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Literature Update on

Wheat, Barley, and Triticale

CIMMYT

ICARDA

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Several CIMMYT staff made important contributions to this document: Kelly Cassaday, Senior Publications Manager; Efrén Orozco, Library Manager (editor); Fernando García, Electronic Information Specialist, and Pedro Santamaría, Database Administrator (data processing); José Juan Caballero, Cataloguer (categorization); Miguel Mellado, Coordinator of Design and Photography Department, and Eliot Sánchez, Design Assistant (design); Ma. Concepción Zavala, Bilingual Secretary (production, coordination and distribution).

Literature Update on Wheat, Barley, and Triticale

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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.

Timothy Reeves
Director General, CIMMYT

Adel El-Beltagy
Director General, ICARDA

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

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

(2 = author(s); 3 = publication year; 4 = title in English; 6 = source; 7 = language of text; 8 = organization where work was carried out)

b) Sample entry retrieved from AGRIS (journal article)

1 → 69 Alizaga, R. (Costa Rica Univ., San Jose (Costa Rica). Centro para Investigaciones en Granos y Semillas); Sterling, F.; Herrera, J. (1992) 4 → **[Evaluation of the vigor in maize seeds and its relationship with the behaviour in the field]. Evaluación del vigor en semillas de maíz y su relación con el comportamiento en el campo.** *Agronomia Costarricense (Costa Rica) v. 16(2) p. 203-210.* 20 ref.; grafs. Spanish. (AGRIS 94-116456).

(2 = author(s); 8 = organization where work was carried out; 3 = publication year; 4 = title in English; 5 = original title; 6 = source; 7 = language of text; 9 = AGRIS reference number)

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

1 → 1 Gonzalez Estrada, Adrian (INIFAP. C.E. Valle de Mexico. Ap. Postal 10, Chapingo, Mex. 56230 (Mexico)) (1992) **[Economic aspects of agricultural research in relation to the production of wheat in Mexico]. Aspectos economicos de la investigacion agricola en el cultivo del trigo en Mexico.** 6 → Primera conferencia nacional sobre la produccion de trigo en Mexico. (Memoria); Cd. Obregon, Sonora (Mexico); 22-25 Mar 1988. [National conference on wheat production in Mexico. (1, 1988, Cd. Obregon, Son.) (Proceedings)]. Conferencia nacional sobre la produccion de trigo en Mexico. (1, 1988, Cd. Obregon, Son.) (Memoria). *Publicacion Especial. Centro de Investigacion Regional del Noroeste (Mexico); no. 4 p. 539-550.* Centro de Investigacion Regional del Noroeste. 21 ref. 2o. tomo. Spanish. (AGRIS 9 → 94-114649).

(8 = organization where work was carried out; 3 = publication year; 4 = title in English; 5 = original title; 6 = source; 7 = language of text)

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

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

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

E10 AGRICULTURAL ECONOMICS AND POLICIES

1174 **[French production of starch [wheat and maize] and potato starch]** (1999) Union des Syndicats des Industries de Produits Amylaces et de leurs Derives (France). *Industries Alimentaires et Agricoles (France) v. 116(7-8) p. 96-97.* 7 graph. French. (AGRIS 2000-014844).

On presente l'industrie francaise des sucres d'origine non betteraviere ou canne a sucre. Il s'agit d'une industrie tres concentree, dont les sites de transformation comme ceux de l'industrie de transformation de la betterave sont principalement localises, au Nord de la Loire mais avec egalement une forte implantation dans l'Est et trois localisations Regions Rhodanienne et Sud-Ouest.

1175 Darracq, S. (Union Nationale Interprofessionnelle des Plantes Riches en Proteines, Paris (France)); Carrouee, B.; Cottart, J.; Lemaitre, G. (1998) **[Protein and energy production: comparison between Picardie (France) and Illinois (USA)].** *Perspectives Agricoles (France) (no 237) p. 26-28.* French. (AGRIS 2000-014860).

Les rotations pois/ble/colza/ble en Picardie et mais/soja dans l'Illinois (deux regions parmi les plus fertiles de l'Union Europeenne et des Etats Unis) sont equivalentes pour la production d'elements nutritionnels pour l'alimentation animale. Par contre le systeme picard apporte une plus grande quantite d'huile mais presente des couts de production plus eleves. La difference entre les couts de production des deux systemes de culture vient principalement de la mecanisation.

1176 Deleau, J. (Compagnie Contionentale France, Labege (France)) (1999) **[Production of wheat in the European Community, in the major exporting countries and in the world].** 50. Journees Techniques. Paris (France). Nov 1999. *Industries des Cereales (France) (no 115) p. 31-34.* 5 tableaux. French. (AGRIS 2000-014867).

E14 DEVELOPMENT ECONOMICS AND POLICIES

1177 Maredia, MK.; Byerlee, D. (2000) **Efficiency of research investments in the presence of international spillovers: wheat research in developing countries.** *Agricultural Economics. 22(1):1-16.* English. [Michigan State Univ, Dept Agr Econ E Lansing, MI 48824 USA].

Expenditures on agricultural research in the public sector, including the International Agricultural Research Centers (IARCs) have stagnated and in some cases, declined sharply in recent years. This has focused attention on issues of efficiency of agricultural research systems, especially the number, size, scope, type, and locations of their programs. This paper examines the issue of research efficiency through a case study of wheat improvement research in developing countries. The basic premise of this study is that the optimal level of research investment should be determined in a global model that incorporates direct research spill-ins. An analytical framework is developed to determine the threshold levels of crop production in a country (or a region within a country) needed to justify crop improvement research programs of different sizes in the presence of spill-ins from abroad. Spill-in coefficients ar estimated from yield performance of varieties of different origins grown across a range of environments. The model is then applied to analyze the efficiency of current investments in 69 wheat improvement research programs in 35 developing countries. A major conclusion of the paper is that given the magnitude of potential spill-ins from the international research system, many wheat research programs could significantly increase the efficiency of resource use by reducing the size of their wheat research programs and focusing on the screening of varieties developed elsewhere. [References: 23].

1178 Tripathi, SC.; Chauhan, DS.; Sharma, RK.; Dhillon, OP. (1999) **Productivity and economics of different wheat (Triticum aestivum) based cropping sequences.** *Indian Journal of Agronomy. 44(2):237-241.* English. [Directorate Wheat Res Karnal 132001 Haryana India].

A field study was carried out for three years at the experimental farm of the Directorate of Wheat Research, Karnal to compare the productivity and economics of six important wheat based cropping sequences. Among the crop sequences tried, the most remunerative crop sequence was the one where Pusa Basmati were grown during kharif and wheat during rabi season with and without green manuring in one year crop rotation followed by the sequences where a crop of berseem was included during rabi or soybean and Pusa Basmati were grown during kharif in two-year rotation. Maize-wheat rotation gave the lowest average returns and the least profit. In basmati rice-wheat sequence, on an average about 85% net return was contributed by basmati rice and only 15% by wheat. Among the crops, the most remunerative was basmati rice followed by berseem, soybean and last profitable was maize. [References: 4].

E16 PRODUCTION ECONOMICS

1179 Boatto, V.; Bordin, F. (Padua Univ. (Italy). Dipartimento del Territorio e Sistemi Agroforestali) (1998) **[The prospects are not grey [soft wheat - Italy]].** *Terra e Vita (Italy) v. 39(35) p. 69-72, 74.* 9 tables. Italian. (AGRIS 2000-015028).

1180 Ghelfi, R. (Bologna Univ. (Italy). Dipartimento di Economia e Ingegneria Agrarie); Corticelli, C. (Associazione Interprofessionale Cerealicola (ASSINCER), Bologna (Italy)) (1992) **[Productive situation and economic aspects [wheat]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 59-62.* 4 tables; 2 graphs. Italian. (AGRIS 2000-015014).

1181 Zubal, P.; Kubankova, M.; Gabcova, I. (1999) **Analysis of economical efectivity of growing cereals in the Slovak regions.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 5-12.* Vyskumny Ustav Rastlinnej Vyroby. 4 tables, 1 ill.; 10 ref. Slovak. (AGRIS 2000-022141).

On the basis of the data from the set of respondents of the Research Institute of Economy in Agriculture and Food Industry in Bratislava the following data collected in the years 1995, 1996 and 1997 were analysed: amount of prime costs (VN), cost profitability, yield per hectare and exercise price at wheat, barley, rye and oat growing in 13 soil and ecological subregions (PEPO) in Slovakia. In the set of respondents as a whole, on the average wheat growing was the most profitable from the said cereals with profitability ratio of 9.4% at the yield of 4.40 t/ha and prime costs (VN) of SKK 14, 248 per ha. The highest profitability (37.1) based on the highest hectare yield (5.3 t/ha) was reached in PEPO 22 - Podunajska hills and the lowest- loss, in fact, (- 34.6%), as a result of high VN (18, 608 SK/ha) appeared in PEPO 47 - High mountains. The wheat growing was profitable in 10 PEPOs. Barley showed cost profitability of 6.1% in all the set on the average, at the yield of 3.4 t/ha and average VN of SKK 11, 538 per ha. The highest profitability (33.6%) was found in PEPO 45 (mountains and highlands of volcanic Carpathians), although connected with extremely high exercise price. In production subregions 21 and 22 (Podunajska lowland a Podunajska hills) profitability scored 32.7%. The lowest profitability (- 48.0%) was in PEPO 47 and negative profitability ratios were recorded in two more subregions. The average oat growing profitability was 3.6% at average yield of 3.0 t./a - and level of VN SKK 10, 280 per ha. The highest level in this character (50.7 %) was found out in PEPO 12 (Chvojska hills), mainly ow2ng to the high hectare yield (4.0 t/ha). Negative profitability values were obtained in 4 PEPOs, among them the highest (- 19.2%) in PEPO 46 (Lower mountains). The rye growing was just about the limits of profitability (0.2 %) in all the set on average. PEPO 22 had the highest level of cost profitability (33.4%) and its negative value (- 26.0%) was the highest in PEPO 44 (mountains and highlands of flysch belt), especially due to the low yield (2.8 t./a). The highest average exercise price was in rye (3 695 SKK./) and the lowest in wheat (3, 523 SKK/t). In all the monitored crops the profitability was in positive, highly significant dependency on the hectare yield reached and in wheat and barley on the exercise rice as well. The price in rye affected

profitability only significantly and in the price of oat it was not dependent on profitability. The relation between the level of VN and profitability was not unambiguous.

E20 ORGANIZATION, ADMINISTRATION AND MANAGEMENT OF AGRICULTURAL ENTERPRISES OR FARMS

1182 Harasim, A. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Systems and Economics of Crop Production) (1999) **Organizational and economic aspects of increase cereal percentages in cropping structure.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 143-150.* 3 tables; 12 ref. Polish. (AGRIS 2000-015076).

In the study an evaluation was presented of four-course rotations with the cropping structure involving 50, 75 and 100 percent cereals. The study showed that under multispecific cereal monoculture it is possible to have an overall increase of grain production that is nearly proportional to the increase in area cropped to the cereals on condition that a different cereal species, including maize for grain, is grown in each field. The rotation with 25 percent of sugar beets and 75 percent of cereal is the best, both - when related to until area or to cereal unit.

E70 TRADE, MARKETING AND DISTRIBUTION

1183 Amadei, G. (Bologna Univ. (Italy). Istituto di Economia e Politica Agraria) (1996) **[Prospects of valuation of triticum durum in Italy].** [Accademia Nazionale di Agricoltura. Meeting on prospects of valuation of hard wheat in Italy]. Rome (Italy). 8 Apr 1997. *Annali Accademia Nazionale di Agricoltura - Bologna (Italy) v. 116-117 p. 131-134.* Issued 1998. Italian. (AGRIS 2000-022320).

1184 Kisiel, M. (Institute of Agriculture Economics and Food Husbandry, Warsaw (Poland)) (1999) **Poland's demand for cereal grain of different use utilization method.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 167-175.* 4 ref. Polish. (AGRIS 2000-015327).

The paper presents results of analysis of demand developments taking place in the Polish domestic grain market after implementation of the 1990 economic reform. It has been proved that after four year period of contraction, since 1993/94 season the domestic demand for grains has significantly grown. This has happened mainly due to the revival of demand for animal products as well as some beverages and corresponding growth of feed use of wheat, rye and other coarse grains and industrial use of rye, barley and wheat.

E71 INTERNATIONAL TRADE

1185 Zanias, G.P. (Athens Univ. of Economics and Business (Greece). Dept. of International and European Economic Studies) (1999) **Seasonality and spatial integration in agricultural (product) markets.** *Agricultural Economics (Netherlands) v. 20(3) p. 253-262.* 18 ref. English. (AGRIS 2000-015392).

F01 CROP HUSBANDRY

1186 **Trigo argentino. Informe institucional sobre su calidad. Cosecha 1998/99** *Buenos Aires (Argentina). 1999. 65 p.* GJSecretaría de Agricultura, Ganadería, Pesca y Alimentación, Buenos Aires (Argentina). INTA. SENASA65 pSpanish(AGRIS 2000-015803).

1187 Adamu Mola; Zewdu Yilma (Sheno Research Center (Ethiopia)) (1998) **Agronomy research in North Shewa.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 118-125.* EARO. English. (AGRIS 2000-015506).

1188 Arslan, A.; Gulcan, H. (Cukurova Univ., Faculty of Agriculture, Adana (Turkey). Div. of Field Crops) (1996) **A research on the effects of cutting time to herbage yield and some agricultural characters on the mixtures of common vetch and barley grown as fallow crop under Southeastern Anatolia region.** Turkiye 3. Cayir-Mer'a ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996. *3. Meadow-Pasture and Fodder Congress in Turkey. Sagsoz, S.; Serin, Y.; Gokkus, A.; Comakli, B.; Comakli, B.; Tan, M.; Sengul, S.; Koc, A. (Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey). Div. of Field Crops). Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey) 822 p. p. 341-347.* Ataturk University. 1 table; 15 ref. Turkish. (AGRIS 2000-022618).

This study was conducted to determine the effect of harvest time to forage yield and some agricultural characters of different common vetch + burley mixtures grown winter fallow crop under irrigated conditions of Southeastern Anatolia region, at the Koruklu-GAP Agricultural Research and Development Station of Cukurova University Agriculture Faculty in 1990-91 growing season. This study was designed as split plots with four replications, the mixtures were main plots and the harvest times were sub plots.

1189 Badaruddin, M.; Reynolds, MP.; Ageeb, OAA. (1999) **Wheat management in warm environments: Effect of organic and inorganic fertilizers, irrigation frequency, and mulching.** *Agronomy Journal. 91(6):975-983.* English. [Apartado 370, POB 60326 Houston, TX 77205 USA].

Wheat (Triticum aestivum L.) yields are reduced by heat stress in many countries worldwide. The main objective of this study was to determine whether modifications to currently recommended crop management practices could improve wheat yield at hot-environment sites in three countries. Field trials were conducted between 1991 and 1993 in Sudan and Bangladesh by their respective national agricultural research systems (NARS) and in Mexico by the International Maize and Wheat Improvement Center (CIMMYT). Crop establishment and other plant characteristics were measured to help understand the basis of improved performance and to identify potential diagnostic traits. Management factors included (i) irrigation, (ii) inorganic fertilizer (NPK), (iii) organic fertilizer in the form of farmyard manure (FYM), (iv) straw mulch, (v) genotype, and (vi) sowing date. Control treatments represented recommended practices and gave yields of 3.6 t ha(-1), averaged across all environments. Considering main effects, FYM (10 t ha(-1)) gave the highest yield response (14%) and approximately equivalent levels of NPK gave the lowest (5.5%), suggesting that organic fertilizer provided growth factors in addition to nutrient content. Mulch and extra irrigation increased yield in Sudan and Mexico, which are hot environments with low relative humidity, but not in hot, humid Bangladesh. In Mexico, extra inputs were more beneficial under hotter, spring-sown conditions than for winter sowings, with responses of 17 and 8% to extra NPK, 17 and 14% to FYM, and 11 and 6% to mulch, respectively. Comparison of heat-tolerant (Glennson 81) and heat-sensitive (Pavon 76) genotypes showed that the heat-tolerant genotype was generally more responsive to additional inputs. Improved performance in response to inputs was generally associated with better stand establishment, and with significant increases in plant height, grain per unit area, and aboveground biomass; in Mexico, there was also an association with higher canopy temperature depression and light interception. The possibilities of realizing the benefits of applied organic matter and mulch treatments through residue retention and reduced tillage are briefly discussed. [References: 24].

1190 Bar L'Helgouach, C. (Institut Technique des Cereales et des Fourrages, Paris (France). Laboratoire Qualite des Cereales); Martin, G. (1999) **[Agroclimate and crop quality of soft wheat in France in 1999].** 50. Journees Techniques. Paris (France). Nov 1999. *Industries des Cereales (France) (no 115) p. 14-17.* French. (AGRIS 2000-015753).

1191 Baumhardt, RL.; Lascano, RJ. (1999) **Water budget and yield of dryland cotton intercropped with terminated winter wheat.**

Agronomy Journal. 91(6):922-927. English. [USDA ARS, Conservat & Prod Res Lab PO Drawer 10 Bushland, TX 79012 USA].

A Texas South Plains production system for reducing wind erosion in irrigated cotton (Gossypium hirsutum L.), a low-residue crop, is to plant winter wheat (Triticum aestivum L.) after cotton harvest, chemically terminate the wheat in the spring, and plant cotton using conservation tillage. The terminated wheat-cotton system (TWC) utilizes fall rain to grow wheat residue, This system has increased irrigated cotton lint yields compared with continuous clean-tillage cotton (CCC), but there is limited information on the annual water budget and adaptability of TWC under dryland conditions. This study compares CCC and TWC effects on (i) runoff and infiltration of rain, (ii) the annual water balance, and (iii) cotton hint yield under dryland conditions. The water budget of TWC end CCC was measured in 3-by 30-m subplot watersheds from May 1992 to December 1995 on an Amarillo sandy loam (fine-loamy, mixed, thermic Aridic Paleustalf) at Wellman, TX, Compared with CCC plots, the TWC residue reduced average annual runoff by 43 mm, but increased average fallow water use by 28 mm (tor growing wheat), The use of TWC did not significantly (P = 0.05) increase either water conservation or cotton lint yields compared with CCC. Cotton establishment was problematic due to limited soil water at planting in 1993 for TWC and CCC. This prevented 1994 TWC cotton establishment, thus offsetting improved establishment in 1992, when residue protected cotton seedlings during above-average rain. In semiarid regions, inadequate soil water for crop establishment is an uncontrolled risk with dryland TWC production. Because no significant gains in mater storage or cotton lint yield were observed under dryland conditions with TWC compared with CCC, undertaking the greater crop establishment risk with TWC cotton production is not recommended in the Tex-as South Plains. [References: 27].

1192 Bianchi, A.A.; Peccetti, G. (Perugia Univ. (Italy). Istituto di Agronomia Generale e Coltivazioni Erbacee); Santilocchi, R. (Ancona Univ. (Italy). Dipartimento di Biotecnologie Agrarie ed Ambientali) (1996) **Productivity of durum and soft wheat sown both in Autumn and in Spring at increasing sowing densities and nitrogen fertilisation levels [Triticum durum Desf. - Triticum aestivum L. - Latium].** *Annali della Facolta' di Agraria, Universita' degli Studi di Perugia (Italy) v. 50 p. 55-73.* 3 tables; 9 graphs. Italian. (AGRIS 2000-022599).

A field experimental study was carried out from 1985 to 1988 on the Rieti plateau (Central Italy) to evaluate yield response to sowing time (Autumn and Spring), sowing density (600 to 800 plants m*[-2)) and N fertilisation (100 to 200 kg ha*[-1)) for three durum wheat varieties and one soft wheat variety. Results showed that in the case of Autumn sowing durum wheat varieties gave yield levels not significantly lower than the soft wheat variety, while in the case of Spring sowing durum wheat varieties were remarkably more yielding than soft wheat. In the case of Autumn sowing, the overall yield of all the varieties was positively related to N fertilisation in all the experimental years, while, in the case of Spring sowing, yield levels were positively related to N fertilisation in two years out of three. In all the cases, increasing N rates resulted in an increase of protein content in wheat kernels. On the other hand, increasing sowing densities did not result in higher yield levels in the case of Autumn sowing, while it positively affected yield in the case of Spring sowing [Dal 1985 al 1988, nella piana di Rieti (Italia Centrale) e' stato condotto uno studio sperimentale per valutare la risposta produttiva all'epoca di semina (autunnale e primaverile, alla densita' di semina (da 600 a 800 piante m*[-2)) e alla concimazione azotata (da 100 a 200 kg ha*[-1)) per tre varieta' di grano duro e una di grano tenero. I risultati hanno dimostrato che nel caso della semina autunnale le varieta' di grano duro fornivano livelli di resa produttiva non inferiori in modo significativo alla varieta' di grano tenero, mentre nel caso della semina primaverile le varieta' di grano duro risultavano sensibilmente piu' produttive del grano tenero. Nel caso della semina autunnale, la resa produttiva complessiva delle varieta' era correlata positivamente con la concimazione azotata in tutti gli anni della sperimentazione, mentre, nel caso della semina primaverile, i livelli produttivi sono risultati correlati positivamente con la concimazione azotata in due anni su tre. In tutti i casi, l'aumento del livello di azoto si traduceva in un aumento del contenuto proteico delle cariossidi. Dall'altro lato, l'aumento della densita' di semina non determinava un incremento dei livelli produttivi nel caso della semina autunnale, mentre influenzava positivamente la resa nel caso della semina primaverile].

1193 Bugdaycigil, M.; Sabanci, C.O.; Eginlioglu, G.; Ozpinar, H. (Aegean Agricultural Research Inst., Menemen, Izmir (Turkey)) (1996) **The effect of different mixture rations of vetch-barley varieties on forage yield and quality.** General Directorate of Agricultural Research, Ankara (Turkey). Aegean Agricultural Research Institute. 7 tables; 13 ref. 12 p. Turkish. (AGRIS 2000-015765).

The study on the effects of the varying mixture ratios of common vetch and barley on forage yield and quality was carried out at Aegean Agricultural Research Institute in two successive growing periods. At this work seed rate of 12 kg/da was fixed, the ratio of %60 commen vetch to %40 barley gave rise to maximum yield for dry matter and protein production.

1194 Camargo, CED.; Ferreira, AWP.; Felicio, JC. (2000) **Variance, heritability and correlations in wheat hybrid populations for grain yield and other agronomic characteristics.** *Pesquisa Agropecuaria Brasileira. 35(2):369-379.* Portuguese. [Inst Agron IAC Caixa Postal 28 BR-13001970 Campinas SP Brazil].

The objective of the present work was to estimate the variance, heterosis and heterobeltiosis, and the narrow-sense heritability values for grain yield, spike length, rachis internode length and height of wheat plants (Triticum aestivum L.), as well as the environmental, phenotypic and genetic correlations between these characteristics. Degrees of dominance were also estimated for all characteristics except for grain yield. The experiment was carried out at the Experimental Center, in Campinas, Sao Paulo State, Brazil, under a screen house condition on crosses of the standard height cultivar IAC-227 (P-1) with four mexican lines: CMH 78.390/CMH 77 A.917//CMH 79.215 (P-2), CMH 79.959/2* CNO 79 (P-3), CMH 79.481/CMH 77A.917 (P-4) and CMH 80A. 747 (P-5). The narrow sense heritability values for plant height (0.608-0.861), spike length (0.406-0.667), rachis internode length (0.545-0.781) and grain yield (0.421-0.550) indicated that the great part of the verified genetic variability in the hybrid populations for these traits were due to additive gene action. The phenotypic correlations between plant height with grain yield and between spike length and rachis internode length were positive and significant to all crosses, showing to have associations between these characters; however the obtained results suggest that large F-2 populations will be required to ensure the frequency of desired recombinants, showing semidwarf plants with high yield potential. [References: 17].

1195 Celik, N.; Bulur, V. (Uludag Univ., Faculty of Agriculture, Bursa (Turkey). Div. of Field Crops) (1996) **The use of cereals as forage and their potantials in future.** Turkiye 3. Cayir-Mer'a ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996. 3. *Meadow-Pasture and Fodder Congress in Turkey. Sagsoz, S.; Serin, Y.; Gokkus, A.; Comakli, B.; Tan, M.; Sengul, S.; Koc, A. (Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey). Div. of Field Crops). Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey) 822 p. p. 513-519.* Ataturk University. 17 ref. Turkish. (AGRIS 2000-022462).

Cereals have long been important for human and livestock. However, their use as forage has expanded since 1950's. Although other feed sources have well been improved in developed countries, cereals are to some important extent benefitted from in this connection. The way of use from as feed is grain and forage.

1196 Cupa, J. (2000) **The effect of previous crop soil cultivation on the yield of grain maize and winter wheat in the drier area of southern Moravia.** *Rostlinna Vyroba. 46(3):113-117.* Czech. [OSEVA Kotlarska 53 Brno 60200 Czech Republic].

The work presents the results of minimization in soil cultivation at the seeding sequences: I. seed maize, 2. seed maize, 3. winter wheat, 4. winter wheat. These seeding sequences have been repeated several times at the experimental site in Hrusovany u Brna and represent a four-year period of 1990 to 1993 incl. The experiment was organized with the method of randomized blocks at four repetitions. Three

systems and ways of soil cultivation were established at the experimental sites. Variant I assigns processing tillage at all crops of the four-year seeding plan. Variant II (limited cultivation) only claims tillage for maize at the sequence 1. For maize at the sequence 2 and for the double sequence of winter wheat the soil cultivation is realized with plate tools. Variant III (variant without soil cultivation) claims tillage for seed maize at the sequence 1, soil cultivation with plate tools for seed maize at the sequence 2. For winter wheat at the sequences 3 and 4, no-till seeding with no soil cultivation was processed. The tillage for seed maize was processed to the depth of 0.24 m, for winter wheat 0.20 m, always with plough. At the limited soil cultivation for seed maize (to the depth of 15 cm) and winter wheat (12 cm) plate stubble plough. Fertilization was processed uniformly at particular soil cultivation variants. For the seed maize at the sequence I, wheat straw and pig slurry (50 t.ha(-1)) were mulched into the soil together with artificial fertilizers (at the conversion to kg.ha(-1) 140 kg N, 176 kg P2O5, 361 kg K2O). Then follows seed maize at the sequence 2 where maize straw and 220 kg N.ha(-1) were used as a fertilizer. The winter wheat of the sequence 3 was fertilized with 20 kg N.ha(-1) on the leaf and at the sequence 4 the amount was 100 kg N.ha(-1) before seeding. At all soil cultivation variants, the crops were uniformly treated with herbicides according to the valid plant protection methodology. In 1989 and 1993 soil samples were taken from the depth of 0 to 0.1 m, then 0.1 to 0.2 m and 0.2 to 0.3 m for monitoring the effect of the long-time impact of soil cultivation intensity on soil physical characteristics. The basic indicators of soil physical characteristics were assessed according to the comprehensive methodology of complex soil research. The yield of grain and straw was cast by calculation of harvested products from the area of the experimental plots on the area of 1 ha on t.ha(-1) according to the soil cultivation variants. These data were later evaluated by the method of variance analysis. According to the mean numerical data of 1989 (the time of initial state of monitoring) and 1993 (the end of the experiment), the soil physical characteristics showed a certain tendency of soil settling at the variant 1 (tillage). Much more remarkable changes of soil physical characteristics were monitored in this period at applying the minimization elements. The monitored changes certify a progressive soil concretion during the time. In relation to the demands of the experimental crops there was nor monitored soil deterioration to such extent that the changes would negatively influence the growth, development and the final production. As to the evaluation the crops of maize and winter wheat seed, the yield was influenced by three factors: the year, the position at the crop sequence and the soil cultivation variant. The influence of the year during the time of the experiment (1990 to 1993 incl.) showed that for seed maize the years 1991 and 1993 were the most favourable, lower crop was observed in 1990 and the absolutely lowest in 1992. The highest crop of winter wheat influenced by the effect of the year was in 1990 and 1991, then comes the year 1993 and the absolutely lowest crop was in 1992 just like maize. Another factor influencing the crop results of maize and winter wheat was the position of the crop within the framework of the seeding sequence. At the sequence 2 (maize after maize) higher crop was observed. The crop of winter wheat was significantly higher at the sequence 3 (except the year 1992) when it was planted after a double sequence of seed maize. At the sequence 3 (wheat after wheat) the crop was lower in 1990, 1991 and 1993, the reason are generally known demands of wheat on the preceding plant. The third factor of the soil cultivation variants I, II and III had the least influence on the yield of maize and winter wheat. The monitored crops were balanced with minimal differences, statistically inconclusive (except the sequence I, variant III). The reason can be among others high natural soil fertility which can eliminate crop differences between the monitored soil cultivation variants at the experimental sites as well as relatively high level of nutrition of experimental crops. Similar results were certified even in the case of achieved production of side products of maize and winter wheat straw. The same goes for the case of productivity evaluation of the four-year experimental sequence according to soil cultivation variants in cereal units at the conversion to 1 ha. The applying of minimization elements at soil cultivation issues from the principle that the traditional tillage soil cultivation on one hand and the limited soil cultivation including seeding into uncultivated soil on the other hand is not self-contradictory in the soil management system of an agriculture company but, on the contrary, complementing each other. This is the only way to use the agrotechnical strengths of both of the systems st the synchronous limitation interference into production and achieving a significant economic gains at plant production. [References: 8].

1197 Dencic, S.; Kastori, R.; Kobiljski, B.; Duggan, B. (2000) **Evaluation of grain yield and its components in wheat cultivars and landraces under near optimal and drought conditions.** *Euphytica. 113(1):43-52.* English. [Inst field & Vegetable Crops M Gorkog 30 YU-21000 Novi Sad Yugoslavia].

In a 2-years experiment, 30 wheat cultivars and 21 landraces from different countries were tested under near optimum and drought stress conditions. Plant height, number of sterile spikelets per spike, number of spikelets per spike, number of kernels per spike, kernel weight per spike, 1000 kernel weight and grain yield were evaluated. The number of kernels per spike, 1000 kernel weight and especially yield were more sensitive to drought stress in the cultivars than plant height and number of spikelets per spike, while in the landraces these traits did not differ under drought stress compared to near optimum conditions. The average yield of cultivars was significantly better than the average yield of landraces under near optimum as well as drought stress conditions. Path coefficient analysis showed that for cultivars under near optimum conditions there was no significant direct association of any of the analysed characters with yield, while under drought stress conditions, number of kernels per spike had a significant positive direct effect. Under drought stress conditions, the number of sterile spikelets displayed a negative direct effect, while kernel weight per spike had a positive direct effect on yield. Hierarchical cluster analysis was used as a tool to classify cultivars and landraces according to their yield ability under near optimum and drought stress conditions. Among the cultivars, two groups out of five and among one of three in the landraces were characterised by high yields in both near optimum as well as under drought stress conditions. These genotypes may serve as sources of germplasm for breeding for drought tolerance. [References: 24].

1198 DePauw, RM.; Clarke, JM.; Knox, RE.; Fernandez, MR.; McCaig, TN.; McLeod, JG. (2000) **AC Abbey hard red spring wheat.** *Canadian Journal of Plant Science. 80(1):123-127.* English. [Agr & Agri Food Canada, Semiarid Prairie Agr Res Ctr POB 1030 Swift Current SK S9H 3X2 Canada].

AC Abbey, hard red spring wheat (Triticum aestivum L.), is adapted to the Canadian prairies. It is significantly shorter than any of the check cultivars and has solid stems. AC Abbey expressed higher grain yield, earlier maturity, and heavier kernels than AC Eatonia, the solidstem check cultivar. It is resistant to the wheat stem sawfly (Cephus cinctus Nort.) and to prevalent races of common bunt and has moderate resistance to leaf rust and stem rust. AC Abbey is eligible for grades of Canada Western Red Spring wheat. [References: 11].

1199 Dizdaroglu, T. (Aegean Agricultural Research Inst., Menemen, Izmir (Turkey)) (1996) **Production cost and input usage of vetch+barley mixtures in Izmir.** Turkiye 3. Cayir-Mera ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996. *3. Meadow-Pasture and Fodder Congress in Turkey. Sagsoz, S.; Serin, Y.; Gokkus, A.; Comakli, B.; Tan, M.; Sengul, S.; Koc, A. (Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey) 822 p. p. 348-354.* Ataturk University. 5 tables; 11 ref. Turkish. (AGRIS 2000-022608).

The objective of this study was to examine the changes of current and real production costs and cost items of vetch+barley mixture production in the period of 1991-1993 in Izmir province. The data collected with questionnaire forms from 30 farmers, were grouped in different characteristics, and analyzed with percentage, mean, index and graphs.

1200 Dizdaroglu, T.; Balkan, C. (Aegean Agricultural Research Inst., Menemen, Izmir (Turkey)) (1995) **Production costs of vetch-barley mixture in the counties of Izmir province where the intensive production is made.** General Directorate of Agricultural Research,

Ankara (Turkey). Aegean Agricultural Research Institute. 8 tables; 1 graph.; 18 ref. 34 p. Turkish. (AGRIS 2000-015764).

The aim of this research was to examine the changes of current and real production costs and cost items of vetch+barley mixture production. The study was carried out in Tire, Torbali, Bayindir, Bergama and Urla counties providing 58 % or more of vetch+barley mixture production of Izmir province, between the years of 1991 and 1993.

1201 Giordani, G. (Bologna Univ. (Italy). Dipartimento di Agronomia); Assirelli, A.; Guidotti, R. (Federazione Emilia Romagna Imprese Agromeccaniche (FERIA), Bologna (Italy)) (1992) **[The sowing [Triticum aestivum L. - Triticum durum Desf.]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 27-31.* 1 table. Italian. (AGRIS 2000-015742).

1202 Han Limei; Zou Yongjiu; Wang Shuqi (University of Agriculture and Animal Science of the PLA, Changchun (China). Dept. of Agronomy) (1998) **Influence of water stress and fertilizer application on the economic characters and yield of wheat.** *Jilin Agricultural Sciences (China). Jilin Nongye Kexue (China) (no. 2) p. 19-22.* 3 tables; 3 ref. Chinese. (AGRIS 2000-015642).

1203 Hill, HSJ.; Park, J.; Mjelde, JW.; Rosenthal, W.; Love, HA.; Fuller, SW. (2000) **Comparing the value of Southern Oscillation Index-based climate forecast methods for Canadian and US wheat producers.** *Agricultural & Forest Meteorology. 100(4):261-272.* English. [Texas A&M Univ, Dept Agr Econ College Stn, TX 77843 USA].

Southern Oscillation Index (SOI) based forecasting methods are compared to determine which method is more valuable to Canadian and US wheat producers. Using decision theory approach to valuing information, the more commonly used three-phase method of El Nino, La Nina, and other is compared to a five-phase system. Because of differences in growing season and yearly SOI classification schemes, two different three-phase methods are used. The five-phase system is based on the level and rate of change of the SOI over a 2 month period. Phases are consistently negative, consistently positive, rapidly falling, rapidly rising, and near zero. As expected, results vary by the method used, Winter wheat producers in Illinois place no value on either of the SOI-based forecasting systems. Producers at seven of the 13 sites prefer the five-phase method over either of the three-phase method (spring wheat producers in Manitoba, Alberta, North Dakota and South Dakota, along with winter wheat producers in Oklahoma, Texas, and Washington). The value of the five-phase approach is up to 70 times more valuable than the three-phase approach. Producers growing spring wheal in Saskatchewan and Montana, along with winter wheat producers in Ohio and Kansas value the three-phase approach more than the five-phase. In this case, the value of the three-phase system is up to two times more valuable than the five-phase system. Depending on expected price and region, the values of the SOI-based forecasts range from 0 to 22% of the value of perfect forecasts. In both absolute and percentage of perfect forecasts, producers in Oklahoma, Texas, Manitoba, Saskatchewan, and South Dakota value either system more than producers in thr remaining regions. Economic value and distributional aspects of the value of climate forecasts have implications for producers, policy makers, and meteorologists. Finally, the results clearly suggest all producers will not prefer one forecast type. Forecasts need to be tailored to specific regions. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 29].

1204 Ho, KM.; Seaman, WL.; Choo, TM.; Martin, RA.; Rowsell, J.; Guillemette, L.; Dion, Y.; Rioux, S. (2000) **AC Legend barley.** *Canadian Journal of Plant Science. 80(1):113-115.* English. [Agr & Agri Food Canada, Res Branch, Eastern Cereal & Oilseed Res Ctr Ottawa ON K1A 0C6 Canada].

AC Legend is a six-rowed spring feed barley (Hordeum vulgare L.) cultivar bred at the Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, and evaluated by the Easter Canada Barley Breeding Group. It was selected from a Chapais/CIMMYT-6 cross and is suitable for growing in eastern Canada, where it out-yielded the check cultivars AC Stephen, Chapais, Myriam, ACCA and AC Westech. AC Legend is resistant to scald. [References].

1205 Hubik, K. (Zemedelsky Vyzkumny Ustav, Kromeriz (Czech Republic)); Novotny, F.; Marecek, J.; Sychra, L. (1999) **Technological quality of baking wheat and possibilities of its influencing.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 244-250.* Mendelova Zemedelska a Lesnicka Univ. 4 graphs, 1 table; 8 ref. Czech. (AGRIS 2000-015751).

1206 Hummadi, K. B.; Al Khafaji, A.A. ; Sliem, T.S.(IPA Agricultural R. Center, Baghdad (Iraq)). (1997) **Effect of zinc application on the yield of wheat and rice grown on calcareo us.** *Mij"alat IPA lil-abh"a:t" al-zira:3iyah. IPA J. of Agricultural research. v. 7 (no.2) p. 215-225.* Arabic. (AGRIS 2000-015818).

Field experiments were conducted to study the effect of zinc application (soil and foliar application) on grain yield and yield components of wheat and rice grown on calcareous soils. Soil application levels for wheat were (0, 02, 40 kg zn/ha) and (0, 4. 8 kg zn/ha)for rice where as foliar application levels were 0.05 and 1.0g ZN S04/l for wheat and 0.5 Zn SO4/l applied once or twice during the reason for rice. Rusults showed that application of Zn significantly increased grain of wheat but not grain yield of rice compared to the control increases in wheat grain yield were 25. 12 and 30 -39.

1207 Jarman, RJ.; Niab, HJ. (1999) **A note on research in progress: A MAFF funded project to manage and rationalise variety reference collections in testing for Distinctness, Uniformity and Stability (DUS) using winter wheat Triticum aestivum Fiori et Paol. as the example species.** *Plant Varieties & Seeds. 12(3):221-223.* English. [Huntingdon Rd Cambridge CB3 0LE England].

Winter wheat varieties, drawn from the European Union's Common Catalogue, are being described and catalogued using morphological descriptors and electrophoresis profiles. The aim is to reduce the size of the reference collection grown in DUS tests. The project outline and progress to dale are presented. [References: 3].

1208 Kamboh, MA.; Oki, Y.; Adachi, T. (2000) **Effect of presowing seed treatments on germination and early seedling growth of wheat varieties under saline conditions.** *Soil Science & Plant Nutrition. 46(1):249-255.* English. [Okayama Univ, Grad Sch Nat Sci & Technol 2-5-1 Shikata Cho Okayama 7008530 Japan].

The effect of presowing wheat seed treatments was investigated for the salt-sensitive variety Blue Silver and relatively salt-tolerant variety PARI-73 at the germination and early seedling stages, Seeds were treated with distilled water (DW) or 10/50 mM KCl, KNO3, CaCl2, and Ca(NO3)(2) and then germinated in DW or 200 mM NaCl. Treatment with calcium (Ca) or potassium (K) did not lead to a significantly higher rate for final germination than the DW treatment. Ca salt treatments significantly improved shoot growth during the early seedling establishment stage in both varieties, especially in the salt-sensitive variety Blue Silver. There were significant differences in the Ca content of seeds after various presowing treatments. There were also significant differences between both varieties in the ion contents after seed treatment. However, these differences appeared to be related to the improvement of shoot growth during the early seedling establishment stage and not to the effectiveness of presowing seed treatments in increasing germination. [References: 6].

1209 Kari, A. (Agricultural Res. Inst., Nicosia (Cyprus)) (1999) **Management of barley straw and stubble under rainfed conditions.** *Technical Bulletin (Cyprus); no. 201 8 p.* 5 tables; 14 ref. English. (AGRIS 2000-022469).

Two methods of managing barley straw and stubble, remaining on field surface after harvesting, and their effect on disease severity of foliar diseases and agronomic characters on the following barley crop were compared at two sites in four years. The methods used were either burning or burying barley straw and stubble. Management method had no effect on the degree of disease severity of the foliar diseases net blotch, scald and powdery mildew on the following

barley crop. No differences were obtained between the cultivars used either in disease severity or agronomic characters. Differences among years in disease severity and green leaf area were mainly attributed to the amount of moisture and temperatures prevailing in each year and site. Differences in grain yield and 1000-grain weight were attributed to moisture stress of plants during the filling period, particularly in the 1996/97 season. The view that the disease development of barley foliar diseases is enhanced by the amount of the accumulated straw and stubble remaining on the field surface after harvesting, which is true in others environments, was not substantiated under the rainfed conditions of this trial. Little evidence was found to suggest that one of the two methods tested is better under rainfed conditions.

1210 Krasowicz, S. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Systems and Economics of Crop Production) (1999) **Cereal grain production in Poland and EU countries. 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999.** *Pamietnik Pulawski (Poland) (no.114) p. 185-200.* 11 tables; 12 ref. Polish. (AGRIS 2000-015744).

The comparison of cereal grain production in Poland and EU countries is the aim of this paper. Statistical data, reports and expertises referring to cereal grain production were used in order to make the analysis. The area, yields and production of cereals that are cultivated in Poland were compared with data referring to selected EU countries. The criterion for selection was a significant position a given country is taken up in a world cereal grain production. It was stated that two times lower than in EU countries grain yields are achieved in Poland.

1211 Kurzo, B.V.; Tsechanovich, Yu.V. (Inst. of Problem of Nature Resources Using and Ecology, Minsk (Belarus)); Shaydak, L. (Research Agricultural and Forestry Centre, Poznan (Poland)); Ochkovskaya, L.V. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Ecological problems of sapropel application in Belarus Polesye].** Inst. of Problem of Nature Resources Using and Ecology, Minsk (Belarus). *Mezhdunarodnyj agrarnyj zhurnal (Belarus) (no.7) p. 29-30.* Russian. (AGRIS 2000-015631).

Parameters of sapropel resources ability (on typological composition) in Belarus Polesye have been adduced. Their favourable effect onthe yield and the quality of agricultural products (potato, barley) has been described.

1212 Kus, J. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Systems and Economics of Crop Production) (1999) **Organizational conditions of cereal grain production. 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999.** *Pamietnik Pulawski (Poland) (no.114) p. 201-219.* 1 fig., 6 tables; 13 ref. Polish. (AGRIS 2000-015745).

In Poland organizational factors influence cereal yielding more so than natural and agricultural factors. Distinct, regional differentiation in cereal production and yielding is observed. The commercial production of cereals is concentrated in the north and west part of Poland. Just on this area largest average size of a farm is noted. In agricultural practise the big share of cereal in cropping system decrease mainly their yields. In many rural communes more than 80 percent of arable lands are sown with cereal.

1213 Kwiatkowski, J.; Tworkowski, J.; Szczukowski, S. (University of Agriculture and Technology, Olsztyn (Poland). Dept. of Plant Breeding and Seed Production) (1999) **Yield and seed value of ten generations of winter wheat. 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999.** *Pamietnik Pulawski (Poland) (no.114) p. 221-226.* 4 tables; 16 ref. Polish. (AGRIS 2000-015746).

The reproduction of sowing material of winter wheat cultivar Emika during ten years was performed. The significant yield reduction and decrease of seed sowing value were not found during ten years of reproduction of winter wheat. Maintaing appropriate agricultural practise and precisely clearing of harvested seeds caused that the yield was stable and the yield decline was not observed.

1214 Laml, P. (Hybritech, Kromeriz (Czech Republic)) (1999) **Effect of the conditions of the year and environment on quality parameters of winter wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 270-273.* Mendelova Zemedelska a Lesnicka Univ. 3 tables. Czech. (AGRIS 2000-015752).

1215 Lapa, V.V.; Bosak, V.N.; Germanovich, T.M.; Trofimova, T.P.; Malej, E.S. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Formation of winter wheat yield depending on nitrogen regime conditions of soils].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 96-104.* BRISSA. 6 tables; 3 ref. Russian. (AGRIS 2000-015739).

In field experiences was found that maximum winter wheat yield 52, 3 c/ha on high cultivated sod-podzolic light loamy soil is formed at the application of N60 in spring at the beginning of plant vegetation on the background P60 K90 and after effect of 20 t/ha manure. Coefficient of nitrogen using from mineral fertilizers on this variant amounted to 53%. Content of nitrogen forms in soil (potential assimilable, ammonium, nitrate) depends in considerable measure on the level of nitrogen fertilizer application and plant development stage. Ammonium nitrogen forms take more stable part in nutrition of winter wheat plants. Nitrate nitrogen is more active in plant nutrition in the first growth and development stages.

1216 Lehotska, Z.; Klimekova, M. (1999) **Testing of convenience of spring barley varieties for ecological cultivation.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 23-30.* Vyskumny Ustav Rastlinnej Vyroby. 3 tables; 11 ref. Slovak. (AGRIS 2000-022442).

The aim of a field trial realised in the years from 1996 to 1998 in the purpose - made farm of Research Institute of Plant Production in Borovce was to test the convenience of 6 varieties of spring barley grown for ecological cultivation. In the experiment with 4-strip-of field sowing process (pea, winter wheat, potatoes, spring barley) these varieties were used: Tolar, Stabil, Akcent, Sladko, Orbit, Kompakt. The field trial was established in the year of 1996 by a block method with randomisation in four replications. Each small plot had size of 8m x 1.25 m and total small plot size was 10 square m. Sowing was done with a small-plot seed drill Ojord, the seed used was not chemically treated and the stand was not protected against diseases and pests with synthetically produced agrochemicals. Weed protection was only realized by harrowing. The seed rate was 4.5 million germinable seeds. The harvest was collected with a small-plot harvester Wintersteiger. In the trial the following parameters were monitored: emergence rate, spike number per square m, number of grains per spike, TGW, main product yield and technological quality (crude protein content and malt extract). The grain yield of the tested varieties was compared between each other and with average yields in the monitored years and in the three-year period. Statistical significance of differences between the yields was stated by variance analysis with testing differences according to Tukey. During the three-year trial period we recorded the average field emergence rate of 77.3% in existing ecological conditions. In the years of the trial (1996, 1997, 19998) we reached the field emergence rate of 65.11; 74.89 and 92%. As for individual tested varieties, the highest field emergence of rate was found with the Kompakt variety (357 plants, which represents difference in comparison with the average by 2.6%), the lowest rate with the Sladko variety (342 plants, which represents decrease by 1.7% in comparison with the average). These are average results obtain in the three-year trial period. There were 705 spikes in square m, 21 grains per spike and 1000-grain weight (TGW) was 44.45 g on average for all years and varieties in the trial. The highest average number of spikes in 1 square m appeared with the Akcent variety (732 spikes in 1 square m, which represents 103.8% in comparison with the average value), Tolar and Stabil varieties had both the highest average number of grains in a spike (22 grains in a spike, that represents 5% - increase in comparison with the average value), and Kompakt variety had the highest TGW in the experiment (45.30 g, which represents 101.91% in comparison with the average TGW value). Variance of

analysis showed that the variability of fertility elements in the trial was highly - significantly influenced by varieties and interaction of variety x years and statistically significant differences in spike number and TGW were between the years. Stabil appeared as the most fertile variety (6.06 t/ha). It reached 103.95% in comparison with the average grain yield of six varieties. The differences in grain yield were highly - significant in years, differences among the varieties were not significant. At evaluation of qualitative traits on average for three-year testing period the best quality appeared with the Stabil and Kompakt varieties. The year as a whole was the most significant factor at forming the basic qualitative parameters of the technologic value of tested varieties of spring barley. On the basis of our results we recommend to choose the Stabil variety for requirements of alternative agriculture in this special land -climatic conditions. At its evaluation we scored balanced and stable results. Orbit also had good results, however, it reached lower average grain yield (1.5% less than Stabil variety).

1217 Leszczynska, D. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Crops Cultivation) (1999) **Effect of agricultural factors on the yield of the tree-cereal mixture.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 233-239.* 3 tables; 7 ref. Polish. (AGRIS 2000-015581).

The aim of the study was to determine effects of seeding rate and seeding date on the yield of the tree-cereals mixture (at different participation of components) in 1993-95. The experiment was located on very good and good rye soils. The highest yield gave the mixture with the highest participation of barley (50 percent barley + 25 oat + 25 wheat) in seeding lot. Delaying the seeding date decreased grain yield of mixtures. The barley-oat-wheat mixture can be recommended for very good rye soils. The best proportions of invividual components in seed lot are 2:1:1 and 1:1:1.

1218 Liang Xuelian; Yang Wenyu (Sichuan Agricultural Univ., Yaan (China). Coll. of Agriculture) (1998) **The effects of S3307 applied to seeds on morphology and nutrition in winter wheat.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 16(4) p. 403-406.* 4 tables; 5 ref. Chinese. (AGRIS 2000-015741).

1219 Liang Xuelian; Yang Wenyu (Sichuan Agricultural Univ., Yaan (China). Coll. of Agriculture) (1998) **The effects of S3307 applied to seeds under different sowing dates on growth and development stage in winter wheat.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 16(4) p. 398-402.* 2 tables; 7 ref. Chinese. (AGRIS 2000-015740).

1220 Miller, PR. (2000) **Effect of varying seeding date on crop development, yield and yield components in canaryseed.** *Canadian Journal of Plant Science. 80(1):83-86.* English. [Montana State Univ, Dept Land Resources & Environm Sci POB 173120 Bozeman, MT 59717 USA].

The effects of varying seeding date on crop development, yield and yield components in canaryseed (Phalaris canariensis L.) have not been previously reported. In 1996 and 1997, a seeding date study was conducted at Swift Current, SK, which included barley (Hordeum vulgare L.), canaryseed and wheat (Triticum aestivum L.) sown at three dates in separate tilled fallow and untilled wheat stubble sites. Terminal summer drought occurred in both years of this experiment. Cumulative degree days (DD0) to reach maturity did not differ significantly among seeding dares for barley, or for wheat in 1997, while cumulative degree days to reach maturity decreased by 60 DD0 with delayed seeding for wheat in 1996. In contrast, cumulative degree days to reach maturity in canaryseed increased by 70 DD0 in 1996 and by 90 DD0 in 1997 with delayed seeding. Delaying seeding from the early to the late date decreased canaryseed yield by 29%, while barley and wheat yields decreased only 14 and 11%, respectively. Panicle density in canaryseed was reduced 24% between the early and late seeding dates, while barley and wheat spike densities were reduced only 2 and 6%, respectively. The large yield reduction in canaryseed was likely due to slowed crop development with delayed seeding, which intensified late-season drought stress. The slowed crop development with delay in seeding date in canaryseed may be due to vernalization requirement in this crop. In the semiarid prairie region, canaryseed should be seeded early to maintain a rapid crop development rate to minimize yield loss due to drought stress. [References: 10].

1221 Mishra, AK.; Tiwari, RC. (1999) **Effect of seeding method and fertilizer application on weed biomass and yield of wheat (Triticum aestivum).** *Indian Journal of Agronomy. 44(2):353-356.* English. [Banaras Hindu Univ, Dept Soil Sci & Agr Chem Varanasi 221005 Uttar Pradesh India].

A field experiment was conducted on sandy loam soil analysing low in N and medium in P and K during rabi season of 1993-94 and 1994-95 at Varanasi to evaluate the effect of different methods of sowing and fertilizer application in wheat (Triticum aestivum L. emend. Fiori & Paol.). Line sowing and placement of fertilizer in rows 5 cm below the seed showed significant reduction in weed biomass and increased the yield of wheat over broadcast sowing and fertilizer application. Seed emergence was markedly reduced when fertilizer and seed were mixed and then sown in rows. The root weight of plants grown with broadcast sowing was lower than of row sown crop. The row sowing of seed and placement of fertilizer in rows or broadcast of fertilizer but sowing of seed in rows removed higher amount of N, P and K than broadcast of seed and fertilizers. [References: 6].

1222 Nandal, DP.; Rana, P.; Kumar, A. (1999) **Growth and yield of wheat (Triticum aestivum) under different tree spacings of Dalbergia sissoo based agrisilviculture.** *Indian Journal of Agronomy. 44(2):256-260.* English. [CCS Haryana Agr Univ, Dept Forestry Hisar 125004 Haryana India].

A field experiment was conducted during the winter seasons of 1994-95 and 1995-96 to find out the response of five wheat (Triticum aestivum L,) varieties to two spacings of Dalbergia sissoo Roxb. in an agrisilviculture system. Both the tree canopies of 5 x 5 m spacing and 10 x 10 m spacings of D. sissoo had adverse effect on plant dry matter production, leaf area index, earheads/m and grains/earhead of intercropped wheat, resulting in 71 per cent decrease in wheat yield under 5 x 5 m spacing and 24 per cent under 10 x 10 m spacing as compared to control (without trees) field. Among the wheat varieties, WH 533 and WH 542 showed greater tolerance to shade and their yield did not differ significantly from control when intercropped with 10 x 10 m spacing of D. sissoo. [References: 6].

1223 Obolevica, D. (Latvian Univ. of Agriculture, Jelgava (Latvia). Faculty of Agriculture. Dept. of Plant Production) (1999) **[The influence of different agrochemicals on winter wheat growing dynamics].** Zinatnes nakotne musu rokas. Jelgava (Latvia). 26-28 May 1999. *[The future of science is in our hands. Conference papers of the candidates for the doctor's degree]. Latvian Univ. of Agriculture, Jelgava (Latvia) 290 p. p. 41-45.* Latvian University of Agriculture. 3 ill., 4 ref. Latvian. (AGRIS 2000-015802).

The objective of the research was to determine the influence of different agrochemicals (fungicides, herbicides, nitrogen and retardant) on changes in winter wheat growing process during 24 hours (daynight) as well as on the development of vegetation stages. Field trials were carried out at the Research Station of Latvia University of Agriculture in 1997. The dynamics of wheat growing was determined by means of auxsographs. It was established that the most intensive growing proceeded in the morning (9-12 a.m.) and afternoon (3-6 p.m.). At night and at midday the intensity of growing decreased. The use of agrochemicals increased the period and the intensity of growing.

1224 Ozgen, M.; Erac, A.; Altinok, S.; Ulukan, H. (Ankara Univ., Faculty of Agriculture, Ankara (Turkey). Div. of Field Crops) (1996) **The effect of cutting on grain yield of winter wheat and barley in tillering stage under Ankara conditions.** Turkiye 3. Cayir-Mer'a ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996. *3. Meadow-Pasture and Fodder Congress in Turkey. Sagsoz, S.; Serin, Y.; Gokkus, A.; Comakli, B.; Tan, M.; Sengul, S.; Koc, A. (Ataturk Univ., Faculty of*

Agriculture, Erzurum (Turkey). Div. of Field Crops). Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey) 822 p. p. 448-456. Ataturk University. 8 tables; 11 ref. Turkish. (AGRIS 2000-022597).

This research is carried out at the experimental field of Agronomy Department of Agricultural Faculty, Ankara university in 1994 and 1995, wheat cv. Gerek 79 and Bezostaja 1, and barley cv. Tokak 157/37 and st. H_510 were used. The cut was done half of each plot, when the winter seeded plants were reached 30 cm.

1225 Rudnicki, F.; Wasilewski, P.; Jaskulski, D.; Kotwica, K. (Akademia Techniczno Rolnicza, Bydgoszcz (Poland). Wydzial Rolniczy)) (1999) **Impact of sowing date, nitrogen fertilisation and rainfall spring triticale grain yield.** *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland) (no.44) p. 257-263.* 6 tables; 12 ref. Polish. (AGRIS 2000-022596).

The total impact of the sowing date, nitrogen fertilization and rainfall on the grain yield of spring triticale was studied with the results obtained from ten-year experiments. There was observed a total impact of these factors on the yield and grain yield components. It was found that the later the sowing date and the higher nitrogen fertilization dose, the more important the sufficient rainfall. The yield loss due to a delayed sowing date was high under dry conditions and at high nitrogen doses, while such loss was inconsiderable under opposite conditions. The highest yield was observed for the fertilization dose ranging from 65 to 105 kg N/ha. The fertilization dose exceeding 65 kg N per ha was justifiable only at early sowing and the rainfall not lower than 180 mm from April to July.

1226 Rukshan, L.V. (Mogilev Technological Inst., Mogilev (Belarus)) (1999) **[Features of wheat grain drying].** Mogilev Technological Inst., Mogilev (Belarus). *Mezhdunarodnyj agrarnyj zhurnal (Belarus) (no.6) p. 55-57.* 4 tables; 3 ref. Russian. (AGRIS 2000-015804).

Process of drying various sorts of wheat grown in Belarus has been studied. The sort effect on the drying condition choice has been found out.

1227 Setie Agmas; Yigzaw Desalegh; Mulu mengest (Adet Research Center (Ethiopia)) (1998) **Production status limitation and research achievements of barley, maize and finger millet in Northwestern Ethiopia.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 27-39.* EARO. 2 tables. English. (AGRIS 2000-015486).

1228 Singh, AK.; Pandey, K.; Singh, SS.; Thakur, SS. (1999) **Agronomic management for maximizing the productivity of late sown wheat (Triticum aestivum).** *Indian Journal of Agronomy. 44(2):357-360.* English. [Project Directorate Cropping Syst Res Modipuram 250110 Uttar Pradesh India].

An experiment was carried out at Pusa during winter seasons of 1994-95 and 1995-96 for yield maximization of late sown wheat (Triticum aestivum L.). Furrow mulching with 10 t/ha FYM application produced significantly higher yield (27.94) q/ha) than control (23.50) q/ha). Amongst the inorganic treatments, 150 : 75 : 50 kg N : P2O5 : K2O/ha and 125 : 60 : 40 N : P2O5.

1229 Singh, D.; Rana, DS.; Pandey, RN.; Kumar, K. (1999) **Response of fertilizers in maize (Zea mays)-wheat (Triticum aestivum)-cowpea (Vigna unguiculata) cropping system.** *Indian Journal of Agronomy. 44(2):242-245.* English. [Indian Agr Res Inst, Div Agr Chem & Soil Sci New Delhi 110012 India].

A field experiment was conducted for 3 years on a Typic Ustochrept of Delhi under the All-India Co-ordinated Research Project on Long-Term Fertilizer Experiments with different fertilizer combinations following maize (Zea mays L.)-wheat (Triticum aestivum L. emend. Fiori & Paol.)- cowpea [Vigna unguiculata (L.) Walp.] (fodder) sequence. Soil-test based 100% optimum recommended dose of 120, 60 and 40 kg/ha N, P2O5 and K2O for wheat and maize and 20, 40 and 20 kg/ha for cowpea showed significantly higher grain and straw or stover yields of both grain crops as well as the dry-fodder yield of cowpea during all the 3 years than unfertilized plots. Use of N or NP alone yielded quite low, comparable to 50% of the recommended dose. NPK + FYM gave as high yield of maize as the superoptimal dose of 150% and consistently higher yield of wheat grain. Use of S or Zn or hand-weeding showed no yield advantage. The FYM treatment maintained high level of fodder yield of cowpea. [References: 4].

1230 Singh, RP.; Mundra, MC.; Gupta, SC.; Agarwal, SK. (1999) **Effect of integrated nutrient management on productivity of pearlmillet (Pennisetum glaucum)-wheat (Triticum aestivum) cropping system.** *Indian Journal of Agronomy. 44(2):250-255.* English. [CCS Haryana Agr Univ, Dept Agron Hisar 125004 Haryana India].

In a field experiment conducted at Hisar from 1984-85 to 1996-97, integration of chemical fertilizers and organic manures in the form of FYM or green manure in the ratio of 50:50 or 75:25 applied in pearlmillet (Pennisetum glaucum L.) and followed by 100% recommended dose of fertilizer in wheat (Triticum aestivum L. emend Fiori & Paol) crop gave the yield at par to that of when 100% recommended dose of fertilizers was applied to both the crops of the sequence. These treatments were significantly better than control and farmer's practice. The 4.63-43.27% and 35.27-47.18% higher yields were obtained in pearlmillet-wheat respectively over farmer's practices. in general, the NPK status decreased successively after harvesting of both the crops of the sequence due to removal of nutrients in large quantity by the crops. After more than one decade of experimentation at permanent site the nutrient status of soil under control and lower doses of fertilizer application declined to a much higher degree as compared to the application of either 100% recommended dose of chemical fertilizers or combination of organic and inorganic fertilizers. [References: 5].

1231 Smagacz, J. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Systems and Economics of Crop Production) (1999) **Value triticale in conditions of considerable share of cereals in a cropping system.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 325-334.* 3 tables; 32 ref. Polish. (AGRIS 2000-015736).

The results that are presented in this paper confirm a big productive potential of triticale. It was started that on very good rye soils this cereal is competitive in relation to other cereals, especially to spring barley and rye. In conditions of worse soils its competition to other cereal in smaller. However due to high feed value of triticale grain, in the crop rotations with big share of rye, the latter should be replaced just by triticale. The reason is that especially in conditions of light soils rye very often for many years is cultivated after itself.

1232 Sowinski, J.; Hryncewicz, Z.; Kozak, M. (Agricultural University, Wroclaw (Poland). Dept. of Detailed Plant Cultivation) (1999) **Differences of cereals technology in mountains conditions based on selected farms.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 335-341.* 6 tables; 8 ref. Polish. (AGRIS 2000-015748).

The dates from more than 200 good farms from Sudety Mountains were used for analysis of agricultural production on difficult environmental and economical conditions. The main purpose of this research was effect of some agrotechnical treatments on the grain yield. Analysis included value of forecrops, sowing dates, sowing rate, NPK fertilization level and pesticide doses. The all dates from farms were divided by altitude zones on three groups: below 400, 400-500 m and 500 m above sea level. The grain yield decreased on the highest altitude zone.

1233 Soya, H.; Avcioglu, R.; Geren, H. (Ege Univ., Faculty of Agriculture, Izmir (Turkey). Div. of Field Crops) (1996) **Effect of barley (Hordeum vulgare L.) as nurse crop and rate of mixtures and row spacing on the seed yield and yield characteristics of common vetch (Vicia sativa L.).** Turkiye 3. Cayir-Mera ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996. 3. *Meadow-Pasture and Fodder Congress in Turkey. Sagsoz, S.; Serin, Y.; Gokkus, A.; Comakli, B.; Tan, M.; Sengul, S.; Koc, A. (Ataturk Univ., Faculty of Agriculture,*

Erzurum (Turkey) 822 p. p. 328-333. Ataturk University. 2 tables; 11 ref. Turkish. (AGRIS 2000-022617).

Effect of row spacing (20-40-60 cm) and rate of barley in mixtures (0-15-30-45%) on the seed yield of common vetch were investigated in this study conducted in the ecological conditions of Bornova-Izmir during the growing period of November-June in 1989-1990 and 1990-1991.

1234 Tadese Desalegn (Adet Research Center (Ethiopia)) (1998) **Production limitations and research achievements of tef and wheat in Northwestern Ethiopia.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 52-56.* EARO. 3 tables. English. (AGRIS 2000-015523).

1235 Tan, M.; Serin, Y. (Ataturk Univ., Faculty of Agricluture, Erzurum (Turkey). Div. of Field Crops) (1996) **The effects of mixture rates and cutting dates on the macro nutrient compositions in vetch+cereal mixtures.** Turkiye 3. Cayir-Mera ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996. *3. Meadow-Pasture and Fodder Congress in Turkey. Sagsoz, S.; Serin, Y.; Gokkus, A.; Comakli, B.; Tan, M.; Sengul, S.; Koc, A. (Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey). Div. of Field Crops). Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey) 822 p. p. 308-315.* Ataturk University. 5 tables; 9 ref. Turkish. (AGRIS 2000-022607).

1236 Tosi, L. (1998) **[Sod seeding. A profitable choice [wheat - rapeseed]].** *Terra e Vita (Italy) v. 39(30) p. 26-29.* 2 tables; 1 graph. Italian. (AGRIS 2000-015738).

1237 Tripathi, SC.; Nagarajan, S.; Chauhan, DS. (1999) **Evaluation of zero tillage in wheat (Triticum aestivum) under different methods of rice (Oryza sativa) transplanting.** *Indian Journal of Agronomy. 44(2):219-222.* English. [Directorate Wheat Res Karnal 132001 Haryana India].

A two-year study was carried out at Karnal to compare the performance of zero tillage in wheat [Triticum aestivum (L.) emend. Fiori & Paol.] under different methods of rice (Oryza sativa L.) transplanting viz. broadcast in puddled condition, transplanting, and dry seeding. Transplanting of rice (Pusa basmati-370) recorded 14% higher yield as compared to dry seeding of rice in kharif season. In wheat ('UP 2338'), zero and conventional tillage recorded comparable yield irrespective of different rice seeding/transplanting methods. Zero tillage under dry seeding of rice gave significantly higher yield (49.6 q/ha) than conventionally tilled plot of transplanted rice (43.3 q/ha). The study reveals that zero tillage in dry seeding of rice was similar to that of puddled rice but better than conventional tillage. Zero tillage saved more than 16% cost of cultivation. Even total tonnage of rice and wheat in dry seeded and transplanted condition was similar. [References: 3].

