxyl was used to protect seedlings from pythiaceus attack. Seedling vigour and emergence were enhanced by the application of metalaxyl, and by the total suppression of weed growth. Invasion of cereal seedlings by pythiaceus fungi was greatest when seed was sown into cloddy seedbeds within 1-3 days after herbicide application. Debilitated weeds enhanced the activity of pythiaceus pathogens, promoting the invasion of cereals sown into the residues. If sowing is delayed for 3 weeks after herbicide application, pythiaceus activity will be reduced by saprophytic competitors colonizing the residues, resulting in improved seedling vigour and establishment. [References: 26].

3136 Qasem, J.R. (1995) THE ALLELOPATHIC EFFECT OF THREE AMARANTHUS SPP (PIGWEEDES) ON WHEAT (TRITICUM DURUM). *Weed Research*. 35(1):41-49. English. [UNIV JORDAN FAC AGR DEPT PLANT PROTECT AMMAN JORDAN].

The allelopathic effect of *Amaranthus retroflexus* L., *Amaranthus blitoides* S. Wats, and *Amaranthus gracilis* Desf. on wheat *Triticum durum* L. was investigated under laboratory, glasshouse and field conditions. Laboratory experiments showed that fresh shoot or root extract of the three weed species reduced germination, coleoptile length, root length and root dry weight of wheat seedlings. The inhibitory effects were rate dependent, with low concentrations of shoot extract promoting shoot growth of wheat. Fresh plant extracts were more phytotoxic than dried plant extracts and shoot extracts had higher detrimental effects than root extracts. In pot experiments, dried shoot extract of *A. gracilis* increased shoot and root dry weights of wheat seedlings. For *A. retroflexus* and *A. blitoides* the extracts of these and dried shoots (8 g kg⁻¹), which had been added to soil mixtures significantly reduced germination and growth of wheat seedlings. Addition of up to 16 g kg⁻¹ of *A. gracilis* residues promoted shoot growth of wheat and had no significant harmful effect on root growth. Roots appeared more sensitive to allelopathic effect than shoots. Under field conditions, incorporation of *A. retroflexus* or *A. blitoides* residues in the soil reduced height, grain and straw yield of wheat, whereas *A. gracilis* residues stimulated plant height and increased yield. [References: 32].

3137 Rafii, S. (Giessen Univ. (Germany). Wissenschaftliches Zentrum Tropeninst. Pflanzenbau und Pflanzenzüchtung) (1993) [Interaction between different methods of weed control and an increased fertilization of several wheat varieties (Iran Islamic Republic)]. Wechselwirkung zwischen unterschiedlichen Methoden der Unkrautbekämpfung und einer erhöhten Düngung bei verschiedenen Weizensorten in der Isl.

Rep. Iran. Giessen Univ. (Germany). Fachbereich 17 - Agrarwissenschaften. Selbstverlag. 49 ill., 49 tables. Bibliography p. 148-157. 176 p. German. (AGRS 95-067254).

3138 Samsonaw, U.P.; Paznyak, S.S. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1993) [Photodynamic herbicides used for weed control in barley]. Vykarystanne fotagerbitsydaw u barats'be z pustazellem na pasevakh yaravoga yachmenyu. *Vesti Akademiï Agrarnykh Navuk Belarusi (Belarus) (no.4)* p. 39-41. 3 tables; 5 ref. Byelo Russian. (AGRS 95-053712).

3139 Satao, R.N.; Padole, S.G. (1994) EFFECT OF WEED CONTROL ON GROWTH AND YIELD OF LATE-SOWN WHEAT (TRITICUM AESTIVUM). *Indian Journal of Agronomy*. 39(4):645-647. English. [DEPT AGRON AKOLA 444104 MAHARASHTRA INDIA].

3140 Sin, G.; Pintilie, C.; Ionita, S.; Petcu, G. (Academia de Stiinte Agricole si Silvice "Gheorghe Ionescu Sisesti, Fundulea (Romania). Institutul de Cercetari pentru Cereale si Plante Tehnice) (1993) [Changes in botanical composition on weed infestation in winter wheat, as effect of crop rotation and fertilization]. Modificarea compozitiei floristice a imburuienarii culturii graului sub influenta asolamentelor si fertilizarii. *Analele Institutului de Cercetari pentru Cereale si Plante Tehnice Fundulea (Romania)* v. 60 p. 115-126. 6 tables; 6 graphs; 4 ref. Romanian. (AGRS 95-053680).

Research was carried out at Fundulea, in a stationary experiment, initiated in 1967. The determination of weed infestation was made in monoculture (M) and 2-3-4 year rotations: maize-wheat (R-2), peas-wheat-maize (R-3) and sunflower-wheat-sugar beet-maize (R-4), at the beginning of April and in July (at harvesting). After 24 years, the weed infestation was strongly decreased by crop rotation (M=100 percent, R-2=40 percent, R-3=23 percent, R-4=6 percent). The floral composition of weed infestation was obviously modified by crop rotation and fertilisation: Polygonum convolvulus decreased and Veronica sp. increased. Veronica sp. and Papaver rhoeas are predominant in M, Veronica sp. in R-2 and R-3 and Sisymbrium sophia in R-4. The number of species decreased, especially in rotations. The fertilisation with NP or manure favoured Sisymbrium sophia and determined a decrease of Veronica sp. Erbicide (2,4 D + Dicamba) application favoured Papaver rhoeas and diminished Centaurea cyanus and Sisymbrium sophia.

3141 Sixto, H.; Silvela, L.; Escorial, C.; Garciabaudin, J.M.; Chueca, M.C. (1995) ON THE INHERITANCE OF TOLERANCE TO CHLOROTOLURON APPLICATION IN WHEAT USING A VERY EFFICIENT SCORE TEST. *Weed Research*. 35(1):7-13. English. [INST NACL INVEST AGR CIT DEPT PROTECC VEGETAL APT 8111 CRTA CORUNA KM 75 E-28080 MADRID SPAIN].

We present a nondestructive, easy to handle, cheap, fast and efficient assay to score wheat responses to herbicides. The application of the assay is illustrated by the reactions of the bread wheat cultivars 'Castan' and 'Recital' to the urea herbicide, chlorotoluron. The results not only confirm the presence of a major tolerant allele controlling the differences in response between the two cultivars, but also, show the contributions of modifier genes present in 'Castan', 'Recital' and other related cultivars. [References: 17].

3142 Szydal, J.; Sykut, A. (Akademia Rolnicza, Lublin (Poland). Katedra Biochemii) (1993) [Influence of treatment with herbicides on wheat on macro- and microelements content in the grain]. Wplyw herbicydow stosowanych w uprawie pszenicy na zawartosc makro- i mikroelementow w ziarnie. *Roczniki Nauk Rolniczych. Seria E - Ochrona Roslin (Poland); Polish Agricultural Annual. Series E - Plant Protection* v. 22(1-2) p. 91-96. table; 18 ref. Polish. (AGRS 95-053744).

The effect of Aminopielik D, Aminopielik M, Arelon 75 WP, Dicuran 80, Glean, Pielisam, Trinulan in a field experiment after application them in weed control doses on the content of dry matter, total ash and macro- and microelements (Ca, Mg, K, Cu, Fe, Mn, Zn) in grain of three winter wheat varieties (Alba, Delta, Koda) was investigated. The significant influence of herbicides on the content of some determined components (Ca, K, Mn, Zn) in investigated material was corroborated.

3143 Tian Anping; Qin Shu; Wu Linxiang (Shanxi Provincial Academy of Agricultural Sciences, Taiyuan (China). Inst. of Plant Protection) (1993)

Applicated technique of thibenuon methyl for weed control in wheat fields. *Journal of Shanxi Agricultural Sciences (China)* v. 21(4) p. 39-43. 3 tables. Chinese. (AGRI 95-053739).

3144 Xu Honglin; Chen Lihua (Baoshan Station of Plant Protection and Quarantine, Shanghai (China)); Su Guilong (1994) Effects of *Sclerochloa kengiana*, *Beckmannia syzigachne* and *Galium aparine* on production of wheat in Shanghai area. *Acta Agriculturae Shanghai (China)* v. 10(1) p. 69-72. 2 tables, 6 ref. Chinese. (AGRI 95-053740).

3145 Yumino, I. (Ibaraki ken. Agricultural Experiment Inst., Mito (Japan)); Kinouti, K.; Aitani, T. (1992) Control of mixed spontaneous buckwheat [*Fagopyrum esculentum*] in wheat at farming system on buckwheat and wheat [*Triticum aestivum*] cropping. *Bulletin of the Ibaraki-ken Agricultural Experiment Institute (Japan)* (no.31) p. 127-132. 5 tables; 2 fig.; 10 ref. Japanese. (AGRI 95-053743).

3146 Zalatar, A.K.; Yurehovich, T.M. (Belaruski Navukova Dasledchy Instytut Zemlyarobstva i Karmow, Zhodzina (Belarus)) (1994) [Dynamics of weed infestation of barley crops in dependence on previous cultures]. *Zmyanenne zasmehanastsi pasevaw yachmenyu pustazellem u zalezhnastsi ad papyarehndnikh kul'tur. Vestsi Akadehmii Agrarnykh Navuk Belarusi (Belarus)* v. 2 p. 32-35. 1 table. Byelo Russian. (AGRI 95-053713).

J11 HANDLING, TRANSPORT, STORAGE AND PROTECTION OF PLANT PRODUCT

3147 [Study of cereal mechanized harvesting loss in the Arab world]. *dir:asat> al-fa:qid al-na:tij* 3an al-h"as" d al-a:li: lil-h"ubu:b fi: al-wat'an al-3arabi: (1993) Arab Organization for Agricultural Development (AOAD), Khartoum (Sudan). *Agriculture and Development in the Arab World - AOAD (Sudan)*; al-zira:3at wal-tanmiyat fi: al-wat'an al-3arabi: v. 12(1) p. 39-41. 2 tables. Arabic. (AGRI 95-067538).

3148 Azraq, Al Sadiq Al Fadil (1993) [Cereal production in the Arab World and harvesting losses]. *'intaj* al-h"ubu:b fi: al-wat'an al-3arabi: wal-3awa:mil 'allati: tu'addi: 'ila: fuqda:n al-mah"s"u:l nati:j"at 'istih"da:m 'a:lat al-h"as" a:d. *Agriculture and Development in the Arab World - AOAD (Sudan)* v. 12(3) p. 45-51. 7 tables. Arabic. (AGRI 95-067534).

3149 Bason, M.L. (Newport Scientific, Warriewood (Australia)); Booth, R.I. (Prime Wheat, Narrabri (Australia)) (1994) Comparison of stirring number and falling number tests for detecting sprout damage in wheat during harvest. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 511. English. (AGRI 95-053848).

3150 Blanco, M.J.; Almendros, G. (1995) EVALUATION OF PARAMETERS RELATED TO CHEMICAL AND AGROBIOLOGICAL QUALITIES OF WHEAT STRAW COMPOSTS INCLUDING DIFFERENT ADDITIVES. *Bioresource Technology*. 51(2-3):125-134. English. [CIEMAT INST ENERGIAS RENOVABLES DIV BIOMASA AVE COMPLUTENSE 22 E-28040 MADRID SPAIN].

The chemical and agrobiological characteristics of 37 composts from wheat straw with different additives were evaluated through routine tests. In general, the plant yield under greenhouse conditions in soils amended with these composts was unrelated to data from the phytotoxicity germination biotest, but with the chemical parameters reflecting selective biopolymer degradation in straw. This suggests that factors such as microbial immobilization of nutrients had greater influence than phytotoxic inhibitor compounds in the plant yield of the soils amended with the composts studied. Monitoring the composition of the water-soluble fraction was also useful as regards crop yield of soils improved with compost. The factors potentially connected with the positive or depressive effect of composts in soil were assessed through factorial design experiments involving successive harvesting calcium carbonates and mineral fertilization. In general, mineral fertilization may lead to decreased yields in soils to which immature composts are applied. The effects on compost maturity of the different by-products used as additives are discussed for the system studied. [References: 22].

3151 Blank, G.; Goswami, N.; Madrid, F.; Marquardt, R.R.; Frohlich, A.A. (1995) EVALUATION OF TRIBOLIUM CASTANEUM (HERBST) (COLEOPTERA, TENEBRIONIDAE) EXCRETA ON OCHRATOXIN PRODUCTION IN STORED WHEAT. *Journal of Stored Products Research*. 31(2):151-155. English. [UNIV MANITOBA DEPT FOOD SCI WINNIPEG MB R3T 2N2 CANADA].

The influence of excreta from the red flour beetle, *Tribolium castaneum* (Herbst), on the growth of *Aspergillus alutaceus* (formerly *A. ochraceus* Wilhelm NRRL 3174) and ochratoxin A (OA) production in sterile wheat was investigated. When sterile excreta (3-6%) was added to wheat, OA production by *A. alutaceus* during the first 2 weeks of growth was significantly ($P > 0.05$) reduced. A similar trend was observed with fungal growth. The addition of equivalent levels of uric acid (76.8 or 153.5 mg/g wheat) to sterile wheat resulted in no significant ($P > 0.05$) effect on OA production although fungal growth appeared slightly enhanced. In non-sterile wheat, the addition of sterile excreta (5%) significantly ($P > 0.05$) reduced OA production compared to the control. The presence of excreta in a grain bulk may favor fungal competition thereby inhibiting OA production. [References: 17].

3152 He, Y.L.; Geng, X.L.; Yang, S.H. (1995) SLUDGE GRANULATION IN A UASB REACTOR FOR THE TREATMENT OF SODA-ANTHRAQUINONE CHEMICAL WHEAT-STRAW PULP BLACK LIQUOR. *Bioresource Technology*. 51(2-3):213-215. English. [NW INST LIGHT IND DEPT PULP & PAPER ENGN XIANYANG 712081 PEOPLES REPUBLIC OF CHINA].

Two lab-scale UASB reactors were used to treat black liquor. In both the reactors, granulation was achieved. Granular sludge could be formed with or without supplementation of biodegradable carbohydrates in the treatment of black liquor, although the supplementation could accelerate the rate of granulation and lead to a quick enhancement of COD removal. The UASB reactor without a gas-solid separator (GSS) was more suitable for sludge granulation, due to accelerated wash-out of the dispersed sludge. Low influent concentration was also essential for granulation. At a loading of 10 kg COD/(m³ d), 40-46% of influent COD and 56-65% of BOD were removed. The specific yield of biogas was 510 l/kg COD removed. [References: 10].

3153 Jan, E.Z.; McCartney, D.; Mir, Z.; Hill, L.; Berkenkamp, B.; Wright, T. (1995) AN EVALUATION OF HARVESTING LOSSES AND LOW COST STORAGE SYSTEMS FOR HIGH MOISTURE BARLEY. *Canadian Agricultural Engineering*. 37(1):13-17. English. [AGR & AGRIFOOD CANADA RES CTR POB 1030 SWIFT CURRENT SK S9H 3X2 CANADA].

Barley was harvested at 21.6% kernel moisture content (KMC) as high moisture barley (HMB) and at 14% KMC as dry barley (DB). Harvesting losses were evaluated at various KMC by measuring cutting, pick-up, and combine losses. The HMB was stored using one of four systems: ammoniation, urea addition, vacuum storage, or silo bag. Grain temperatures were recorded for two months. The cutting loss was about 0.5% of the yield potential. The pick-up loss was negligible for the 3.66 m swath but it increased from 0.25% to 1% as KMC decreased from 32% to 13% in the 6.4 m swath. At the practical material other than grain (MOG) feedrate, the combining loss was about 0.25% higher for dry grain than HMB. Overall, harvesting losses were 1% lower for HMB than dry grain. The four storage systems preserved HMB equally well. Temperatures remained under 40 degrees C except for the ammoniation treatment in which a short rise to 101 degrees C acid fall back to 40 degrees C within 10 h was recorded. [References: 18].

3154 Letellier, C.; Haubruge, E.; Gaspar, C. (Faculte des Sciences Agronomiques de Gembloux (Belgium). Unite de Zoologie Generale et Appliquee) (1994) [Importance of insect pests of stored products in Belgium]. *Importance des insectes ravageurs des cereales stockees en Belgique. Parasitica (Belgium)* v. 50(1-2) p. 81-88. 3 tables; 4 ref. French. (AGRI 95-067525).

Bins in farms and grain elevators were visited in 1991, 1992 and 1993. More of 50 per cent of those bins were infested. The most important species were *Sitophilus granarius* and *Oryzaephilus surinamensis*. The infestation rate of grain batches from flour and feed mills was determined during one year of storing. The mean of infected batches was 30 per cent but raised during the year. Infestation rate of batches from an industry producing starch, glucose and fructose syrups was more important than infestation

rate of flour mills. The most important species in those batches were also *Sitophilus oryzae* and *Oryzaephilus surinamensis*.

3155 Niquet, G. (Institut Technique des Cereales et des Fourrages, Paris (France)); Berhaut, P.; Lasseran, J.C. (1993) [Grain cold storage]. *Stockage des grains: refroidir les grains pour préserver la qualité. Perspectives Agricoles (France) (no 182) p. 77-82. French. (AGRIS 95-053847).*

3156 Schoeller, M. (1993) [Evaluation of use of *Trichogramma evanescens* Westwood and *Trichogramma embryophagum* Quednau (Hymenoptera: Trichogrammatidae) for biological control of *Ephestia kuehniella* Zeller and *Ephestia elutella* Huebner (Lepidoptera: Pyralidae) in stored products protection]. *Evaluation eines Einsatzes von Trichogramma evanescens Westwood und Trichogramma embryophagum Quednau (Hymenoptera: Trichogrammatidae) zur biologischen Bekämpfung von Ephestia kuehniella Zeller und Ephestia elutella Huebner (Lepidoptera: Pyralidae) im Vorratsschutz. Frankfurt Univ. (Germany). Fachbereich Biologie. Selbstverlag. 41 ill., 16 tables. Bibliography p. 89-101. 101 p. German. (AGRIS 95-067537).*

3157 Weinberg, Z.G.; Ashbell, G.; Bolsen, K.K.; Pahlow, G.; Hen, Y.; Azrieli, A. (1995) THE EFFECT OF A PROPIONIC ACID BACTERIAL INOCULANT APPLIED AT ENSILING, WITH OR WITHOUT LACTIC ACID BACTERIA, ON THE AEROBIC STABILITY OF PEARL MILLET AND MAIZE SILAGES. *Journal of Applied Bacteriology*. 78(4):430-436. English. [AGR RES ORG VOLCANI CTR FORAGE PRESERVAT & BYPROD RES UNIT IL-50250 BET DAGAN ISRAEL].

The effect of applying a new strain of *Propionibacterium shermanii* (PS), alone or with lactic acid bacteria inoculants (LAB) at ensiling, on the aerobic stability of pearl millet and maize silages was studied under laboratory conditions. The LAB inoculants comprised of *Pediococcus pentosaceus* (PP) in the experiments with millet, and PP + *Lactobacillus plantarum* (LP) in various combinations in the experiments with maize. The inoculants (made by Lallemand, France) were applied each at 0.5×10^6 cfu g⁻¹. Silages with no additives served as controls. The pearl millet used was either fresh, or wilted for 2 or 4 d (at 201, 268 and 448 g DM kg⁻¹, respectively). There were two experiments with maize (at 401 and 353 g DM kg⁻¹). After treatment, the chopped forages were ensiled in 1.5-l anaerobic jars. Three jars per treatment were sampled on days 2, 5, 10 and 90. At the end of the experiments, the silages were subjected to an aerobic stability test lasting 6 d, in which CO₂ production was measured along with chemical and microbiological parameters, to evaluate aerobic deterioration. The PS inoculant resulted in improvement in the aerobic stability as compared with the control, only in the fresh and 2-d wilted pearl millet silages. The amounts of CO₂ (g kg⁻¹ DM) produced were 8.5 ± 7.7 and 6.8 ± 1.1 vs 18.8 ± 22.7 and 27.0 ± 18.5 in the PS treated and control of the fresh and 2-d-wilted pearl millet, respectively. All silages of the Cd-wilted millet were stable upon aerobic exposure. In the first maize experiment the PS treatment and the control were more stable than the LAB inoculated silages. In the second experiment with maize, none of the silages were stable upon aerobic exposure; they showed increased pH values and CO₂ production around 20 g kg⁻¹ DM. The propionic acid bacteria inoculant had only a marginal effect on the aerobic stability of the pearl millet and maize silages, probably because it could not sustain under silage conditions. [References: 16].

L01 ANIMAL HUSBANDRY

3158 Little, D.L.; Ewers, A.L. (South Australian Research and Development Inst., Rosedale, Turretfield Research Centre); Carter, E.D. (Adelaide Univ., Roseworthy (Australia). Roseworthy Campus) (1993) Liveweight change, wool production and wool quality of Merino lambs grazing barley grass pastures sprayed to control grass or unsprayed [sheep]. *Wool Technology and Sheep Breeding (Australia) v. 41(4) p. 369-378. 3 tables, 4 fig., 22 ref. English. (AGRIS 95-068031).*

Barley grass (*Hordeum* spp.) dominant pastures were sprayed to control grass in September 1990 or left unsprayed and stocked with woolly Merino lambs from September to December 1990, after which, the lambs were slaughtered. A second group of Merino lambs grazed the same pastures from September 1991 to May 1992. For the second group of lambs, the grassy pastures were mechanically slashed and half the lambs on both pasture types were shorn in October 1991. All lambs were shorn in May 1992 producing subgroups of once- and twice-shorn lambs. Lamb liveweights were greater on the sprayed pastures in both seasons. Wool

production was greater on the sprayed pastures in the second group of lambs only as the first group of lambs had grazed the pastures for only 47 days before shearing. Vegetable fault in wool from the grassy pastures was double that of the sprayed pastures in the first season when grasses (hence seeds) were not controlled. In the second season, vegetable fault was slightly higher in wool from the sprayed pastures due to an increase of *Burr medic* (*Medicago polymorpha*) and the invasion of *Erodium* species. Net returns per animal from wool were higher for the sprayed group in both years and for the one-shorn group in the second year. Supplementary feeding over summer was restricted to lambs grazing the unsprayed pastures in the second year.

L02 ANIMAL FEEDING

3159 Akin, D.E.; Kimball, B.A.; Windham, W.R.; Pinter, P.J.; Wall, G.W.; Garcia, R.L.; Lamorte, R.L.; Morrison, W.H. (1995) EFFECT OF FREE-AIR CO₂ ENRICHMENT (FACE) ON FORAGE QUALITY OF WHEAT. *Animal Feed Science & Technology*. 53(1):29-43. English. [USDA ARS RICHARD B RUSSELL AGR RES CTR POB 5677 ATHENS, GA 30604 USA].

Wheat (*Triticum aestivum* L., cultivar 'Yecora rojo') was grown in ambient (370 μ mol mol⁻¹) or enriched (550 μ mol mol⁻¹) concentrations of CO₂ in the free-air CO₂ enrichment (FACE) project, and components were analyzed for in vitro digestibility, fiber constituents, and crude protein. Four replicated plots of each CO₂ treatment were split for irrigation: 'wet' regions received 60 cm of water and 'dry' regions received 30 cm of water through underground tubes. Enriched CO₂ concentrations had no effect on in vitro digestion of intact sections of young (26-32-day-old plants) leaf blades except at 24-27 h incubation, at which time enriched leaves were lower in digestibility than control ones. Enriched CO₂ concentrations increased the content of acid detergent fiber (ADF) and cellulose of young wet leaves. Sections of main shoots at 26 days tended to have increased digestibility with elevated CO₂ levels. Enriched CO₂ concentrations did not alter the digestibility of flag leaves from 105-day-old plants or of flag leaves, uppermost stems, and sheaths from plants at full grain maturity. Enriched CO₂ levels reduced the acid detergent lignin (ADL) and tended to reduce the protein of leaves from 105-day-old plants. For mature leaf blades, neutral detergent fiber, ADF, and cellulose were, or tended to be, higher while protein content tended to be lower in elevated CO₂-grown plants; for both CO₂ treatments, 'dry' leaves were higher in digestibility and lower in ADL than 'wet' samples. Mature stems plus sheaths had lower protein contents in plants grown in elevated CO₂. Results indicated that enriched CO₂ concentrations to 550 μ mol mol⁻¹ did not substantially alter wheat in vitro digestibility, regardless of irrigation treatment. Elevated CO₂ altered fiber components and protein, but these were not consistent among parts and harvests. [References: 38].

3160 Almirall, M.; Francesch, M.; Perezvendrell, A.M.; Brufau, J.; Estevegarria, E. (1995) THE DIFFERENCES IN INTESTINAL VISCOSITY PRODUCED BY BARLEY AND BETA-GLUCANASE ALTER DIGESTA ENZYME ACTIVITIES AND ILEAL NUTRIENT DIGESTIBILITIES MORE IN BROILER CHICKS THAN IN COCKS. *Journal of Nutrition*. 125(4):947-955. English. [CTR MAS BOVE INST RECERCA & TECNOL AGROALIMENTAIRE DEPT ANIM NUTR E-43280 REUS SPAIN].

The objectives of this study were to determine whether intestinal viscosity caused by mixed linked barley beta-glucan depresses ileal nutrient digestibility and digestive enzyme activities and to determine the interaction of intestinal viscosity, digestive enzyme activities and ileal nutrient digestibility in different ages of poultry. In Experiments 1 and 2, 1-d-old broiler chicks and 1-y-old cocks, respectively, were fed diets with 60% corn, low and high viscosity barley with or without beta-glucanase, for 3 wk. A 3 x 2 factorial design was used. Comparisons were made only within the same age group. In Experiment 3, 1-d-old broiler chicks were fed high viscosity barley with and without beta-glucanase to measure fecal nutrient and ileal and fecal amino acid digestibility. Broiler chicks fed barley ate less and gained less weight than those fed corn; added beta-glucanase resulted in increases in both food consumption and weight gain for the barley-fed chicks ($P < 0.05$). Relative pancreas weight was higher ($P < 0.05$) in chicks fed barley than in those fed corn, and lower with beta-glucanase ($P < 0.05$). Digesta from barley-fed birds had the highest viscosities, which were decreased ($P < 0.05$) by beta-glucanase. Amylase and lipase were lower in broiler chicks fed high viscosity barley compared with corn ($P < 0.05$), and beta-glucanase increased both activities and that of trypsin as well ($P < 0.05$). In barley-fed broiler chicks, ileal starch, protein and fat digestibility,

as well as fecal fat, protein and amino acid digestibility were lower ($P < 0.05$), but increased with beta-glucanase ($P < 0.05$). Although barley increased intestinal viscosity and beta-glucanase lowered it in poultry of both ages, barley-fed broiler chicks had decreased digestive enzyme activities and ileal nutrient digestibility that were increased with beta-glucanase, indicating that viscosity is more limiting in broiler chicks than in cocks. [References: 36].

3161 Alzubaidy, SS. (1994) COMPARATIVE NUTRITIVE VALUE OF HIGH PROTEIN, WHITE, AND BLACK BARLEYS FOR BROILER CHICKS. *Tropical Agriculture*. 71(2):153-156. English. [UNIV BAGHDAD COLL AGR DEPT ANIM PROD BAGHDAD IRAQ].

Two experiments were conducted with broiler chicks up to 4 weeks of age to compare the nutritive value of three high-protein barleys, No. 95, white, and black which were analysed for proximate composition. In experiment 1, chicks were fed diet 1 which consisted of 64% maize (control), and diets 2, 3, and 4 which consisted of 32% maize and 32% barley for each diet using the three barleys, respectively. Results showed that chicks fed diets 1 and 2 gained significantly ($P < 0.05$) more weight and had higher feed/gain ratio than chicks fed diets 3 and 4. High-protein barley No. 95 containing 14.22% protein was superior to white and black barleys containing 11.63 and 11.07% protein, respectively. The chicks in experiment 2 were fed three isonitrogenous and isocaloric diets which varied in the quantities of the three barleys and soya bean meal to test the effect of additional protein to barley of high-protein content. Results showed no significant ($P > 0.05$) differences in body weight, feed/gain ratio, and protein efficiency ratio among the three diets. Although the performance of chicks fed high-protein barley No. 95 was not statistically superior in this study, it can replace a portion of soya bean meal as a supplemental protein for broiler chicks. [References: 11].

3162 Damme, K. (Lehr und Versuchsstation fuer Kleintierzucht, Kitzingen (Germany)) (1994) [Broiler fattening feed with wheat, triticale or maize?]. *Haehnenmastfutter mit Weizen, Triticale oder Mais? Deutsche Gefluesselwirtschaft und Schweineproduktion (Germany) v. 46(36) p. 13-15. 2 ill., 3 tables. German. (AGRIS 95-054961).*

3163 Damme, K. (Lehr und Versuchsstation fuer Kleintierzucht, Kitzingen (Germany)) (1994) [Broiler fattening: Fattening feed out - wheat in?]. *Haehnenmast: Mastfutter out - Weizen in? Deutsche Gefluesselwirtschaft und Schweineproduktion (Germany) v. 46(40) p. 11-14. 2 ill., 6 tables. German. (AGRIS 95-068361).*

3164 Fitzgerald, RD.; Curll, ML.; Heap, EW. (1995) WHEAT FOR FODDER AND GRAIN ON THE NORTHERN TABLELANDS OF NEW SOUTH WALES. *Australian Journal of Experimental Agriculture*. 35(1):93-96. English. [NSW AGR AGR RES & ADVISORY STN GLEN INNES NSW 2370 AUSTRALIA].

Thirty varieties of wheat originating from Australia, UK, USA, Ukraine, and France were evaluated over 3 years as dual-purpose wheats for the high rainfall environment of the Northern Tablelands of New South Wales (mean annual rainfall 851 mm). Mean grain yields (1.9-4.3 t/ha) compared favourably with record yields in the traditional Australian wheatbelt, but were much poorer than average yields of 6.5 t/ha reported for UK crops. A 6-week delay in sowing time halved grain yield in 1983; cutting in spring reduced yield by 40% in 1986. Grazing during winter did not significantly reduce yields. Results indicate that the development of wheat varieties adapted to the higher rainfall tablelands and suited to Australian marketing requirements might help to provide a useful alternative enterprise for tableland livestock producers. [References: 11].

3165 Ganeva, G. (Institut po Genetika pri BAN, Sofia (Bulgaria)); Van, K. (1994) [Study on the effect of a new high-protein soft wheat line in broiler mixtures]. *Pouchvane v'rkh uchiati na nova liniya visokoproteinova meka pshenitsa v smeski za pileta brojleri. Selskostopanska Akademiya, Sofia (Bulgaria). Zhivotnov'dni Nauki (Bulgaria); Animal Science v. 31(1-4) p. 184-191. 7 tables; 38 ref. Bulgarian. (AGRIS 95-068357).*

3166 Godfrey, SL.; Rowe, JB.; Thorniley, GR.; Boyce, MD.; Speijers, EJ. (1995) VIRGINIAMYCIN TO PROTECT SHEEP FED WHEAT, BARLEY OR OATS FROM GRAIN POISONING UNDER SIMULATED DROUGHT FEEDING CONDITIONS. *Australian Journal of Agricultural Research*.

46(2):393-401. English. [WESTERN AUSTRALIA DEPT AGR BARON HAY COURT S PERTH WA 6151 AUSTRALIA].

Lactic acidosis can occur when cereal grains are fed to sheep in large quantities without an adequate introduction. Virginiamycin has been shown to reduce lactic acid accumulation in vitro and in the rumen of sheep following ingestion of readily fermentable carbohydrates. The aim of this experiment was to determine if virginiamycin would prevent acidosis in hungry sheep fed wheat, barley or oat grain without any introductory period. Merino wethers were penned individually and fed wheaten chaff (300 g/day for 9 days) before being offered 2.1 kg of wheat, barley or oat grain, with or without virginiamycin ($n = 20$, $N = 120$). Rumen fluid was collected prior to grain feeding and at 6 and 24 h following grain feeding. Blood samples were obtained prior to feeding and at 24 and 48 h following grain feeding. Twenty-four hours following access to grain, the rumen pH was lower ($P < 0.001$) and the rumen L-lactate was higher ($P < 0.05$) in sheep fed wheat without virginiamycin compared to sheep fed wheat plus virginiamycin. D- and L-lactate were produced in equal proportions in sheep fed grain plus virginiamycin, while sheep fed grain without virginiamycin produced more of the L-isomer at 24 h following grain feeding. There was no effect ($P > 0.05$) of virginiamycin on grain intake, although intake of sheep fed oat grain was lower ($P < 0.01$) than intake of sheep fed wheat or barley. The number of sheep withdrawn from the experiment following grain feeding was lower ($P < 0.05$) when wheat was fed to sheep with virginiamycin compared to untreated wheat grain. Inclusion of virginiamycin with grain did not reduce grain intake, but did reduce the severity of acidosis in sheep fed wheat grain. [References: 15].

3167 Gonzalez, LM.; Valdivie, M.; Elias, A.; Gutierrez, O. (1993) SACCHARINA IN WHEAT OR MAIZE DIETS FOR BROILERS. *Cuban Journal of Agricultural Science*. 27(3):325-328. English. [INST CIENCIA ANIM APARTADO 24 HAVANA CUBA].

720 broilers (ES(54) of both sexes from 7 to 49 of age were used to evaluate the inclusion of Saccharina in wheat or maize cereal diets. The treatments were: 1) maize control diet, 2) 10% of Saccharina in the maize diets, 3) wheat control diet and 4) 10% of Saccharina in wheat cereal diets. A completely randomized design with 4 treatments and 6 replications was used. Live weight gains of 1571, 1506, 1461 and 1462 g/bird at 49 days, conventional feed consumptions of 3409, 2844, 3198 and 2706 g/bird and conventional feed conversions of 2.27, 1.96, 2.32 and 1.94 were obtained for the treatments described here, respectively. The results justify the utilization of 10% of Saccharina in diets for broilers regardless of the type of basic cereal used (maize or wheat).

3168 Masseller, M. (1994) [Marketing of maize and wheat by way of gizzard]. *Mais und Weizen ueber den Huehnermagen vermarkten. Deutsche Gefluesselwirtschaft und Schweineproduktion (Germany) v. 46(37) p. 6-9. 6 ill. German. (AGRIS 95-054989).*

3169 Piva, G.; Prandini, A.; Cerioli, C. (Universita Cattolica del Sacro Cuore, Piacenza (Italy). Istituto di Scienze della Nutrizione); Morlacchini, M. (Centro Ricerche per la Zootecnica e l'Ambiente (CERZOO), San Bonico, Piacenza (Italy)); Fusari, A. (Parma Univ. (Italy). Istituto di Biochimica) (1994) [Effects of supplementing salts of fatty acids on performances and fat quality in Italian heavy pigs]. *Effetto dei grassi salificati sulle performances produttive e sulla qualita' del grasso di deposito in suini pesanti. Rivista di Suinicoltura (Italy) v. 35(11) p. 53-62. 10 tables; 32 ref. Italian. (AGRIS 95-054909).*

3170 Plaza, J.; Fernandez, E.; Quintana, A. (1993) EFFECT OF AN INTEGRAL WHEAT OR MAIZE CONCENTRATE ON CALF PERFORMANCE. *Cuban Journal of Agricultural Science*. 27(3):285-290. English. [INST CIENCIA ANIM APARTADO 24 HAVANA CUBA].

Forty eight female calves of 12 to 90 days of age were used in a random block with 6 replications with two animals in each one. The treatments were as follow A) maize concentrate and long hay given separately; B) integral maize concentrate with 20% ground hay; C) wheat concentrate and long hay given separately and D) integral wheat concentrate with 20% ground hay. All the animals received concentrate and roughage ad libitum from 21 to 90 days of age and 6 litres of yogurt from 12 to 30 days twice daily and 4 litres from 31 to 60 days once. Live weight and daily gains (from 12 to 60 days and from 12 to 90 days) in the wheat and long hay treatment were poorer than the remaining treatments. Feed consumption and nutrients did not differ between treatments. The poorest performance of calves fed wheat

concentrates or long hay indicates that it is possible to obtain a better efficiency of utilization of the feed and live weight gains when the integral wheat concentrate and 20% of ground hay was used.

3171 Redmon, LA.; Horn, GW.; Krenzer, EG.; Bernardo, DJ. (1995) A REVIEW OF LIVESTOCK GRAZING AND WHEAT GRAIN YIELD - BOOM OR BUST [Review]. *Agronomy Journal*. 87(2):137-147. English. [OKLAHOMA STATE UNIV DEPT ANIM SCI STILLWATER, OK 74078 USA].

Winter wheat (*Triticum aestivum* L.) grown as a dual-purpose crop is a unique and economically important resource, especially in the southern Great Plains. Since the last major review of grazing effects on grain yield, in 1956, wheat cultivars have been developed that may affect the productivity of the grazing-grain enterprise. Thus, we decided to review current research on grazing winter wheat and the effects on grain yield in light of earlier information. During a year of favorable precipitation and adequate to excess soil fertility, tall winter wheat cultivars grazed prior to jointing experienced increased grain yield relative to nongrazed wheat, because of reduced lodging. Current research suggests that the grain yield of semidwarf wheat cultivars is more sensitive to forage removal than for tall cultivars. Grazing termination dates necessary to prevent grain yield reduction of semidwarf cultivars also appear to be much earlier than for taller wheat cultivars. The reason for the difference in grazing tolerance is not clear; however, research suggests that semidwarf cultivars require maximum leaf area at anthesis for maximum grain yield. Tall wheat cultivars are not affected in the same manner, and decreased leaf area due to later grazing does not reduce grain yield of taller wheat cultivars to the same extent as for the semidwarf cultivars. Thus, taller wheat cultivars have the potential for extending the grazing period for livestock producers while producing grain yield similar to that of semidwarf wheat cultivars (which generally produce more grain in a nongrazed situation). [References: 45].

3172 Redmon, LA.; McCallum, FT.; Horn, GW.; Cravey, MD.; Gunter, SA.; Beck, PA.; Mieres, JM.; Sanjulian, R. (1995) FORAGE INTAKE BY BEEF STEERS GRAZING WINTER WHEAT WITH VARIED HERBAGE ALLOWANCES. *Journal of Range Management*. 48(3):198-201. English. [OKLAHOMA STATE UNIV DEPT AGRON STILLWATER, OK 74074 USA].

Two grazing trials were conducted in separate years on a 5.86 ha winter wheat (*Triticum aestivum* var. Chisholm) pasture divided into 10 experimental paddocks. Paddocks were differentially grazed with beef steers to produce an array of different herbage mass levels, expressed as kg dry matter (DM)/ha. Each experimental paddock was then continuously stocked with 3 beef steers during each 7-day forage intake trial. Daily forage intake, expressed as kg organic matter (OM)/100 kg body weight (BW), was estimated from fecal output (Cr2O3 dilution) of the beef steers and in vitro organic matter disappearance of esophageal masticate collected from each paddock. Estimated daily gain was calculated from forage intake and net energy values calculated from organic matter disappearance data. Forage intake, organic matter disappearance, and estimated daily gain were related to daily herbage allowance, expressed as kg DM 100 kg BW⁻¹ day⁻¹, and herbage mass utilizing a quadratic equation with a plateau function. As herbage allowance increased, organic matter disappearance improved ($Y = 62.18 + 1.08 \text{ herbage allowance} - .022 \text{ herbage allowance}^2$; $r^2 = .64$, $MSE = 5.06$) as did forage intake ($Y = 1.3 + .12 \text{ herbage allowance} - .003 \text{ herbage allowance}^2$; $r^2 = .52$, $MSE = .07$), and estimated daily gain ($Y = -.059 + .12 \text{ herbage allowance} - .003 \text{ herbage allowance}^2$; $r^2 = .59$, $MSE = .07$). Plateaus were achieved at herbage allowance between 20 to 24 kg DM 100 kg BW⁻¹ day⁻¹. Results of this study indicate forage intake and estimated daily gain declined severely as herbage allowance fell below 20 to 24 kg DM 100 kg BW⁻¹ day⁻¹. This data may provide a threshold herbage allowance for initiation of energy supplementation programs for growing cattle on wheat pasture. [References: 20].

3173 Reiter, K. (Hohenheim Univ., Stuttgart (Germany). Inst. fuer Tierhaltung und Tierzuechtung. Fachgebiet Kleintierzucht); Zernig, F.; Meyer, H. (1994) [Turkeys: Don't be sparing with wheat]. Puten: Mit Weizen nicht geizen. *Deutsche Gefluegelwirtschaft und Schweineproduktion (Germany)* v. 46(34) p. 11-12. 1 ill., 2 tables. German. (AGRIS 95-055017).