1238 Wang Yulong; Wei Chengxi; Peng Shuyu (Guizhou Univ., Guiyang (China). Coll. of Agronomy) (1999) **Research on density of planting and fertilizing constant for wheat in Dafang area [China].** *Journal of Mountain Agriculture and Biology (China). Shandi Nongye Shengwu Xuebao (China) v. 18(1) p. 1-7.* 8 tables; 5 ref. Chinese. (AGRIS 2000-015749).

1239 Wesolowski, M.; Kwiatkowski, C. (Agricultural University, Lublin (Poland). Dept. of Soil and Plant General Cultivation) (1999) **Productivity of spring barley intercultivar mixtures in crop rotation and monoculture.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 357-363.* 5 tables; 15 ref. Polish. (AGRIS 2000-015582).

The yielding and canopy weed infestation of spring barley three cultivars sowing as pure stand or mixtures in crop rotation and monoculture were presented in the paper. An field experiment was carried out on loessal soil at central part of Lublin region. The significant decrease of spring barley grain yield under four-year monoculture was proved. It was due to decline of value of the yield structure components, as well as the increase of the weedy state.

1240 Whitbread, AM.; Blair, GJ.; Lefroy, RDB. (2000) **Managing legume leys, residues and fertilisers to enhance the sustainability of wheat cropping systems in Australia 1. The effects on wheat yields and nutrient balances.** *Soil & Tillage Research. 54(1-2):63-75.* English. [CSIRO, Trop Agr POB 102 Toowoomba Qld 4350 Australia].

Farming activities practiced on many Australian soils have resulted in substantial losses of soil organic matter (SOM), nutrient loss, soil structural degradation and declines in cereal yield and quality. Field trials, consisting of a legume or fallow phase followed by three wheat (Triticum aestivum L.) crops, were established on a degraded Ferric Luvisol (Red Earth) soil in New South Wales to investigate the effect of crop residue and fertiliser management on wheat yield and nutrient balances. There were no effects of a chickpea (Cicer arietinum L. cv Amethyst), barrel medic (Medicago truncatula L. cv Sephi), or fallow phase on the grain yields of three subsequent wheat crops. Grain yield was depressed by 12% following a lucerne (Medicago sativa L. cv Trifecta) crop from which the plant residues had been removed, relative to when residues were returned or grazed. Consecutively, higher wheat grain yield losses of 7.4 and 8.6% in 1994 and 1995 were found on treatments from which wheat stubble was annually removed from the system. Grain yield losses of 6, 7 and 13% in three consecutive wheat crops were found where no fertiliser was applied at sowing. Nutrient balances, based on inputs of nutrients in fertilisers and residues, and the export of nutrients in grain and crop residue were found to be useful in describing the flow of nutrients in a farming system and predicting possible soil nutrient depletion. Fallow systems provide no nutrient inputs and result in N losses of up to -189 kg ha(-1) over three wheat crops. The balance of nutrients such as potassium (K), which are contained in larger proportions in stubble, were found to be -102 kg ha(-1) on the wheat stubble removed treatments and +8 kg ha(-1) on the stubble retained treatments. Better recycling of crop residues and improving ley system to increase nutrient and C inputs have the potential to improve soil fertility and grain production. [References: 18].

1241 Whitbread, AM.; Blair, GJ.; Lefroy, RDB. (2000) **Managing legume leys, residues and fertilisers to enhance the sustainability of wheat cropping systems in Australia 2. Soil physical fertility and carbon.** *Soil & Tillage Research. 54(1-2):77-89.* English. [CSIRO, Trop Agr POB 102 Toowoomba Qld 4350 Australia].

Soil organic matter (SOM) is considered as a key indicator of sustainability, therefore measurements of SOM changes under various forms of management are needed for the development of sustainable systems. Because the measurement of total SOM is not sensitive enough to monitor short and medium term changes, techniques that measure meaningful fractions of SOM should be used. In this study both total carbon (CT) measured by combustion and labile carbon (CL) determined by oxidation with 333 mM potassium permanganate (KMnO4) were measured. Field trials, consisting of a legume phase followed by three wheat (Triticum aestivum L. cv. Janz) crops, were established on a degraded Ferric Luvisol (Red Earth) soil in New South Wales to investigate the effect of crop residue and fertiliser management on wheat yield, soil physical properties and SOM, Total and labile C increased following a lucerne (Medicago sativa L. cv. Trifecta) phase, however, chickpea (Cicer arietinum L. cv. Amethyst), barrel medic (Medicago truncatula L. cv. Sephi) and fallow leys resulted in no increases in soil C concentrations. During the wheat phase the concentration of CL significantly increased on the treatments with wheat stubble retention. This resulted in the C Management Index (CMI), an index comparing changes in labile and total C fractions relative to an uncropped reference soil, increasing from 19 to 27. The greatest treatment effect on soil physical properties was the retention of wheat stubble on the soil surface over the summer fallow period which increased hydraulic conductivity (K) by more than 65%, relative to the stubble removed treatment. Mean weight diameter (MWD) increased from 799 to 920 mu m and a significant relationship was found between hydraulic conductivity and water stable aggregates >500 mu m. Soil strength at 15 cm decreased from

2713 in the non-return to 2064 kPa in the stubble retained treatments with both treatments having a similar water content at the time of measurement. Although legume species are widely used as a rotation phase, their use in combination with cereal stubble retention is more likely to improve the overall fertility of the farming system. [References: 33].

1242 Yilmaz, S.; Gunel, E. (Mustafa Kemal Univ., Faculty of Agriculture, Hatay (Turkey). Div. of Field Crops) Saglamtimur, T. (Cukurova Univ., Faculty of Agriculture, Adana (Turkey). Div. of Field Crops) (1996) **A research to determination of the most suitable seeding rates and cutting times of common vetch (Vicia sativa L.) + barley (Hordeum vulgare L.) mixture under Hatay ecological condition.** *Turkiye 3. Cayir-Mera ve Yembitkileri Kongresi. Erzurum (Turkey). 17-19 Jun 1996.* Ataturk Univ., Faculty of Agriculture, Erzurum (Turkey). Ataturk University. 3 tables; 15 ref. p. 355-361. Turkish. (AGRIS 2000-022619).

The study was conducted to determine the most suitable seeding rates and cutting times of vetch+barley mixture at the farmers field in Amik Plain under Hatay ecological condition in 1994-1995 winter growing season. Field trials were arranged in split-plot design with three replication. The cultivars used were "Urem-79" common vetch, "Gem" barley.

1243 Zajac, T. (Agricultural University, Krakow (Poland). Dept. of Detailed Plant Cultivation) (1999) **Leaf area index and winter triticale yielding depending on selected forecrop.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 375-380.* 2 tables; 18 ref. Polish. (AGRIS 2000-015737).

The number and area of winter triticale culm leaves were investigated at the earning stage. The triticale was cultivated after nine forecrops. The evaluation included also leaf area index and photosynthetic active radiation used by the stand, as well as the amount and structure of grain yield. The amount of winter triticale grain yield was significantly depended on selected forecrop. Winter triticale grown on the site after field beans and spring rape producing the highest yields.

1244 Zarychta, M.; Noworolnik, K. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Crops Cultivation) (1999) **Variability of spring barley yielding in various edaphic conditions of fields.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 381-385.* 2 tables; 6 ref. Polish. (AGRIS 2000-015583).

The investigations were carried out on 63 spring barley fields (1.0-16.0 ha) in 1983-88. On each field, 6 trial plots representing edaphic condition of its parts were determinated. The grain yield components of barley on these plots were estimated. The relationships between grain yield and various edaphic factors of plantations were studied. The grain yield of barley depended mainly from soil quality and fertility (suitability of soils for barley) and magnesium content. The grain yield variation between 6 plots on plantation was very large (67-135 percent).

1245 Zelezna, A. (Ustav Zemedelskych a Potravinarskych Informaci, Prague (Czech Republic)) (1999) **Unconventional fodder plants (Review).** *Studijni Informace - Rostlinna Vyroba (Czech Republic); no. 1 no. 1.* Ustav Zemedelskych a Potravinarskych Informaci. 2 tables; 51 ref. Czech. (AGRIS 2000-015531).

F02 PLANT PROPAGATION

1246 Arzani, A.; Mirodjagh, SS. (1999) **Response of durum wheat cultivars to immature embryo culture, callus induction and in vitro salt stress.** *Plant Cell Tissue & Organ Culture. 58(1):67-72.* English. [Isfahan Univ Technol, Coll Agr Isfahan 84156 Iran].

Response of twenty eight cultivars of durum wheat (Triticum turgidum var. durum) to immature embryo culture, callus production and in vitro salt tolerance was evaluated. For assessment of cultivars to salt tolerance, growing morphogenic calli were exposed to different concentrations of NaCl (0, 0.3, 0.6, 0.9, 1.2, 1.5, 1.8 and 2.1% w/v) added to the culture medium during two subsequent subcultures (4 weeks each). Comparison of cultivars for callus induction from immature embryo was based on callus induction frequency and fresh weight growth of callus (FWG). While, for salt tolerance, the relative fresh weight growth (RFWG) and necrosis percent of callus were used. There were significant differences among cultivars for potential of regeneration from immature embryo, and `Shahivandi' a native durum wheat cultivar originating from western Iran was superior among the cultivars tested. The FWG distinguished cultivars more than callus induction frequency did for callus induction evaluation. Hence, a range of FWG from 1.23 to 14.65 g was observed in 'Mexical-75' and 'Omrabi-5' cultivars, respectively. Growing calli derived from cultivars 'PI 40100' and 'Dipper-6' showed superiority for tolerating salinity under in vitro conditions. [References: 29].

1247 Castillo, AM.; Valles, MP.; Cistue, L. (2000) **Comparison of anther and isolated microspore cultures in barley. Effects of culture density and regeneration medium.** *Euphytica. 113(1):1-8.* English. [CSIC, Dept Genet & Producc Vegetal, Estac Expt Aula Dei Apartado 202 E-50080 Zaragoza Spain].

A comparison of anther and microspore culture efficiency for green doubled haploid plant production was undertaken using 17 F-1 crosses with potential agronomic performance. Green doubled haploid plants were produced from all F-1 crosses by anther and microspore cultures, although there was a great variation among crosses. On average, anther culture resulted in a production of green plant twice that of isolated microspore culture (30 and 14 green plants/100 anthers, respectively). The effect of microspore culture density on green plant regeneration was studied with the cultivars Igri, Reinette and Hop which have a high, medium and low androgenic response. The highest number of dividing microspores was obtained at a density of 2.4 x 10(5) viable microspores/ml for the three cultivars. However, the optimal density for the percentage of embryos/dividing microspores and green plants/10(3) microspores depended on the cultivar. The highest number of green plants/10(3) microspores was produced at 1.2 x 10(5) viable microspores/ml for cv. Igri and 2.4 x 10(5) for cultivars Reinette and Hop. Percentage of green plants/total plants was raised when the culture density was increased up to 6.0 x 10(5) viable microspores/ml, especially for cv. Reinette. Six regeneration media differing in maltose concentration, organic nitrogen and type of auxin were assayed with embryos from cultivar Reinette. Media without organic nitrogen containing 31 g l(-1) maltose and the auxins IAA or NAA produced more vigorous green plants. [References: 34].

1248 Chand, S.; Sahrawat, AK. (2000) **Efficient plant regeneration from root callus tissues of barley (Hordeum vulgare L.).** *Journal of Plant Physiology. 156(3):401-407.* English. [Devi Ahilya Univ, Sch Life Sci, Plant Tissue Culture & Genet Res Grp Khandwa Rd Campus Indore 452001 India].

An efficient method was established for high frequency plant regeneration from 3, 5 and 7-day-old root segments of barley (Hordeum vulgare L.). Compact and white to pale yellow embryogenic callus developed from the cut ends of the root segments on Murashige and Skoog (1962) medium supplemented with 2, 4-D (10 to 30.0 mu mol/L), BAP (4.4 mu mol/L), thiamine HCl (2.9 mu mol/L), myo-inositol (110.0 mu mol/L) and casein hydrolysate (0.1%, w/v). Somatic embryogenesis was achieved on MS medium containing low concentration of 2, 4-D (5.0 mu mol/L) and BAP (2.2 mu mol/L). Shoot buds regeneration occurred with the transfer of embryogenic calli clumps on MS medium enriched with BAP (17.6 mu mol/L), 2, 4-D (2.5 mu mol /L) and thiamine HCl (2.9 mu mol/L). Histological sections through regenerating embryogenic calli revealed shoot bud induction and globular somatic embryos. 3 and 5-day-old root segments showed statistically significant difference for embryogenic callus induction, shoot buds regeneration and mean number of regenerated plantlets in comparison to 7-day-old root segments. Root differentiation occurred on MS medium containing IBA (4.9 mu mol/L). Well rooted plants were transferred to soil where they attained maturity and produce fertile seeds. [References: 33].

1249 Chen Rongmin (Hebei Agricultural Univ., Baoding (China). Biotechnology Center) (1999) **Effect of ABA on wheat anther culture.** *Journal of Agricultural University of Hebei (China). Hebei Nongye Daxue Xuebao (China) v. 22(2) p. 24-26.* 3 tables; 6 ref. Chinese. (AGRIS 2000-015900).

1250 Dunaeva, SE.; Kovaleva, ON.; Golubeva, EA.; Moskaleva, GI.; Kozyreva, OG. (2000) **Plant regeneration from cultured immature embryos of early and late barley cultivars: 2. Morphological differentiation of embryos as an indicator of their competence for plant regeneration.** *Russian Journal of Plant Physiology. 47(1):52-57.* English. [Russian Acad Agr Sci, Vavilov Inst Plant Ind Bolshaya Morskaya Ul 42 St Petersburg 190000 Russia].

The frequency of multiple plant regeneration (MPR) was studied in the calli derived from the embryos of three early-ripening and three late-ripening barley (Hordella vulgare L.) cultivars differing in their size, the degree of transparency, and morphological differentiation. The loss of embryonic cell capacity for plant regeneration in vitro coincided with the termination of morphological differentiation in the embryonic axis. In the early-ripening cultivars, the differentiation of embryonic axes terminated earlier, at smaller sizes and higher transparency of embryos. In all cultivars, the termination of the differentiation of embryonic axes into plant organs was accompanied by changes in the coleoptile shape from spherical into semispherical and by the loss of the coleoptile capacity for staining bright blue-green with toluidine blue. These coleoptile characteristics were chosen for the workable markers of embryo morphological differentiation in selecting the embryos with a high potential for plant regeneration in vitro. [References: 15].

1251 Dunaeva, SE.; Luk'yanova, MV.; Kovaleva, ON.; Kozyreva, OG. (2000) **Plant regeneration from cultured immature embryos of early and late barley cultivars: 1. Plant regeneration in the primary callus derived from immature embryos.** *Russian Journal of Plant Physiology. 47(1):48-51.* English. [Russian Acad Agr Sci, Vavilov Inst Plant Ind Bolshaya Morskaya Ul 42 St Petersburg 190000 Russia].

The frequency of multiple plant regeneration (MPR) of cultured primary calli derived from developing embryos of 22 barley (Hordeum vulgare L.) cultivars differing in ripening time (the period between seedling emergence and ear formation) was determined. The capacity for MPR was lower in the early-ripening cultivars as compared to the late-ripening ones. Changes in embryo transparency within an intact ear (an index characterizing embryo development) were monitored visually during the period between 6 and 12 days after artificial pollination in a climatic chamber. During this period, completely transparent embryos became opaque at the axis, then at the scutellum, and, finally, they became completely nontransparent. This process proceeded more rapidly in the early-ripening cultivars. We suggested that the cause of the lower level of MPR in the early-ripening cultivars was the accelerated development of their embryos and, as a result, the shortening of the period for which they were capable of MPR. [References: 16].

1252 Immonen, S.; Anttila, H. (2000) **Media composition and anther plating for production of androgenetic green plants from cultivated rye (Secale cereale L.).** *Journal of Plant Physiology. 156(2):204-210.* English. [Agr Res Ctr Myllytie 10 FIN-31600 Jokioinen Finland].

Media composition and anther plating environment were studied in rye anther culture. In the studies on media the effects of basal media composition, plant growth regulators, glutamine, sucrose and maltose, and solidification of media were investigated. Increase in the size of the induction dish improved regeneration of green plants. The basal media W14 and 190-2 were superior in promoting callus induction and green plant regeneration. Genotype by medium interactions for induction were not recorded. Dicamba auxin in the induction medium seemed beneficial for the green to albino plant ratio. Glutamine improved induction generally and green plant regeneration with a responsive genotype. Adding 10% ficoll type 400 was favourable for induction with one rye line, but this effect was not confirmed in subsequent testing with two different ryes. Solid medium promoted the highest production of green plants. Maltose in induction medium was superior to glucose and the maltose concentration of 6% seemed optimal for induction in comparison with higher concentrations and most cost-effective for production of green plants. [References: 35].

1253 Kunz, C.; Islam, SMS.; Berberat, J.; Peter, SO.; Buter, B.; Stamp, P.; Schmid, JE. (2000) **Assessment and improvement of wheat microspore derived embryo induction and regeneration.** *Journal of Plant Physiology. 156(2):190-196.* English. [ETH Zurich, Inst Plant Sci, Res Stn Eschikon CH-8315 Lindau Switzerland].

In this study we present an efficient protocol for the production of embryos in isolated wheat microspore culture and discuss parameters determining the efficiency of embryo induction and green plant regeneration. Microspores were isolated from the spring wheat genotypes DH83Z118.32 and DHBW3 showing high and low androgenetic response, respectively The washing (WM) and induction/culture medium (AMC) were optimised and led to an average embryo yield of 1350 embryos per 10(5) microspores with DH83Z118.32. One single culture dish yielding 7250 embryos per 105 microspores demonstrated that the androgenetic potential of this genotype is even higher. With DHBW3 an average of 82 embryos per 10(5) microspores was achieved. We developed a non-destructive UV fluorescence image processing system that revealed a correlation between size parameters of microspore populations and their embryo yield. For DH83Z118.32 we found the ability of embryos to regenerate green plants (embryo quality) to be strongly determined by embryo age and size. The highest yield of regenerated green plants was obtained when large embryos (>4 mm) were transferred to regeneration medium 25 days after microspore isolation. The formation of albinos was negatively correlated with the embryo size. The early assessment of microspore size and embryo quality combined with optimised culture methods demonstrated that the potential of wheat haploid induction by isolated microspore culture is not yet fully exploited. [References: 22].

1254 Li, HC.; Machii, H.; Hagio, T.; Takezaki, A.; Hirabayashi, T. (1999) **Plant regeneration from protoplasts of Triticum aestivum L. cv. Nakasoushu.** *Plant Cell Tissue & Organ Culture. 58(2):119-125.* English. [Natl Inst Sericultural & Entomol Sci Tsukuba Ibaraki 3058634 Japan].

A fast-growing, small, granular, embryogenic callus was selected from primary calli induced from the Japanese wheat cultivar Nakasoushu and the Australian wheat cultivar Bodallin. Regenerable and fine suspension cultures were induced three to six months after liquid culture was initiated and were characterized by dense cytoplasm and active division. These suspension cultures routinely provided high yields of protoplasts with about 90% viability when incubated in a modified KMP (Kao and Michayluk, 1975) medium containing 1 mg l(-1) 2, 4-D (2, 4-dichlorophenoxyacetic acid), and 1 mg l(-1) zeatin. Nakasoushu and Bodallin protoplasts divided at frequencies of 8.6% and 11.1%, respectively, in agarose-solidified media. When Nakasoushu protoplasts were cultured with effective nurse cells of sorghum and wheat, protoplast division increased to 16.9% and 12.6%, respectively. Plating efficiencies varied from 0.03% to 2.5%. After subculture, protocolonies yielded embryogenic calli and somatic embryos, from which green plants were eventually regenerated. Whole plants obtained from Nakasoushu protoplasts were fertile, demonstrating the first report of Japanese cultivars in wheat protoplast cultures. [References: 18].

1255 Puolimatka, H.; Pauk, J. (2000) **Effect of induction duration and medium composition on plant regeneration in wheat (Triticum aestivum L.) anther culture.** *Journal of Plant Physiology. 156(2):197-203.* English. [Plant Prod Inspect Ctr, Seed Testing Dept Tampereentie 51 Loimaa 32201 Finland].

The effect of induction duration, medium form and medium composition on plant regeneration from microspore-derived embryo-like structures (ELS) in anther culture of two genetically non-related spring wheat (Triticum aestivum L.) genotypes was investigated using liquid W-14 as a basic induction medium. Induction duration had a significant effect on the regeneration capacity of ELS. The highest: percentage (63%) of regenerable ELS was obtained with 7 weeks of

induction whereas the corresponding values with 6, 8 and 12 weeks were 57%, 38% and 9%, respectively. Application of ficoll to the medium, changing the medium form from liquid to solid during the induction or supplementing the medium with glutamine, maltose, cellobiose or trehalose neither increased the number of ELS nor improved plant regeneration. The average number of ELS per 100 anthers decreased from 75 to 9 but the percentage of regenerable ELS increased from 53% to 75%, when sucrose was replaced by cellobiose. We conclude that there was an optimum time for maximum plant regeneration and that ELS should be transferred from induction to regeneration no later than 7 weeks after anther isolation. [References: 26].

1256 Tanee Sreevongchai (1997) **Study on factors suitable to barley (Hordeum vulgare L.) anther culture apply for F1 hybrids.** Kasetsart Univ., Bangkok (Thailand). Graduate School. 7 ill.; 36 tables; Ref.p. 64-74. 85 leaves. Thai. (AGRIS 2000-015855).

High, intermediate and low response of anther cuturability of barley varieties (P11-16, BRB9 and SB27, respectively) were used. The optimum condition for barley anther culture to obtain high percentage of plant was as followed. Barley plant were grown in growth chamber. Spikelets having distance 5 cm between the auricles of flag leaf and adjacent leaf were collected from barley and pretreated in the dark condition at 4 deg C for 5-6 weeks. Then anthers were cultured on FW medium supplemented with 0.6 mg/l BA and 1.0 mg/l IAA for callus or embryoid induction for 4-5 weeks and calli or embryoids were transferred to FWR medium supplemented with 0.5 mg/l BA for plant regeneration for 4-5 weeks. The suitable conditions studied were applied for anther culture of four F1 hybrid crosses (BRB9 X F590 no.63, BRB9 X MONA, BRB9 X BRB2, and BRB9 X P11-16), two F1 hybrid reciprocal crosses (F590 no.63 X BRB9 and MONA X BRB9) and their parents for comparision. Reciprocal effect was observed on percentage of anthers developed to be calli or embryoids in 1 from 2 crosses studied and the values of the hybrids were among their parents. For percentage of green plants regeneration, most of the F1 the hybrids were observed to have the values among their parents except F1 hybrids between BRB9 and MONA which had higher value than their parents. All of the 2 reciprocal crosses tended to have reciprocal effect in this characters. The minimum and maximum percentages of green plants regeneration of the F1 hybrids studied were 0.33 and 6.52 in BRB9 X BRB2 and BRB9 X MONA, respectively.

1257 Teneqexhi, K. (Stacioni i Panxhar Sheqerit, Korce (Albania)) (1997) **[The optimal planting dates of barley distic "Terova"].** *Buletini i Shkencave Bujqesore (Albania) (no. 2) p. 55-58.* 3 tables; 4 ref. Albanian. (AGRIS 2000-022647).

The study aimed at the determination of optimal terms of the sowing of distic barley "Terova" in different terms of sowing, beginning with the first 10 days of February until the first 10 days of April. The most appropriate sowing time is February up to the first 10 days of March. Every 10 days after 10 March the output is decreased by 5-10 kv/ha. The late sowing are associated with both the output rate lowering and with the decrease of agronomical quality of the seed, as the weight of 1000 seeds and their homogeneity.

F03 SEED PRODUCTION

1258 Kashem, M.A.; Sultana, N.; Kamal, A.M.A. (Bangladesh Agricultural Univ., Mymensingh. Dept. of Biochemistry and Dept. of Agronomy) (1996) **Biochemical changes in wheat seed during germination.** *Thai Journal of Agricultural Science (Thailand) v. 29(1) p. 75-82.* 5 tables. English. (AGRIS 2000-015942).

Changes of biochemical constituents were studied in germinating seeds of eight modern wheat varieties (Aghrahani, Akbar, Ananda, Balaka, Barkat, Kanchon, Pavon and Sonalika), Results indicated that the alpha-amylase activity was variable. Alpha-amylase activity was observed to be highest in Sonalika and followed by other seven varieties. Enzyme activity was low at the initial stages and thereafter significantly increased with time of germination. Ascorbic acid, total phenol, chlorophyll and carotenoid contents were variable among the varieties and their contents were significantly increased with time of germination.

1259 Kwiatkowski, J.; Szczukowski, S.; Tworkowski, J. (University of Agriculture and Technology, Olsztyn (Poland). Dept. of Plant Breeding and Seed Production) (1999) **Sowing value of wheat seeds after storage in different periods.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 227-231.* 4 tables; 7 ref. Polish. (AGRIS 2000-015940).

The seeds of winter wheat cultivar Emika were stored during short period (from the harvesting to the sowing) and a long period (for 1 year and 2 years) in storehouse. Germination capacity before and after storage was tested. Plant density, yield and seed value for offspring generation were then determined. The germination capacity of wheat seeds was reduced by ca. 3 percent after 1 year and by ca. 5 percent after 2 years of storage. When these seeds were sown at higher sowing rate the planned plant density will be obtained.

1260 Matus, A.; Walley, F.; Hnatowich, G.; van, Kessel, C.; Knight, JD. (1999) **Use of anhydrous ammonia in single-pass seeding operations of spring wheat at varied landscape positions.** *Agronomy Journal. 91(6):969-974.* English. [Univ Saskatchewan, Dept Soil Sci Saskatoon SK S7N 5A8 Canada].

Adoption of no-till seeding practices by many farmers has increased interest in using anhydrous ammonia (AA) in single-pass seeding operations. It is expected that crop response to different fertilizer N sources and fertilizer placement will vary at the landscape level, because of inherent differences in soils related to topography. Two openers (side-band and sweep wing tip) were evaluated for use in a single-pass seeding operation of spring wheat (Triticum aestivum L.). The openers differed in fertilizer placement and soil disturbance. The effect of AA on grain yield and protein content as influenced by application rate and opener was investigated at varied landscape positions. The experiment was conducted at six sites in two years using a randomized complete block design. Averaged across year and location, wheat grain yield was higher on footslopes than on shoulders; however, the effect of landscape position was not consistent at all locations. Landscape position did not affect protein content. Application of AA with either opener resulted in grain yields and protein contents comparable to granular urea and ammonium nitrate (AN) fertilizers. Even at the highest AA application rate tested (105 kg N ha(-1)), no crop damage was expressed in final yield. [References: 19].

1261 Menabde, D.; Gotsiridze, I.; Chaduneli, M. (I. Kanchaveli Scientific Research Institute for Plant Protection (Georgia)) (1999) **Wheat Streak Mosaic.** *Kvali (Georgia) (no. 9-10) p. 25-26.* Georgian. (AGRIS 2000-022739).

A harmful virus disease of grain wheat streak mosaic was registred in Georgia in 1984. Studies are made on the diseases symptoms, its occrrence, its effect on yields, and resistance of wheat varieties to the viruc. A mite (Aceria tritici Schev) is identified as avector of wheat streak mosaic virus. Methodology for disease menegment is developed.

1262 Mos, M. (Agricultural University, Krakow (Poland). Chair of Plant Breeding and Seed Production) (1999) **Effect of sprouting damage on vigour of triticale.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 275-281.* 3 fig., 1 table; 14 ref. Polish. (AGRIS 2000-015938).

The vigour changes in grain with sprouting damages for four cultivars were examined in two successive years. The germination ability, the lenght of shoots and roots of 8-day seedling were determined. The significant influence of the stages of sprouting, terms of sowing and interaction of the two factors on the grain vigour has been estabilished (86.6-96.3 percent of total variability). The control grains after dormancy and those with no visible sprouting damages showed high vigour within 12 months. Sprouting damages significantly influenced decrease in germination ability, and the lenght of shoots and roots.

1263 Pancaldi, D. (Bologna Univ. (Italy). Dipartimento di Protezione e Valorizzazione Agroalimentare) (1992) **[The seed dressing [wheat - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 10-12.* 2 tables. Italian. (AGRIS 2000-015939).

1264 Podlaski, S. (Agricultural University, Warsaw (Poland). Dept. of Plant Breeding and Seed Production) (1999) **Seed production of cereals.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 295-304.* 1 fig., 1 table; 20 ref. Polish. (AGRIS 2000-015941).

The paper presents organization and performance of cereal seed production in Poland in relation to other more developed European countries. The one of the main features of Polish seed production is disintegration, resulting from the fact that breeding, seeding and commercial organization are not concentrated. It seems that strict compliance with quality norms for grain used by food industry might be one of the possibilities to increase use of qualified seed material.

1265 Troccoli, A.; Codianni, P.; Paoletta, G.; Gallo, A.; Di Fonzo, N. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)) (1998) **Seed dressing in durum wheat. It isn't a reality worth undervaluing [Triticum durum Desf.].** *Sementi Elette (Italy) v. 44(2) p. 41-43.* 1 table; 2 graphs; 10 ref. Italian. (AGRIS 2000-022742).

In this paper a trial carried out from Experimental Institute for Cereal Research, Section of Foggia is reported, in order to evaluate if the dry-seed dressing treatment, an usual procedure in small and medium farms of Southern Italy, determined in five durum wheat (Triticum durum Desf.) varieties a higher performance, compared to the thesis that was not treated. Even though this procedure is faulty as for distribution homogeneity, adhesivity and persistency of the active substance on the seed, across the varieties the seed dressing treatment significantly increased of 14.8% and 19.7% the grain yield and the number of germinated plants, respectively, whereas decreased of 1.3% 1000-kernel weight [In questo articolo viene riferito di una prova condotta dall'Istituto Sperimentale per la Ceralicoltura. Sezione di Foggia, allo scopo di valutare se il trattamento di concia a secco del seme, una procedura usuale nelle aziende piccole e medie del Sud di Italia, determinava, in cinque cultivar di grano duro (Triticum durum Desf.), un miglioramento delle prestazioni produttive rispetto alla tesi di controllo, non trattata. Anche se questa procedura e' difettosa per omogeneita' della distribuzione, adesivita' e persistenza della sostanza attiva sul seme, il trattamento di concia incrementava, nelle diverse varieta', la resa in granella e il numero di piante germinate, rispettivamente, del 14.8 e del 19.7%, mentre determinava una diminuzione pari all'1.3% del peso di mille semi].

F04 FERTILIZING

1266 Anderson, WK.; Hoyle, FC. (1999) **Nitrogen efficiency of wheat cultivars in a Mediterranean environment.** *Australian Journal of Experimental Agriculture. 39(8):957-965.* English. [Agr Western Australia, Ctr Cropping Syst POB 483 Northam WA 6401 Australia].

Experiments were conducted at 3 sites in Western Australia in 1993 using 33 wheat cultivars and crossbreds. Two rates of applied nitrogen fertiliser (0 and 40 kg/ha of nitrogen) were used to screen the lines for efficiency of nitrogen uptake, grain yield and grain protein production per unit of nitrogen applied, and nitrogen translocation to the grain. This information can be useful in determining nitrogen fertiliser strategies for wheat cultivars in the field. Nitrogen uptake in the plant tops was measured during the season and in the grain and straw at maturity. Grain yield, grain protein and nitrogen efficiency parameters were not markedly different between grain quality grades which are largely based on grain hardness. Yield efficient lines (high net yield increase per unit of applied nitrogen) were characterised by greater net uptake and net utilisation efficiencies but had similar yields and grain protein percentages as yield inefficient lines. Protein efficient lines (high net grain protein increase per unit of applied nitrogen) also had greater uptake efficiencies but lower utilisation efficiencies than protein inefficient lines. No lines were both yield and protein efficient suggesting that lines either use fertiliser nitrogen preferentially in yield production or in production of protein. The results indicate that in nitrogen-responsive situations it will be more profitable to use yield-efficient lines. Further investigation is needed to examine the suggestion that where soil nitrogen levels are higher (and yield responses to nitrogen are less) a greater economic return may come from using protein efficient lines. Some wheat lines had a high ability to recover fertiliser nitrogen applied to the crop. Others had a high ability to take up soil nitrogen. Tt is postulated that these differences may be due to differences in root systems. Some mid- and long-season lines that had high concentrations of nitrogen in the tops at anthesis metabolised that nitrogen poorly into grain yield or protein, This suggests that nitrogen efficiency may be partly related to maturity relative to length of growing season. [References: 26].

1267 Andriesh, S. (1999) **[The management of nutritive regimes of soils of Moldova].** Problems of agrochemistry in contemporary agriculture. Kishinev (Republic of Moldova). 19-20 Aug 1999. *[Problems of agrochemistry in contemporary agriculture]. Institute of Pedology, Agrochemistry and Soil Amelioration, Kishinev (Republic of Moldova) p. 31-49.* Institute of Pedology, Agrochemistry and Soil Amelioration. Russian. (AGRIS 2000-016064).

1268 Andriesh, S.; Leah, N.; Taganok, V. (1999) **[The optimization of winter wheat mineral nutrition on the base of diagnosis of system soil-plant].** Problems of agrochemistry in contemporary agriculture. Kishinev (Republic of Moldova). 19-20 Aug 1999. *[Problems of agrochemistry in contemporary agriculture]. Institute of Pedology, Agrochemistry and Soil Amelioration, Kishinev (Republic of Moldova) p. 152-161.* Institute of Pedology, Agrochemistry and Soil Amelioration. Romanian. (AGRIS 2000-016081).

1269 Bodilis, A.M. (Institut Technique des Cereales et des Fourrages, Paris (France)); Bouthier, A.; Castillon, P.; Laurent, F.; Desvignes, P. (1998) **[Piloting nitrogen fertilizer supply with "Jubil": crop range is increasing].** *Perspectives Agricoles (France) (no 236) p. 57-63.* 9 ref., 5 graph. French. (AGRIS 2000-015985).

S'appuyant sur la combinaison d'un "indicateur sol" (prevision de la dose d'azote a apporter par la methode du bilan) et d'un "indicateur plante" (teneur en nitrate du jus de la base des tiges de cereales, du jus de petiole dans le cas de la pomme de terre), Jubil permet d'ajuster les apports d'azote au plus pres des besoins de la plante. Ce pilotage de la fertilisation en temps reel autorise une modulation de la dose d'azote prevue au depart et permet de se rapprocher de l'optimum reel pour chaque parcelle. Il devient ainsi possible d'atteindre des performances technico-economiques elevees en matiere de fertilisation tout en preservant au maximum l'environnement. Propose sur ble tendre d'hiver depuis 1993, cette methode est aujourd'hui disponible sur orge brassicole, mais et pomme de terre.

1270 Bogdevich, I.M.; Pirogovskaya, G.V.; Ochkovskaya, L.V.; Titova, S.A.; Soroko, V.I.; Rusalovich, A.M. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Expenses of mineral fertilizers on the barley yield formation on sod-podzolic soils].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 105-113.* BRISSA. 4 tables; 3 ref. Russian. (AGRIS 2000-016006).

It is conducted the evaluation of the expenses of optimum mineral fertilizer dose on the formation of 1 t barley yield on a sod-podzolic soil, which sestablished on the basis of field trial results, carried out in the Republic of Belarus over 1989-1997 years. The efficiency of application separately of nitrogen, phosphorus and potassium is analyzed. Coefficient of useful action (CUA) of optimum mineral fertilizer dose application under barley is calculated. The comparison evaluation of the level of mineral fertilizer application under barley in economies of the republic in 1996-1997 is carried out.

1271 Carnevali, G. (Regione Emilia Romagna, Bologna (Italy). Servizio Sviluppo Agroalimentare); Sarno, G. (Centro Ricerche Produzioni Vegetali (CRPV), Cesena, Forli (Italy)) (1992) **[The fertilization [Triticum - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 32-34.* 5 tables. Italian. (AGRIS 2000-016124).

1272 Carvalho, M.J.G.P.R.; Azavado, A.L.; Basch, G. (Evora Univ. (Portugal). Dept. de Fitotecnia) (1996) **Nitrogen fertilization optimization: its relation with rainfall and predicted production [Portugal].** Estacao Agronomica Nacional, Oeiras (Portugal). *Agronomia Lusitana (Portugal) v. 45(1-3) p. 121-135.* 7 tables, 15 ref. Portuguese. (AGRIS 2000-022811).

1273 Ceban, T.; Lungu, V.; Nichitoi, A. (1999) **[The influence of mineral fertilizers on crop yield and quality of winter wheat grain].** Problems of agrochemistry in contemporary agriculture. Kishinev (Republic of Moldova. 19-20 Aug 1999. *[Problems of agrochemistry in contemporary agriculture]. State University, Kishinev 9Republic of Moldova) p. 180-181.* Institute of Pedology, Agrochemistry and Soil Amelioration. Romanian. (AGRIS 2000-016092).

1274 Djuric, M. (Agronomski fakultet, Cacak (Yugoslavia)); Boskovic Rakocevic, Lj.; Pavlovic, R. (1999) **[The influence of soil calcification on spike length and grain mass in the wheat variety Srbijanka].** Naucno-strucni skup Zimska skola za agronome. Cacak (Yugoslavia). 5-6 Mar 1999. *[Winter school for agriculturists: scientific-professional meeting. Proceedings]. Mandic, L. (Ed.) p. 111-116.* Agronomski fakultet. 6 tables; 10 ref. Serbian. (AGRIS 2000-016126).

The influence of pseudogley calcification on the spike length and grain mass of wheat variety Srbijanka was investigated. The results obtained show that the effect of calcification had great influence on mentioned indicators and also that at the both followed has been showed the best calcification with two grams of CaCO3 on 1 kg of soil.

1275 Filipek Mazur, B.; Mazur, K.; Gondek, K. (Hugon Kollataj Agricultural Univ., Krakow (Poland)) (1999) **Fertilizing value of sludges from tannery sewages treatment plant.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 99-101.* Mendelova Zemedelska a Lesnicka Univ. 2 tables; 7 ref. English. (AGRIS 2000-016121).

1276 Galova, z.; Smolkova, H.; Michalik, I. (Slovenska Polnohospodarska Univ., Nitra (Slovak Republic)) (1999) **Effect of various forms of nitrogen application on wheat grain quality.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 200-203.* Mendelova Zemedelska a Lesnicka Univ. 2 tables; 7 ref. Slovak. (AGRIS 2000-016140).

1277 Hrivna, L. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)); Prokes, J. (1999) **Influence of Titavin on the technological parameters of brewing barley.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 210-213.* Mendelova Zemedelska a Lesnicka Univ. 3 graphs, 4 tables. Czech. (AGRIS 2000-016011).

1278 Hrivna, L.; Richter, R.; Raskova, J.; Ryant, P. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)) (1999) **Applying nitrogen and sulphur to affect the quality of winter wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 176-180.* Mendelova Zemedelska a Lesnicka Univ. 3 graphs, 6 tables. Czech. (AGRIS 2000-016139).

1279 Hruby, J.; Badalikova, B. (Vyzkumny Ustav Picninarsky, Troubsko u Brna (Czech Republic)) (1999) **Influence of organic fertilization and of phyto-curative methods on yields of spring barley in monoculture.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 105-108.* Mendelova Zemedelska a Lesnicka Univ. 1 table; 8 ref. Czech. (AGRIS 2000-016010).

1280 Jelic, M. (Agricultural Research Institute "Serbia", Kragujevac (Yugoslavia). Center for Small Grains); Lomovic, S.; Milivojevic, J., Stevanovic, D. (1998) **Effect of nitrogen and phosphorus fertilizers on potassium content in soil and winter wheat plants.** *Zemljiste i biljka (Yugoslavia) v. 47(1) p. 9-15.* 3 graphs; 12 ref. English. (AGRIS 2000-022806).

Studies were conducted in a stationary field trial on the vertisol soil type. Two kinds of nitrogen fertilizers with six rates and two kinds of phosphorus with one rate of fertilizers were applied. Content of available potassium in the soil was slightly increased at the stem elongation stage after application of carbamide. Use of a high level of nitrogen fertilizers reduced the content of available potassium in the soil (at the full maturity stage). A greater increase of available potassium in the soil was obtained with super-phosphate as compared to MAP (mono-ammonium-phosphate). Potassium concentration in roots and shoots of winter wheat at the stem elongation stage as well as in the straw at full maturity was enhanced by high levels of nitrogen fertilizers. Application of KAN (calcium-ammonium-nitrate) exerted a greater effect on the potassium concentration in the plant than did carbamide. Use of MAP led to a high potassium concentration in wheat tops than after application of super-phosphate.

1281 Kadar, I.; Kazo, B.; Bartfai, T.; Zilahy, P. (1999) **Mineral nutrition of wheat (Triticum aestivum L.) on calcareous chernozem soil. II.** *Novenytermeles. 48(5):523-534.* Hungarian. [Hungarian Acad Sci, Res Inst Soil Sci & Agr Chem Herman Otto Ut 15 H-1022 Budapest Hungary].

In a fertilisation experiment set up in autumn 1973 on calcareous loamy chernozem soil, studies were made on the effect of different N, P and K supply levels and their combinations on the development, powdery mildew infection, protein and amino acid contents of wheat, and on major soil properties, The agrochemical parameters of the ploughed layer of the soil were as follows: CaCO3 5%, humus 3%, PH(KCl) 7.3, AL-P2O5 60-80 ppm, AL-K2O 140-160 ppm, KCl-soluble Mg 150-180 ppm, KCl+EDTA Mn 100-150 ppm, Cu 3 ppm, Zn 2 ppm. The factorial experiment represented 4N x 4P x 4K = 64 treatments in 2 replications, giving a total of 128 plots. The mineral fertiliser was applied in the form of 25% calcium ammonium nitrate, 18% super-phosphate and 50% potassium chloride. The main results can be summarised as follows: The degree of infection of wheat with powdery mildew rose from 24% to 56% when N was over-supplied. As the P and K supplies improved, the degree of infection dropped by 10 and 14%, respectively. Balanced nutrition led to an improvement in powdery mildew resistance and better yields. Measurements show that at the tillering stage the toxic chloride limit tolerated by wheat is indicated by a Cl- content of around 0.2% in the shoots. As the result of N x P interactions the 4 t/ha grain yield obtained in the control rose by 35-40% and the protein yield per hectare by 60-65%. Little change was observed in the amino acids, which are largely genetically determined. Maximum yield and quality (protein and amino acid content or yield) were achieved as a function of balanced N x P supplies. The AL-soluble P2O5 content of the soil, however, should not be increased to more than 150-200 mg/kg to improve either the quantity or quality of the yield. After the wet first year the NO3-N in the N-3 treatment was leached to a depth of 60 cm. According to analyses of the 1:5 aqueous extract, the leaching of the Cl- ions introduced with the potassium fertiliser could be observed even at a depth of 1 m, with concentrations an order of magnitude greater than normal in the 40-80 cm layer. The K+ and Na+, and the SO42- and Ca2+ from the P treatments remained in the upper 0-40 cm soil layer. The "total salt" gave a good indication of the movement of electrolytes in the soil profile. [References: 9].

1282 Karele, I. (Latvian Univ. of Agriculture, Jelgava (Latvia). Faculty of Agriculture. Dept. of Plant Production) (1999) **[Distribution of nitrogen and its changes in winter wheat plants during the vegetation period].** Zinatnes nakotne musu rokas. Jelgava (Latvia). 26-28 May 1999. *[The future of science is in our hands. Conference papers of the candidates for the doctor's degree]. Latvian Univ. of Agriculture, Jelgava (Latvia) 290 p. p. 27-34.* Latvian University of Agriculture. 1 table; 3 ill., 4 ref. Latvian. (AGRIS 2000-016125).

The accumulation of nitrogen in winter wheat plants during different stages of their growth and development has been studied. The trials carried out on the experimental field of the Latvia University of Agriculture in 1997 are described. Two winter wheat varieties - the mid-intensive "Sirvinta - 1" and the intensive variety "Otto" were investigated. The investigation results show that: 1) the highest nitrogen content in different parts of winter wheat plants is reached in the stooling stage; 2) in the flowering stage the movement of nitrogen to the reproductive parts of wheat plants is observed; 3) in all plant development stages there is a close positive correlation between the total nitrogen content in the above ground plant parts and the protein content in grain.

1283 Kralovec, J. (Ustredni Kontrolni a Zkusebni Ustav Zemedelsky, Plzen (Czech Republic)) (1999) **Effect of restriction of chemicals application on yields of potatoes and winter wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 166-169.* Mendelova Zemedelska a Lesnicka Univ. 5 tables; 8 ref. Czech. (AGRIS 2000-016117).

1284 Lapa, V.V.; Lavinskij, Kh.Kh.; Borisova, T.S.; Ivakhenko, N.N.; Burzhanova, N.I. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Biological values of spring wheat grain depending on rates and times of nitrogen fertilizer application].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 17-24.* BRISSA. 2 tables; 8 ref. Russian. (AGRIS 2000-016127).

Biological value of the spring wheat grain depending on rates and times of nitrogen fertilizer application was studied by the chemical (the content of irreplaceable amino acids, amino acid scor and Aser index) and biological (on white young males rates) methods. More objectively assessment of nourishing value of grain is defined in experiments on biomodels. Taking into account the quality of obtaining protein more optimum nitrogen rates under spring wheat "Ivolga" are N60-90 under presowing cultivation +N30 in the phase of leaf-tube formation. The actual protein in these variants was maximal and amounted to 13, 35-13, 65 %.

1285 Lavinskij, Kh.Kh.; Lapa, V.V.; Borisova, T.S.; Ivakhnenko, N.N.; Burzhanova, N.I. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Effect of growth regulators on the protein quality and biological value of a spring wheat].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 89-95.* BRISSA. 2 tables; 4 ref. Russian. (AGRIS 2000-016129).

Effect of growth regulators tur, cherkaz, quartazin and epibrassinolides on the biological value of the spring wheat grain "Ivolga" by method of biological testing was studied. Cherkaz, quartazin and epibrassinolid of native production have the most effective influence on the protein quality. The actual protein of grain cultivated with the application of above indicated growth regulators, excels the control variant on 30, 18 and 15% accordingly.

1286 Lozek, O.; Fecenko, J.; Varga, L. (Slovenska Polnohospodarska Univ., Nitra (Slovak Republic)) (1999) **Optimization of productional fertilization of winter wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 92-94.* Mendelova Zemedelska a Lesnicka Univ. 3 tables; 5 ref. Slovak. (AGRIS 2000-016136).

1287 Malik, RS.; El, Bassam, N.; Haneklaus, S. (1999) **A contribution towards sustainable agriculture identification of low input sorghum genotypes: II. Nutritional aspects.** *Landbauforschung Volkenrode. 49(4):185-191.* English. [Fed Agr Res Ctr, Inst Crop & Grassland Sci Braunschweig Germany].

1288 Manolov, I.; Chalova, V.; Kostadinova, S. (Agricultural University, BG 4000 Plovdiv (Bulgaria)) (1999) **Effect of nitrogen fertilization and variety differences on nitrate reductase activity of wheat (Triticum aestivum).** Agricultural Academy, Sofia (Bulgaria). *Bulgarian Journal of Agricultural Science (Bulgaria) v. 5(4) p. 599-604.* 1 ill., 3 tables; 13 ref. English. (AGRIS 2000-016134).

The study included 9 varieties and lines winter soft wheat grown on three levels of nitrogen fertilizing (N0, N120, N240). The effect of nitrogen fertilization, variety differences and their interaction on plant nitrate content (NC) and nitrate reductase activity (NRA) in tilling, jointing, flowering stages and yield were studied. Analyse of variance showed that nitrogen fertilization had the highest effect on Nc and NRA. The three fertilizing levels formed different models of Nc and NRA changes during plant growth. Concerning to obtained yields, variety differences showed much lower effect in comparison with soil nitrogen level. The varieties Sadovo1, Record, and LC-318 were the most productive at nitrogen level N240.

1289 Mazid, A.; Jones, M. (1998) **Impact of fertilizer use under rainfed system. Case study: fertilizer use on rainfed barley in Syria.** Regional Workshop on Fertilizer Use for Sustainable Agriculture. Amman (Jordan). 4-6 Nov 1996. *Proceedings. Awamleh, M. (Ed.); Hamdallah, G. (Ed.). FAO, Cairo (Egypt). Regional Office for the Near East.* FAO. English. (AGRIS 2000-022771).

1290 Mouchova, H.; Ruzek, P.; Manev, M.; Kusa, H. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyne (Czech Republic)) (1999) **Effect of different methods of nitrogen fertilization on yields and quality of winter wheat grain.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 161-165.* Mendelova Zemedelska a Lesnicka Univ. 1 graph, 3 tables. Czech. (AGRIS 2000-016138).

1291 Nedealcov, S.; Buiuc, L.; Solysh, M. (1999) **[The influence of fertilizers on radionucleic compounds and heavy metals accumulation in winter wheat yield].** Problems of agrochemistry in contemporary agriculture. Kishinev (Republic of Moldova). 19-20 Aug 1999. *[Problems of agrochemistry in contemporary agriculture]. Institute of Agrochemical Service of Agriculture, Kishinev (Republic of Moldova) p. 78-79.* Institute of Pedology, Agrochemistry, Soil Amelioration. Russian. (AGRIS 2000-016067).

1292 Noworolnik, K.; Sulek, A. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Crops Cultivation) (1999) **Comparison of nitrogen fertilization efficiency of spring cereals. 3.** All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 289-293.* 3 tables; 8 ref. Polish. (AGRIS 2000-016008).

The eleven field experiments with spring barley, spring wheat and the mixture: barley + wheat + oats were carried out in the period 1995-97. The grain yields and nitrogen rates efficiency of these cereal were determined. The spring wheat characterized the higher efficiency of nitrogen rates: 50 and 75 kg/ha, higher protein content in grain and lower yielding than spring barley and cereal mixture. The higher efficiency of cereal nitrogen rates was observed on poorer soils, or delayed sowing.

1293 Panayotova, G. (Cotton and Durum Wheat Institute, BG 6200 Chirpan (Bulgaria)); Gorbanov, S. (1999) **Influence of the fertilization on the properties of durum wheat grain and pasta products.** Agricultural Academy, Sofia (Bulgaria). *Bulgarian Journal of Agricultural Science (Bulgaria) v. 5(3) p. 425-430.* 4 tables; 6 ref. English. (AGRIS 2000-016133).

Seed samples during the period 1988-1995 was analysed. It was determined the weight of 1000 grains, test weight, total glassiness, crude protein, wet and dry gluten, semolina output, carotinoids content. Macaroni (a hollow long tubes of 5 mm diameter), produced of seed samples with different fertilization was analysed. The 1000 grains weight varies from 28, 4 to 51.2 depending on the weather conditions and fertilization and decreases with 5.07% at higher nitrogen rates. The test weight is not influences significantly by nitrogen application. The nitrogen may increases the crude protein, wet and dry gluten and carotenoides. The protein does up to 28.20%, wet gluten - to 43.16%, dry gluten - with 29.10 to 43.64%, carotinoid pigments - to 15.7% over the check. Nitrogen application increases the

strength of macaroni with 25.7% at higher rates, dry matter loss in boiled water decreases and at N180 is 4.04 times less, the elasticity and the form is keep at boiling.

1294 Ping, JL.; Bremer, E.; Janzen, HH. (2000) **Foliar uptake of volatilized ammonia from surface-applied urea by spring wheat.** *Communications in Soil Science & Plant Analysis. 31(1-2):165-172.* English. [Texas Tech Univ, Dept Plant & Soil Sci Lubbock, TX 79409 USA].

Large volatile losses of NH3 can occur from surface-applied urea in semiarid areas. Our objective was to determine possible absorption of this volatilized N by the crop canopy under field conditions. At two different times during crop growth, N-15-enriched urea was surface-applied at rates equivalent to 100 kg N ha(-1) to soil contained in trays placed between two rows of spring wheat. Seven days after application, the soil in the trays was removed from the field and analyzed for N-15 content. Addition of HCl during soil air drying was necessary to prevent volatile losses of N-15. Of applied urea-N, 13% was volatilized over seven days at both application times. Of the urea-N that was volatilized, 15% was absorbed by wheat at the first application time and 7% was absorbed by wheat at the second application time. Plant absorption of urea N (Y, mg) declined with distance from the source (x, cm) following the equation Y=10.95*10((-0.0142x)). About 90% of absorbed N was within the first three wheat rows. Our findings suggest that a significant portion of ammonia volatilized from top-dressed urea might be captured by plant foliage. [References: 16].

1295 Richter, R.; Provaznik, K. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)); Zimolka, J. (1999) **Nutritional soil regime in spring barley after ploughing-in sugar beet tops.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 64-67.* Mendelova Zemedelska a Lesnicka Univ. 3 graphs, 5 tables; 3 ref. Czech. (AGRIS 2000-016009).

1296 Rotkoglo, N. (1999) **[The energetical and economical analysis of fertilizers application under maize and winter wheat on common cernozem].** Problems of agrochemistry in contemporary agriculture. Kishinev (Republic of Moldova). 19-20 Aug 1999. *[Problems of agrochemistry in contemporray agriculture]. University, Komrat (Republic of Moldova) p. 208-209.* Institute of Pedology, Agrochemistry and Soil Amelioration. Russian. (AGRIS 2000-022796).

1297 Shatalova, R.V. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Yield and quality of spring wheat depending on nitrogen fertilizer rates on various levels of organic fertilizers and soil acidity degree].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 76-88.* BRISSA. 6 tables; 11 ref. Russian. (AGRIS 2000-016128).

On well cultivated sod-podzolic light loamy soils at the average level of the manure application in a crop rotation 10 t/ha in an interval of soil acidity degree 5, 5-5, 7 - 6, 3-6, 5 on the bachground P60 K120 on the average under spring wheat yield (45, 9-48, 3 c/ha) is more effectively the dose N60 in the main application. It is permitted to regulate nitrogen top-dressing dose in the phase of beginning of leaf-tube formation using the developed diagnostic scale on the total nitrogen content in plants. Oscillations of gluten content in spring wheat grain from 18 to 31 % are determined in considerable measure by interaction of nitrogen fertilizers with weather conditions.

1298 Shi Yi; Xu Xingkai; Zhou Likai (Academia Sinica, Shenyang (China). Inst. of Applied Ecology) (1998) **Effect of inhibitors and their combination on the behaviour and fate of urea N15 in wheat-soil system.** *Chinese Journal of Applied Ecology (China). Yingyong Shengtai Xuebao (China) v. 9(2) p. 168-170.* 5 tables; 5 ref. Chinese. (AGRIS 2000-016130).

1299 Singh, MK.; Verma, UN.; Pal, SK.; Thakur, R. (1999) **Efficacy of slow release N-fertilizers for rice and their residual effect on wheat.** *Indian Journal of Agronomy. 44(2):216-218.* English. [Birsa Agr Univ, Dept Agron Ranchi 834006 Bihar India].

A field experiment was conducted during 1989-91 on sandy clay loam soil at Ranchi to study the efficiency of forms of urea viz, prilled (PU), lac coated (LCU), rock phosphate coated (RCU), karanj cake coated (KCU) and neem cake coated (NCU) at varying N rates (40, 80, 120 kg/ha) on the productivity of rice and their residual effect on succeeding wheat. LCU had markedly higher grain yield of rice than other forms of urea. Each incremental N level recorded higher grain yield over its preceding level. However, nitrogen use efficiency decreased with increasing N levels. Application of LCU and NCU had higher soil available N after rice as compared with other forms of urea. This was reflected on the productivity of succeeding wheat. Rice fertilized with 120 kg N/ha also recorded the maximum grain yield of succeeding wheat. [References: 3].

1300 Singh, VP. (1999) **Effect of organic and inorganic sources of nutrients on rainfed wheat (Triticum aestivum).** *Indian Journal of Agronomy. 44(2):347-352.* English. [Govind Ballabh Pant Univ Agr & Technol, Dept Agron Pantnagar 263145 Uttar Pradesh India].

Field experiment conducted during winter (rabi) season of 1991-92, 1992-93 and 1993-94, to study the effect of different revels of organic (FYM) and inorganic (N, P and K) sources of nutrient on rainfed wheat (Triticum aestivum L.), revealed that application of 10 t FYM/ha yielded significantly higher grain and straw yields of wheat over 5 t/ha and control (no FYM). Application of inorganic fertilizer 80 N + 60 P2O5 kg/ha being at par with 60 N + 30 P2O5 + 30 K2O kg/ha during 1991-92 and 1993-94 recorded significantly higher grain yield than this treatment during 1992-93 and rest of fertility levels. Incorporation of FYM and application of N, P and K also exhibited significant effect on uptake of NPK by grain and straw. FYM 10 t/ha with 60 N + 30 P2O5 + 30 K2O kg/ha was found optimum level to get the maximum yield in rainfed wheat under low/valley situation of UP hills. [References: 7].

1301 Sippola, J. (2000) **Estimation of soil nitrate in the spying as a basis for adjustment of nitrogen fertiliser rates.** *Agricultural & Food Science in Finland. 9(1):71-77.* English. [Agr Res Ctr Finland FIN-31600 Jokioinen Finland].

The performance of SOILN model, which simulates soil nitrogen dynamics, was evaluated in respect to its ability to predict nitrate content in soil in spring when growing barley. The data obtained in three year nitrogen fertiliser experiments on different soil types was used. Model was parametrised using the data of the first experimental year and validation results obtained in following years are presented. The results of the simulations of the springtime nitrate in the root zone showed a reasonably small deviation from the measured values. The coefficient of determination, R-2 = 0.56 was significant. The regression equation was y = 4 + 0.66x where the constant term was not significantly different from zero and the slope deviated from zero. The mean value of measured nitrate in the root zone in spring was 16 kg/ha and that from the simulation was 15 kg/ha showing that the mean values were close to each other. The mean of deviations between measured and simulated values was 4 kg/ha and the maximum deviation 9 kg/ha. It is concluded that simulation estimated springtime soil nitrate concentration with reasonable confidence that further testing of estimating soil nitrate concentration in spring for adjustment of nitrogen fertilisation using SOILN model should be continued. [References: 11].

1302 Surovcik, J. (1999) **Effect of fertilization and agrochemicals on some qualitative characters of winter wheat.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 39-44.* Vyskumny Ustav Rastlinnej Vyroby. 4 tables; 9 ref. Slovak. (AGRIS 2000-022744).

In field experiments established in the years of 1995 - 1997 in maize production area on degraded chernozem with mildly acid soil reaction the effect of agrochemicals on some qualitative characters of wheat grain was tested. The long-term average of the experimental site is 9.2 degree C per year, 15.5 degree C per vegetation period, rainfall 593 nun per year and 358 per vegetation period. Silage maize was used as

a forecrop. The Blava variety used was fertilized with 3-level N fertilization (0, 50, 150 kg/ha) and against harmful agents the following pesticides and their combinations were used: the control variant (zero treatment), complete protection (herbicide, fungicide, growth stimulant), herbicide + growth stimulant, herbicide + fungicide, fungicide + growth stimulant and separate applications of herbicide, fungicide and growth stimulant. Wheat was sown at the seed rate of 4.0 mil. of germinable grains and the interrow width of 125 mm. The fertilization with nitrogen significantly affected the protein content in wheat grain (table 2). The highest protein content in the grain was reached at the highest nitrogen dose. Apart from fertilization, the weather also had positive effect. In 1997, when the lowest yields of grain were reached (table 1), the protein content was at the lowest level, too. The highest was in the yield in 1995, when the grain yield was the highest as well. Pesticides did not have significant effect on protein content in the grain, but the highest was found at separate fungicide application. The application of fungicide together with the growth stimulant resulted in protein content decrease in the grain although the yield was the highest. In the unfavourable year the protein content may have been negatively affected with the growth stimulant. Like protein content, the gluten content was also the most affected by nitrogen fertilization and the highest gluten content was obtained at the highest N dose. The weather in the individual years was also significant and in 1997, which was unfertile, the highest wet gluten content was scored. The high nitrogen dose in the unfertile year 1997 significantly increased the wet gluten content. In 1996 there were minimum differences between individual nitrogen doses and gluten content (table 3) and in 1997 at zero N dose higher gluten content in grain was found than in 1996 at the highest N dose. Significantly highest gluten content was reached at interaction of 150 kg N x herbicide and fungicide, the lowest at the complete treatment and zero N dose. The sedimentation test was the character which reacted to the application of agrochemicals the most (table 4). Significantly favourable effect appeared at the complete pesticide treatment and separate herbicide application. On the contrary, the common herbicide and growth stimulant application had significantly negative effect. The effect of fertilization, although significant, shows that fertilization is more effective rather in the interaction with pesticides and the weather because at 50 kg N dose it was lower than at the zero one and even at I50 kg it was on the significance limit. Sedimentation positively reacted to the higher nitrogen dose at the complete use of means of wheat protection.

1303 Tissot, S.; Quenon, G.; Miserque, O. (Centre de recherches agronomiques, Gembloux (Belgium). Dept. genie rural) (1999) **Tolerance of wheat crop [Triticum aestivum] towards the spreading heterogeneity of nitrogen manure.** *BASE - Biotechnologie, Agronomie, Societe et Environnement (Belgium). Biotechnology, Agronomy, Society and Environment v. 3(4) p. 247-252.* 5 ill., 1 table, 17 ref. French. (AGRIS 2000-016132).

The homogeneity of fertilizer application depends mainly on the regularity of transversal distribution. During the last few years, we have tested more than 300 distributors on farms. Results show big differences between the machines (CV between 5/ and more than 50/). The result is linked to distributor features, fertilizer characteristics and user skills. Moreover, crop yield is a function of fertilizer availability for plants. In the case of wheat, nitrogen is particularly important. Using farm application data, a simulation of wheat yield is built in relation with an increase of typical distribution mistakes. Thus, it is possible to assess an acceptable level of heterogeneity for the crop.

1304 Titova S.A. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Effect of various doses of nitrogen fertilizers on yield and quality of barley grain].** *Mezhdunarodnyj agrarnyj zhurnal (Belarus) (no. 8) p.22-24.* Russian. (AGRIS 2000-016003).

Optimum doses of nitrogen fertilizers, contributin for obtaining barley yield from 57 to 60 metric centners per 1 ha on well cultivated sod-podzolic slightly loam soil under two levels of soil acidity and organic fertilizers effect, have been adduced.

1305 Vach, M. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyne (Czech Republic)) (1999) **Effect of supplementary plant nutrition on yields and quality of some field crops.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 156-160.* Mendelova Zemedelska a Lesnicka Univ. 2 graphs, 3 tables; 4 ref. Czech. (AGRIS 2000-016137).

1306 Verma, UN.; Pal, SK.; Singh, MK.; Thakur, R.; Upasani, RR. (2000) **Nutrient utilization of late sown wheat (Triticum aestivum) on acid soil (Haplustalf) of Bihar plateau.** *Indian Journal of Agricultural Sciences. 70(2):93-96.* English. [Birsa Agr Univ, Dept Agron Ranchi 834006 Bihar India].

A field experiment was conducted during winter season of 1994-96 to study the nutrient utilization of late sown wheat (Triticum aestivum L. emend.Fiori.&Paol.) in split-plot design on acid soil (Haplustalf) of Bihar plateau. Main-plot included 4 seeding time, viz moderately late(1 December), late (16 December), very late(1 January) and extremely late (16 January) and sub-plot consisted of 4 nutrient levels, viz N0P0K0, N40P8.7K16.6, N80P17.5K24.9 and N120P26.2K33.2 Moderately late planted wheat responded to N120P26.2K33.2 yielding 4 661 kg/ha grain and removed 173.44, 16.67 and 148.00 kg/ha N, P and K respectively with 60.28 % nutrient uptake efficiency. Similarly, late planted crop responded to N80P17.5K24.9 yielding 3 061 kg/ha grain and absorbed 123.33, 9.67 and 95.21 kg/ha N, P and K respectively with 45.28 % nutrient uptake efficiency. Likewise very late planted wheat exhibited response only up to N40P8.7K16.6 gave 2 035 kg/ha grain and removed 76.90, 6.51 and 70.28 kg/ha N, P and K respectively with uptake efficiency of 34.39 %. However, extremely late planted wheat did not respond to fertilizer application. Nutrient-use efficiency gradually decreased either with subsequent delay in seeding or increasing nutrient level. [References: 4].

1307 Vildflush, I.R.; Gurban, K.A.; Kurulenko, V.M. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Effect of fertilizers and new growth regulators of on the yield and quality of barley grain].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 124-129.* BRISSA. 4 tables; 4 ref. Russian. (AGRIS 2000-016007).

On the sod-podzolic light-textured loamy soils the application of 4 t/ha of vermicompost under barley increased grain yield by 8, 5 c/ha and the effect was equivalent to 25 t/ha farmyard manure. The application of growth regulator epin tended to increase the barley yield at the background of N60P40K60 by 3, 4 c/ha and it allows to reduce the rates of mineral fertilizers under this crop by 30%.

1308 Xu Haiguang (Hebei Agricultural Univ., Baoding (China). Coll. of Agronomy) (1999) **Effect of using nitrogen fertilizer on the growth and development of rice after wheat in different stages.** *Journal of Agricultural University of Hebei (China). Hebei Nongye Daxue Xuebao (China) v. 22(2) p. 5-9.* 6 tables; 5 ref. Chinese. (AGRIS 2000-016045).

1309 Yadav, RL.; Dwivedi, BS.; Pandey, PS. (2000) **Rice-wheat cropping system: assessment of sustainability under green manuring and chemical fertilizer inputs.** *Field Crops Research. 65(1):15-30.* English. [Project Directorate Cropping Syst Res Meerut 250110 Uttar Pradesh India].