3174 Roensch, M. (Jena Univ. (Germany). Inst. fuer Ernaehrung und Umwelt); Flachowsky, G. (1994) [Influence of different concentrate levels to whole crop barley pellets on slaughtering results and body composition

of growing bulls]. Einfluss unterschiedlicher Konzentratgaben zu Gerste-Ganzpflanzenpellets auf Ausschlaechtungsergebnisse und Koerperzusammensetzung von Jungbullen im Mastverlauf. Proceedings of the Society of Nutrition Physiology (Germany); no. 2 p. 94. DLG. 1 table. p. 94. German. (AGRIS 95-054758).

3175 Schulthess, U.; Tedla, A.; Mohamedsaleem, MA.; Said, AN. (1995) EFFECTS OF VARIETY, ALTITUDE, AND UNDERSOWING WITH LEGUMES ON THE NUTRITIVE VALUE OF WHEAT STRAW. *Experimental Agriculture*. 31(2):169-176. English. [MICHIGAN STATE UNIV DEPT CROP & SOIL SCI E LANSING, MI 48824 USA].

Wheat was planted at different altitudes in the Ethiopian highlands. Increased altitude led to a lower neutral detergent fibre (NDF) content and a higher in vitro organic matter digestibility (IVOMD) of the leaf blades, leaf sheaths and stems. The varieties tested did not differ in NDF content, however, because of the improved NDF digestibility of all three straw fractions. The semi-dwarf varieties had a higher IVOMD than the standard tall wheats. The local durum wheat variety showed a much higher sodium content and a more favourable Na:K ratio. Undersowing with an equal mixture of *Trifolium ruebellianum* (Fres.) and *Trifolium steudneri* (Schw.) led to a small reduction in straw yield but increased the crude protein content of the crop residues from 2.3 to 7.1% and the IVOMD from 44 to 51% as compared to the sole wheat stand. [References: 19].

3176 Singh, GP.; Singh, K.; Gupta, BN. (1995) BIOCONVERSION OF AMMONIA TO BIOLOGICAL PROTEIN BY COPRINUS FIMETARIUS DURING SOLID SUBSTRATE FERMENTATION OF AMMONIATED (UREA) WHEAT STRAW. *Indian Journal of Animal Sciences*. 65(5):602-605. English. [NATL DAIRY RES INST DIV DAIRY CATTLE NUTR KARNAL 132001 HARYANA INDIA].

3177 Soukupova, Z.; Pribylova, J.; Pribyl, J.; Vymola, J. (1995) REPLACEMENT OF SOYBEAN AND MAIZE MEAL IN GOOSE BROILER DIETS BY RAPESEED, WHEAT, BARLEY AND PEA. *Zivocisna Vyroba*. 40(3):129-133. Czech. [VYZKUMNY USTAV ZIVOCISNE VYROBY CR-10400 PRAGUE 10 CZECH REPUBLIC].

Formulae of feeding mash were proposed and tested for the goose broiler production in which extracted soybean and maize meal were fully or partially replaced by rapeseed meal, pea, wheat and barley. Three mixtures were tested on 582 geese of two genotypes of Italian goose with the sex ratio 1 : 1. About 300 goslings of each genotype were housed in a warm rearing house, on deep litter in boxes (2.71 birds/m²) till the age of 105 days. Within each genotype the goslings were divided into three groups. From the 1st to the 28th day of age all goslings were fed ad libitum with the starter granular mash, from the 29th to the 105th day with grower pelleted diets, differing in their composition (Tab. I). Mixture No.1 was used as standard. Live weight at the age of 105 days, mortality and total feed consumption were monitored. Traits measured on individuals were analyzed by model (1), traits measured on box basis (mortality and feed consumption) were analyzed according to model (2), where y_{ijkl} is the value of the i -th individual of the k -th sex, receiving the j -th diet and belonging to the i -th genotype, y_{ij} is the value of the box where birds of the i -th genotype are housed receiving the j -th diet, μ is general mean, g_i is the effect of the i -th genotype, v_j is the effect of the j -th diet, p_k is the effect of the k -th sex, $(gv)_{ij}$, $(gp)_{ik}$, $(vp)_{jk}$, $(gvp)_{ijk}$ are the appropriate interaction effects, e_{ijkl} the residual effect for models (1) and (2), resp. All calculations were carried out using the procedure GLM of SAS. At the end of experiment the live weight of goose broilers was 5.28-5.63 kg and feed conversion 4.97-5.45 kg/kg LW (Tab. II). The live weight was significantly influenced by sex and diet. Goslings fed experimental mixtures had significantly higher live weight. The feed consumption and mortality were not influenced by the diet at all. The interactions between genotype and diets (genotype $\times$ sex, sex $\times$ diet and genotype $\times$ diet $\times$ sex) were not significant. Using native sources of nutrients may considerably reduce the production costs of goose broiler raising (Tab. III).

3178 Sundberg, B.; Pettersson, D.; Aman, P. (1995) NUTRITIONAL PROPERTIES OF FIBRE-RICH BARLEY PRODUCTS FED TO BROILER CHICKENS. *Journal of the Science of Food & Agriculture*. 67(4):469-476. English. [SWEDISH UNIV AGR SCI DEPT FOOD SCI S-75007 UPPSALA SWEDEN].

The chemical composition of roller-milled fractions of barley from a commercial plant was studied and a fraction rich in mixed-linked beta-

glucans selected. This fraction contained 560 g kg⁻¹ starch, 120 g kg⁻¹ crude protein, 170 g kg⁻¹ dietary fibre and 70 g kg⁻¹ mixed-linked beta-glucans. An unprocessed, drum-dried or extrusion-cooked fraction was used as the major ingredient in diets for broiler chickens. The diets were fed with or without a supplementary fibre-degrading enzyme preparation in order to evaluate specifically the nutritional effects of the soluble dietary fibres. Processing significantly retarded growth, cumulative feed intake and feed conversion efficiency of the diets fed without enzyme supplementation, while the supplementation significantly improved all three parameters for each diet. Generally, processing decreased plasma triglycerides and total cholesterol and increased the ratio between high-density lipoproteins (HDL) and total cholesterol of chickens fed diets without enzyme supplementation. The enzyme supplementation increased the triglyceride and total cholesterol values and decreased the HDL/total cholesterol ratio, with more pronounced effects for chickens fed the processed diets. [References: 35].

3179 Uehara, T. (Kagawa ken. Livestock Research Station, Miki (Japan)); Shirakawa, A.; Masukawa, S.; Minato, S. (1993) A comparison of feeding values of high protein barley varieties for pork production. *Bulletin of the Kagawa Prefecture Livestock Research Station (Japan) (no.29)* p. 53-64. 19 tables. Japanese. (AGRI 95-054879).

3180 Vladimirova, L. (Institut po Z'meni Khrani i Furazhna Promishlenost, Kostinbrod (Bulgaria)); Van, K. (1994) [Effect of enzyme additive to wheat mixtures for broilers]. *Efekt ot dobavkata na enzimen preparat k'm pshenichni smeski za pileta brojleri. Selskostopanska Akademiya, Sofia (Bulgaria). Zhivotnovodni Nauki (Bulgaria); Animal Science v. 31(1-4)* p. 179-183. 4 tables; 38 ref. Bulgarian. (AGRI 95-068356).

3181 Watanabe, H. (Chiba ken. Livestock Experiment Station, Yachimata (Japan)); Mitsui, Y. (1992) Studies on the ammonia treatment of low quality roughages. 7: Influence of ammoniation of rice straw and barley straw on intake, digestibility and rumen fermentation of steers. *Bulletin of the Chiba Prefectural Livestock Experiment Station (Japan) (no.16)* p. 37-44. 5 tables; 4 fig.; 23 ref. Japanese. (AGRI 95-054751).

3182 Wootton, M.; Acone, L.; Wills, RBH. (1995) PENTOSAN LEVELS IN AUSTRALIAN AND NORTH AMERICAN FEED WHEATS. *Australian Journal of Agricultural Research*. 46(2):389-392. English. [ACAD GRAIN TECHNOL WERRIBEE WERRIBEE VIC 3030 AUSTRALIA].

Pentosan levels in 19 Australian and 12 North American wheats, predominantly of feed grade, were determined. Values were not significantly different between wheats from the two regions and ranged from 5.4 to 7.2% in the Australian and from 5.5 to 6.5% in the North American samples. Apparent metabolizable energy (AME) values for the Australian wheats, when used in poultry rations, showed a positive correlation with pentosan levels, which is counter to current thinking that suggests a negative relationship. These results imply that any difference between feed wheats from the two regions with respect to AME in poultry rations cannot be attributed to pentosan content. [References: 7].

3183 Yuan Jingkai (Zhoukou Regional Bureau of Animal Husbandry, Henan (China)) (1993) Effects of supplementation of cottonseed cake and ammoniated wheat straw on the performance of beef cattle. *Chinese Journal of Animal Science (China) v. 29(6)* p. 3-5. 4 tables, 6 ref. Chinese. (AGRI 95-054809).

L10 ANIMAL GENETICS AND BREEDING

3184 Jensen, N.E. (1994) [The Rabbit Test Station 1992-93: Breeding and feeding tests]. *Kaninforsøgsstationen 1992-93: Avls- og fodringsforsøeg. Statens Husdyrbrugsforsøeg, Foulum (Denmark). Beretning fra Statens Husdyrbrugsforsøeg (Denmark); no. 726 31 p. SH. 22 tables; 11 ref. Danish. (AGRI 95-055236).*

L20 ANIMAL ECOLOGY

3185 Hance, T. (Universite Catholique de Louvain, Louvain la Neuve (Belgium). Unite d'Ecologie et de Biogeographie) (1992) Spring densities of Ground beetles (Coleoptera, Carabidae) in cultivated fields. *Bulletin et Annales de la Societe Royale Belge d'Entomologie (Belgium); Bulletin en Annalen*

van de Koninklijke Belgische Vereniging voor Entomologie v. 128(10-12) p. 319-324. 2 tables; 14 ref. English. (AGRI 95-055318).

The density of Carabidae present in a winter wheat field and in a stubble field was determined in April with the quadrat method. Fourteen species were caught which were principally small spring breeders. The density varied between 16 and 33 individuals per cube meter according to field and proximity of the field edges. Two species were the most abundant, *Bembidion lampros* (Herbst) and *Asaphidion flavipes* (L.), with respectively 29.8 to 49 per cent and 32 to 38 per cent of the total density. Aggregation of total carabids was only detected by means of a variance/mean ratio index in the stubble field, probably because of the presence of small patches of organic matter there.

L51 ANIMAL PHYSIOLOGY-NUTRITION

3186 Bergner, H. (Humboldt Universitaet, Berlin (Germany). Inst. fuer Ernahrungswissenschaften); Goetz, K.P.; Simon, M.; Rennert, B. (1993) [15N-labelling of fishes by means of (15N)-isotope in the water of aquarium and the influence of a different protein nutrition on the (15N)-elimination after the labelling period]. (15N-Markierung von Fischen ueber (15N)-Isotope im Aquarienwasser und der Einfluss einer unterschiedlichen Eiweissernaehrung auf die (15N)-Eliminierung nach der Markierungsperiode. *Archives of Animal Nutrition (Germany) v. 45(2)* p. 139-154. 8 ill., 7 tables; 5 ref. German. (AGRI 95-055767).

3187 Bergner, H. (Humboldt Univ. zu Berlin (Germany). Landwirtschaftlich Gaertnerische Fakultaet. Inst. fuer Grundlagen der Nutztierwissenschaften. Fachgebiet Tierernaehrung); Woidke, D.; Lenk, J. (1994) [In sacco digestibility of dry matter of wheat straw after treatment with urea-saccharose-mixtures]. *In-sacco-Verdaulichkeit der Trockensubstanz von Weizenstroh nach Behandlung mit Harnstoff-Saccharose-Mischungen. Monatshefte fuer Veterinaermedizin (Germany) v. 49(6)* p. 263-267. 2 tables, 2 graphs; 23 ref. German. (AGRI 95-069114).

3188 Egashira, Y. (Chiba Univ., Matsudo (Japan). Faculty of Horticulture); Namiki, H.; Ohta, T.; Sanada, H.; Ayano, Y.; Numayama, K. (1994) Effect of dietary fiber isolated from wheat endosperm on cholesterol metabolism, gastrointestinal transit time and glucose tolerance in rats. *Technical Bulletin of Faculty of Horticulture - Chiba University (Japan) (no.48)* p. 37-43. 5 tables; 2 fig.; 13 ref. Japanese. (AGRI 95-055624).

The effects of dietary fiber isolated from wheat endosperm (WEF) on cholesterol metabolism, gastrointestinal transit time and glucose tolerance were investigated in rats and compared with fiber free diet (DFF) and cellulose diet (CEL). (1) Dietary WEF, DFF and CEL groups did not suppress the elevation of serum cholesterol levels. (2) The mean of gastrointestinal transit time were 58.2 hr for WEF, 51.2 hr for CEL and 69.6 hr for DFF group. Fecal moisture were the same of all groups. (3) The diet containing WEF suppressed the rise of serum glucose levels in the presence of corn oil.

3189 Inbarr, J. (Finnfeeds International Ltd., Marlborough (United Kingdom)) (1994) [Effect of beta-glucanase supplementation of diets with low or high beta-glucan content on gut parameters and performance of early-weaned pigs]. *Einfluss eines beta-Glucanase-Zusatzes zum Ferkelfutter mit unterschiedlichem beta-Glucan-Gehalt auf Wachstumsleistung und Darmparameter. Proceedings of the Society of Nutrition Physiology (Germany); no. 2 p. 100. DLG. 1 ref. p. 100. German. (AGRI 95-055722).*

L53 ANIMAL PHYSIOLOGY-REPRODUCTION

3190 Birkan, M. (Office National de la Chasse, Auffargis (France). Centre National d'Etude et de Recherche Appliquee Petite Faune Sedentaire de Plaine); Avignon, T.; Reitz, F.; Vignon, V. (1994) Highway effect on breeding success of the grey partridge (*Perdix perdix*) in a plain of large-scale wheat farming. Influence d'une autoroute sur le succes reproducteur de la perdrix grise (*Perdix perdix*) en plaine de grande culture. *Einfluss einer Autobahn auf den Bruterfolg des Rebhuhns (Perdix perdix) in der Grosskulturebene. Gibier Faune Sauvage (France) v. 11(3)* p. 207-218. 59 ref. French. (AGRI 95-056110).

L74 MISCELLANEOUS ANIMAL DISORDERS

3191 Fekete, S.; Huszenicza, G. (1993) Effects of T-2 toxin on ovarian activity and some metabolic variables of rabbits. *Laboratory animal science (USA)* v. 43(6) p. 646-649. references. English. (AGRIS 95-070753).

M12 AQUACULTURE PRODUCTION AND MANAGEMENT

3192 Przybyl, A. (Academy of Agriculture, Poznan (Poland). Chair of Inland Fisheries and Aquaculture); Madziar, M.; Tartowski, I. (1994) Assessment of the suitability of triticale in the extruded feeds table carp. *Archiwum Rybactwa Polskiego (Poland); Archives of Polish Fisheries* v. 2(1) p. 103-112. 7 tables; 13 ref. English. (AGRIS 95-057695).

Six feed mixtures produced using the extrusion were tested. Optimal share of triticale in the feeds was 22 percentage.

N20 AGRICULTURAL MACHINERY AND EQUIPMENT

3193 Kahrs, J. (Hohenheim Univ., Stuttgart (Germany). Inst. fuer Agrartechnik) (1994) [Threshing weeded grain]. *Drusch von verunkrautetem Getreide. Landtechnik (Germany)* v. 49(3) p. 164-165. 3 ill.; 4 ref. German. (AGRIS 95-071115).

The ways in which the separating characteristics of a modern rasp-bar thresher with straw walkers change, when adding herbage, were investigated in Hohenheim. More green rubbish means higher grain losses; grain moisture and impurity are negatively effected. Because the green rubbish is threshed too, such threshing tests can be seen as threshing mixed crops. Weed seeds are separated differently than grain. The loss curves of weed seeds differ significantly from those of wheat.

3194 Michalak, D. (Politechnika Poznanska, Poznan (Poland)) (1994) [Research of stresses in pressed grain agriculture materials]. *Badania naprezen wewnetrznych w materialach ziarnistych zagaszczanych cisnieniowo. Prace Przemyslowego Instytutu Maszyn Rolniczych (Poland)* v. 39(4) p. 40-45. 4 fig.; 7 ref. Polish. (AGRIS 95-057936).

The paper shows research results of stress decreasing of the pressed agriculture materials during hold time with constant strain. The values of relaxation were given for two sorts of chopped grains. Applied pressing pressures were among 44 and 140 MPa, while moisture content was 11 to 20 per cent. The value of moisture content assuring maximum relaxation was found for the whole range of applied pressures.

3195 Regner, S. (1995) Kernel mass related properties of cereal grains. *Sveriges Lantbruksunivers., Uppsala (Sweden). Rapport - Sveriges Lantbruksuniversitet, Institutionen foer Lantbruksteknik (Sweden); no. 194* 47 p. Bibliography p. 44-47. A dissertation bound with a collection of 5 reprints. SLU-LT-R--194-SE. English. (AGRIS 95-057961).

3196 Uebe, N. (Halle Univ. (Germany). Inst. fuer Agrartechnik) (1994) [On throughput-loss-behaviour of a rotary combine]. *Zum Durchsatz-Verlust-Verhalten eines Axialmaehdreschers. Landtechnik (Germany)* v. 49(3) p. 166-167. 3 ill.; 2 tables; 2 ref. German. (AGRIS 95-071116).

Ascertaining throughput-loss-curves is the basis for evaluating combine capacity. Because these characteristic curves are only valid under specific harvesting conditions, investigations on throughput-loss-behaviour of the Case IH 1860 AF were carried out for various crops and at various locations.

P30 SOIL SCIENCE AND MANAGEMENT

3197 Beck, A.J.; Harris, G.L.; Howse, K.R.; Johnston, A.E.; Jones, K.C. (1995) EFFECT OF CROP RESIDUE MANAGEMENT AND DRAINAGE ON THE PERSISTENCE AND MOVEMENT OF ISOPROTURON IN A STRUCTURED CLAY SOIL OVER THE GROWING SEASON OF A WINTER BARLEY CROP. *Journal of Agricultural & Food Chemistry*. 43(5):1368-1376. English. [UNIV LANCASTER INST ENVIRONM & BIOL SCI LANCASTER LA1 4YQ ENGLAND].

The persistence of isoproturon [3-(4-isopropylphenyl)-1,1-dimethylurea] in the cultivated horizon and losses from mole drains in a structured clay

soil sown with winter barley and managed by crop residue burning and ash incorporation were compared with those where the crop residues were chopped and plowed in. Desorption coefficients (X_{app}) increased over time as isoproturon concentration declined and were greater on the burnt plot than on the unburnt plot on every sampling occasion. By contrast, sorption coefficients (K_d) were more consistent at approximately 5.0 L/kg on both plots. The variability of sorption and desorption was sensitive to temporal variation of rainfall. Sorption nonideality was observed on every sampling occasion with the nonideality index (K_d/K_{app}), declining with time following isoproturon application. Twenty-seven days following the autumn pre-emergent herbicide application [2.475 kg of active ingredient (ai) on October 9, 1991] K_d/K_{app} was approximately 0.5 and after 97 days had fallen to approximately 0.2, where it stabilized until the post-emergent application (1.625 kg of ai/ha on May 4, 1992) three months later. The variability of all parameters was almost as great at the local scale as at the field scale. Total isoproturon losses in drainflow over the growing season were similar at 869 and 943 mg/ha for the burnt plot and unburnt plot, respectively. However, temporal variation in leaching losses was complex, being influenced by a number of factors including dilution effects, soil solution contact times, and possibly particle-assisted transport. [References: 33].

3198 Berndtsson, R.; Bahri, A. (1995) FIELD VARIABILITY OF ELEMENT CONCENTRATIONS IN WHEAT AND SOIL. *Soil Science*. 159(5):311-320. English. [LUND UNIV DEPT WATER RESOURCES ENGN BOX 118 S-22100 LUND SWEDEN].

Field variability of element concentrations in crops is important to consider for nutrient application as well as for evaluation of environmental hazards. The paper gives an analysis of spatially sampled wheat plant tissue in the field to determine spatial properties of 20 elements for a partly sludge-applied agricultural soil in northern Tunisia. A comparison is made with the spatial variability of geochemical elements in the soil. A geostatistical analysis shows that both soil and plant metal concentrations have a spatial structure with a range of 10 to 30 m for the sampling scale considered. Compared with the soil, element variability in the plant is almost an order of magnitude larger. Consequently, the study indicates that field variability of element concentrations in plants can only partially be explained by the corresponding soil variability. [References: 32].

3199 Blackshaw, R.E.; Lindwall, C.W. (1995) MANAGEMENT SYSTEMS FOR CONSERVATION FALLOW ON THE SOUTHERN CANADIAN PRAIRIES. *Canadian Journal of Soil Science*. 75(1):93-99. French. [AGR & AGRIFOOD CANADA RES CTR POB 3000 LETHBRIDGE AB T1J 4B1 CANADA].

Fallow continues to be a common agronomic practice on the southern Canadian prairies, but it has been associated with increased soil erosion and salinity and declining soil fertility. Field experiments were conducted at Lethbridge, Alberta, from 1987 to 1992 to determine the effects of various fallow treatments on weed control, conservation of surface crop residues, accumulation of soil water, and succeeding spring and winter wheat yields. Conventional cultivation during the fallow year with 168-cm sweeps controlled most spring-germinating weeds but did not adequately control overwintered flaxweed or downy brome. Repeated applications of glyphosate and 2,4-D effectively controlled most weeds. Paraquat did not control wild buckwheat or dandelion. Glyphosate alone often did not control wild buckwheat or Russian thistle. Treatments involving a combination of herbicides and tillage gave the best control of all weed species. Although not as effective in conserving surface crop residues as sole use of herbicides, many of the combined herbicide-tillage treatments maintained sufficient crop residue to keep the risk of soil erosion low. Soil water accumulation and succeeding wheat yields with the combined herbicide-tillage treatments were similar to, or greater than, those attained with repeated herbicides or repeated tillage. Management systems combining herbicides and tillage for fallow weed control may reduce costs and prevent or retard the development of herbicide resistance. [References: 27].

3200 Cresswell, H.P.; Kirkegaard, J.A. (1995) SUBSOIL AMELIORATION BY PLANT ROOTS - THE PROCESS AND THE EVIDENCE. *Australian Journal of Soil Research*. 33(2):221-239. English. [CSIRO DIV SOILS GPO BOX 639 CANBERRA ACT 2601 AUSTRALIA].

Actively growing plant root systems have the potential to ameliorate subsoil in poor physical condition (biological drilling). Studies in which

improved crop growth has been attributed to biological drilling by previous crops are reviewed. Whilst we might expect that plants are able to modify subsoil pore size distribution and that subsequent crops will benefit from the improved structure, this has yet to be demonstrated. Improvements in root growth, water extraction and grain yield do not, on their own, definitively establish the occurrence or benefits of biological drilling. Firstly, specific measurements of soil pores, their size, number and continuity are required to establish that soil structural change occurs through biological drilling. Secondly, the effects of biological drilling must be isolated from other confounding influences such as disease reduction and improvements in plant nutrition that might occur from crop rotation. The expected benefits from biological drilling might not eventuate where roots are unable to function efficiently in large pores or are unable to exit from them into the soil matrix. Model approaches can extend site and season specific observations and link soil structural changes to soil-plant-water processes, thus improving assessment of the consequences of biological drilling. Results are presented from an investigation into biological drilling by canola (*Brassica napus* L.) and the subsequent benefits to following wheat crops. Two seasons of canola did not create any measurable changes to soil structure at the top of the B horizon of a red brown earth (Natric Palexeralf) at Temora, N.S.W., even though grain yield and water extraction were greater for wheat following canola compared with wheat following wheat (probably due to reduced incidence of root disease). The canola appeared unable to create new pores due to the high strength of the soil matrix, and thus relied on the pre-existing pores. This, and other studies, tend to indicate that tap rooted annual crops such as lupins or canola are unlikely to be able to improve B-horizon porosity in dense, duplex soil. Perennial species (e.g. lucerne [*Medicago sativa*]) might be more effective at biological drilling because of the longer time and wider range of water content conditions in which to establish a deep root system. It remains to clearly demonstrate biological drilling as an effective process for ameliorating these dense subsoils. [References: 68].

3201 Janzen, HH. (1995) THE ROLE OF LONG-TERM SITES IN AGROECOLOGICAL RESEARCH - A CASE STUDY. *Canadian Journal of Soil Science*. 75(1):123-133. French. [AGR & AGRIFOOD CANADA RES CTR LETHBRIDGE AB T1J 4B1 CANADA].

Gradual, episodic or subtle changes in agroecosystems can be definitively measured only in long-term studies. The objective of this paper is to illustrate the benefits and limitations of long-term agroecological sites using a crop rotation study (Rotation ABC) established at Lethbridge, Alberta in 1910. Long-term agroecological sites, envisioned as part of a continuum of research levels, seek to determine the persistence of cropping systems with respect to their effects on soil resources and the larger environment. Examples of research findings arising from such sites include the documentation of long-term changes in agricultural productivity, measurement of organic matter changes over time, calculation of long-term nutrient budgets, and verification of simulation models. For example, soil organic matter concentrations in Rotation ABC were found to decline abruptly within the first few decades of cultivation and then approach a new steady state. Despite the continual removal of N in harvested grain, soil N concentrations also appear to have stabilized, suggesting an accession of N approximately equivalent to the amount harvested. Common limitations of long-term sites like that at Lethbridge include: rudimentary experimental design, evolving management practices, incidental changes at the sites, and variation in sampling protocols. The successful use of long-term agroecological sites depends on well-defined objectives, simplicity of design, adequate scale, consistent data and sample collection, and collaboration among sites. The primary justification for the establishment and maintenance of long-term agroecological sites may be their future role in answering questions not yet envisioned. [References: 41].

3202 Lavelle, P.; Lattaud, C.; Trigo, D.; Barois, I. (1995) MUTUALISM AND BIODIVERSITY IN SOILS. *Plant & Soil*. 170(1):23-33. English. [ORSTOM ECOL SOLS TROP LAB 72 ROUTE AULNAY F-93143 BONDY FRANCE].

Most soil invertebrates and roots have developed strong interactions with micro-organisms to exploit the organic and mineral resources of soil. Micro-fauna are mainly predators of microorganisms whereas larger organisms interact with micro-organisms through the "external rumen" or facultative endosymbiotic digestive systems. Mobilisation of nutrient and organic resources through mutualism with soil microflora seems to be all the more efficient as the organisms are large (like e.g., roots, termites or earthworms) and temperature is high. In the humid tropics, part of the

existing species richness may have originated from an increased base of resources resulting from the development of mutualistic relationships. Evidence for this process is given for earthworm communities. Consequences for soil function and the species richness of plants and consumers are discussed. [References: 98].

3203 Lindwall, CW.; Larney, F.J.; Carefoot, JM. (1995) ROTATION, TILLAGE AND SEEDER EFFECTS ON WINTER WHEAT PERFORMANCE AND SOIL MOISTURE REGIME. *Canadian Journal of Soil Science*. 75(1):109-116. French. [AGR & AGRIFOOD CANADA RES CTR RES BRANCH LETHBRIDGE AB T1J 4B1 CANADA].

The optimum management system for winter wheat (*Triticum aestivum* L.) production in southern Alberta has not been adequately defined. A 9-yr (1978-1986) study was conducted to determine the effects of three rotations (continuous winter wheat, winter wheat-fallow and winter wheat-barley (*Hordeum vulgare* L.)-fallow), two tillage systems (conventional tillage, zero tillage) and two seeder types (hoe-drill, disc drill) on winter wheat growth, yield and water use. Continuous cropping to winter wheat was terminated after 4 yr because of a heavy downy brome (*Bromus tectorum* L.) infestation. Soil moisture reserves to 1.5-m depth fell to only 61% of that under the wheat-fallow rotation. Wheat grown in the wheat-barley-fallow rotation yielded on average 4% higher than that in the wheat-fallow rotation. Yields under zero tillage were significantly higher in 3 of the 9 study years, and slightly higher in 5 yr, due to better soil moisture conservation once the zero-tillage treatment was established for 2 yr. Zero tillage was most beneficial when precipitation at fall planting was less than normal. The hoe-drill provided more effective seed placement than the disc drill when surface soil conditions were dry at or soon after seeding. A management system which incorporates zero tillage (and preferably seeding with a hoe drill) into a 3-yr (wheat-barley-fallow) rotation is best suited for winter wheat production in southern Alberta. [References: 31].

3204 Lippold, H.; Nebe, D. (1994) DISPLACEMENT OF N-15-LABELLED NITRATE IN THE WINTER SEASON AND THE SUBSEQUENT UTILIZATION BY WINTER WHEAT IN FIELD EXPERIMENTS ON DIFFERENT SITES. *Agribiological Research-Zeitschrift für Agrarbiologie Agrikulturchemie Ökologie*. 47(3-4):295-302. German. [SACHS LANDESANSTALT LANDWIRTSCHAFT FACHBEREICH BODENKULTUR & PFLANZENBAU GUSTAV KUHN STR 8 D-04159 LEIPZIG GERMANY].

The autumn-applied N-15-nitrate-tracers showed in 8 field experiments the nitrate-displacement until spring, which is usually hidden by mineralization. On the heavier soils displacement was small. Therefore the nitrate from the autumn remained available to the winter wheat, or spent the winter partially inside the plants and - possibly - entered the organic N-fraction of the soils. On the sandy soil the nitrate-leaching was more pronounced; the plants incorporated not much of ¹⁵N and its utilization during the growing season was small. Immobilization of the nitrate applied in autumn in the top soil was also small. Denitrification during the winter may have happened. Surplus of nitrogen after harvest may pollute the groundwater and should be avoided by adequate crop management. [References: 8].

3205 Papastylianou, I. (1995) DIURNAL VARIATION OF NITRATE CONCENTRATION IN CEREALS GROWN UNDER RAINFED MEDITERRANEAN CONDITIONS. *Communications in Soil Science & Plant Analysis*. 26(7-8):1121-1131. English. [AGR RES INST NICOSIA CYPRUS].

Standardization of sampling methodology is essential when using plant analysis as an indicator of the nutrition status of a crop. Time of sampling during the day is a factor which was shown to affect tissue nitrate (NO₃) concentration of irrigated crops. The diurnal variation of NO₃ concentration in small grain cereal plants, grown under rainfed mediterranean conditions, was tested by an in situ sap test and by analysing dried tissue. Variation in NO₃ concentration was shown to exist among plants grown under field conditions. Variation was also shown to exist at different hours of sampling within the day. However, these variations did not follow any diurnal trend and the magnitude of the difference in NO₃ concentration did not affect the diagnosis of the nitrogen (N) nutrition status of the crop. The results suggest that diurnal variation of NO₃ concentration of cereals grown under rainfed Mediterranean conditions is not a major concern in using NO₃ tissue tests to predict N availability provided that sampling is done during the daylight hours. [References: 15].

3206 Rasmussen, PE. (1995) EFFECTS OF FERTILIZER AND STUBBLE BURNING ON DOWNY BROME COMPETITION IN WINTER WHEAT. *Communications in Soil Science & Plant Analysis*. 26(7-8):951-960. English. [USDA ARS COLUMBIA PLATEAU CONSERVAT RES CTR POB 370 PENDLETON, OR 97801 USA].

Increased downy brome (*Bromus tectorum*) infestation is one of the dominant impediments to adoption of conservation tillage. Surface residues often increase grassy weed competition and lower the yield of cereal crops. Crop residue and fertilizer placement effects on downy brome growth and nutrient uptake in relation to that of winter wheat (*Triticum aestivum* L.) were conducted in two separate years; one involving conventional (plow) tillage and the other no-till. Crop residue (burning versus no burning) and fertilizer placement (broadcasting versus subsurface banding) differentials were present both years. The conventional-till study also included nitrogen (N) rates from 0 to 168 kg/ha and an N only versus nitrogen+phosphorus+sulfur (N+P+S) comparison. Burning increased early-spring wheat growth substantially, with only limited effect on downy brome population or growth. Broadcasting of fertilizer increased downy brome density and growth compared to banding. Wheat, in contrast, had greater growth and higher N uptake from banded fertilizer. Increasing N increased both seedling survival and culm production of downy brome. Addition of N+P+S increased both wheat and downy brome growth more than N applied alone, but wheat appeared more responsive. Wheat yield tended to be less with higher downy brome infestation. [References: 12].

3207 Rayment, GE. (1993) SOIL ANALYSIS - A REVIEW [Review]. *Australian Journal of Experimental Agriculture*. 33(8):1015-1028. English. [DEPT PRIMARY IND LAND USE & FISHERIES MEIERS RD INDOOROOPILLY QLD 4068 AUSTRALIA].

This paper reviews most aspects of soil analysis, with particular emphasis on soil chemical testing in Australia. Water quality, sample contamination, and the effects of soil drying, soil storage, and particle size are recognised as important components in the laboratory preparation of soil samples for analysis. The subsequent effects of choice of soil to solution ratio, leaching v. equilibration, soil shaking equipment, and the choice of extracting and digesting solutions are reviewed with examples. The review includes an overview of key chemical soil tests including pH, electrical conductivity, chloride, phosphate, sulfur, exchangeable cations, and cation exchange capacity. There is an examination of field v. laboratory tests and comment on analytical quality assurance. The recent release of the Australian Laboratory Handbook of Soil and Water Chemical Methods and the emerging activities of the Australian Soil and Plant Analysis Council should ensure the direction of soil testing in Australia remains positive. [References: 135].

3208 Sawyer, JE.; Ebelhar, SA. (1995) SULFUR NUTRITION OF WINTER WHEAT VARIETIES WITH TILL AND NO-TILL PLANTING ON HIGHLY WEATHERED ALFISOL SOILS. *Communications in Soil Science & Plant Analysis*. 26(7-8):1257-1271. English. [GROWMARK INC 1701 TOWANDA AVE POB 2500 BLOOMINGTON, IL 61702 USA].

Winter wheat (*Triticum aestivum* L.) occupies large hectareage and is important in crop rotations on the highly weathered, low organic matter silt loam soils common in southern Illinois and the southern midwest United States region. Sulfur (S) is an essential element with some potential for deficiency, but it is not commonly applied to winter wheat grown on these soils. This study was conducted to determine if S nutrition is limiting winter wheat growth and grain yield. Interactive effects of topdressed fertilizer S (0 and 28 kg S/ha), tillage (disk-till, DT and no-till, NT), and wheat variety on plant growth, nutrient concentration, and grain yield were investigated for three crop years on two soils in southern Illinois; Cisne silt loam (fine, montmorillonitic, mesic Mollic Albaqualf), Brownstown site, and Grantsburg silt loam (fine-silty, mixed, mesic Typic Fragiudalf), Dixon Springs site. Grain yield was unaffected by S application although flag leaf and whole plant S concentrations increased. Lack of yield response to S application was consistent each year on both soils and across all varieties and tillage systems. Equivalent yields were produced with both tillage systems at Brownstown, but slightly lower yield occurred with no-till at Dixon Springs. Plant S concentrations and soil sulfate levels indicated sufficient S was available from sources other than fertilizer S, including extractable soil S and atmospheric deposition. Wheat variety consistently influenced plant nutrient composition and grain yield more than tillage or application of S fertilizer. If, in the future, wheat grain production, atmospheric S deposition, and extractable soil S remain at levels measured

in this study, then S fertilizer applications would not be expected to increase winter wheat grain yield. [References: 29].

3209 Schroeder, SA. (1995) TOPOGRAPHIC INFLUENCES ON SOIL WATER AND SPRING WHEAT YIELDS ON RECLAIMED MINELAND. *Journal of Environmental Quality*. 24(3):467-471. English. [N DAKOTA STATE UNIV LAND RECLAMAT RES CTR BOX 459 MANDAN, ND 58554 USA].

Topographic positions on undisturbed soils affect available soil water and crop yields. Reclaimed minelands are required by regulation to have productivity levels "equal to or greater than" premine levels. Since a normal reclamation technique is to place uniform depths of topsoil and subsoil across the topography, this technique often changes the topsoil and subsoil depths from the premine condition. The objective of this research was to determine if these changes in topsoil and subsoil depths have resulted in effects on soil water and crop yields unlike those documented for undisturbed soils. This study was initiated on reclaimed mineland in 1986 at two North Dakota coal mines where topographic positions (summit, shoulder, backslope, and footslope) were monitored for 6 yr for available water at planting, spring wheat (*Triticum aestivum* L.) yields, and soil water recharge from harvesting to planting the following year. Results showed that downslope topographic positions had nearly 300% more available soil water at planting (0- to 1.2-m depth due to greater recharge) and generally significantly greater ($P = 0.10$) spring wheat yields than upslope positions. Relationships between total water use and wheat yields were similar to those found for undisturbed soils. These results seem to suggest that the uniform depths of replaced topsoil and subsoil have not affected soil water and wheat yields differently on reclaimed minelands than on undisturbed landscapes in a semi-arid climate. [References: 7].

3210 Tanaka, DL. (1995) SPRING WHEAT STRAW PRODUCTION AND COMPOSITION AS INFLUENCED BY TOPSOIL REMOVAL. *Soil Science Society of America Journal*. 59(3):649-654. English. [USDA ARS NO GREAT PLAINS RES LAB POB 459 MANDAN, ND 58554 USA].

Wind and water erosion have resulted in reduced crop productivity and created soil management problems. Management of crop residues can be effective for soil erosion control, but influences of soil erosion on crop residue production is unknown. The purpose of this study was to determine total residue production and residue N and P concentration and content for 8 yr as influenced by topsoil removal and additions of N and P fertilizer for a spring wheat (*Triticum aestivum* L.)-fallow system. Total straw production for the first increment of P increased approximate to 14% for 0.00- and 0.06-m soil removal treatments compared with approximate to 33% for 0.12- and 0.18-m soil removal treatments. Total straw production was increased more than total grain production with the addition of N and P fertilizer. Total straw production for 0.12- and 0.18-m soil removal treatments needed at least 20 kg P ha⁻¹ and 35 kg N ha⁻¹ to equal or exceed that for 0.00-m soil removal treatment with no fertilizer additions. Total straw N content decreased 33% as soil removal increased from 0.00 to 0.18 m. While total straw P content was considerably less than total straw N content, both decreased about 32% for 0.18 m compared with 0.00-m soil removal treatments. Greater total straw N and P content for the 0.00-m soil removal treatment was due to greater total straw production as well as greater N and P concentrations. Consequently, cycling of N and P may be reduced for eroded soils due to low quantities of residue as well as low N and P concentrations in the residues. [References: 18].

3211 Unger, PW. (1995) RESIDUE MANAGEMENT FOR CONTINUOUS WINTER WHEAT PRODUCTION WITH LIMITED IRRIGATION. *Journal of Soil & Water Conservation*. 50(3):317-320. English. [USDA ARS CONSERVAT & PROD RES LAB PO DRAWER 10 BUSHLAND, TX 79012 USA].

Crop residue management was chosen as a key practice to help control erosion on nearly 75% of the highly erodible land covered by conservation plans. This study determined the effects of treatments that involved retaining all residues on the surface (NT+Res), removing some residues at harvest (NT-ResH) or at planting (NT-ResP), and conventional tillage (ConvT) on soil water storage and use, and yields of continuous winter wheat (*Triticum aestivum* L.) produced with limited irrigation. Water storage between crops was greater with NT+Res (95 mm) and NT-ResH (100 mm) than with ConvT (79 mm), but soil water depletion was not affected by treatments. Grain yield was greater with NT+Res (4.56 Mg ha⁻¹), than with ConvT (4.26 Mg ha⁻¹) and NT-ResH (4.18 Mg ha⁻¹), but straw yield

was not affected by treatments. Grain and straw yield differed among crops. Continuous wheat production with limited irrigation resulted in an estimated 2.2 Mg ha⁻¹ of residues on the surface at planting with the NT-ResH and NT-ResP treatments. The initial amount was 9.0 Mg ha⁻¹ with the NT+Res treatment, and much of this remained on the surface at planting of the next crop. In all cases, the residue amounts provided considerably more (a minimum of about 70%) than the 30% surface cover usually required to control erosion on highly erodible land. Hence, use of limited irrigation and no-tillage can help producers meet the surface residue requirements established for their conservation plans for highly erodible lands in the southern Great Plains. [References: 16].