Rice-wheat rotations are the most important cropping system of the Indo-Gangetic plains. We measured the long-term sustainability of the system for green manuring and chemical fertilizer input practices utilising the trends in grain yield, partial factor productivity (PFP), agronomic efficiency, benefit:cost ratio, soil organic carbon content (OC) and sustainable yield index (SM). The data of a long-term experiment conducted at six locations in the Indo-Gangetic plain region of India revealed that grain yield and PFP of both rice and wheat declined under control (no fertilizer, no green manure) and sub-optimal fertilizer inputs (50 or 75% recommended fertilizer NPK) at all locations. Complete dose of fertilizer NPK (100% recommended) increased grain yields as well as PFP in rice but did not prevent decline in these parameters in wheat. Partial substitution of chemical fertilizer with Sesbania green manure, however, brought further improvement in yield and PFP in rice and the residual effect of green

manure reversed the declining trend in wheat. The SYI and agronomic efficiency of fertilizers were also greater in plots receiving 100% fertilizer NPK or green manuring along with 50 or 75% recommended NPK. Benefit : cost ratio of fertilizer inputs and green manuring practices increased in both crops and for all treatments, indicating that the benefit accruing from fertilizer improved with time. At locations with high initial OC, a depletion of OC was noticed whereas OC increased at locations with low initial OC, with OC stabilizing between 0.60 and 0.65%. Trends in grain yield, PFP and agronomic efficiency of fertilizer appear promising tools to measure sustainability of fertilizer management practices. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 38].

1310 Yanishevsky, S.B. ("AgroIncome" Scientific and Production JSC, Chabany, Kyiv oblast (Ukraine)) (1998) **[Determining the optimal conditions of triticale biological potential realization in the Polissya (Forest zone) of Ukraine].** 274 ref.; 9 ill.; 33 tables; 4 ann. 151 p. Russian. (AGRIS 2000-016142).

The Amphidiploid 3/5 triticale variety is studied. As a result, optimal parameters of fertilizing are revealed for realizing potential of its productivity. The technology of growing triticale by means of using intensive-type varieties according to the Polissya soil climatic zone. The yield increase stands at 0.91-1.26 tonnes per hectare.

1311 Zapotocny, V.; Bizik, J.; Mala, S. (Research Institute of Irrigation, Bratislava (Slovak Republic)) (1999) **Effects of irrigation and fertilization on yields of main crops.** *Scientific papers of the Research Institute of Irrigation Bratislava. Rehak, S. (Ed.) (Research Institute of Irrigation, Bratislava (Slovak Republic)) 216 p. p. 203-211.* Research Institute of Irrigation. 3 tables, 2 ill.; 12 ref. English. (AGRIS 2000-022776).

The problems were studied in a stationary experiment started in 1973 on carbonate chernozem in south western Slovakia. The paper assesses yields of main crops over the 26 year period (1973 to 1998), namely of corn maize grown 5 x, silage maize grown 4 x, winter wheat grown 6 x, spring barley grown 4 x, sugar beet grown 2 x (4 years). Even though the experiment included a number of fertilization variants, the paper evaluates just five of them, namely O, PK, NPK, N1PK, N1P1K1. The index 1 corresponds approximately to 1.5 dose of a given nutrient. Results reveal varying responsiveness of stated crops to irrigation and fertilization. Maize yields are higher with irrigation rather than fertilization applied, specifically in case of corn maize taken as 5 year average by as much as 54.7%. Years characterized by large precipitation deficit in July and August, as was the case in 1990 and 1973, had very high efficiency of irrigation, namely as much as 456.8% and 72.5%, respectively. Favourable distribution of precipitation meant low irrigation generated increases in yields. Maize responded to fertilization by 1.3 % to 15.3 % yield increase, whereas non-irrigated maize virtually did not respond to the former (see Figure 1). A similar high responsiveness to irrigation was found in case of silage maize. Fertilization proved more efficient than in corn maize, with yield increases for non-irrigated and irrigated variants ranging from 6.5% to 11.6% and 7.4% to 15.8%, respectively. Yields of cereals and the responsiveness of the former to irrigation varies according to the distribution of precipitation in May, June and July. Provided precipitation deficiency occurs at least in two of the above stated months, then winter wheat responds positively to irrigation. To illustrate this, in 1993, when April and May were considered as dry, irrigation generated yield increases represented as much as 26%. Fertilization is more efficient with irrigated wheat, ranging in efficiency from 4.6% to 18.2%, where higher nitrogen doses contribute to lower yields as a consequence of lodging. Spring barley grown 4 x did not provide any valid evidence as to beneficial effects of irrigation. Increased yields were registered only in 1977 when May and June were dry. A similar high increase in barley yields, by as much as 1 t/ha, was found in the same location in 1998 (BIZIK et al., 1998), characterized by high temperatures and low precipitation volume over these months. On average, barley responded to fertilization in a larger measure. Increased nitrogen doses caused lodging. Results obtained in sugar beet growing confirm high responsiveness to irrigation and furthermore reveal that there was a sufficient supply of nitrogen from soil and manure and that application of nitrogen from fertilizers to increased refined sugar production proved inefficient. These facts point out to the need to use available data on various nitrogen forms contained in soil when applying nitrogen as a fertilizer to sugar beet. Alfalfa is a crop in which it is necessary to offset the shortage of water resources by means of irrigation, the more so if June, July and August are dry. Non-irrigated alfalfa responded to fertilization in a greater measure.

1312 Zerulla, W.; Pasda, G.; Huther, O. (1999) **Optimum timing for sulfur application in winter wheat with respect to crop yield and quality.** *Agribiological Research-Zeitschrift fur Agrarbiologie Agrikulturchemie Okologie. 52(3-4):251-260.* German. [BASF Agrarzentrum Limburgerhof Carl Bosch Str 64 D-67117 Limburgerhof Germany].

Between 1995 and 1997, we have conducted 32 fertilizer trials with sulphur (30 kg/ha S plus 60 kg/ha N as Ammonium Sulphate Nitrate BASF 26) at various sites in Germany to determine the optimum timing of a sulphur application for winter wheat (beginning of vegetation, growth stage 30/32 or growth stage 49/51). The summarized results are: 1. Averaged over 32 fertilizer trials, a sulphur application at the beginning of vegetation or at growth stage 30/32 resulted in a significant yield increase compared to N application only. Sulfur application at growth stage 49/51 had no effect on crop yield. 2. Depending on the weather during the trial year, the highest yield increase was obtained with sulfur application at the beginning of vegetation when temperature and precipitation in winter were above average (here: 1995), and with sulfur application at growth stage 30/32 after a cold and dry winter (here: 1996). 3. Sulfur application - regardless of timing - had no effect on the crude protein content. 4. On the basis of the found S-min-values, neither the necessity of a sulfur-application nor the optimal date of sulfur-application could be prognosed. [References: 11].

1313 Zhang Lifu (Huazhong Agricultural Univ., Wuhan (China). Dept. of Agronomy) (1998) **Study on effects of applying phosphate to winter wheat.** *Hubei Agricultural Sciences (China). Hubei Nongye Kexue (China) (no. 3) p. 37-39.* 2 tables; 7 ref. Chinese. (AGRIS 2000-016135).

1314 Zhang, MC.; Nyborg, M.; Malhi, SS.; Solberg, ED. (2000) **Yield and protein content of barley as affected by release rate of coated urea and rate of nitrogen application.** *Journal of Plant Nutrition. 23(3):401-412.* English. [Univ Alberta, Dept Renewable Resources Edmonton AB T6G 2E3 Canada].

Coated urea consists of a urea core and a polymer coating. It meters out urea over a period of time. In the market place, price is favorable for high protein content feed barley. The objectives of this study were to determine release rate of urea from coated urea products and relative effectiveness of urea, coated urea or a mixture of coated urea products with different release rates in increasing yield and protein content of barley. Release rate of coated urea Mini I (quick release) and Mini II (slow release) in water was determined at 23 degrees C by recovering ten pre-weighed granules from 500 mL water at 6 h, 2, 4, 6, 8, 10, and 12 days. The recovered granules were dried and then weighed. Barley (Hordium vulgare L. cv. Duke) was grown in potted soil (2 L) at 15 degrees C for 90 days in a growth chamber with treatments of Nil, non-coated urea, Mini I, Mini II, Mixture I (1/3 urea+1/3 Mini I+1/3 Mini II) and Mixture II (1/5 urea+2/5 Mini I+2/5 Mini II). The nitrogen (N) application rates were 100, 200 and 300 kg N ha(-1). Above-ground plant samples were taken at 22, 44, 66, and 90 (maturity) days after seeding, and dry matter mass per pot and N content of the plant samples were determined. The release of urea from Mini I and Mini II followed a lognomial pattern. Increasing N application rate increased dry matter yield of barley. Dry matter yield from urea tended to be higher than other treatments at each rate of N application, but that did not couple with high grain protein content. At 100 kg N ha(-1), there was no post anthesis N assimilation (PANA) for urea and Mini I, but there were 4, 14, and 13% PANA for Mini II, Mixture I, and Mixture II, respectively. However, when N application rate was increased to 200 and 300 kg N ha(-1), there was PANA even for urea treatment. Protein content of barley grain was higher with coated urea or mixture treatments than with urea at each rate of N application. The potential N loss (i.e., difference between percent N

released from fertilizers and percent fertilizer N recovered by barley) was Mini II<Mini I<Mixture II<Mixture I for the same N application rate, and was 100<200<300 kg N ha(-1) for the same fertilizer treatment. In conclusion, at a limited N application rate, coated urea with a slow release rate or a combination of two coated urea products (quick and slow release) with urea increased grain protein content of barley. The potential N loss was less with coated urea applied alone than with a mixture of coated urea and urea. [References: 25].

1315 Zhu, YG.; Shaw, G.; Nisbet, AF.; Wilkins, BT. (2000) **Effects of external potassium supply on compartmentation and flux characteristics of radiocaesium in intact spring wheat roots (vol 84, pg 639, 1999).** *Annals of Botany. 85(2):293-298.* English. [Univ Adelaide, Dept Soil & Water Glen Osmond SA 5064 Australia].

Short term experiments investigated the effects of potassium supply on radiocaesium influx/efflux and the radiocaesium compartmentation in intact spring wheat roots. Short term (24-72 h) influx analysis showed that net influxes of radiocaesium to both root and xylem were reduced approximately ten-times by increasing external potassium concentration from 50 mu M to 200 mu M. Efflux analysis distinguished three components for radiocaesium (namely cell wall + free space, cytoplasm and vacuole) and showed that the rates of Cs+ efflux at an external potassium concentration of 100 mu M (19.16 and 1.70 Bq g(-1) min(-1) for phi(eo) and phi(vo), respectively) were about three-times faster than those at 50 mu M (7.24 and to 0.41 Bq g(-1) min(-1) for phi(co) and phi(vo), respectively). The results also showed that external potassium concentration did not have a significant effect on the distribution of Cs-137 between cytoplasm and vacuole, as indicated by the ratio of Cs-137 in the two compartments. Results obtained in this study suggested that the inhibitory effect of potassium on the net uptake of radiocaesium by the plant root may be partially ascribed to the fact that at higher external potassium concentrations Cs+ efflux rates were much higher. The mechanisms involved are discussed. (C) 2000 Annals of Botany Company. [References: 20].

1316 Zimolka, J.; Richter, R.; Ehrenbergerova, J.; Cerkal, R. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)) (1999) **Effect of N doses in combination with ploughdown of sugar-beet tops on yields and malting quality of spring barley.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 241-243.* Mendelova Zemedelska a Lesnicka Univ. 1 table; 4 ref. Czech. (AGRIS 2000-016012).

F06 IRRIGATION

1317 Maliwal, GL.; Patel, JK.; Kaswala, RR.; Patel, ML.; Bhatnagar, R.; Patel, JC. (2000) **Scheduling of irrigation for wheat (Triticum aestivum) under restricted water supply in Narmada region.** *Indian Journal of Agricultural Sciences. 70(2):90-92.* English. [Gujarat Agr Univ, BA Coll Agr Anand Campus Anand 388110 Gujarat India].

A field experiment was conducted during winter season (rabi) of 1994-95 to 1996-97 at Khandha, Gujarat to study the effect of irrigation schedule on yield and quality of wheat (Triticum aestivum L. emend. Fiori & Paol.) under restricted water supply. The treatments conprised 8 levels of irrigation schedule. Results indicated that 4 irrigtations at pre-sowing, crown root initiation, tillering and flowering under restricted water supply gave consistently higher grain yield of wheat during all the years and also in pooled. The water-use efficiency was also higher with this treatment. The quality of wheat grain (lysine and tryptophan) does not affect due to reduction in number of irrigation under constraint of irrigation water than normal recommended irrigation. [References: 7].

1318 Playan, E.; Martinez Cob, A. (Consejo Superior de Investigaciones Cientificas, Zaragoza (Espana). Estacion Experimental de Aula Dei) (1999) **Simulation of basin irrigation scheduling as a function of discharge and leveling.** *Investigacion Agraria. Produccion y Proteccion Vegetales (Espana) t. 14(3) p. 545-554.* 4 tablas, 2 graf.; 12 ref. English. (AGRIS 2000-016180).

Se realizo una simulacion de una programacion de riegos para varios casos con riego por inundacion mediante un modelo hidrodinamico bidimensional. La programacion se realizo para dos cultivos y dos localidades. Los cultivos fueron trigo y alfalfa, y las localidades fueron Zaragoza y Daroca, con evapotranspiracion de referencia 1.194 y 926 mm anoE-1, respectivamente. Se consideraron dos variables de riego, relacionadas con el diseno y el manejo. La primera de las variables fue el caudal de riego, para el que se consideraron valores de 0, 05 a 0, 20 m cubicos sE-1. La calidad de la explanacion , cuantificada con la desviacion estandar de la elevacion del terreno (SD), fue la segunda variable utilizada. Se utilizaron valores de SD de 0 a 30 mm. Los resultados indicaron que el aumento del caudal de 0, 05 a 0, 20 m cubicos sE-1 reduce el numero de riegos estacionales en un 32% en promedio. En cuanto a la explanacion, si se mejorara la SD de 30 a 0 mm, el numero de riegos estacionales se reduciria en un 22%. Un bajo caudal de riego y una mala calidad de la explanacion se traducen en una baja eficiencia del riego por inundacion que produce un volumen importante de perdidas por percolacion profunda.

1319 Soumi, G.; Al Shayeb, R. (1998) **[The supplementary irrigation in Syria].** Directorate of irrigation and water use, Damascus (Syria). Directorate of irrigation and water use. 7 ref.; 12 tables. 48 p. Arabic. (AGRIS 2000-016177).

1320 Zarski, J.; Rzekanowski, Cz.; Dudek, S.; Rolbiecki, S. (Akademia Techniczno Rolnicza, Bydgoszcz (Poland). Wydzial Rolniczy)) (1999) **Cost-effectiveness of overhead irrigation of field crops cultivated in the vicinity of Bydgoszcz.** *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland) (no.44) p. 315-320.* 3 tables; 16 ref. English. (AGRIS 2000-022824).

The present paper concerns the results of 72 one-year field experiments on overhead irrigation of 8 field crop species, carried out from 1986 to 1998 on a very light soil in the vicinity of Bydgoszcz. The investigation confirmed that the use of sprinkler irrigation under such conditions contributed to a very high multiyear productivity which ranged from 72 to 188 percent, depending on the species. Economic results of sprinkler irrigation depended on the value of produce increase and sprinkling irrigation costs. With the agricultural income of over 3 000 zl/ha, the sprinkler irrigation of the table potato appeard most cost-effective, whereas sugar beet and faba bean as well as some cereals less.

F07 SOIL CULTIVATION

1321 Arshad, M.A. (Agriculture and Agri Food Canada, Beaverlodge, Alta. (Canada).); Franzluebbers, A.J.; Azooz, R.H. (1999) **Components of surface soil structure under conventional and no-tillage in northwestern Canada.** *Soil and Tillage Research (Netherlands) v. 53(1) p. 41-47.* 30 ref. English. (AGRIS 2000-022860).

1322 Ball, B.C. (Scottish Agricultural Coll., Edinburgh (United Kingdom). Environmental Div.); Scott, A.; Parker, J.P. (1999) **Field N(2)O, CO(2) and CH(4) fluxes in relation to tillage, compaction and soil quality in Scotland.** *Soil and Tillage Research (Netherlands) v. 53(1) p. 29-39.* 18 ref. English. (AGRIS 2000-022859).

1323 Bostrom, U. (Swedish Univ. of Agricultural Sciences, Uppsala (Sweden). Dept. of Crop Production Science) (1999) **Type and time of autumn tillage with and without herbicides at reduced rates in southern Sweden. 1. Yields and weed quantity.** *Soil and Tillage Research (Netherlands) v. 50(3-4) p. 271-281.* 22 ref. English. (AGRIS 2000-016186).

1324 Bostrom, U. (Swedish Univ. of Agricultural Sciences, Uppsala (Sweden). Dept. of Crop Production Science); Fogelfors, H. (1999) **Type and time of autumn tillage with and without herbicides at reduced rates in southern Sweden. 2. Weed flora and diversity.** *Soil and Tillage Research (Netherlands) v. 50(3-4) p. 283-293.* 39 ref. English. (AGRIS 2000-016187).

1325 Ferreras, LA.; Costa, JL.; Garcia, FO.; Pecorari, C. (2000) **Effect of no-tillage on some soil physical properties of a structural degraded Petrocalcic Paleudoll of the southern "Pampa" of Argentina.** *Soil & Tillage Research. 54(1-2):31-39.* English. [Italia 647 9 Dpto B RA-2000 Rosario Santa Fe Argentina].

Soil structural deterioration from continuous cropping systems can adversely affect crop development. Conservation tillage systems are useful to control soil degradation, but may lead to excessive soil compaction, negatively impacting crop growth. Physical measurements were made during 1994 on a Chernozemic loam soil (Petrocalcic Paleudoll) with a petrocalcic horizon at a depth of 1.2 m in Balcarce (Buenos Aires, Argentina). The experiment started in 1992 with wheat (Triticum aestivum L.), followed in 1993 with soybean (Glycine max. (L.) Merr.) and in 1994 with wheat again. The soil had been previously cultivated for 25 years and presented structural degradation (40% of the optimum value). The aim of the study was to evaluate the effect of two tillage systems: conventional tillage (CT) and no-tillage (NT) on soil physical properties and to determine soil physical factors related to reduced growth of wheat under NT. Soil bulk density in the 3-8 and 15-20 cm layers was measured by the cylinder and the paraffin methods. There were no significant differences between treatments (P less than or equal to 0.05). Mechanical resistance measured by the cone penetrometer at emergence gave the following values (P less than or equal to 0.05): NT: 1.6 MPa, CT: 1.1 MPa at 5-10 cm depth; NT: 1.6 MPa, CT: 1.0 MPa at 10-15 cm depth; and NT: 1.3 MPa, CT: 0.9 MPa at 15-20 cm depth. The function of pore size distribution determined by the water desorption method was significantly different between tillage systems (P less than or equal to 0.05). The volume of pores with a diameter larger than 20 mu m was greater under CT than under NT (CT: 26.1%, NT: 16.8%). Structural stability as measured by both dry and wet sieving was not significantly different between treatments (P less than or equal to 0.05). Plots under CT and NT had low stability indexes (NT: 30%, CT: 26%), showing a deterioration of soil structure. The saturated hydraulic conductivity determined by a constant head technique was significantly lower (P less than or equal to 0.05) in NT than in CT plots (NT: 3.5x10(-7) m s(-1) CT: 10.9x10(-7) m s(-1)). Soil water content in the topsoil measured by neutron probe was higher for NT in the early in the growth season. From anthesis to physiological maturity no significant difference (P less than or equal to 0.05) in soil water content was found between tillage systems. Data suggest that increased soil mechanical resistance under NT can decrease growth of wheat roots and reduce dry matter accumulation and wheat yield. [References: 36].

1326 Gajri, P.R. (Punjab Agricultural Univ., Ludhiana, Punjab (India). Dept. of Soils); Gill, K.S.; Singh, R.; Gill, B.S. (1999) **Effect of pre-planting tillage on crop yields and weed biomass in a rice-wheat system on a sandy loam soil in Punjab.** *Soil and Tillage Research (Netherlands) v. 52(1-2) p. 83-89.* 14 ref. English. (AGRIS 2000-022867).

1327 Huang Minjing; Jin Fansheng; Chi Baoling (Shanxi Academy of Agricultural Sciences, Taiyuan (China). Centre of Arid Farming) (1998) **Influence of different ways of plastic covering on the photosynthesis property and yield increasing potential in winter wheat.** *Acta Agriculturae Boreali-Sinica (China). Huabei Nongxuebao (China) v. 13(2) p. 25-29.* 2 tables; 4 ill., 7 ref. Chinese. (AGRIS 2000-016208).

1328 Noworolnik, K. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Cereal Crops Cultivation) (1999) **Effect of different intensive technology of cultivation on spring barley yielding.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 283-287.* 3 tables; 6 ref. Polish. (AGRIS 2000-016189).

The series of field experiments with spring barley was carried out in various edaphic conditions in the period 1992-97. The effect of four different technologies of spring barley cultivation on grain and protein yield was examined. The technologies differed from one another with NPK fertilization level and plant protection level. NPK decline and plant protein limit caused decrease of grain and protein yields of barley, especially in unfavourable edaphic conditions. The reduction of barley cultivation inputs is rational in a good envirinment conditions (forecrop - root crops, high soil culture).

1329 Pikul, J.L. Jr (Northern Grain Insects Research Lab. USDA ARS, Brookings, SD (USA).); Aase, J.K. (1999) **Wheat response and residual soil properties following subsoiling of a sandy loam in eastern Montana.** *Soil and Tillage Research (Netherlands) v. 51(1-2) p. 61-70.* 21 ref. English. (AGRIS 2000-022889).

1330 Sartori, L.; Sandri, R. (Padua Univ. (Italy). Dipartimento del Territorio e Sistemi Agroforestali); Anken, T. (Stazione Federale di Genio Rurale, Tanikon (Switzerland)) (1998) **[Seedbed. The best refining of soil [Triticum - Veneto]].** *Terra e Vita (Italy) v. 39(35) p. 40-43.* 3 tables; 2 graphs. Italian. (AGRIS 2000-016207).

1331 Selles, F. (Agriculture and Agri Food Canada, Swift Current, Sask. (Canada). Semiarid Prairie Agricultural Research Centre); McConkey, B.G.; Campbell, C.A. (1999) **Distribution and forms of P under cultivator- and zero-tillage for continuous- and fallow-wheat cropping systems in the semi-arid Canadian prairies.** *Soil and Tillage Research (Netherlands) v. 51(1-2) p. 47-59.* 44 ref. English. (AGRIS 2000-022888).

1332 Williams, JR.; Roth, TW.; Claassen, MM. (2000) **Profitability of alternative production and tillage strategies for dryland wheat and grain sorghum in the Central Great Plains.** *Journal of Soil & Water Conservation. 55(1):49-56.* English. [Kansas State Univ, Dept Agr Econ Manhattan, KS 66506 USA].

Three tillage systems used in continuous cropping and rotations with wheat (Triticum aestivum L.) and grain sorghum [Sorghum bicolor (L.) Moench] were compared. Experiment station yield data and annual price darn from 1986 to 1995 were coupled with 1995 cost-of-production estimates to determine expected net returns for a typical dryland farm in south central Kansas. In general, risk analysis indicated thar risk-averse managers preferred ed reduced-tillage systems. A rotation of reduced-tillage sorghum and no-tillage wheat was preferred by moderately risk-averse producers. A combination of reduced-tillage continuous sorghum and reduced-tillage continuous wheat was preferred by more risk-averse producers. Planting wheat and grain sorghum in a rotation provided a small economic advantage compared to planting a single crop of wheat or sorghum. [References: 21].

1333 Wolgast Broberg, Aa. (SLU, Uppsala (Sweden). Inst. foer Ekologi och Vaextproduktionslaera) (1999) **Mulching with organic material in spring barley.** SLU, Uppsala (Sweden). *Ecology and Crop Production Science (Sweden); no. 1 44 p.* Bibliography: p. 40-44. A thesis bound with 2 reprints. Swedish. (AGRIS 2000-016190).

F08 CROPPING PATTERNS AND SYSTEMS

1334 Caporali, E.; Campiglia, E.; Paolini, R.; Mancinelli, R. (Universita della Tuscia, Viterbo (Italy). Dipartimento di Produzione Vegetale) (1998) **The effect of crop species - nitrogen fertilization and weeds on winter cereal/pea intercropping [Triticum aestivum L. - Hordeum vulgare L. - Pisum sativum L.].** *Italian Journal of Agronomy (Italy) v. 2(1) p. 1-9.* 5 tables; 2 graphs; 24 ref. English. (AGRIS 2000-022928).

1335 Hechmi, N. (Institut National de la Recherche Agronomique de Tunisie, Ariana (Tunisie)) (1999) **Comparative study of a few grass/legume associations in the wetter part of Tunisia.** *Fourrages (France) (no 158) p. 269-275.* 19 ref., 3 tableaux. French. (AGRIS 2000-016224).

Un essai conduit pendant 2 campagnes a la station de l'INRAT de Sedjenane a permis de comparer 9 associations vesce-graminee; elles associaient une des 3 vesces locales (Vicia sativa ou commune, Vicia narbonensis 19 et 22), et une graminee, locale (triticale 109 ou orge Rhihane) ou introduite (avoine Avon). En presence d'un effet annee significatif, l'association vesce commune-triticale est la plus productive (10 t MS/ha). Le triticale est tres peu attaque par les maladies, en annee moyenne comme en annee humide. D'autre part,

les associations a base de vesce commune apparaissent plus productives que celles a base de vesce de Narbonne. L'association vesce commune-triticale est egalement la plus riche en legumineuse (63%).

1336 Stupnicak Rodzynkiewicz, E.; Pasek, T.; Lepiarczyk, A.; Scigalska, B. (Agricultural University, Krakow (Poland). Dept. of General Cultivation Soil and Plants) (1999) **King of crop rotation and winter wheat yielding.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 345-347.* 2 tables; 6 ref. Polish. (AGRIS 2000-016277).

The yielding of winter wheat cultivated in three kinds of crop rotation which differed with cereal share and wheat position in crop rotation was compared. Both cereal share and forecrop affected the yield, but the forecrop more influenced yields of grain and crude protein in grain as well as the shape of grain and number of ears per unit area. The highest wheat yields were obtained in position after cereal mixture (spring wheat + spring barley).

1337 Urbanowski, S.; Piekarczyk, M.; Rajs, T. (Akademia Techniczno Rolnicza, Bydgoszcz (Poland). Wydzial Rolniczy)) (1999) **Yielding of spring barley in crop rotations and monoculture.** *Zeszyty Naukowe Akademii Techniczno-Rolniczej w Bydgoszczy. Rolnictwo (Poland) (no.44) p. 279-284.* 4 tables; 14 ref. Polish. (AGRIS 2000-022916).

The paper presents the results on the yielding of spring barley from 1989 to 1998 in traditional 6-years crop rotation (control), simplifield 3-year crop rotation and monoculture on the lessive soil of a good rye soil suitability complex. The shortening of the rotation to three years resulted in the spring barley grain yield decrease by 14.1 percent, on average. Continuous cultivation for 10 years (between the 15th and 25th year of experiment) reduced the yield by 41.9 percent, while for 25 years by 33.8 percent as compared with the control.

1338 Wanic, M.; Nowicki, J.; Bielski, S. (University of Agriculture and Technology, Olsztyn (Poland). Dept. of Agricultural Systems) (1999) **Role of cereal mixture in stabilizing cereal yield in crop rotation.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 349-355.* 3 tables; 11 ref. Polish. (AGRIS 2000-016243).

In the long-term experiment the reaction of cereal mixture consisting of spring barley and oats upon the cultivation in rotations with its 25 and 75 percent share was examined. It was stated that both components in the mixture and as a pure cultures, decreased their yields when they followed themselves in rotation with their 75 percent share, however in the case of mixture the decrease was significantly smaller.

F30 PLANT GENETICS AND BREEDING

1339 **Redesigned barley could thwart scab disease** (2000) *Outlook on Agriculture. 29(1):12.* English.

1340 Akopian, TA.; Vasil'ev, SA.; Ermishev, VY.; Zabrodina, MV.; Karyagina, AS.; Naroditsky, BS.; Khavkin, EE. (2000) **Conserved fragments of the MADS-box genes in perennial and annual rye.** *Russian Journal of Plant Physiology. 47(1):89-96.* English. [Russian Acad Agr Sci, Inst Agr Biotechnol Timiryazevskaya Ul 42 Moscow 127550 Russia].

MADS-box and K-box sequences of the MADS-box genes in wild perennial rye (Secale montanum Guss.) and cultivated annual rye (S. cereale L.) were studied by the direct amplification of genomic DNA with degenerated primers. The lengths of the DNA fragments corresponding to the MADS-box motif (about 150 base pairs, bp) were similar in two rye species, and also in maize, wheat, and barley. Amplification of the K-box sequence in three classes of the MADS-box genes produced DNA fragments of varying lengths. In the agamous class, the amplicon lengths were 180, 240, 280, and 400 bp in rye, 180, 240, 280, and 340 bp in wheat, 200, 280, and 340 bp in barley, and 190, 240, 560, and 650 bp in maize. The lengths of agamouslike6 amplicons in rye, barley, and maize corresponded to 1700, 1200, and 1700 bp. In the apetala1 class, the respective rye, wheat, barley, and maize amplicons were 485, 480-490, 480-490, and 440-450 bp. Two rye species did not differ in the length of K-box amplicons in the three classes of the MADS-box genes. Four characterized Fragments of rye MADS-box genes (GenBank accession numbers AF15709-AF159712) were compared to the corresponding regions of the MADS-box genes in other grasses (wheat, darnel, maize, sorghum, and rice) and in arabidopsis. [References: 26].

1341 Alemayehu Asefa; Wendafrash Mulugeta (Sheno Research Center (Ethiopia)) (1998) **Crop improvement research in North Shewa.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 97-109.* EARO. 3 tables. English. (AGRIS 2000-016397)..

1342 Alexandrova, N.; Todorovska, E.; Marinova, E.; Atanasova, A. (Institute of Genetic Engineering, BG 2232 Kostinbrod 2 (Bulgaria)) (1999) **DNA markers and their application in plant breeding for disease resistance in wheat.** Agricultural Academy, Sofia (Bulgaria). *Bulgarian Journal of Agricultural Science (Bulgaria) v. 5(4) p. 551-560.* 2 tables; 60 ref. English. (AGRIS 2000-016759).

Techniques which are particularly promising in assisting selection for agronomically important traits involve the use of molecular markers such as random - amplified polymorphic DNAs (RAPDs), restriction fragment lenght polymorphisms (RFLPs), microsatellites and PCR - based DNA-markers such as sequence characterized amplified regions (SCARs) and amplified fragment length polymorphisms (AFLPs). Molecular markers tightly linked to several disease resistance genes in wheat are reviewed.

1343 Alvarez, ML.; Guelman, S.; Halford, NG.; Lustig, S.; Reggiardo, MI.; Ryabushkina, N.; Shewry, P.; Stein, J.; Vallejos, RH. (2000) **Silencing of HMW glutenins in transgenic wheat expressing extra HMW subunits.** *Theoretical & Applied Genetics. 100(2):319-327.* English. [Univ Nacl Rosario, CONICET, Ctr Estudios Fotosintet & Bioquim Suipacha 531 RA-2000 Rosario Santa Fe Argentina].

Wheat HMW glutenin subunit genes 1Ax1 and 1Dx5 were introduced, and either expressed or overexpressed, into a commercial wheat cultivar that already expresses five subunits. Six independent transgenic events were obtained and characterized by SDS-PAGE and Southern analysis. The 1Dx5 gene was overexpressed in two events without changes in the other endosperm proteins. Overexpression of 1Dx5 increased the contribution of HMW glutenin subunits to total protein up to 22%. Two events express the 1Ax1 subunit transgene with associated silencing of the 1Ax2* endogenous subunit. In the SDS-PAGE one of them shows a new HMV glutenin band of an apparent M-r lower than that of the 1Dx5 subunit. Southern analysis of the four events confirmed transformation and suggest that the transgenes are present in a low copy number. Silencing of all the HMW glutenin subunits was observed in two different events of transgenic wheat expressing the 1Ax1 subunit transgene and overexpressing the Dx5 gene. Transgenes and expression patterns were stably transmitted to the progenies in all the events except one where in some of the segregating T-2 seeds the silencing of all HMW glutenin subunits was reverted associated with a drastic lost of transgenes from a high to a low copy number. The revertant T-2 seeds expressed the five endogenous subunits plus the 1Ax1 transgene. [References: 32].

1344 Amara, H.S. (Institut National de la Recherche Agronomique de Tunisie, Tunis (Tunisie). Departement des Sciences de la Production Vegetale); Benzaghou, S.; Lepoivre, P. (1999) **Androgenic ability of Tunisian durum wheat (Triticum durum Desf.) cultivars.** *Cahiers d'Etudes et de Recherches Francophones Agricultures (France) v. 8(4) p. 334-338.* 7 illus., 14 ref., 3 tableaux. French. (AGRIS 2000-016794).

Le ble dur (Triticum durum Desf.) est recalcitrant a la culture d'antheres in vitro etant donne le taux eleve de plantes albinos regenerees. La capacite androgenetique de six varietes de ce ble a ete analysee sur la base du developpement cytologique des microspores durant la phase induction in vitro. Deux milieux de culture ont ete

utilises: le milieu I1(mis au point a l'ICARDA) pour des varietes de ble tendre et le milieu I2 modifie par l'apport de 0, 5 mg/lde kinetine et 100 mg/l de PAA. Les observations microscopiques du developpement des microspores chez le ble dur ont montre que ces dernieres suivaient deux voies de divisions differentes: une de division symetrique (B) dominante et une de division asymetrique (A) chez un faible nombre de microspores. Elles aboutissent a la formation de microstructures a caractere callogene ou embryogene. On observe une grande variabilite de la reponse a l'androgenese parmi les six genotypes de ble dur etudies en fonction du milieu d'induction (production de cals allant de 1, 6 % pour la variete Khiar a 2, 1 % pour la variete Jeneh-Khotifa sur le milieu I2). Le pourcentage de plantules vertes regenerees a partir des structures pluricellulaires ainsi induites a varie de 55, 8 % pour la variete Om Rabia a 83, 1 % pour la variete Azizi.

1345 Aung, T.; Hussain, A.; Lukow, O.M. (Cereal Research Centre, Winnipeg (Canada). Agriculture and Agrifood) (1998) **Influence of chromosome constitution on the gene expression of seed morphology and endosperm proteins of wheat [Triticum durum Desf.].** *Journal of Genetics & Breeding (Italy) v. 52(1) p. 1-8.* 2 graphs; 18 ref. English. (AGRIS 2000-023282).

1346 Badea, E. (Universite de Bucarest (Roumanie). Institut de Biologie); Scripcariu, A.; Gregorian, L.; Gorenflot, R. (1999) **Variability evaluation of wheat somaclones by meiotic study.** *Revue de Cytologie et de Biologie Vegetales Le Botaniste (France) v. 22(1-2) p. 3-7.* 5 illus., 6 ref. French. (AGRIS 2000-016789).

L'etude de la meiose chez 29 somaclones de ble (Triticum aestivum L.) a mis en evidence des anomalies d'appariement des chromosomes dans les microsporocites du pollen. La frequence de ces aberrations est de 27, 77 % chez les somaclones derives des varietes Lovrin 41 et Fundulea 29 et de 72, 23 % cez les somaclones provenant de lignees haploides doublees. Nos analyses revelent la presence d'univalents, de chromosomes annulaires et d'isochromosomes en metaphase I, de ponts chromosomiques et de chromosomes retardataires en anaphase ainsi que de micronoyaux dans les tetrades. Ces anomalies meiotiques au niveau des plantes regenerees suggerent l'induction de deletions et/ou de translocations dans les cellules cultivees in vitro d'ou sont issus les somaclones etudies.

1347 Balyan, H.S.; Tejbir Singh (Chaudhary Charan Singh University, Meerut (India). Department of Agricultural Botany. (1997) **The usefulness of biparental matings and geno-phenotypic selection for yield improvement in wheat (Triticum aestivum L.).** *Indian Journal of Genetics & Plant Breeding (India) v. 57(4) p. 401-410.* 5 tables; 4 ill., 13 ref. English. (AGRIS 2000-023262).

1348 Barnabas, B.; Kovacs, G.; Hegedus, A.; Erdei, S.; Horvath, G. (2000) **Regeneration of doubled haploid plants from in vitro selected microspores to improve aluminium tolerance in wheat.** *Journal of Plant Physiology. 156(2):217-222.* English. [Hungarian Acad Sci, Agr Res Inst, Dept Cell Biol & Plant Physiol Brunszvik 2 H-2462 Martonvasar Hungary].

The present study was designed to investigate the possibility of selection for aluminium tolerant doubled haploid lines from wheat anther culture. To carry out the experiment anthers from Mv16 were cultured on a solidified W14 induction media supplemented with 50 and 100 mu mol/L aluminium sulfate, at low pH (pH 4.5). After 5 weeks of induction period the obtained embryoids were regenerated on 190-2 regeneration medium supplemented with Al in the concentrations as mentioned above. The offspring generation was rested in hematoxilin staining test to define the Al tolerance of the obtained DH lines. According to the results obtained Al added to the induction media had no negative effect on the androgenic responses (anther response, induction frequency of embryo like structures and their regeneration ability) of the genotype examined. The application of in vitro Al selection significantly increased the probability of obtaining DH lines with significantly higher tolerance, compared to the original genotype. Seeds of 10 selected DH lines were multiplied under field conditions for physiological studies. Seeds of the R4 generation were germinated in 10, 50 and 100 mu mol/L Al containing media, and the root and shoot growth characteristics were measured after 10 days of germination. The chlorophyll and Al contents were also determined. In the physiological tests the shoot and root elongation of the Al tolerant lines was also inhibited but the degree of inhibition was significantly less pronounced up to 50 mu mol/L Al. Similar concentration dependent responses were obtained by comparing the fresh and dry weight of sensitive and tolerant lines. The toxic effect of Al was also reflected in chlorophyll content of the leaves. The increasing Al concentration decreased the chlorophyll content of the sensitive lines, but not in the Al tolerant ones. [References: 41].

1349 Bednar, J.; Vyhnanek, T. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic). Ustav Genetiky); Martinek, P. (1999) **Prediction of bread-making quality in multispikelet winter wheat (Triticum aestivum) donors using protein signal genes.** *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis (Czech Republic) v. 47(4) p. 83-89.* 2 ill., 2 tables; 20 ref. Czech. (AGRIS 2000-016784).

New multispikelet winter wheat genotypes with non-standard spike morphotype (preliminarily designated "multirow spike" - MRS) were analysed. Bread-making grain quality was predicted in three genotypes with MRS (KM 240-97, KM 244-97, and KM 246-97) using protein signal genes. The allelic block GLD 1B3, a marker of poor bread-making quality and the so-called rye resistance to stem rust, was detected in KM 240-97 genotype that was heterogeneous in gliadin proportion. These characters are conditioned by 1R/1B translocation. A translocated segment of the 1R chromosome carries Sr-31 gene of resistance to stem rust and secalin genes whose translocation product markedly decreases gluten quality in wheat. In KM 240-87 the presence of allelic block GLD 1B1 was confirmed. The presence of 1B1 was confirmed in genotype KM 244-97 in all cases: Heterogeneity of KM 244-97 was expressed by 1D5 and 1D2 blocks. The 1B1-gliadin block was detected in KM 246-97, a source of homogeneous gliadin proportion. The 1B1-gliadin block is considered a marker of excellent bread-making quality.

1350 Bijral, J.S.; Sharma, T.R.; Singh, Kuldip (Shere e Kashmir University of Agriculture Science and Technology, R.S.Pura (India). Regional Agricultural Research Station) (1997) **Cytogenetics of BC1 and BC2 derivatives of a cross between triticum aestivum L. and aegilops ovata L.** *Indian Journal of Genetics & Plant Breeding (India) v. 57(4) p. 483-484.* 7 ref. English. (AGRIS 2000-023264).

1351 Boggini, G.; Tusa, P.; Di Silvestro, S.; Pogna, N.E. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)) (1998) **Agronomical and quality characteristics of durum wheat lines containing the 1BL/1RS translocation [Triticum durum Desf. - Sicily].** *Journal of Genetics & Breeding (Italy) v. 52(2) p. 167-172.* 4 tables; 17 ref. English. (AGRIS 2000-023283).

Six durum wheat lines containing the 1BL/1RS chromosome translocation were grown in replicated plots in Sicily during three years of testing and analysed for their agronomical and quality characteristics, as determined by the SDS-sedimentation volume, and alveograph and mixograph parameters. The translocated lines showed low yield potential and poor quality as compared to three control durum wheat cultivars. The sticky dough and weak gluten characteristics of the 1BL/1RS lines were attributed to the presence of secalins encoded by the Gli-R1 locus on chromosome 1RS and the absence of low Mr glutenin subunits encoded by the Glu-3 locus on chromosome 1BS, respectively. The occurrence of high Mr glutenin subunits 7 + 9 in one of the translocated lines did not improve its poor dough properties [Nel corso di tre anni di prova, in Sicilia, sono state coltivate in parcelle replicate sei linee di frumento duro contenenti la traslocazione cromosomica 1Bl/1RS, che sono state studiate relativamente alle caratteristiche agronomiche e agli aspetti qualitativi, indagati mediante l'accertamento di parametri con il volume di sedimentazione SDS, l'alveografo e il mixografo. Le linee traslocate manifestavano un basso potenziale produttivo e una cattiva qualita', in confronto con tre varieta' di frumento duro utilizzate come controllo. L'impasto colloso e le caratteristiche di scarsa forza del glutine delle linee 1BL/1RS venivano attribuiti, rispettivamente, alla

presenza di secaline codificate dal locus Gli-R1 sul cromosoma 1RS e all'assenza di subunita' di glutenine a basso Mr codificate dal locus Glu-3 sul cromosoma 1BS. La presenza di subunita' di glutenine 7 + 9 ad alto Mr in una delle linee traslocate non determinava un miglioramento delle caratteristiche dell'impasto].

1352 Borner, A.; Chebotar, S.; Korzun, V. (2000) **Molecular characterization of the genetic integrity of wheat (Triticum aestivum L.) germplasm after long-term maintenance.** *Theoretical & Applied Genetics. 100(3-4):494-497.* English. [IPK Correnstr 3 D-06466 Gatersleben Germany].

The genetic identity of eight wheat (Triticum aestivum L.) accessions maintained in the Gatersleben genebank and regenerated up to 24 times was studied by using wheat microsatellite markers (WMS). It was demonstrated that WMS can be used to analyze bulks of seeds stored more than 50 years in a seed reference collection at room temperature. No contamination due to foreign pollen or incorrect handling during the multiplication cycles was discovered. For one accession (TRI 4599) genetic drift was observed, whereas for TRI 249 a heterogenous situation for two markers was maintained over the years. We were able to show that microsatellites can be used as a simple and reliable marker system for the verification of the integrity and genetic stability of genebank accessions. [References: 11].

1353 Bouzergour, H. (Centre Universitaire d'Oum El Bouaghi (Alg@7erie). Ecole Normale Sup@7erieur, (ENS)). Benmahoned. A.; Hassoup, K.L. (Institut Technique des Grandes Cultures, (ITGC); Setif (Alg@7erie). Ferme experimentale (1997) **Variabilit@7e genetique, heritabilit@7e et corrlation entre caract@6eres mesures sur orge en milieu semi-aride** *C@7er@7ealiculture (Alg@7erie). Revue Technique et Scientifique (no. 30) p.11-156* tableaux; 1 fig.; 11 r@7efFrench(AGRIS 2000-023036).

1354 Calderini, DF.; Reynolds, MP. (2000) **Changes in grain weight as a consequence of de-graining treatments at pre- and post-anthesis in synthetic hexaploid lines of wheat (Triticum durum x T-tauschii).** *Australian Journal of Plant Physiology. 27(3):183-191.* English. [Univ Buenos Aires, Fac Agron, Dept Prod Av San Martin 4453 RA-1417 Buenos Aires DF Argentina].

Grain weight is a trait which has hardly been exploited for raising genetic yield potential of wheat. A clearer understanding of physiological determinants of grain weight potential would be useful in establishing the potential value of this trait in future breeding programs. The objective of this study was to improve understanding of how intra-spikelet competition for assimilates pre- and post-anthesis affect grain weight potential, and to evaluate possible mechanisms determining final grain weight in wheat. Two experiments were carried out under field conditions. Proximal or distal grains from the two central spikelets of spikes of three synthetic hexaploid lines were detached at heading or 7 d after anthesis. Synthetic wheats were used since they represent a potential source of genetic variability for grain weight potential. Carpel size at anthesis and grain weight during the grain filling period were measured. The de-graining treatment at heading significantly increased grain weight, especially in distal positions. On the contrary, the de-graining treatment carried out after anthesis caused no increase in final grain weight. The largest response to pre- anthesis de-graining occurred in grain positions with the lowest grain mass. In addition, the effect of de-graining prior to anthesis was associated hyperbolically with weight of carpels at anthesis within each grain position. Therefore, carpel weight at anthesis could be partially associated with the regulation of grain weight potential. [References: 45].

1355 Cantone, F. (Ministero per le Politiche Agricole, Rome (Italy)); Perenzin, M.; Minoia, C.; Empilli, S.; Vaccino, P.; Faccini, N.; Biancolatte, E.; Pasquini, M.; Galterio, G.; Paoletta, G.; Boggini, G.; Borghi, B. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)); Snidaro, M. (Ente Regionale per la Promozione e lo Sviluppo dell'Agricoltura per il Friuli Venezia Giulia (ERSA), Gorizia (Italy)); Padovan, S. (Istituto di Genetica e di Sperimentazione Agraria "N. Strampelli", Lonigo, Vicenza (Italy)); Concari, L. (Azienda Stuard, Parma (Italy)); Poli, M. (Azienda Marani, Ravenna (Italy)); Porfiri, O. (Centro Ricerche e Sperimentazione per il Miglioramento Vegetale "N. Strampelli", Tolentino, Macerata (Italy)) (1998) **The new varieties of bread wheat - triticum durun and barley registered in the Italian national catalogue in the year 1997 [variety trials).** *Sementi Elette (Italy) v. 44(3-4) p. 11-24.* 15 tables; 8 ref. Italian. (AGRIS 2000-023265).

The results of the variety trials carried out in several locations in the years 1995-96, 1996-97 are tabulated. Two winter barley varieties evaluated in 15 locations, 12 bread wheat varieties evaluated in 9 locations, 6 varieties of durum wheat evaluated in 13 locations, 2 varieties of spring barley evaluated in 7 locations, and 1 variety of triticale evaluated in 10 locations have been registered in 1997 in the Italian national catalogue [Sono riportati in tabelle i risultati delle prove varietali condotte in diverse localita' nelle annate agrarie 1995-1996, 1996-1997. Nel 1997 sono state iscritte al Registro Nazionale Italiano 2 varieta' di orzo autunnale valutate in 15 localit..., 12 varieta' di frumento tenero valutate in 9 localita', 6 varieta' di frumento duro valutate in 13 localita', 2 varieta' di orzo primaverile valutate in 7 localita' e 1 varieta' di triticale valutata in 10 localita'].

1356 Cherkaoui, S.; Lamsaouri, O.; Chlyah, A.; Chlyah, H. (2000) **Durum wheat x maize crosses for haploid wheat production: Influence of parental genotypes and various experimental factors.** *Plant Breeding. 119(1):31-36.* English. [Univ Mohammed V, Fac Sci, Dept Biol BP 1014 Rabat Morocco].

To improve haploid plant production in durum wheat, the haplomethod involving intergeneric crossing with maize followed by embryo rescue was used. The influence of parental genotypes and various experimental factors were studied. Ten cultivars of Triticum turgidum ssp. durum (female parent) were crossed with eight genotypes of Zea mays. After pollination, plant stems were either maintained in situ or cut near the base and kept in a 2, 4-dichlorophenoxyacetic acid (2, 4-D)-sucrose solution. Ten to 18 days after pollination, embryos were excised from developed ovaries and cultured on one of MS, MS/2, or B5 media. Haploid embryos and plants were obtained (78 green haploid plants regenerated in 1 year). The wheat genotype was significant for ovary development, embryo and plant formation, whereas the maize genotype was significant only for embryo formation. Detailed results of all crosses showed the best crossing partner for each wheat genotype. Cutting the plant stems after pollination gave better results than maintaining them in situ. The optimal stage for embryo rescue was 14 days and B5 and MS/2 media were more efficient than MS for embryo culture. [References: 27].

1357 Chlyah, O. (Universite Mohamed 5, Rabat (Maroc). Faculte des Sciences, Departement de Biologie, Laboratoire de Physiologie Vegetale); Amail, O.; Saidi, N.; Cherkaoui, S.; Lamsaouri, O.; Bouchra Chlyah, A.; Chlyah, H. (1999) **Doubled haploid plant production in durum wheat through wide crossing with Hordeum bulbosum and maize.** *Cahiers d'Etudes et de Recherches Francophones Agricultures (France) v. 8(4) p. 330-333.* 17 ref., 3 tableaux. French. (AGRIS 2000-016793).

On a obtenu des plantes haploides (n= 14) chlorophylliennes chez le ble dur en le pollinisant soit par H. bulbosum soit par le mais. Ces deux types de pollinisation ont ete compares pour 8 genotypes de ble dur. La nouaison est en general superieure apres croisement avec H. bulbosum mais la formation d'embryons et de plantes vertes est plus elevee avec le mais. La pollinisation de 4 genotypes de ble avec 4 varietes de mais a ete etudiee. Trois genotypes de ble ont forme des embryons avec les 4 varietes de mais et des plantes vertes avec 3 d'entre elles. Les genotypes de ble dur et de mais ont ete classes selon leurs capacites de formation d'embryons et de plantes vertes: le ble Sarif et le mais Guich se sont reveles les plus performants a cet egard.

1358 Desiderio, E.; Brogna, G.; Magini, M. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)) (1998) **[For hard wheat a high year [Triticum durum Desf.]].** *Terra e Vita (Italy) v. 39(39) p. 66-68, 70-74.* 7 tables; 4 graphs. Italian. (AGRIS 2000-016791).

1359 Dong Yongqin (Guizhou Academy of Agricultural Sciences, Guiyang (China). Inst. of Upland Crops) (1999) **Breeding of a new octoploid triticale cultivar Qianzhong 3.** *Guizhou Agricultural Sciences*

(China). Guizhou Nongye Kexue (China) v. 27(3) p. 1-4. 4 tables; 8 ref. Chinese. (AGRIS 2000-016704).

1360 Dzhatov, G.; Kt"steva, A. (Institut po Pivovarna Promishlenost i Khmeloproizvodstvo, Sofia (Bulgaria)) (1999) **European sorts barley.** Glavno Upravlenie po Khranitelno-vkusova Promishlenost k"m Ministerstvo na Promishlenostta, Sofia (Bulgaria). Kooperativno-izdatelska K"shcha "Khranitelno-vkusova Promishlenost. *Khranitelno-vkusova Promishlenost (Bulgaria). Food Industry v. 3(5) p. 2-3.* 1 ill., 2 tables; 2 ref. Bulgarian. (AGRIS 2000-016478).

1361 Fan Lian; Wu Yaoting; Yu Debin (Henan Agricultural Univ., Zhengzhou (China)) (1998) **Study on the fertility restoration of male sterility in wheat with Ae. kotschyi cytoplasm.** *Acta Agriculturae Universitatis Henanensis (China). Henan Nongda Xuebao (China) v. 32(3) p. 212-215.* 4 tables; 3 ref. Chinese. (AGRIS 2000-016765).

1362 Ferraresi, A. (Centro Ricerche Produzioni Vegetali (CRPV), Cesena, Forli (Italy)) (1992) **[The choice of varieties [Triticum aestivum L. - Triticum durum Desf. - variety trials - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 15-25.* 4 tables; 8 graphs. Italian. (AGRIS 2000-016753).

1363 Forster, BP. (1999) **Studies on wild barley, Hordeum spontaneum C-Koch at the Scottish Crop Research Institute.** *EVOLUTIONARY THEORY AND PROCESSES: MODERN PERSPECTIVES : PAPERIS IN HONOUR OF EVIATAR NEVO. :325-341.* English. [Scottish Crop Res Inst, Abiot Stress Grp Dundee DD2 5DA Scotland].

1364 Franzone, P.M.; Rios, R.D.; Procopiuk, A.M.; Diaz, D.G.; Roredo, C.G. (Instituto Nacional de Tecnologia Agropecuaria, Castelar (Argentina). Instituto de Genetica); Aguinaga, A. (Cerveceria y Malteria Quilmes, Buenos Aires (Argentina)) (1998) **Genetic analysis of in vitro regeneration in wheat (Triticum aestivum L.).** *Journal of Genetics & Breeding (Italy) v. 52(3) p. 195-201.* 6 tables; 2 graphs; 27 ref. English. (AGRIS 2000-023271).

The genetic analysis of the ability to regenerate in vitro of wheat immature embryos was carried out from crosses between the high responsive line FLX and the Argentinean cultivars Leones INTA and Marcos Juarez INTA. In vitro response of the parental lines was dependent on the genotype and year and a significant interaction genotype x year was detected, being Leones INTA the most unstable cultivar. Results obtained from a disruptive selection carried out in F3 segregating populations of both crosses as well as from backcrosses, provided evidence of a genetic control of the in vitro regeneration capability. The influence of gai allele Rht2 on the in vitro response was also studied [E' stata effettuata l'analisi genetica della capacita' di rigenerazione in vitro di embrioni immaturi di frumento mediante l'impiego di incroci fra la linea FLX, altamente reattiva, e le cultivar argentine Leones INTA e Marco Juarez INTA. La risposta in vitro delle linee parentali era dipendente dal genotipo e dall'annata, ed e' stata riscontrata un'interazione significativa genotipo x annata; la cultivar Leones INTA era la piu' instabile. I risultati ottenuti da una selezione destabilizzante condotta nelle popolazioni segreganti F3 di ambedue gli incroci, cosi' come dagli incroci di ritorno, evidenziava l'esistenza di un controllo genetico della capacita' di rigenerazione in vitro. E' stata pure studiata l'influenza dell'allele gai Rht2 sulla risposta in vitro].

1365 Fu Daxiong; Ruan Renwu; Zong Xuefeng (Southwest Agriculutral Univ., Chongqing (China). Dept. of Agronomy) (1998) **Application of the dominant dwarf gene RHt10 in breeding for hybrid wheat.** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 20(6) p. 577-583.* 4 tables; 7 ref. Chinese. (AGRIS 2000-016777).

1366 Fu Tihua; Ren Zhenglong (Sichuan Agricultural Univ., Yaan (China). Coll. of Agronomy) (1998) **Cytogenetic analysis of F1 hybrid between 6x Triticum durum-dasypyrum villosum amphiploid and 8x Agrotriticum.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 16(4) p. 394-397.* 2 tables; 3 ill.; 7 ref. Chinese. (AGRIS 2000-016792).

1367 Fu, P.; Wilen, RW.; Wu, GH.; Robertson, AJ.; Gusta, LV. (2000) **Dehydrin gene expression and leaf water potential differs between spring and winter cereals during cold acclimation.** *Journal of Plant Physiology. 156(3):394-400.* English. [Univ Saskatchewan, Ctr Crop Dev 51 Campus Dr Saskatoon SK S7N 5A8 Canada].

Spring and winter cultivars of wheat (Triticum aestivum L.) and rye (Secale cereale L.) were cold acclimated using controlled environment and natural conditions. With respect to freezing tolerance, winter cereal seedlings could be distinguished from their spring counterparts by their initiation of acclimation at a warmer temperature, increasing in freezing tolerance sooner, and by achieving greater freezing tolerance at the end of the acclimation period. The timing and extent of expression of a family of dehydrin genes correlated with the increase in measured freezing tolerance in both spring and winter genotypes. The expression of these genes was detected sooner in the winter types, and dehydrin mRNA accumulated to higher levels in the winter cereals. Dehydrin transcripts could be detected throughout the acclimation period in winter cereals, but were only moderately expressed in spring cereals in response to acclimation. Similar results were obtained using western blot analysis with a dehydrin carboxy terminal antibody. Crown moisture content (CMC), crown osmotic potential (COP) and leaf water potential decreased in spring and winter cereals in response to acclimating conditions in both controlled environment and field conditions, but were lowest in fully acclimated winter cereals. However, the onset and rate of decrease in CMC and COP did not differ between the spring and winter genotypes, suggesting that neither CMC nor COP were involved in the initial regulation of dehydrin gene expression. Leaf water potential (LWP) also declined at similar rates in the spring and winter cereals in the field between September and November. However, a difference in LWP was observed between spring and winter wheat subjected to a cold shock treatment. The winter genotype LWP decreased within 10 h of exposure to 2 degrees C, reached significantly lower levels than prior to the cold shock, but returned to pre cold-shock level after 7 days at 2 degrees C. In contrast, the decline in leaf water potential in spring wheat was slower and less pronounced than in winter wheat. These results correlate well with those observed with dehydrin gene expression and suggest a relationship between water potential and cold-induced gene expression. [References: 30].

1368 Fu, T.H.; Ren, Z.L.; Zhang, H.Q. (Sichuan Agricultural Univ. (China). State Key Lab. of Plant Genetics and Breeding) (1997) **Cytogenetic analysis of a trigeneric hybrid of Triticum, Dasypyrum and Secale by C-banding technique.** *Journal of Genetics & Breeding (Italy) v. 51(4) p. 335-340.* 2 tables; 27 ref. English. (AGRIS 2000-023281).

1369 Gao Chongsheng (Tianjin Bureau of Animal and Plant Quarantine (China)) (1998) **The relations between free amino acids of winter wheat varieties and resistance to Macrosiphum avenae Fabricius.** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuebao (China) v. 7(1) p. 23-26.* 3 tables; 8 ref. Chinese. (AGRIS 2000-016751).

In this paper, ten wheat varieties of different resistances were studied. Their contents of seventeen species free anino acids were determined at jointing stage. The analysis results showed that the resistance of winter wheat to Macrosiphum avenae Fab. ishigher when contents of leucine, isoleucine, proline, valine are greater; the resitance of winter wheat to M. avenae is lower when contents of gluta mate, alanine, lysine, aspartate are higher.

1370 Gao Dongying (Jiangsu Academy of Agricultural Sciences, Nanjing (China). Inst. of Genetics and Physiology) (1998) **Cytological studies on microspore abortion in thermo-sensitive male strerile wheat C49s.** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 20(1) p. 16-18.* 1 table; 5 ref. Chinese. (AGRIS 2000-016776).

1371 Giordani, G. (Florence Univ. (Italy). Dipartimento di Agronomia) (1998) **[The varieties that satisfy the farmer [Triticum durum Desf. - variety trials]].** *Terra e Vita (Italy) v. 39(36) p. 66-68.* 3 tables. Italian. (AGRIS 2000-016790).

1372 Gnudi, G. (1992) **[A crop with further opportunities of growth [Hordeum vulgare L. - Italy]].** *Terra e Vita (Italy) v. 39(37) p. 75-80.* 9 tables. Italian. (AGRIS 2000-016480).

1373 Gnudi, G. (1998) **[Soft wheat. The serach for the best varieties [Triticum aestivum L.]].** *Terra e Vita (Italy) v. 39(39) p. 61-65.* 6 tables. Italian. (AGRIS 2000-016754).

1374 Grausgruber, H.; Burstmayr, H. (Vienna Univ. of Agricultural Sciences (Austria). Dept. of Plant Breeding); Lemmens, M.; Ruckenbauer, P. (Institute of Agrobiotechnology, Tulln (Austria). Dept. of Plant Biotechnology) (1998) **Chromosomal location of Fusarium head blight resistance and in vitro toxin tolerance in wheat using the Hobbit "sib" (Triticum macha) chromosome substitution lines [Triticum aestivum L.].** *Journal of Genetics & Breeding (Italy) v. 52(2) p. 173-180.* 3 tables; 2 graphs; 47 ref. English. (AGRIS 2000-023269).

Resistance to head blight caused by Fusarium culmorum and F. graminearum was investigated in a series of substitution lines of single chromosomes from Triticum macha into Hobbit "sib". Resistance to initial infection and invasion of the host, as well as resistance to yield loss was determined. Additionaly, in vitro toxin tolerance was investigated at the seedling stage. Chromosomes 3A, 4A and 5A from T. macha were found to have positive effects on single resistance mechanisms. Chromosome 6B, however, seems to carry a major determinant of head blight resistance, since it affected all resistance mechanisms which were evaluated [E' stata studiata la resistenza alla golpe bianca causata da Fusarium culmorum e F. graminearum in una serie di linee di sostituzione di singoli cromosomi da Triticum macha in Hobbit "sib". E' stata determinata la resistenza all'infezione iniziale e all'invasione dell'ospite, cosi' come la resistenza al calo di resa produttiva. Inoltre, e' stata studiata in vitro la tolleranza alle tossine allo stadio di plantula. Si e' riscontrato che i cromosomi 3A, 4A e 5A derivanti da T. macha avevano effetti positivi sui meccanismi di resistenza. Il cromosoma 6B, comunque, sembra portare un determinante principale della resistenza alla golpe bianca, dal momento che influenzava tutti i meccanismi di resistenza valutati].

1375 Hang, A.; Burton, C.S.; Satterfield, K. (Idaho Univ., Aberdeen (USA)) (1998) **Nearly compensating diploids involving chromosomes 6 (6H) in barley (Hordeum vulgare L.).** *Journal of Genetics & Breeding (Italy) v. 52(2) p. 161-165.* 1 table; 1 graph; 18 ref. English. (AGRIS 2000-023037).

A plant with 2n = 13 + 2 acrocentric chromosomes was found in the progeny of an acrocentric trisomic plant (2n = 14 + 1 acrocentric chromosome). Cytological study indicated that one acrocentric chromosome, acro6S*[L), consisted of the short arm and 33% of the long arm of chromosome 6 (6H). The other, cro6L*[S), has the long arm and 23% of the short arm. When selfing, the plant with 2n = 13 + 2 acros produced three chromosome types including 2n = 14; 2n = 13 + 2 acros, and 2n = 12 + 4 acros. Since the two acrocentric chromosomes compensate for the loss of one chromosome 6, and four acrocentric chromosomes replace two missing chromosomes 6, they are referred to as nearly compensating diploids. These plants may be useful for genetic and breeding studies, particularly for the genes in triple and quadruple doses [Nella progenie di una pianta trisomica acrocentrica (2n = 14 + 1 cromosoma acrocentrico) e' stata rinvenuta una pianta con 2n = 13 + 2 cromosomi acrocentrici. Lo studio citologico ha indicato che un cromosoma acrocentrico, acro6S*[L), consiste del braccio corto e del 33% del braccio lungo del cromosoma 6 (6H). L'altro, acro6L*[S), ha il braccio lungo e il 23% del braccio corto. Tramite autoimpollinazione, la pianta con 2n = 13 + 2 acrosomi produceva tre tipi cromosomici: 2n = 14; 2n = 13 + 2 acrosomi; 2n = 12 + 4 acrosomi. Dal momento che i due cromosomi acrocentrici compensano per la perdita di un cromosoma 6 e 4 cromosomi acrocentrici sostituiscono i due cromosomi 6 mancanti, queste piante sono indicate come pressoche' compensanti. Si tratta quindi di materiale utile per studi di genetica e miglioramento genetico, particolarmente per i geni in dose tripla e quadrupla].

1376 Harjit Singh; Nanda, G.S.; Aujla, S.S. (Punjab Agricultural University, Ludhiana (India). Department of Plant Breeding) (1997) **Sources of resistance to predominant pathotypes of leaf rust of wheat.** *Indian Journal of Genetics and Plant Breeding (India) v. 57(3) p. 243-245.* 1 table; 4 ref. English. (AGRIS 2000-023261).

1377 Hill, J.; Wagoire, WW.; Ortiz, R.; Stolen, O. (2000) **Cross prediction in bread wheat germplasm using single seed descent lines.** *Euphytica. 113(1):65-70.* English. [Int Crops Res Inst Semi Arid Trop Patancheru 502324 Andhra Pradesh India].

Populations of F-6 recombinant inbred lines, generated by single seed descent from a half diallel among eight bread wheat lines adaptcd to the East African highlands, were used to identify those crosses that were more likely to produce cultivars which combined resistance to yellow rust with improved yield. Crosses having the most resistant line as one parent offered the best prospect of success, particularly those which produced F-1 hybrids exhibiting better parent heterosis. For plot grain yield there was a highly significant correlation between the observed and predicted rankings of the recombinant inbred line populations for the proportion of individual lines equalling or surpassing the target value. For yellow rust severity, however, this correlation was non-significant when a target value of zero was used. Adopting a slightly less stringent target of 0.25, coupled with the omission of two aberrant populations, increased this correlation significantly. The plant breeding implications of these results are discussed. [References: 14].

1378 Hoisington, DA. (1999) **Biotechnology for maize and wheat improvement in developing countries: a need, a reality, or a dream?** *BIOTECHNOLOGY OF FOOD CROPS IN DEVELOPING COUNTRIES. :61-77.* English. [CIMMYT Apdo 6-641, Lisboa 27 Mexico City 06600 DF Mexico].

1379 Hoxha, S.; Sulovari, H. (Universiteti Bujqesor, Tirane (Albania)) (1997) **[Concepts about the durum wheat ideotype].** *Buletini i Shkencave Bujqesore (Albania) (no. 2) p. 45-49.* 12 ref. Albanian. (AGRIS 2000-023278).