P31 SOIL SURVEYS AND MAPPING

3212 Peverill, K.I. (1993) SOIL TESTING AND PLANT ANALYSIS IN AUSTRALIA. *Australian Journal of Experimental Agriculture*. 33(8):963-971. English. [DEPT AGR STATE CHEM LAB 5 MACARTHUR ST MELBOURNE VIC 3002 AUSTRALIA].

During the past 3-4 decades, there has been a modest growth in the demand for soil and plant testing services in Australia. Such development reflects an increasing awareness by farmers that there are tangible benefits from the regular use of soil and plant analysis. Concomitant with these changes, there has been an increasing breadth and sophistication in the range of available services, instrumental advances that permit more rapid analytical throughput, evolution of computer management systems (including computer-generated reports), and a general decrease in reporting time to primary producers. These developments have not always been matched with adequate quality control and uniformity in sampling, analysis, interpretation, and fertiliser advice procedures. There is need for further research and method development leading to the introduction of universal reagents or ion exchange resin extractions, or new test procedures into laboratory routines, to enhance laboratory capacities and turnaround times or to improve interpretation skills. Advances in decision support software are also required in order to refine fertiliser advice to primary producers. The challenge for the future is the standardisation of procedures and maintenance of adequate quality control by the various agencies offering soil and plant testing services. The Australian Soil and Plant Analysis Council (ASPAC) will play a pivotal role in this process. [References: 62].

P33 SOIL CHEMISTRY AND PHYSICS

3213 Dolling, P.J.; Porter, W.M.; Rowland, I.C. (1994) ACIDIFICATION RATES IN THE CENTRAL WHEATBELT OF WESTERN AUSTRALIA. 2. ON A DEEP YELLOW SAND. *Australian Journal of Experimental Agriculture*. 34(8):1165-1172. English. [WESTERN AUSTRALIA DEPT AGR KATANNING WA 6317 AUSTRALIA].

The rate and mechanisms of acidification were determined on a sandy duplex soil (depth of sand 30-45 cm) under a cereal-annual pasture rotation in Western Australia. We also evaluated the effect of rotation (intensity of cropping) on relative acidification of a sandy duplex soil. Rate of acidification was based on a linear regression analysis between soil pH and years since clearing. Sites were sampled to a depth of 50 cm in 10-cm increments and measurements included soil pH, pH buffering capacity, and bulk density. The effect of different rotations on the acidification rate was determined by soil sampling a rotation experiment which had been established for 25 years. Sampling and measurements were similar to the regression analysis. From regression, the rate of acidification for the profile was 0.15 kmol H⁺/ha.year, requiring 7.7 kg CaCO₃ to neutralise. Most of the acidification could be accounted for by removal of alkaline products. Acidification was occurring to a depth of 30 cm, the acidification rate decreasing with depth. In the surface 20 cm the pH decline was 0.005-0.006 units/year. In the rotation experiment, the rate of acidification relative to continuous wheat without fertiliser nitrogen (N) ranged from 0.35 kmol H⁺/ha.year (17.5 kg CaCO₃) for continuous wheat with fertiliser N to 0.92 kmol H⁺/ha.year (45.8 kg CaCO₃) for continuous pasture. Between these rates was 1 year pasture-1 year cereal (0.41 kmol H⁺/ha.year, 20.5 kg CaCO₃) and 2 years pasture-1 year cereal (0.82 kmol H⁺/ha.year, 41.2 kg CaCO₃). Acidification was occurring to 60 cm depth in all rotations, mostly due to nitrate leaching, removal of alkaline products, and build-up of organic matter. [References: 22].

3214 Meng Qingwei; Li Dequan; Zhao Shijie (Shandong Agricultural Univ., Taian (China)) (1994) Effect of slow soil dehydration on osmotic adjustment, photosynthesis and membrane lipid peroxidation in winter wheat. *Journal of Shandong Agricultural University (China)* v. 25(1) p. 9-14. 7 ill., 14 ref. Chinese. (AGRI 95-058794).

3215 Mueller, T.; Joergensen, R.G. (1994) Time-course of the soil microbial biomass under wheat: some aspects of a one-year field study. Danish Soil Organic Matter Research; Foulum (Denmark); 17 Nov 1993. Statens Planteavltsforsoeg, Lyngby (Denmark). SP-Rapport (Denmark) (no.20) p. 37-40. 2 ill., 10 ref. English. (AGRI 95-058865).

P34 SOIL BIOLOGY

3216 Altimirska, R. (Institut po Pochvoznanie i Agroekologiya "N. Pushkarov", Sofia (Bulgaria)) (1994) [Inoculation of wheat with Azospirillum species bacteria under field conditions. II. Effect on the biological activity of soil in rhizosphere field]. *Inokulatsiya na pshenitsa s bakterii ot rod Azospirillum pri polski usloviya. II. Vliyanie v"rkhu biologichnata aktivnost na pochvata ot rizosferata. Selskostopanska Akademiya, Sofia (Bulgaria). Pochvoznanie, Agrokhimiya i Ekologiya (Bulgaria); Soil Science Agrochemistry and Ecology* v. 29(3) p. 31-34. 4 tables; 8 ref. Bulgarian. (AGRI 95-071953).

P35 SOIL FERTILITY

3217 Hylander, L. (1995) EFFECTS OF LIME, PHOSPHORUS, MANGANESE, COPPER AND ZINC ON YIELD OF BARLEY, GROWN IN A POT EXPERIMENT WITH THREE ACID, SWEDISH MINERAL SOILS. *Swedish Journal of Agricultural Research*. 25(1):13-24. English. [SWEDISH UNIV AGR SCI DEPT SOIL SCI POB 7014 S-75007 UPPSALA SWEDEN].

Acidification of arable soils usually decreases yields but liming of acid soils does not always increase the yields, possibly due to interactions of lime with other elements. The effects of lime, P and micro-nutrient amendments on barley (*Hordeum vulgare* c.v. Etu) yield were studied in a pot experiment with three acid, Swedish soils of different texture. Combinations of five rates of CaCO₃, P, Mn, Cu and Zn were applied in 27 treatments according to a central composite design. Yields of straw and grain were measured. Soil texture affected yield and interacted with the treatments. In a sandy loam with low nutrient status, P and Cu*Zn increased the straw yield. In a silty clay, P, P*Cu and Mn*Cu increased the grain yield. In a clay soil, P*Mn and Mn*Zn increased the grain yield. Factorial analysis revealed that application of lime had a negative effect on the yields in the least acid soil (the sandy loam, pH 6.2) and a weak positive effect in the most acid one (the clay, pH 5.2) soil. [References: 41].

3218 Li Junliang (Laiyang Agricultural Coll., Shandong (China). Dept. of Agronomy); Zhang Dechang; Sun Yuncai (1994) The studies of relationship between the amount of phosphorus and C/P in organic manure and the phosphorus absorbed by crop. *Journal of Laiyang Agricultural College (China)* v. 11(3) p. 165-169. 1 ill., 3 tables, 4 ref. Chinese. (AGRI 95-059051).

3219 Mortensen, J.; Eriksen, J. (Research Centre Foulum, Foulum (Denmark). Danish Institute of Plant and Soil Science) (1994) Effect of sulphur deficiency on amino acid composition. *Norwegian Journal of Agricultural Sciences (Norway)*; no. 15(suppl.) p. 135-142. Statens Fagteneste for Landbruget. 5 tables, 2 figures; 11 ref. p. 135-142. English. (AGRI 95-072051).

P40 METEOROLOGY AND CLIMATOLOGY

3220 Brignall, A.P.; Rounsevell, M.D.A. (1995) LAND EVALUATION MODELLING TO ASSESS THE EFFECTS OF CLIMATE CHANGE ON WINTER WHEAT POTENTIAL IN ENGLAND AND WALES. *Journal of Agricultural Science*. 124(Part 2):159-172. English. [UNIV OXFORD ENVIRONM CHANGE UNIT 1A MANSFIELD RD OXFORD OX1 3TB ENGLAND].

The effects of climate change on crop suitability in England and Wales were estimated by systematically adjusting agroclimatic data inputs to a land evaluation model. Mean temperature rises of 1 and 2 degrees C increased drought risk and reduced the length of time when soil was at held

capacity over-winter by raising potential evapotranspiration. In eastern England, this change had a detrimental effect on the potential for cultivating winter wheat because of drought stress. In northern and western England and Wales, drier conditions promoted greater opportunities for soil tillage, especially when temperature rises were associated with decreased precipitation. The effect of increased temperature was offset by increased precipitation. The magnitude of the drought stress and length of field capacity periods are similar to current mean conditions when a +1 degrees C temperature change is coupled with a 10% increase in precipitation. This demonstrates that winter wheat suitability in England and Wales is affected more by changes in precipitation than by changes in temperature. The local limitations of soils and relief notwithstanding, it appears that the northern and western areas of England and Wales are most likely to gain from a warmer, drier climate. [References: 41].

Q01 FOOD SCIENCE AND TECHNOLOGY

3221 REPORT ON THE 45TH MEETING ON WHEAT CHEMISTRY - THE WHEAT RESEARCH GROUP IN COLLABORATION WITH THE FEDERAL INSTITUTE FOR WHEAT, POTATO AND FAT RESEARCH IN DETMOLD, JUNE 15-16, 1994 - ABSTRACTS (1995) *Deutsche Lebensmittel-Rundschau*. 91(3):84-86. German.

3222 Biliaderis, CG.; Izydorczyk, MS.; Rattan, O. (1995) EFFECT OF ARABINOXYLANS ON BREAD-MAKING QUALITY OF WHEAT FLOURS. *Food Chemistry*. 53(2):165-171. English. [ARISTOTELIAN UNIV THESSALONIKI SCH AGR DEPT FOOD SCI & TECHNOL GR-54006 THESSALONIKI GREECE].

Two highly purified arabinoxylan preparations of different molecular weight (HMW, [eta] = 5.48 dl/g and LMW, [eta] = 3.69 dl/g) were used to study the effect of these water-soluble polysaccharides on the bread-making quality of two wheat flours: a Canada western red spring (CWRS) composite sample and a Canada prairie spring (CPS), cv. HY 368. Both preparations significantly increased the farinograph water absorption and the dough development time for the two flours; the HMW arabinoxylans exerted significantly ($P < 0.01$) greater effects than the LMW preparation. The HMW arabinoxylans maximally improved the loaf volume of CWRS and CPS breads at a level of 0.5% (w/w) supplementation. The LMW arabinoxylans maximally increased the loaf volume of CWRS and CPS breads at 0.7 and 1.1% (w/w), respectively. Breads containing HMW arabinoxylans retained significantly ($P < 0.01$) more water than the breads with LMW polymers at 0.5-0.9% (w/w) supplementation levels. Because of their higher moisture content the arabinoxylan-fortified breads exhibited a greater rate of starch retrogradation as assessed by calorimetry. Nevertheless, these breads had softer breadcrumbs than the controls; breads fortified (0.3-0.9% w/w) with HMW arabinoxylans were significantly ($P < 0.01$) less firm than those with LMW polymers over the 7-day storage period. [References: 33].

3223 Eliasson, AC.; Gudmundsson, M.; Svensson, G. (1995) THERMAL BEHAVIOUR OF WHEAT STARCH IN FLOUR - RELATION TO FLOUR QUALITY. *Food Science & Technology-Lebensmittel-Wissenschaft & Technologie*. 28(2):227-235. English. [TECHNOL INST ICELAND DEPT FOOD TECHNOL IS-112 REYKJAVIK ICELAND].

A large number of wheat varieties (n=69) were investigated for their gelatinization properties as measured by differential scanning calorimetry (DSC). The wheats were divided into the following subgroups: spring wheats with a protein content above 13 g/100g, spring wheats with a protein content below 12 g/100g, winter wheats for feed or biscuit making, winter wheats of bread baking quality, and durum wheats. Correlations between DSC-parameters and other quality parameters (Zeleny value, falling number kernel hardness and baking quality) were calculated for these subgroups. The wheat varieties had typical DSC values depending on the end-use of the wheat. Durum wheats gave high gelatinization temperature (t(m)) values and low gelatinization enthalpy (Delta H-gp) values, wheats for feed or biscuit gave low t(m) values and high Delta H-gp values whereas wheats for baking were in between. There was a relation between the t(m) or Delta H-gp and baking quality, such as that increased t(m) values and decreased Delta H-gp values would improve the baking quality. A strong relation between t(m) and Delta H-gp and kernel hardness was found, although for one single variety there was no such relation. However, the range in the values of the DSC-parameters was rather narrow and the relations between DSC-parameters and end-use quality found could

be expected to explain differences between varieties only in special cases. [References: 29].

3224 Greenblatt, GA.; Bettge, AD.; Morris, CF. (1995) RELATIONSHIP BETWEEN ENDOSPERM TEXTURE AND THE OCCURRENCE OF FRIABILIN AND BOUND POLAR LIPIDS ON WHEAT STARCH. *Cereal Chemistry*. 72(2):172-176. English. [WASHINGTON STATE UNIV USDA ARS WESTERN WHEAT QUAL LAB PULLMAN, WA 99164 USA].

Endosperm texture affects the milling and end-use properties of wheat grain. A better understanding of the physical-chemical mechanism and the genetic control of endosperm texture in wheat would aid in breeding, marketing, and utilization of grain. Here, we report on the relationship between endosperm texture and the occurrence of friabilin, a family of 15-kDa proteins, and bound glyco- and phospho-lipids on water-washed wheat starch. These two classes of bound polar lipids follow the same pattern of occurrence as friabilin: approximately equal levels in soft and hard wheat flour, much reduced levels in water-washed soft wheat starch compared to flour, and much reduced levels in hard wheat starch compared to soft. The type and quantity of these bound polar lipids is highly conserved among both soft and hard wheat starches. Further, these lipids are implicated in the interaction of friabilin with soft wheat starch. Propan-2-ol and water (90:10), which is effective in removing bound polar lipids from starch, renders most friabilin components extractable with an aqueous salt solution. These results suggest that most friabilin components interact with starch through lipid-mediated hydrophobic interactions and ionic interactions. In addition, the results provide both an additional biochemical marker for grain softness and new insight into the possible physical-chemical mechanism and the genetic control of endosperm texture in wheat. [References: 14].

3225 Gupta, RB.; Popineau, Y.; Lefebvre, J.; Cornec, M.; Lawrence, GJ.; Macritchie, F. (1995) BIOCHEMICAL BASIS OF FLOUR PROPERTIES IN BREAD WHEATS. 2. CHANGES IN POLYMERIC PROTEIN FORMATION AND DOUGH/GLUTEN PROPERTIES ASSOCIATED WITH THE LOSS OF LOW M(R) OR HIGH M(R) GLUTENIN SUBUNITS. *Journal of Cereal Science*. 21(2):103-116. English. [CSIRO DIV PLANT IND GPO BOX 1600 CANBERRA ACT 2601 AUSTRALIA].

Polymeric protein plays a critical role in governing the functional properties of wheat flour. Wheat genetic lines lacking high M(r) and, similarly, low M(r) glutenin subunits from one, two or all three Glu-1 or Glu-3 loci, respectively, were thus used to investigate the effects of these polypeptides on glutenin polymer formation and dough/gluten properties. Polymer formation (quantity, size distribution) was studied by size-exclusion highperformance liquid chromatography (SE-HPLC) using extractable, unextractable and total protein from flour, as well as by diagonal electrophoresis using total protein extracts. The loss of Glu-1 or Glu-3 subunits had significant effects on the quantity of total, extractable and unextractable polymeric protein and on the dough and gluten properties of these lines. Dough and gluten properties were significantly correlated with the proportions of both total and unextractable polymers (a measure of the relative molecular size distribution of polymeric protein), although more strongly with the proportions of unextractable polymers in the case of Glu-1 null lines. The proportion of total polymeric protein decreased more markedly when all the Glu-3 subunits were deleted than when all the Glu-1 subunits were absent, which was in accordance with the relative quantities of these two types of the subunits in the grains. In contrast, loss of all the Glu-1 subunits, on an equal weight basis, reduced the amounts of the larger polymers to a much greater extent than the loss of all the Glu-3 subunits, reflecting more than the molecular size differences in these subunits. SE-HPLC and diagonal electrophoresis of total protein extracts from the triple Glu-1 and Glu-3 null lines also revealed that Glu-1 or Glu-3 subunits form large polymers on their own. When both high and low M(r) glutenin subunits were present together, however, the amount of large polymer was much greater than the sum of the amounts when only one group was present, suggesting a positive interaction between these two groups of subunits with respect to polymer formation. [References: 28].

3226 Hargreaves, J.; Popineau, Y.; Marion, D.; Lefebvre, J.; Lemeste, M. (1995) GLUTEN VISCOELASTICITY IS NOT LIPID-MEDIATED - A RHEOLOGICAL AND MOLECULAR FLEXIBILITY STUDY ON LIPID AND NON-PROLAMIN PROTEIN DEPLETED GLUTENS. *Journal of Agricultural & Food Chemistry*. 43(5):1170-1176. English. [INRA BIOCHIM & TECHNOL PROT LAB BP 1627 F-44316 NANTES 03 FRANCE].

Wheat flours differing in their lipid and non-prolamins protein (NPP) contents were obtained by chloroform or Lubrol PX extraction. Starch was hand-washed out of the flour, and the resulting glutens were studied by dynamic rheology and electron spin resonance spectroscopy (ESR) spin probing and spin labeling. Compared to control gluten, the storage modulus of NPP-including lipoprotein-depleted gluten is unchanged, and the loss modulus is not significantly different. The mobility of spin probes differing in size in the gluten aqueous phase suggests the existence of at least two compartments: a network with a mesh size of about 0.8 nm and larger water pockets. These compartments are present in all glutens. The spectra resulting from ESR spin labeling experiments are composite, reflecting the contribution of at least two types of polypeptides differing in flexibility. The population of mobile spin labels linked to the lysine residues is much larger in control gluten compared to NPP depleted gluten, indicating the lysine residues of these proteins are in a less flexible environment. On the contrary, only a slight difference is observed between the various samples when cysteine residues are labeled. These results suggest that NPP and lipids behave only as fillers in the prolamin network. [References: 27].

3227 Henriksson, K.; Telemann, A.; Suortti, T.; Reinikainen, T.; Jaskari, J.; Telemann, O.; Poutanen, K. (1995) HYDROLYSIS OF BARLEY (1-3), (1-4)-BETA-D-GLUCAN BY A CELLOBIOHYDROLASE II PREPARATION FROM *TRICHODERMA REESEI*. *Carbohydrate Polymers*. 26(2):109-119. English. [VTT BIOTECHNOL & FOOD RES POB 1503 SF-02044 ESPOO FINLAND].

The molecular weight of commercial barley beta-glucan was 250,000 as determined by dual angle laser light scattering. H-1 NMR analysis showed the polymer to contain 29% (1 → 3)-linkages and 71% (1 → 4)-linkages. The barley beta-glucan was readily hydrolysed by a highly purified cellobiohydrolase II (CBHII) preparation from *Trichoderma reesei*. NMR data demonstrated that the cellulase preparation degraded only (1 → 4)-linkages in the P-glucan chain. Neither internal G(1 → 3)G(1 → 4) nor reducing end G(1 → 3)C(1 → 4)G(1 → 4)G sequences were hydrolysed. The main hydrolysis products were: cellobiose, beta-D-Glcp-(1 → 3)-beta-D-Glcp-(1 → 4)-D-Glcp, beta-D-Glcp-(1 → 3)-beta-D-Glcp-(1 → 4)-beta-D-Glcp-(1 → 4)-D-Glcp and beta-D-Glcp-(1 → 4)-beta-D-Glcp-(1 → 3)-beta-D-Glcp-(1 → 4)-beta-D-Glcp. Statistical models of the glucan linkage sequence were fitted to the relative fragment concentrations after CBHII and lichenase degradations. The hydrolysate compositions are well reproduced by a second order Markov chain. All degradation data are consistent with the assumed degradation mechanisms of the two enzymes, including the hypothesis that hydrolysis by CBHII depends on the glycosidic bond orientation. [References: 39].

3228 Henry, R.J. (1995) BIOTECHNOLOGY APPLICATIONS IN THE CEREAL INDUSTRY - PROCEDURES AND PROSPECTS. *Cereal Foods World*. 40(5):370-373. English. [UNIV QUEENSLAND QUEENSLAND AGR BIOTECHNOL CTR ST LUCIA QLD 4067 AUSTRALIA].

3229 Ingledew, W.M.; Jones, A.M.; Bhatti, R.S.; Rosnagel, B.G. (1995) FUEL ALCOHOL PRODUCTION FROM HULL-LESS BARLEY. *Cereal Chemistry*. 72(2):147-150. English. [UNIV SASKATCHEWAN DEPT APPL MICROBIOL & FOOD SCI SASKATOON SK S7N 0W0 CANADA].

Hull-less barleys were easily milled, mashed, and fermented to ethanol. Problems experienced with viscosity were quickly eliminated by addition of beta-glucanase, but even without enzyme, viscosity decreased over the duration of fermentation. Barley mash prepared by adding 0.33 kg grain to 1 L of water fermented slightly faster than did corresponding wheat mashes, and over 10% v/v alcohol was obtained (94% of theoretical). Distillers' hull-less barley grains collected at end-fermentations and were higher in protein than dried grains obtained from hulled barley. They were correspondingly lower in nondigestible fiber. [References: 19].

3230 Inoue, Y.; Sapirstein, H.D.; Bushuk, W. (1995) STUDIES ON FROZEN DOUGHS. 4. EFFECT OF SHORTENING SYSTEMS ON BAKING AND RHEOLOGICAL PROPERTIES. *Cereal Chemistry*. 72(2):221-226. English. [JAPAN SCH BAKING TOKYO JAPAN].

Effects of three types of shortening systems on baking and rheological properties of frozen doughs were studied. The first type included hydrogenated canola oil (control) and canola oil. Type 2 included control, control + 5% (oil basis) lysolecithin, control + 5% calcium stearoyl lactylate (CSL), and control + 5% diacetyl tartaric acid esters of monoglyceride (DATEM). Type 3 included control, water (40 and 60%) in control emulsion,

and control (40 and 60%) in water emulsion. The amount of shortening in the dough formula was 10% (flour basis). Molded doughs were prepared by a short-rime dough procedure and frozen at -20 degrees C. After up to 10 weeks of frozen storage, the doughs were thawed, and replicate doughs were tested on the extensigraph and baked. Of the shortening systems tested, CSL, DATEM, and the two oil in water (O/W) emulsions produced a significant improvement in baking properties. The CSL and DATEM formulae resulted in significantly higher loaf volumes for the nonfrozen and one-day frozen dough treatments. There was no significant difference between these surfactants and the 40% O/W emulsion system after four weeks of frozen dough storage. Comparing all shortening systems after 10 weeks of frozen storage, the O/W emulsion systems were associated with the lowest final proof times and highest loaf volumes; gassing power was similar to that of the CSL and DATEM treatments. Most notable was the observation that for the O/W emulsion treatments, the loaf volumes hardly decreased during the extended frozen storage period. Results of this study showed that the loss in breadmaking potential of frozen doughs during storage can be mitigated by including in the formula a shortening system specially formulated for frozen doughs. [References: 35].

3231 Iori, R.; Cavaliere, B.; Palmieri, S. (1995) CATHODIC PEROXIDASES OF DURUM WHEAT FLOUR. *Cereal Chemistry*. 72(2):176-181. English. [MRAAF IST SPERIMENTALE CULTURE IND VIA CORTICELLA 133 I-40129 BOLOGNA ITALY].

Two cathodic peroxidases (C-1, C-2) were purified from durum wheat (*Triticum durum*) flour by ion-exchange chromatography. Both peroxidases appear to be homogeneous when analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis and isoelectric focusing. The isolated isoenzymes, both with a purity index (A(402nm)/A(280nm)) of 3.7, are polypeptides of 39.7 kDa (C-1) and 38.6 kDa (C-2), with pI > 9.3. The calcium ion strongly activates the C-1 and C-2 isoenzymes, which increases their specific activity 92 and 690 times, respectively, when stored at pH 6.5. This effect is presumably due to the stabilization of the heme moiety structure, which was observed with the increase of the Soret band absorption. We consider this enzyme activity of great importance both in the production technology of high quality pasta and more generally in other bakery products. [References: 24].

3232 Kaneko, S.; Nagamine, T.; Yamada, T. (1995) ESTERIFICATION OF ENDOSPERM LUTEIN WITH FATTY ACIDS DURING THE STORAGE OF WHEAT SEEDS. *Bioscience Biotechnology & Biochemistry*. 59(1):1-4. English. [NATL AGR RES CTR TSUKUBA IBARAKI 305 JAPAN].

The structural changes in lutein, one of the major carotenoid pigments of wheat endosperm, during the storage of seeds were investigated. Wheat seeds were stored for up to 120 days at 30 degrees C under a relative humidity of 75, 56, 32, or 8%. The wheat seeds were then milled, and carotenoid pigments were extracted from the flour with water-saturated butanol. The HPLC analysis revealed that the hydroxyl groups of lutein had been gradually esterified with fatty acids during storage. Esterification proceeded faster as the relative humidity was reduced. It seems that the rate of esterification was increased when the water generated by esterification evaporated from the seeds at low relative humidity. The amounts of free fatty acids, substrates for the esterification of lutein, in the flour increased during storage, the increase in free fatty acids proceeding faster as the relative humidity was increased. When the seeds were heated in an autoclave at 120 degrees C for 20 min before storage, neither the esterification of lutein nor an increase in free fatty acids occurred. These results indicate that both reactions proceeded enzymatically. We speculate that the esterification of lutein occurred due to catalysis by lipase (triacylglycerol acylhydrolase), which produced free fatty acids from glycerides, or by other acylhydrolases which have similar kinetic properties to those of lipase. [References: 18].

3233 Laude, M.; Meuser, F. (1995) INVESTIGATION OF THE INFLUENCE OF PRIMARY WHEAT STARCH CHARACTERISTICS ON THE OXIDIZABILITY WITH SODIUM HYPOCHLORITE. *Starch-Stärke*. 47(5):174-181. German. [TECH UNIV BERLIN INST LEBENSMITTELTECHNOL 2 FACHGEBIET GETREIDE-TECHNOL SEESTR 11 D-13353 BERLIN GERMANY].

The oxidation of primary wheat starches with sodium hypochlorite in a three stage reaction leads to differing degrees of oxidation depending on the analytical composition, particle size distribution and degree of purification of the starches. Furthermore, it was found that differences in the viscous

properties of the starches present before oxidation remained afterwards. The dependence of the degree of oxidation, attained under the reaction conditions, on the protein and fat concentrations, as well as on the median of the particle size distribution, could be described using regression equations. The protein content had a negative and the particle size a positive effect on the degree of oxidation. All three influencing factors interacted with one another. The degrees of oxidation attained were in good agreement with the described equation. [References: 21].

3234 Liu, CY. (1995) IDENTIFICATION OF A NEW LOW M(R) GLUTENIN SUBUNIT LOCUS ON CHROMOSOME 1B OF DURUM WHEAT. *Journal of Cereal Science*. 21(2):209-213. English. [UNIV ADELAIDE WAITE AGR RES INST DEPT PLANT SCI GLEN OSMOND SA 5064 AUSTRALIA].

3235 Madhusudhan, B.; Tharanathan, RN. (1995) LEGUME AND CEREAL STARCHES - WHY DIFFERENCES IN DIGESTIBILITY .1. ISOLATION AND COMPOSITION OF LEGUME (GREENGRAM AND BENGALGRAM) STARCHES. *Starch-Stärke*. 47(5):165-171. English. [CENT FOOD TECHNOL RES INST DEPT BIOCHEM & NUTR MYSORE 570013 KARNATAKA INDIA].

A range of starch granule populations varying in size and shape characteristics was isolated from greengram (GG) and Bengalgram (BG) flours. All the starches were non-ionic and exhibited single state swelling with high solubility in water, but extensive solubility in DMSO. The starch content of the different populations varied from 40-80%, whereas the protein and lipid contents of the isolates I to III were lower than those of the isolate IV. Their amylose content ranged between 32-46%. Brabender viscometers indicated low values for peak and setback viscosities in the case of BG starch compared to GG starch. Fatty acid analysis of the lipid fractions indicated predominance of palmitic acid. GG starch exhibited a slightly higher in vitro digestibility than BG starch. [References: 31].

3236 Mariani, BM.; Degidio, MG.; Novaro, P. (1995) DURUM WHEAT QUALITY EVALUATION - INFLUENCE OF GENOTYPE AND ENVIRONMENT. *Cereal Chemistry*. 72(2):194-197. English. [IST SPERIMENTALE CEREALICOLTURA VIA CASSIA 176 I-00191 ROME ITALY].

Protein content and gluten quality (alveograph W) were determined for 21 durum wheat cultivars grown in several locations in Italy from 1990 to 1993. Cultivars and sites were not the same in all years, but three cultivars that are considered as standards were used to link all analyzed data. Each site-year combination constituted an environment. The effect of genotype, environment, and their interaction on protein content and alveograph W, which are the most important variables in predicting pasta cooking quality, were studied. Protein content was essentially determined by additive effects of environment, whereas alveograph W appeared more influenced by additive effects of genotype. Genotype-environment (GE) interaction for both the variables was significant but small in magnitude when compared with the additive effects of genotype and environment. The majority of cultivars appeared stable; coefficient of regression was equal to one, and deviation from regression mean square was negligible. The large additive effects of environment and genotype and the small GE interaction provide efficiency in the selection of new lines grown in only one environment and allow the average quality of a cultivar to be established by compositing samples over many locations. [References: 12].

3237 Mckendry, AL.; Henke, GE.; Finney, PL. (1995) EFFECTS OF SEPTORIA LEAF BLOTCH ON SOFT PIED WINTER WHEAT MILLING AND BAKING QUALITY. *Cereal Chemistry*. 72(2):142-146. English. [UNIV MISSOURI DEPT AGRON COLUMBIA, MO 65211 USA].

Septoria leaf blotch causes economic yield losses in wheat worldwide. Research on the impact of septoria leaf blotch on grain quality, however, has been limited to its effect on test weight. The objectives of this study were to determine the effect of septoria leaf blotch severity on soft red winter wheat quality in cultivars with varying levels of resistance and to assess the impact of disease pressure on selection for improved quality in breeding programs. Twelve cultivars expressing a range of genetic resistance were grown in a split-plot design with four replicates in two Missouri environments. Cultivars were considered main plots. Five experimental subplot treatments, including a noninoculated unprotected control and plots with fungicide protection as well, as plots inoculated at tillering, jointing, and flag leaf, were used to establish a range of septoria

leaf blotch severity. Increased disease pressure resulted in linear reductions in test weight ($r=0.97^{**}$), milling quality ($r=0.98^{**}$), adjusted flour yield ($r=0.97^{**}$), and a linear increase in water absorption in the flour ($r=0.95^{**}$). Increased disease severity also resulted in an increase in flour protein and a decrease in baking quality, however, the linear correlation coefficients were nonsignificant. The role of resistance genes for maintaining quality was important for milling quality but was negligible for baking quality. Cultivar by treatment interactions were due primarily to changes in magnitude and not in cultivar rank, which suggested that selection for milling and baking quality would be effective even when septoria leaf blotch disease pressure is high. [References: 26].

3238 Morgan, JE.; Williams, PC. (1995) STARCH DAMAGE IN WHEAT FLOURS - A COMPARISON OF ENZYMATIC, IODOMETRIC, AND NEAR-INFRARED REFLECTANCE TECHNIQUES. *Cereal Chemistry*. 72(2):209-212. English.

Thirty-two flour samples were used to evaluate three methods for determining starch damage: an iodometric method presented by the Tripette/ Renaud (Chopin) Company using their SD4 instrument; an enzymatic method marketed by the MegaZyme Company; and a rapid colorimetric method. These methods were compared to the approved AACC method 76-30A and the Farrand method as to their ease of use, precision, and accuracy. For all except the Chopin method, comparative coefficients of determinations ($r(2)$) greater than 0.90 were obtained. For the Chopin method, the $r(2)$ value ranged from 0.78 to 0.82, depending on the method used for the comparison. When data for soft wheats were excluded, the Chopin method also had $r(2)$ values of greater than 0.90. In a separate study, damaged starch values were determined on 187 flour samples (covering two crop years) by the approved AACC and Farrand methods, giving a coefficient of determination of 0.95. The regression equation generated was used to evaluate near-infrared spectroscopy as another method for starch damage determination, and resulted in a coefficient of determination of 0.90 between the laboratory value and the near-infrared predicted values. [References: 18].

3239 Perkowski, J.; Miedaner, T.; Geiger, HH.; Muller, HM.; Chelkowski, J. (1995) OCCURRENCE OF DEOXYNIVALENOL (DON), 3-ACETYL-DON, ZEARELENONE, AND ERGOSTEROL IN WINTER RYE INOCULATED WITH FUSARIUM CULMORUM. *Cereal Chemistry*. 72(2):205-209. English. [ACAD AGR POZNAN DEPT CHEM UL WOJSKA POLSKIEGO 75 PL-60625 POZNAN POLAND].

To investigate the occurrence of Fusarium culmorum mycotoxins and ergosterol (ERG) in winter rye, 29 single-cross hybrids were artificially inoculated at anthesis in 1992. Single-cross hybrids revealed a significant genotypic differentiation for head blight rating and relative grain-weight per spike. Deoxynivalenol (DON) content ranged from 0.72 to 28.0 mg kg⁻¹ (average 10.8 mg kg⁻¹); 3-acetyl DON (3-Ac DON) ranged from 0.1 to 3.4 mg kg⁻¹ (average 1.2 mg kg⁻¹); the two were closely correlated ($r=0.79$, $P=0.01$). Correlation coefficients between head blight rating or relative grain-weight per spike and DON or 3-Ac DON content were nonsignificant ($r=0.34-0.36$). For a subset of 10 single-cross hybrids, the proportion of Fusarium-damaged kernels was closely correlated to relative grain-weight per spike ($r=-0.93$, $P=0.01$), but showed nonsignificant correlations to the DON and 3-Ac DON contents ($r=0.45-0.60$). For the other 19 single-cross hybrids, zearelenone (ZEA) and ERG contents ranged from 0.02 to 0.15 mg kg⁻¹ (average 0.07 mg kg⁻¹) and 42.9 to 135.4 mg kg⁻¹ (average 84.5 mg kg⁻¹), respectively. ERG content was significantly correlated with relative grain-weight per spike ($r=-0.52$, $P=0.05$), and with DON, 3-Ac DON, and ZEA contents ($r=0.57-0.79$). ERG-DON ratios varied between 3.6 and 14.4. Winter rye artificially inoculated with F. culmorum accumulated DON, 3-Ac DON in high amounts with considerable differentiation among 29 single-cross hybrids. [References: 24].

3240 Ranhotra, GS.; Gelroth, JA.; Langemeier, J.; Rogers, DE. (1995) STABILITY AND CONTRIBUTION OF BETA CAROTENE ADDED TO WHOLE WHEAT BREAD AND CRACKERS. *Cereal Chemistry*. 72(2):139-141. English. [AMER INST BAKING MANHATTAN, KS USA].

Whole wheat bread and crackers were fortified with beta carotene using three pure (all-trans) sources: one water-soluble and two oil-soluble. Two sources contained added antioxidants. Carotene in both bakery products was highly stable during the prebaking steps and also during the typical market shelf life of the products. However, carotene losses were appreciable during baking, ranging from 4-15% for bread products to 18-33% for

crackers. Beta carotene sources with added antioxidants generally exhibited greater carotene stability, but only during baking and not during product storage. Baking caused a steric shift in carotene, with *cis* isomers averaging similar to 18% in bread products and similar to 34% in crackers. A serving of each product would provide over 500 IU of vitamin A activity (can be labeled a "good source" of vitamin A) and nearly 0.4 mg of carotene. [References: 11].

3241 Ravi, R.; Rao, PH. (1995) FACTORS INFLUENCING THE RESPONSE OF IMPROVERS TO COMMERCIAL INDIAN WHEAT FLOURS. *Journal of Food Science & Technology-Mysore*. 32(1):36-41. English. [CENT FOOD TECHNOL RES INST DEPT MILLING & BAKING TECHNOL MYSORE 570013 KARNATAKA INDIA].

Effect of potassium bromate and ascorbic acid on rheological characteristics and bread making quality of Indian commercial wheat flours was studied. Ascorbic acid brought about greater change in the extensograph characteristics and improvement in the baking quality, as compared to potassium bromate. Soft wheat flour responded more than medium or hard wheat flours to improvers. The effect of potassium bromate on rheological characteristics was more pronounced, when pH of dough was lowered to less than 5.0. Potassium bromate and ascorbic acid brought about a greater improvement in milk bread as compared to other varieties such as plain, sugar, and fruit bread.

3242 Ruiz, M.; Carrillo, JM. (1995) SEPARATE EFFECTS ON GLUTEN STRENGTH OF GLI-1 AND GLU-3 PROLAMIN GENES ON CHROMOSOMES 1A AND 1B IN DURUM WHEAT. *Journal of Cereal Science*. 21(2):137-144. English. [UNIV POLITECN MADRID ESCUELA TECN SUPER INGN AGRON DEPT GENET CIUDAD UNIV E-28040 MADRID SPAIN].

Two recombinants between Gli-A1 and Glu-A3 prolamin genes and seven between Gli-B1 and Glu-B3 obtained from two crosses of durum wheat were classified on the basis of the prolamin alleles at the Gli-A1, Gli-A1, Glu-A3, Gli-A2, Glu-B1, Gli-B1 and Glu-B3 loci. The separate effects on gluten strength of gliadin genes at Gli-1 and low M(r) glutenin subunit genes at Glu-3 were estimated by comparing the SDS-sedimentation test values of the recombinants with those of the same progeny having the same prolamin composition, except for the recombined alleles. The results showed clearly that low M(r) glutenin subunit genes at Glu-A3 and Glu-B3, rather than gliadin genes at Gli-A1 and Gli-B1, were responsible for the differences in gluten strength. [References: 21].

3243 Sampson, DA.; Eoff, LA.; Yan, XL.; Lorenz, K. (1995) ANALYSIS OF FREE AND GLYCOSYLATED VITAMIN B6 IN WHEAT BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY. *Cereal Chemistry*. 72(2):217-221. English. [COLORADO STATE UNIV DEPT FOOD SCI & HUMAN NUTR FT COLLINS, CO 80523 USA].

We developed an high-performance liquid chromatography (HPLC) method for analysis of vitamin B6 in wheat, based on modifications of existing reverse-phase ion-pairing procedures. The method is much simpler than multistep HPLC-based procedures required for exhaustive analysis of all B6 forms in foods, including minor components, or methods based on microbiological analysis. The method is suitable for analysis of major B6 forms in wheat, including pyridoxine glucoside. The method entails extraction of wheat B6 using metaphosphoric acid followed by quantitation of B6 in a single binary-gradient HPLC separation. Analysis of three randomly selected wheat cultivars with this method revealed significant variation in content of pyridoxine (2.2-3.3 nmol/g) and pyridoxine glucoside (1.8-9.4 nmol/g). The method should facilitate analysis of different wheat cultivars for vitamin B6 content. [References: 41].

3244 Schofield, JD.; Chen, X. (1995) ANALYSIS OF FREE REDUCED AND FREE OXIDISED GLUTATHIONE IN WHEAT FLOUR. *Journal of Cereal Science*. 21(2):127-136. English. [UNIV LONDON KINGS COLL DIV LIFE SCI CAMPDEN HILL RD LONDON W8 7AH ENGLAND].

A rapid and sensitive high-performance liquid chromatography (HPLC) method is described for the determination of reduced and oxidised glutathione (GSH and GSSG, respectively) in wheat flour. The procedure, in which the various steps were optimised, involves extraction with 5% (W/V) perchloric acid (PCA) so as to prevent sulphhydryl-disulphide (SH/SS) interchange reactions and to separate PCA-extractable peptides from proteins, the latter being insoluble in PCA. After S-carboxymethylation of free sulphhydryl groups by alkylation with iodoacetic acid (IAA) and di-

nitrophenylation of free amino groups with 1-fluoro-2,4-dinitrobenzene (FDNB), the derivatives are analysed by HPLC on an amino-bonded phase silica column. Recoveries of GSH and GSSG standards added during extraction averaged 98% and 86%, respectively, and detector responses were linear up to 100 nmol GSH/g flour and 50 nmol GSSG/g flour. GSH levels in 'straight-run' Brabender Quadrumat Junior-milled white flours from single samples of grain of 11 U.K.-grown wheat cultivars ranged from 18 to 89 nmol/g flour and GSSG levels from 12 to 22 nmol/g flour. The ratio of GSH/GSSG varied between 0.9 and 5.9. No clear relationships were noted for this limited sample set between either the flour GSH or GSSG contents or the GSH/GSSG ratios and the bread making classifications of these cultivars. Storage of white flour samples at 4 degrees C for 90 days resulted in substantially reduced values for both GSH and GSSG necessitating standardisation of the time between milling and subsequent analysis. [References: 29].