The strategy of genetic improvement of durum wheat by creation of cultivars of high productivity and high technological quality is presented. Durum wheat is a typical model for achieving improvements in plant architecture. Through traditional genetic improvement, a genetic potential of product of up to 75 per cent was achieved, and the other 25 per cent from ideotype improvement. Though the improvement of ideotype narrows o lot genetic basis, efforts for hypothetical design and the putting into practice of a model architecture in durum wheat as well for other plants.

1380 Hsam, SLK.; Mohler, V.; Hartl, L.; Wenzel, G.; Zeller, FJ. (2000) **Mapping of powdery mildew and leaf rust resistance genes on the wheat-rye translocated chromosome T1BL center dot 1RS using molecular and biochemical markers.** *Plant Breeding. 119(1):87-89.* English. [Tech Univ Munich, Inst Pflanzenbau & Pflanzenzuchtung D-85350 Freising Germany].

Powdery mildew and leaf rust resistance genes on the 1RS arm of the T1BL.1RS translocated chromosome were mapped in relation to the Sec-1 locus and AFLP and restriction fragment length polymorphism markers, respectively, employing segregating F-3 populations. Integration of molecular markers indicated that Pm17 lies between the Lr26 and Sec-1 loci, with both resistance genes allocated distally to the Sec-1 locus in the satellite of the IRS arm. [References: 26].

1381 Ingram, HM.; Power, JB.; Lowe, KC.; Davey, MR. (1999) **Optimisation of procedures for microprojectile bombardment of microspore-derived embryos in wheat.** *Plant Cell Tissue & Organ Culture. 57(3):207-210.* English. [Univ Nottingham, Sch Biol Sci, Plant Sci Div Univ Pk Nottingham NG7 2RD England].

Using the PDS-1000/He Biolistic(R) Particle Delivery System, the microprojectile travel distance, rupture disk pressure and DNA/gold particle concentrations were assessed in order to optimise short and longer-term beta-glucuronidase reporter gene expression in microspore-derived embryos of wheat. The effects were also evaluated of using sterile filter paper to support explants and treatment with a high osmoticum medium (0.2 M mannitol/0.2 M sorbitol or 0.4 M maltose). In the optimised procedure, wheat microspore-derived embryos (MDEs), were placed on filter paper and incubated on medium containing 0.4 M maltose, for 4 h pre- and 45 h post-bombardment. Five mu l pAHC25 (0.75 mg ml(-1) in TE buffer) was precipitated onto 25 mu l gold particles (60 mg ml(-1) in sterile water), using 20 mu l spermidine (0.1 M) and 50 mu l CaCl2 (2.5 M). The particles were centrifuged and resuspended in 75 mu l absolute ethanol prior to the preparation of 6 macrocarriers. A microprojectile travel distance of 70 mm, a rupture pressure of 1300 p.s.i., and a vacuum of 29 " Hg were employed. Maltose at 0.4 M in the support medium was the most important factor influencing GUS activity in bombarded tissues. GUS activity, 1 day post-bombardment, reached 52 +/- 17 GUS-positive foci/MDE (mean +/-s.e.m, n=3), with 17 +/- 4 foci/MDE at 15 days, giving a 3.0-fold increase ($p<0.05$) compared to expression in MDEs bombarded on medium without a high osmoticum treatment. [References: 11].

1382 Jahier, J.; Abelard, P.; Tanguy, A.M.; Barloy, D. (Institut National de Recherches Agronomiques (INRA), Le Rheu (France). Station d'Amelioration des Plantes); Rivoal, R. (Institut National de Recherches Agronomiques (INRA), Le Rheu (France). Lab. de Zoologie); Yu, M.Q. (Chengdu Inst. of Biology (China)) (1998) **Transfer of genes for resistance to cereal cyst nematode from Aegilops variabilis Eig to wheat [Triticum aestivum L.].** *Journal of Genetics & Breeding (Italy) v. 52(3) p. 253-257.* 2 graphs; 18 ref. English. (AGRIS 2000-023272).

Aegilops variabilis accession n.1 previously used as a donor to wheat for resistance to the root knot nematode, Meloidogyne naasi, has also been shown to have complete resistance to the cereal cyst nematode (CCN), Heterodera avenae. The progeny of the cross between Ae. variabilis and wheat was screened to introduce CCN resistance. Two different disomic addition lines and six lines with 42 chromosomes, which are likely to be translocation lines, were found to be partially resistant to H. avenae. As the F1 interspecific hybrid was as resistant as the wild parent, it is expected that the cumulative resistances carried by the two added chromosomes of the addition lines will lead to a wheat genotype with complete resistance. The relationship between the gene Rkn-mn1 for resistance to M. naasi and resistance to H. avenae is discussed [L'accessione n. 1 di Aegilops variabilis, utilizzata in precedenza come donatore al frumento per la resistenza al nematode galligeno delle radici, Meloidogyne naasi, ha evidenziato pure una resistenza completa all'anguillula dei cereali (CCN), Heterodera avenae. La progenie dell'incrocio fra Ae. variabilis e il frumento e' stata verificata per introdurre la resistenza a CCN. E' stato riscontrato che due linee diverse di addizione bisomiche e sei linee con 42 cromosomi, probabilmente linee di traslocazione, erano resistenti a H. avenae. Dato che l'ibrido interspecifico F1 era resistente tanto quanto il parentale selvatico, e' da prevedere che la resistenza cumulativa portata dai due cromosomi aggiunti delle linee di addizione porteranno a un genotipo di frumento completamente resistente. Viene discusso il rapporto fra il gene Rkn-mn1 per la resistenza a M. naasi e la resistenza a H. avenae].

1383 Jalli, M.; Robinson, J. (2000) **Stable resistance in barley to Pyrenophora teres f. teres isolates from the Nordic-Baltic region after increase on standard host genotypes.** *Euphytica. 113(1):71-77.* English. [Agr Res Ctr Finland, Inst Crop Protect, Plant Pathol Sect FIN-31600 Jokioinen Finland].

Results from tests of a mixture of Finnish net blotch, Pyrenophora teres Drechs. f. teres Smedeg., isolates on a differential series of barley seedlings, comprising 17 genotypes, indicated that patterns of infection response (IR) and percentage leaf area damaged (PLAD) were unaffected by differences in seedling size. Variation of the concentration of inoculum between 1, 250 conidia ml(-1) and 20, 000 conidia ml(-1) produced similar patterns of IR and PLAD on the differential series. IR and PLAD scored on the second seedling leaf differentiated resistance to P. teres f. teres among the genotypes better than on the first seedling leaf. In a second experiment, 120 single-spore P. teres f. teres isolates from Finland, Sweden, Norway, Latvia, Estonia and Ireland were used in tests conducted in the greenhouse to differentiate them in terms of virulence reaction on seedlings of six differential barley genotypes. Each isolate was tested directly following isolation from the leaf material and after having passaged each through barley cvs. Arve or Pohto, to produce 360 isolates in total. Virulence of the isolates differed significantly on the members of the differential series, but differences associated with country of origin and passaging, and interactions, were small. It is concluded that little variation between virulence of P. teres f. teres isolates is evident over a large geographic area, incorporating Nordic and Baltic countries, and Ireland. Barley genotype response to P. teres f. teres appeared to be of more significance than relative virulence of the pathogen isolates. This could simplify breeding barley for improved resistance to this phytopathogen. [References: 19].

1384 Jirapa Pongjanta; Thirawan Chanrittisen; Niramon Utama ang (Lampang Agricultural Research and Training Centre (Thailand)) (1996) **Wheat quality analysis for the selection of suitable varieties for Thailand.** 13. Annual Conference on Food Science and Home Economics. Lampang (Thailand). 24-26 Jan 1996. *[Proceeding of the 13th Rajamangala Inst. of Technology annual conference: Food Science and Home Economics]. Lampang Agricultural Research and Training Centre (Thailand) 94 p. p. 54-66.* 2 tables. Thai. (AGRIS 2000-016758).

Twenty varieties of wheat grown at Lampang Agricultural Research and Training Centre during 1992-1993 were analysed for the physical and chemical properties. The completely randomized design was used in the study. The study showed that there were six varieties of wheat: WAYN LARTC-W 91003, 91005, 91006, 91010, INSEE1 CHECK and WTYN LARTC-W 89011. to be suitable for all purpose flour. There appeared to be some good properties of those six varieties which were high in thousand grain, weight by volume, hardness and extraction rate. Nevertheless, the protein and dry gluten content were also suitable for all purpose flour, which were 10-11 percent. The varieties of WAYT-W 91001 91002 and Multiple seed LARTC-W 91013 were suitable for bread flour due to the protein and dried gluten content which were 11-12 percent.

1385 Josephides, C.M. (Agricultural Res. Inst., Nicosia (Cyprus)) (1999) **Gavdos: A bread wheat variety with high stable grain yield and quality characteristics under Cyprus conditions.** *Technical Bulletin (Cyprus); no. 198 11 p.* 3 tables; 3 illus.; 13 ref. English. (AGRIS 2000-023306).

Gavdos (BCH 'S'/SHORK*2/3/CNO 'S'/GLL/BB No4A/K CYA85-81-OD-32P-OP-3P-3P-OP) is a bread wheat variety originated from a cross made at the Agricultural Research Institute (ARI) in 1985. The parents used, were two selected CIMMYT lines introduced in Cyprus through the cooperative program of ARI with CIMMYT, Mexico. The F1 was grown at Athalassa. The consequent breeding methodology used up to F6 generation was a modification of the pedigree method pursuing early-generation selection for quality and yield impovement. Gavdos was evaluated in the multienvironmental testing program of the Institute at a total of 18 environments in five growing seasons (1993-1998). It gave (5930 kg/ha) a significantly higher yield than Karpasia, Pitic 62 and Hazera 18 (12, 14 and 55 higher respectively). Regression analysis of yield data revealed that Gavdos has the most stable grain yield among the tested varieties. Agronomically, Gavdos, is intermediate in plant height at maturity and resistant to lodging. Its heading date was within the first half of March. In all growing environments, Gavdos had better grain hectoliter weight then E.U. standards. Farinogram and alveogram data showed that Gavdos had a similarity strong gluten with Hazera 18. Gavdos gave 100 g loaves of pan bread with average volume 709 cc compared to 707 cc obtained from imported hard red winter wheat. Its milling and bread processing charactristics were comparable to the imported red wheat with strong gluten, in a 1997 commerical testing.

1386 Joshi, P. (Agricultural Research Station, Sriganganagar 335 001 (India)) (1997) **Effect of nongenetic variation in seed size on growth,**

grain yield and its components in wheat (Triticum aestivum L.). *Indian Journal of Genetics and Plant Breeding (India) v. 57(3) p. 223-228.* 3 tables; 9 ref. English. (AGRIS 2000-023260).

1387 Kajaneca, L. (Latvian Univ. of Agriculture, Jelgava (Latvia). Faculty of Agriculture. Dept. of Plant Production) (1999) **[Influence of different seed sizes of summer barley varieties on their germination indices].** Zinatnes nakotne musu rokas. Jelgava (Latvia). 26-28 May 1999. *[The future of science is in our hands. Conference papers of the candidates for the doctor's degree]. Latvian Univ. of Agriculture, Jelgava (Latvia) 290 p. p. 6-10.* Latvian University of Agriculture. 4 tables; 8 ref. Latvian. (AGRIS 2000-016307).

An important factor determining crop productivity and seed quality is the quality of seed material including the size of seeds. In the given research the influence of barley seed size on the germination process of its summer varieties has been studied. The germination indices, such as energy, germination ability and dry matter of seedlings have been analysed under laboratory conditions. The experimental material included five local summer barley varieties having different seed sizes (Abava, Ansis, Gate, Maiva, Sencis). The varieties having the highest (Sencis) and the lowest (Gate) germination indices have been established. The seed size 2.8x20 mm has been found to be the optimal. The experimental results have proven that the nergy of germination depends on the variety and the seed size, but the germination ability - only on the variety.

1388 Khan, IA. (2000) **Molecular and agronomic characterization of wheat-Agropyron intermedium recombinant chromosomes.** *Plant Breeding. 119(1):25-29.* English. [Univ Calif Davis, Dept Agron & Range Sci Davis, CA 95616 USA].

Thirty-six wheat-Agropyron intermedium (host) Beauv. [Syn. Trichopyrum intermedium (host) A. Love, Elytrigia intermedia (host) Nevski, Thinopyrum intermedium (host) Barkworth and Dewey] 7A/7Ai-1 recombinant chromosomes were characterized using DNA markers. Analysis of recombinant chromosomes using 15 restriction fragment length polymorphism probes identified the homoeologous crossover products that had varying length of A. intermedium chromatin introgressed onto chromosome 7A of common wheat. The linear order of the probe loci was established along the lengths of the chromosomes. The short arm recombinants that had A. intermedium chromatin distal to the locus Xpsr108 and proximal to the locus Xpsr119 were resistant to wheat stem rust, indicating that the rust resistance gene (Sr44) was located on the distal part of chromosome arm 7Ai-1s. The barley yellow dwarf virus (BYDV) resistance gene reported to be present on the long arm of chromosome 7Ai-1 was found to be ineffective against the BYDV serotype used in the present study. [References: 34].

1389 Kharkwal, M.C.; Chaudhary, H.B. (Indian Agricultural Research Institute, New Delhi (India). Division of Genetics) (1997) **Grain density as selection criterion in chickpea and wheat.** *Indian Journal of Genetics & Plant Breeding (India) v. 57(4) p. 415-423.* 8 tables; 13 ref. English. (AGRIS 2000-022969).

1390 Knott, DR. (2000) **The inheritance of stem rust resistance in Thatcher wheat.** *Canadian Journal of Plant Science. 80(1):53-63.* English. [Univ Saskatchewan, Dept Plant Sci Saskatoon SK S7N 5A8 Canada].

Thatcher was the predominant wheat (Triticum aestivum L.) cultivar on the Canadian prairies in the 1950s. Until race 15B (TMH) of stem rust (Puccinia graminis pers. f. sp. tritici Eriks. sr Henn.) became widespread, Thatcher had good resistance to stem rust, but was susceptible to leaf rust (P. recondita f. sp. tritici Rob. ex Desm.). Although genes for stem rust resistance have been identified in Thatcher, the inheritance of its resistance has never been fully understood. The objective of this research was to attempt to elucidate the inheritance of the resistance of Thatcher and to determine why it had a reputation as a poor parent for rust resistance. Over a period of 40 yr, crosses and backcrosses to a susceptible genotype and two sets of single seed descent (SSD) lines were studied. The second set of SSD lines was tested with isolates of six races of stem rust to which Thatcher is resistant. The data showed that Thatcher is a very heterogenous cultivar with individual plants differing widely in the genes for stem rust resistance that they carry. The inheritance of rust resistance varied greatly from race to rate and was often quite complex. Either complementary genes or a gene plus a suppressor appeared to condition resistance to one race. Most genes gave resistance to only one race. The presence of Sr5, which Thatcher is known to have obtained from Kanred, was confirmed. Most of its many additional genes probably came from Iumillo durum wheat. [References: 12].

1391 Kolesnichenko, AV.; Zykova, VV.; Voinikov, VK. (2000) **A comparison of the immunochemical affinity of cytoplasmic, mitochondrial and nuclear proteins of winter rye (Secale cereale L.) to a 310 kD stress protein in control plants and during exposure to cold stress.** *Journal of Thermal Biology. 25(3):203-209.* English. [Russian Acad Sci, Siberian Div, Siberian Inst Plant Physiol & Biochem Irkutsk 664033 Russia].

An investigation of immunochemical affinity to stress protein CSP 310 proteins among the native cytoplasmic, mitochondrial and nuclear proteins of winter rye (Secale cereale L.) was carried out by PAGE-electrophoresis in control plants and in plants during exposure to cold stress. Western blotting showed that among the native proteins of all cellular fractions of control plants investigated there was immunochemical affinity to CSP 310 proteins with molecular weights about 230 and to a number of proteins of about 140 kD. The protein with molecular weight 310 kD was found only in cytoplasmic and mitochondrial fractions of control plants. Proteins with molecular weights 470 kD and 320-330 kD with immunochemical affinity to CSP 310, were also found in the nuclear fraction of control plants. By ethidium bromide staining, a cytoplasmic protein with molecular weight 310 kD, as well as nuclear proteins with weights 470 kD and 320-330 kD, were shown to be nucleoprotein complexes. It was shown that during exposure to cold stress the amounts of cytoplasmic proteins 310 and 470 kD and nuclear protein 320 kD are arises. In mitochondrial fraction new proteins appear of molecular weight 320 and 470 kD. By ethidium bromide staining, a cytoplasmic protein with molecular weight 310 kD, as well as nuclear proteins with weights 470 kD and 320-330 kD;, were shown not to be nucleoprotein complexes during exposure to cold stress. At the same time cytoplasmic protein with molecular weight 470 kD was shown to be nucleoprotein complex during exposure to cold stress. [References: 26].

1392 Kronberga, A. (State Priekuli Plant Breeding Station, Priekuli (Latvia)) (1999) **The estimation of traits for including in the triticale ideotype.** Zinatnes nakotne musu rokas. Jelgava (Latvia). 26-28 May 1999. *[The future of science is in our hands. Conference papers of the candidates for the doctor's degree]. Latvian Univ. of Agriculture, Jelgava (Latvia) 290 p. p. 21-27.* Latvian University of Agriculture. 3 ill., 8 ref. Latvian. (AGRIS 2000-016745).

The adequacy of triticale traits was estimated for including in variety ideotype. The correlation between main traits (yield, grain quality, suitability for processing) and other analysed traits was used to find out acceptable traits for ideotype. Modificative and genotypic variabilities were determined. Such traits as grains per spike, grain weight per spike and spike lenght must be included in ideotype to increase grain yield. To improve suitability for processing it is necessary to include plant height and time to maturity in variety ideotype. Correlation is important between protein content in grains and time to maturity as well as grain number and weight, but changes in these traits acceptable for breeder decrease protein content in grains. The most genotypic variable has following traits: plant height, 1000 kernel weight, grain weight per spike. The inclusion of the mentioned traits in the ideotype makes it possible to select valuable genotypes.

1393 Labuschagne, MT.; van, Vuuren, A. (2000) **The inheritance and expression of grain texture in wheat, as measured by a microtome procedure.** *Euphytica. 112(3):261-265.* English. [UOFS, Dept Plant Breeding POB 339 Bloemfontein South Africa].

Although grain texture has been extensively studied, there is still some controversy about its mode of inheritance. The aim of this study was to use a microtome method to determine the inheritance of grain

texture. The backcross method was used with a hard, well adapted cultivar, M29519 as recurrent parent, and Edwall, a soft cultivar with good biscuit-making quality, as donor. Segregation ratio's for grain texture were calculated after each backcross. The backcross derivates M29519 (soft) and M29519 (hard) and the donor and recurrent parents were also compared for biscuit-making quality. The microtome method was found to be very effective to determine grain texture. In this study grain softness was determined by a single dominant gene. M29519 (hard) and the recurrent parent did not differ significantly for any quality characteristics. M29519 (hard) and M29519 (soft) differed significantly for seven characteristics associated with biscuit-making quality, and M29519 (soft) produced a significantly larger biscuit diameter than M29519 (hard). M29519 (soft) differed significantly from the donor parent for six of the measured characteristics. Despite this, M29519 (soft) produced a biscuit similar in diameter to that of the donor parent. Therefore, although the transfer of the softness genes into a different genetic background did not transfer all the factors generally associated with good biscuit-making quality, it did produce a biscuit that did not differ significantly from that of the donor. [References: 18].

1394 Landjeva, S.; Ganeva, G. (Academy of Science, Sofia (Bulgaria). Institute of Genetics); Todorova, M. (Plant Protection Inst., Kostinbrod (Bulgaria)) (1998) **Development and cytogenetic characterization of a disomic wheat-Aegilops ovata chromosome addition line with leaf rust resistance [Triticum aestivum L. - Bulgaria].** *Journal of Genetics & Breeding (Italy) v. 52(2) p. 181-186.* 2 tables; 1 graphs; 18 ref. English. (AGRIS 2000-023270).

A fertile disomic Triticum aestivum L. - Aegilops ovata L. chromosome addition line (2n=44, 22 bivalents) with resistance to leaf rust of wheat (causal agent Puccinia recondita Rob. ex Desm. f.sp. tritici Eriks.) was obtained. To produce the line, selection for resistance and for presence of Ae. ovata chromosomes was carried out in four consecutive self-generations (F2 to F5) of BC3 of a partial amphiploid between "Chinese Spring" wheat and Ae. ovata. The resistance was expresed at the seedling stage against the two most wide spread races in the pathogen population in Bulgaria. The added alien chromosomes were similar in their N-banding pattern to a submetacentric chromosome of the parental Ae. ovata accession, but were shorter in length and lacked the terminal N-band in the long arm. Based on the data from the chromosome banding analysis of Ae. ovata and its putative donors, Ae. umbellulata (U-genome donor) and Ae. comosa (M-genome donor), a suggestion was made thet the Ae. ovata chromosome in the resistant line probably belongs to the M-genome [E' stata ottenuta una linea bisomica Triticum aestivum L. - Aegilops ovata L. con trasferimento dei cromosomi (2n = 44, 22 bivalenti), caratterizzata da resistenza alla ruggine delle foglie (agente causale Puccinia recondita Rob. ex Desm. F.sp. tritici Eriks.). Per produrre la linea e' stata effettuata una selezione per la resistenza e per la presenza dei cromosomi di Ae. ovata in quattro generazioni autofecondate consecutive (da F2 a F5 di BC3 di un anfidiploide parziale fra il frumento Chinese Spring ed Ae. ovata. La resistenza era espressa allo stadio di plantula nei confronti delle due razze piu' diffuse, nell'ambito della popolazione del patogeno, in Bulgaria. I cromosomi estranei aggiunti erano simili nel bandeggio N a un cromosoma submetacentrico dell'accessione di Ae. ovata parentale, ma erano piu' corti in lunghezza e mancavano della banda N terminale nel braccio lungo. Sulla base dei dati derivanti dall'analisi del bandeggio cromosomico di Ae. ovata e dei suoi donatori putativi, Ae. umbellata (donatore del genoma U) e Ae. comosa (donatore del genoma M), si e' ipotizzato che il cromosoma di Ae. ovata nella linea resistente appartenga al genoma M].

1395 Lazarevich, S.V. (Academy of Agricultural Sciences of the Republic of Belarus, Minsk (Belarus)) (1999) **[Correlation analysis of the parameters of photosystem 2 and morfological-anatomic indications of wheat species].** Academy of Agricultural Sciences of the Republic of Belarus, Belarus. *Vestsi Akadehmii Agrarnykh Navuk Rehspubliki Belarus (Belarus) (no.1) p. 32-35.* 3 tables; 18 ref. Russian. (AGRIS 2000-023305).

Parameters of chlorofyll fluorescence of 23 wheat varieties grown in a hot-house with regulated climate were studied, as well as morphological and anatomy research was carried out. The obtained data are used for coorelation analysis of the parameters of the photosystem 2 as well as for evaluation of their relation with morphological and anatomy characteristics of the plant. In the given research essencial coorelation of a relative amount of reaction centres (Fv/Fm) with the width of a flag leaf and stem diametre in the upper interknots as well as with the development of the guiding bunches were defined. The obtained data can be used for explanation of the ways of wheat evolution as well as for making up selection programmes.

1396 Li Bangfa; Zhou Junru; Li Quan (Mianyang Inst. of Agricultural Sciences, Sichuan (China)) (1998) **The relationship between yield and main characters in new wheat variety Mianyang 26.** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuebao (China) v. 7(4) p. 59-61.* 1 table; 5 ref. Chinese. (AGRIS 2000-016763).

1397 Li Chengzuo; Pan Tianchun; Ji Jianhua (Xichang Agricultural Coll., Sichuan (China)) (1999) **A study on biological effect of wheat generations induced by He-Ne and N2 laser.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(1) p. 17-22.* 3 tables; 16 ref. Chinese. (AGRIS 2000-016775).

1398 Li Chengzuo; Pan Tianchun; Zhang Wenyou (Xichang Agricultural Coll., Sichuan (China)) (1998) **Genetic variation in L2 generation of wheat induced by laser and [60]Co-r radiation and its selection.** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 20(6) p. 584-587.* 7 ref. Chinese. (AGRIS 2000-016778).

1399 Li Lanzhen; Yang Huiwu (Henan Agricultural Univ., Zhengzhou (China)) (1998) **The breeding of a new winter wheat variety "Yumai 39" characterized by high and stable yield and disease resistance.** *Acta Agriculturae Boreali-Sinica (China). Hubei Nongxuebao (China) v. 13(1) p. 13-17.* 1 table; 1 ill., 4 ref. Chinese. (AGRIS 2000-016752).

1400 Li Shuhua (Ningxi Academy of Agro Forestry Sciences, Ninchuan (China). Biological Lab.) (1998) **Analysis of correlation between heterosis and isozyme patterns in spring wheat.** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuebao (China) v. 7(2) p. 32-36.* 3 tables; 1 ill., 9 ref. Chinese. (AGRIS 2000-016734).

1401 Li Tongzhu (Academia Sinica, Beijing (China). Inst. of Botany) (1998) **The gel-protein complexes of a mutant barley Mb1832C.** *Acta Botanica Yunnanica (China). Yunnan Zhiwu Yanjiu (China) v. 20(4) p. 453-458.* 6 ill.; 16 ref. Chinese. (AGRIS 2000-016485).

1402 Li Yuejian; Song Hexian; Zhu Huazhong (Sichuan Academy of Agricultural Sciences, Chengdu (China)) (1998) **Stability analysis of harvest index, biomass and grain yield in wheat.** *Southwest China Journal of Agricultural Sciences (China). Xinnan Nonye Xuebao (China) v. 11(1) p. 25-30.* 4 tables; 3 ill.; 13 ref. Chinese. (AGRIS 2000-016769).

1403 Li, ZY.; Chen, SY. (2000) **Isolation and characterization of a salt- and drought-inducible gene for S-adenosylmethionine decarboxylase from wheat (Triticum aestivum L.).** *Journal of Plant Physiology. 156(3):386-393.* English. [Chinese Acad Sci, Inst Genet, Lab Plant Biotechnol Beijing 100101 Peoples R China].

A full-length cDNA for S-adenosylmethionine decarboxylase (SAMDC), a key enzyme involved in the biosynthesis of spermidine and spermine, was isolated from wheal (Triticum aestivum L.) by using reverse transcription PCR technique. Sequence analysis of the wheat SAMDC cDNA (designated TaSAMDC) revealed chat it was significantly homologous to SAMDC genes from both monocot and dicot plant species. Alignment of the deduced polypeptide sequence of TaSAMDC with those of plant, yeast and human SAMDC genes identified several conserved domains, suggesting the structural and functional similarities of SAMDC proteins in eukaryotes. These conserved regions included a proenzyme cleavage site and a putative PEST domain which is characteristic of the rapid protein turnover. Genomic Southern blot indicated that two Or three homologous

sequences of TaSAMDC gene were present in the wheat genome. Comparative mapping in rice predicts that this gene locates on the long arm of the homologous group 2 of the wheat genome. The expression of TaSAMDC gene under environmental stress conditions nas investigated by Northern blot analysis. It was observed that salinity, drought and exogenous ABA can all induce the expression of TaSAMDC, suggesting that this gene is implicated in response of wheat plants to the adverse circumstances. [References: 35].

1404 Liao Xiaohong (Yunnan Agricultural Univ., Kunming (China). Coll. of Agricultural Science and Technology); Pu Zongjun; Yang Wuyun (1999) **Crossability of common wheat line 86-741 with rye.** *Journal of Yunnan Agricultural University (China). Yunnan Nongye Daxue Xuebao (China) v. 14(1) p. 37-39.* 1 table; 7 ref. Chinese. (AGRIS 2000-016703).

1405 Liu Jinyuan (Shandong Academy of Agricultural Sciences, Jinan (China). Inst. of Atomic Energy Application in Agriculture) (1999) **Study on transformation of wheat and maize via gene-gun bombardment.** *Shandong Agricultural Sciences (China). Shandong Nongye Kexue (China) No. (2) p. 5-8.* 2 tables; 1 ill., 13 ref. Chinese. (AGRIS 2000-016749).

1406 Liu Shudong; Wang Zhuling; Xi Yajun (Northwestern Agricultural Univ., Yangling, Shaanxi (China)) (1998) **Studies on the heterosis and correlation of grain filling characteristics in hybrid wheat with Ae. kotschyi cytoplasm.** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuebao (China) v. 7(2) p. 37-40.* 3 tables; 8 ref. Chinese. (AGRIS 2000-016762).

1407 Liu Zhongqi; Rao Shida; Pu Zongjun (Sichuan Academy of Agricultural Sciences, Chengdu (China). Inst. of Crop) (1999) **Effects of nuclear and cytoplasmic factors on seed quality of hybrid wheat with T. timopheevi cytoplasm.** *Southwest China Journal of Agricultural Sciences (China). Xinan Nongye Xuebao (China) v. 12(1) p. 26-31.* 4 tables; 10 ref. Chinese. (AGRIS 2000-016770).

1408 Liu, J.; Liu, D.; Tao, W.; Li, W.; Wang, S.; Chen, P.; Cheng, S.; Gao, D. (2000) **Molecular marker-facilitated pyramiding of different genes for powdery mildew resistance in wheat.** *Plant Breeding. 119(1):21-24.* English. [Nanjing Agr Univ, Agr Minist Crop Cytogenet, Key Open Lab Nanjing 210095 Peoples R China].

Breeding durable resistance to pathogens and pests is a major task for modern plant breeders and pyramiding different resistance genes into a genotype is one way of achieving this. Three powdery mildew resistance gene combinations, Pm2 + Pm4a, Pm2 + Pm21, Pm4a + Pm21 were successfully integrated into an elite wheat cultivar 'Yang158'. Double homozygotes were selected from a small F-2 population with the help of molecular markers. As the parents were near-isogenic lines (NILs) of 'Yang158', the progenies showed good uniformity in morphological and other non-resistance agronomic traits. The present work illustrates the bright prospects for the utilization of molecular markers in breeding For host resistance. [References: 26].

1409 Lu Debin (Henan Agricultural Univ., Zhengzhou (China)) (1998) **Study on isozymes in anther of male sterile wheat lines with Ae. kotschyi and T. timopheevi cytoplasm.** *Acta Agriculturae Universitatis Henanensis (China). Henan Nongda Xuebao (China) v. 32(3) p. 208-211.* 2 ill., 8 ref. Chinese. (AGRIS 2000-016764).

1410 Luo, MC.; Yang, ZL.; Dvorak, J. (2000) **The Q locus of Iranian and European spelt wheat.** *Theoretical & Applied Genetics. 100(3-4):602-606.* English. [Univ Calif Davis, Dept Agron & Range Sci 1 Shields Ave Davis, CA 95616 USA].

A dominant allele at the Q locus on chromosome 5A is believed to be the principal factor responsible for free-threshing, square-head spikes with a nonfragile rachis in bread wheat, Triticum aestivum ssp. aestivum. The spelt syndrome, resulting in pyramidal spikes with a brittle rachis and hulled grain in I: aestivum, is believed to be principally caused by the q allele. Chromosome 5A of European and Iranian spelt was substituted for 5A of bread wheat and the lines were characterized with molecular markers. The substitution of bread wheat chromosome 5A by 5A of European spelt resulted in weakly hulled, pyramidal spikes with a non-brittle rachis, whereas and the substitution of 5A by 5A of Iranian spelt did not alter spike morphology at all. It is concluded that the expression of the spelt syndrome depends, to a large extent, on the interactions of q with genes controlling glume tenacity and rachis fragility on other chromosomes. The genetic basis for the spelt syndrome and the apparent presence of the Q allele in Iranian spelt are discussed. [References: 14].

1411 Luo, MC.; Yang, ZL.; Kota, RS.; Dvorak, J. (2000) **Recombination of chromosomes 3A(m) and 5A(m) of Triticum monococcum with homeologous chromosomes 3A and 5A of wheat: The distribution of recombination across chromosomes.** *Genetics. 154(3):1301-1308.* English. [Univ Calif Davis, Dept Agron & Range Sci 1 Shields Ave Davis, CA 95616 USA].

Recombination of chromosomes 3A(m) and 5A(m) of Triticum monococcum closely homeologous chromosomes 3A and SA of T. aestivum was compared with recombination across corresponding homologous chromosome pairs. Differentiation between rile: homeologues impacted recombination in the proximal regions of the long arms the most and in the distal regions of the long arms the least. It is concluded that this variation principally reflects allocation of multiple crossovers across an arm and positive crossover interference across chromosome arms. Recombination rates between homeologous chromosomes 5A(m) and 5A differed in the opposite sexes. [References: 41].

1412 Marmiroli, N.; Maestri, E.; Liviero, L.; Massari, A.; Malcevschi, A.; Monciardini, P. (1999) **Application of genomics in assessing biodiversity in wild and cultivated barley.** *Molecular Ecology. 8(12 Suppl 1):S95-S106.* English. [Univ Parma, Dept Environm Sci, Div Genet & Environm Biotechnol Viale Sci I-43100 Parma Italy].

Biodiversity, the substrate for natural selection and adaptation to the environment, is of foremost importance in species conservation. Genomics, the study of the structure and function of complex genomes, can be applied to the assessment of the genetic component of biodiversity in animals and plants. Genomic analysis within the genus Hordeum, in cultivars of a vulgare and in wild accessions of H. spontaneum, was performed by different types of molecular markers, such as restriction fragment length polymorphisms (RFLP) and long primer-polymerase chain reaction (LP-PCR), and simple sequence repeats (SSR). The aim of this approach was to compare the correlation existing between genotypic variation at specific regions of the genome, as targeted with the different probes obtained from stress-responsive genes, and phenotypic variation, as shown by adaptation to different environments and climates. H. vulgare cultivars with contrasting growth habits (spring or winter) and H. spontaneum accessions adapted to different locations in Israel have been analysed. The results showed the existence of some tight associations between adaptive traits and markers (RFLP, LP-PCR) derived from specific genes induced in response to environmental stress. The correlation between adaptive phenotypes and genetic variation obtained with these markers was similar to that observed with SSRs. However, a considerable amount of the global genetic variation (83% in H. vulgare and 65% in H. spontaneum) seemed to have no direct correlation with the particular genetic traits involved in differentiating the individuals. Molecular markers are therefore a useful tool to target genomic regions involved in adaptation to the environment. [References: 44].

1413 Masarova, K.; Masar, S. (1999) **Chromosome constitution of wheat-barley hybrids.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 111-117.* Vyskumny Ustav Rastlinnej Vyroby. 4 tables, 2 ill.; 14 ref. Slovak. (AGRIS 2000-023256).

Intergeneric hybridization between hexaploid bread wheat Triticum aestivum L. cv. Norin 61 and diploid barley Hordeum vulgare L. cv. Hiproly resulted in 11 regenerated plants, obtained through the culture of immature embryo. In the F1 generation the regenerated plants had 27, 28 and 35 chromosomes (tab. 1). This indicates that only one (i.e. 9%) was true wheat x barley hybrid with

28 chromosomes. The 27 chromosome plant could accrue after elimination of one barley chromosome during embryogenesis. Pentaploid (35 chromosomes) genotype arose probably by fusion of normal wheat gamete (21 chromosomes) with unreduced barley gamete (14 chromosomes). Experiment for fertility restoration of all the 11 genotypes by backcross with mother hexaploid wheat cv. Norin 61 was realised. The first generation after backcrossing (F1BC1) in the mitosis were analysed. In somatic cells of genotypes R2, R5 and R10 complete hexaploid wheat genome and one additive eventually barley chromosome, or barley chromosome fragments in 10.3% of cells on the average were detected. All of the genotypes showed mosaicism for chromosome number (tab. 2). In the next generation (F2BC1) hybrid progenies in mitosis and meiosis were analysed. Likewise high chromosome variability in karyotype was observed. Somatic chromosome number was aneuploid and euploid between 30-43 chromosomes (tab. 3). One overlap chromosome in 7.6% of cells on the average in two genotypes R2 and R10 was observed. At metaphase I (MI) 20.58 bivalents and 0.63 probably barley univalents in pollen mother cells (PMCs) were detected. This is more than complete hexaploid wheat genome, which contains 21 bivalents (tab. 4, fig. 1a, b).

1414 Masarykova, M. (1999) **Productivity of genetic resources of spring triticale.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 139-145.* Vyskumny Ustav Rastlinnej Vyroby. 3 tables; 13 ref. Slovak. (AGRIS 2000-023252).

From 1996 to 1998 in VURV Piestany, 22 spring triticale genotypes of different ecological origin were evaluated. As control varieties, spring wheat Linda and Saxana were used. Results of the experiments were statistically processed by the method of variance analysis (Tab. 3). In comparison with the control varieties, the tested triticale had higher 1000 grain weight (TGW). Statistically significant differences in TGW between the varieties were only found in the set 2. Differences in the yields between the wheat and triticale were statistically nonsignificant, but from percent evaluation of triticale yields as compared with the wheat it follows that most tested genotypes reached higher yields than the control. The tested triticale was medium - resistant to stem rust and Septoria disease. High protein content appeared in the variety Cachirulo (ESP). Attention should be paid to Mexican genotypes Line 59938, 59942, 59946, Polish variety MAH 1093 and Canadian variety Carman. They are suitable for use in breeding programs and should also be included into the state variety experiments, since spring triticale is missing in the National List of Varieties.

1415 Masci, S.; D'Ovidio, R.; Lafiandra, D.; Kasarda, DD. (2000) **A 1B-coded low-molecular-weight glutenin subunit associated with quality in durum wheats shows strong similarity to a subunit present in some bread wheat cultivars.** *Theoretical & Applied Genetics. 100(3-4):396-400.* English. [Univ Tuscia, Dipartimento Agrobiol & Agrochim Via S Camillo Lellis I-01100 Viterbo Italy].

Good quality durum wheats usually present the LMW-2 type of SDS-PAGE pattern, whereas the LMW-1 type of pattern is usually associated with poor duality durum wheats. The two patterns are distinguished mainly by the presence of a strongly expressed protein band with molecular weight around 42, 000 (42 K subunit) in the LMW-2-type pattern; this subunit is absent in the LMW-1-type pattern. Here we show that this particular low-molecular-weight glutenin subunit has strong similarity to a subunit present in some bread wheat cultivars. This correspondence has been demonstrated through SDS-PAGE, PCR analysis of the corresponding genes, a comparison of the deduced amino acid sequences. and RP-HPLC. This last approach showed a slight difference in retention time between the 42 K protein of bread and durum wheats that might be attributed to the eight amino acid differences found between the deduced amino acid sequences of the two corresponding genes. [References: 20].

1416 McIntosh, RA.; Lagudah, ES. (2000) **Cytogenetical studies in wheat. XVIII. Gene Yr24 for resistance to stripe rust.** *Plant Breeding. 119(1):81-83.* English. [Univ Sydney, Plant Breeding Inst Private Bag 11 Camden NSW 2570 Australia].

A new gene, Yr24, for resistance to stripe rust was transferred from a durum accession to common wheat via an amphiploid (synthetic wheat) with Aegilops tauschii. Yr24 was located in chromosome 1B by monosomic analysis. Its genetic linkage of 4 cM with Yr15 indicated its localization to the short arm. [References: 8].

1417 Menon, Uma; Sharma, S.N. (Agricultural Research Station, Jaipur (India). Department of Genetics and Plant Breeding) (1997) **Genetics of yield determining factors in spring wheat over environments.** *Indian Journal of Genetics and Plant Breeding (India) v. 57(3) p. 301-306.* 2 tables; 15 ref. English. (AGRIS 2000-023254).

1418 Messmer, MM.; Seyfarth, R.; Keller, M.; Schachermayr, G.; Winzeler, M.; Zanetti, S.; Feuillet, C.; Keller, B. (2000) **Genetic analysis of durable leaf rust resistance in winter wheat.** *Theoretical & Applied Genetics. 100(3-4):419-431.* English. [Univ Zurich, Inst Plant Biol Zollikerstr 107 CH-8008 Zurich Switzerland].

Quantitative resistance that delays the epidemic development of leaf rust in wheat is an important source for durable resistance breeding. The Swiss winter wheat variety 'Forno' shows a high level of quantitative resistance against leaf rust. This resistance has been effective for more than 10 years and can therefore be considered to be durable. In order to map quantitative trait loci (QTL) for durable leaf rust resistance we analysed 204 F-5 recombinant inbred lines (RILs) of the cross between the winter wheat 'Forno' and the winter spelt 'Oberkulmer' for their level of leaf rust resistance (LR) and leaf tip necrosis (LTN) in four different environments. Both traits showed a continuous distribution and were significantly correlated (r=-0.5). Across environments we detected 8 QTL for leaf rust resistance (6 inherited from 'Forno') and 10 QTL for the quantitative expression of LTN (6 inherited from 'Forno'). Of the 6 QTL responsible for the durable leaf rust resistance of 'Forno', 1 major QTL coincided with a thaumatin locus on 7BL explaining 35% of the phenotypic variance. Four QTL for LR coincided with QTL for LTN. At these loci the alleles of 'Forno' increased the level of resistance as well as the extent of LTN, indicating pleiotropy. [References: 40].

1419 Metakovsky, EV.; Gomez, M.; Vazquez, JF.; Carrillo, JM. (2000) **High genetic diversity of Spanish common wheats as judged from gliadin alleles.** *Plant Breeding. 119(1):37-42.* English. [Univ Politecn Madrid, ETSI Agronomos, Unidad Genet E-28040 Madrid Spain].

Gliadin alleles were identified in 100 common wheat cultivars registered and/or grown in Spain during the last 40 years. A very high level of genetic polymorphism was found: in total, 103 allelic variants including one nuli-allele were found at the six major Gli loci in the Spanish wheats studied. An average genetic diversity for these six loci was found to be higher (H = 0.844) than in any group of wheat cultivars studied previously. Spanish wheats bred in Spain demonstrated even higher genetic diversity (H = 0.868), probably because of the occurrence in this group of some landraces (local varieties) assumed to be strongly differentiated to fit local environments. The high level of genetic diversity of wheats grown in Spain was maintained by the introduction of distantly related wheat germplasm from different sources, especially from Italy and CIMMYT. A slight decrease of genetic diversity in recently registered cultivars might be caused by the excessive introduction of French wheats. Thirteen new alleles found in Spanish wheats were catalogued, including Gli-D2w which encodes the first Gli-D2-controlled gamma-gliadin to be found. [References: 33].

1420 Minasbekyan, LA.; Parsadanyan, MA.; Panosyan, GA.; Vardevanyan, PO. (2000) **Changes in the nucleotide composition and pattern of DNA methylation during the germination of cereal seeds.** *Russian Journal of Plant Physiology. 47(2):256-259.* English. [Yerevan State Univ, Dept Biol Ul Manukyana 1 Yerevan 375049 Armenia].

DNA properties (the degree of cytosine methylation, nucleotide composition, and melting point) were compared in dry embryos of Triticum aestivum L., T dicoccum L., and Triticale differing in their genomic formulae. Differently directed changes in DNA melting parameters were found in seeds germinated for 72 h. The content of 5-methylcytosine residues was determined in DNA from dry and germinating seeds. During germination, the level of DNA methylation

increased by 15% in T aestivum, by 27% in Triticale, and by 95% in tetraploid spelt embryos. We concluded that hexaploid cereals differ from tetraploid ones in sequence amplification and methylation. [References: 21].

1421 Moghaddam, M. (Tabriz Univ. (Iran). Dept. of Agronomy); Ehdaie, B.; Waines, J.G. (California Univ., Riverside (USA). Dept. of Botany and Plant Sciences) (1998) **Genetic variation for and interrelationships among agronomic traits in landraces of bread wheat from South-western Iran [Triticum aestivum L.].** *Journal of Genetics & Breeding (Italy) v. 52(1) p. 73-81.* 5 tables; 33 ref. English. (AGRIS 2000-023267).

1422 Molnar-Lang, M.; Linc, G.; Friebe, BR.; Sutka, J. (2000) **Detection of wheat-barley translocations by genomic in situ hybridization in derivatives of hybrids multiplied in vitro.** *Euphytica. 112(2):117-123.* English. [Hungarian Acad Sci, Agr Res Inst POB 19 H-2462 Martonvasar Hungary].

Wheat-barley translocations were identified by genomic in situ hybridization (GISH) in backcross progenies originating from in vitro regenerated wheat (Triticum aestivum L. cv. Chinese Spring) x barley (Hordeum vulgare L. cv. Betzes) hybrids. The regenerated hybrids were pollinated with the wheat line Martonvasari 9 kr1. Five translocated wheat-barley chromosomes were recovered among 51 BC2F2 progeny from the in vitro regenerated wheat x barley hybrids. All were single breakpoint translocations with the relative positions of the breakpoints ranging from the centromere to about 0.8 of the relative arm length. Of the four translocations with intercalary breakpoints, three were transfers of terminal barley segments to wheat chromosomes; one was a transfer of a terminal wheat segment to a barley chromosome. Because of the absence of diagnostic N-bands, the identity of three barley segments could not be determined; in one translocation the barley chromosome involved had a NOR so it must have been 5H or 6H, and the centric translocation was 4HS.2BL. Following selfing, homozygotes of four translocations were selected. The experiment suggests that in vitro culture conditions are conducive for major genome rearrangements in wheat-barley hybrids. [References: 26].

1423 Nakamura, H. (2000) **Allelic variation at high-molecular-weight glutenin subunit loci, Glu-A1, Glu-B1 and Glu-D1, in Japanese and Chinese hexaploid wheats.** *Euphytica. 112(2):187-193.* English. [Tohoku Natl Agr Expt Stn Morioka Iwate 0200198 Japan].

Variation in the electrophoretic banding patterns of high-molecular-weight (HMW) glutenin subunits of 274 hexaploid wheat (Triticum aestivum) varieties from China was examined by sodium dodecyl sulfate polyacrylamide gel electrophoresis and 27 different major HMW glutenin subunits were identified. Each variety contained three to five subunits and 29 different glutenin subunit patterns were observed in 274 Chinese hexaploid wheats. Seventeen alleles were identified based on the comparison of subunits mobility with that previously identified in a set of standard hexaploid wheats. The Chinese hexaploid wheats exhibited allelic variation in HMW glutenin subunit composition and the variation differed from that of Japanese and hexaploid wheats of other countries. [References: 21].

1424 Negri, V.; Russi, L. (Perugia Univ. (Italy). Istituto di Miglioramento Genetico Vegetale) (1996) **Landraces in Central Italy. Genetic erosion and activites to safeguard them [vegetables - wheat - lentil - emmer].** *Annali della Facolta' di Agraria, Universita' di Perugia (Italy) v. 50 p. 243-249.* 1 graph; 10 ref. English. (AGRIS 2000-023287).

Landraces of plant species for human use can still be found in various areas of Central Italy. During germplasm collection missions conducted by the Istituto di Miglioramento Genetico Vegetale (IMGV), University of Perugia, information was collected on the extent of genetic erosion, incentives to farmers to mantain landraces and agronomic, adaptive and qualitative characters of materials found. In intensively cultivated areas it is much more difficult to find landraces than in marginal areas. In the intensively cultivated areas landraces of horticultural crops can be found in kitchen gardens, in the marginal areas landraces of field crops such as wheat and lentil can also be found. The risk of genetic erosion appears to be greater for horticultural crops, since their conservation is almost entirely in the hands of elderly people who still like the old flavours of their youth. Wheat and lentil landraces are cultivated as field crops in relatively large areas of Central Italy; presently due to the extent of their cultivation and the relatively high income they give in these areas, they are effectively preserved in situ. The activities of IMGV in safeguard this germplasm both ex situ and in situ are briefly discussed Nel corso di missioni per la collezione di vecchie varieta' di specie coltivate per l'alimentazione umana, l'IMGV ha raccolto informazioni sull'entita' dell'erosione genetica, sugli incentivi che portano gli agricoltori a coltivarle, sulle loro caratteristiche agronomiche, di adattamento e qualitative. Nelle zone ad agricoltura intensiva risulta molto difficile trovare vecchie varieta'. Solo specie di interesse orticolo sono sporadicamente rintracciabili negli orti di vecchi agricoltori. In aree piu' marginali e' possibile trovare qualche varieta' di grano (in specie farro) e lenticchia. Il rischio di erosione genetica appare elevato per le orticole, che sono propagate solo da vecchi agricoltori, mentre e' piu' limitato per farro e lenticchia. Queste specie sono al momento efficacemente conservate in situ perche', fornendo un prodotto di ottima qualita', consentono di spuntare prezzi sul mercato piu' alti e di ottenere un reddito relativamente buono. Il lavoro condotto dall'IMGV nella conservazione in situ ed ex situ di queste vecchie varieta' viene brevemente descritto.

1425 Nuutila, AM.; Hamalainen, J.; Mannonen, L. (2000) **Optimization of media nitrogen and copper concentrations for regeneration of green plants from polyembryogenic cultures of barley (Hordeum vulgare L.).** *Plant Science. 151(1):85-92.* English. [VTT Biotechnol & Food Res POB 1500 FIN-02044 Espoo Finland].

In recent years particle bombardment has become the most used method for gene transfer to barley (Hordeum vulgare L.). Transformation efficiency depends greatly on the ability of the target material to regenerate into green plants. In this work we improved the regeneration efficiency of polyembryogenic cultures of barley (cv. Kymppi) by optimizing the nitrogen and copper concentrations in the media. [References: 29].

1426 Obery, Kh. (1998) **[The hereditary stocks species of wild Oat and barley and wheat].** *The arab agricultural engineer (Syria) (no.46) p. 31-38.* Arabic. (AGRIS 2000-016356).

1427 Permeti, M. (1997) **[A contribution for genetic improvement of soft wheat in Albania].** *Buletini i Shkencave Bujqesore (Albania) (no. 3) p. 55-62.* 2 tables; 10 ref. Albanian. (AGRIS 2000-023259).

Some varieties of soft wheat were experimented, coming from neighbouring countries and from USA. The experiments and the overall agricultural output have shown that those varieties have lower output rates and lower performance in our country climate, soil and practice. This state of affairs urges the enhancement of genetic selection activity for soft wheat in our conditions. Its continuation ought to be considered very profitable for the economy of our country.

1428 Pfluger, L.A.; Suarez, E.Y. (Instituto Nacional de Tecnologia Agropecuaria, Castelar (Argentina). Biological Resource Inst.); Lafiandra, D. (Universita della Tuscia, Viterbo (Italy). Dipartimento di Agrobiologia e Agrochimica) (1998) **Relationships between wheat high molecular weight glutenin subunits compositions - 1RS translocations and sodium dodecyl sulfate sedimentation volume [Triticum aestivum L.].** *Journal of Genetics & Breeding (Italy) v. 52(3) p. 271-279.* 5 tables; 4 graphs; 42 ref. English. (AGRIS 2000-023273).

1429 Pozzi, C.; Faccioli, P.; Terzi, V.; Stanca, AM.; Cerioli, S.; Castiglioni, P.; Fink, R.; Capone, R.; Muller, KJ.; Bossinger, G.; Rohde, W.; Salamini, F. (2000) **Genetics of mutations affecting the development of a barley floral bract.** *Genetics. 154(3):1335-1346.* English. [Max Planck Inst Zuchtungsforsch Carl Von Linne Weg 10 D-50829 Cologne Germany].

Two groups of mutants that affect the morphology of the lemma, a floral bract of bar-ley, are described. The fir st comprises phenotypes associated with mutant alleles of calcaroides loci. On the lemma of these mutants, a well-organized neomorphic structure is formed, tel-

med the sac. We provide a morphological description of wild-type (WT) and mutant lemmas, based on scanning electron microscopy (SEM), showing that both consist of similar tissues, but that the mutant is characterized by reversed growth polarity. The sac is a unique structure among grasses, and it is remarkable that recessive mutations at five different generic loci lead to the same organ. The second group of mutants carry recessive alleles of two leafy lemma genes, both of which ar-e necessary to cause the transformation of the lemma into a structure having all characteristics of a vegetative leaf, as shown by SEM analysis. The presence of sheath, blade, and ligule in the mutant lemma suggests that wild-type lemma development is interrupted at a leaf-like stage. The genes cal a, b, C, d, 23, lel1, and lel2 have no cz; been mapped at precise positions on linkage groups 2, 7, 7, 3, 7, 5, and 7, respectively. The mutants considered in this article are unaffected in other floral organs. A model for lemma development is suggested. [References: 46].

1430 Prasad, M.; Varshney, RK.; Roy, JK.; Balyan, HS.; Gupta, PK. (2000) **The use of microsatellites for detecting DNA polymorphism, genotype identification and genetic diversity in wheat.** *Theoretical & Applied Genetics. 100(3-4):584-592.* English. [Ch Charan Singh Univ, Dept Agr Bot, Mol Biol Lab Meerut 250004 Uttar Pradesh India].

A set of 20 wheat microsatellite markers was used with 55 elite wheat genotypes to examine their utility ii in detecting DNA polymorphism, (2) in the identifying genotypes and (3) in estimating genetic diversity among wheat genotypes. The 55 elite genotypes of wheat used in this study originated in 29 countries representing six continents. A total of 155 alleles were detected at 21 loci using the above microsatellite primer pairs (only 1 primer amplified 2 loci; all other primers amplified I locus each). Of the 20 primers amplifying 21 loci, 17 primers and their corresponding 18 loci were assigned to 13 different chromosomes (6 chromosomes of the A genome, 5 chromosomes of the B genome and 2 chromosomes of the D genome). The number of alleles per locus ranged from to 13, with an average of 7.4 alleles per locus. The values of average polymorphic information content (PIC) and the marker index (MI) for these markers were estimated to be 0.71 and 0.70, respectively. The (GT)(n) microsatellites were found to be the most polymorphic. The genetic similarity (GS) coefficient for ail possible 1485 pairs of genotypes ranged from 0.05 to 0.88 with an average elf 0.23. The dendrogram, prepared on the basis of similarity matrix using the UPGMA algorithm, delineated the above genotypes into two major clusters (I and II), each with two subclusters (Ia, Ib and IIa, IIb). One of these subclusters (Tb) consisted of a solitary genotype (E3111) from Portugal, so that it was unique and diverse with respect to all other genotypes belonging to cluster I and placed in subcluster Ia. Using a set of only 12 primer pairs, we were able to distinguish a maximum of 48 of the above 55 wheat genotypes. The results demonstrate the utility of microsatellite markers for detecting polymorphism leading to genotype identification and for estimating genetic diversity. [References: 36].

1431 Qing Yingbu; Guo Ruixing; Wang Jiacai (Hubei Academy of Agricultural Sciences, Wuhan (China). Inst. of Grain Crops) (1998) **Breeding and high-yield cultural techniques of new barley variety E-Danmai No.6.** *Hubei Agricultural Sciences (China). Hubei Nongye Kexue (China) (no. 2) p. 23-26.* 2 tables; 4 ref. Chinese. (AGRIS 2000-016484).

1432 Rebetzke, GJ.; Richards, RA. (2000) **Gibberellic acid-sensitive dwarfing genes reduce plant height to increase kernel number and grain yield of wheat.** *Australian Journal of Agricultural Research. 51(2):235-245.* English. [CSIRO POB 1600 Canberra ACT 2601 Australia].

The Norin-10 dwarfing genes, Rht-B1b (Rht1) and Rht-D1b (Rht2), have been used to reduce plant height and increase grain yield in wheat breeding programs worldwide. Other dwarfing genes are available to reduce plant height of wheat but little is known of their effects on grain yield. A set of random, F-5-derived wheat lines containing either minor genes for reduced plant height, or major gibberellic acid (GA) sensitive Rht8 and Rht9 dwarfing genes, were obtained from 3 different populations. Environment mean yields ranged from 2.5 to 4.6 t/ha. Genotypic variation was large and significant ($P < 0.05$) for plant height, grain yield and its components, and kernel number and size. Approximately 30% of lines were as short as variety Hartog, while kernel number per m(2), harvest index, and grain yield of the shortest GA-sensitive lines were not significantly different ($P < 0.05$) from the commercial semidwarf checks Janz or Hartog. Furthermore, genotypic differences in plant height were genetically correlated (r(g)) with variation in kernel number (r(g) = -0.76*), harvest index (-0.71*), and grain yield (-0.62*). These correlated effects were confirmed with retrospective selection for height and were consistent with reported height effects of Rht-B1b and Rht-D1b dwarfing genes on kernel number and harvest index in wheat. Plant height differences among GA-sensitive lines were independent of variation in seedling characteristics (r(2) = 0.01-0.02 n.s.), while a number of reduced-height lines produced 50% longer coleoptiles and greater seedling biomass than Janz. These studies demonstrate a correlation between the shorter height of GA-sensitive dwarfing genes and increased grain yield, and suggest their potential for improving wheat establishment through greater coleoptile length and early vigour. [References: 44].

1433 Rodriguez Quijano, M.; Vazquez, J.F.; Carrillo, J.M. (Escuela Tecnica Superior de Ingenieros Agronomos, Madrid (Spain). Unidad de Genetica); Moita Brites, C. (Estacao Nacional de Melhoramanto de Plantas, Elvas (Portugal)) (1998) **Allelic variation of HMW glutenin subunits in Portuguese landraces of Triticum aestivum ssp vulgare [HMW, high molecular weight].** *Journal of Genetics & Breeding (Italy) v. 52(1) p. 95-98.* 2 tables; 21 ref. English. (AGRIS 2000-023268).

Sixty-four Portuguese landraces of hexaploid wheat were analyzed for their high molecular weight glutenin subunits (HMW) by SDS-polyacrylamide gel electrophoresis. A total of 16 alleles were identified: three at the Glu-A1 locus, eight at the Glu-B1 locus, four at the Glu-D1 locus and a new association (7+20y) of subunits at the Glu-B1 locus. The most frequent HMW glutenin subunits were 2* (60.9%) at Glu-A1 locus, 20+20y (50%) at Glu-B1 locus and 2+12 (89.0%) at Glu-D1 locus [Sessantaquattro varieta' locali portoghesi di frumento esaploide sono state analizzate per quanto riguardava le subunita' di glutenine ad alto peso molecolare mediante elettroforesi in gel di SDS-poliacrilamide. E' stato identificato un totale di 16 alleli: tre al locus Glu-A1, otto al locus Glu-B1, quattro al locus Glu-D1 e una nuova associazione di subunita' (7+20y) al locus Glu-B1. Le subunita' ad alto peso molecolare piu' frequenti erano 2 (60.9%) al locus Glu-A1, 20+20y (50%) al locus Glu-B1 e 2+12 (89.0%) al locus Glu-D1].

1434 Roos, W. (2000) **Ion mapping in plant cells - methods and applications in signal transduction research [Review].** *Planta. 210(3):347-370.* English. [Univ Halle Wittenberg, Dept Cell Physiol, Inst Pharmaceut Biol Kurt Mothes Str 3 D-06120 Halle Germany].

This review covers both methodical aspects and actual applications of ion imaging techniques in plant cell signal research. The methodological section explains the basic principles of fluorescence ion imaging, the impact of modern developments in fluorescence microscopy and introduces the most important fluorescence probes including aequorin and other photoproteins. It critically comments on loading strategies, intracellular compartmentation of probes and calibration procedures. The second part compiles actual research areas where the application of ion imaging procedures has gained substantial achievements and helped to establish new concepts of calcium- and pH-dependent signalling. Examples comprise the hormonal control of stomatal movements, effects of gibberellic and abscisic acids in aleurone cells, elicitation of phytoalexin production, cytosolic pH and cell development, and signatures of Ca2+ as a universal signal in plant cells. [References: 192].

1435 Rychtarik, J.; Macuha, P. (1999) **Introgression of tolerance donor to low pH and toxicity of aluminium in winter wheat hybrids.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 91-100.* Vyskumny Ustav Rastlinnej Vyroby. 3 tables; 13 ref. Slovak. (AGRIS 2000-023255).

In the field and laboratory experiments the progenies of winter wheat in F1 and F2 generations from reciprocal crossing of domestic variety Regia with tolerant variety Albota (ROM) and sensitive variety

Scout 66 (USA) for tolerance and sensitivity to low pH and Al3 ions were evaluated. Testing for tolerance was performed at juvenile plants of winter wheat in laboratory conditions. Experimental plants were grown hydroponically in acid nutrient solution (pH4 +- 0.2) with 10 ppm Al3 ions added in the form AlCl3.6H20 in the climatically controlled growth chamber. After ten days of cultivation length and weight of roots and leaves were measured. Donor of tolerance (Albota) did not achieve grain yield formation parameters of domestic registered varieties. Progenies of variety Albota and Scout with Regia did not achieve grain yield parameters of domestic registered standard varieties, but they had higher parameters of tolerance than a variety Regia and their progenies with variety Scout. Observed traits were heritable intermediary and among reciprocal combinations no significant differences were found out. The variability was caused mainly by varieties and progenies. Relatively high genetic parameters of tolerance traits are in progenies of variety Albota a good assumption for selection of more tolerant genotypes which can be realised only from sufficiently wide select population.

1436 Sasek, A.; Bradova, J. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyne (Czech Republic)); Hubik, K. (1999) **Using protein electrophoresis to control the varietal declaration of doses of food wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 266-269.* Mendelova Zemedelska a Lesnicka Univ. 4 tables; 2 ref. Czech. (AGRIS 2000-016830).

1437 Sasek, A.; Bradova, J.; Sykorova, S. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyne (Czech Republic)) (1999) **Electrophoretic characteristics of wheat and barley varieties newly registered in 1997 and 1998.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 335-338.* Mendelova Zemedelska a Lesnicka Univ. 2 tables; 3 ref. Czech. (AGRIS 2000-016787).

1438 Schut, JW.; Dourleijn, CJ. (2000) **Prediction of barley progeny performance in the presence of genotype-environment interaction.** *Plant Breeding. 119(1):47-50.* English. [Advanta Seeds BV POB 1 NL-4410 AA Rilland Netherlands].

Twenty recombinant inbred line (RIL) populations of European two-row spring barley and their parents were tested in six environments in the Netherlands to investigate the prediction of progeny yield level, yield variance, stability level and stability variance, based on parent information. Progeny yield level is positively correlated with midparent value for average yield. Progeny yield variance is more difficult to predict, but there does appear to be a promising negative correlation between progeny yield variance and Habgood's (1977) parental similarity measure. To quantify yield stability, three statistics were calculated: Finlay and Wilkinson's (1963) regression coefficient b(i), Shukla's (1972) stability variance sigma(i)(2) and Eberhart and Russell's (1966) mean squared deviation d(i)(2). The first stability statistic describes a different aspect of the response pattern to change in environment from the last two. Parents with high b(i) values appear to have a better average yield, i.e. they react more positively to an improvement in the environment than the other genotypes. The average bi value of the progeny is positively correlated with the midparent value, indicating its heritable nature. There are also indications that d(i)(2) and sigma(i)(2) are heritable but their repeatability is poor. Therefore, it is concluded that only prediction of b(i) is useful in practical plant breeding. There is a positive correlation between progeny yield variance and progeny Variance for b(i) but we conclude that the inaccuracy of the stability variance estimates is too high for good predictors for progeny stability variance to be found. [References: 15].

1439 Schwarz, G.; Herz, M.; Huang, XQ.; Michalek, W.; Jahoor, A.; Wenzel, G.; Mohler, V. (2000) **Application of fluorescence based semi-automated AFLP analysis in barley and wheat.** *Theoretical & Applied Genetics. 100(3-4):545-551.* English. [Tech Univ Munich, Lehrstuhl Pflanzenbau & Pflanzenzuchtung Alte Akad 12 D-85350 Freising Germany].

Genetic mapping and the selection of closely linked molecular markers for important agronomic traits require efficient, large-scale genotyping methods. A semi-automated multifluorophore technique was applied for genotyping AFLP marker loci in barley and wheat. In comparison to conventional P-33-based AFLP analysis the technique showed a higher resolution of amplicons, thus increasing the number of distinguishable fragments. Automated sizing of the same fragment in different lanes or different gels showed high conformity, allowing subsequent unambigous allele-typing. Simultaneous electrophoresis of different AFLP samples in one lane (multi-mixing), as well as simultaneous amplification of AFLP fragments with different primer combinations in one reaction (multiplexing), displayed consistent results with respect to fragment number, polymorphic peaks and correct size-calling. The accuracy of semi-automated codominant analysis for hemizygous AFLP markers in an F-2 population was too low, proposing the use of dominant allele-typing defaults. Nevertheless, the efficiency of genetic mapping, especially of complex plant genomes, will be accelerated by combining the presented genotyping procedures. [References: 21].

1440 Sharma, HC.; Benlhabib, O.; Ohm, HW. (1999) **Anther culture and chromosome reduction in wheat x Thinopyrum wide crosses.** *Plant Cell Tissue & Organ Culture. 57(3):215-218.* English. [Purdue Univ, Dept Agron W Lafayette, IN 47907 USA].

There is little information on the anther culture response and cytogenetic nature of pollen-derived calli and regenerants of wide crosses in wheat. The anther culture response of three Thinopyrum species (wheatgrasses), their hybrids and backcrosses with wheat, and the chromosome composition of calli and regenerants were studied to determine the feasibility of efficient chromosome elimination and production of alien addition lines from wide crosses by anther culture in comparison with conventional backcrossing and selfing. Wide hybrids between wheat and wheatgrasses had up to a 2% callus induction response. Pollen sterility of wide hybrids and recalcitrance of wheatgrass parents may largely be responsible for their low response, in addition to culture stage, media and environmental factors. Anther culturability improved in backcrosses as the proportion of wheatgrass chromosomes decreased and fertility increased. Overall the wheat x Th. trichophorum cross had the best response; that is up to 37% callus induction from some BC2 plants. A large variation was found in chromosome numbers in callus roots examined in the BC2 generation. Mixoploidy was frequent. Data indicated that the chromosome numbers in the pollen-derived organs/plants can be reduced to produce alien addition lines. [References: 16].

1441 Shen, XC.; Yao, SL.; Fukano, H.; Kitayama, A.; Nagamune, T.; Suzuki, E. (2000) **Ribosomal RNA supplementation highly reinforced cell-free translation activity of wheat germ.** *Journal of Bioscience & Bioengineering. 89(1):68-72.* English. [Res Inst Innovat Technol Earth 9-2 Kizugawadai Kizu Kyoto 6190292 Japan].

We have constructed an inexpensive, highly efficient eukaryotic cell-free translation system. Wheat germ rRNA (WG rRNA) was prepared by phenol/chloroform (P/C) extraction, a simple and quick method, from wheat germ, an inexpensive and commercially available by-product of flour production. Addition of a small amount of WG rRNA into a wheat germ cell-free translation system increased the protein productivity of the system 6- to 8-fold. Isolated 18S or 28S rRNA alone enhanced the protein production only 2 fold or 3.9-fold, respectively, at maximum. On the other hand, their equimolar mixture enhanced the production as much as the whole WG rRNA, indicating 18S and 28S rRNA synergistically functioned to enhance protein synthesis. Addition of WG rRNA slightly improved the stability of mRNA in the cell-free translation system, which explained only partly the enhancement of protein production. Addition of WGE or ribosome containing approximately the same amount of rRNA in the form of protein-rRNA complex as WG rRNA added to the system did not increase the protein production in the translation system. When ribosome in the cell-free translation system was replaced with WG rRNA, the system did not exhibit any detectable translation activity,

indicating that the translation activity of WG rRNA is negligible in comparison with that of ribosome. These results indicated that WG rRNA affected some mechanisms regulating the translation rate in wheat germ cell free system, resulting in increased protein production. [References: 12].

1442 Simon, M.; Foroughi-Wehr, B. (2000) **Inhibition of extracellular DNase activity of barley microspores in the presence of polyethylene glycol and silicon carbide fibers.** *Journal of Plant Physiology. 156(2):184-189.* English. [Univ British Columbia, Dept Bot 1316-6270 Univ Blvd Vancouver BC V6T 1Z4 Canada].

Nucleolytic activity was detected extracellularly in barley microspore (MS) cultures directly for up to 6 days after isolation. Treatment of MS with polyethylene glycol (PEG) enhanced nucleolytic activity, whereas the addition of silicon carbide fibers (SCF) resulted in some protection of DNA. Extracellular nucleolytic activity was reduced when MS were treated with 12% PEG after addition of a mixture of 8 mmol/L dNTP, 8 mmol/L EDTA, 40 mmol/L spermidine and 1.7 mg/mL proteinase K. In the presence of SCF a mixture without nucleotides was also effective. Gene transfer approaches with PEG and SCF were carried out under conditions of nuclease inhibition, but transient GUS activity was obtained very rarely. [References: 43].

1443 Singh, K.H.; Singh, T.B. (Gobind Ballabh Pant University of Agricultural & Technology, Pantnagar (India). Department of Genetics and Plant Breeding. (1997) **Effectiveness of individual plant selection in early generations of bread wheat.** *Indian Journal of Genetics & Plant Breeding (India) v. 57(4) p. 411-414.* 2 tables; 6 ref. English. (AGRIS 2000-023263).

1444 Singh, S.; Chaudhary, HK.; Sethi, GS. (2000) **Distribution and allelic expressivity of genes for hybrid necrosis in some elite winter and spring wheat ecotypes.** *Euphytica. 112(1):95-100.* English. [Himachal Pradesh Agr Univ, Dept Genet & Plant Breeding Palampur 176062 Himachal Prades India].

The distribution and allelic expressivity of hybrid necrosis genes (Ne-1 and Ne-2) were studied in 21 winter (mostly exotic) and 43 spring type elite wheat genotypes, by crossing them with two known testers, C 306 (Ne-1-carrier) and HD 2380 (Ne-2-carrier). Ne-1 gene was present in one north-west Himalayan winter wheat landrace, Shoure Local, but absent in the other winter as well as spring wheats. Ne-2 gene was prevalent to a much lower extent in the exotic winter wheat germplasm (31.57%) as compared to the recently developed Indian and Mexican spring wheat semidwarfs (69.80%). This may suggest that breeders have tried to preclude hybrid necrosis by selecting for non-carrier genotypes in the development of exotic winter wheats in contrast to the situation in spring wheats. Based on the degree of expression of hybrid necrosis genes in the F-1 hybrids, the carrier genotypes were characterized with respect to the allelic strength of the hybrid necrosis genes. The 27 non-carrier genotypes of the two ecotypes identified in the present study have a greater potential use in future hybridization programmes so as to overcome the problem of hybrid necrosis. [References: 16].

1445 Stoddard, FL. (2000) **Genetics of wheat starch B-granule content.** *Euphytica. 112(1):23-31.* English. [Qual Wheat CRC Ltd Locked Bag No 1345, PO N Ryde N Ryde NSW 2113 Australia].

Two lines of hexaploid wheat were crossed and the basic generations of parent, F1, F2 and back-cross were sown in a controlled-environment chamber. Fresh F1 and back-cross grains were generated, so the material could be handled either as the standard set of basic generations on a whole-plant basis, or as an extended set on an embryo or endosperm basis. The experiment was repeated. Mature grains were harvested and the starch particle size distribution was analysed in 3284 grains from 111 plants. Means and variances were partitioned into additive, dominance and interaction components. Grains from cross-pollinations had B-granule contents between parental values, rather than of the maternal parent, indicating an involvement of the grain genotype. Quantitative models based on endosperm genotype gave a better fit to the data than those based on embryo genotype. The difference in starch B-granule content between the parents was largely due to additive genes. Dominant genes were also indicated, with the first dose in the triploid endosperm having a large effect while the second dose had little or none. Non-allelic interactions were significant in the second experiment where the use of more types of backcross made them more detectable. There were also small and significant residual effects of the maternal plant in the first experiment, attributed to the vigour of the F1 mother plant and to the cytoplasm of Sunco. Narrow-sense heritability was low, between 0.05 and 0.18 depending on the generation. Transgressive segregation was not found, suggesting that all alleles tending to increase the B-granule content were found in the Sunco parent and none in ME71. There was also no detectable heterosis in this character. The results show that breeding and selection for a low B-granule content should be possible but a further reduction will require new and complementary genes. [References: 15].

1446 Sudyova, V.; Slikova, S.; Gregorova, E. (1999) **Evaluation of intergeneric hybrids triticum aestivum cv. Ilona with Agropyron crystatum (L.) Gaertn. in F1, F2 and BC1 generation.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 119-127.* Vyskumny Ustav Rastlinnej Vyroby. 3 tables, 6 ill.; 12 ref. Slovak. (AGRIS 2000-023257).

The aim of our work was to obtain intergeneric hybrids after crossing hexaploid winter wheat cv. Ilona (2n=6x=42) and tetraploid wild species Agropyron cristatum (2n=4x=28). Seedlings F1 and BC1 were developed from dissected immature embryos subsequently cultured to artificial medium. Some quantitative characteristics such as number of tillers, ear length, and grains number per ear on F1, F2 and BC1 plants were evaluated. The somatic chromosomes were counted in root-tip cells from F1 and BC1 and meiotic analyses were made in pollen mother cells (PMCs) from BC1 plants. We obtained only one F1 plant from the cultured embryos and this grew into maturity. This plant had four tillers, two of them were sterile. Average length of ears was 76 mm. Twelve dwarf shrivelled grains were formed. The plant was annual, morphologically intermediate between Agropyron and wheat. We observed pentaploid number of chromosomes (2n=35) in root-tip cells and electrophoretic profiles of seed gliadins confirmed the hybrids of F, generation. The complete profile of densitometric gliadins records showed changes in area of gamma and omega gliadins. These arose by addition of storage protein fractions from Agropyron cristatum. We evaluated six individual plants in F2. These had 3.5 tillers per plant in average. Ears achieved length from 48 mm to 58 mm with average number of 5.3 grains per ear. We excised 9 immature embryos after backcrossing, 6 of which germinated in vitro. Plants developed from 4 to 10 tillers with ear length of 71 mm - 75 mm. There were differences between plants in grain number per ear, which were connected with male pollen fertility. The highest number of grains (27) was in the plant with the pollen fertility of 78.3% and pollen germination in vitro of 71.0%. The lowest male pollen fertility was 65.1% and we obtained 11 grains in an ear. Plants BC1 had the somatic chromosome number from 39 to 41. Analyses from PMCs showed presence 5 to 7 univalents. At first anaphase (AI) bridges and lagging chromosomes were observed. These meiotic irregulaties had influence on male pollen fertility and production of grains from BC1 plants.

1447 Tang, S.; Li, Z.; Jia, X.; Larkin, PJ. (2000) **Genomic in situ hybridization (GISH) analyses of Thinopyrum intermedium, its partial amphiploid Zhong 5, and disease-resistant derivatives in wheat.** *Theoretical & Applied Genetics. 100(3-4):344-352.* English. [Chinese Acad Sci, Inst Genet, State Key Lab Plant Cell & Chromosome Engn Beijing 100101 Peoples R China].

Genomic in situ hybridization (GISH) to root-tip cells at mitotic metaphase, using genomic DNA probes from Thinopyrum intermedium and Pseudorogneria strigosa, was used to examine the genomic constitution of Th. intermedium, the 56-chromosome partial amphiploid to wheat called Zhong 5 and disease-resistant derivatives of Zhong 5, in a wheat background. Evidence from GISH indicated that Th. intermedium contained seven pairs of St, seven J(S) and 21 J chromosomes;; three pairs of Th. intermedium chromosomes with satellites in their short arms belonging to the St, J, J genomes and

homoeologous groups 1, 1, and 5 respectively. GISH results using different materials and different probes showed that seven pairs of added Th. intermedium chromosomes in Zhong 5 included three pairs of St chromosomes, two pairs of JS chromosomes and two Fairs of St-J(S) reciprocal tanslocation chromosomes. A pair of chromosomes, which substituted a pair of wheat chromosomes in Yi 4212 and in HG 295 and was added to 21 pairs of wheat chromosomes in the disomic additions Z1, Z2 and Z6, conferred BYDV-resistance and was identical to a pair of St-JS tanslocation chromosomes (St)(S)) in Zhong 5. The StJS chromosome had a special GISH signal pattern and could be easily distinguished from other added chromosomes in Zhong 5; it has not yet been possible to locate the BYDV-resistant gene(s) of this translocated chromosome either in the St chromosome portion belonging to homoeologous group 2 or in the J(S) chromosome portion whose homoeologous group relationship is still uncertain. Among 22 chromosome pairs in disomic addition line Z3, the added chromosome pair had satellites and belonged to the St genome and homoeologous group 1. Disomic addition line Z4 carried a pair of added chromosomes which was composed of a group-7 J(S) chromosome translocated with a wheat chromosome; this chromosome was different to 7 Ai-I, but was identical to 7 Ai-2. The leaf rust and stem rust resistance genes were located in the distal region of the long arm, whereas the stripe rust resistance gene(s) was located in the short arm or in the proximal region of the long arm of 7 Ai-2. A pair of J(S)-wheat translocation chromosomes, which originated from the WJ(S) chromosomes in Z4, was added to the disomic addition line Z5; the added chromosomes of Z5 carried leaf and stem rust resistance but not stripe rust resistance Z5 is a potentially useful source for rust resistance genes in wheat breeding and for cloning these novel rust-resistant genes. GISH analysis using the St genome as a probe has proved advantageous in identifying alien Th. intermedium in wheat. [References: 52].

1448 Tao, W.; Liu, D.; Liu, J.; Feng, Y.; Chen, P. (2000) **Genetic mapping of the powdery mildew resistance gene Pm6 in wheat by RFLP analysis.** *Theoretical & Applied Genetics. 100(3-4):564-568.* English. [Nanjing Agr Univ, Minist Crop Cytogenet, Key Open Lab Nanjing 210095 Jiangsu Peoples R China].

Pm6 in bread wheat (Triticum aestivum L.), which was transferred from Triticum. timopheevii L., is a gene conferring resistance to the powdery mildew disease caused by Erysiphe graminis f. sp. tritici. Six near-isogenic lines (NILs) of Pm6 in a cultivar 'Prins' background were analyzed to map this gene using restriction fragment length polymorphism (RFLP). Each of the six NILs possessed a T. timopheevii-derived segment, varying in length, and associated with powdery mildew resistance. Lines IGV1-465 (FAO163b/ 7*Prins) and IGV1-467 (Idaed 59B/7*Prins) had the shortest introgressed segments, which were detected only by DNA probes BCD135 and PSR934, respectively. The polymorphic loci detected by both probes were mapped to the long arm of chromosome 2B. Lines IGV1-458 (CI13250/7*Prins) and IGV1-456 (CI12559/8*Prins) contained the longest I: timopheevii segments involving both arms of donor chromosome 2G across the centromere. All these introgressed segments had an overlapping region flanked by the loci xspr934 and xbcd135 on 2BL. Thus, Pm6 was located in this region since the powdery mildew resistance in all the NILs resulted from the introgressed fragments. Using the F-2 mapping population from a cross of IGV1-463 (PI170914/7*Prins)xPrins, Pm6 was shown to be closely linked to the loci xbcd135 and xbcd266 at a genetic distance of 1.6 cM and 4.8 cM, respectively. BCD135 was successfully used in detecting the presence of Pm6 in different genetic backgrounds. [References: 27].

1449 Tisova, V. (1999) **Evaluation of selected traits of winter wheat collection as for occurence of dwarfing genes (Rht).** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 129-137.* Vyskumny Ustav Rastlinnej Vyroby. 3 tables, 2 ill.; 13 ref. Slovak. (AGRIS 2000-023258).

In 1997-1998 in VURV Piestany a collection of 70 new varieties and newbreedings of winter wheat was tested in plant height, yield-forming and qualitative traits were evaluated and presence as well as influence of Rht genes on these elements were studied. As could be see from the results, the average plant height of the collection at the genotypes where presence of Rht genes was identified was lower than at genotypes of transient type. Genotypes with presence of Rht genes had the highest grain yield, number of spikes per area unit and number of grains in a spike. Negative highly-significant correlation ratio was found (r = -0.415++) between plant height and number of grains in a spike at genotypes with Rht genes and positive highly-significant ratio (r = 0.392++) between the plant height and TGW at genotypes with dwarfing Rht genes. Highly-significant correlation ratio (r = 0.551++) was found between grain yield and spike number per area unit at genotypes with dwarfing genes and without them (r = 0.748++) and significant correlation (r = 0.323+) between the grain yield and number of grains in a spike at genotypes with Rht genes. The highest TGW was found in high-stemmed genotypes and the said was going down through the genotypes of transient type and reached the highest values at genotypes with Rht genes. The highest protein content was found at genotypes of transient type and the highest values of sedimentation test at genotypes with Rht genes. Negative highly-significant correlation ratio was found (r = -0.463++) between protein content and sedimentation test at genotypes with Rht genes and also without Rht genes (r = -0.576++). The grain yield as well was in negative correlation (r = -0.362+) with protein content at genotypes with Rht genes and without them (r = -0.452+). Genotypes with the best parameters of evaluated traits and with presence of Rht genes are recommended for use in breeding programs on dwarfing as perspective parental forms.

1450 Van, Campenhout, S.; Koebner, RMD.; Volckaert, G. (2000) **The applicability of consensus PCR primers across species and genera: the use of wheat Em sequences to develop markers for orthologues in rye.** *Theoretical & Applied Genetics. 100(2):328-336.* English. [Katholieke Univ Leuven, Lab Gene Technol K Mercierlaan 92 B-3001 Louvain Belgium].

Two wheat consensus primer sets, directed to "early-methionine-labelled" (Em) gene sequences, were tested for their ability to amplify beyond their original source. A range of widely diverse templates, including other Triticeae species and sample monocot and dicot species, was assayed. Primer set EMC5/EMC3, amplifying the entire coding region with its intron and part of the 3' untranslated region, targets Triticeae and sorghum Fm sequences. The other set, EMC5/EMC031, directed to the coding region and its intron, amplifies templates from all the grass species. Both primer sets fail to amplify Fm sequences from more distant monocots and the dicots. Using set EMC5/EMC3, we isolated and sequenced ten members of the rye Em gene family from five differ ent rye sources. Significant DNA sequence variation between wheat and rye sequences in the non-coding regions was found, and this was used to develop seven sequence-specific primers. Twelve primer combinations were analysed, 7 of which were Em-R1-specific, amplifying a product in at least one of the tested rye or rye-carrying genotypes but not in wheat. Four sets exhibited clear amplification length polymorphisms which allowed discrimination between and within the Die sources. The primers also discriminated between wheat-rye recombinants with proximal 1RL rye chromatin and those carrying distal 1RL rye chromatin. These results show that wheat consensus primer sets can be used to isolate orthologous sequences, especially from species that are used for alien gene transfer in wheat. Subsequently, species-specific assays can be designed that are useful tools for this application. [References: 34].

1451 Veisz, O.; Bedo, Z.; Lang, J.; Tischner, T. (Academy of Sciences, Martonvasar (Hungary). Agricultural Research Inst.) (1997) **Reversal of dominance in wheat frost resistance as a function of the freezing temperature [Triticum aestivum L.].** *Journal of Genetics & Breeding (Italy) v. 51(4) p. 289-294.* 1 table; 2 graphs; 20 ref. English. (AGRIS 2000-023266).

1452 Vranova, J.; Bednar, P. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic). Ustav Genetiky); Martinek, P. (1999) **The effect of the seeding rate on the formation of yield characters in the genetic resources of winter wheat (Triticum aestivum) with a non-standard morphological spike structure.** *Acta Universitatis*

Agriculturae et Silviculturae Mendelianae Brunensis (Czech Republic) v. 47(4) p. 91-96. 4 tables; 14 ref. Czech. (AGRIS 2000-016785).

The effect of increasing seeding rates: 2.0; 2.5; 3.0; 3.5; 4.0; 4.5 and 5.0 million germinating seeds (MGS) per 1 ha on yield characteristics of three genetic resources of winter wheat (Triticum aestivum) was studied KM 142-94 with a markedly elongated spike - normal structure (NS) gigas, KM 1307-95 with vertical sessile spikelets (VSS), KM 2217-95 with screwed spike rachis (SCR) and two control varieties, i.e. Astella and Record, were used. The results confirmed the capacity of the KM-genotypes with a higher spike productivity to maintain a higher spike weight even when the seeding rate was higher. The yields of the Astella and Record varieties were on average by 30 % higher. Genotypes with a non-standard morphological spike structure showed a lower tillering capacity and lower number of spikes per 1 square m compared with the controls. Maximal yields were obtained when the seeding rate was lower (3, 5-4, 5 MGS per 1 ha), while the higher yields of control varieties were obtained with higher seeding rates (4, 0-4, 5 MGS per 1 ha). The weight af the grain in the spike of genotypes with a non-standard spike morphology was higher with all the seeding rates.

1453 Wang Honggan (Shangdong Agricultural Univ., Taian (China). Dept. of Agronomy) (1998) **Cytological studies on the way of gamete formation in hybrid between Flytrigia intermedium and Triticum aestivum.** *Journal of Wuhan Botanical Research (China). Wuhan Zhiwuxue Yanjiu (China) v. 16(3) p. 202-206.* 1 table; 16 ill., 12 ref, Chinese. (AGRIS 2000-016411).

1454 Watanabe, N. (Gifu Univ. (Japan). Lab. of Genetics and Plant Breeding) (1998) **A method to distinguish leaf colour variation in Syrian barley [Hordeum vulgare L.].** *Journal of Genetics & Breeding (Italy) v. 52(4) p. 289-293.* 4 tables; 2 graphs; 13 ref. English. (AGRIS 2000-023038).

Barley breeders at ICARDA have observed that higher grain yield under conditions of heat and water stress is associated with lighter leaf colour genotype. The objectives of the present study was to assess the relationships of visual observation and spectra-colorimetric determination of leaf colour. The colour of the leaves was spectro-colorimetrically determined for 12 genotypes of barley taken from the breeding programme at ICARDA. The genotype of visually light-green leaf colour group reflected more light than that of the dark-green one, especially in the green region (520-600 mm). The light-green group had a lower colour temperature than dark-green group. In the colour space, psychometric lightness (L] of the group of light-green leaves was greater than that of dark-green leaves. In a* coordinate (red and green hues), the light-green group had a more green hue than dark-green group. The two groups were also different for the b* coordinate (blue and yellow hues). The leaves of the light-green group were more yellowish that those of dark-green group to the human eye. As visually perceived, the leaves of the light-green group had greater green and yellow hue than those of the dark-green group. Colour space could be used to score leaf colour of barley breeding lines [I genetisti dell'orzo all'ICARDA hanno notato che le rese piu' elevate di granella in condizioni di stress termico e idrico erano associate con il genotipo caratterizzato da foglie piu' chiare. Gli obiettivi di questo studio consentivano nell'accertare i rapporti fra osservazione visiva e determinazione spettro-colorimetrica del colore della foglia. Il colore delle foglie e' stato determinato per via spettro-colorimentrica su 12 genotipi di orzo derivanti dal programma di miglioramento genetico dell'ICARDA. Il genotipo del gruppo di colore della foglia verde chiaro all'osservazione visiva rifletteva una maggior quantita' di luce di quello di colore verde scuro, specialmente nella regione del verde (520-600 nm). Il gruppo verde chiaro aveva una temperatura di colore piu' bassa rispetto al gruppo verde scuro. Nello spazio del colore, la luminosita' psicometrica (L] del gruppo delle foglie verde chiaro era maggiore di quella delle foglie verde scuro. Nella coordinata a* (toni rosso e verde), il gruppo verde chiaro aveva un tono verde maggiore rispetto al gruppo verde scuro. I due gruppi erano pure differenti per la cordinata b* (toni blu e gialli). Le foglie del gruppo verde chiaro erano piu' giallastre di quelle del gruppo verde scuro per l'occhio umano. Come poteva essere percepito visivamente, le foglie del gruppo verde chiaro avevano un maggior tono verde e giallo rispetto a quelle del gruppo verde scuro. Lo spazio del colore potrebbe essere utilizzato per determinare quantitativamente il colore delle foglie delle linee di orzo in miglioramento genetico].

1455 Weng, Y.; Tuleen, NA.; Hart, GE. (2000) **Extended physical maps and a consensus physical map of the homoeologous group-6 chromosomes of wheat (Triticum aestivum L-em Thell.).** *Theoretical & Applied Genetics. 100(3-4):519-527.* English. [Texas A&M Univ, Dept Soil & Crop Sci College Stn, TX 77843 USA].

Extended physical maps of chromosomes 6A, 6B and 6D of common wheat (Triticum aestivum L. em Thell., 2n=6x=42, AABBDD) were constructed with 107 DNA clones and 45 homoeologous group-6 deletion lines. Two-hundred and ten RFLP loci were mapped, including three orthologous loci with each of 34 clones, two orthologous loci with each of 31 clones, one locus with 40 clones, two paralogous loci with one clone, and four loci, including three orthologs and one paralog, with one clone. Fifty five, 74 and 81 loci were mapped in 6A, 6B and 6D, respectively. The linear orders of the mapped orthologous loci in 6A, 6B and 6D appear to be identical and 65 loci were placed on a group-6 consensus physical map. Comparison of the consensus physical map with eight linkage maps of homoeologous group-6 chromosomes from six Triticeae species disclosed that the linear orders of the loci on the maps are largely, if not entirely, conserved. The relative distributions of loci on the physical and linkage maps differ markedly, however. On most of the linkage maps, the loci are either distributed relatively evenly or clustered around the centromere. In contrast, approximately 90% of the loci on the three physical maps are located either in the distal one-half or the distal two-thirds of the six chromosome arms and most of the loci are clustered in two or three segments in each chromosome. [References: 57].

1456 Werck-Reichhart, D.; Hehn, A.; Didierjean, L. (2000) **Cytochromes P450 for engineering herbicide tolerance [Review].** *Trends in Plant Science. 5(3):116-123.* English. [CNRS, Inst Plant Mol Biol, Dept Cellular & Mol Enzymol, UPR 406 28 Rue Goethe F-67083 Strasbourg France].

In recent years, genome sequencing has revealed that cytochromes P450 (P450s) constitute the largest family of enzymatic proteins in higher plants. P450s are mono-oxygenases that insert one atom of oxygen into inert hydrophobic molecules to make them more reactive and hydrosoluble. Besides their physiological functions in the biosynthesis of hormones, lipids and secondary metabolites, P450s help plants to cope with harmful exogenous chemicals including pesticides and industrial pollutants, making them less phytotoxic. The recovery of an increasing number of plant P450 genes in recombinant form has enabled their use in experimentation, which has revealed their extraordinary potential for engineering herbicide tolerance, biosafening, bioremediation and green chemistry. [References: 39].

1457 Wrigley, CW.; Batey, IL. (1999) **Methods for establishing distinctness of cereal-grain genotype in cultivar registration.** *Plant Varieties & Seeds. 12(3):169-179.* English. [CSIRO N Ryde NSW 1670 Australia].

There are many tests of genotypic identity with the potential to establish the distinctness of a cultivar that is offered for registration. These include the range of laboratory-based tests for protein composition and for DNA testing, in addition to judging the more conventional morphological descriptors. whilst the availability of so many methods is a great advantage, if becomes more difficult to select the most suitable sub-set of methods to establish distinctness for a specific case. As a likely solution to this problem, a computer-based program (WhatWheat) has been adapted from its original identification role to assist in the task of establishing distinctness. Normally, the program provides a large two-way table summarising the results for a set of established cultivars on the basis of a range of testing methods. This can be interrogated in various ways to expedite identification of a sample. If WhatWheat were lo be used for cultivar-group classification, an initial test should be performed, and the result entered for the cultivar being offered for registration. More likely, the information provided with the nomination of the new cultivar would

serve this function (e.g. its morphological description). Further selection of tests would then occur, based on the result of the first test information in providing a sub-set of cultivars, and the potential differentiating ability of those next tests. The additional inclusion of pedigree information would further serve to narrow the range of relevant cultivars for examination. [References: 27].

1458 Wu Wei; Zheng Youliang; Wei Yuming (Sichuan Agricultural Univ., Dujiangyan (China). Inst. of Triticeae) (1999) **Parental diversity of the crosses with strong heterosis in wheat based on gliadin electrophoretic patterns.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(2) p. 130-135.* 3 tables; 2 ill.; 16 ref. Chinese. (AGRIS 2000-016781).

1459 Wu Wei; Zheng Youliang; Wei Yuming (Sichuan Agricultural Univ., Dujiangyan (China). Inst. of Triticeae) (1999) **Parental diversity of the crosses with strong heterosis in wheat based on glutein electrophoretic patterns.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(2) p. 141-145.* 2 tables; 1 ill.; 16 ref. Chinese. (AGRIS 2000-016782).

1460 Wu Wei; Zheng Youliang; Wei Yuming (Sichuan Agricultural Univ., Dujiangyan (China). Inst. of Triticeae) (1999) **Parental diversity of the crosses with strong heterosis in wheat based on RAPD markers.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(2) p. 123-129.* 2 tables; 1 ill.; 38 ref. Chinese. (AGRIS 2000-016780).

1461 Wu Wei; Zheng Youliang; Zhou Yonghong (Sichuan Agricultural Univ., Dujiangyan (China). Inst. of Triticeae) (1999) **Analysis of heterosis and correlation of major aronomic characters of the crosses from wheat-rye recombinant.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(2) p. 146-151.* 3 tables; 2 ill.; 13 ref. Chinese. (AGRIS 2000-016783).

1462 Wu Wei; Zheng Youliang; Zhou Yonghong (Sichuan Agricultural Univ., Yaan China)) (1999) **Study on the selection of crosses with strong heterosis from wheat-rye recombinant.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(1) p. 11-16.* 4 tables; 24 ref. Chinese. (AGRIS 2000-016774).

A wheat -rye recombinant, Yiyuan 2 was crossed with 115 varieties or lines. According to grain weight per spike, 22 crosses with strong heterosis were selected out primarily. Therefore, the standard, mid-, male and female parent heterosis of 7 traits, including heading date, plant height, spike number per plant, spikelet number per spike, grain number per spike, 1000 grain weight and grain weight per spike, were analysed respectively. Through comprehensive evaluation, 4 relatively better crosses with strong heterosis, namely SW90-2321/Yiyuan 2, Mianyang 26/Yiyuan 2, 45661/Yiyuan 2 and Mianyang 94-334/Yiyuan2, were selected out. The result showed that Yiyuan 2 was an excellent parent. If it was crossed with another parent with high 1000 grain weight and early mature traits, some strong heterotic hybrid varieties with high yield in accord with breeding goals might be selected out to apply for the production.

1463 Xin Weili (Heilongjiang Provincial Academy of Agricultural Sciences, Harbin (China). Inst. of Crop Breeding) (1998) **A cytogenetic study on the crosses between octoploid Tititrigia and hexaploid Tititrigia.** *Heilongjiang Agricultural Science (China). Heilongjiang Nongye Kexue (China) (no. 3) p. 4-7.* 3 tables; 5 ref. Chinese. (AGRIS 2000-016748).

1464 Xu Naiyu; Yan Jiaqi (Wuhan Univ., Hubei (China). Coll. of Life Sciences) (1998) **Studies on photoperiod-Sensitive cytoplasmic male sterity in wheat.** *Journal of Wuhan Botanical Research (China). Wuhan Zhiwuxue Yanjiu (China) v. 16(2) p. 97-105.* 5 tables; Chinese. (AGRIS 2000-016766).

1465 Xu Zuyuan; Zhou Kinghe; Jiang Jinbao (Jingzhou Normal Coll., Hubei (China)) (1998) **A cytological observation on pollen abortion in a new typic cytoplasmic male-sterile wheat.** *Journal of Wuhan Botanical Research (China). Wuhan Zhiwuxue Yanjiu (China) v. 16(3) p. 193-196.* 2 tables; 21 ill., 9 ref. Chinese. (AGRIS 2000-016767).

1466 Yamaguchi, H.; Nakanishi, H.; Nishizawa, NK.; Mori, S. (2000) **Induction of the IDI1 gene in Fe-deficient barley roots: A gene encoding a putative enzyme that catalyses the methionine salvage pathway for phytosiderophore production.** *Soil Science & Plant Nutrition. 46(1):1-9.* English. [Univ Tokyo, Plant Mol Physiol Lab Tokyo 1138657 Japan].

IDI1, a cDNA induced by Fe-deficiency, was isolated from Fe-deficient barley roots by differential hybridization screening. IDI1 transcripts in roots increased with Fe-deficiency treatment. IDI1 cDNA encoded a protein with 198 amino acids. The IDI1 protein is homologous to the bacterial protein E-2, which catalyzes the formation of a 2-keto-methylthiobutyric acid in the methionine salvage pathway. IDI1 protein is postulated to be an enzyme that participates in the pathway providing methionine for phytosiderophore production in Fe-deficient barley roots. [References: 29].

1467 Yan Zehong; Zheng Youliang (Sichuan Agricultural Univ., Dujiangyan (China). Inst. of Triticeae) (1999) **Esterase isoenzyme analysis for wheat-rye recombinant lines.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(1) p. 5-10.* 4 tables; 1 ill.; 14 ref. Chinese. (AGRIS 2000-016773).

Seventy one wheat-rye recombinant lines, derived from the triple cross of mutispiklet wheat line 10-A with 88-1643 and Chuanyu 12, and their parents, were used to investigate the esterase isoenzyme. There existed polymorphism among these recombinant lines. The esterase isoenzyme pattern of these lines can be divided into 3 type, 10-A type, 88-1643 type, and recombinant type and no Chuanyu 12 type were found. The isoenzyme band variance in E6 may result in difference in heading date and mutispiklete number per spike. The selecting of major breeding characters can be assistant by these two bands. On the paper, the esterase isoenzyme polymorphism among these recombinant lines and the relationship of 10-A, 88-1643 and Chuanyu 12 with rye were studied.

1468 Yan Zehong; Zheng Youliang (Sichuan Agricultural Univ., Dujiangyan (China). Inst. of Triticeae) (1999) **The correlation analysis among major breeding objective characters in wheat-rye recombinant lines.** *Journal of Sichuan Agricultural University (China). Sichuan Nongye Daxue Xuebao (China) v. 17(1) p. 1-4.* 3 tables; 13 ref. Chinese. (AGRIS 2000-016772).

The partial correlation coefficient among 7 characters in wheat-rye recombinant lines were studied. The positive significant correlations were found between heading date and spikelet per spike, plant height and protein content, 1000-grain weight and grain numbers per spike, and grain weight per spike, respectively. But a negative significant partial correlation was found between 1000-grain and grain numbers per spike. The other correlation involved in the seven characters were not significant. The positive correlation between 1000-grain weight and grain numbers per spike, plant height and protein content, heading date and spikelet number per spike, have disadvantageous effect on the genetic improvement of wheat-rye recombinant lines. In the paper, the combination among 1000-grain weight, grain numbers per spike and multispikelet have been discussed. Furthermore, how to coordinate these disadvantage correlation was discussed.

1469 Yang Wuyun; Rao Shida; Hu Xiaorong (Sichuan Academy of Agricultural Sciences, Chengdu (China). Crop Research Inst.) (1998) **Development of high compatible multiple gene wheats.** *Southwest China Journal of Agricultural Sciences (China). Xinan Nongye Xuebao (China) v. 11(1) p. 1-6.* 5 tables; 5 ill.; 16 ref. Chinese. (AGRIS 2000-016768).

1470 Yang Xueju (Hebei Agricultural Univ., Baoding (China)) (1999) **Quality differences of HMW glutenin subunits in hybrid generation of bread wheat.** *Journal of Agricultural University of Hebei (China). Hebei Nongye Daxue Xuebao (China) v. 22(2) p. 1-4.* 3 tables; 12 ref. Chinese. (AGRIS 2000-016750).

1471 Yang, ZP.; Yang, XY.; Huang, DC. (2000) **Improvement of resistance to Fusarium head blight by recurrent selection in an intermating breeding spring wheat population using the dominant male-sterile gene ms(2).** *Euphytica. 112(1):79-88.* English. [Agr & Agri Food Canada, Res Ctr Lacombe AB T4L 1W1 Canada].

Four cycles of recurrent selection for FHB resistance were conducted in an intermating wheat breeding population using the dominant male-sterile gene ms(2) during 1987-1991. Five cycles of phenotypic mass selection for male-sterile plants were evaluated using the soil-surface inoculation method in Experiment I. Experiment II evaluated changes in FHB scores during five cycles of progeny selection for fertile plants using the single-floret inoculation method. In Experiment I, the average level of FHB response increased to MR level in C-4, compared to MS level in C-0. The numbers of infected spikelets and diseased kernels decreased 0.32 and 2.68 per cycle, respectively. In Experiment II, the average level of FHB response increased to R level in C4F1. The numbers of infected spikelets and diseased kernels decreased 0.93 and 4.58 per cycle, respectively. In both experiments, the largest selection gains were realized in the first cycle. The frequencies of R and MR individuals were increased significantly. The frequencies of individuals with FHB response equal and/or superior to Sumai 3 were increased to 5-8% in C-4 and 25% in C4F1 after the fourth cycle. Agronomic traits tended to be slightly improved in selected populations. Compared to 2% in C-0, about 34% of lines superior in both FHB resistance and agronomic traits in C4F1 were selected to enter the conventional breeding program for further evaluation. Sixty three semidwarf lines superior in both FHB resistance and yield potential were selected from the F-5 generations derived from C1F1 to C4F1. From them, two resistant cultivars with high-yielding potential were developed and commercialized in the Lower Yangtze Valley. Recurrent selection appears to be highly effective and feasible in shifting the average FHB response of the intermating population in the desirable direction, thereby enhancing the frequency of resistant individuals. [References: 31].

1472 Yencho, GC.; Cohen, MB.; Byrne, PF. (2000) **Applications of tagging and mapping insect resistance loci in plants [Review].** *Annual Review of Entomology. 45:393-422.* English. [N Carolina State Univ, Vernon G James Res & Extens Ctr, Dept Hort Sci 207 Res Stn Rd Plymouth, NC 27962 USA].

This review examines how molecular markers can be used to increase our understanding of the mechanisms of plant resistance to insects and develop insect resistant crops. We provide a brief description of the types of molecular markers currently being employed, and describe how they can be applied to identify and track genes of interest in a marker-assisted breeding program. A summary of the work reported in this field of study, with examples in which molecular markers have been applied to increase understanding of the mechanistic and biochemical bases of resistance in potato and maize plant/pest systems, is provided. We also describe how molecular markers can be applied to develop more durable insect-resistant crops. Finally, we identify key areas in molecular genetics that we believe will provide exciting and productive research opportunities for those working to develop insect-resistant crops. [References: 109].

1473 Zhang Qingqin (Guizhou Univ., Guiyang (China). Tritical Crop Center) (1999) **The methodology of multi-resistance to diseases in wheat distant breeding.** *Southwest China of Agricultural Sciences (China). Xinan Nongye Xuebao (China) v. 12(1) p. 32-38.* 3 tables; 5 ref. Chinese. (AGRIS 2000-016771).

1474 Zhang Shushen; Qiu Yongchun; Yao Ping (Shenyang Agricultural Univ., (China). Laboratory of North China Crop Immunology) (1998) **Determination of the genes responsible for the resistance to wheat stem rust in 94 wheat varieties as the important resources of rust resistance.** *Journal of Shenyang Agricultural University (China). Shenyang Nongye Daxue Xuebao (China) v. 29(2) p. 117-122.* 2 tables; 6 ref. Chinese. (AGRIS 2000-016760).

1475 Zhang, XG.; Jessop, RS.; Ellison, F. (1999) **Combining ability for aluminium tolerance in triticale.** *Journal of Agricultural Science. 133(Part 4):371-377.* English. [Univ New England, Div Agron & Soil Sci Armidale NSW 2351 Australia].

Root re-growth, following aluminium (Al) stress, has been used as an indicator of Al stress tolerance. Genetic variation in root re-growth characteristics among eight triticale genotypes was investigated by a diallel analysis. Highly significant variation due to both general combining ability (GCA) effects and specific combining ability (SCA) effects indicated that both additive effects and non-additive effects were important in explaining the genetic variation for Al tolerance. The high estimates of heritability and the predictability ratio for root re-growth revealed the preponderance of additive genetic variance in the inheritance of Al tolerance. Differences in patterns of GCA effects and SCA effects among the parents provided strong evidence that the genetic control of variation for Al tolerance as assessed by root re-growth was a complex polygenic system. Three Al-tolerant genotypes, Tahara, Abacus, and 19th ITSN 70-4, were found to be the best general combiners for larger root re-growth, and they could be used in hybridization programmes to improve Al stress tolerance by following a simple pedigree method of selective breeding. [References: 32].

1476 Zhou Chunju; Zhang Songwu; Wang Changfa (Northwestern Agricultural Univ., Yangling, Shaanxi (China)) (1998) **Study on the photosynthetic character of hybrid wheat "901".** *Acta Universitatis Agriculturalis Boreali-Occidentalis (China). Xibei Nongda Xuebao (China) v. 26(5) p. 1-4.* 3 tables; 8 ref. Chinese. (AGRIS 2000-016761).

1477 Zhu Huazhong (Sichuan Academy of Agricultural Sciences, Chengdu (China). Crop Research Inst.); Xu Tingwen (1998) **Combining ability of barley grain protein percentage and it's sub-traits.** *Southwest China Journal of Agricultural Sciences (China). Xinan Nongye Xuebao (China) v. 11(1) p. 31-35.* 3 tables; 9 ref. Chinese. (AGRIS 2000-016486).

1478 Zofajova, A.; Uzik, M. (1999) **Characterization of spring barley lines F3 generation originated from hybridization of foreign varieties tolerant to low pH with local productive varieties.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 101-110.* Vyskumny Ustav Rastlinnej Vyroby. 6 tables; 7 ref. Slovak. (AGRIS 2000-022943).

In the year 1995, 6 spring barley combinations were developed from local productive varieties (Novum, Orbit, Galan) (as maternal parents) and foreign Al-tolerant varieties (Bawaria, Dzugjaj) (as paternal parents). In F2 generation in box experiments, 84 to 90 plants from each combination and parents were evaluated in natural acid soil substrate. After the evaluation of length of root system approximately half of the plants were replanted into flowerpots and grown to harvest. Offspring of plants of F2 generation as lines of F3 generation were evaluated together with the parental and control varieties in the field experiment without replication in the year 1998. In comparison to parental varieties F1 generation had higher values in most grain yield formation traits (from 3.1% at HI to 13.7% at grain weight per spike). Combinations with Bawaria variety had the highest plant height. Heritability coefficient estimated for root length of each population of F2 generation varied from 0.055 to 0.412 and this trait is probably controlled by genes with additive effects. On the base of root length, Bawaria variety was better donor of A1 tolerance than Dzugjaj variety, because combinations with Bawaria had root length 122.6 mm, while those with Dzugjaj only 113 mm. Populations of F2 and F1 generations had similar values in plant height in comparison to the parents which indicated assumptions for recombination and selection in the next generation. Prospects of selection could be estimated from average values of traits of 16 lines F3 generation, selected according to maximum yield of above-ground biomass and grain yield, which overclassed control variety Novum. The values were from 114.3 to 156.7% and from 114.0 to 142.0%, respectively. High grain and biomass yields were, though, connected with agronomically undesirable plant height and therefore selection in the next generations will be aimed at lower types.

F40 PLANT ECOLOGY

1479 Peculi, V. (Universiteti Bujqesor, Tirane (Albania)); Giovanardi, R.; Danuso, F. (1998) **[Ecological aspects of Albanian territory. Environmentparticularities and wheat production].** *Buletini i Shkencave Bujqesore (Albania) (no. 1) p. 7-14.* 1 table; 4 ill., 15 ref. Albanian. (AGRIS 2000-023333).

The climatic conditions have a great and more decisive inflience on the wheat than those agropedologic have. The agropedologic, agroclimatic and agroecological registration of the whole albanian territory that actually deals with the wheat has made. The most important and significant conclusion the study has reached is that albanian territory in reference to the wheat can be divided into two ecological regions 1. Suitable regions for wheat cultivations, where the included districts are Durres, Lushnje, Fier, Shkoder, Elbasan, Kruje, Sarande, Berat, Lezhe, Tirane, Vlore, Korce. 2. Unsuitable regions for wheat cultivation where the included districts are Librazhd, Mat, Skarapar, Tepelene, Mirdite, Gramsh, Kolonje, Tropoje, Permet, Pogradec, Diber, Puke, Kukes.

F50 PLANT STRUCTURE

1480 Kurzyp, T. (Akademia Rolnicza, Lublin (Poland). Katedra Fizyki) (1999) **Comparative evaluating of wheat (Tercja cv.) stalk mechanical properties determined by ultrasonic method and strength test.** *Problemy Inzynierii Rolniczej (Poland) (no.4) p. 33-40.* 4 fig., 5 tables; 5 ref. Polish. (AGRIS 2000-023352).

Selected mechanical parameters of wheat stalks, determined by using an ultrasonic method and the strength test, were compared and evaluated. The quantitative relationships between values obtained by different methods were described by correlation coefficients and linear regression equations.

1481 Yang Li; Fan Sanhong; Guo Aiguang (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Dept. of Basci Sciences) (1998) **Research on polymorphism of cp DNA in wheat albescent line.** *Acta Universitatis Agriculturalis Boreali-Occidentalis (China). Xobei Nongda Xuebao (China) v. 26(6) p. 14-16.* 1 tables; 30 ref. Chinese. (AGRIS 2000-017001).

1482 Zhou Zhiguo (Shandong Agricultural Univ., Taian (China)) (1999) **Study of relationship between fiber strength and meteorological factors at bolling stage under cotton-wheat double cropping system.** *Acta Gossypii Sinica (China). Mianhua Xuebao (China) v. 11(3) p. 134-140.* 3 tables; 5 ref. Chinese. (AGRIS 2000-016956).

F60 PLANT PHYSIOLOGY AND BIOCHEMISTRY

1483 Aase, JK.; Pikul, JL. (2000) **Water use in a modified summer fallow system on semiarid northern Great Plains.** *Agricultural Water Management. 43(3):345-357.* English. [USDA ARS, NW Irrigat & Soils Res Lab 3793 N 3600 E Kimberly, ID 83341 USA].

Wheat (Triticum aestivum L.) is the major crop on semiarid northern Great Plains of the USA. Attempts to introduce alternate crops have had limited success. Alternate fallow-spring wheat rotation is the most common cultural practice. Our objective was to investigate water use and water use efficiency and suitability of alternative crops in semiarid northern Great Plains agricultural environment. The study was on glacial till Williams loam (fine-loamy mixed, Typic Argiboroll) 11 km north of Culbertson, MT. Plots, replicated four times in randomized blocks, were 12 m x 15 m. Rotations were: (1) fallow, sunflower (Helianthus annus L.), barley (Hordeum vulgare L), winter wheat; (2) fallow, safflower (Carthamus tinctorious L.), barley, winter wheat; (3) fallow, buckwheat (Fagopyrum esculentum Moench.), annual legume/grain forage crop, spring wheat; (4) fallow, buckwheat, annual legume/grain forage crop, winter wheat; (5) fallow, spring wheat; (6) continuous spring wheat. Soil water to 1.8 m depth was determined near rime of seeding and of harvest by neutron attenuation. The soil reached an upper drained limit of 0.20-0.25 m(3) m(-3) water in a 1.8 m profile, equating to no more than 450 m water. Safflower and sunflower used ca. 500 mm water, more water than any of the other crops used. The greatest growing season water use efficiency was captured by the annual forage crop. Except following safflower and sunflower, soil water every spring was near the upper drained limit. Deep rooted crops can have a place in rotations on the semiarid northern Great Plains. But one must be prepared for variable yields and potential reduced yields following deep rooted crops, and for an occasional crop failure. Crop and soil management for alternative crops differ from that of small grain management, requiring some adaptation of management practices. [References: 23].

1484 Afzal, TM.; Abe, T. (2000) **Simulation of moisture changes in barley during far infrared radiation drying.** *Computers & Electronics in Agriculture. 26(2):137-145.* English. [Ehime Univ, United Grad Sch Agr Sci Tarumi 3-5-7 Matsuyama Ehime 7908566 Japan].

Thin-layer drying experiments were conducted with barley at three radiation intensities, 0.167, 0.333 and 0.500 W cm(-2); three inlet air velocities, 0.3, 0.5 and 0.7 m s(-1) two levels of initial moisture 25 and 40% d.b.; and two Levels of inlet air relative humidity, 36 and 60%. A computer controlled data logging system was used to measure loss in weight at specified time interval. A total of 72 drying runs were conducted comprised of two replications. The drying data were fitted to the modified exponential model using NLIN regression technique. The coefficients obtained were then correlated against independent variables using stepwise multiple linear regression. The proposed model gave adequate simulation of the experimental data. [References: 25].

1485 Arapi, V. (Universiteti Buujqesor, Tirane (Albania)) (1997) **[The study and valuation of variation of physical-chemical-technological indexes in some cultivars of soft wheat].** *Buletini i Shkencave Bujqesore (Albania) (no.4) p. 57-62.* 2 tables; 3 ill., 7 ref. Albanian. (AGRIS 2000-023445).

The changes of physical, chemical and technological parameters for 13 cultivars of soft wheat were recorded. It was noted the weight of 1000 seeds and the hectolitric one is of 34-54 g and 69-80, 5 g respectively. The proteinic fraction content soluble in KOH 0, 5 is 10, 75-21, 98 in relation to seed proteins. The sediment coefficient K-SDS is determined by the average value. From the complex evaluation of the quantitative content of cemical and technological parameters, the est characteristics for bred production are those of the cultivars 1, 3, 4, 8, 9, 10.

1486 Biemelt, S.; Keetman, U.; Mock, HP.; Grimm, B. (2000) **Expression and activity of isoenzymes of superoxide dismutase in wheat roots in response to hypoxia and anoxia.** *Plant, Cell & Environment. 23(2):135-144.* English. [Inst Pflanzengenet & Kulturpflanzenforsch Gatersl Corrensstr 3 D-06466 Gatersleben Germany].

We investigated the effects of hypoxia, anoxia and reaeration on enzymatic activity and expression of superoxide dismutase (SOD) isoforms in wheat roots (Triticum aestivum L.). Neither hypoxia nor subsequent re-aeration caused significant changes in SOD isoenzyme pattern compared with aerated controls. However, anoxia led to the appearance of additional activity bands of SOD in native gels resulting in an increase in total activity. Additional isoformic bands remained also apparent in the following recovery period. Re-aeration following both hypoxia and anoxia resulted in an increased content of hydrogen peroxide in roots. SOD transcript and protein levels were only slightly altered in response to hypoxia. Although SOD mRNA levels were diminished, protein content of different SOD isoforms increased with duration of anoxia. Incubation of roots with cycloheximide revealed that the additional activity bands and higher SOD protein content under anoxia were not due to de novo synthesis. Crude subcellular fractionation experiments implied that the anoxia-responsive SOD isoforms might be plastid-associated. We suggest that SOD is a very stable enzyme which, under anoxia, accumulates relative to total protein content and remains active even after protein modification under severe environmental stress conditions. [References: 49].

1487 de Faria, R.T. (Instituto Agronomico do Parana, Londrina PR (Brazil). Area de Engenharia Agricola); Madramootoo, C.A. (Macdonald Campus of McGill University, Ste. Anne de Bellevue, P.Q. (Canada). Department of Agricultural and Biosystems Engineering) (1997) **Evaluation of crop-water production functions for wheat (Triticum aestivum L.) in Brazil.** *Tropical Agriculture (Trinidad and Tobago) v. 74(1) p. 18-24.* 3 figs.; 3 tables; 20 ref. English. (AGRIS 2000-017150).

The performance of seven linear crop-water production functions was evaluated for wheat (Triticum aestivum L.) in Parana State, Brazil. Regression parameters for relationships between crop yield and water stress index were obtained by linear regression using data from field experiments conducted over three years. Three seasonal and two growth-stage functions showed significant correlations and similar performance for predicting wheat yield. Those functions were considered appropriate for use in further studies on assessments of risk of water deficit, and crop response to irrigation in the region.

1488 Ding Yi; Feng Weiguo; Ding Xiaoming (Wuhan Univ., Hubei (China). Coll. of Life Sciences) (1998) **Study on relation between the esterase isozyme zymogram and district distribution of cultivars in Hubei barley [China].** *Journal of Wuhan Botanical Research (China). Wuhan Zhiwuxue Yanjiu (China) v. 16(1) p. 5-10.* 3 tables; 3 ill., 10 ref. Chinese. (AGRIS 2000-017072).

1489 Feng Guanglong (China Agricultural Univ., Beijing (China). Coll. of Environments and Resources) (1998) **Effects of water-saving irrigation on dry matter partitioning, seed filling and water use efficiency.** *Acta Agriculturae Boreali-Sinica (China). Huabei NOngxuebao (China) v. 13(2) p. 11-17.* 2 tables; 10 ill., 10 ref. Chinese. (AGRIS 2000-017148).

1490 Kim, H.K.; Lee, S.Y. (Kangwon National University, Chunchon (Korea Republic). Department of Environmental Science, College of Natural Sciences) (1999) **Effect of barley tea on the reduction of the tap water chlorination by-products in top water and identification of maillard reaction products in the extracts of barley tea, corn tea, and Cassia tora seed tea using GC/MSD.** *The Korean Society of Agricultural Chemistry and Biotechnology v. 42(3) p. 256-261.* 1 illus.; 5 tables; 19 ref. Korean. (AGRIS 2000-023369).

1491 Kim, Y.S. (Chonbuk National University, Chonju (Korea Republic). Department of Food Science and Technology); Lee, Y.T. (Kyungwon University, Songnam (Korea Republic). Department of Food and Bioengineering); Seog, H.M. (Korea Food Research Institute) (1999) **Physicochemical properties of starches from waxy and non-waxy hull-less barleys.** *The Korean Society of Agricultural Chemistry and Biotechnology v. 42(3) p. 240-245.* 4 illus.; 4 tables; 30 ref. Korean. (AGRIS 2000-023373).

1492 Kochkina, VM. (2000) **Improved method of aspartate aminotransferase isolation and purification from leaves.** *Russian Journal of Plant Physiology. 47(1):148-150.* English. [Russian Acad Sci, VA Engelhardt Mol Biol Inst Ul Vavilova 32, GSP-1 Moscow 117984 Russia].

An improved method of aspartate aminotransferase purification from barley (Hordeum vulgare L.) leaves by fractionation with ammonium sulfate, chromatography on DE-52, and fractionation with ethanol is described. The application of this method resulted in 2100-fold purification of the enzyme protein; the yield of the enzyme achieved 16%. Enzyme specific activity increased by 343 times. From 1 kg of fresh leaves, 38 mg of aspartate aminotransferase was obtained. [References: 8].

1493 Kolesnichenko, AV.; Zykova, VV.; Grabelnych, OI.; Sumina, ON.; Pobezhimova, TP.; Voinikov, VK. (2000) **Screening of mitochondrial proteins in winter rye, winter wheat, elymus and maize with an immunochemical affinity to the stress protein 310 kD and their intramitochondrial localization in winter wheat.** *Journal of Thermal Biology. 25(3):245-249.* English. [Russian Acad Sci, Siberian Div, Siberian Inst Plant Physiol & Biochem POB 1243 Irkutsk 664033 Russia].

An investigation of mitochondrial proteins with immunochemical affinity to winter rye CSP 310 was carried out in members of the Graminacea with different tolerances to low temperature - maize, winter wheat and winter rye and the low temperature tolerant wild grass - Elymus sibiricus using PAGE-electrophoresis. Western blotting showed that among the native mitochondrial proteins of all species investigated there are proteins with immunochemical affinity to cytoplasmatic CSP 310 with molecular weights 310 kD, about 230 and about 140-110 kD. Western blotting of submitochondrial fractions showed that in outer mitochondrial membrane there are polypeptides with molecular weights 60 and 58 kD with immunochemical affinity to CSP 310 subunits. In inner mitochondrial membrane, western blotting showed polypeptides with molecular weights 66, 60, 55 and 23 kD. In mitochondrial matrix polypeptides with molecular weights 56 and 66 kD were found. (C) 2000 Elsevier Science Ltd. All rights reserved. [References: 18].

1494 Lee, Y.T.; Mok, C.K. (Kyungwon University, Sungnam (Korea Republic). Department of Food and Bioengineering) (1999) **Activities of hydrolytic enzymes in barley malts prepared under different germination conditions.** *The Korean Society of Agricultural Chemistry and Biotechnology v. 42(4) p. 324-329.* 5 illus.; 1 tables; 18 ref. Korean. (AGRIS 2000-023374).

1495 Luscher, M.; Hochstrasser, U.; Boller, T.; Wiemken, A. (2000) **Isolation of sucrose: sucrose 1-fructosyltransferase (1-SST) from barley (Hordeum vulgare).** *New Phytologist. 145(2):225-232.* English. [Univ Basel, Inst Bot Hebelstr 1 CH-4056 Basel Switzerland].

The enzyme sucrose: sucrose 1-fructosyltransferase was partially purified from barley leaf growth zones. Four steps (ammonium sulphate precipitation and polyethylene glycol precipitation, followed by chromatography on Concanavalin A-sepharose and hydroxylapatite) yielded a 35-fold purification. The resulting preparation of 1-SST which still contained a number of different activities related to fructan metabolism, was subjected to preparative isoelectric focusing, and sections of the gel were analysed individually for 1-SST and related activities, using sucrose and 1-kestose as substrates. This procedure yielded a 196-fold purification and revealed the presence of two isozymes of 1-SST with pi values of 4.93 and 4.99, as determined by analytical isoelectric focusing of the corresponding fractions. Both isozymes produced glucose and 1-kestose when incubated with sucrose. In addition, small amounts of 6-kestose and tetrasaccharides were formed. In particular, one of the two 1-SST isozymes yielded fructose when incubated with 1-kestose, indicating that it also acts as a fructan exohydrolase. The other isozyme exhibited less fructan exohydrolase activity. Nystose was also degraded by the fructan exohydrolase activity but less than 1-kestose, whereas 6-kestose was not a substrate for the enzyme. Incubation of both 1-SSTs with different concentrations of sucrose showed that the enzyme was not saturated even at 500 mM. As for the barley sucrose: fructan 6-fructosyltransferase, both isozymes of 1-SST yielded two polypeptide bands of molecular weight 50 and 22 kDa upon sodium dodecylsulphate polyacrylamide gel electrophoresis, suggesting their close relationship to invertase (composed of two subunits of similar size), as previously reported for other plants. [References: 18].

1496 Maki, Y.; Tanaka, A.; Wada, A. (2000) **Stoichiometric analysis of barley plastid ribosomal proteins.** *Plant & Cell Physiology. 41(3):289-299.* English. [Kyoto Univ, Fac Sci, Dept Bot, Sakyo Ku Kyoto 6168502 Japan].

We analyzed the protein composition of plastid 70S ribosomes isolated from the stromal fractions of barley plastids by the radical-free and highly reducing method of two dimensional polyacrylamide gel electrophoresis (RFHR 2D-PAGE). Intactness of the ribosomes was confirmed by the poly(U)-directed phenylalanine polymerization activity and by the reassociation capacity of the subunits into 70S ribosomes. The small and large ribosomal subunits were composed of 23 and 36 proteins, respectively. In addition, one acidic protein associated with ribosomes in low salt buffer but released in high salt buffer was found. The plastid ribosomes contained relatively larger

numbers of acidic proteins than prokaryotic ribosomes. Stoichiometric analysis revealed the presence of several ribosomal proteins in low copy numbers, indicating that the ribosomes of plastids were heterogeneous. We also investigated the protein composition of plastid ribosomes from greening barley leaves and found that it did not change during greening. [References: 46].

1497 Nedomova, L.; Martinek, P. (Zemedelsky Vyzkumny Ustav, Kromeriz (Czech Republic)); Bednar, J.; Budikova, M. (1999) **Evaluation of the size distribution of starch granules in selected wheat and triticale genotypes.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 317-321.* Mendelova Zemedelska a Lesnicka Univ. 1 graph, 1 ill., 3 tables; 16 ref. English. (AGRIS 2000-017152).

1498 Rukshan, L.V.; Danilova, L.N.; Malinovski, A.A. (Mogilev Technological Inst., Mogilev (Belarus)) (1999) **[Technological properties of barley grown in Belarus].** Academy of Agricultural Sciences of the Republic Of Belarus, Belarus. *Vestsi Akadehmii Agrarnykh Navuk Rehspubliki Belarus (Belarus) (no. 1) p.81-84.* 3 tables. Russian. (AGRIS 2000-023372).

Technological property of barley grown in several locations Mogilev region of Belarus was explored from the results of the research 1992-1996. Estimation of quality of barley was defined for standard physics-chemical indicess of grain, flour and bread. The attempt application doing of new indices just vitreousness, falling number, hardness and amylaze activity. The granulation of flour was defined. The terms "hard" and "soft" applied to wheats are known for ages. It was related that when ground or milled soft barley fractures into significantly smaller particles than hard barley which is reflected in the greater "break flour yield" upon milling. The grain quality of barley variability greatly depends on the conditions of planting. As a result grain and flour technological properties are improved when selection crops rational gives the best results. The judgement of region growing is strengthen on influence of all factors in flour extraction, milling and breading properties. This study illustrate that network technology holds great promice for the food, agricultural and biological industry.

1499 Rumbo, M.; Chirdo, FG.; Fossati, CA.; Anon, MC. (2000) **Analysis of anti-prolamin monoclonal antibody reactivity using prolamin fractions purified by preparative electrophoresis.** *Food & Agricultural Immunology. 12(1):41-52.* English. [UNLP, CONICET, CIDCA Calle 47 & 116 RA-1900 La Plata Argentina].

Coeliac disease (CD) is a gastrointestinal affliction triggered by the ingestion of prolamins from wheat, barley, rye and possibly oats. The only treatment for CD is a strict diet, free of the toxic components. Immunochemical methods are usually applied to certify foods aimed at coeliac patients. The characterization of a panel of four anti-prolamin monoclonal antibodies (MAbs) to be used to certify gluten-free products is described here. To this aim, purified gliadin, secalin and hordein fractions were obtained by preparative electrophoresis at acid pH. This procedure provides purified fractions not exposed to denaturing conditions. The specificity of the MAbs was tested by ELISA against purified fractions and ethanol extracts of wheat, barley, rye, oats, rice, maize, buckwheat, sorghum and soy. The four MAbs recognized only coeliac-toxic cereals. Each MAb reacted strongly wit gliadins and showed differential reactivity against the different prolamin purified fractions. Some MAbs showed a broad pattern of recognition whereas others presented a more restricted one. The reactivity observed corresponded to structural homologies among gliadin, secalin and hordein fractions. It is remarkable that some fractions obtained by electrophoresis in the presence of sodium dodecylsulphate were not recognized by some MAbs, whereas the same components obtained by preparative A-PAGE showed high reactivity. This reinforces the suitability of the purification method employed in this study to isolate prolamin fractions. Using these purified prolamins, characterization of anti-prolamin MAb reactivity was achieved. [References: 29].

1500 Sue, M.; Ishihara, A.; Iwamura, H. (2000) **Purification and characterization of a hydroxamic acid glucoside beta-glucosidase from wheat (Triticum aestivum L.) seedlings.** *Planta. 210(3):432-438.* English. [Kyoto Univ, Div Appl Life Sci, Grad Sch Agr Kyoto 6068502 Japan].

A beta-glucosidase (EC 3.2.1.21) with a high affinity for cyclic hydroxamic acid beta-D-glucosides was purified from 48-h-old wheat (Triticum aestivum L.) seedlings. The activity occurred transiently at a high level during the non-autotrophic stage of growth, and the nature of the transient occurrence was correlated with that of 2, 4-dihydroxy-7-methoxy-1, 4-benzoxazin-3-one glucoside (DIMBOA-Glc). The glucosidase had maximum activity at an acidic pH (pH 5.5) and the purified enzyme showed a high affinity for DIMBOA-Glc, V-max and K-m being 4100 nkat/mg protein and 0.27 mM, respectively. It also hydrolyzed p-nitrophenol beta-glycosides, as well as flavone and isoflavone glucosides, but to a lesser extent. The results indicated that the primary natural substrate for the glucosidase is DIMBOA-Glc and that the enzyme is involved in defense against pathogens and herbivores in non-autotrophic wheat. The glucosidase was found to be present as oligomeric forms with a molecular mass of 260-300 kDa comprising 60- and 58-kDa monomers. The N-terminal 12-amino-acid sequences of the two monomers were identical (Gly-Thr-Pro-(Ser?)-Lys-Pro-Ala-Glu-ProGly-Pro), and showed no similarity to those of other plant glucosidases. Polyacrylamide gel electrophoresis under nondenaturing condition indicated the existence of at least eight isozymes. Three cultivars of Triticum aestivum had the same zone of glucosidase activity on zymograms, but the activity zones of the Triticum species, T. aestivum L., T. spelta L. and T. turgidum? L. had different mobilities. [References: 31].

1501 Tao Zongya (Sichuan Normal Univ., Chnegdu (China). Dept. of Biology); Zou Qi (1999) **Regulating effect of salicylic acid on the metabolism of active oxygen species and its relation to ethylene biosynthesis in wheat leaves.** *Southwest China Journal of Agricultural Sciences (China). Xinan Nongye Xuebao (China) v. 12(1) p. 39-44.* 5 ill.; 29 ref. Chinese. (AGRIS 2000-017151).

1502 Tomos, D. (2000) **The plant cell pressure probe [Review].** *Biotechnology Letters. 22(6):437-442.* English. [Univ Wales, Sch Biol Sci Bangor LL57 2UW Gwynedd Wales].

The pressure probe is a micro manometer for the simultaneous direct recording and manipulation of plant cell hydrostatic pressure. It is used to map in space and time the turgor pressures of individual cells within tissues and organs of intact plants. This is used to study the hydraulic architecture of tissues, tissue movement and the responses of tissues to water stress. The approach can be augmented by simultaneous measurement of individual cell osmotic pressure. This permits the hydraulic driving forces across selectively permeable membranes and walls to be assessed fully. By manipulating manually the pressure, cell wall elasticity and its properties can also be mapped. Under some conditions this can be extended to plastic behaviour. [References: 27].

1503 Turnbull, KM.; Gaborit, T.; Marion, D.; Rahman, S. (2000) **Variation in puroindoline polypeptides in Australian wheat cultivars in relation to grain hardness.** *Australian Journal of Plant Physiology. 27(2):153-158.* English. [CSIRO POB 1600 Canberra ACT 2601 Australia].

The sequence of the puroindoline-b gene from 15 Australian wheat cultivars was determined. Sequence variation was observed in the WPTKWWKGGCE motif of the deduced puroindoline-b protein sequence. Previously, it has been suggested that this sequence is crucial in determining grain hardness. In this study, no correlation was found between the variation in this sequence and the hardness or softness of the cultivar. The amounts of puroindoline-a and puroindoline-b protein in a selection of hard and soft Australian wheat cultivars were also determined using ELISA techniques. Both soft and hard cultivars had variable amounts of puroindoline-a and puroindoline-b. In particular, it is notable that the hard cultivars Cook and Diaz contained high amounts of puroindoline-a and puroindoline-b and also contained the puroindoline-b sequence previously reported to be associated with grain softness. These results

suggest that if the puroindoline proteins are involved in determining grain softness or hardness they do so as part of a multi-component mechanism. [References: 22].