3245 Sebecic, B.; Sebecic, B. (1995) WHEAT FLOUR STARCH GRANULE-SIZE DISTRIBUTION AND RHEOLOGICAL PROPERTIES OF DOUGH .1. GRANULOMETRIC ANALYSIS OF STARCH. *Nahrung*. 39(2):106-116. English. [UNIV ZAGREB FAC PHARM & BIOCHEM DEPT FOOD CHEM DOMAGOJEVA 2-I ZAGREB 41000 CROATIA].

The quantitative microscopic method for measuring wheat flour starch granule size, i.e. determination of granule-size distribution, directly in wheat flour microscopic thin-section by means of polarisation microscope was described. Wheat flour starch granule-size distribution was described by application of some granulometric and statistic parameters commonly used in interpretation of granulometric analyses results in sedimentology as well as by parameters of distribution of grouped data (sorting skewness, kurtosis, mean, mode etc.). A normal, mostly bimodal distribution with platykurtic or leptokurtic positively skewed curves were found. Data show that the investigated qualitatively different wheat flour samples differed as related to applied granulometric and statistic parameters of distribution as well. [References: 36].

3246 Sebecic, B.; Sebecic, B. (1995) WHEAT FLOUR STARCH GRANULE-SIZE DISTRIBUTION AND RHEOLOGICAL PROPERTIES OF DOUGH .2. EXTENSOGRAPHIC MEASUREMENTS. *Nahrung*. 39(2):117-123. English. [UNIV ZAGREB FAC PHARM & BIOCHEM DEPT FOOD CHEM DOMAGOJEVA 2-I ZAGREB 41000 CROATIA].

To examine the interdependence of granulometric composition of wheat flour starch and rheological properties of dough, the content of starch fractions, i.e. the granulometrical and statistical parameters of granule-size distribution determined in previous work (*Nahrung* 39 (1995) 106), were correlated with extensograms evaluated after AACC and ICC criteria as well as after recently proposed criteria by BALINT et al. (*Nahrung* 35 (1991) 721). Data show that smaller granules (6.5-19.5 μ m in diameter) significantly increase the extensibility of dough ($r = 0.600$, $P < 0.05$) and decrease resistance to extension ($r = 0.756$, $P < 0.005$) as well as the ratio between resistance and extensibility ($r = 0.855$, $P < 0.005$), respectively. Granules $> 27.5 \mu$ m increase resistance to extension ($0.1 > P > 0.005$). Significant correlation between parameters of extensograms and different statistical, i.e. granulometrical parameters of granule-size distribution suggests the possibility that granule-size distribution can influence the visco-elastic properties of dough (elastic deformation in particular) under the conditions of extensographic measurements, as well. [References: 13].

3247 Sundberg, B.; Tilly, AC.; Aman, P. (1995) ENRICHMENT OF MIXED-LINKED (1-3), (1-4)-BETA-D-GLUCANS FROM A HIGH-FIBRE BARLEY-MILLING STREAM BY AIR CLASSIFICATION AND STACK-SIEVING. *Journal of Cereal Science*. 21(2):205-208. English. [SWEDISH UNIV AGR SCI DEPT FOOD SCI BOX 7026 S-75007 UPPSALA SWEDEN].

3248 Svensson, E.; Eliasson, AC. (1995) CRYSTALLINE CHANGES IN NATIVE WHEAT AND POTATO STARCHES AT INTERMEDIATE WATER LEVELS DURING GELATINIZATION. *Carbohydrate Polymers*. 26(3):171-176. English. [LUND UNIV DEPT FOOD TECHNOL POB 124 S-22100 LUND SWEDEN].

Changes in the crystallinity of cereal and tuber starches were investigated with WAXS (wide-angle X-ray scattering) under realistic water and temperature conditions during gelatinization. Due to experimental factors the water starch ratios 43, 51 and 58% (w/w) for the wheat starch samples, and 49, 56 and 64% for the potato starch samples were chosen for the examinations. The results of the X-ray investigation are compared with

DSC data and indicate a two-stage process. The crystalline properties are strongly affected by the amount of water available during gelatinization, and the present study demonstrates that the subcell of cereal starches is more stable to water than the subcell of tuber starches. [References: 29].

3249 Tanaka, T.; Teshima, R.; Ikebuchi, H.; Sawada, J.; Ichinoe, M. (1995) SENSITIVE ENZYME-LINKED IMMUNOSORBENT ASSAY FOR THE MYCOTOXIN ZEAREALONE IN BARLEY AND JOBS-TEARS. *Journal of Agricultural & Food Chemistry*. 43(4):946-950. English. [NATL INST HLTH SCI DIV BIOCHEM & IMMUNOHISTOCHEM SETAGAYA KU TOKYO 158 JAPAN].

An easy, sensitive, competitive indirect enzyme-linked immunosorbent assay (CI-ELISA) for zearealone in barley and Job's-tears was established. To improve sensitivity of the assay system for zearealone, a solid phase antigen was prepared by affinity purification. This assay system uses a purified antigen and specific monoclonal antibodies for zearealone. Consequently, the detection limit of zearealone by CI-ELISA was increased to 0.2 ng/mL (equivalent to 10 ng/g in barley and Job's-tears). Zearealone in barley and Job's-tears samples could be determined in the range of 25-1000 ng/g using method A (methanol-water and dichloromethane extraction) and method B (methanol-water alone) as sample preparation. The average recoveries of zearealone from barley samples were observed to be 106% (mean CV, 10.3%) by method A and 98% (mean CV, 7.5%) by method B; also, those of zearealone from Job's-tears samples were observed to be 96% (mean CV, 9.4%) by method A and 102% (mean CV, 6.5%) by method B. There was little or no difference between method A and method B for the recovery. For the benefit of a facile sample preparation, unknown amounts of zearealone in barley and Job's-tears samples were assayed by method B. The results obtained by CI-ELISA were closely correlated with those of high-performance Liquid chromatography. [References: 24].

3250 Trucksess, MW.; Thomas, F.; Young, K.; Stack, ME.; Fulgueras, WJ.; Page, SW. (1995) SURVEY OF DEOXYNIVALENOL IN US 1993 WHEAT AND BARLEY CROPS BY ENZYME-LINKED IMMUNOSORBENT ASSAY. *Journal of AOAC International*. 78(3):631-636. English. [US FDA DIV NAT PROD WASHINGTON, DC 20204 USA].

Wheat and barley from the 1993 crop year were analyzed for deoxynivalenol (DON). A total of 630 samples were collected by the Federal Grain Inspection Service in 25 states and analyzed using a commercially available, direct competitive, enzyme-linked immunosorbent assay. The limit of determination was about 0.5 µg/g. DON contamination in the 483 wheat samples averaged 2.0 µg/g and ranged from <0.5 to 18 µg/g. DON contamination in the 147 barley samples averaged 4.2 µg/g and ranged from <0.5 to 26 µg/g. About 40% of the wheat samples and 57% of the barley samples contained DON levels that were greater than the U.S. Food and Drug Administration 1982 advisory level of 2 µg/g for DON in wheat designated for milling (human consumption). [References: 24].

3251 Weegels, PL.; Orsel, R.; Vandepijpekamp, AM.; Lichtendonk, WJ.; Hamer, RJ.; Schofield, JD. (1995) FUNCTIONAL PROPERTIES OF LOW M(R) WHEAT PROTEINS 2. EFFECTS ON DOUGH PROPERTIES. *Journal of Cereal Science*. 21(2):117-126. English. [TNO DEPT BIOCHEM & PHYS CHEM POB 360 3700 A] ZEIST NETHERLANDS].

The effects of non-gluten low M(r) wheat proteins on bread-making quality and dough properties were investigated. Low M, proteins retarded the re-polymerisation of SDS-unextractable glutenin (glutenin macropolymer-GMP; gel protein) during resting of doughs from the cultivars Obelisk, Camp Remy, Castan and Rektor. Polymerisation in the overly-strong cultivar, Fresco, was not affected substantially. Additions of 0.2% to 0.4% by weight of low M(r) proteins to flour increased the relaxation half-times of doughs from cvs Camp Remy and Rektor as measured in a Bohlin VOR Rheometer. Furthermore, the phase angle, delta (ratio of loss modulus to storage modulus), decreased at these levels of low it, protein addition, indicating the formation of a dough with greater elastic character. At 0.8% (w/w) addition, the relaxation time decreased and the phase angle increased. The effects on the dough of cv. Obelisk were relatively slight. The complex dynamic moduli of doughs from cvs Camp Remy and Rektor were relatively unaffected by the addition of low M(r) proteins, but the moduli decreased when they were added to cv. Obelisk flour. The rate of GMP re-polymerisation during resting was related negatively to the phase angle, whereas the complex modulus increased to a plateau value as the rate of

GMP reassembly increased. In micro-baking tests with 10-g and 100-g pan leaves, increases in loaf volume of 11% to 12% were observed with up to 0.8% (w/w) addition of low M(r) proteins to cv. Camp Remy dough. For the weaker cultivar, Obelisk, addition of low M(r) proteins caused either no increase in loaf volume or a decrease of 13%, depending on the level of addition. The results indicate that, although low M(r) wheat proteins have inconsistent effects on loaf volume, they have profound effects on both the biochemical and rheological properties of dough. [References: 13].

3252 Yoon, SH.; Berglund, PT.; Fastnaught, CE. (1995) EVALUATION OF SELECTED BARLEY CULTIVARS AND THEIR FRACTIONS FOR BETA-GLUCAN ENRICHMENT AND VISCOSITY. *Cereal Chemistry*. 72(2):187-190. English. [N DAKOTA STATE UNIV DEPT FOOD & NUTR FARGO, ND 58105 USA].

Two waxy hull-less (Apollo and Wanubet) and one nonwaxy hulled (Robust) barley cultivars were milled on a hammer mill, using three screens to produce two grinds (coarse and fine) of whole grain barley flour (BF). Each grind of each BF was fractionated by means of sieves and combined into four fractions (A-D, largest to smallest particle size, respectively), based on similar particle sizes and extract viscosities. Percent distribution of weight in each fraction was similar among cultivars within the same grind but differed significantly between the coarse and the fine grinds. Apollo and Wanubet, both waxy hull-less cultivars, had higher beta-glucan contents and extract viscosities than did the nonwaxy hulled cultivar for BF and all fractions. beta-Glucan contents and extract viscosities of all fractions of the fine grind, except D, were higher than the original. BF, in all cultivars, beta-Glucan concentrations in fine-grind fractions were 1.38- to 1.88-fold greater than those of the original barley grains. Thus, milling with a hammer mill and fractionation produced fractions with higher beta-glucan and extract viscosity when compared to the original BF. [References: 18].

Q02 FOOD PROCESSING AND PRESERVATION

3253 Balzhiev, D.; Kr'steva, A.; Ferdinandov, D.; Kalchev, P. (Vissh Institut po Khranitelna i Vkusova Promishlenost, Plovdiv (Bulgaria)) (1994) [Improvement of the technology for the preparation of wheat for grinding [milling industry]]. Us"v"rshestvuvane na tekhnologiyata za podgotovka na pshenitsata za smilane [melnichna promishlenost]. Firma "Nikolov-Internesh" n"t, Sofia (Bulgaria). Institut po Kriobiologiya i Liofilizatsiya na Selskostopanska Akademiya. S'yuz po Khranitelno-vkusova Promishlenost. Khranitelna Promishlenost (Bulgaria); Food Industry v. 43(9-10) p. 37-39. 1 ill., 1 table; 4 ref. Bulgarian. (AGRI 95-072345).

3254 Nam, K.D.; Lee, I.K.; Cho, H.H.; Choi, M.H.; Kim, W.S. (Isan Trading Company, Pusan (Korea Republic)) (1992) Continuous ethanol fermentation using starchy raw material in pilot scale multi-stage CSTR. *Korean Journal of Applied Microbiology and Biotechnology (Korea Republic)* v. 20(3) p.324-328. 5 illus.; 4 tables; 14 ref. Korean. (AGRI 95-072340).

3255 Pommer, G. (Bayerische Landesanstalt fuer Bodenkultur und Pflanzenbau, Freising (Germany)) (1994) [On baking wheat in ecological [organic] cropping system]. Zum Anbau von Backweizen im oekologischen Landbau. Schule und Beratung (Germany) (no.5,pt.4) p. 5-8. 1 graph, 3 tables; ref. German. (AGRI 95-059332).

3256 Prabhanjan, D.G.; Raghavan, G.S.V.; Bosio, R.G. (1992) Drying kinetics and quality of wheat in a surface wave applicator (2450 MHz). Paper - American Society of Agricultural Engineers (USA); no. 92-3051 12 p. references. Paper presented at the "1992 International Summer Meeting sponsored by the American Society of Agricultural Engineers," June 21-24, 1992, Charlotte, North Carolina. English. (AGRI 95-059334).

3257 Terzic Vidojevic, A.I. (1994) [Investigation into the radioresistance of barley microflora used as the support of antibiotics producers]. Ispitivanje radiorezistentnosti mikroflora jecma kao nosaca proizvodjaca antibiotika. Tehnoloski fakultet, Novi Sad (Yugoslavia). 42 ill.; 1 graphs; 44 tables; 223 ref. 198 p. Serbian. (AGRI 95-059323).

Barley is used as the support for the inoculation of antibiotics in the pharmaceutical industry. Due to such a specific use, the barley has to be completely sterile for the breeding of appropriate molds i.e. production of appropriate antibiotics. The following microorganisms were found on the raw material, enterobacteria, micrococci, clostridia, aerobic sporogenous bacteria, molds and yeasts. Cold sterilization was chosen for the thorough

decontamination of barley seed. The samples of barley were irradiated with gamma-rays, using ^{60}Co as the source of ionizing irradiation. As the barley was contaminated with sporogenous and radioresistant microorganisms, somewhat higher doses of gamma irradiation were applied: 10, 15, 20 and 25 kGy.

3258 Tosi, E.; Ciappini, M.C.; Masciarelli, R.; Re, E. (1994) [Whole amaranth flour and wheat flour use in cookies formulations]. *Uso de harina integral de amaranto y harina de trigo en la fabricacion de galletitas. Alimentaria (España) (no.258) p. 51-53. 4 tab.; 8 ref. Spanish. (AGRI 95-072432).*

3259 Wagner, R. (1994) [Starch made of wheats: The world looks at Eastern Germany]. *Staerke aus Weizen: Die Welt blickt auf Ostdeutschland. Deutsche Milchwirtschaft (Germany) v. 45(16) p. 736-737. 3 ill. German. (AGRI 95-059563).*

004 FOOD COMPOSITION

3260 Alisauskas, V. (Australian Wheat Board, Melbourne) (1994) Varietal control - environment and niche marketing wheats for end-products [Australia]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 501. English. (AGRI 95-060031).*

3261 Alkanhal, M.A.; Almohizea, I.S.; Alothaimeen, A.I.; Khan, M.A. (1994) NUTRITIVE VALUE OF SOME WHEAT BASED DISHES CONSUMED IN THE KINGDOM OF SAUDI ARABIA. *Ecology of Food & Nutrition. 32(3-4):219-226. English. [KING SAUD UNIV COLL APPL MED SCI DEPT COMMUNITY HLTH POB 10219 RIYADH 11433 SAUDI ARABIA].*

Nutrient composition and nutritional quality of six Saudi Arabian dishes based on wheat were studied. The dishes, on fresh weight basis, contained 2.4-6.7% protein (N x 6.25), 0.4-6.0% fat, 10.4-31.4% carbohydrates, 1.7-4.6 dietary fibre, 0.7-2.0% ash and 66-206 kcal per 100 g. The concentrations of vitamin A (Retinol Equivalent), thiamin, riboflavin and vitamin C ranged from 0-411 µg, 0.02-0.06 mg, 0.04-0.94 mg and 0.52-2.87 mg per 100 g respectively. The mineral contents (mg/100 g) were: calcium 0-35.5, phosphorus 5.4-5.9, iron 0.5-1.8, sodium 109.8-305.5 and potassium 49.9-294.7. The dishes contributed 13-20%, 5-27% and 57-82% of the total food energy from protein, fat and carbohydrate respectively. The nutritional quality of all dishes were adequate to meet the protein requirements of all age groups when compared with reference protein energy ratios (PE %). [References: 32].

3262 Andrews, J.L. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Skerritt, J.H. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry); Howes, N.K. (Agriculture Canada Research Station, Winnipeg) (1994) Extensibility screening with low Mr glutenin subunit selective antibodies [wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 506. English. (AGRI 95-060037).*

3263 Anon. (1994) [Spanish wheats quality survey. 1994 harvest]. *Encuesta de calidad de los trigos españoles. Cosecha 1994. Boletín de Informacion Agraria y Pesquera - Junta de Andalucía (España) (no.84) p. 56-61. 6 tab. Spanish. (AGRI 95-072728).*

3264 Azudin, M.N. (Pertanian Malaysia Univ., Selangor); Wootton, M.; Willis, R. (Academy of Grain Technology, Werribee (Australia)) (1994) Characteristics of instant noodles made from different wheat noodles. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 503. English. (AGRI 95-060204).*

3265 Bariana, H.S.; Blundell, M.J.; Gianibelli, M.C.; MacRitchie, F. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Gupta, R.B.; Leach, G. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry) (1994) Biochemical and genetic basis of variation in dough properties [wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic.

(Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 505. English. (AGRI 95-060197).*

3266 Becker, H. G. (Vereinigung Getreide, Markt und Ernährungsforschung e.V., Bonn (Germany)) (1994) [Buckwheat, spelt, barley, oat, millets and rice - cereals and their importance for human nutrition]. *Buchweizen, Dinkel, Gerste, Hafer, Hirse und Reis - die Schaal- und Spelzgetreide und ihre Bedeutung fuer die Ernährung. AID Verbraucherdienst (Germany) v. 39(6) p. 123-130. 9 tables; 21 ref. German. (AGRI 95-072737).*

3267 Bekes, F.; Batey, I.L.; Gras, P.W. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Gupta, R.B. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry) (1994) Isolation of single polypeptides from wheat flour for functional studies using RP-HPLC. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 509. English. (AGRI 95-060198).*

3268 Bekes, F.; Gras, P.W.; Murray, D. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry) (1994) Investigating structure-function relationships using purified wheat polypeptides. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 505. English. (AGRI 95-060036).*

3269 Bekes, F.; Murray, D.; Gras, P.W. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Skerritt, J. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry) (1994) The effects of different isolation treatments on the functionality of gliadin and glutenin proteins [wheat flour]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 509. English. (AGRI 95-060199).*

3270 Belcheva, L. (Institut po Z'meni Khani i Furazhna Promishlenost, Kostinbrod (Bulgaria)) (1994) [Technological characterization of the common winter wheat varieties Zlatostroy and Vulshebnitsa]. *Tekhnologichna kharakteristika na sortovete obiknovena zimna pshenitsa Zlatostroy i Vulshebnitsa. Selskostopanska Akademiya, Sofia (Bulgaria). Rasteniev'dni Nauki (Bulgaria); Plant Science v. 31(1-2) p. 12-14. 7 tables; 5 ref. Bulgarian. (AGRI 95-072823).*

3271 Blakeney, A.B.; Welsh, L.A.; Martin, M. (New South Wales Agriculture, Yanco (Australia). Yanco Agricultural Inst.) (1994) Analytical methods for wheat starch amylose. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 508. English. (AGRI 95-060040).*

3272 Collins, H.M.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) Assessment of spectrophotometric analysis of soluble protein for a barley breeding program. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 505. English. (AGRI 95-059994).*

3273 Correll, R.L. (Commonwealth Scientific and Industrial Research Organisation, Glen Osmond (Australia). INRE Biometrics Unit); Spouncer, L.R.; Butler, J.H.A. (Commonwealth Scientific and Industrial Research Organisation, Glen Osmond (Australia). Div. of Soils) (1994) A grain protein prediction model for South Australian ASW [Australian standard white] wheat. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia) v. 61(9) p. 501-502. English. (AGRI 95-060033).*

3274 Every, D.; Gilpin, M.; Larsen, N.G. (New Zealand Inst. for Crop and Food Research, Christchurch) (1994) Ascorbic acid oxidizing factors in wheat. [Conference abstract]. 44. Royal Australian Chemical Institute

Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 506. English. (AGRI 95-060039).

3275 Ferris, D.J.; MacLeod, L.C. (Adelaide Univ., Glen Osmond (Australia). Waite Campus) (1994) Cone-plate viscometry and its application to barley breeding. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 511. English. (AGRI 95-059998).

3276 Fox, G.P.; Inkerman, P.A.; Fry, K.M.; Gunnourie, C.M. (Queensland Dept. of Primary Industries, Toowoomba (Australia). Food Research Inst.); Butler, D. (Queensland Dept. of Primary Industries, Toowoomba (Australia). Biometry Section) (1994) Preliminary comparison of the Kjeldahl and Dumas methods for determination of nitrogen content in barley grain. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 507. English. (AGRI 95-059995).

3277 Fukushima, Y. (Fukuoka ken. Agricultural Research Center, Chikushino (Japan)); Okuma, M.; Manabe, H. (1993) Influences of cultivars and cultural conditions of wheat (*Triticum aestivum*) on eating quality of Japanese noodle. *Bulletin of the Fukuoka Agricultural Research Center. Series A. Crop (Japan)* (no.12) p. 33-36. 4 tables; 3 fig.; 9 ref. Japanese. (AGRI 95-060028).

3278 Glennie Holmes, M.R. (New South Wales Agriculture, Yanco (Australia). Yanco Agricultural Inst.); Taylor, H.R. (New South Wales Agriculture, Wagga Wagga (Australia). Agricultural Research Inst.) (1994) Objective measurement of barley grain brightness. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 510. English. (AGRI 95-059997).

3279 Gras, P.W. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Bason, M.L. (Newport Scientific, Warriewood (Australia)); Banks, H.J. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Entomology) (1994) Effect of environmental safe storage on quality of barley and wheat. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 502. English. (AGRI 95-060034).

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3281 Marinov, V.; Stefanov, G.; Vichev, V. (Vissh Institut po Khranitelna i Vkusova Promishlenost, Plovdiv (Bulgaria)) (1994) [A study of the technological properties of new sorts of hard wheat for the production of macaroni products]. Prouchvane na tekhnologichnite svojstva na novi sortove tv'rda pshenitsa za proizvodstvo na makaroneni izdeliya. Firma "Prokom", Plovdiv (Bulgaria). *Khlyab (Bulgaria); Bread* v. 2(9-10) p. 11. Bulgarian. (AGRI 95-072731).

3282 Martin, D.J.; Stewart, B.G. (Queensland Dept. of Primary Industries, Toowoomba (Australia). Wheat Research Inst.) (1994) Measuring dough mixing times and energy requirements in a test bakery [bread wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 510. English. (AGRI 95-060200).

3283 Martin, G. (Institut Technique des Cereales et des Fourrages, Paris (France)) (1993) [Wheat for French bread making]. Collecte ble 93: des bles mieux adaptes a la panification francaise. *Perspectives Agricoles (France)* (no 186) p. 92-94. French. (AGRI 95-060027).

3284 Milson, M.; Panozzo, J.F. (Victorian Dept. of Agriculture, Horsham (Australia). Inst. for Dryland Agriculture); Downie, P.G. (Perten Instruments, West Melbourne (Australia)) (1994) Use of the falling number

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3285 Morrison, P.G.; Oliver, J.R. (New South Wales Agriculture, Wagga Wagga (Australia). Agricultural Research Inst.) (1994) A standardized test milling procedure for soft wheats. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 510. English. (AGRI 95-060041).

3286 Ohmura, Y. (Tokushima ken. Industrial Research Inst., Ishii (Japan)); Watanabe, T. (1992) Cake-making quality of a Japanese domestic wheat, Shirasagikomugi. *Report of Tokushima Prefectural Industrial Technology Center (Japan)* v. 1 p. 173-176. 4 tables; 2 fig.; 9 ref. Japanese. (AGRI 95-072732).

3287 Okawa, T. (Kagawa ken. Agricultural Experiment Station, Takamatsu (Japan)); Noda, H.; Nakamichi, K. (1992) Wheat properties in Kagawa prefecture [Japan] related to noodle (udon) making quality. *Bulletin of the Kagawa Agricultural Experiment Station (Japan)* (no.43) p. 17-23. 9 tables; 9 ref. Japanese. (AGRI 95-060042).

3288 Oliver, J.R.; Allen, H.M. (New South Wales Agriculture, Wagga Wagga (Australia)) (1993) Evaluation of noodle, steam bread and biscuit quality wheat crossbreds. *New South Wales Agriculture*. 1 fig., 5 ref. 8 p. English. (AGRI 95-072822).

The aim of this project was to improve the evaluation of wheat crossbreds at an early generation stage for noodle, Chinese steam bread and biscuit quality by assessing starch quality parameters. The methods and equipment used to undertake the evaluation of the starch qualities are discussed and the implications for the selection of wheat varieties for particular markets are outlined. This study supplements work done by the authors on quality assessment of crossbred wheats from central and southern New South Wales.

3289 Prodanova, A.; Nikolova, L. (Institut po Semeznanie i Semproizvodstvo "Obraztsov Chiflik", Pyce (Bulgaria)) (1994) [Indirect valuation of the baker's quality of some perspective soft wheat lines]. Kosvena otsenka na khleboppekamoto kachestvo na nyakoi perspektivni linii meka pshenitsa. Firma "Nikolov-Internesh"n"l, Sofia (Bulgaria). Institut po Kriobiologiya i Liofilizatsiya na Selskостopanska Akademiya. S'yuz po Khranitelno-vkusova Promishlenost. *Khranitelna Promishlenost (Bulgaria); Food Industry* v. 43(9-10) p. 24-26. 2 tables; 12 ref. Bulgarian. (AGRI 95-072730).

The effect of the structural and mechanical qualities of the endosperm of perspective soft wheat lines on their technological qualities have been studied. Lines 1105, 6367 and 1173 are notable for their excellent structural and mechanical qualities of the grains and could be used in the breeding process as sources for improvement the hardness of the breeding material in case they do not reach the state variety testing.

3290 Rath, C.R.; Appels, R. (Commonwealth Scientific and Industrial Research Organisation, Canberra (Australia). Div. of Plant Industry); Gras, P.W.; Bekes, F. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Zhonglin, Z. (Bread Research Inst., North Ryde (Australia)) (1994) A prototype extension tester for two-gram dough samples [wheat]. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 503. English. (AGRI 95-060035).

3291 Salem, A.E. (ConAgra Inc., Omaha (USA)) (1994) Sourcing wheats for domestic consumption in the United States. [Conference abstract]. 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 501. English. (AGRI 95-060030).

3292 Sorensen, S.B.; Bech, L.M.; Muldbjerg, M.; Beenfeldt, T.; Breddam, K. (1993) Barley lipid transfer protein 1 is involved in beer foam formation. *Technical quarterly (USA)* v. 30(4) p. 136-145. ref. English. (AGRI 95-060332).

3293 Suter, D. (Westons Cereal Lab., Enfield (Australia)); McKenzie, E. (New South Wales Agriculture, Tamworth (Australia). Tamworth Agricultural Research Centre); Bekes, F. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry); Oliver, J. (New South Wales Agriculture, Wagga Wagga (Australia). Agricultural Research Inst.) (1994) **Anomalous flours from 1993-94 harvest [wheat; Australia]. [Conference abstract].** 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 501. English. (AGRIS 95-060032).

3294 Vichev, V. (Institut po Z'meni Khani i Furazhna Promishlenost, Kostinbrod (Bulgaria)) (1994) **[Wheat bran application in the enrichment of bread with nutritious and biologically valuable substances].** *Prilozhenie na pshenichnite tritsi za obogatavane na khlyaba s khranitelni i biologichni tsenni veshchestva.* Firma "Prokom", Plovdiv (Bulgaria). *Khlyab (Bulgaria); Bread* v. 2(7) p.10-11. Bulgarian. (AGRIS 95-072826).

3295 Wooding, A.R.; Martin, R.J. (New Zealand Inst. for Crop and Food Research Ltd, Christchurch); MacRitchie, F. (Commonwealth Scientific and Industrial Research Organisation, North Ryde (Australia). Div. of Plant Industry) (1994) **Effect of sulfur-nitrogen treatments on work input requirements of different [wheat] cultivars. [Conference abstract].** 44. Royal Australian Chemical Institute Cereal Chemistry Conference; Ballarat, Vic. (Australia); 12 Sep 1994. *Chemistry in Australia (Australia)* v. 61(9) p. 506. English. (AGRIS 95-060038).

Q05 FOOD ADDITIVES

3296 Bollinger, H. (1994) **[Extremely high in dietary fibre. Use of novel wheat fibres in pasta].** *Extrem hoher Ballaststoffgehalt. Anwendung einer neuartigen Weizenfaser am Beispiel von Teigwaren.* *Lebensmitteltechnik (Germany)* v. 26(4) p. 17-18, 21. 2 ill., 1 graph, 3 tables. German. (AGRIS 95-072955).

Q52 FEED PROCESSING AND PRESERVATION

3297 Bem, C.; Spiridon, G. (Institutul de Biologie si Nutritie Animala, Balotesti (Romania)) (1993) **[Determination of the soluble protein fraction (soluble protein) from cereals (corn, barley and wheat) thermally treated].** *Determinarea fractiei proteice solubile (azot solubil) din cereale - porumb, orz, griu, supuse tratamentelor termice.* *Analele Institutului de Biologie si Nutritie Animala Balotesti (Romania)* v. 16 p. 239-242. 1 table; 9 ref. Romanian. (AGRIS 95-060404).

In order to determine the quality of the compound feed submitted to simple or complex thermal treatments, the specific technique may be successfully applied.

3298 Moyson, E. (1994) **Microbial upgrading of wheat straw: selective degradation of lignin by higher fungi and an Actinomycetes.** Katholieke Univ. Leuven (Belgium). Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen. *Dissertationes de Agricultura (Belgium)*; no. 253 163 p. KULFLTB. 41 ill.; 30 tables; bibliography p. 150-163. English. (AGRIS 95-072967).

Physical and chemical treatment influence the straw composition and as a consequence its digestibility in ruminants. The combination of heating and concentrated NaOH solutions severely decreased the ration lignin / carbohydrates, resulting in a highly digestible substrate. As this is at the expense of high dry matter losses and because of the polluting impact on the environment, biological methods for the selective delignification of wheat straw are preferred. White-rot fungi such as *Pleurotus pulmonarius*, *Pleurotus sajor-caju*, *Lentinus edodes* and *Phanerochaete chrysosporium* were shown to effectively upgrade wheat straw. The digestibility was doubled and the lignin content halved within 4 to 12 weeks solid state fermentation (SSF) of ground wheat straw. SSF of chopped straw resulted in a slower fungal growth, lower lignin losses and a slower increase of straw digestibility. The results could be improved using cylindrical fermentors flushed with oxygen and the effect was pronounced when supplements were added. As an alternative to pasteurization, pre-incubation of the substrate with lactic acid bacteria was proposed. Although, after such pre-incubation, straw must still be dried to a moisture content, optimal for fungal growth (80 per cent), ensiling was a good alternative. SSF with an

actinomycetes, *Streptomyces viridosporus*, yielded a substrate with a higher lignin concentration and a lower digestibility than the unfermented substrate. The increase in lignin was due to the formation of acid-precipitable polymeric lignin, a lignin degradation intermediate, complexed with carbohydrates and proteins. As *Pleurotus pulmonarius* was able to consume this compound, the co-incubation with both organisms resulted in a highly digestible and lignin-poor straw. Lignin peroxidase (LiP), which is thought to play an important role in lignin degradation was produced in liquid cultures of *Phanerochaete chrysosporium*. It is rather delicate process and subjected to many variables. In addition to effects caused by carbon- or nitrogen-limitation, agitation speed and detergents, it was found that the media used to produce spores also showed effects. More important, however, were the effects caused by repeated subculturing, resulting in a quasi disappearance of enzyme activity. The results obtained in liquid media were taken in consideration when studying lignin degradation in solid substrates. However, it is still not clear that LiP alone should play the initiative role in transformation of barley.

3299 Yoshida, N. (Saitama ken. Livestock Experiment Station, Konan (Japan)); Kakimoto, T.; Takemasa, Y.; Takahashi, T. (1993) **Fermentation of lignocellulosic by-products by *Pleurotus ostreatus* for improvement of feed value for ruminants, 5: Voluntary intake and digestibility of wheat straw treated with edible mushroom by sheep.** *Bulletin of the Saitama Prefectural Livestock Experiment Station (Japan)* (no.31) p. 54-56. 5 tables; 6 ref. Japanese. (AGRIS 95-060411).

3300 Yoshida, N. (Saitama ken. Livestock Experiment Station, Konan (Japan)); Okabe, T.; Takemasa, Y.; Takahashi, T. (1993) **Fermentation of lignocellulosic by-products by *Pleurotus ostreatus* for improvement of feed value for ruminants, 3: The selection of high delignification fungus cultured on wheat straw.** *Bulletin of the Saitama Prefectural Livestock Experiment Station (Japan)* (no.31) p. 45-49. 4 tables; 7 ref. Japanese. (AGRIS 95-060409).

Q54 FEED COMPOSITION

3301 Metayer, J.P. (Institut Technique des Cereales et des Fourrages, Paris (France)); Grosjean, F.; Castaing, J. (1993) **[Feeding value of French cereals for monogastric animals].** *Alimentation des monogastriques. Composition des cereales francaises et valeur energetique.* *Perspectives Agricoles (France)* (no 176) p. 70-76. 7 tableaux, 5 graph. French. (AGRIS 95-060456).

Q60 PROCESSING OF NON-FOOD OR NON-FEED AGRICULTURAL PRODUCTS

3302 Gontard, N. (Ecole Nationale Supérieure des Industries Agricoles et Alimentaires, Massy (France). Laboratoire de Genie et de Technologie Alimentaires) (1994) **[Edible and biodegradable films: study of wheat gluten film-forming properties].** *Films comestibles et biodegradables: etude des proprietes filmogenes du gluten de ble.* *Comptes Rendus de l'Academie d'Agriculture de France (France)* v. 80(4) p. 109-117. 19 ref. French. (AGRIS 95-073038).

Q70 PROCESSING OF AGRICULTURAL WASTES

3303 Yoshida, N. (Saitama ken. Livestock Experiment Station, Konan (Japan)); Takahashi, T.; Nagao, T.; Chen, J.F. (1993) **Fermentation of lignocellulosic by-products by *Pleurotus ostreatus* for improvement of feed value for ruminants, 1: Effect of edible mushroom cultivation on in vitro digestibility of wheat straw and sawdust substrate.** *Bulletin of the Saitama Prefectural Livestock Experiment Station (Japan)* (no.30) p. 73-77. 4 tables; 19 ref. Japanese. (AGRIS 95-060566).

S30 DIET AND DIET-RELATED DISEASES

3304 McIntosh, G.H.; Le Leu, R.K.; Royle, P.J. (Commonwealth Scientific and Industrial Research Organisation, Adelaide (Australia). Div. of Human Nutrition) (1994) **Barley grain for food-use - quo vadis. [Conference abstract].** 44. Royal Australian Chemical Institute Cereal Chemistry

T01 POLLUTION

3305 Boissavy Vinau, M. (1995) [Ozone in towns and country]. L'ozone des villes et l'ozone des champs. *Recherche (France)* v. 26(272) p. 86-87. 6 ref. French. (AGRI 95-061234).

U10 MATHEMATICAL AND STATISTICAL METHODS

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U30 RESEARCH METHODS

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CIMMYT ADDRESSES

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Headquarters

CIMMYT
Lisboa 27
Apdo. Postal 6-641
06600 México, D.F.
MEXICO
Internet: cimmyt@cimmyt.mx
Telex: 1772023 CIMTME
Telefax: INTL (52595)54425
Telefax: NATL(91595)54425
(52-5) 726-75-59/726-75-58

Other CIMMYT Offices

CIMMYT
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Internet: c.meisner@cgnet.com
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CIMMYT
c/o ANAPO
Casilla 2305
Santa Cruz
BOLIVIA
Internet: cimmyt@ugrm.bo
Telefax: (591-3) 427194

CIMMYT
c/o CIAT
Apdo. Aéreo 67-13 Cali **COLOMBIA**
Internet: ciat@cgnet.com
s.pandey@cgnet.com
Telex: 5769 CIATCO
Telefax: (57-23) 4450273

CIMMYT
Apartado 55
2200 Coronado
San José,
COSTA RICA
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Dialcom: 157:CGI066
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c/o ITA 01 B. P. 2559
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COTE D'IVOIRE
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Dialcom: 157:CGI125 (WARDA)
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CIMMYT
P. O. Box 5689
Addis Ababa
ETHIOPIA
Internet:
cimmyt-ethiopia@padis.
gn.apc.org
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w.mwangi@padis.gn.apc.org
Dialcom: 157:CGI070 (ILCA)
Telex: 21207 ILCA ET
Telefax: (251-1) 611 892

CIMMYT
Crops Research Institute
c/o Canadian High Commission
Box 1639 , Accra
GHANA
Internet:
fax+23321772562@cgnet.com
r.soza@cgnet.com
Telex: 2024 DOMCAN GH
(Canadian High Commission in
Ghana)
Telefax: (233-21) 772562 (CIDA)

CIMMYT
12 Calle 1-25 Zona 10
Torre Norte 16 Nivel, Of. 1606
Apdo. Postal 231-A
GUATEMALA
Internet:
cimmyt-guatemala@cgnet.com
j.bolanos@cgnet.com
Dialcom: 157:CGI080
Telex: 6215 (ANAVI GU)
Telefax: (502) (2) 353407

CIMMYT
P.O. Box 25171
Nairobi
KENYA
Internet:
cimmyt-kenya@cgnet.com
j.ransom@cgnet.com
hassanr@ilrad.msm.cgnet.com
Telex: 33075
Telefax: (254-2) 631499/630164

CIMMYT
P.O. Box 677
Njoro
KENYA
Internet: cimmyt-kenya@cgnet.com
a.palmer@cgnet.com
Telefax: (254-37) 61145

CIMMYT
P. O. Box 5186
Kathmandu
NEPAL
Internet: cimmyt-nepal@cgnet.com
e.saari@cgnet.com
p.hobbs@cgnet.com
Dialcom: 157:CGI089
Telex: 2276 HOSANG NP
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977 (1) 414184 -
Att'n. CIMMYT

CIMMYT
Cereal Improvement Program
c/o ICARDA
P. O. Box 5466
Aleppo
SYRIA
Internet: icarda-fax@cgnet.com
Telex: 331206 ICARDA SY
Telefax: (963-21) 213490

CIMMYT
P.O. Box 9-188
Bangkok 10900
THAILAND
Internet: bangkok@cimmyt.mx
mmomis@cimmyt.mx
cdeleon@cimmyt.mx
jlothrop@cimmyt.mx
Dialcom: 157:CGI205
Telex: 84478 INTERAG TH
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CIMMYT
P. K. 39 Emek
Ankara
TURKEY
Internet: cimmyt-turkey@cgnet.com
h.j.braun@cgnet.com
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CIMMYT
c/o IICA
CC 1217
Montevideo
URUGUAY
Internet: cimmyt@chasque.apc.org
Telex: IICA UY 22571
Telefax: (598-2)928522

CIMMYT
P. O. Box MP163
Mount Pleasant
Harare
ZIMBABWE
Internet:
cimmyt-zimbabwe@cgnet.com
d.jewell@cgnet.com
s.waddington@cgnet.com
k.pixley@cgnet.com
t.payne@cgnet.com
b.zambesi@cgnet.com
Dialcom 157:CGI237
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ICARDA ADDRESSES

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Headquarters

ICARDA
P.O. Box 5466
Aleppo
SYRIA
Telex: 331206/331208 ICARDA SY
Phone: (963-21) 213433/213477

ICARDA
c/o CIMMYT
P.O. Box 6-641
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MEXICO
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Regional Offices

ICARDA
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11th Floor
P.O. Box 2416
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EGYPT
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