1504 Weschke, W.; Panitz, R.; Sauer, N.; Wang, Q.; Neubohn, B.; Weber, H.; Wobus, U. (2000) **Sucrose transport into barley seeds: molecular characterization of two transporters and implications for seed development and starch accumulation.** *Plant Journal. 21(5):455-467.* English. [Inst Pflanzengenet & Kulturpflanzenforsch D-06466 Gatersleben Germany].

In order to understand sucrose transport in developing seeds of cereals at the molecular level, we cloned from a caryopses library two cDNAs encoding sucrose transporters, designated HvSUT1. and HvSUT2. Sucrose uptake activity was confirmed by heterologous expression in yeast. Both transporter genes are expressed in maternal as well as filial tissues. In a series of in situ hybridizations we analysed the cell type-specific expression in developing seeds. HvSUT1 is preferentially expressed in caryopses in the cells of the nucellar projection and the endospermal transfer layer, which represent the sites of sucrose exchange between the maternal and the filial generation and are characterized by transfer cell formation. HvSUT2 is expressed in all sink and source tissues analysed and may have a general housekeeping role. The rapid induction of HvSUT1 gene expression in caryopses at approximately 5-6 days after fertilization coincides with increasing levels of sucrose as well as sucrose synthase mRNA and activity, and occurs immediately before the onset of rapid starch accumulation within the endosperm. Starch biosynthesis requires sucrose to be imported into the endosperm, as direct precursor for starch synthesis and to promote storage-associated processes. We discuss the possible role of HvSUT1 as a control element for the endospermal sucrose concentration. [References: 41].

1505 Zhang Ailiang (Shanxi Agricultural Univ., Taigu (China)) (1998) **Effects of different soil water content on physiological characters of the flag leaf of winter wheat.** *Journal of Shanxi Agricultural University (China). Shanxi Nongye Daxue Xuebao (China) v. 18(3) p. 200-202.* 1 table; 3 ill., 5 ref. Chinese. (AGRIS 2000-017147).

1506 Ziegler, T.; Richter, IG. (2000) **Analysing deep-bed drying based on enthalpy-water content diagrams for air and grain.** *Computers & Electronics in Agriculture. 26(2):105-122.* English. [Inst Agr Engn ATB, Dept Post Harvest Technol Max Eyth Allee 100 D-14469 Potsdam Germany].

The enthalpy-water content diagram for moist wheat was combined with the enthalpy-water content diagram for humid air for the case of deep-bed drying at constant inlet air conditions. Referring to the mean moisture content of the grain, the driving forces of mass transfer within the drying zone were computed directly and definitely from the combined diagram and then related to the measured time course of temperature respectively to the drying rate of the grain. The method led to a thin-layer equation for wheat basing exactly on the thermodynamic relationships between the air and the grain that appear in the drying zone at certain drying conditions. The thin-layer equation was integrated into a mathematical model developed to analyse solar assisted drying of hygroscopic bulk materials and short-time storage of low-temperature heat. The deep-bed drying model was validated for wheat with a good agreement between experimental and simulation results including varying inlet air conditions. [References: 16].

F61 PLANT PHYSIOLOGY-NUTRITION

1507 Box, S.; Schachtman, DP. (2000) **The effect of low concentrations of sodium on potassium uptake and growth of wheat.** *Australian Journal of Plant Physiology. 27(2):175-182.* English. [CSIRO, Hort Unit POB 350 Glen Osmond SA 5064 Australia].

Sodium is a beneficial mineral for some plant species when external concentrations are low. The role of Na+ in energising K+ acquisition in terrestrial plants has recently been suggested because of evidence demonstrating that wheat root cells express a high-affinity Na+-energised K+ symporter. To determine whether low concentrations of Na+ improve the K+ nutrition and growth of wheat, long-term growth and short-term tracer flux experiments were conducted. Long-term growth experiments were conducted over a range of K+ concentrations, at acidic and alkaline pH, with and without 500 mu M NaCl. Plant biomass and tissue Na+ and K+ content was measured. Short-term experiments were conducted using tracers to determine whether low concentrations of Na+ or K+ stimulate Rb+ or Na+ uptake, respectively. Sodium stimulated the growth of wheat only at low (20 mu M) external K+ in one of the long-term experiments, but not in two other experiments. Na+ did not stimulate Rb+ uptake, but K+ stimulated Na+ uptake in short-term tracer flux experiments. The results suggest that low concentrations of Na+ do not increase K+ uptake to a large extent, and only when light levels are low does Na+ have a beneficial effect on the growth of wheat. [References: 33].

1508 Cernohorska, J.; Natr, L.; Zvara, K. (Karlova Univ., Prague (Czech Republic)); Holubec, V. (1999) **Growth characteristics of Triticum and Aegilops seedlings as influenced by nitrogen and irradiance.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 197-199.* Mendelova Zemedelska a Lesnicka Univ. 4 ref. English. (AGRIS 2000-017171).

1509 Choudhury, BJ. (2000) **A sensitivity analysis of the radiation use efficiency for gross photosynthesis and net carbon accumulation by wheat.** *Agricultural & Forest Meteorology. 101(2-3):217-234.* English. [NASA, Goddard Space Flight Ctr, Lab Hydrospher Proc, Hydrol Sci Branch Greenbelt, MD 20771 USA].

Radiation use efficiency (RUE) provides a useful diagnostic approach for estimating carbon accumulation by terrestrial plant communities. A model for instantaneous gross photosynthesis by a canopy, considering sunlit and shaded leaves, variation of maximum rate of leaf photosynthesis within the canopy and a solution of the radiative transfer equation for propagation of direct and diffuse photosynthetically active radiation within the canopy, is numerically integrated in space (angular variation of radiances and depth within the canopy) and time (diurnal variation) to obtain daily total gross photosynthesis. Then, to obtain net carbon accumulation, growth and maintenance respiration at a prescribed temperature are calculated from nitrogen content of foliage, stem and root using field measurements for 27 canopies representing two cultivars of winter wheat and average data for five cultivars of spring wheat. The leaf area index (L-0) of these canopies varies between 0.5 and 5.2. The results show that for any given irradiance, the coefficient of variation of RUE for gross photosynthesis and net carbon accumulation due to changes in Lo is generally less than 10%. Strongly linear relationships are found between the RUE and diffuse fraction of the incident radiation, with slope varying with Lo. Temperature appears as an important factor determining RUE under predominantly cloudy conditions. The calculated RUE values are compared with observations. [References: 64].

1510 Cochrane, MP.; Paterson, L.; Gould, E. (2000) **Changes in chalazal cell walls and in the peroxidase enzymes of the crease region during grain development in barley.** *Journal of Experimental Botany. 51(344):507-520.* English. [19 Blackford Hill Rise Edinburgh EH9 3HB Midlothian Scotland].

In an investigation of the role of peroxidase enzymes in the differentiation of the tissues of the crease region of barley, plants of winter barley cv, Halcyon were grown from anthesis onwards in controlled conditions at a constant temperature of 16 degrees C, Four ears were harvested at 2-d intervals from 6 d after anthesis (daa) until 50 daa, Grains from mid-ear were used for (i) fresh and dry weight determinations, (ii) extraction of crease tissue for the determination of peroxidase activity and for the separation of isozymes of peroxidase by isoelectric focusing (IEF) and (iii) detection of lignin and suberin in the tissues of the crease using autofluorescence and cytochemistry, Peroxidase activity was located histochemically in the crease tissue of cv. Chariot. Scanning electron microscopy studies were carried out on developing grains of cv, Blenheim, Maximum grain water content was

achieved at 14 daa, Lignin and suberin were detected in the walls of the chalazal cells from 18 daa onwards. No changes in the staining of chalazal cell walls were detected at the end of grain filling (32 daa), but loss of autofluorescence and staining were observed at 42 daa, just prior to the final, rapid phase of grain dehydration. Peroxidase activity per fresh weight of crease tissue was high at 6 daa and low at 22 daa, It was also low between 32 and 40 daa, but it rose again from 42 daa onwards. IEF demonstrated that both anionic and cationic isozymes of peroxidase were present in crease tissue, the pattern of bands showing some marked changes during the course of grain development. [References: 35].

1511 Didonet, AD.; Lima, OD.; Candaten, AA.; Rodrigues, O. (2000) **Reallocation of nitrogen and biomass to the seeds in wheat inoculated with Azospirillum bacteria.** *Pesquisa Agropecuaria Brasileira. 35(2):401-411.* Portuguese. [EMBRAPA, CNPT Caixa Postal 451 BR-99001970 Passo Fundo RS Brazil].

The effect of inoculating wheat (Triticum aestivum L.) seeds, cultivar Embrapa 16, with powder peat inoculant containing Azospirillum bacteria on yield and remobilization of nitrogen and biomass was studied under field conditions. The strain of Azospirillum brasilense 245 and the isolate 10 of Azospirillum lipoferum were used as inoculants. Different rates of nitrogen were applied at varying stages of plant growth for each inoculated and non-inoculated treatment, distributed in blocks at random with split plots. The accumulation of dry matter and total nitrogen in plant parts was evaluated at anthesis and physiological maturity stages. Harvest index for biomass and N, main yield components, and total N content in the seeds, in addition to yield, were also evaluated at harvest. The preliminary results showed that, even without inoculation effect on yield, there was a better allocation of nitrogen and biomass to the seeds, resulting in heavier seeds, with a lower amount of nitrogen remaining in the straw at physiological maturity. Such effects resulted from a lower number of spikes m(-2), probably due to the death of tillers, determining a greater availability of N and biomass to the remaining spikes and seeds. [References: 39].

1512 Gutierrez-Rodriguez, M.; Reynolds, MP.; Larque-Saavedra, A. (2000) **Photosynthesis of wheat in a warm, irrigated environment - II. Traits associated with genetic gains in yield.** *Field Crops Research. 66(1):51-62.* English. [CIMMYT Apartado 370, POB 60326 Houston, TX 77205 USA].

Net photosynthetic rate (A(n)), stomatal conductance (g(s)), intercellular CO2 concentration (C-i), and chlorophyll concentration estimate ([Chl]) were measured on flag leaves of 30 random individual F-5 plants within each of eight F-2-derived bulks, from a cross between two spring wheat (Triticum aestivum L.) cultivars, Seri-M82, and Siete Cerros-T66 contrasting in A(n), and realized grain yield. Measurements were made on fully irradiated leaves of field plots growing in a warm, low relative humidity, irrigated environment. Average A(n) of F-2-derived families measured during grain filling ranged from 19.1 to 24.4 mu mol m(-2) s(-1) among families, with standard errors ranging from 0.35 to 0.53. Based on measurements of A(n) of flag leaf lamina of individual plants, measured several times during grain filling, four plants from each of four bulks were selected for high and low A(n) to represent the range of genetic diversity within and among F-2:5 families. From each of these 16 selected F-5 plants, head rows were grown to generate inbred F-5:7 lines for replicated yield trials, which were sown in two environments in the same locality, differing by five weeks in sowing date, and having mean grain yields of approximately 3.5 t ha(-1). Mean A(n) measured on randomly selected flag leaves of the inbred lines ranged from 16.3 to 24.6 mu mol m(-2) s(-1) over both sowing dates. A(n), g(s), and C-i all correlated with yield of inbred lines. Furthermore, A(n) and g(s) measured on individual F-5 plants correlated genetically and phenotypically with A(n), g(s), and yield of the inbred lines deriving from the same plants, in both environments where yield was evaluated. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 18].

1513 Haberle, J.; Svoboda, P.; Krejcova, J. (Vyzkumny Ustav Rostlinne Vyroby, Prague Ruzyne (Czech Republic)) (1999) **Utilization of water and nitrogen from deep subsoil by winter wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 204-205.* Mendelova Zemedelska a Lesnicka Univ. 3 graphs; 1 ref. Czech. (AGRIS 2000-017260).

1514 Jiang Qingzhen (Hebei Agricultural Univ., Baoding (China). Coll. of Agronomy) (1999) **Preliminary study on the simulation model of effect of water on biomass production of winter wheat.** *Journal of Agricultural University of Hebei (China). Hebei Nongye Daxue Xuebao (China) v. 22(2) p. 27-31.* 2 tables; 1 ill., 13 ref. Chinese. (AGRIS 2000-017256).

1515 Lasserre, F.; Vong, PC.; Guckert, A. (2000) **Fate of nitrogen and sulphur as affected by the rhizosphere of oilseed rape and barley.** *Communications in Soil Science & Plant Analysis. 31(1-2):173-185.* English. [INRA, ENSAIA, Lab Agron & Environm F-54505 Vandoeuvre Nancy France].

Within plants, sulphur (S), and nitrogen (N) equilibrium is a requisite for their normal development. Pot experiments with oilseed rape and barley fertilized at different N to S ratios were carried out under glasshouse conditions by using the "rhizobag" technique. The objective was to compare the induced-influence of rhizosphere and non-rhizosphere soil on N and S nutrition of the studied plants. Thus, SO42-S, NO3–N and NH4+-N concentrations, and total N and S taken up by the plants were examined. Barley increased the pH of rhizosphere soil whereas no real change of pH was observed with oilseed rape. Both plants took up all the NO3- present in the soil solution, but rapeseed took up greater quantities of NH4+-N and SO42–S than barley. Moreover, the ratio values of N to S of the aerial parts of the rapeseed were significantly and positively correlated to those of soil available-N to -S ratios while this correlation was significant but negative with barley. This indicated a clearcut different influence between the two rhizospheres which oppositely induce the N and S nutrition of the two plant species. [References: 30].

1516 Leah, N. (1999) **[The optimization of winter wheat nutrition with nitrogen for receiving of supposed yields in the conditions of irrigation].** Problems of agrochemistry in contemporary agriculture. Kishinev (Republic of Moldova). 19-20 Aug 1999. *[Problems of agrochemistry in contemporary agriculture]. Institute of Pedology, Agrochemistry and Soil Amelioration, Kishinev (Republic of Moldova) p. 60-61.* Institute of Pedology, Agrochemistry and Soil Amelioration. Romanian. (AGRIS 2000-017240).

1517 Ouerghi, Z.; Cornic, G.; Roudani, M.; Ayadi, A.; Brulfert, J. (2000) **Effect of NaCl on photosynthesis of two wheat species (Triticum durum and T-aestivum) differing in their sensitivity to salt stress.** *Journal of Plant Physiology. 156(3):335-340.* English. [Univ Paris Sud, Inst Biotechnol Plantes Bat 630 F-91405 Orsay France].

Two wheat species, Triticum aestivum, cv. Tanit and T. durum, cv. Ben Bachir, were cultivated hydroponically and subjected to salt stress (50 or 100 mmol/L NaCl) up to 21 days. NaCl treatment resulted in growth reduction for both varieties (but less for Ben Bachir than for Tanit), equivalent Na+ and Cl- absorption by the whole plants, and the capacity for Ben Bachir to transport ions into the leaves where they accumulated. This accumulation process accounts for the maintainance of the water status in Ben Bachir leaves. As a whole, Ben Bachir shows characteristics of a NaCl-tolerant species. Net CO2 uptake by the non-tolerant Tanit variety was markedly reduced at PPFD higher than 500 mu mol m(-2) s(-1), mostly because of stomatal closure, as shown by the decrease in the C-i/C-a ratio, the effect of saturating CO2 concentrations (5%) and the increase in the delta(13)C in the salt-treated leaf tissues. No effect of salt stress could be found either on the initial slopes of the net CO2 assimilation curve, on the F-v/F-m ratio of chlorophyll fluorescence, or on the carboxylative capacities in the leaves. As a whole, these results favour the hypothesis of an exclusive effect of salt stress on the stomatal behaviour of the treated leaves. [References: 27].

1518 Pogrebneac, A.; Vacarciuc, V. (1999) **[The biological nitrogen and winter wheat crop yield].** Problems of agrochemistry in

contemporary agriculture. Kishinev (Republic of Moldova). 19-20 1999. *[Problems of agrochemistry in contemporary agriculture]. Research Institute of Agriculture, Kishinev (Republic of Moldova) p. 96-97.* Institute of Pedology, Agrochemistry and Soil Amelioration. Russian. (AGRIS 2000-017247).

1519 Reynolds, MP.; Delgado, MI.; Gutierrez-Rodriguez, M.; Larque-Saavedra, A. (2000) **Photosynthesis of wheat in a warm, irrigated environment - I: Genetic diversity and crop productivity.** *Field Crops Research. 66(1):37-50.* English. [CIMMYT Apartado 370, POB 60326 Houston, TX 77205 USA].

Net photosynthetic rate (A(n)), stomatal conductance (g(s)), chlorophyll content and dark respiration rate were measured on 16 wheat cultivars (Triticum aestivum L.), grown in replicated yield trials in a warm, irrigated, and low relative humidity environment in central Mexico. Measurements were made on flag leaves in full sunlight at three different stages of plant development (booting, anthesis, and grain filling), and at different times of the day. Two experiments were conducted with sowing dates in December 1991 and March 1992, whose average daily temperature for their respective growing cycles were 21 and 25 degrees C. Physiological measurements were compared with agronomic performance on the same field plots. A(n) was fairly stable during the day between 10:00 and 14:00 h, and across experiments, despite differences in leaf temperature of up to 4 degrees C. A(n) fell noticeably at successively later stages of plant development, however, and there were clear differences among cultivars. With both sowing dates, A(n) and g(s) measured at all three stages of development correlated significantly with yield and biomass of the cultivars. A(n) during the grain filling period was also strongly associated with chlorophyll loss. The data indicate that differences in A(n) throughout the crop cycle as well as variation in the onset of senescence may be important variables affecting wheat yield potential in warm environments. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 39].

1520 Richardson, AE.; Hadobas, PA.; Hayes, JE. (2000) **Acid phosphomonoesterase and phytase activities of wheat (Triticum aestivum L.) roots and utilization of organic phosphorus substrates by seedlings grown in sterile culture.** *Plant, Cell & Environment. 23(4):397-405.* English. [CSIRO GPO Box 1600 Canberra ACT 2601 Australia].

Wheat seedlings exhibited a differential ability to utilize P from a range of organic P substrates when grown in agar culture under sterile conditions. Plants showed limited ability to obtain P from inositol hexaphosphate (IHP), whereas other monoester substrates such as glucose 1-phosphate (G1P), were equivalent sources of P for plant growth as compared with inorganic phosphate (P-i). Poor utilization of IHP was exemplified by significantly lower rates of dry matter accumulation and reduced P content of tissues, which were generally not significantly different to control plants that were grown in the absence of added P. The inability of wheat seedlings to obtain P from IHP was not associated with poor substrate availability but was due to either insufficient root phytase activity or inappropriate localization of phytase within root tissues. Phytase activities of 4 and 24 mU g(-1) root fresh weight (FW) were determined for crude root extracts prepared from plants that were grown with either adequate P or under deficient conditions, respectively. Similar levels of phytase activity (approximately 12 mU g(-1) FW) were observed in assays using intact roots, although no secreted activity was detected. By comparison, a secreted acid phosphomonoesterase activity was observed, and activities of between 466 and 1029 mU phosphomonoesterase g(-1) root FW were measured for intact roots. On the basis of the differences in enzyme activity, and the observed differences in the ability of wheat seedlings to utilize G1P and IHP, it is evident that low intrinsic levels of phytase activity in wheat roots is a critical factor that limits the ability of wheat to obtain P from phytate when supplied in agar under non-limiting conditions. This hypothesis was further supported by the observation that the ability of wheat to obtain P from IHP was significantly improved when the seedlings were inoculated with a soil bacterium (Pseudomonas sp. strain CCAR59) that possesses phytase activity. [References: 32].

1521 Rosiak-Figielek, B.; Jackowski, G. (2000) **The disappearance kinetics of Lhcb polypeptides during dark-induced senescence of leaves.** *Australian Journal of Plant Physiology. 27(3):245-251.* English. [Adam Mickiewicz Univ, Dept Plant Physiol Al Niepodleglosci 14 PL-61713 Poznan Poland].

A set of polyclonal antibodies in conjunction with immunoblot technique and integrating densitometry has been used to positively identify and quantify Lhcb 1-6 polypeptides in barley (Hordeum vulgare L.) leaves in which senescence processes were induced by detachment and dark incubation for 0-6 d. A considerable heterogeneity with regard to disappearance kinetics on a chlorophyll basis during the course of senescence has been found among individual Lhcbs. Lhcb 2/1 (the heavier of two polypeptides representing barley Lhcb2) and Lhcb3 exhibited the most rapid disappearance kinetics and decreased to 20 and 42% of their initial levels, respectively, after 6 d of dark incubation. Lhcb 1, 4 and 6 levels were maintained through the senescence, at a level very similar to that of fresh leaves, while Lhcb 2/2 (the lighter of two polypeptides representing barley Lhcb 2) and Lhcb 5 were the most stable of all Lhcbs - their relative abundance increased after 6 d of dark incubation of the leaves to 181 and 120%, respectively, of the value detected in fresh leaves. [References: 40].

1522 Savitch, LV.; Massacci, A.; Gray, GR.; Huner, NPA. (2000) **Acclimation to low temperature or high light mitigates sensitivity to photoinhibition: roles of the Calvin cycle and the Mehler reaction.** *Australian Journal of Plant Physiology. 27(3):253-264.* English. [Univ Western Ontario, Dept Plant Sci London ON N6A 5B7 Canada].

Winter wheat (Triticum aestivum L cv. Monopol) plants grown under either control (20 degrees C, 250 PFD), low temperature (5 degrees C, 250 PFD) or high light conditions (20 degrees C, 800 PFD) were compared in order to assess the roles of the Calvin cycle and the Mehler reaction in the differential sensitivity to chronic photoinhibition. Despite similar photosynthetic responses to irradiance, the partial pressure of CO2 [p(CO2)] and photoinhibition, photosynthetic acclimation to cold temperature appears to be quite distinct from acclimation to high light. First, the lower ratio of Rubisco oxygenation/Rubisco carboxylation and the reduced effects of p(CO2) on number of electrons per mole of CO2 fixed in cold-acclimated compared to high light-grown wheat indicate that photorespiration is differentially suppressed in cold-acclimated Monopol. Second, inhibition of the Calvin cycle by glyceraldehyde during photoinhibition indicated that the sensitivity of high light-acclimated Monopol to photoinhibition was more dependent on Rubisco activity than the sensitivity of cold-acclimated plants to photoinhibition. Third, cold-acclimated Monopol exhibited higher electron transport rates in the presence of either ambient CO2, 2 kPa O-2 or N-2, 2 kPa O-2 (either 77% or 68%, respectively) relative to controls compared to high light-acclimated plants exposed to similar gaseous environments (either 57% or 38%, respectively). Last, the activation state of NADP-malate dehydrogenase indicated that the stroma is highly reduced during cold acclimation relative to either controls or high light-grown Monopol. Thus, in cold-acclimated wheat, the Mehler reaction appears to play an important role while photorespiration plays a minimal role in mitigating the sensitivity to photoinhibition. In contrast, both photorespiration and the Mehler reaction appear to mitigate the sensitivity to photoinhibition in high light-grown Monopol. This is consistent with the differential sensitivity to methylviologen and the differential SOD activity observed between cold-acclimated and high light-grown Monopol. [References: 67].

1523 Schweiger, PF.; Jakobsen, I. (1999) **Direct measurement of arbuscular mycorrhizal phosphorus uptake into field-grown winter wheat.** *Agronomy Journal. 91(6):998-1002.* English. [Riso Natl Lab, Plant Biol & Biogeochem Dep DK-4000 Roskilde Denmark].

The aim of the study was to measure hyphal P uptake by native arbuscular mycorrhizal fungi using a test system designed for field conditions. Phosphorus uptake by external hyphae of a native arbuscular mycorrhizal (AM) fungal community was studied in the winter wheat (Triticum aestivum L, ev. Stava) crop of an organic cropping rotation. Mesh containers containing a soil of volume accessible only to external hyphae were buried in the ground. The soil

inside these hyphal compartments (HCs) was labeled with P-32 to distinguish P taken up from inside the HCs from overall P uptake. As an additional control treatment, half of the HCs received the fungicide carbendazim [methyl benzimidazol 2-y carbamate] at a rate known to disrupt AM hyphal P uptake. Wheat tillers were harvested throughout the experimental period to monitor the time course of hyphal P uptake. final harvest was at plant maturity, at which time the HCs a ere excavated and the soil inside was analyzed for hyphal length, NaHCO3-extractable P and specific activity of the extracted P. External hyphae of the native AM fungi grew into the HCs without added carbendazim and took up substantial amounts of P. Addition of carbendazim at a rate known to inhibit hyphal P uptake resulted in no P uptake from inside those HCs. This is due to the design of the HCs used in this study, which successfully prevented P uptake by plant roots and root hairs from inside the HCs. The HCs are therefore well suited for field measurements of plant P uptake, ia external hyphae of the native MI fungi. Estimates for length-specific hyphal P uptake per unit time (37.8 +/- 5.2 fmol P m(-1) s(-1)) were similar to published estimates obtained in growth chamber studies with cultured isolates of AM fungi (1-430 fmol P m(-1) s(-1)). The results of this study demonstrate the considerable contribution of native Mi fungi to overall P uptake of field-grown winter wheat, even at typical field soil fertility levels (28 mu g NaHCO3-extractable P g(-1) soil). [References: 40].

1524 Shabala, S.; Newman, I.; Wilson, S.; Clark, R. (2000) **Nutrient uptake patterns over the surface of germinating wheat seeds.** *Australian Journal of Plant Physiology. 27(2):89-97.* English. [Univ Tasmania, Sch Agr Sci GPO Box 252-54 Hobart Tas 7001 Australia].

K+, Ca2+ and H+ flux profiles were studied around the surface of germinating wheat (Triticum aestivum L. cv. Machete) seeds using a non-invasive microelectrode technique. The seed surface was scanned every 500 mu m along the longitudinal axis, and net ion fluxes were measured 2 min and 1, 4 and 24 h after seed rehydration commenced. Functionally different seed zones exhibited different ion exchange patterns, which also changed differently with time. One h after seed rehydration, the peak of H+ extrusion was observed in the embryo-scutellum region. By 24 h this peak had shifted towards the region of radicle emergence, and its magnitude had increased 5-fold. By contrast, H+ activity in the endosperm region decreased noticeably during this period. At the same time, Ca2+ flux shifted from initial net influx to efflux in the embryo and scutellum zones. Most striking were K+ flux profiles, with large K+ efflux observed at each end and almost zero flux near the geometrical center of the seed. Significant K+ extrusion from the embryo end was observed for as long as 24 h after seed rehydration and was not related to the loss of membrane integrity. Seed treatment with metabolic inhibitors (vanadate and tetraethylammonium) caused significant changes in both H+ and K+ fluxes suggesting that at least part of the measured fluxes originated from activities of plasma membrane transporters. We discuss possible mechanisms responsible for the observed regularities and question whether the seed coat in wheat caryopses is as ion-impermeable as previously believed. [References: 34].

1525 Shangguan, ZP.; Shao, MG.; Dyckmans, J. (2000) **Effects of nitrogen nutrition and water deficit on net photosynthetic rate and chlorophyll fluorescence in winter wheat.** *Journal of Plant Physiology. 156(1):46-51.* English. [Chinese Acad Sci, Inst Soil & Water Conservat, Natl Lab Soil Eros & Dryland Farming Yangling 712100 Shaanxi Peoples R China].

The responses of photosynthetic gas exchange and Chl fluorescence to nitrogen nutrition were studied under well-watered and drought conditions in winter wheat leaves. Nitrogen deficiency and water deficit strongly reduced the photosynthetic activity at light saturation level. For the well-watered treatment, the net photosynthetic rate was stimulated in the high-N (15 mmol/L N) plants as compared with the low-N (1.5 mmol/L N) plants and leaf conductance for water vapour was lower in the high-N than in the low-N treatment. As drought progressed, the net photosynthetic rate was significantly inhibited in the high-N plants as compared with the low-N plants. However, no significant nitrogen effect was noticed for net photosynthetic rate and leaf conductance for water vapour. The quantum yield of photochemical efficiency of PS II (Fv/Fm) determined on the youngest fully expanded leaf was unaffected by water stress, but it was lower for the low-N than for the high-N treatment. Nitrogen deficiency resulted in a decrease in the total Chi content and an inaease in the Chi nib ratio; however, no difference was observed between the water treatments. During steady-scare photosynthesis, the values of photochemical quenching decreased with increasing water stress in all treatments. For plants grown at low nitrogen nutrition photochemical quenching was higher than that for plants receiving high-N nutrition. The values of non-photochemical quenching decreased with increasing water stress in all treatments. Nitrogen deficiency and water stress decreased the efficiency of the PS II (Fv/Fo) and the efficiency of potential photosynthetic quantum conversion (Fd/Fs) of leaves significantly. [References: 32].

1526 Tian Qizhuo; He Mingrong (Shandong Agricultural Univ., Taian (China). Dept. of Agronomy) (1998) **Study on uptake, accumulation and distribution of calcium and magnesium in high yield winter wheat.** *Acta Agriculturae Universitatis Henanensis (China). Henan Nongda Xuebao (China) v. 32(2) p. 138-143.* 3 tables; 1 ill., 10 ref. Chinese. (AGRIS 2000-017257).

1527 Uzik, M.; Zofajova, A.; Bielikova, M. (1999) **Efeects of genotypes and nutrition on chlorophyll content and nitrogen in spring barley leaves.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 83-91.* Vyskumny Ustav Rastlinnej Vyroby. 8 tables; 14 ref. Slovak. (AGRIS 2000-023454).

On the breeding-research station Viglas-Pstrusa field small-plot trials were established. In the 1998 year five spring barley varieties and in the 1999 three spring barley varieties were evaluated with different N treatments (N = 0, 30, 60 kg/ha) and P treatments (P = 0, 10, 20 kg/ha). In the 1998 SPAD meter readings were taken from 30 plant leaves per plot (six observations), each as average from five measurements. The observations were as follows: 18 observations (90 measurements) per one variety or 30 observations (150 measurements) per one nutrition treatment. In the 1999 the SPAD meter readings were taken from 60 plant leaves per plot recorded as four observations, 360 leaves per one variety or observations totally and 180 measurements or 12 observations per one nutrition treatment. The reciprocal relationships among SPAD meter readings, % N in leaves and N treatments (N kg/ha) were high. These results showed that SPAD meter readings are reliable indicators of nitrogen concentration in leaves and N treatment at fertilization and therefore indirect measured chlorophyll concentration by Minolta chlorophyll-meter can be used in nutrition and breeding of spring barley for the reasons of expeditiousness and reliability.

1528 Wang Fahong (Shandong Academy of Agricultural Sciences, Jinan (China). Inst. of Crops) (1999) **Relationship between heading rate and root activity of different wheat varieties.** *Shandong Agricultural Sciences (China). Shandong Nongye Kexue (China) No. (2) p. 12-14.* 5 tables; 5 ref. Chinese. (AGRIS 2000-017255).

1529 Zerche, S.; Hecht, R. (1999) **Nitrogen uptake of winter wheat during shoot elongation phase in relation to canopy height and shoot density.** *Agribiological Research-Zeitschrift fur Agrarbiologie Agrikulturchemie Okologie. 52(3-4):231-250.* English. [Inst Gemuse & Zierpflanzenbau Grossbeeren Erfurt, Inst Erfurt Kuhnhauser Str 101 D-99189 Erfurt Germany].

During three years a computer program for nitrogen fertilizer recommendations to cereals was tested at selected winter wheat fields of an agricultural farm in Mockern near Altenburg in eastern Thuringia. During elongation phase, the following parameters were measured: dry matter (DM), canopy structure (shoot height SH; shoot number - SNmax), nitrogen concentration (N %) and nitrogen uptake (NU). The data were used to validate independent parameters of regression functions that calculate actual dry matter and nitrogen uptake as components of the tested computer program. Correlation analyses of data were followed by estimations of site specific parameters of corresponding models: DM = f (SH, SN); N % = f (DM) = a x (DM)(-b); NU = f(DM;N %) and NU = f (DM) = 0.1a x (DM)((1-

b)). Site and year specific validations are presented. The validation of dry matter calculations was successful but strictly limited to the elongation phase (DC31-DC55), which coincides with model theory. Year specific variability occurred in nitrogen concentration with increasing dry matter accumulation. The range of measured nitrogen uptake (NUmeas) of 30 to 300 kg N x ha(-1) corresponded with the calculated one (NUcalc) between 30 and 250 kg N x ha(-1). Reliable results of NUcalc validations were obtained from the beginning to the end of shoot elongation at a:NU range of 30 to 180 kg N x ha(-1). The investigation showed the possibility to validate dry matter and nitrogen uptake estimations despite of differences in specific years. However, for further improving of model precision beside canopy structure climatic variables (radiation, temperature rsp. water balance) and soil nitrogen dynamics should be considered. [References: 48].

F62 PLANT PHYSIOLOGY-GROWTH AND DEVELOPMENT

1530 Ganeva, G.; Zozikova, E.; Dryanova, A. (2000) **Physiological activity of free auxins in aneuploid wheat lines.** *Russian Journal of Plant Physiology. 47(2):207-210.* English. [Bulgarian Acad Sci, Inst Genet BU-1113 Sofia Bulgaria].

The coleoptile test was used to assess the activitjes of free auxins at tillering and heading stages in 32 aneuploid wheat (Triticum aestivum L., cv. Chinese Spring) lines, including ditelosomic, tetrasomic, and nullisomic-tetrasomic lines in the homoeologous chromosome groups 2-4 and the 2R, 2H, 3R, 4R, and 4H addition lines. The loss of particular chromosome arms and the addition of extra chromosomes affected auxin activities, and we presume that these chromosomes comprise the genes in control of auxin content in wheat tissues. In particular, the chromosome arm 2DL comprises the gene positively affecting the auxin content, whereas the chromosomes 2AS, 2B, 3D, and 4B contain the genes exerting the inhibiting effect. The effect of the genes located on 2A and 2D was dosage-dependent and species-specific: the homoelogous chromosomes of wheat, rye, and barley, when added to a euploid wheat chromosome set, produced different effects. The compensatory effect of homoelogous chromosomes varied in nullisomic-tetrasomic lines: the best compensation was observed in the N3AT3B, N4AT4B, and N4BT4D lines at the tillering stage and in the N3AT3D, N3DT3A, and N3BT3D at the heading stage. [References: 16].

1531 Harrison, PA.; Porter, JR.; Downing, TE. (2000) **Scaling-up the AFRCWHEAT2 model to assess phenological development for wheat in Europe.** *Agricultural & Forest Meteorology. 101(2-3):167-186.* English. [Univ Oxford, Environm Change Inst 1A Mansfield Rd Oxford OX1 3TB England].

A method was developed for scaling-up the AFRCWHEAT2 model of phenological development from the site to the continental scale. Four issues were addressed in this methodology: (i) the estimation of daily climatic data from monthly values, (ii) the estimation of spatially variable sowing dates, (iii) the simulation of multiple cultivars, and (iv) the validation of broad-scale models. Three methods for estimating daily minimum and maximum temperatures from monthly values were compared using AFRCWHEAT2: a sine curve interpolation, a sine curve interpolation with random daily variability, and two stochastic weather generators (WGEN and LARS-WG). The sine curve interpolation was selected for the continental scale application of AFRCWHEAT2 because computational time was short and errors were acceptably small. The average root mean square errors (RMSEs) for the dates of double ridges, anthesis and maturity were 6.4, 2.2 and 2.1 days, respectively. The spatial variability of European sowing dates was reproduced using a simple climatic criterion derived from the AFRCWHEAT2 vernalization curve. The use of several cultivar calibrations enabled the broad-scale model to capture current responses and compare responses to future climate change. Results from the continental scale model were validated using a geographically-referenced database of observed phenological dates, output from other site-based models and sensitivity analysis. The spatial model was able to emulate a similar spatial and temporal variability in phenological dates to these sources under the present climate. The predominant effect of an increase in mean temperature was a reduction in the emergence to double ridges phase. The shift in the timing of subsequent development stages to earlier in the season meant that changes in their duration were relatively minor. Changes in inter-annual temperature variability resulted in only small changes in the mean date of development stages, but their standard deviation altered significantly. [References: 69].

1532 Hu, YC.; von, Tucher, S.; Schmidhalter, U. (2000) **Spatial distributions and net deposition rates of Fe, Mn and Zn in the elongating leaves of wheat under saline soil conditions.** *Australian Journal of Plant Physiology. 27(1):53-59.* English. [Tech Univ Munich, Chair Plant Nutr D-85350 Freising Germany].

In this study, we quantified the spatial distributions of Fe, Mn and Zn and their net deposition rates in the elongating and mature zones of leaf 4 on the main stem of spring wheat (Triticum aestivum L.) on a millimetre scale during its linear growth phase under saline soil conditions. Plants were grown in an illitic-chloritic silty loam with 0 and 120 mM NaCl in growth chambers. The sampling was conducted on the 3rd day after leaf 4 emerged during the photoperiod. The patterns of spatial distributions of Fe, Mn and Zn concentrations (mmol kg(-1) FW) in the growing leaves were distinct. Salinity affected the distribution pattern of Fe concentration on the FW basis, whereas it did not affect those of the Zn and Mn. The distribution patterns of Fe and Mn differed from those for N, P, K, Ca and Mg found in a previous study, whereas the distribution pattern of Zn was similar to those of Mg, P and N. The spatial distribution of the net deposition rates (mmol kg(-1) FW h(-1)) in both treatments demonstrated the strongest sink for the micronutrients in the elongation zone, and their net deposition rates were enhanced by 120 mM NaCl at the middle of the elongation zone. From the results, we conclude that the inhibition of leaf growth of wheat is probably not due to the effect of salinity on Fe, Mn and Zn in leaves. [References: 37].

1533 King, RW.; von, Wettstein-Knowles, P. (2000) **Epicuticular waxes and regulation of ear wetting and pre-harvest sprouting in barley and wheat.** *Euphytica. 112(2):157-166.* English. [CSIRO GPO Box 1600 Canberra ACT 2601 Australia].

Morphological features of the cereal ear, including awns, alter pre-harvest sprouting damage by changing the rate of water absorption during rainfall. In this paper, the potential for wheat (Triticum sp.) arid barley (Hordeum vulgare L.) waxes to reduce sprouting by increasing water repellency of the mature ear has been examined. Six barley F-2 populations segregating for different non-glaucous single-gene mutants controlling waxes on ears were examined. Water repellency was assessed by measuring both the contact angle of a water drop placed on the lemma surface (internal angle) and by repetitive weighings of whole ears during their exposure to simulated rainfall. The lemma of glaucous (wild type) lines had larger water drop contact angles, an indication of poorer spread of water over the surface. In simulated rainfall, ears of the glaucous lines showed a clear reduction of wetting (20-30% less) and, after 72 h of wetting, their in-ear sprouting was reduced by 50 to 65%. When pre-wet, the glaucous ears also shed water more readily when shaken to simulate the combined effect of wind and rainfall. To reduce pre-harvest sprouting of barley it may be possible to screen visually for ears that are more glaucous but a more specific screen would be to select for lemma water drop contact angle since it is a good indicator of ear wettability and so allows differences in surface properties to be assessed. For bread wheat (T. aestivum L.), as for barley, the more glaucous the ear, the greater the water drop contact angle and the more tubular surface wax coverage seen in scanning electron microscope images. In addition, surface wax amount apparently affected in-ear wetting in lines of durum wheat, (T. turgidum L.). Possible genetic relationships between waxy/waxless genes in wheat and barley are suggested with the aim, ultimately, of altering ear glaucousness to give increased water repellency and a reduction of in-ear sprouting of wheat. [References: 37].

1534 Lovegrove, A.; Hooley, R. (2000) **Gibberellin and abscisic acid signalling in aleurone [Review].** *Trends in Plant Science. 5(3):102-110.* English. [Univ Bristol, Dept Agr Sci, Long Ashton Res Stn, IACR Bristol BS41 9AF Avon England].

The plant hormones gibberellin and abscisic acid regulate gene expression, secretion and cell death in aleurone. The emerging picture is of gibberellin perception at the plasma membrane whereas abscisic acid acts at both the plasma membrane and in the cytoplasm - although gibberellin and abscisic acid receptors have yet to be identified. A range of downstream-signalling components and events has been implicated in gibberellin and abscisic acid signalling in aleurone. These include the G(alpha) subunit of a heterotrimeric G protein, a transient elevation in cGMP, Ca2+-dependent and Ca2+-independent events in the cytoplasm, reversible protein phosphorylation, and several promoter cis-elements and transcription factors, including GAMYB. In parallel, molecular genetic studies on mutants of Arabidopsis that show defects in responses to these hormones have identified components of gibberellin and abscisic acid signalling. These two approaches are yielding results that raise the possibility that specific gibberellin and abscisic acid signalling components perform similar functions in aleurone and other tissues. [References: 60].

1535 Maucher, H.; Hause, B.; Feussner, I.; Ziegler, J.; Wasternack, C. (2000) **Allene oxide synthases of barley (Hordeum vulgare cv. Salome): tissue specific regulation in seedling development.** *Plant Journal. 21(2):199-213.* English. [Leibniz Inst Plant Biochem POB 110432 D-06018 Halle Saale Germany].

Allene oxide synthase (AOS) is the first enzyme in the lipoxygenase (LOX) pathway which leads to formation of jasmonic acid (JA). Two full-length cDNAs of AOS designated as AOS1 and AOS2, respectively, were isolated from barley (H. vulgare cv. Salome) leaves, which represent the first AOS clones from a monocotyledonous species. For AOS1, the open reading frame encompasses 1461 bp encoding a polypeptide of 487 amino acids with calculated molecular mass of 53.4 kDa and an isoelectric point of 9.3, whereas the corresponding data of AOS2 are 1443 bp, 480 amino acids, 52.7 kDa and 7.9. Southern blot analysis revealed at least two genes. Despite the lack of a putative chloroplast signal peptide in both sequences, the protein co-purified with chloroplasts and was localized within chloroplasts by immunocytochemical analysis. The barley AOSs, expressed in bacteria as active enzymes, catalyze the dehydration of LOX-derived 9- as well as 13-hydroperoxides of polyenoic fatty acids to the unstable allene oxides. In leaves, AOS mRNA accumulated upon treatment with jasmonates, octadecanoids and metabolizable carbohydrates, but not upon floating on abscisic acid, NaCl, Na-salicylate or infection with powdery mildew. In developing seedlings, AOS mRNA strongly accumulated in the scutellar nodule, but less in the leaf base. Both tissues exhibited elevated JA levels. In situ hybridizations revealed the preferential occurrence of AOS mRNA in parenchymatic cells surrounding the vascular bundles of the scutellar nodule and in the young convoluted leaves as well as within the first internode. The properties of both barley AOSs, their up-regulation of their mRNAs and their tissue specific expression suggest a role during seedling development and jasmonate biosynthesis. [References: 70].

1536 Pang Hongxi (Shaanxi Academy of Agricultural Sciences, Yangling (China)) (1998) **Studies on grain growth and filling properties of big-spike wheat varieties (lines).** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuevao (China) v. 7(3) p. 23-26.* 2 tables; 2 ill., 8 ref. Chinese. (AGRIS 2000-017336).

1537 Plotnikov, VK.; Bakaldina, NB.; Smetanin, DV. (2000) **Light-induced changes in the stability of phytochrome A mRNA in wheat and barley seedlings.** *Russian Journal of Plant Physiology. 47(2):180-185.* English. [Russian Acad Agr Sci, Lukyanenko Res Inst Agr Krasnodar 350012 Russia].

The stability of total poly(A)-containing mRNA and mRNA for phytochrome A (PhyA) was studied in etiolated and green seedlings of several cultivars of wheat (Triticum aestivum L.) and barley (Hordeum vulgare L.) using an in vitro (ommp) system, which adequately characterizes the relative mRNA stability in vivo. Light effects on mRNA stability were shown to be cultivar-specific. The ratio between dominant and recessive vm and ppd genes was assumed to determine the cultivar specificity of mRNA stability. In winter wheat, cv. Krasnodarskaya 39, cAMP was shown to destabilize PhyA, eEF-1 alpha, and Wx mRNAs, whereas irradiation destabilized only PhyA mRNA but stabilized two other mRNAs tested. Our results present new methodological possibilities for investigating the post-transcriptional photoregulation of gene expression. [References: 32].

1538 Przulj, N.; Momcilovic, V.; Mladenov, N. (2000) **Grain filling in two-rowed winter barley.** *Rostlinna Vyroba. 46(2):81-86.* English. [Inst Field & Vegetable Crops Maksima Gorkog 30 YU-21000 Novi Sad Yugoslavia].

Kernel weight depends on the rate and duration of grain filling (GF). Rate of GF presents the rate of dry matter accumulation per kernel and GF period duration from anthesis to physiological maturity. In this paper two two-rowed winter barley cultivars were used to investigate the rate and duration of GF and rate of kernel water release during the GF period. Accumulated growing-degree days (GDD) from anthesis were used as a time scale. The relation between kernel weight and accumulated GDD was presented by fitting a quadratic polynomial and the relation between kernel water content and accumulated GDD by fitting a linear equation. Depending on the cultivar and year, rate of GF ranged from 0.068 to 0.082 mg/kernel/GDD and the duration of CF from 572 to 778 GDD. Both the rate and duration of GF were influenced the most by environmental factors. Yield was positively correlated with rate of GF, while between yield and duration of GF there was no significant correlation. The phenotypic correlation between rate and duration of GF was negative. Rate of GF had positive and duration of GF negative indirect effects on yield through yield components. The positive correlations between the rate of GF and kernel weight as well as kernel weight and yield enable indirect selection for yield and a high rate of GF via breeding for a larger kernel. [References: 29].

1539 Serodio, M.I.; Novais, M.C. (Lisboa Univ., Lisbon (Portugal). Faculdade de Ciencias) (1996) **Homeostasis in Triticum aestivum L. during flooding stress.** Estacao Agronomica Nacional, Oeiras (Portugal). *Agronomia Lusitana (Portugal) v. 45(1-3) p. 169-176.* 5 tables, 13 ref. Portuguese. (AGRIS 2000-023500).

1540 Tripathi, P.; Tomar, SK.; Adhar, S. (2000) **Effect of moisture regimes and genotypes on biomass accumulation, radiation interception and its use in wheat (Triticum aestivum).** *Indian Journal of Agricultural Sciences. 70(2):97-101.* English. [Narendra Deva Univ Agr & Technol, Dept Agr Meteorol Faizabad 224229 Uttar Pradesh India].

A field experiment was carried out during 1994-95 and 1995-96 to study the effect of moisture regimes and genotypes on biomass accumulation, radiation interception and radiation-use efficiency in wheat (Triticum aestivum L, emend Fiori & Paol.) at Faizabad. Moisture regime I-4 (CRI + late tillering + flowering + milking) being at par with I, (CRI + late jointing + milking) recorded significantly higher leaf area index at 75-105 day after sowing over I, (CRI) and I, (CRI + flowering). Significantly higher biomass, absorbed photosynthetically active radiation and radiation-use efficiency were recorded with I-4 moisture regime over those of I-3, I-2 and I-1. However, difference between I-2 and I-3 moisture regimes was not perceptible in respect of biomass accumulation. Among the genotypes tested, 'HD 2285' wheat being at par with 'HP 1633' recorded significantly higher leaf area index than 'HUW 234' from 75-90 days after sowing during both the years. 'HP 1633' and 'HUW 234' were found identical in respect of leaf area index at most of the crop stages. 'HD 2285' recorded significantly higher biomass (831.1 and 949.5 g/m(2)), absorbed photosynthetical active radiation (412.1 and 522.9 MJ) and radiation-use efficiency (1.69 and 1.48 g/MJ) over 'HP 1633' during both the years. [References: 11].

1541 Yue Shousong (Shenyang Agricultural Univ., Liaoning (China). Coll. of Agronomy); Yu Songlie; Yu Zhenwen (1998) **Changes of photosynthesis and ultrastructure of mesophyll cells during senescence of wheat flag leaves.** *Journal of Shenyang Agricultural*

University (China). Shenyang Nongye Daxue Xuebao (China) v. 29(1) p. 1-5. 1 table; 9 ill., 10 ref. Chinese. (AGRIS 2000-017335).

1542 Zhang, M.; Nyborg, M.; Malhi, SS.; Solberg, ED. (2000) **Localized root growth in soil induced by controlled-release urea granule and barley nitrogen uptake.** *Journal of Plant Nutrition. 23(3):413-422.* English. [Univ Alberta, Dept Renewable Resources Edmonton AB T6G 2E3 Canada].

Controlled-release urea is a fertilizer which meters out urea over a long period of time. It can provide a favorable nitrogen (N) concentration for root growth, especially at the early stage of plant development. The objective of this study was to determine the interactions of urea or controlled-release urea granules with barley roots and the resultant N uptake by plants. Two experiments (Experiment I and Experiment II) with treatments of Nil, non-coated urea, Coated I and Coated II (Coated I and Coated II are controlled-release urea products) were conducted in a greenhouse at 23+/-5 degrees C. In both experiments, one barley (Hordeum vulgare L. cv. Duke) seed and one granule of urea or controlled-release urea were placed in a pot (5.2-cm height and 8-cm diameter) containing soil low in mineral N. In Experiment I, shoot and soil samples were taken at 14, 28, and 46 days after seeding. Roots and fertilizer interaction were visually examined and photographed. In Experiment II, root samples both around the fertilizer granule and away from the granule were taken only at 28 days after seeding. In both experiments, dry matter mass and total N content of shoot and root, and mineral N in soil were determined. In Experiment I, at the 28-day sampling roots proliferated around the controlled-release urea granule but not around the urea granule. Shoot N uptake since the 28 days was higher with controlled-release urea than with urea because of the root proliferation. In Experiment II, root dry mass and N content around the granule was higher with controlled-release urea than with urea. In the controlled-release urea treatments, root mass and N content away from the granule were also increased in comparison to the Nil. This shows a stimulus relationship between the two portions of the roots in the same plant, i.e., the roots being accessed to the N source increased growth of the other roots with no access to the source. Because only a small portion of roots was involved in N uptake in the controlled-release urea treatments, the intensity of N uptake per unit of root mass was much higher with controlled-release urea as compared to urea. In conclusion, root growth was enhanced around controlled-release urea granule, and that portion of roots around the fertilizer granule played a major role in absorbing N. In addition, a stimulus relationship existed between roots grown around the granule and those grown away from the granule. [References: 15].

1543 Zhao Huijie; Li Lanzhen; Yang Huiwu (Henan Agricultural Univ., Zhengzhou (China)) (1998) **Physiological characteristics of new wheat cultivar Yumai 39 during seed-filling.** *Acta Agriculturae Boreali-Sinica (China). Huabei Nongxuebao (China) v. 13(2) p. 6-10.* 5 tables; 1 ill., 8 ref. Chinese. (AGRIS 2000-017338).

1544 Zhou ZHuqing; ZHu Xutong (Huazhong Agricultural Univ., Wuhan (China). Dept. of Agronomy) (1998) **Study on nutrient absorption and metabolism of new wheat varieties (lines) in late growing stages by using 32p tracers in Hubei [China].** *Hubei Agricultural Sciences (China). Hubei Niongye Kexue (China) (no. 2) p. 14-17.* 4 tables; 4 ref. Chinese. (AGRIS 2000-017337).

F63 PLANT PHYSIOLOGY-REPRODUCTION

1545 Matsui, T.; Omasa, K.; Horie, T. (2000) **Rapid swelling of pollen grains in the dehiscing anther of two-rowed barley (Hordeum distichum L. emend. LAM.).** *Annals of Botany. 85(3):345-350.* English. [Kyoto Univ Expt Farm, 12-1 Hatchonawate Osaka 5690096 Japan].

The role of rapid swelling of pollen grains in anther dehiscence in Hordeum distichum L. emend. LAM. and the mechanism of this swelling were examined. Artificial opening of the floret induced rapid swelling of pollen grains and thecae dehiscence. The theca dehisced as pollen grains became swollen and dehisced anthers had larger pollen grains than indehisced anthers. Septa in the anther segments dehisced as a result of water-induced pollen pressure. These results strongly support the theory that the rapid swelling of pollen grains is a driving force for anther dehiscence. On the other hand, potassium was detected in pollen grains from dehisced anthers, but not in pollen grains in indehisced anthers. This suggests that potassium ions function as a turgor regulator in the rapid swelling of pollen grains. The mechanism of anther dehiscence is discussed in relation to the swelling of pollen grains, as is the possible mechanism of this swelling. (C) 2000 Annals of Botany Company. [References: 17].

1546 Patruno, A.; Cavazza, L. (Bologna Univ. (Italy). Dipartimento di Agronomia); Ponzoni, G. (1998) **Germination of triticum aestivum L. caryopsides in peats at different matrix potential.** *Sementi Elette (Italy) v. 44(5) p. 5-10.* 1 table; 8 graphs; 6 ref. Italian. (AGRIS 2000-023555).

Triticum aestivum caryopsis have been germinated on three comercial peats: a blond, a dark, and a mixed one and on a mineral loam for comparison; all were kept at given moisture content. The blond and dark peat were used both unlimed and neutralized with lime. The results show the strong depressive effect of very high moisture content (near saturation). In limed peats, as soon as the airfilled porosity reaches about 25% of total porosity, the germination reaches its maximum value; the air content must be higher (30 to 50%) for unlimed peats as well as for mineral soils. At lower matrix potential the germination decreases; germination speed index (Vmg) seems to express this effect better than the usual MGT. Unlimed peats are much less favourable for germination. Seedlings height and their dry matter content seem more sensitive to dry substrate condition than germination itself [Cariossidi di frumento sono state fatte germinare su tre torbe di origine commerciale, una chiara, una scura e una mista, e su un terreno argilloso, preso come confronto; tutti i substrati erano mantenuti a un dato livello di umidita'. Le torbe chiara e scura sono state utilizzate sia non calcitate, sia neutralizzate con calce. I risultati evidenziano il forte effetto depressivo del contenuto molto alto di umidita' (vicino alla saturazione). Nelle torbe calcitate, come il contenuto di aria raggiunge circa il 25% della porosita' totale, la germinazione raggiunge il valore massimo; il contenuto di aria del substrato deve essere maggiore (da 30 a 50%) per torbe non calcitate e per i terreni minerali. A minori potenziali matriciali la germinazione diminuisce; l'indice di velocita' della germinazione (V infmg) sembra esprimere questo effetto meglio del tradizionale MGT. Le torbe non calcitate sono meno favorevoli per la germinazione. L'altezza delle plantule e il loro contenuto di sostanza secca sembrano piu' sensibili alla condizione di secchezza del substrato rispetto alla germinazione in se'].

F70 PLANT TAXONOMY AND GEOGRAPHY

1547 Chen Qingfu (Guizhou Normal Univ., Guiyang (China). Dept. of Biology) (1999) **Discussion on origin of Chinese endemic wheat.** *Guizhou Agricultural Sciences (China). Guizhou Nongye Kexue (China) v. 27(1) p. 20-25.* 52 ref. Chinese. (AGRIS 2000-017445).

1548 Sahuquillo, E.; Fraga, M.I.; Martinez Cortizas, A. (Santiago de Compostela Univ., La Coruna (Spain)) (1996) **A comparison of classical and numerical taxonomic methods as applied to infraspecific taxa of triticum aestivum cultivated in Galicia (NW Spain).** Estacao Agronomica Nacional, Oeiras (Portugal). *Agronomia Lusitana (Portugal) v. 45(1-3) p. 225-239.* 6 tables, 13 ref. English. (AGRIS 2000-023605).

H01 PROTECTION OF PLANTS-GENERAL ASPECTS

1549 Amare Andargie; Adisu Berhan (Sheno Research Center (Ethiopia)) (1998) **Research on insect pests and disease in North Shewa.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 140-155.* EARO. 3 tables. English. (AGRIS 2000-017462).

1550 Lipa, J.J. (Institute of Plant Protection, Poznan (Poland)) (1999) **Modern protection of cereal crops.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 241-259.* 8 tables; 85 ref. Polish. (AGRIS 2000-017473).

The cereals, especially wheat and barley, are grown on the largest areas in Europe and in Poland being the most profitable crops for farmers. Tendency to obtain the high yields induce simplification of crop rotation and the high fertilizier use. This induce various crop protection problems. The appearance of new pests or increase of economic significance of old pests induce necessity of high pesticide use to the level creating environmental or economical risk. Several aspects of rationalization of plant protection products are discussed using the new technologies.

1551 Melaku Wale; Melaku Ayalew; Fantahun Mengistu; Birhane Asayehegne; Amare Getaneh (Adet Research Center (Ethiopia)) (1998) **Research on insect pests and diseases of field crops in Northwestern Ethiopia.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 89-96.* EARO. English. (AGRIS 2000-017461).

H10 PESTS OF PLANTS

1552 Al-Hazmi, AS.; Al-Yahya, FA.; Abdul-Razig, AT. (1999) **Damage and reproduction potentials of Heterodera avenae on wheat under outdoor conditions.** *Journal of Nematology. 31(4 Suppl S):662-666.* English. [King Saud Univ, Dept Plant Protect Box 2460 Riyadh 11451 Saudi Arabia].

Two pot experiments, in consecutive years, were conducted under outdoor conditions during the wheat growing season to examine the relationship between increasing initial population densities (Pi: 0-3, 000 cysts/pot) of Heterodera avenae and corresponding responses of wheat cv. Yecora Rojo. Results of both experiments were very similar. The nematode suppressed plant height, root and biomass dry weights, and grain yield at all Pi's studied. The suppression of these parameters, as well as the final nematode population densities (Pf), increased with increasing Pi levels. The reproduction factor (Pf/Pi) decreased as Pi increased but was always greater than 1.0. When data from both experiments were combined for regression analyses, inverse relationships were found between log, , (Pi + 1) and both plant growth and yield. These negative relationships were highly significant and adequately described by linear models. Final population (Pf) increased linearly with Pi. The wheat cultivar cv. Yecora Rojo was found to be highly vulnerable to damage and a good host for H. avenae. [References: 26].

1553 Blot, Y.; Brunel, E.; Courbon, R. (1999) **Survey on the infection of wheat and maize by larvae of wireworms of Agriotes and Athous genera (Coleoptera : Elateridae) in some areas of West France.** *Annales de la Societe Entomologique de France. 35(Suppl S):453-457.* French. [INRA, Zool Lab BP 29 F-35653 Le Rheu France].

Wheat was often attacked by wireworms. Observations were made from 1996 to 1998 one hundred and ten cultivated fields in the west of France. We have estimated the larval population by using traps and we noted the insecticides factors for each field. The results of the captures show that 39 fields are infested with Agriotes larvae, 21 fields are infested with Athous larvae and 39 fields are infested with both genera. We show that two years of insecticide treatement has an effect on the decrease of the Agriotes population. Athous larvae are still present in the maize-wheat rotation parcels which are regularly treated; they attack the wheat and do not seem to be attracted by maize. [References: 9].

1554 Brewer, M.J. (Wyoming Univ., Laramie, WY (USA). Dept. of Renewable Resources); Mornhinweg, D.W.; Huzurbazar, S. (1999) **Compatibility of insect management strategies: Diuraphis noxia abundance on susceptible and resistant barley in the presence of parasitoids.** *BioControl (Netherlands) v. 43(4) p. 479-491.* 28 ref. English. (AGRIS 2000-017594).

1555 Chen Zhijie; Wu Guangjun; Zhang Shulian (Shaanxi Inst. of Zoology, Xian (China)) (1998) **Integrated pest management in cotton field of wheat in-terplanting with cotton.** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuebao (China) v. 7(1) p. 27-31.* 3 tables; 3 ill., 6 ref. Chinese. (AGRIS 2000-017579).

1556 El, Bouhssini, M.; Hatchett, JH.; Wilde, GE. (1999) **Hessian fly (Diptera : Cecidomyiidae) larval survival as affected by wheat resistance alleles, temperature, and larval density.** *Journal of Agricultural & Urban Entomology. 16(4):245-254.* English. [Kansas State Univ, Dept Entomol Manhattan, KS 66506 USA].

The effects of allelic dosage of wheat resistance genes; larval density; and temperature on the expression of resistance and on Hessian fly, Mayetiola destructor (Say), larval survival was studied in a growth chamber. Wheat plants homozygous and heterozygous for resistance genes H3, H5, H7H8, H9, H10, and H11 expressed a high level of resistance as indicated by levels of plant damage. Plants heterozygous for the H6 gene were only moderately resistant. Little or no larval survival occurred on resistant plants homozygous and heterozygous for the H13 and H22 genes. However, significantly more larvae survived on resistant plants heterozygous for the H3, H5, H6, H7H8, H9, H10, or H11 genes compared to the corresponding homozygous plants. Thus, larval survival on resistant heterozyous plants rather than levels of plant damage appears to be the best criterion to determine if a resistance gene has complete or incomplete dominance. Wheats with resistance genes H1H2, H7H8, H11, and H13 expressed a high level of resistance across all egg (larval) densities (5, 10, 20 eggs per plant) and temperature. Larval survival increased on resistant plants having H1H2 and H7H8 genes as egg density and temperature (18, 24, 28 degrees C) increased, with the highest survival recorded at 24 degrees C. Little or no larval survival occurred on resistant plants carrying the XII or H13 genes across density and temperature treatments. [References: 22].

1557 Elliott, NC.; Kieckhefer, RW.; Beck, DA. (2000) **Adult coccinellid activity and predation on aphids in spring cereals.** *Biological Control. 17(3):218-226.* English. [USDA ARS, SPA, Plant Sci Res Lab 1301 N Western St Stillwater, OK 74075 USA].

Improved understanding of coccinellid activity and predation on aphids in the field could clarify their potential in aphid biological control, Our objective was to determine the influence of abiotic and biotic factors on activity and predation by adults of three coccinellid species (Hippodamia convergens Guerin-Meneville, H. tredecimpunctata tibialis (Say), and Coleomegilla maculata DeGeer) in spring cereal fields. The proportion of time coccinellids spent searching was correlated with air temperature, aphid density, and time of day. The relationship between searching and these variables differed among species. Mean walking speed ranged from 66.4 cm/min for C. maculata to 83.2 cm/min for H. tredecimpunctata and increased with temperature for all species. The frequency of short flights (<2 m) by beetles increased with temperature and decreased with increasing aphid density for all species, but the relationship of short flight frequency to these variables differed among species. The frequency of long flights (>2 m) was similar for all species and influenced by temperature and calendar date. The frequencies with which aphids were encountered and eaten were correlated with aphid density and temperature for H. convergens and H. tredecimpunctata. Despite over 250 h spent observing adult coccinellid behavior in the field, predation data were insufficient to develop a useful predation model. [References: 28].

1558 Hass, B.; Hughes, LA.; Glen, DM. (1999) **Overall versus band application of the nematode Phasmarhabditis hermaphrodita with and without incorporation into soil, for biological control of slugs in winter wheat.** *Biocontrol Science & Technology. 9(4):579-586.* English. [Univ Bristol, Long Ashton Res Stn, IACR, Dept Agr Sci Bristol BS41 9AF Avon England].

In two concurrent field experiments the effects of three types of soil cultivation and two patterns of nematode application were studied in order to investigate their effects on damage to winter wheat by slugs (assessed at Zadoks Growth Stage 12). In experiment I, infective

juveniles (IJs) of the nematode Phasmarhabditis hermaphrodita were applied to soil as an overall spray or as a band spl ay (8-cm wide), centred on the drill rows (16.7-cm apart). Nematodes were either left undisturbed on the soil surface or hai rowed into the soil immediately after application. The control provided by nematodes was compared with that provided by metaldehyde and methiocarb pellets broadcast at the recommended rare immediately after drilling. In this experiment, winter wheat on plots treated with IJs showed significantly less slug damage than on wheat plots treated with metaldehyde or methiocarb pellets or untreated plots. There was no significant difference in plant damage between plots treated with band and overall spray applications of IJs, nor was there any significant difference between plots with and without harrowing. There was also no significant difference between untreated plots and plots treated with metaldehyde or methiocarb pellets, probably because rainfall shortly after treatment rendered the pellets ineffective. In experiment 2, nematodes were applied as an overall spray or plots were not treated with nematodes before soil was cultivated, vith tines, Roterra or Dutzi cultivator. Nematode application before soil cultivation using tines or Roterra reduced the number of plants damaged significantly However; nematodes applied before Dutzi cultivation appeared to be rendered ineffective. Damage to winter wheat was lowest in plots that had been sprayed with nematodes and subsequently cultivated with tines or Roterra. [References: 14].

1559 Ishikawa, Y.; Kanke, T. (2000) **Feeding deterrence of barley seedlings against the migratory locust Locusta migratoria (Orthoptera : Acrididae).** *Applied Entomology & Zoology. 35(1):125-130.* English. [Univ Tokyo, Lab Appl Entomol, Grad Sch Agr & Life Sci Tokyo 1138657 Japan].

Barley seedlings strongly deterred feeding of the migratory locust Locusta migratoria. Analysis of feeding-related behavior revealed that approach to barley seedlings and palpation occurred just as with palatable plants, but rejection of the plant occurred immediately after biting. Excision of the maxillary and labial palps had no effect on the rejection of barley seedlings, and feeding of palatable plants occurred as with intact insects. Removal of compounds on the surface of the barley leaves also had no effect, while ethanol extraction of the leaves diminished the deterrence of the barley seedlings. These results indicated that feeding deterrent(s) are localized inside the seedlings. An ethanol extract of barley seedlings exhibited strong deterrence in a feeding assay using a piece of sucrose-impregnated filter paper as the feeding substrate. Fractionation of the ethanol extract revealed that the strongest feeding deterrence was observed with the basic fraction, which contains alkaloids such as gramine. The other fractions also showed weak feeding deterrence. A crude alkaloid extract equivalent to 100 mg of barley leaf inhibited feeding of the locusts by 90%. [References: 26].

1560 Kaniuczak, Z.; Matlosz, I. (Institute of Plant Protection in Poznan, Rzeszow (Poland). Branch Experimental Station) (1999) **Effects of the economical profitability of chemical control of pests in cereals.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 159-165.* 4 tables; 6 ref. Polish. (AGRIS 2000-017520).

Studies on economical effects of chemical control of pests in spring crops barley and wheat were carried out in Boguchwala in 1997-98. The best coefficient of expense defrayal was obtained in spring barley applying Fury 100 EC in 1997, but also in 1998 after Bulldock 025 EC treatment. The coefficient for spring wheat was the best after Bancol 50 WP treatment in 1997. Chemical control of pests caused limitation in the grain yield losses of spring barley from 0.29 to 1.0 t per ha and of spring wheat from 0.51 to 0.92 t per ha.

1561 Keresi, T. (1999) **Bug fauna (Heteroptera) on winter wheat and soybean dependent on cropping system.** Univerzitet u Novom Sadu, Novi Sad (Yugoslavia). POljoprivredni fakultet. 1 ill.; 46 graphs; 39 tables; Bibliography: p. 124-133. Supplement: 23 tables. 133 p. Serbian. (AGRIS 2000-023751).

The bug fauna was studied on winter wheat and soybean, grown under different cropping systems at locality Rimski Sancevi, Serbia (Yugoslavia). In 1993-1994, five wheat fields and two soybean fields were inspected in 8-14 day intervals from April to August. The total of over 21300 insects were collected by sweep-net method (100 sweeps per plot), out of which 8% or 1685 specimens belonged to order Heteroptera. Among 11 registered families, Miridae, Nabidae and Scutelleridae were dominant on wheat and Miridae, Nabidae and Pentatomidae on soybean. The total of 48 species were identified, out of which 44 on wheat, 27 on soybean and 23 were common for both crops. Abundance, dominance and constancy were calculated for each species, as well as IPS indexes between plots and crops. The number of species was significantly higher (about 50%) in wheat fields under intensive cropping system (including fertilization) and slightly higher (15%) in indirectly fertilized soybean fields than on unfertilized ones. The number of individuals was significantly higher (twice on wheat and 64% on soybean) on fertilized in relation to unfertilized plots. Structure and population density of Heteroptera on wheat grown in a 2 and 3-crop rotation was similar. The most abundant predator on both crops was Nabis feroides, but quite numerous were also species Nabis pseudoferus, Nabis ferus and Orius niger. The seasonal activity of the most abundant genera Eurygaster, Exolygus, Trigonotylus and Nabis was established.

1562 Landis, DA.; Wratten, SD.; Gurr, GM. (2000) **Habitat management to conserve natural enemies of arthropod pests in agriculture [Review].** *Annual Review of Entomology. 45:175-201.* English. [Michigan State Univ, Dept Entomol E Lansing, MI 48824 USA].

Many agroecosystems are unfavorable environments for natural enemies due to high levels of disturbance. Habitat management, a form of conservation biological control, is an ecologically based approach aimed at favoring natural enemies and enhancing biological control in agricultural systems. The goal of habitat management is to create a suitable ecological infrastructure within the agricultural landscape to provide resources such as food for adult natural enemies, alternative prey or hosts, and shelter from adverse conditions. These resources must be integrated into the landscape in a way that is spatially and temporally favorable to natural enemies and practical for producers to implement. The rapidly expanding literature on habitat management is reviewed with attention to practices for favoring predators and parasitoids, implementation of habitat management, and the contributions of modeling and ecological theory to this developing area of conservation biological control. The potential to integrate the goals of habitat management for natural enemies and nature conservation is discussed. [References: 191].

1563 Nicol, JM.; Davies, KA.; Hancock, TW.; Fisher, JM. (1999) **Yield loss caused by Pratylenchus thornei on wheat in South Australia.** *Journal of Nematology. 31(4):367-376.* English. [CIMMYT, Wheat Program Lisboa 27, Apartado Postal 6-641 Mexico City 06600 DF Mexico].

A two-year field trial with 130 plots was conducted at Tanunda, South Australia. Ten cereal cultivars differing in susceptibility to Pratylenchus thornei, two poor host crops (non-leguminous), and a bare fallow treatment were used to manipulate the numbers of nematodes in the plots in the first year. Initial and final densities were determined for each plot and varied from 0 to 9, 400 nematodes/200 g oven-dried soil at the beginning of the second year. A highly susceptible wheat cultivar, Warigal, and two wheat lines known to have some resistance to P. thornei, GS50A and AUS4930, were planted in the second year. High densities of P. thornei caused more extensive lesions and severe cortical degradation in roots of Warigal than in GS50A or AUS4930. There was a significant linear relationship between initial density of P. thornei and Warigal grain yield (t/ha), with the estimated regression equation Y = 1.86 - 0.0000557x, where Y is the grain yield in t/ha and x is the number of P. thornei/200 g oven-dried soil. High initial densities (9, 000 P. thornei/200 g oven-dried soil) caused up to 27% yield loss of this commercial Australian wheat. In contrast, the yield of the two resistant lines was not affected by initial density, suggesting that both were tolerant as well as resistant in the field. [References: 37].

1564 Ridgway, C.; Chambers, J.; Cowe, IA. (1999) **Detection of grain weevils inside single wheat kernels by a very near infrared two-**

wavelength model. *Journal of Near Infrared Spectroscopy. 7(4):213-221.* English. [Cent Sci Lab York YO41 1LZ N Yorkshire England].

Near infrared reflectance spectroscopy in the very near infrared region (700 nm to 1100 nm) has been investigated for the detection of grain weevil larvae and pupae inside single wheat kernels. Using a total of 80 samples, simple, two-wavelength classification models have been identified, based on either log 1/R (982 nm)-log 1/R (1014 nm) or log 1/R (972 nm)-log 1/R (1032 nm). Both models correctly classified over 96% of samples as uninfested or infested. Detection performance equalled that obtained using the full-spectrum approach of principal components analysis. In a separate experiment, repeatedly scanning samples over time demonstrated detection of younger larvae as well as later developmental stages. This experiment confirmed that the observed spectral differences arise from the actions of the developing insect, rather than from any feature specific to kernels selected by adult females for egg-laying. The origins of the spectral differences are almost certainly decreasing grain starch, for log 1/R (982 nm)-log 1/R (1014 nm), or increasing grain moisture, for log 1/R (972 nm)-log 1/R (1032 nm), with infestation. These results indicate that the future incorporation of the wavelength pair, 982 nm and 1014 nm, as camera lens filters in a very near infrared imaging system, could lead to an inexpensive, rapid and reliable machine-vision method for detecting internal insects in grain. [References: 11].

1565 Rotundo, G.; Germinara, GS.; De, Cristofaro, A. (2000) **Immuno-osmophoretic technique for detecting Sitophilus granarius (L.) infestations in wheat.** *Journal of Stored Products Research. 36(2):153-160.* English. [Univ Molise, Dipartimento Sci Anim Vegetali & Ambiente Via Sanctis I-86100 Campobasso Italy].

Granary weevil Sitophilus granarius (L.) infestations in stored cereals are generally difficult to detect since the life cycle mainly takes place (from egg to pupa) inside the kernel. In order to detect the immature stages of S. granarius in wheat kernels a serological technique was set up. The antiserum was prepared by injecting rabbits with crude extract from larvae and pupae of S. granarius. Two different serological techniques (double diffusion and immuno-osmophoresis) were compared using crude extracts coming from 10 g of wheat variably infested and ground by different procedures. The immuno-osmophoresis displayed higher analytical resolution than the double diffusion and it was able to detect the infestation due to a single larva (2nd, 3rd or 4th instar) or pupa in the crude extract. Moreover, this technique also provided information about the degree of infestation and the insect instar present in the kernel, based on the number of serologically positive samples (n 5 x 10 g) and the position of the precipitin lines, respectively. The reproducibility of the results, the high analytical resolution, as well as its rapidity and technical simplicity, demonstrated the usefulness of the immuno-osmophoretic technique for the detection and quantification of hidden insect infestations in stored wheat. [References: 12].

1566 Shi Wangcheng; Liu Xu (Sichuan Academy of Agricultural Sciences, Chengdu (China). Inst. of Plant Protection) (1999) **Study on occurrence characteristic of barley pests in western plateau of Sichuan (China).** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 21(1) p. 43-47.* 3 ref. Chinese. (AGRIS 2000-017595).

1567 Tesfaye Belay; Zenebe Woldu (Mekele Research Center (Ethiopia)) (1998) **Barley fly incidence on tef in Tigray.** 4. Proceedings of Technology Generation, Transfer and Gap Analysis Workshop. Bahir Dar (Ethiopia). 18-21 Mar 1997. *Agricultural research and technology transfer attempts and achievements in Northern Ethiopia. Beyene Seboka; Abera Deresa (EARO, Addis Abeba (Ethiopia)) p. 173-179.* EARO. 2 tables. English. (AGRIS 2000-017550).

1568 Zhang Wujun; Zhang Hui (Sichuan Academy of Agricultural Sciences, Chengdu (China). Inst. of Plant Protection) (1999) **Occurance of wheat pests, weeds and their chemical control in Sichuan [China].** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 21(1) p. 24-26.* 2 ref. Chinese. (AGRIS 2000-017727).

H20 PLANT DISEASES

1569 Adamovskaya, VG.; Klechkovskaya, EA.; Molodchenkova, OO.; Vovchuk, SV. (2000) **The effects of salicylic acid and Fusarium infection on proteinases and their inhibitors.** *Russian Journal of Plant Physiology. 47(2):186-190.* English. [Ukrainian Acad Agr Sci, Inst Breeding & Genet Ovidiopolskaya Dor 3 UA-270036 Odessa Ukraine].

The activities of neutral (pH 6.0) and acidic (pH 3.5) proteinases and the content of trypsin inhibitor were studied in 6-day-old winter wheat (Triticum aestivum L.) seedlings as affected by Fusarium graminearum Schwabe and salicylic acid. Fusarium infection and salicylic acid were shown to activate proteinases and increase the content of trypsin inhibitor in the resistant wheat cultivars. Neutral proteinases were activated under both treatments, whereas acidic proteinases responded only to salicylic acid. Electrophoretic analysis of the infected plants demonstrated an elevated level of polypeptides with mol wts of 14 and 20 kD and the appearance of a new polypeptide with a mol wt of 29 kD. An increase in the level of trypsin inhibitor in the infected and salicylic acid-treated wheat plants can be seen as a defense response enhancing plant resistance. [References: 19].

1570 Bailey, KL.; Johnston, AM.; Kutcher, HR.; Gossen, BD.; Morrall, RAA. (2000) **Managing crop losses from foliar diseases with fungicides, rotation, and tillage in the Saskatchewan Parkland.** *Canadian Journal of Plant Science. 80(1):169-175.* English. [Agr & Agri Food Canada 107 Sci Pl Saskatoon SK S7N 0X2 Canada].

The effects of three tillage systems, three crop rotations, and fungicide applications were evaluated on diseases of barley, wheat, canola and pea at Melfort, SK, from 1994 to 1998. During these years, reduced tillage did not increase crop losses due to diseases. Four-year rotations with higher proportions of broad-leaved crops and more crop diversity (i.e., canola, pea, flax, and barley) had higher yields than rotations with fewer broad-leaved crops and less crop diversity (i.e., canola, wheat, barley, and barley). However, these rotations did not influence the severity of septoria leaf blotch of wheat, net blotch of barley, the incidence of sclerotinia stem rot and blackleg of canola, or the severity of mycosphaerella blight of pea. Interplot interference may have been a factor influencing some diseases in plots, as the size was only 270 m(2). Fungicide application of propiconazole on Harrington barley decreased foliar disease severity and increased yield by 23%, seed weight by 13%, and kernel plumpness by 25%. Application of azoxystrobin decreased foliar disease and increased pea yield 29% and seed weight by 7% for the pea cultivars Express and Highlight. Foliar disease severity on AC Taber wheat was reduced by application of propiconazole in 2 of 4 yr, but the yield response was very inconsistent. Similarly, AC Excel canola had inconsistent disease and yield response to applications of propiconazole and benomyl, but levels of sclerotinia stem rot and blackleg were very low in all years. These results indicate that reduced tillage will not result in significantly higher levels of disease that require fungicide inputs to maintain yield. Moving from cereal-based rotations to more diverse, broad-leaved based rotations improves the yield of cereals. However, regardless of tillage or rotation, higher yields may be obtained in barley and pea with fungicides for control of leaf spot disease in susceptible cultivars. [References: 21].

1571 Bock, CH.; Cotty, PJ. (1999) **Wheat seed colonized with atoxigenic Aspergillus flavus: Characterization and production of a biopesticide for aflatoxin control.** *Biocontrol Science & Technology. 9(4):529-543.* English. [USDA ARS, So Reg Res Ctr POB 19687 New Orleans, LA 70179 USA].

Biocontrol of aflatoxin contamination using atoxigenic Aspergillus flavus to competitively exclude aflatoxin-producing strains has previously been reported and is currently in the third year of commercial-scale tests (treating 50-200 ha per annum). Wheat seed colonized with atoxigenic A. flavus has been used in the commercial trials. Requirements Sor production of this colonized wheat seed are described and the spore yield of wheat is compared to other substrates. The study suggests that the most cost-effective inoculum production would require colonization of wheat (10(6) conidia kg(-1)

of wheat seed) at 25% (w/w) moisture for 18 h at 31 degrees C. To prevent fungal growth and associated wheat aggregation in storage, seed had to be dried below, 15% (w/w) moisture, although a moisture content of 35% (w/w) did not reduce viability in sealed containers stored at 18-25 degrees C over an 8-month period. The dry biopesticide had multi-year stability without refrigeration and withstood temperatures of 70 degrees C for 20 min. Sporulation of the product occurred within 3 days at 31 degrees C and 100% relative humidity with yields averaging 4.9 x 10(9) conidia g(-1) by day 7. [References: 26].

1572 Bottalico, A. (Sassari Univ. (Italy). Istituto diPatologia Vegetale) (1998) **Fusarium diseases of cereals. Species complex and related micotoxin profiles in Europe.** *Journal of Plant Pathology (Italy) v. 80(2) p. 85-103.* 5 tables; 137 ref. English. (AGRIS 2000-023779).

1573 Braun-Kiewnick, A.; Jacobsen, BJ.; Sands, DC. (2000) **Biological control of Pseudomonas syringae pv. syringae, the causal agent of basal kernel blight of barley, by antagonistic Pantoea agglomerans.** *Phytopathology. 90(4):368-375.* English. [Montana State Univ, Dept Plant Sci 205 Ag Biosci Bldg, POB 173150 Bozeman, MT 59717 USA].

Strains of Pantoea agglomerans (synanamorph Erwinia herbicola) suppressed the development of basal kernel blight of barley, caused by Pseudomonas syringae pv. syringae, when applied to heads prior to the Pseudomonas syringae pv. syringae infection window at the soft dough stage of kernel development. Field experiments in 1994 and 1995 revealed 45 to 74% kernel blight disease reduction, whereas glasshouse studies resulted in 50 to 100% disease control depending on the isolate used and barley cultivar screened. The efficacy of biocontrol strains was affected by time and rate of application. Percentage of kernels infected decreased significantly when P. agglomerans was applied before pathogen inoculation, but not when coinoculated. A single P. agglomerans application 3 days prior to the pathogen inoculation was sufficient to provide control since populations of about 10(7) CFU per kernel were: established consistently, while Pseudomonas syringae pv. syringae populations dropped 100-fold to 2.0 x 10(4) CFU per kernel. An application to the flag leaf at EC 49 (before heading) also reduced kernel infection percentages significantly. Basal blight: decreased with increasing concentrations (10(3) to 10(7) CFU/ml) at P. agglomerans, with 107 CFU/ml providing the best control, For long-term preservation and marketability, the survival of bacterial antagonists in several wettable powder formulations was tested. Over all formulations tested, the survival declined between 10- to >100-fold over a period of 1.5 years (r = -0.7; P = 0.000). Although not significant, storage of most formulations at 4 degrees C was better for viability (90 to 93% survival) than was storage at 22 degrees C (73 to 79%). However, long-term preservation had no adverse effect on biocontrol efficacy. [References: 42].

1574 Caten, CE.; Newton, AC. (2000) **Variation in cultural characteristics, pathogenicity, vegetative compatibility and electrophoretic karyotype within field populations of Stagonospora nodorum.** *Plant Pathology. 49(2):219-226.* English. [Univ Birmingham, Sch Biosci Birmingham B15 2TT W Midlands England].

Isolates of Stagonospora nodorum, the cause of septoria leaf and glume blotch of wheat, were sampled intensively from single fields in two consecutive years and compared for growth rate, colony morphology, pathogenicity, vegetative compatibility and electrophoretic karyotype. The two populations were highly variable for all characters, even though the isolates in each population originated from a small geographical area. Studies of vegetative compatibility within each population indicated the presence of many genotypes and suggested that clonal spread was very limited. Individual lesions contained a single genotype and therefore, presumably, originated from a single unit of inoculum. However, adjacent lesions, even on the same leaf, frequently contained different genotypes. Ten isolates from population II possessed six different karyotypes, demonstrating that polymorphism for this fundamental feature of the genome occurs within field populations. The population structure revealed by these studies supports the hypothesis that ascospores play a major role in the epidemiology of the disease. On this basis, the observed variation in all the characters, including karyotype, can be explained by recombination during sexual reproduction. [References: 31].

1575 Chen Wenquan; Qin Qingming; Chen Yanglin (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1998) **Preliminarily screening of slow leaf rusting in the adult plant period of Chinese wheat cultivars.** *Southwest China Journal of Agricultural Sciences (China). Xinan Nongye Xuebao (China) v. 11(1) p. 54-61.* 3 tables; 1 ill.; 12 ref. Chinese. (AGRIS 2000-018042).

1576 Clear, RM.; Patrick, SK. (2000) **Fusarium head blight pathogens isolated from fusarium-damaged kernels of wheat in western Canada, 1993 to 1998.** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):51-60.* English. [Canadian Gain Commiss, Grain Res Lab 1404-303 Main St Winnipeg MB R3C 3G8 Canada].

Survey results from 1993 to 1998 for fungi isolated from fusarium-damaged kernels of wheat are presented. There is compelling evidence that Fusarium graminearum has recently been spreading westward from southeastern Manitoba, replacing less pathogenic Fusarium species as the principal fusarium head blight (FHB) pathogen. This movement has been accompanied by increasing economic losses from the effects of FHB. Environmental factors such as a lower average daily temperature in June and July may be influential in limiting the damage from F. graminearum in the western prairies, where F. graminearum currently is rare. However, precipitation levels at anthesis equal to those in the areas presently affected by economic levels of FHB occur in many western crop districts, suggesting that precipitation levels during the period of anthesis will likely promote further westward spread of this pathogen. The potential role of infected seed as a mechanism for long-distance dispersal of F. graminearum is considered. [References: 53].

1577 Clear, RM.; Patrick, SK.; Gaba, D. (2000) **Prevalence of fungi and fusariotoxins on barley seed from western Canada, 1995 to 1997.** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):44-50.* English. [Canadian Grain Commiss, Grain Res Lab 1404-303 Main St Winnipeg MB R3C 3G8 Canada].

To determine the mycoflora of barley seed (Hordeum vulgare) grown in western Canada, 1494 grain samples were collected over three years and combined according to year and crop district. Two hundred randomly selected seeds per crop district were tested for the presence of fungal infection by surface disinfecting then plating onto potato dextrose agar. At least 70 species representing 40 fungal genera were identified. Levels of Alternaria alternata, Bipolaris sorokiniana, and Fusarium graminearum were highest in the eastern prairies, whereas Cladosporium species, Drechslera teres, and Stagonospora nodorum were highest in samples from the western prairies. In 1996 and 1997, composite samples were analyzed by mass spectrometry for the presence of eight fusariotoxins. Deoxynivalenol levels greater than or equal to 0.05 ppm were found in samples from 7 of 10 Manitoba crop districts and 1 of 19 Saskatchewan crop districts in 1996, and from 8 of 11 Manitoba and 1 of 20 Saskatchewan crop districts in 1997. Detectable levels of 15-O-acetyl-4-deoxynivalenol were present in samples from two Manitoba crop districts in 1996 and four in 1997. [References: 31].

1578 Clover, G.; Henry, C. (1999) **Detection and discrimination of wheat spindle streak mosaic virus and wheat yellow mosaic virus using multiplex RT-PCR.** *European Journal of Plant Pathology. 105(9):891-896.* English. [Minist Agr Fisheries & Food, Cent Sci Lab York YO41 1LZ N Yorkshire England].

Wheat spindle streak mosaic virus (WSSMV) and wheat yellow mosaic virus (WYMV) are two closely related bymoviruses which cause significant yield losses in wheat. There is no molecular diagnostic protocol available for either virus nor are serological methods able to discriminate them. A multiplex reverse transcription-polymerase chain reaction (RT-PCR) protocol was developed for their detection and discrimination. Twenty-three isolates of WSSMV and WYMV were collected from a range of countries and the sequence of 834-837 nucleotides of the coat protein gene of three representative

WSSMV isolates and one WYMV isolate was determined. This sequence data provided further evidence that the two viruses are distinct species and was used together with previously published sequence data to design specific oligonucleotide primers to discriminate the two viruses. Using total RNA isolated from eighteen WSSMV and five WYMV isolates in either one-step or two-step RT-PCR, these primers were shown to detect and discriminate the two viruses reliably. The primers were specific to either WSSMV or WYMV and no PCR product was obtained with either soil-borne wheat mosaic virus, which is frequently associated with both diseases, or with the closely related viruses, barley yellow mosaic virus, barley mild mosaic virus or oat mosaic virus. This new diagnostic protocol will enable more effective management of the diseases caused by these viruses by enabling correct identification of the causal pathogen and earlier detection than is possible by serological methods. [References: 18].

1579 Datta, R.; Rajebhosale, MD.; Dhaliwal, HS.; Singh, H.; Ranjekar, PK.; Gupta, VS. (2000) **Intraspecific genetic variability analysis of Neovossia indica causing Karnal bunt of wheat using repetitive elements.** *Theoretical & Applied Genetics. 100(3-4):569-575.* English. [Natl Chem Lab, Div Biochem Sci, Plant Mol Biol Unit Poona 411008 Maharashtra India].

Neovossia indica (Tilletia indica), causing Karnal bunt of wheat, affects major wheat growing regions all over the world. Karnal bunt ranks as one of the major diseases of wheat causing quality losses and monetary losses due to international quarantine regulations. The present work is the first report of a genetic diversity analysis of Indian isolates of N. indica. A library of N. indica isolate Ni7 was constructed in a lambda ZAPII system, and three repetitive elements were identified for molecular analysis. These repetitive elements generated complex hybridization profiles producing fingerprint patterns of all seven isolates. Copy-number estimation of these three elements, pNiR9, pNiR12 and pNiR16 indicated the presence of 32, 61 and 64 copies, respectively. Cluster analysis based on hybridization patterns grouped together moderately virulent isolates Nil, Ni7 and Ni8, thus suggesting a positive correlation between virulence typing and cluster analysis based on molecular data. Variability analysis of N. indica isolates will aid in checking new resistant sources in host germplasm. [References: 42].

1580 Deng Yuanlu; Liu Xian (Dachuan Prefectural Station of Plant Protection, Sichuan (China)) (1999) **A study on forecast of wheat ear scab in east Sichuan east [China].** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 21(1) p. 33-36.* 3 tables; 3 ref. Chinese. (AGRIS 2000-018044).

1581 Dmitriev, AP.; Lisker, IS.; Konovalova, GS.; Soloviev, SV. (1999) **Photometric method of determination of resistance of cereals to diseases.** *Mikologiya i Fitopatologiya. 33(6):412-420.* Russian. [All Russian Plant Protect Res Inst St Petersburg Russia].

The study of chlorophyll content in infected and healthy leaves of wheat and barley seedlings was conducted using the laser photometer <<LAFOT>>. It was measured by absorption degree of laser radiation on a wave 632.8 nm by leaves of living seedlings. The received data have shown the possibility to work up a simple, fast and effective techniques of the estimation of wheat tolerance to brown rust, wheat resistance to snow mold and barley resistance to rhynchosporiosis. [References: 32].

1582 Duffy, B. (2000) **Combination of pencycuron and Pseudomonas fluorescens strain 2-79 for integrated control of rhizoctonia root rot and take-all of spring wheat.** *Crop Protection. 19(1):21-25.* English. [ETH Zurich, Inst Plant Sci, Phytopathol Grp CH-8092 Zurich Switzerland].

Pencycuron (tradename Monceren(R), a fungicide developed specifically to control Rhizoctonia) was evaluated for in vitro growth inhibition of wheat pathogenic Rhizoctonia spp., Gaeumannomyces graminis var. tritici and Pythium spp., and for control of wheat root diseases in greenhouse trials. In the greenhouse, pencycuron inhibited binucleate Rhizoctonia, R. oryzae, or R. solani in vitro and reduced Rhizoctonia root rot. Pencycuron also inhibited G. graminis var. tritici strains in vitro and slightly reduced take-all disease in the greenhouse. Moreover, pencycuron seed treatment protected plants against a disease mixture of Rhizoctonia root rot and take-all. Pythium spp. were not inhibited by pencycuron in vitro. Pencycuron did not adversely affect seedling emergence, nor did it inhibit rhizosphere colonisation by Pseudomonas fluorescens biocontrol strain 2-79. Combined application of the fungicide and strain 2-79 to seed was more effective than either treatment alone for controlling disease. [References: 19].

1583 Duveiller, E.; Garcia, Altamirano, I. (2000) **Pathogenicity of Bipolaris sorokiniana isolates from wheat roots, leaves and grains in Mexico.** *Plant Pathology. 49(2):235-242.* English. [CIMMYT, Wheat Program Lisboa 27, Apdo Postal 6-641 Mexico City 06600 DF Mexico].

Pathogenicity of 27 Bipolaris sorokiniana isolates from roots, leaves and grains of spring wheat, collected at a site in Mexico, showed no clear differences between groups of isolates, based on lesion density after seedling inoculation of the susceptible cultivar Ciano T-79 under controlled conditions. Results were variable when tests were repeated over time or in experiments using a smaller number of isolates. The lesion number per leaf was significantly different depending on the isolate used for inoculation, irrespective of the plant part group. No difference was found between individual isolates when pathogenicity was assessed using a disease severity scale. No cultivar-isolate interaction was observed for lesion density when 12 isolates were tested on six cultivars, but there were some significant differences between cultivars and between isolates. Results obtained confirmed that infection by B. sorokiniana is highly variable, and very sensitive to environmental conditions. In this study no physiological specialization was observed. The fungus appeared as a continuum of isolates differing in aggressiveness. This work was conducted with isolates from a single site, and highlights the need to assess carefully the biological significance of any differences observed among B. sorokiniana isolates. [References: 39].

1584 Fernandez, M.R. (Agriculture and Agri Food Canada, Swift Current, Sask. (Canada). Semiarid Prairie Agricultural Research Centre); McConkey, B.G.; Zentner, R.P. (1999) **Effects of tillage method and fallow frequency on leaf spotting diseases of spring wheat in the semiarid Canadian prairies.** *Soil and Tillage Research (Netherlands) v. 50(3-4) p. 259-269.* 38 ref. English. (AGRIS 2000-018040).

1585 Geagea, L.; Huber, L.; Sache, I.; Flura, D.; McCartney, HA.; Fitt, BDL. (2000) **Influence of simulated rain on dispersal of rust spores from infected wheat seedlings.** *Agricultural & Forest Meteorology. 101(1):53-66.* English. [INRA, Unite Rech Bioclimatol BP 01 F-78850 Thiverval Grignon France].

Spores of both Puccinia recondita f sp, tritici and P striiformis (brown rust and yellow rust of wheat) are thought to be primarily dispersed by wind. The results of experiments, using a rain simulator with uniform drop sizes (2.5, 3.4, 4.2 or 4.9 mm), on the effect of rain on dispersal of brown (leaf) rust and yellow (stripe) rust spores are reported. Experiments on both pathogens were done in still air; additional experiments were done on brown rust with simulated wind and rain. Spore dispersal was estimated by trapping spores on wheat plants and assessing the disease symptoms which subsequently developed under optimum conditions. Simulated rainfall of each the four drop sizes tested dispersed spores of both pathogens. In still air spore dispersal patterns were similar to those usuary found for pathogens which are characteristically splash-dispersed. Rain exhausted the source of spores in about 20 min for the four drop sizes. When the plants were kept under optimal conditions for sporulation, the source of brown rust spores available for dispersal was restored to its initial numbers in about 2 h after depletion. For yellow rust, spore numbers in the source had not been restored to their original value after 6 h, even under optimal conditions. In the wind tunnel experiments, simulated rain did not inhibit the dispersal of brown rust spores by wind. Large incident drops dispersed more spores of both pathogens than small drops. A simulation study based on the experimental relationships obtained was done. Although these experiments clearly show that rainfall has the potential to spread both

brown rust and yellow rust of wheat, the understanding of the exact role of rain dispersal in the epidemiology of both diseases requires further investigation. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 35].

1586 Gilbert, J.; Tekauz, A. (2000) **Review: Recent developments in research on fusarium head blight of wheat in Canada [Review].** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):1-8.* English. [Agr & Agri Food Canada, Cereal Res Ctr 195 Dafoe Rd Winnipeg MB R3T 2M9 Canada].

The recent increase in prevalence and severity of fusarium head blight (FHB), in cereals in Canada and elsewhere, has caused hardship and economic loss to producers and the grain industry. This review emphasizes Canadian contributions, but incorporates studies from North America to put that research into perspective. Since the reviews of Sutton in 1982 and Miller in 1994, significant advances in our understanding of the epidemiology of the disease have occurred that are fundamental to the development of appropriate management strategies. Also, we now better understand the genetics of resistance in wheat and there is a consensus that resistant cultivars will provide the most stable and durable solution to the problem of FHB. Our knowledge of the genetic basis of resistance in wheat, and the development of molecular markers to facilitate early generation selection for resistance to FHB, are essential tools to this end. Resistant cultivars will ensure stable yields and high-quality grain free of mycotoxins. [References: 85].

1587 Hare, MC.; Parry, DW.; Baker, MD. (1999) **The relationship between wheat seed weight, infection by Fusarium culmorum or Microdochium nivale, germination and seedling disease.** *European Journal of Plant Pathology. 105(9):859-866.* English. [Harper Adams Univ Coll, Crop & Environm Res Ctr Newport TF10 8NB Shrops England].

The distribution of seeds by weight for three lots of winter wheat cv. Avalon infected by Fusarium culmorum and three lots of winter wheat cv. Riband infected by Microdochium nivale was determined. The distribution of infected seeds within each seed lot was then determined by isolating F. culmorum from seeds on moist filter paper and M. nivale from seeds on potato dextrose agar. The distribution of M. nivale infected seeds between seeds of different weight was similar to that of the seed lot as a whole, whereas the distribution of F. culmorum was greater in light seeds than heavy seeds. The percentage germination of infected seeds decreased with seed weight. A similar situation was found with respect to seedling emergence in compost for F. culmorum infected seeds. However, with M. nivale infection, similar numbers of seedlings emerged from both light and heavy infected seeds. Seed treatment with guazatine increased seedling emergence for both light and heavy seed infected by M. nivale. However, seedling emergence from F. culmorum infected seed was poor even following treatment with guazatine. Poor emergence was most evident from light seed. [References: 23].

1588 Huang Guohong (Hebei Agricultural Univ., Baoding (China). Dept. of Plant Protection) (1999) **A comparative histopathological study of the expression of Lr9, Lr29 and Lr27 alleles for low reaction resistance to wheat leaf rust.** *Journal of Agricultural University of Hebei (China). Hebei Nongye Daxue Xuebao (China) v. 22(1) p. 54-59.* 9 tables; 14 ref. Chinese. (AGRIS 2000-018038).

1589 Jacobs, AS.; Pretorius, ZA.; Coutinho, TA. (2000) **Quantification of early infection structures of Puccinia recondita f. sp tritici in wheat with leaf rust resistance derived from Triticum monococcum.** *South African Journal of Science. 96(2):86-90.* English. [Univ Orange Free State, Dept Plant Pathol POB 339 ZA-9300 Bloemfontein South Africa].

Using scanning electron microscopy, the formation of Puccinia recondita f. sp. tritici infection structures was studied in the Triticum aestivum line KS93U9 (pedigree: Karl(star)3//Pl266844/Pl355520), Karl (a leaf rust-susceptible bread wheat cultivar) and the T. monococcum lines Pl266844, Pl355520 and Tm2126/5. Leaf sections infected with pathotype UVPrt9 of P. recondita f. sp. tritici were sampled 6, 12, 24, 36 and 48 h after inoculation. Infection structures were classified according to the following categories: germ tubes not forming appressoria, appressoria formed over stomata and elsewhere on the leaf surface, substomatal and aborted vesicle initials, substomatal and aborted vesicles, primary infection hyphae with and without haustorium mother cells, and secondary infection hyphae, with and without haustorium mother cells. Indications of variable fungal behaviour on the leaf surface were observed among lines. KS93U9 and Tm2126/5 responded similarly in the occurrence of aborted infection structures at most sampling times. Fewer aborted substomatal vesicles or their initials, and more secondary hyphae with haustorium mother cells, were observed in the leaf rust-susceptible cultivar Karl and the T. monococcum lines Pl266844 and Pl355520. Based on the frequency of aborted substomatal vesicles or their initials, the onset of leaf rust resistance appeared to be as early as 6 h post-inoculation in KS93U9 and Tm2126/5. However, vesicle abortion occurred more commonly in these lines between 12 and 48 h post-inoculation. Scanning electron microscopy of epidermal strips allowed a precise determination of early infection structures of P. recondita f. sp. tritici. [References: 33].

1590 Joergensen, L.N.; Nielsen, G.C. (1999) **[Septoria in wheat; alternative control methods].** Danmarks Jordbrugsforskning, Foulum (Denmark). *Groen Viden. Markbrug (Denmark); no. 216 8 p.* DJF. 13 ill., 6 tables. Danish. (AGRIS 2000-023849).

1591 Joergensen, L.N.; Rasmussen, G.; Olsen, C.C.; Olesen, J.E.; Jensen, L.S. (1999) **[Influence of nitrogen on diseases and weeds in winter wheat].** Danmarks Jordbrugsforskning, Foulum (Denmark). *Groen Viden. Markbrug (Denmark); no. 213 8 p.* DJF. 5 ill., 4 tables. Danish. (AGRIS 2000-023848).

1592 Jonczyk, K. (Institute of Soil Science and Plant Cultivation, Pulawy (Poland). Dept. of Systems and Economics of Crop Production) (1999) **Effectiveness of chemical diseases control in winter wheat and rye cultivation.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 151-158.* 4 tables; 17 ref. Polish. (AGRIS 2000-018041).

The three series of experiments with winter wheat were conducted in the years 1987-98 and one with rye in the 1990-94. The experiments were placed in different regions of the country on the good wheat and good rye soils. The objective of this study was to evaluate the effectiveness of chemical diseases control in winter wheat and rye cultivation in dependence on number of fungicide spraings. The chemical diseases control in tree terms was very effective both for control treatments (without fungicides) and for treatment with one spraying in a stage of earning.

1593 Jorgensen, JH.; Bech, C.; Jensen, J. (2000) **Reaction of European spring barley varieties to a population of the net blotch fungus.** *Plant Breeding. 119(1):43-46.* English. [Riso Natl Lab, Plant Genet Plant Biol & Biogeochem Dept POB 49 DK-4000 Roskilde Denmark].

About 320 European spring barley varieties and about 40 spring barley lines were tested in the field for reaction to a local population of the spot form of the net blotch fungus Pyrenophora teres forma maculata with the imperfect stage Drechslera ter es. The European barley varieties showed a wide range of disease reactions, from nearly resistant to very susceptible. At least three groups of genetically related barley varieties could be distinguished: (1) 'Agneta' and 'Clermont', (2) 'Nordal' and 'Arve', and (3) 'Tellus', 'Pamina', 'Albert' and 'Birka'. The parentages of these three groups of barley are mutually distantly related and may thus constitute three different sources of resistance to the pathogen population used. The range of disease reaction is similar in Varieties from different European countries but it differs among different breeding stations. The relatively high level of resistance is fairly uniformly distributed in contemporary barley varieties all over most of Western Europe. Over time, from about 1830-1982, the average level of resistance varied around 4.0 (scale value) (from 2.8 to 4.8). However, since about 1940 the variation in disease reaction has become much wider (from 1.8 to 6.9) for unknown reason(s). [References: 12].

1594 Kettlewell, PS.; Cook, JW.; Parry, DW. (2000) **Evidence for an osmotic mechanism in the control of powdery mildew disease of wheat by foliar-applied potassium chloride.** *European Journal of Plant Pathology. 106(3):297-300.* English. [Harper Adams Univ Coll, Crop & Environm Res Ctr Newport TF10 8NB Shrops England].

The mechanism by which foliar application of potassium chloride solution reduces symptoms of powdery mildew disease (Erysiphe graminis f.sp. tritici) of wheat was investigated. The hypothesis that potassium chloride reduces mildew by an osmotic effect on spore germination was tested in three glasshouse experiments. Either potassium chloride solution or the osmoticum polyethylene glycol 200 was sprayed on wheat at the three- or four-leaf stage. The plants were inoculated with spores and spore germination and leaf area affected by mildew were assessed. Leaf water potential was determined as a measure of the osmotic effect of the treatments. Spore germination and leaf area affected by mildew were related to leaf water potential using regression analysis in groups on the data averaged over the three experiments. Both spore germination on the leaf and leaf area affected by mildew were reduced as leaf water potential decreased. There was no difference between potassium chloride or polyethylene glycol in the relationship between spore germination and leaf water potential, but polyethylene glycol was slightly less effective at reducing mildew symptoms at any given leaf water potential. The results are compatible with the hypothesis that potassium chloride reduces symptoms of powdery mildew by an osmotic effect on spore germination. [References: 9].

1595 Khairullin, RM.; Yusupova, ZR.; Maksimov, IV. (2000) **Protective responses of wheat treated with fungal pathogens: 1. Interaction of wheat anionic peroxidases with chitin, chitosan, and thelyospores of Tilletia caries.** *Russian Journal of Plant Physiology. 47(1):97-102.* English. [Russian Acad Sci, Bashkirian Res Ctr, Dept Biochem & Cytol Pr Oktyabrya 69 Ufa 450054 Bashkortostan Russia].

Active anionic isoenzymes of peroxidase (AP) in the roots and coleoptiles of wheat seedlings were shown to directly bind to chitin and chitosan in 100 mM Na-phosphate buffer, pH 6.4. Upon exhaustive deacetylation, chitin loses its ability to bind wheat AP. The fact that chitin is a component of the cell wall of phytopathogenic fungi suggested that AP can bind to the surface cellular structures of these microorganisms. Bulk chromatography showed that APs of wheat seedlings can bind to both ungerminated and germinated thelyospores of the pathogen of stinking smut (Tilletia caries (DC.) Tul). On the basis of our data, the mechanisms are suggested for AP participation in protective responses of wheat plants affected by phytopathogenic fungi. [References: 24].

1596 Khairullin, RM.; Yusupova, ZR.; Troshina, NB. (2000) **Protective responses of wheat treated with fungal pathogens: 2. Activation of anionic peroxidase isoforms in wheat seedlings induced by inoculation with Tilletia caries spores.** *Russian Journal of Plant Physiology. 47(1):103-108.* English. [Russian Acad Sci, Bashkirian Res Ctr, Dept Biochem & Cytol Pr Oktyabrya 69 Ufa 450054 Bashkortostan Russia].

A comparative analysis was conducted of peroxidase isoenzymes from the apical and basal zones of roots and coleoptiles of 4-day-old etiolated seedlings of wheat (Triticum aestivum L.), cv. Zarya, resistant to stinking smut (the gene BtZ) and cv. Zhnitsa, susceptible to this pathogen. The activity of anionic isoenzymes of peroxidase (AP) including those binding to chitin (chitin-specific) was related to the processes of growth and tissue differentiation, In the basal zone of the root and coleoptile of seedlings, in both resistant and sensitive cultivars, AP was activated following infection by the fungus Tilletia caries (DC.) Tul. In the resistant cultivar, AP activity was elevated owing to the isoforms AP1 and AP2, which were bound to chitin; in the susceptible cultivar, at the expense of AP isoforms, which do not bind chitin, the activity of chitin-specific AP1 decreased. [References: 19].

1597 Kokko, EG.; Conner, RL.; Lee, B.; Kuzyk, AD.; Kozub, GC. (2000) **Quantification of common root rot symptoms in resistant and susceptible barley by image analysis.** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):38-43.* English. [Agr & Agri Food Canada, Lethbridge Res Ctr POB 3000 Lethbridge AB T1J 4B1 Canada].

A series of tests were carried out to determine the effect of common root rot, caused by Cochliobolus sativus, on root growth and discolouration in the moderately resistant cv. Bonanza and the susceptible cv. Gateway of barley. An image analyser was used to quantify the growth and discolouration (mesa intensity) of the roots and the subcrown internode (SCI) of individual plants. The plants were also visually rated for root rot severity and their root dry weight was determined. In the absence of disease, no differences in root discolouration or growth were observed between the two barley cultivars. In plants grown in naturally infested soil, visual root rot ratings and mean intensity values indicated that the SCIs of Bonanza were less discoloured than those of cv. Gateway. Tn cu, Gateway, higher levels of disease were usually associated with a smaller root system than in cv. Bonanza, bur the effect was significant ($P < 0.01$) only in the first experiment. The root system of cv. Gateway had lower ($P > 0.05$) mean intensity values (i.e., darker) than those of cv. Bonanza in the first experiment. Seedling emergence of cv. Gateway was lower in naturally infested soil than in fumigated soil, but this was not evident in cv. Bonanza. There was a strong inverse relationship between the mean intensity and visual rating of the SCI and a positive association between coral root area as measured using image analysis and root weight. Image analysis also determined that in the severe root rot category, plants of cv. Gateway had SCIs that were more discoloured than those of cv. Bonanza. Discolouration of the SCI of root rot susceptible barley appeared to adversely influence the growth and discolouration of the root system, but this effect was not always significant. [References: 23].

1598 Kolmer, JA.; Liu, JQ. (2000) **Virulence and molecular polymorphism in international collections of the wheat leaf rust fungus Puccinia triticina.** *Phytopathology. 90(4):427-436.* English. [N Carolina State Univ, USDA ARS, Dept Plant Pathol Raleigh, NC 27607 USA].

Collections of Puccinia triticina, the wheat leaf rust fungus, were obtained from Great Britain, Slovakia, Israel, Germany, Australia, Italy, Spain, Hungary, South Africa, Uruguay, New Zealand, Brazil, Pakistan, Nepal, and eastern and western Canada. All single-uredinial isolates derived from the collections were tested for virulence polymorphism on 22 Thatcher wheat lines that are near-isogenic for leaf rust resistance genes. Based on virulence phenotype, selected isolates were also tested for randomly amplified polymorphic DNA (RAPD) using 11 primers. The national collections were placed into 11 groups based on previously established epidemiological zones. Among the 131 single-uredinial isolates, 105 virulence phenotypes and 82 RAPD phenotypes were described. In a modified analysis of variance, 26% of the virulence variation was due to differences in isolates between groups, with the remainder attributable to differences within groups. Of the RAPD variation, 36% was due to differences in isolates between groups. Clustering based on the average virulence distance (simple distance coefficient) within and between groups resulted in eight groups that differed significantly. Collections from Australia-New Zealand, Spain, Italy, and Britain did not differ significantly for virulence. Clustering of RAPD marker differences (1 - Dice coefficient) distinguished nine groups that differed significantly. Collections from Spain and Italy did not differ significantly for RAPD variation, neither did collections from western Canada and South America. Groups of isolates distinguished by avirulent/virulent infection types to wheat lines with resistance genes Lr1, Lr2a, Lr2c, and Lr3 also differed significantly for RAPD distance, showing a general relationship between virulence and RAPD phenotype. The results indicated that on a worldwide level collections of P. triticina differ for virulence and molecular backgrounds. [References: 28].

1599 Liu, CH.; Shang, HS.; Tan, RX. (2000) **Infection process of take-all causing fungus (Gaeumannomyces graminis var tritici) on wheat (Triticum aestivum) and oat (Avena sativa) roots.** *Indian Journal of Agricultural Sciences. 70(1):23-27.* English. [Nanjing Univ, Sch Life Sci, Dept Biol Sci & Technol Nanjing 210093 Peoples R China].

The infection process of take-all causing fungus Gaeumannomyces graminis (Sacc.) Arx & Oliver var tritici J. Walker on the seminal roots of wheat (Triticum aestivum L. emend Fiori and Paol.) and oat (Avena sativa L.), cultured at 15+/-1 degrees C under 12 hr intervals of light and dark, was shown by microscopic observations to consist of 4 stages, viz pre-infection, invasion of epidermis, invasion of cortex and invasion of stele stages. In the pre-infection stage, fungus spreads mainly as runner hyphae on the root and root hair surface, Sister hyphae matted and brown kidney- or fork-shaped hyphopodia formed on wheat and oat roots were observed, respectively. After 48 hr (wheat) and 120 hr (oat) of inoculation, the runner hyphae producing hyaline infection hyphae penetrated into the epidermal cells of roots through intercellular spaces. However, the invasion of infection hyphae on oat roots was hindered. After 60 hr (wheat) and 132 hr(oat) of inoculation, the take-all fungus penetrated epidermal cells into the cortical cells and spread radially in the cortex. Some infection hyphae in the cortex of oat roots were dissolved. After 120 hr (wheat) and 240 hr (oat) of inoculation, G. graminis var tritici reached stele tissue resulting in the blockage of the vascular cells and making the transport system abnormal. [References: 14].

1600 Mao Jianhui; Yang Jiaxiu; Li Yunpeng (Sichuan Academy of Agricultural Sciences, Chengdu (China). Inst. of Plant Protection) (1999) **Studies on dynamics and controlling techniques of wheat stripe rust in Sichuan [China].** *Journal of Southwest Agricultural University (China). Xinan Nongye Daxue Xuebao (China) v. 21(1) p. 27-32.* 2 tables; 4 ref. Chinese. (AGRIS 2000-018043).

1601 Matthies, A.; Buchenauer, H. (2000) **Effect of tebuconazole (Folicur (R)) and prochloraz (Sportak (R)) treatments on Fusarium head scab development, yield and deoxynivalenol (DON) content in grains of wheat following artificial inoculation with Fusarium culmorum.** *Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz-Journal of Plant Diseases & Protection. 107(1):33-52.* English. [Univ Hohenheim, Inst Phytomed D-70593 Stuttgart Germany].

The effectiveness of the fungicides Folicur(R) (a. i. tebuconazole) and Sportak(R) (a. i. prochloraz) applied either separately or in combination was tested in field experiments in 1995 and 1996 against Fusarium head scab. Wheat plants were inoculated artificially with a conidia suspension (5 x 10(5) spores . ml(-1)) of Fusarium culmorum (isolate F. c. 46) mid of flowering (GS 65). Besides the development of Fusarium head scab, grain yield, thousand-grain weight (TGW) and deoxynivalenol (DON) content in the grain were determined. In 1995, head scab diseases in infected control plants of the cv. 'Greif' continuously increased until 26 days after inoculation (dpi) and reached a disease index of 7.9. All Folicur(R) and Sportak(R) treatments reduced disease severity compared to the infected control. The early postinfectional applications (2 dpi; GS 65) proved to be most effective. Folicur(R) diminished disease severity by 56 % and Sportak(R) by 41 %. The early preinfectional (8 dai; GS 60) and the late postinfectional (9 dpi, GS 69) applications were less effective. The fungicide treatments resulted in higher grain yields as compared to the inoculated control. The early postinfectional (2 dpi: CS 65) application affected yield more than the late postinfectional (9 dpi: GS 69) and the early preinfectional Fungicide treatments. The TGWs showed similar tendencies as the grain yields. The severe Fusarium head scab symptoms in cv. 'Greif of the inoculated control variant were associated with a high DON content (27 mg.kg(-1)) in the grain. The DON contents in the grain of the fungicide-treated variants were reduced related to the inoculated control; the most distinct reduction by 71 % was obtained by the combined treatment 2 dpi. In 1996, field experiments with the two winter wheat cvs. 'Kontrast' and 'Pegassos' on two different sites were carried our. Both fungicides were applied exclusively 2 dpi. At the site Karlshof, the more sensitive cv, 'Kontrast' exhibited 31 dpi a disease incidence of 91 % and a disease index of 6.1; the less sensitive cv. 'Pegassos' showed a disease incidence of 67 % and a disease index of 4.4. Of tbe fungicide treatments, the combined application suppressed disease development most effectively; the disease incidence of the cvs. 'Kontrast' and 'Pegassos' was diminished by 52 and 64 %, respectively; the disease index in both cultivars was 2.8. Fusarium head scab reduced in both cultivars the grain yield by 29 % as compared to the not inoculated control. Folicur(R) treatments increased grain yields in the cvs. 'Kontrast' and 'Pegassos' by and 22 %, respectively, and Sportak(R) applications by 17 and 18 %. The combined treatment resulted in the highest yield increases: 31 % in cv. 'Kontrast' and 29 % in cv. 'Pegassos'. DON contents in the grain of the cv. 'Kontrast' and 'Pegassos' were 11.77 and 8.11 mg . kg(-1), respectively. Single Folicur(R) treatments diminished DON content in the grain as compared to the infected control in the cvs. 'Kontrast' and 'Pegassos' by 55 and 49 %, respectively; Sporcak(R) treatments by 43 and 42 % and the combined applications by 61 and 62 %. Similar results were obtained with both cultivars on the field site Neuhausen. The studies indicate that fungicide treatments may nor always bt sufficient to reduce both Fusarium head slab and trichothecene contaminations in the grain of wheat. Research demands include e. g., improving predictions of infection probabilities, fungicide formulations and application techniques as well as combining trichothecene biosynthesis inhibitors with fungicides. [References: 59].

1602 McCallum, BD.; Harder, DE.; Dunsmore, KM. (2000) **Stem rusts on wheat, barley, and oat in Canada in 1998.** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):23-28.* English. [Agr & Agri Food Canada, Cereal Res Ctr 195 Dafoe Rd Winnipeg MB R3T 2M9 Canada].

Severities of the stem rusts of wheat and barley [Puccinia graminis f. sp. tritici] and oat [P. graminis f. sp. avenae] were light in Canada in 1998. Sixteen different pathotypes were identified from 151 P. g. tritici isolates, and 4 pathotypes were identified from 105 P. g. avenae isolates. The majority of P. tritici isolates from wheat were collected in Alberta and British Columbia, where the pathotype QFCSR made up 78% of the isolates. The majority of P. g. tritici isolates from barley were collected in Manitoba, where RCRSK made up 63% of the isolates. All P. g. tritici isolates were virulent to Sr5, Sr21, Sr9g, and Sr9d and avirulent to Sr22, Sr24, Sr25, Sr26, Sr27, Sr29, Sr30, Sr31, Sr32, Sr33, Su37, and Sr40, a series of resistant lines, and commonly grown bread and durum wheat varieties. Most P. g. avenae isolates from both cultivated and wild oat were NA29. A pathotype new to western Canada, NA67, was identified that has combined virulence to Pg13, Pg9, and Pg2. It constituted 15% of isolates from wild oat and 27% of isolates from cultivated oat and is virulent to the commonly grown oat cultivars in western Canada. [References: 11].

1603 Mikhailov, LA.; Prigorovskaya, TI. (2000) **Yellow leaf spot of wheat - Pyrenophora tritici-repentis [Review].** *Mikologiya i Fitopatologiya. 34(1):7-16.* Russian. [All Russian Plant Protect Inst St Petersburg Russia].

Tan spot or yellow leaf spot caused by Pyrenophora tritici-repentis occurs worldwide and has become economically important disease of wheat in Russia (Northern Caucasus) in recent years. Present review covers issues of disease symptoms, fungal life cycle and morphology, toxin-production, genetical diversity for virulence and other genetic markers, development of infection into plant tissue and genetic control of resistance to disease. [References: 70].

1604 Moon, JS.; Allen, RG.; Domier, LL.; Hewings, AD. (2000) **Molecular and biological characterization of a trackable Illinois isolate of Barley yellow dwarf virus-PAV.** *Plant Disease. 84(4):483-486.* English. [Univ Illinois, Dept Crop Sci 1102 S Goodwin Ave Urbana, IL 61801 USA].

In consecutive annual statewide surveys of the incidence of Barley yellow dwarf viruses (BYDVs) in Illinois wheat and oat fields, 27 BYDV-PAV-like isolates were identified. Using polymerase chain reaction (PCR), the coat protein regions of all 27 isolates were analyzed for restriction fragment length polymorphisms. The PCR products of two isolates, one from each year, had restriction fragment profiles after digestion with HaeIII that differed from the other isolates. The nucleotide sequences of the coat protein regions of a laboratory isolate, BYDV-PAV-IL (PAV-IL), two of the isolates with the common restriction profile, and the two isolates with polymorphic profiles were more than 98% identical. The relatively rare isolate identified during the first year was designated BYDV-PAV-DK1 (PAV-DK1) and further characterized biologically. PAV-DK1 and PAV-IL did not differ significantly in symptom expression, but did differ significantly in rates of transmission by two of the three

biotypes of Rhopalosiphum padi examined. Since PAV-DK1 does not occur in high levels in the state of Illinois, and its PCR products have a unique restriction enzyme profile, it has the potential to be used as a traceable isolate in field epidemiological experiments. [References: 22].

1605 Newton, AC.; Guy, DC.; Gaunt, RE.; Thomas, WTB. (2000) **The effect of powdery mildew inoculum pressure and fertilizer levels on disease tolerance in spring barley.** *Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz-Journal of Plant Diseases & Protection. 107(1):67-73.* English. [Scottish Crop Res Inst Dundee DD2 5DA Scotland].

The effect of inoculum pressure on disease tolerance was studied on a range of spring barley genotypes by manipulating the quantity of spores being deposited on field plots from surrounding plots. Genotypes included previously selected tolerant and non-tolerant types and the modifying effects of fertilizer levels were also studied. Under low fertilizer and 'normal' inoculum pressure and especially high fertilizer and high inoculum pressure conditions, where host and pathogen development were likely to be near equilibrium, designation of barley genotypes as tolerant or non-tolerant was more reliable than under the other conditions tested. Single trials were not reliable for designating tolerance. [References: 13].

1606 Nielsen, M.N. (1999) **Pseudomonas fluorescens as a biological control agent toward root pathogens in sugar beet: Studies of endochitinase and metabolite production [including 4 manuscripts].** Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). KVL. 5 ill., 104 ref. 65 p. English. (AGRIS 2000-023772).

1607 Nolan, S.; Cooke, BM.; Monahan, FJ. (1999) **Studies on the interaction between Septoria tritici and Stagonospora nodorum in wheat.** *European Journal of Plant Pathology. 105(9):917-925.* English. [Univ Coll Dublin, Dept Environm Resource Management Dublin 4 Ireland].

Interactions between Stagonospora nodorum and Septoria tritici were studied. Results from a detached glume experiment indicated that the interaction may be isolate-dependent, as it was shown that the interaction between the two pathogens may be beneficial or antagonistic depending on the isolate of each pathogen present. The number of spores produced by both pathogens was significantly greater when an aggressive isolate of S. tritici was mixed with a non-aggressive isolate of S. nodorum, whereas the number of spores produced by both pathogens was significantly less when two non-aggressive isolates were mixed. There was a significant reduction in disease level when S. tritici was applied prior to S. nodorum, compared to vice versa in the growth chamber. Results from growth chamber and field studies showed that S. nodorum produced significantly more spores when both pathogens were present together. It is concluded that S. tritici has a stimulatory effect on spore production by S. nodorum. However, there was a reduction of S. tritici spores observed in the dual inoculation treatments, suggesting that S. nodorum inhibits S. tritici. [References: 28].

1608 Pancaldi, D. (Bologna Univ. (Italy). Dipartimento di Protezione e Valorizzazione Agroalimentare); Canestrale, R. (Centro Ricerche Produzioni Vegetali (CRPV), Cesena, Forli (Italy)) (1992) **[The plant protection [Triticum - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 40-45.* 3 tables. Italian. (AGRIS 2000-018034).

1609 Plazek, A.; Skrzypek, E.; Zur, I. (2000) **The change of heat emission and phenolic compound level in Hordeum vulgare (L.) and Festuca pratensis (Huds.) calli treated with Bipolaris sorokiniana (Sacc.) shoem. phytotoxins.** *Journal of Agronomy & Crop Science-Zeitschrift fur Acker und Pflanzenbau. 184(1):17-21.* English. [Agr Univ Krakow, Fac Agr, Dept Plant Physiol Podluzna 3 PL-30239 Krakow Poland].

The presented work was conducted on calli of spring barley and meadow fescue that differed in degree of sensitivity to leaf spot pathogen Bipolaris sorokiniana. Callus reaction to fungus phytotoxins was examined on the basis of the amount of total phenolics and heat emission. The study was conducted dynamically - the measurements were performed after 1, 3, 6, 10, 24, 48, 72, 168 and 240 h after the moment when the calli were elicited with fungus metabolites. The greatest metabolic activity of fescue calli was observed between the 6th and the 24th h after treatment with phytotoxins and amounted to 170 % of control values. On the 10th day of culture this activity dramatically decreased in comparison with control (17 %). In the case of barley calli, increased heat emission was registered during the first 10 h of pathogenesis (130-150 % of control values). Calli of both studied plant 150 % species also differed in the dynamics of phenolic content changes. In meadow fescue tissue a significant decrease in phenolic level in comparison with control (40 %) was observed after the 7th day of experiment. In barley calli the amount of total phenolics decreased within the first 3 h (60-70 % of control). The results obtained show that spring barley and meadow fescue differ in the rate of reaction to B. sorokiniana phytotoxins with regard to changes in metabolic activity and phenolic content. It also suggests a different degree of the plants sensitivity to the studied pathogen on tissue level. [References: 20].

1610 Pospisil, A.; Benada, J.; Nedomova, L.; Polisenska, I. (2000) **Incidence variability of wheat bunts (Tilletia caries (DC) Tul. and T-laevis Kuhn) in field trials.** *Zeitschrift fur Pflanzenkrankheiten und Pflanzenschutz-Journal of Plant Diseases & Protection. 107(1):74-80.* English. [Agr Res Inst Kromeriz Ltd CZ-76741 Kromeriz Czech Republic].

Until now, the wheat resistance against common bunt disease (Tilletia sp.) has been studied by most authors in field trials without replications. It was supposed that using 1 g spores per kg seed the inoculum was sufficient for regular infection. In our preliminary field trials with selected winter wheat cultivars inoculated with common bunt, considerable variability was observed in some cases in replications. The reasons for this variability was studied in laboratory and field trials. The incidence of common bunt is influenced, First of all, by the sowing dare and the soil temperature at the time of wheat germination. The germination of spores is adversely influenced by superfluous water in the environment. Some antagonistic micro-organisms can decrease the spore germination and in this way decrease the disease incidence. In 1998, we studied the variability of wheat resistance against common bunt in 32 winter wheat cultivars in replications. The aim was to propose a number of replications and a number of scored ears. It was found that replications without disease incidence appeared in groups and they were higher in the case of higher resistance. No correlation was found between the spore amount in the range from to 10 g spores per kg seed and disease incidence. A good correlation was found between susceptibility of all cultivars to both bunts. To assess wheat resistance to common built, the following rules should be kept: 1) at least g spores per kg seed, 2) four plot replications situated in different parr of field, 3) scoring 100-150 ears, 4) repetitions in different years. [References: 19].

1611 Qiao Hexin (Shanxi Academy of Agricultural Sciences, Linfen (China). Research Inst. of Wheat) (1998) **Study on fungistasis and control effect of wheat compound seed dressings by indoor test.** *Journal of Shanxi Agricultural University (China). Shanxi Nongye Daxue Xuebao (China) v. 18(1) p. 27-29.* 3 tables; 2 ref. Chinese. (AGRIS 2000-018037).

1612 Roberts, DP.; Stromberg, EL.; Lacy, GH.; Buyer, JS. (1999) **Biological disease control: Considerations for seed treatment and stand establishment.** *PROCEEDINGS OF THE SIXTH SYMPOSIUM ON STAND ESTABLISHMENT AND ISHS SEED SYMPOISUM. (504):69-74.* English. [USDA ARS, Biocontrol Plant Dis Lab Beltsville, MD 20705 USA].

Effects of bacterial seed treatments on "take-all" of wheat (Triticum aestivum), a disease caused by Gaeumannomyces graminis var. tritici, and on soilborne pathogens of cucumber (Cucumis sativum) and other vegetables are discussed. Special emphasis is placed on strategies for isolation and identification of bacterial biological control agents from apparently healthy wheat plants from a field that had been continually cropped to wheat since 1988 and has had severe "take-all" outbreaks since 1992. Current research is directed toward evaluating bacterial isolates alone or in various combinations as seed treatments for "take-all" control under field conditions. [References: 39].

1613 Ross, IL.; Alami, Y.; Harvey, PR.; Achouak, W.; Ryder, MH. (2000) **Genetic diversity and biological control activity of novel species of closely related pseudomonads isolated from wheat field soils in South Australia.** *Applied & Environmental Microbiology. 66(4):1609-1616.* English. [CSIRO Land & Water Waite Rd Glen Osmond SA 5064 Australia].

Rhizobacteria closely related to two recently described species of pseudomonads, Pseudomonas brassicacearum and Pseudomonas thivervalensis, were isolated from two geographically distinct wheat field soils in South Australia. Isolation was undertaken by either selective plating or immunotrapping utilizing a polyclonal antibody raised against P. brassicacearum. A subset of 42 isolates were characterized by amplified 16S ribosomal DNA restriction analysis (ARDRA), BIOLOG analysis, and gas chromatography-fatty acid methyl ester (GC-FAME) analysis and separated into closely related phenetic groups, More than 75% of isolates tested by ARDRA were found to have >95% similarity to either Pseudomonas corrugata or P. brassicacearum-P. thivervalensis type strains, and all isolates had >90% similarity to either type strain. BIOLOG and GC-FAME clustering showed a >70% match to ARDRA profiles. Strains representing different ARDRA groups were tested in two soil types for biological control activity against the soilborne plant pathogen Gaeumannomyces graminis var. tritici, the causative agent of take-all of wheat and barley. Three isolates out of 11 significantly reduced take all-induced root lesions on wheat plants grown in a red-brown earth soil. Only one strain, K208, was consistent in reducing disease symptoms in both the acidic red-brown earth and a calcareous sandy loam. Results from this study indicate that P. brassicacearum and P. thivervalensis are present in Australian soils and that a level of genetic diversity exists within these two novel species but that this diversity does not appear to be related to geographic distribution. The result of the glasshouse pot trial suggests that some isolates of these species may have potential as biological control agents for plant disease. [References: 33].

1614 Sekerova, M. (1999) **The impact of organic fertilizers and biodressing powder on occurence of harmful factors in spring barley.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 45-52.* Vyskumny Ustav Rastlinnej Vyroby. 4 tables; 6 ref. Slovak. (AGRIS 2000-023770).

In the years of 1996 to 1998 the impact of organic fertilizers and biopreparations on occurrence of harmful factors in spring barley was tested in a field experiment in Research and Breeding Station in Borovce. Ekovert plus was applied as a biodressing powder. Trichomil biopreparation was applied to the soil to faster liquidate pathogens surviving in the soil on after-harvest remnants. As organic fertilizers, Vermihum and Superfin were used and a control variant and a fertilized variant with nitrogen-phosphor-potassium were included in the experiment. In three-year period of duration of the experiment on average, highly significantly lowest occurrence of Fusarium spp. and Pseudocercosporella herpotrichoides pathogens in the variant with biological treatment of the seed with Ekovert plus and in the variant with Trichomil for soil was found in comparison with the control and all other variants at evaluation in 32 phase DC. The impact of organic fertilizers Vermihum and Superfin on restriction of occurrence of the said pathogens also appeared highly significant in comparison with the control at evaluation in 32 phase DC. As for evaluation of number of whitened spikes due to pathogens Fusarium spp. and Pseudocercosporella herpotrichoides, highly significantly lower number of whitened spikes was found again in the variants with biodressing powder Ekovert plus and Trichomil for soil than in the control variant in 75 phase DC. Similar situation was with the variants with organic fertilizers Vermihum and Superfin. No differences were found between the variants at evaluation of occuerence of Erysiphe graminis and Pyrenophora teres pathogens. From the said it follows that in ecological system of spring barley cultivation and in integrated way of protection it is possible to limit the occurrence of diseases communicable by soil, seed and after-harvest remnants to a great extent after the application of biopreparations and organic fertilizers.

1615 Sharma, KD. (2000) **Wheat (Triticum aestivum) diseases in trans-Himalayan region.** *Indian Journal of Agricultural Sciences. 70(1):42-44.* English. [HPKV, Ctr Biotechnol Palampur 176062 Himachal Prades India].

1616 Sheng Baoqin; Duan Xiayu; Zhou Yilin (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Plant Protection) (1998) **The infection of wheat powdery mildew to Elymus L. introduced from other countries.** *Acta Agriculturae Boreali-Sinica (China). Huabei NOngxuebao (China) v. 13(1) p. 53-56.* 1 table; 3 ref. Chinese. (AGRIS 2000-017825).

1617 Simpson, DR.; Rezanoor, HN.; Parry, DW.; Nicholson, P. (2000) **Evidence for differential host preference in Microdochium nivale var. majus and Microdochium nivale var. nivale.** *Plant Pathology. 49(2):261-268.* English. [John Innes Ctr Plant Sci Res, Cereal Res Dept Colney Lane Norwich NR4 7UH Norfolk England].

The pathogenicity of Microdochium nivale var. majus and var. nivale was tested on wheat, rye and oat seedlings using both visual disease scoring and quantitative PCR measurements. In an individual inoculation trial at 10 degrees C var. majus and var. nivale were strongly pathogenic towards wheat and rye, with var. nivale causing slightly greater disease in rye. At this temperature only var. nivale caused significant disease of oats. In a further experiment M. nivale was inoculated as a series of mixtures of the two varieties and incubated at 15 degrees C. The ratio of the varieties present in the inoculum and present at harvest was analysed by quantitative PCR and this enabled a coefficient of selection to be calculated for the varieties on each host. M. nivale var. majus showed a weak selective advantage over var. nivale on wheat (0.33 +/- 0.08) and oat seedlings (0.35 +/- 0.016) and M. nivale var. nivale showed a strong selective advantage over var. majus on rye seedlings (0.92 +/- 0.26). The isolates were also compared for sensitivity to benzoxazolinone (BOA), a hydroxamic acid compound derived from rye leaves. M. nivale var majus was found to be significantly more sensitive to BOA than M. nivale var. nivale, indicating a possible mechanism for the selective advantage of var. nivale growing on rye. This is the first substantiated indication of a significant difference in host preference between Microdochium nivale var. majus and var. nivale. [References: 34].

1618 Spunar, J.; Oborny, J.; Spunarova, M.; Vaculova, K. (Zemedelsky Vyzkumny Ustav Kromeriz (Czech Republic)) (1999) **Resistance of registered varieties and advanced breeding lines of winter barley from the Czech Republic to the barley yellow mosaic virus complex.** *Czech Journal of Genetics and Plant Breeding - UZPI (Czech Republic) v. 35(3) p. 83-88.* 2 graphs, 2 tables; 14 ref. Czech. (AGRIS 2000-017878).

Resistance to barley yellow mosaic virus (BaYMV) complex was evaluated in winter barley varieties registered in the Czech Republic, advanced lines tested in the Czech Official Trials or multilocation trials and lines developed in the Agricultural Research Institute, Kromeriz. Proportion of plants with mosaic symptoms to the total number of plants was decisive for the determination of resistance level. No Czech variety or line showed resistance to BaYMV-2. Only the variety Tokyo, registered in FRG, could be considered as resistant to the complex of three viruses. The obtained results document that the resistance to BaYMV can be increased with the use of resistant parental varieties, eg. Thalassa or Oceane from France and Jana from Germany.

1619 Tekauz, A.; McCallum, B.; Gilbert, J. (2000) **Review: Fusarium head blight of barley in western Canada [Review].** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):9-16.* English. [Agr & Agri Food Canada, Cereal Res Ctr Winnipeg MB R3T 2M9 Canada].

Fusarium head blight (FHB), caused primarily by Fusarium graminearum, has rapidly become the most notorious disease of cereals in parts of western Canada. The situation in barley is particularly striking, for until 1993 FHB was not observed in the crop at all, but by 1996 it affected every barley field examined in Manitoba. The disease is largely responsible for the decline in acreage and the loss of markets for both malting and feed barley in the region. Several aspects of FHB in barley are examined for this review, beginning with

an overview and description of symptoms and disease epidemiology. Differences in the expression of FHB in barley as compared with wheat, including causal species, infection period, symptoms, and resulting damage (yield and quality losses) are described. These have implications for disease management, including breeding for resistance. The latter is ongoing at several institutions and should result in cultivars with improved resistance to FHB in future. Until then, an integrated protocol for disease management must be implemented to minimize the threat of FHB for producers and the industry. [References: 47].

1620 Tian Lanzhi (Hebei Academy of Agricultural and Forestry Sciences, Baoding (China). Research Inst. of Plant Protection) (1999) **Study on present situation and improvement of winter wheat cultivars or reserve strains resistant to CYR25, CYR29, CYR30, CYR31 in Hebei.** *Journal of Agricultural University of Hebei (China). Hebei Nongye Daxue XueBao (China) v. 22(1) p. 63-66.* 3 tables; 2 ref. Chinese. (AGRIS 2000-018039).

1621 van, Leur, JAG.; Bailey, KL. (2000) **The occurrence of barley root diseases in different agri-ecological zones of Syria.** *Canadian Journal of Plant Pathology-Revue Canadienne de Phytopathologie. 22(1):61-69.* English. [Agr & Agri Food Canada, Res Ctr 107 Sci Pl Saskatoon SK S7N 0X2 Canada].

A survey was conducted to determine the occurrence of root diseases and the identity of causal agents on barley grown in northern agricultural areas of Syria in 1992 and 1993. In 1992, 20 plants with at least 1 cm long subcrown internodes were randomly selected from each of 53 fields when plants were between flowering and maturity. In 1993, 50 plants were selected from each of 72 fields. In addition, four wheat fields were sampled in 1993. Plants were visually rated for disease severity on the subcrown internode. Fungal cultures were isolated from root tissues by plating on selective and general media. Isolates were tested for pathogenicity using a seedling bioassay, and representative pathogens were identified to the species level. Root rot was more severe in the drier agricultural zones and disease severity increased with crop maturity. There was a weak negative association between disease severity and the number of tillers per plant. The most prevalent pathogens in both years were Microdochium nivale (average of 43%), Cochliobolus sativus (35%), red-pigmented Fusarin (13%), and Microdochium bolleyi (8%). More than 80% of the C. sativus and M. nivale isolates, and less than 20% of the Fusarium spp. and M. bolleyi isolates, were pathogenic. Cochliobolus sativus was most common in the drier areas, whereas M. nivale was most common in the wetter areas, particularly from the northwest region. This paper is the first report of M. nivale and M. bolleyi on barley and Gaeumannomyces graminis var, tritici on wheat in Syria. Other root disorders (pests) found included cyst-forming nematodes and Porphyrophora tritici. [References: 44].

1622 Vanco, B.; Janosova, M.; Palkova, M. (1999) **The reaction of barley genotypes to isolates of Rhynchosporium secalis (Oud.) Davis.** *[Scientific papers of the Research Institute of Plant Production, Piestany 1999]. Vyskumny Ustav Rastlinnej Vyroby, Piestany (Slovak Republic) p. 205 p. 53-59.* Vyskumny Ustav Rastlinnej Vyroby. 3 tables; 12 ref. Slovak. (AGRIS 2000-023771).

Under greenhouse condition in period of 1996 to 1998 the isolates of Rhynchosporium secalis (Oud.) Davis, originally from different areas of Slovakia were studied to determine the pathogenic variability at 28 genotypes of barley. In field condition under natural infection pressure of the pathogen, the field resistance of the same genotypes has been examined against Rhynchosporium secalis. The results have shown that ditferences in pathogenity of 24 Rhynchosporium secalis isolates of different areas of Slovakia were statistically highly significant. Under greenhouse and field condition, significant differences have been found out in infection level (resistance) among the varieties. There have been found out acceptable correlations in infection degree of the genotypes among different ¡solates within greenhouse test, in field resistance of genotypes among years and between greenhouse and field tests under natural infection pressure of the pathogen. Genotypes of the Ethiopian origin CI. 9820, CI. 9825, CI. 9768 and K 20019 from VIZR have been arranged to the genotypes of the most stable resistance. Tifang (CI.4407, Manchurian), Lenka (Germany) and Viktor (Czech Republic) genotypes have been part of the most susceptible ones.

1623 Varaku, S. (Instituti i Mbrojtjes se Bimeve, Durres (Albania)) (1997) **[Main wheat disease, suitable growth stages and pesticides for their control].** *Buletini i Shkencave Bujqesore (Albania) (no. 3) p. 83-86.* 1 table; 4 ill., 13 ref. Albanian. (AGRIS 2000-023850).

The study of the main wheat disease dynamics showed the most widespread are Erysiphe graminis , Septoria sp., Fusarium sp. etc. Rainfall is the main reason of the propagation of Septoria tritici. The most appropriate phase for pesticide treatment is that of earing. The best preparate is Tilt (0, 5 kg/ha), Frumidor (3 kg/ha) and Horizon (1kg/ha). Frumidor treatment, apart from its good performance against wheat disease, helps in delaying natural decease of the plant.

1624 Varullina, LG.; Maximov, IV.; Yamaleev, AM. (2000) **Peculiarities of lignification in wheat plants under the influence of immunostimulators and infection by root rot.** *Mikologiya i Fitopatologiya. 34(1):58-62.* Russian. [Ufa Res Inst, Dept Biochem & Cytol Ufa Russia].

Effects of bisol-2 and baytan on lignification processes in wheat plants with different resistance to root rot infection were studied. It was shown, that seed pretreatment with these immunostimulating compounds results in PAL activation and lignin accumulation at the sites of pathogen 'invasion. Induction of lignification in wheat is one of the common mechanisms of plant resistance to pathogens. [References: 17].

1625 von, Tiedemann, A.; Firsching, KH. (2000) **Interactive effects of elevated ozone and carbon dioxide on growth and yield of leaf rust-infected versus non-infected wheat.** *Environmental Pollution. 108(3):357-363.* English. [Univ Rostock, Fac Agr, Dept Phytomed D-18051 Rostock Germany].

Spring wheat (Triticum aestivumn L. cv. Turbo) was grown from seedling emergence to maturity (129 days) in chambers simulating the physical climate and ozone pollution of a field site in Northern Germany from 1 April to 31 July with a mean l-h daily maximum of 61.5-62.4 nl l(-1) ozone compared to a constant low level of 21.5-22.8 nl l(-1) ozone. The two ozone levels were combined with either a current (374.1-380.2 mu l l(-1)) or enriched (610.6-615.0 mu l l(-1)) CO2 atmosphere. Additionally, a leaf rust epidemic (Puccinia recondita f. sp. tritici) was induced at tillering stage by repeated re-inoculations with the inoculum formed on the plants. Leaf rust disease was strongly inhibited by ozone, but largely unaffected by elevated CO2. Ozone damage on leaves was strongly affected by CO2 and infection. On infected plants, ozone lesions appeared 2-4 weeks earlier and were up to fourfold more severe compared to non-infected plants. Elevated CO2 did not delay the onset of ozone lesions but it significantly reduced the severity of leaf damage. It also enhanced the photosynthetic rate of flag leaves and increased the water use efficiency, biomass formation and grain yield. The relative increases in growth and yield induced by CO2 were much larger on ozone-stressed than on non-stressed plants. Both ozone and fungal infection reduced biomass formation, number of grains per plant, thousand grain weight and grain yield; however, adverse effects of leaf rust infection were more severe. Elevated CO2 largely equalized the negative effects of ozone on the photosynthetic rate, growth and yield parameters, but was not capable of compensating for the detrimental effects of fungal infection. The data imply that the impact of ozone in the field cannot be estimated without considering the predisposing effects deriving from fungal infections and the compensating effects deriving from elevated CO2. [References: 26].

H50 MISCELLANEOUS PLANT DISORDERS

1626 Bajji, M.; Lutts, S.; Kinet, JM. (2000) **Physiological changes after exposure to and recovery from polyethylene glycol-induced water deficit in callus cultures issued from durum wheat (Triticum durum Desf.) cultivars differing in drought resistance.** *Journal of Plant*

Physiology. 156(1):75-83. English. [Univ Catholique Louvain, Lab Cytogenet Bte 13, 5 Pl Croix Sud B-1348 Louvain Belgium].

Calli obtained from three durum wheat (Triticum durum Desf.) cultivars with different drought resistance levels were exposed for 30 days to a polyethylene glycol-induced water deficit followed by 30 days of recovery. Relative growth rate, percent dry weight, osmotic potential and the changes in inorganic and organic solutes were determined at the end of both the stress and the recovery periods. After the stress period, calli derived from the drought resistant cultivars, particularly Omrabi 5 and to some extent Haurani, showed a less reduced relative growth rate, lower osmotic potential and higher proline and other amino acid accumulations as compared with the sensitive cultivar Kabir I. Drought resistance could also be associated with a better protection of enzymes involved in nitrogen metabolism. At the end of the recovery period, most of the quantified parameters, except osmotic potential, recovered completely, indicating the reversibility of the changes induced by water deficit at the plant cell level in durum wheat. Our data show that a correlation exists between performances of the cultivars under drought and the responses of callus cultures to PEG-induced water deficit; this suggests that: in durum wheat the degree of resistance to drought at the plant level depends, at least in part, on the existence of mechanisms operating at the cellular level. [References: 45].

1627 Barman, SC.; Sahu, RK.; Bhargava, SK.; Chaterjee, C. (2000) **Distribution of heavy metals in wheat, mustard, and weed grown in field irrigated with industrial effluents.** *Bulletin of Environmental Contamination & Toxicology. 64(4):489-496.* English. [Ind Toxicol Res Ctr, Environm Monitoring Div Post Box 80, M B Marg Lucknow 226001 Uttar Pradesh India].

1628 Bouchard, C. (Institut National de la Recherche Agronomique, Thiverval Grignon (France). Centre de Versailles Grignon, Agronomie); Jeuffroy, M.H. (1998) **[Nitrogen fertilization of winter soft wheat: effects of nitrogen deficiencies on seed number per m2].** *Perspectives Agricoles (France) (no 237) p. 69-76.* 21 ref., 7 graph. French. (AGRIS 2000-018149).

Le contexte agricole actuel et les exigences croissantes de l'environnement augmentent, pour les cultures de ble tendre d'hiver, les risques de situations pour lesquelles ponctuellement les besoins en azote ne sont pas couverts par la fertilisation azotee. Or on sait, d'apres la bibliographie, que le rendement, et particulierement le nombre de grains par metre carre, est sensible a la nutrition azotee. Mais on ne connait pas les consequences que peuvent avoir differentes carences en azote variables selon leur date d'apparition, leur intensite ou leur duree. Sur quatre annees d'experimentation mises en place sur deux lieux differents, on a analyse les consequences, sur le nombre de grains par metre carre, de carences azotees variables, obtenues par des fertilisations azotees tres differenciees (en dates et doses d'azote apporte) et caracterisees entre la "sortie hiver" et la "floraison" par l'indice de nutrition azotee. Ces experimentations ont confirme la non sensibilite du poids moyen d'un grain a la fertilisation azotee. Sur l'ensemble des situations, on a pu relier la perte du nombre de grains, induite par le deficit d'absorption en azote, par rapport a un temoin bien fertilise, a un critere combinant la duree et l'intensite du deficit. Il ressort enfin de cette etude qu'en situation d'alimentation hydrique suffisante, les carences temporaires en azote peuvent n'avoir aucune repercussion sur le rendement a condition qu'elles ne soient ni trop longues, ni trop fortes.

1629 Conti, ME.; Cubadda, F.; Carcea, M. (2000) **Trace metals in soft and durum wheat from Italy.** *Food Additives & Contaminants. 17(1):45-53.* English. [Ist Super Sanita, Lab Alimenti Viale Regina Elena 299 I-00161 Rome Italy].

A survey was carried out with the aim to assess the levels of some toxic (cadmium, lead) and essential (copper, zinc) trace metals in wheat grown in Italy. A total of 178 samples of soft wheat grain and 239 samples of durum wheat grain from all the Italian wheat-growing regions were pooled into 35 and 38 representative samples respectively. After dry ashing, cadmium and lead were determined by graphite furnace atomic absorption spectrometry (GFAAS), whereas copper and zinc were determined by flame atomic absorption spectrometry (FAAS). In soft wheat the mean and median contents of all samples were (on a dry weight basis) 40 and 33 mu g kg(-1) for cadmium, 16 and 14 mu g kg(-1) for lead, 3.4 and 3.2 mg kg(-1) for copper, 33 and 32 mg kg(-1) for zinc. Similar levels were found in durum wheat. In this latter case the mean and median were 42 and 39 mu g kg(-1) for cadmium, 15 and 14 mu g kg(-1) for lead, 3.5 and 3.2 mg kg(-1) for copper, 34 and 34 mg kg(-1) for zinc. Significant differences were detected for some metals in relation to geographical provenance and variety. The average intake of the four selected elements from wheat-based products was estimated for the Italian population. [References: 29].

1630 Dugova, O.; Vizarova, G.; Takac, L. (Slovenska Akademia Vied, Bratislava (Slovak Republic)) (1999) **Study of heavy metals stress effect on growth processes of barley plants and biomass of microbiota.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 142-143.* Mendelova Zemedelska a Lesnicka Univ. 3 tables; 8 ref. English. (AGRIS 2000-018113).

1631 Frantzios, G.; Galatis, B.; Apostolakos, P. (2000) **Aluminium effects on microtubule organization in dividing root-tip cells of Triticum turgidum. I. Mitotic cells.** *New Phytologist. 145(2):211-224.* English. [Univ Athens, Fac Biol, Dept Bot Athens 15784 Greece].

The effects of aluminium (Al) on dividing root-tip cells of Triticum turgidum were investigated with tubulin immunolabelling and electron microscopy. Aluminium affects the mechanisms controlling the organization of microtubule (MT) cytoskeleton, as well as tubulin polymerization, and induces the following aberrations in mitotic cells. (1) It delays the MT disassembly during mitosis, resulting in the persistence of preprophase MT bands in the late prophase cells, the presence of prophase spindles in prometaphase cells, and a disturbance in the shortening of kinetochore MT bundles in anaphase cells. (2) It interferes with the self-organization process of MTs into bipolar systems, inhibiting the formation of prophase and metaphase spindles. (3) Aluminium induces the formation of atypical MT arrays, which in the immunofluorescent specimens appear as ring-like tubulin aggregations in the cortical cytoplasm of the preprophase/prophase cells and as endoplasmic tubulin bundles in prophase and metaphase/anaphase cells; abnormal preprophase MT bands are assembled, consisting of atypical cortical and endoplasmic MT bundles, the latter clearly lining the nuclear envelope on the preprophase MT band plane. (4) It disorders the chromosome movements carried out by the mitotic spindle. In addition, after prolonged Al treatments chromatin condensation is inhibited. The outcome is greatly disturbed organization and function of the mitotic appartus, as well as inhibition of cells from entering mitosis. This study shows that the MT cytoskeleton is a target site of Al toxicity in mitotic root-tip cells of T. turgidum. The possible mechanisms by which Al exerts its toxicity on MT organization and function are discussed. [References: 64].

1632 Gao Jinhua (Shanxi Educational Coll., Taiyuan (China). Dept. of Biology) (1998) **Study on effects of La-rich rare earth on salt-resistance of wheat seedlings.** *Journal of Shanxi Agricultural University (China). Shanxi Nongye Daxue Xuebao (China) v. 18(2) p. 115-117.* 4 tables; 5 ref. Chinese. (AGRIS 2000-018142).

1633 Johnston, T.; Chiotti, Q. (2000) **Climate change and the adaptability of agriculture: A review.** *Journal of the Air & Waste Management Association. 50(4):563-569.* English. [Univ Lethbridge, Dept Geog Lethbridge AB TLK 3M4 Canada].

The assessment of climate change impacts on agriculture has emerged as a recognizable field of research over the past 15 years or so. In a relatively short period, this area of work has undergone a number of important conceptual and methodological developments. Among many questions that have been debated are the adaptability of agriculture to climate change and the importance of land management adjustments in reducing the adverse effects of climate change. In turn, this latter focus has spawned a discussion regarding the nature of adaptation and the ability of agriculture to respond to sudden and

rapid climatic changes. In this paper we present an overview of this debate. It is argued that the first generation of climate change impact studies generally ignored the possibility that agriculturalists may adjust their farming practices in order to cope with climate change or to take advantage of new production opportunities. This conceptual oversight has been largely eliminated over the past five years or so. However, questions remain surrounding the likelihood that various adaptive strategies will actually be deployed in particular places. In this paper, we stress the importance of studying adaptation in the context of decision-making at the individual farm level and beyond. [References: 60].

1634 Landau, S.; Mitchell, RAC.; Barnett, V.; Colls, JJ.; Craigon, J.; Payne, RW. (2000) **A parsimonious, multiple-regression model of wheat yield response to environment.** *Agricultural & Forest Meteorology. 101(2-3):151-166.* English. [Univ London Kings Coll, Inst Psychiat, Dept Biostat & Comp London SE5 8AF England].

A database of nearly 2000 yield observations from winter wheat crops grown in UK trials between 1976 and 1993 was used to develop a new model of effects of weather on wheat yield. The intention was to build a model which was parsimonious (i.e., has the minimum number of parameters and maximum predictive power), but in which every parameter reflected a known climate effect on the UK crop-environment system to allow mechanistic interpretation. To this end, the model divided the effects of weather into phases which were predicted by a phenology model. A maximum set of possible weather effects in different phenological phases on yield was defined from prior knowledge. Two-thirds of the database was used to select which effects were necessary to include in the model and to estimate parameter values. The final model was tested against the independent data in the remaining third of the data set (246 aggregated yield observations) and showed predictive power (r=0.41), which was improved when comparing against mean annual yields (r=0.77). The final model allowed the relative importance of the 17 explanatory variables, and the weather effects they represent (defined before fitting), to be assessed. The most important weather effects were found to be: (1) negative effects of rainfall on agronomy before and during anthesis, during grain-filling and in the spring (2) winter frost damage (3) a positive effect of the temperature-driven duration of grain-filling and (4) a positive effect of radiation around anthesis, probably due to increased photosynthesis. The model developed here cannot be applied outside the UK, but the same approach could be employed for applications elsewhere, using appropriate yield, weather and management data. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 48].

1635 Lu Shihua; Zhang Yunlong (Sichuan Provincial Academy of Agricultural Sciences, Chengdu (China). Inst. of Soils and Fertilizers); Liu Xuejun (1998) **Effect of environmental conditions on Mn deficiency of different wheat varieties.** *Chinese Journal of Applied Ecology (China). Yingyong Shengtai Xuebao (China) v. 9(2) p. 159-162.* 5 tables; 3 ref. Chinese. (AGRIS 2000-018146).

1636 Lu, CM.; Zhang, JH. (2000) **Heat-induced multiple effects on PSII in wheat plants.** *Journal of Plant Physiology. 156(2):259-265.* English. [Hong Kong Baptist Univ, Dept Biol Kowloon Tong Hong Kong Peoples R China].

The effects of heat stress on the various functional aspects of photosystem II (PSII) were investigated by analysis of in vivo chlorophyll fluorescence in wheat (Tritium aestivum L.) leaves exposed in the dark to a wide range of elevated temperatures (25-45 degrees C) for 10 min. The results revealed that the effects of heat stress on PSII were characterised by two distinct domains of temperatures: moderately elevated temperatures (30-37.5 degrees C) and severely elevated temperatures (higher than 37.5 degrees C). In moderately elevated temperatures, no changes in the maximal efficiency of PSII photochemistry (F-v/F-m) and photochemical quenching (q(P)) were observed. The decrease in the quantum yield of PSII electron transport (Phi(PSII)) and the efficiency of excitation energy capture by open PSII reaction centers (F-v'/F-m') was reversible and was due to a significant increase in non-photochemical quenching (q(N)). In severely elevated temperatures, the further decrease in Phi(PSII) and F-v'/F-m' was irreversible and was associated with a decrease in F-v/F-m, which was a result of the decrease in the oxygen-evolving complex activity and of an inhibition of electron transport at the acceptor side of PSII. Our results suggest that heat stress displayed multiple effects on PSII. The following sequential events leading to an inhibition of PSII electron transport in the descending order of sensitivity to heat stress can be proposed: excitation energy capture by open PSII reaction centers --> the oxygen-evolving complex of PSII --> the acceptor side of PSII. [References: 32].

1637 Luo Lixin; Sun Tieheng (Academia Sinica, Shenyang (China). Inst. of Applied Ecology) (1998) **Effect of cadmium-surfactant combined pollution on physiological characteristics of wheat leaves.** *Chinese Journal of Applied Ecology (China). Yingyong Shengtai Xuebao (China) v. 9(1) p. 95-100.* 1 table; 5 ill., 20 ref. Chinese. (AGRIS 2000-018145).

1638 Mahboobi, H.; Yucel, M.; Oktem, HA. (2000) **Changes in total protein profiles of barley cultivars in response to toxic boron concentration.** *Journal of Plant Nutrition. 23(3):391-399.* English. [Middle E Tech Univ, Dept Biol Sci TR-06531 Ankara Turkey].

In this study, ten-day-old seedlings of barley [Hordeum vulgare L. cultivar Anadolu [boron (B)-tolerant] and Hamidiye (B-sensitive)] were used. Boron-treated plants were grown on H3BO3 solution (final concentration of 10 mM) for five days. Control plants received no B treatment during this period. Total protein patterns were obtained by analysis of total protein extract from root and leaf tissues of control and B-treated plants using two-dimensional gel electrophoresis followed by silver staining. The protein profile of B-treated seedlings of each cultivar was compared to the profile of control (no stress treatment) plants of the same cultivar. Silver-stained gels showed that B stress caused increases or decreases in a number of proteins in root and leaf tissues. Moreover, as a result of B treatment, one newly synthesized protein with relative molecular weight (Mr) of 35.0 kDa was detected in root profile of the tolerant cultivar. This protein failed to show up in root profile of the B-treated sensitive cultivar. Three proteins were quantitatively increased in B-treated root profile of both cultivars. Following B treatment, three proteins were increased in root profile of the tolerant cultivar, but were not changed in the sensitive one. In leaf tissues, however, there were remarkable changes in total protein profiles after B treatment, relative to the control. Following B treatment, in leaf tissues, at least seven proteins were increased in amount in tolerant cultivar but were unchanged in the susceptible one. In tolerant and sensitive cultivars, amounts of two proteins were increased in B-treated plants, relative to control seedlings. In addition, four proteins (M:29, 58, 58, and 22 kDa) were unchanged in control and B-treated seedlings of the tolerant cultivar. In the susceptible cultivar however, among these four proteins, the first one (Mr:29) was very much reduced and the others (Mr:58, 58, and 22 kDa) were completely lost in B-treated seedlings. Moreover, following B treatment, a set of high-molecular-weight proteins was quantitatively decreased in the susceptible cultivar but was unchanged in the tolerant cultivar. These results indicate that in barley, certain proteins may be involved in tolerance to B toxicity. In this study, changes in polypeptide composition as a result of B toxic concentration in leaf tissues were more abundant than in roots. Therefore, it is suggested that these changes, especially at shoot level may form the basis of the tolerance mechanism to B toxicity. [References: 22].

1639 Pinto-Carnide, O.; Guedes-Pinto, H. (2000) **Differential aluminum tolerance of Portuguese rye populations and North European rye cultivars.** *Agronomie. 20(1):93-99.* English. [Univ Tras Os Montes & Alto Douro, Dept Genet & Biotechnol AP 202 P-5001 Vila Real Portugal].

Aluminum toxicity is the main toxic factor limiting crop production in acid soils. The development of cereal varieties adapted to such conditions is a great challenge for plant breeding. Identification and introduction of Al-tolerant genes into breeding material is one way of solving the problem. Rye is considered one of the most tolerant species among cereals, although a great intra- and interspecific variability has been found. Al toxicity is usually expressed by an inhibition of root elongation. Therefore, measuring the root regrowth

of plants after exposure to an aluminum solution can give a good indication of a plants behaviour in acid soils. This paper compares the behaviour of Portuguese rye populations and European rye varieties when grown at different aluminum concentrations. The results obtained reveal that Portuguese rye populations are more tolerant than the European cultivars, with most of them being even better than the Al-tolerant cv. Dank. Zlote, used as a tester. [References: 22].

1640 Sairam, RK.; Saxena, DC. (2000) **Oxidative stress and antioxidants in wheat genotypes: Possible mechanism of water stress tolerance.** *Journal of Agronomy & Crop Science-Zeitschrift fur Acker und Pflanzenbau. 184(1):55-61.* English. [Indian Agr Res Inst, Div Plant Physiol New Delhi 110012 India].

The role of plant antioxidant systems in water stress tolerance was studied in three contrasting wheat genotypes. Water stress imposed at different stages after anthesis resulted in an increase in lipid peroxidation and a decrease in membrane stability and chlorophyll and carotenoid contents. The antioxidant enzymes ascorbate peroxidase, glutathione reductase and non-specific peroxidase also increased significantly under water stress. Genotype PEW 175, which had highest ascorbate peroxidase, glutathione reductase and peroxidase activity, had the lowest lipid peroxidation (malondialdehyde content) and highest membrane stability and contents of chlorophyll and carotenoids under water stress, while the susceptible genotype WH 542 exhibited the lowest antioxidant enzyme activity, membrane stability and contents of chlorophyll and carotenoids and the highest lipid peroxidation. Genotype HD 2402 showed intermediate behaviour. It seems that drought tolerance of PEW 175. as represented by higher membrane stability and chlorophyll and carotenoid contents and lower lipid peroxidation, is related to its higher antioxidant enzyme activity. [References: 34].

1641 Sastry, EVD.; Sharma, H. (2000) **Effect of temperature and salinity on the germination and seedling growth in wheat (Triticum aestivum).** *Indian Journal of Agricultural Sciences. 70(2):117-118.* English. [Rajasthan Agr Univ, SKN Coll Agr Jobner 303329 India].

1642 Siddique, MRB.; Hamid, A.; Islam, MS. (2000) **Drought stress effects on water relations of wheat.** *Botanical Bulletin of Academia Sinica. 41(1):35-39.* English. [Bangladesh Rice Res Inst, Div Agron Gazipur 1701 Bangladesh].

Drought effects on the water relations of four wheat (Triticum aestivum L.) cultivars were evaluated. Four cultivars, Kanchan, Sonalika, Kalyansona, and C306, were grown in pots and subjected to four levels of water stress at vegetative or anthesis stages or both. Exposure of plants to drought led to noticeable decreases in leaf water potential and relative water content with a concurrent increase in leaf temperature. The higher leaf water potential and relative water content as well as lower leaf temperature were associated with a higher photosynthetic rate. Drought stressed plants displayed higher canopy temperature than well-watered plants at both vegetative growth and anthesis growth stages. Successive stresses at both developmental stages raised the canopy temperature much higher than in plants stressed only once. [References: 17].

1643 Stefanis, E. de; Sgrulletta, D.; Corbellini, M.; Di Fonzo, N.; Ronga, G. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)) (1998) **Accumulation of acetic acid-soluble and insoluble proteins in grain of Triticum durum cultivars grown under heat stress conditions [Italy].** *Journal of Genetics & Breeding (Italy) v. 52(4) p. 343-352.* 6 tables; 4 graphs; 19 ref. English. (AGRIS 2000-023880).

In the present study the effect of high temperature on the accumulation of protein fractions related to durum wheat end quality was investigated. The study was carried out on four varieties of T. durum grown for two years in two Italian locations, where elevated temperatures were imposed during grain filling by delaying the sowing date or by covering the plots with plastic tunnels. Protein accumulation was followed from 15 to 35 days after anthesis. Elevated temperatures during grain ripening favoured the deposition of total and insoluble acetic acid proteins, while the accumulation of soluble fractions was not modified by heat stress. However, the durum wheat varieties varied consistently in response to high temperature in relation to accumulation of the protein fractions considered in this study [In questo studio si e' investigato sull'effetto dell'alta temperatura sull'accumulo di frazioni proteiche correlate alla qualita' finale del grano duro. Lo studio e' stato condotto su quattro varieta' di T. durum coltivate per due anni in due localita' italiane, dove durante il riempimento della granella erano create condizioni di temperatura elevata ritardando l'epoca di semina e coprendo le parcelle con tunnel plastici. L'accumulo delle proteine veniva seguito da 15 a 35 giorni dopo l'antesi. Le temperature elevate durante la maturazione della granella favorivano la deposizione delle proteine totali e insolubili in acido acetico, mentre l'accumulo delle frazioni solubili non era modificato dallo stress termico. Comunque, le varieta' di grano duro variavano fortemente nella risposta all'alta temperatura per quanto riguarda l'accumulo delle frazioni proteiche considerate in questa ricerca].

1644 Szucs, P.; Veisz, O.; Szunics, L.; Lang, L.; Bedo, Z. (1999) **Dynamics of winter hardiness in Triticum durum (Desf.) genotypes.** *Novenytermeles. 48(5):463-469.* Hungarian. [Hungarian Acad Sci, Agr Res Inst Martonvasar Hungary].

The winter hardiness of seven T. durum genotypes of different origin and with different degrees of frost resistance was evaluated under field conditions between 1995 and 1999. In order to trace changes in winter hardiness over time, the number of surviving plants was counted in early December, January, February, March and April. The bread wheat (T. aestivum) varieties used as the control (Bankuti 1201, which has moderate frost resistance, and NS Rana 2, with poor resistance) only showed poor overwintering in the winter of 1995/96. It can thus be stated that with the exception of 1995/96 the temperature in the years examined was not critical for wheat, as a consequence of which the T. durum varieties, which are more sensitive to frost, ovenwintered without any great loss. The data recorded during the early spring frosts experienced in 1996 confirmed numerically the practical observation that T. durum suffers frost damage in spring, rather than during the winter. The results of experiments carried out in the Martonvasar phytotron and the overwintering data for 1995/96 indicate that the mean level of hardiness of T. durum genotypes is generally lower and lasts for a shorter time than that of the winter T. aestivum Varieties grown in Hungary. Of the four winters examined, a close positive correlation between field winter hardiness dynamics and the dynamics of frost resistance in the phytotron was only obtained under the meteorological conditions of 1995/96. These results confirm that if selection for frost resistance and winter hardiness is to be successful, the evaluation of frost resistance in T. durum wheat varieties and other genotypes should be carried out under controlled conditions in a phytotron. [References: 15].

1645 Tanacs, L.; Matuz, J.; Hampel, G.; Nagy, M. (1999) **Effect of pesticide treatment on the gluten content and falling number of the grain yield in wheat varieties.** *Novenytermeles. 48(5):485-496.* Hungarian. [Attila Jozsef Univ, Coll Food Ind Mars Ter 7 H-6724 Szeged Hungary].

Changes in the gluten content, gluten spread and falling number were studied in 6 winter wheat varieties previously treated in a field experiment with 5 different herbicides, one immune activator and 7 fungicides. The chemicals and agents used were as follows: - herbicides: Protugan (isoproturon), DMA-6 (2, 4-D), 2, 4-D ester (2, 4-D ester), Optics (dicamba + MCPP), Optica Trio (MCPP + MCPA), - immune activator: Bion 50 WG (benzothiodazole), -fungicides: Tango (epoxyconazole + tridemorph), Strob-1 (cresoxym-methyl), Amistar (azoxystrobin), Bumper (propiconazole), Folicur Solo (tebuconazole). The wet gluten content of the grain yield significantly increased in plots treated with the herbicides Protugan, DMA-6, 2, 4-D ester, Optica and Optica Trio over the average of the six varieties compared to the untreated control. Significant increases in wet gluten content were observed in two wheat varieties alter treatment with Protugan and 2, 4-D ester, in 4 varieties for DMA-6, and in 3 varieties' for Optica and Optica Trio. The immune activator and the fungicide Amistar from the caused a significant increase in wet gluten content in only one variety. The dry gluten content increased significantly in all the pesticide treatments when averaged over the six varieties compared to

the untreated control. A significant increase in the dry gluten content was caused in five wheat varieties by DMA-6, in 4 cases by both 2, 4-D ester and Optica, and in 3 cases by Protugan, Optica Trio and the immune activator. Among the fungicides Amistar* significantly increased the dry gluten content in six varieties, Tango, Strob-1 and Folicur Solo in 5, Amistar and Bumper in 4 and Tango* in 3 varieties. The gluten spread significantly increased in plots treated with Optica, but significantly decreased in treatments with Tango, Amistar*, Bumper and Folicur Solo over the average of the six varieties compared to the untreated control. Among the herbicides DMA-6 and Optica Trio significantly increased the gluten spread in 1 wheat variety each. The fungicides generally slightly decreased the gluten spread except in 4 cases: Tango* caused a significant increase in one variety, while Bumper and Folicur Solo caused a significant decrease in 2 and 1 varieties, respectively. The falling number of the yield in plots treated with pesticides did not differ significantly from the untreated (control) plots over the average of the six varieties. Among the herbicides Protugan increased the falling number significantly in one case. The fungicides increased the falling number significantly in 6 varieties and decreased it significantly in one case. The falling number generally increased slightly in the fungicide treatments. [References: 11].

1646 Wei Aili (Shanxi Agricultural Univ., Taigu (China). Research Center of Agro chemical Control) (1998) **Physiological effect of different elements and atrazine on wheat.** *Journal of Shanxi Agricultural University (China). Shanxi Nongye Daxue Xuebao (China) v. 18(4) p. 322-325.* 8 tables; 6 ref. Chinese. (AGRIS 2000-018143).

1647 Zhang Lijun (Shenyang Agricultural Univ., (China). Dept. of Basic Science) (1998) **Relationship between drought stress protein and drought resistance in wheat seedlings.** *Journal of Shenyang Agricultural University (China). Shenyang Nongye Daxue Xuebao (China) v. 29(2) p. 106-109.* 3 tables; 9 ref. Chinese. (AGRIS 2000-018144).

1648 Zhang Linsheng; Wang Peihong; Cao Rang (Northwestern Agricultural Univ., Yangling, Shaanxi (China). Central Lab.) (1998) **Effect of soil drying on the amino acids in leaves of wheat at different development periods.** *Acta Agricultural Boreali-Occidentalis Sinica (China). Xibei Nongye Xuebao (China) v. 7(1) p. 64-66.* 2 tables; 10 ref. Chinese. (AGRIS 2000-018148).

1649 Zhao Sulao (Shaanxi Academy of Agricultural Sciences, Yangling (China)) (1998) **A review of identification indicatiors for wheat salt tolerance.** *Acta Universitatis Agriculturalis Boreali-Occidentalis (China). Xibei Nongda Xuebao (China) v. 26(6) p. 80-85.* 20 ref. Chinese. (AGRIS 2000-018147).

H60 WEEDS

1650 Allegri, A. (Cooperativa Terremerse, Bagnacavallo, Ravenna (Italy). Servizio Ricerca e Sviluppo) (1998) **[The Italian ryegrass threatens the hard wheat [Triticum durum Desf. - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(46) p. 57-59.* 3 graphs. Italian. (AGRIS 2000-018215).

1651 Holm, FA.; Kirkland, KJ.; Stevenson, FC. (2000) **Defining optimum herbicide rates and timing for wild oat (Avena fatua) control in spring wheat (Triticum aestivum).** *Weed Technology. 14(1):167-175.* English. [Univ Saskatchewan, Dept Plant Sci 51 Campus Dr Saskatoon SK S7N 5A8 Canada].

Knowledge of optimal combinations of graminicide rate and stage of application could improve the effectiveness and net benefit of commonly used graminicides. A study was conducted at two locations in Saskatchewan, Canada, from 1994 to 1997. Factorial combinations of five graminicides (CGA 184927, fenoxaprop-p-ethyl, ICIA 0604, imazamethabenz, and flamprop-methyl), three graminicide rates (full, two-thirds, and one-third recommended label rate), and three leaf stages of wild oat (Avena fatua; two-, four-, and six-leaf) were compared to determine their effect on wild oat fresh weight, wheat (Triticum aestivum) seed yield, and net return. Wild oat fresh weight increased and wheat seed yield decreased to a greater extent at Saskatoon (median wild oat fresh weight of 56 g/m(2)) than at Scott (median wild oat fresh weight of 85 g/m(2)) when graminicide rate was reduced from the recommended label rate. Net return consistently decreased at both locations and among all graminicides when application rate was reduced from two-thirds to one-third of the recommended label rate. Imazamethabenz applied at progressively later growth stages caused greater wild oat fresh weight at both locations and reduced wheat yield and net return. Applying other graminicides at the earliest (two-leaf) stage of wild oat generally resulted in more or similar levels of wild oat fresh weight compared with delayed applications, especially at Saskatoon. With the exception of imazamethabenz, crop yield and net return were unaffected by leaf stage at both locations. The optimal graminicide rate is mostly dependent on the level of wild oat infestation, and the best time to control wild oat is dependent mostly on the particular graminicide. [References: 11].

1652 Karpenko, V.P. (Uman Agricultural Acad., Cherkasy oblast (Ukraine)) (1998) **[Agroecological substantiation of using various herbicide rates in pure stands of spring barley and with additional sowing of clover].** 280 ref.; 18 ill.; 40 tables; 4 ann. 150 p. Russian. (AGRIS 2000-018216).

Complex studies are conducted of various herbicides' influence on biological processes in plants and soil depending on herbicide rates and growing of the crop in pure stands and with additional sowing of clover. The experiments are carried out under conditions of the right bank Forest-Steppe of Ukraine. Spring barley yield increased by 5.5-6.0 centners per hectare. Additional sowing of legume grasses is found out to enhance herbicides' influence on weeds that allows to reduce herbicide rates up to ecologically safe ones.

1653 Marocchi, G. (Regione Emilia Romagna, Bologna (Italy). Osservatorio per le Malattie delle Piante) (1998) **[Soft wheat. The pre-emergence weed control [Triticum aestivum L.]].** *Terra e Vita (Italy) v. 39(36) p. 44-46.* 2 tables. Italian. (AGRIS 2000-018210).

1654 Marocchi, G. (Regione Emilia Romagna, Bologna (Italy). Osservatorio per le Malattie delle Piante) (1998) **[The weeding of wheat after emergence [Triticum]].** *Terra e Vita (Italy) v. 39(2) p. 38-41, 43.* 3 tables; 1 graph. Italian. (AGRIS 2000-018207).

1655 Marzocchi, L.; Allegri, A.; Casagrandi, M. (1998) **[Wheat. Post-emergence treatments [Triticum]].** *Terra e Vita (Italy) v. 39(5) p. 47-48, 51-52.* 2 tables; 2 graphs. Italian. (AGRIS 2000-018208).

1656 Montemurro, P. (Bari Univ. (Italy). Istituto di Agronomia Generale e Coltivazioni Erbacee) (1998) **[Hard wheat. Tha management of weeds in Southern Italy [Triticum durum Desf.]].** *Terra e Vita (Italy) v. 39(2) p. 44-47.* 1 table; 4 graphs. Italian. (AGRIS 2000-018213).

1657 Montemurro, P. (Bari Univ. (Italy). Istituto di Agronomia Generale e Coltivazioni Erbacee); Viggiani, P. (Bologna Univ. (Italy). Istituto di Agronomia Generale e Coltivazioni Erbacee) (1998) **[All the weeds of wheat in Southern Italy [Triticum durum Desf. - Apulia - Basilicata]].** *Terra e Vita (Italy) v. 39(4) p. 55-56, 59-60.* 3 tables. Italian. (AGRIS 2000-018214).

1658 Pizzi, M. (1992) **[The weed control [Triticum - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 36-38.* 2 tables. Italian. (AGRIS 2000-018209).

1659 Rasmussen, K.; Rasmussen, J. (2000) **Barley seed vigour and mechanical weed control.** *Weed Research. 40(2):219-230.* English. [Danish Inst Agr Sci, Dept Crop Protect, Res Ctr Flakkebjerg DK-4200 Slagelse Denmark].

Two field experiments investigated the influences of crop seed vigour on the effect of weed harrowing and crop:weed interactions in spring barley. Artificially reduced seed vigour, which was similar to the variation within commercial seed lots, caused a reduction in germination rate, delayed time of emergence and, consequently, caused reduced competitive ability against weeds. During both years,

the reduced seed vigour increased the average weed biomass by 169% and 210%, and reduced the average crop yield by 16% and 21%. Without the influence of weeds, the yield reduction was estimated to be 8% and 10%. A three-times harrowing strategy reduced the weed biomass by 75% and 72% on average. However, it also caused damage to the crop and reduced yield. There was no clear interaction between barley seed vigour and weed harrowing in the experiments but, in one year, reduced seed vigour tended to decrease the effect of weed harrowing and also increased crop damage. Results in both years, however, indicate potential possibilities for successful integrated weed control by adding the use of high seed quality to a weed harrowing strategy. [References: 20].

1660 Rola, H.; Domaradzki, K.; Kieloch, R. (Institute of Soil Science and Plant Cultivation in Pulawy, Wroclaw (Poland). Dept. of Ecology and Weeds Control) (1999) **Tolerance of selected varieties of winter triticale on herbicides.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 313-318.* 3 tables; 4 ref. Polish. (AGRIS 2000-018206).

The reaction of six winter triticale varieties on herbicides was estimated in 1996-98. The unfavourable weather in winter caused decrease of yielding of winter triticale varieties Malno, Moreno, Presto and Vero after applied in autumn of Affinity 50, 75 WG. The same situation after applied in spring of Affinity 5075 WG and after application in autumn of Balance 56, 25 WG for variety Moreno was observed. The remaining herbicides were fully safe for tested winter triticale varieties.

1661 Rola, H.; Domaradzki, K.; Kieloch, R. (Institute of Soil Science and Plant Cultivation in Pulawy, Wroclaw (Poland). Dept. of Ecology and Weeds Control) (1999) **Tolerance of selected varieties of winter wheat on herbicides.** 3. All-Polish Conference IUNG on Crop Husbandry in Poland. Pulawy (Poland). 8-9 Jun 1999. *Pamietnik Pulawski (Poland) (no.114) p. 305-311.* 3 tables; 4 ref. Polish. (AGRIS 2000-018211).

The reaction of winter wheat varieties on herbicides was estimated in 1996-98. The unfavourable weather in winter caused decrease of yielding of winter wheat varieties Aleta and Jubilatka after applied in autumn of Affinity 50, 75 EG. The same situation after applied post emergence in autumn of Dicuran 80 WP was observed. Decrease of yield of Mikon variety after application preemergence in autumn of Glean 57 DF and Stomp 330 EC, and after application in spring of Arelon Forte 61, 5 WG was observed. The remaining herbicides were fully safe for tested varieties.

1662 Singh, S.; Malik, RK.; Ram, M. (1999) **Effect of rice straw burning on the efficacy of herbicides in wheat (Triticum aestivum).** *Indian Journal of Agronomy. 44(2):361-366.* English. [CCS HAU, Reg Res Stn Karnal 132001 India].

The field trials on wheat (Triticum aestivum emend. Fiori & Paol.) were conducted during 1992-94 at Uchani (Karnal) to find out the effect of rice straw burning and weed control treatments on Phalaris minor and wheat yield. Burning of the straw (6 or 12 tonnes/ha) increased the population and dry weight of weed, and decreased the wheat yield over straw removal. Isoproturon (1.00 and 1.25 kg/ha) and pendimethalin (1.50 kg/ha) being on par brought about significant control of weeds reading to increased wheat yield over weedy check. Weed infestation 90 DAS was greater in burnt plots than in unburnt plots, and the herbicides were more effective under unburnt conditions indicating their reduced efficiency under straw burnt conditions. [References: 6].

1663 Soroka, S.V.; Skuriat, A.F.; Soroka, L.I.; Kivachitskaya, M.M. (Belorus Research Inst. of Plants Protection, Priluki (Belarus)) (1999) **[Efficiency of the herbicide zirol in winter grain crops].** Academy of Agricultural Sciences of the Republic of Belarus, (Belarus). *Vestsi Akadehmii Agrarnykh Navuk Respubliki Belarus (Belarus) (no.1) p. 35-38.* 3 tables; 11 ref. Russian. (AGRIS 2000-023888).

Based on the research done in 1991, 1993 and 1994 it is shown that in winter wheat, rye and winter triticale for the control of annual dicotyledonous weeds including the ones resistant to 2, 4-D and 2M-4X one can use successfully at early spring tillering stage the herbicide Zirol, 47, 5% a.s. at the rate of 2, 0 l/ha.

1664 Wang Hongfu (Shanxi Agricultural Univ., Taigu (China). Agrochemical Control Center) (1998) **Studies on techniques of weed chemical control in mung bean, red bean, buck wheat fields.** *Journal of Shanxi Agricultural University (China). Shanxi Nongye Daxue Xuebao (China) v. 18(1) p. 24-26.* 4 tables; 6 ref. Chinese. (AGRIS 2000-018193).

1665 Wu, H.; Pratley, J.; Lemerle, D.; Haig, T. (2000) **Laboratory screening for allelopathic potential of wheat (Triticum aestivum) accessions against annual ryegrass (Lolium rigidum).** *Australian Journal of Agricultural Research. 51(2):259-266.* English. [Charles Sturt Univ, Farrer Ctr Conservat Farming Wagga Wagga NSW 2678 Australia].

A new screening bioassay, the 'equal-compartment-agar-method (ECAM)', was developed and employed to evaluate 92 wheat cultivars for their allelopathic activity on the inhibition of root growth of annual ryegrass (L. rigidum). Results showed that the allelopathic activity of wheat was associated with the sowing time of ryegrass seeds, the number of wheat seedlings, agar quantities, and agar concentrations. The addition of activated charcoal into the agar medium significantly alleviated wheat allelopathic inhibition on the root growth of ryegrass, indicating that wheat allelopathic activity is chemically driven. There were significant differences between wheat cultivars in their allelopathic potential at the seedling stage on the inhibition of root elongation of annual ryegrass, varying from 23.98% to 90.91%. Re-screening of 22 selected wheat accessions showed that the allelopathic potential of wheat cultivars is consistent between different years under the same experimental conditions. This newly developed screening bioassay successfully separated the allelopathic effect from the competitive effect between wheat and ryegrass plants, and enabled the constant release and accumulation of allelochemicals from living wheat seedlings into the growth medium to affect the growth of ryegrass. The influence of microorganisms was also avoided because of the sterile conditions. The present study describes this new bioassay suitable for the efficient screening of a large number of wheat cultivars under laboratory conditions. [References: 21].

1666 Yenish, JP.; Young, FL. (2000) **Effect of preharvest glyphosate application on seed and seedling quality of spring wheat (Triticum aestivum).** *Weed Technology. 14(1):212-217.* English. [Washington State Univ, Dept Crop & Soil Sci Pullman, WA 99164 USA].

Studies were conducted to determine effects of preharvest applications of glyphosate on the seed and seedling quality of 'Alpowa' and 'Penawawa' soft white spring wheat (Triticum aestivum) varieties. Glyphosate was applied at 0.62 or 0.89 kg ae/ha at the milk (Zadoks' scale 70 to 79), soft dough (Zadoks' scale 85), or hard dough stage (Zadoks' scale 87) of wheat development; 7 d following the hard dough treatment; and 1 d prior to wheat harvest. In harvest aid applications, wheat yields were reduced only with glyphosate applied at the milk stage of development. Yield reduction ranged from 20 to 77% depending on the year, variety, and glyphosate rate. Likewise, kernel weight and germination were affected only by glyphosate applications tit the milk stage with reductions from 19 to 73% and from 2 to 46% for kernal weight and percent germination, respectively, compared to untreated wheat. Using wheat from harvest-aided glyphosate treatments at the milk stage as seeds the following year resulted in reductions ranging from 28 to 99%, 19 to 39%, and 12 to 97% for seedling density, plant height, and seed yield, respectively, compared to seeds from untreated wheat. In this study, wheat seed and seedling quality following preharvest glyphosate applications were most greatly influenced by crop maturity stage at time of application than by herbicide rate or variety. [References: 9].

J10 HANDLING, TRANSPORT, STORAGE AND PROTECTION OF AGRICULTURAL PRODUCT

1667 Ermekbayev, S.B.; Iztayev, A.I.; Punkov, S.P. (1998) **[Problems of increase of grain resourses in Kazakhstan].** *Food engineering and service (no. 2)p. 49-53.* 5 ref. Russian. (AGRIS 2000-023907).

From the statistical data it is evident that about 30 of grain in Kazakhstan is lost in afterharvesting treatment and storage. Because of this, increasing of grain afterharvesting treatment efficiency on the basis of new methods providing improvement of its technological qualities is an urgent task. The damaged grainmay be of the following types: germinated, frosted, dry and damaged by field pests, diseases and undesirable plants; hibernated at the field, mechanically-damaged, discolored, yellowed, etc. All types of damage cause losses in quantity and quality. In practice, the quantity of germinated grain in wheat batches coming to grain receiving points varves within the considerable limits and, in some years, reaches 40. Analysis of existing ways for improving of grain quality showed that recirculation-isothermic drying with heating of grain to 65 deg C was the most applicable for all practical purposes. The authors suggest to subgrade 10-20 of flour from full-value grain for production of high-grade bread. Decrease of activity of amilolytic and proleolytic enzimes is a main way for improve ment of germinated grain bakerability, flour from this grain and of bread quality. Physical treatment techniques, electric, in particular, may be promising for grain quality improvement.

J11 HANDLING, TRANSPORT, STORAGE AND PROTECTION OF PLANT PRODUCT

1668 Contessi, A. (Regione Emilia Romagna, Bologna (Italy). Servizio Fitosanitario); Ferraresi, A. (Centro Ricerche Produzioni Vegetali (CRPV), Cesena, Forli (Italy)) (1992) **[The storage [wheat - Emilia-Romagna]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 49-54.* 4 tables. Italian. (AGRIS 2000-018258).

1669 Fields, PG.; Korunic, Z. (2000) **Diatomaceous earth to control Cryptolestes ferrugineus (Coleoptera : Cucujidae) in stored barley in farm granaries.** *Canadian Entomologist. 132(2):247-258.* English. [Agr & Agri Food Canada, Cereal Res Ctr 195 Dafoe Rd Winnipeg MB R3T 2M9 Canada].

Granary trials to determine the efficacy of an enhanced diatomaceous earth (DE) formulation (Protect-It(TM)) at 0.15 kg DE/t grain to control grain-feeding beetles in barley, Hordeum vulgare L. (Poaceae), were conducted at Glenlea, Manitoba. During the test, the grain moisture content ranged from 11 to 13%, and grain temperature ranged from 27 to 2 degrees C. The bulk density of barley was reduced 10-20 kg/m(3) by the addition of diatomaceous earth. Adults of the rusty grain beetle, Cryptolestes ferrugineus (Stephens), were released onto the top surface of the grain of each granary, producing an average density of approximately 4 insects/kg grain. Using Berlese funnels to extract insects from grain samples there was a 95% reduction in adults and an 80% reduction in larvae found in treated grain compared with untreated grain, 1 month after releasing insects into the grain. There was a 95% or greater decrease in the total number of insects caught with probe pitfall traps in the treated barley compared with the untreated barley for all;sampling dates. For the confined populations, 200 adult C. ferrugineus or Tribolium castaneum (Herbst) (Coleoptera: Tenebrionidae) (red flour beetle) were held in screened jars in the grain until the end of October, and there was over a 99% reduction in both insect species, compared with insects held on untreated grain. These results indicate that this diatomaceous earth formulation can control C. ferrugineus in barley in granaries at 0.15 kg DE/t grain. [References: 27].

1670 Goncalves, RA.; Santos, JP.; Chandra, PK.; Germani, R. (2000) **Control of Rhyzopertha dominica using a controlled atmosphere with CO2, in wheat.** *Pesquisa Agropecuaria Brasileira. 35(1):1-9.* Portuguese. [UFLA Caixa Postal 37 BR-37200000 Lavras MG Brazil].

Controlled atmosphere with inert gases offers an alternative to phosphine use to control stored grain pests. The objective of this research was to test a controlled atmosphere with CO2 to control Rhyzoperta dominica, (Fabr.) (Coleoptera: Bostrichidae), an important pest of stored wheat grain. This test consisted of five CO2 concentrations (0, 30, 40, 50 and 60%; completed with N-2), fumigation periods of 5, 10 and 15 days; insect populations collected from Campo Mourao, PR, Sere Lagoas, MG and Santa Rosa, RS, in Brazil, and seven developing stages (egg, larva of 1(st), 2(nd), 3(rd) and 4(th) instar, pupa and adult), in three replications. All the different life stages of the insect were kept as individual samples in a small voile cloth bag and put inside a 200 liter fumigation chamber with 75% of this volume full of grain with the metal lid sealed at the edge with silicone rubber to guarantee hermetic conditions. The different CO2 concentrations were then added inside the chambers. The results showed that all CO2 concentrations tested caused 100% mortality to all adult stage of the three insect populations in all fumigation periods tested. The mortality of the pupa stage of the three insect population was 100% when the 60% CO2 concentration was used in the 15 days fumigation period; however, all CO2 concentrations in 15 days fumigation period caused 100% mortality in pupa of insects collected in Santa Rosa. For adequate control of all larval stages it requires 50% CO2 or above this concentration. During the 10 and 15 days fumigation periods all CO2 concentrations controlled 100% of the eggs from the three populations studied. [References: 12].

1671 Hagstrum, D.W. (Grain Marketing and Production Research Center USDA ARS, Manhattan, KS (USA).); Reed, C.; Kenkel, P. (1999) **Management of stored wheat insect pests in the USA.** *Integrated Pest Management Reviews (Netherlands) v. 4(2) p. 127-142.* Bibliography (116 ref.). English. (AGRIS 2000-023925).

1672 Kljajic, P. (Institut za poljoprivredna istrazivanja "Srbija", Beograd Zemun (Yugoslavia). Centar za pesticide i zastitu zivotne sredine); Peric, Z.; Almasi, R.; Peric, I. (1997) **[Effect of hunger-bitten on the grain weevil (Sitophilus granarius L.) and toxicity of contact insecticides on the survived individuals].** 8. savetovanje dezinfekcija, dezinsekcija, deratizacija, dekontaminacija, dezodoracija u zastiti zivotne sredine sa medjunarodnim ucescem. Subotica (Yugoslavia). 28-30 May 1997. *[Collection of papers]. Hrgovic, N.; Radenkovic, B. (Eds.) p. 103-106.* Veterinarski fakultet, Katedra za zoohigijenu. 5 tables; 10 ref. Serbian. (AGRIS 2000-023924).

1673 Stefani, A.; Meletti, P.; Sbrana, V.; Onnis, A. (2000) **Low temperature storage of caryopses of Triticum durum: Viability and longevity.** *Annals of Botany. 85(3):403-406.* English. [Scuola Super Studi Univ & Perfezionamento S Anna Via G Carducci 40 I-56127 Pisa Italy].

Germination of Triticum durum Desf. 'Cappelli' caryopses stored in hermetically-sealed containers at 10 degrees C or -20 degrees C was analysed. Caryopses were maintained in laboratory conditions (20 +/- 4 degrees C) prior to controlled storage, which began 5 d, 240 d and 7 years after harvesting. In addition, after 9 years of storage, one 10 degrees C stored batch of caryopses and two -20 degrees C stored batches were returned to laboratory conditions. Germination over time and seed longevity were investigated. Results showed that: (1) under laboratory conditions, caryopses in relative (primary) dormancy at the beginning of storage had lost dormancy after 45 d and germination ability was lost by the end of year 7. (2) When stored at 10 degrees C, relative dormancy in caryopses was lost within 1 year, but 100% germination ability was retained after 23 years of storage. (3) When stored at -20 degrees C, caryopses that were dormant at the beginning of storage (5 d after harvesting) maintained this condition for 23 years while caryopses which were placed in storage 240 d after harvesting, when relative dormancy had already been broken, maintained 100% germination ability. Caryopses returned to laboratory conditions after 9 years of storage at 10 degrees C or -20 degrees C showed the same trend as caryopses maintained exclusively in laboratory conditions since the time of harvesting. Caryopses removed from -20 degrees C overcame relative dormancy in 50 d and maintained germination ability for roughly 7 years, while those removed from 10 degrees C lost the ability to germinate by the end of the fifth year. (C) 2000 Annals of Botany Company. [References: 23].

K01 FORESTRY-GENERAL ASPECTS

1674 Li Zhengcai(Chinese Academy of Forestry, Fuyang (China). Inst. of Subtropical Forestry) (1998) **The impacts of new cultivation patterns of incorporating poplar with wheat on the yield and quality of wheat.** *Forest Research (China). Linye kexue yanjiu (China) v. 11(6) p. 629-634.* 6 tables; 7 ref. Chinese. (AGRIS 2000-023962).

L02 ANIMAL FEEDING

1675 Athari, A.K.; Al Bustany, Z.(IPA Agricultural Research Center, Baghdad (Iraq)). (1997) **Subusitativn of maize by Triticale and / or Barleyin broiler diets.** *Mij"alat IPA lil-abh"a:t" al-zira:3yah. IPA J. of Agricultural research. v. 7 (no.1) p. 8-16.* Arabic. (AGRIS 2000-018599).

Nime alternative broiler diets (1-9) were compared. The energy sources used in these diets were locally grown barley (B), maize (M) or tritical (T) were incorporated in different proportions as follow 1 (60 M); 2 (40 M , 20 T); 3 (40 M, 20 B). The results showed that it is possible to achieve the same production performance with the alternative diets: 2; 3; 4; 6 as companed to the control group (diet 1).

1676 De, Brum, PAR.; Zanotto, DL.; Guidoni, AL.; Rosa, PS.; De, Lima, GJMM.; Viola, ES. (2000) **Triticale in diets for broilers.** *Pesquisa Agropecuaria Brasileira. 35(2):229-239.* Portuguese. [EMBRAPA, Ctr Nacl Pesquisa Suinos & Aves Caixa Postal 21 BR-89700000 Concordia SC Brazil].

A study was carried out to determine the best replacement level of corn by triticale in diets for broilers. A total of 1, 560 one-day old birds, both male and female, were used in the study from 1 to 42 days of age. The experimental design was in random blocks with five treatments: 0, 25, 50, 75% of replacement of corn by triticale, and a fifth diet containing basically triticale and soybean meal. There were 12 replicates per treatment, six with males and six with females. All diets were isocaloric and isoproteic. There was an effect of sex ($P<0.05$) for all studied variables, except feed conversion during the first phase of the experiment. Mates showed better performance than females. The interaction between sex and treatment was not significant ($P>0.05$). According to the results, it is possible to replace up to 75% of corn by triticale, without negatively affect the performance of broilers. The use of triticale will be economically possible for broiler of both sexes, when its cost represents 63, 46 and 45% of price of corn, for substitution levels of 25, 50 and 75%, respectively. Although showing worst performance, total substitution of corn by triticale is advantajous if triticale price is up till 42% corn price. [References: 22].

1677 Jobim, C. (Universidade de Maringa (Bresil)); Emile, J.C. (1999) **Utilization of winter cereals for the feeding of ruminants in Brazil.** *Fourrages (France) (no 158) p. 259-267.* 11 ref., 4 tableaux. French. (AGRIS 2000-018608).

Le mode d'utilisation des cereales d'hiver dans les exploitations varie selon la region et le systeme d'elevage concerne. L'avoine est surtout utilisee pour l'alimentation des ruminants (paturage), en particulier l'avoine noire (Avena strigosa). L'avoine blanche (Avena sativa) et le triticale sont utilises dans la moitie des cas comme fourrage (ensilage, foin et paturage). Le ble, l'orge et le seigle sont surtout des cultures industrielles. L'utilisation mixte des cereales, en exploitant une ou deux fois la parcelle sous forme de fourrage avant la recolte en grain, semble tres prometteuse. Elle permet d'ameliorer aussi bien les performances animales que vegetales, et d'augmenter et de securiser le revenu des agriculteurs. Un exemple de ce mode mixte de valorisation est presente.

1678 Kaci, A; Rabane, M. (Institut Technique des Petits Elevages, (ITPE), Bab ALi (Alg@7erie) Station experimentale (1997) **Influence du triticole sur les performances de la poule pondeuse***Bulletin Technique (ALg@7erie) (no.10) p. 10-13*French(AGRIS 2000-024609).

1679 Liu Yanqiang; Han Zhengkang(Nanjing Agricultural Uni., Nanjing (China). College of Animal Science and Technology) (1998) **Effect of crude enzyme preparation supplementaed to barley based diets on growth and pancrea RNB and DNA levels in chickens.** *Chinese Journal of Animal Science (China). Zhongguo xumu zazhi (China) v. 34(5) p. 21-22.* 2 tables; 10 ref. Chinese. (AGRIS 2000-024556).

1680 Massab, A.; Achouri, S.A. (Institut Technique des Petits Elevages, (ITPE), Bab Ali (Alg@7erie). Station experimentale (1997) **Essai d' incorporation du triticole aux haux de 10 et 20 dans l' aliment du poulet de chair***Bulletin Technique (Alg@7erie) (no.10) p. 8-92* tableauxFrench(AGRIS 2000-024537).

1681 Olsen, A.W.; Dybkjaer, L.; Vestergaard, E. M. (1999) **[Barley-pea-whole crop silage as rummage material for bacon pigs].** [Roughage and High-Fibre Feed for Pigs]. Foulum (Denmark). 16 Mar 1999. [Roundtable meeting on roughage and high fibre feed for pigs]. Jakobsen, K.; Danielsen, V. (Eds.). *Intern Rapport. Danmarks Jordbrugsforskning (Denmark); 50 p. p. 38-42. Danmarks Jordbrugsforskning, Foulum (Denmark).* DJF. Danish. (AGRIS 2000-024664).

1682 Piva, G.; Cerioli, C.; Prandini, A. (Universita Cattolica del Sacro Cuore, Piacenza (Italy). Istituto di Scienze degli Alimenti e della Nutrizione); Morlacchini, M. (CERZOO, S.Bonico, Piacenza (Italy)); Colombari, G. (Istituto Superiore Lattiero Caseario, Mantua (Italy)) (1998) **Effects of Aspergillus niger-phytase and plant phytase activity in pig diets formulated on available phosphorus requirements.** *Zootecnica e Nutrizione Animale (Italy) v. 24(2) p. 95-109.* 7 tables; 34 ref. Italian. (AGRIS 2000-024668).

1683 Soerensen, G. (1999) **[Roughage for swine: experience and problems in practical use].** [Roughage and High-Fibre Feed for Pigs]. Foulum (Denmark). 16 Mar 1999. [Roundtable meeting on roughage and high fibre feed for pigs]. Jakobsen, K.; Danielsen, V. (Eds.). *Intern Rapport. Danmarks Jordbrugsforskning (Denmark); 50 p. p. 4-8. Danmarks Jordbrugsforskning, Foulum (Denmark).* DJF. 7 tables. Danish. (AGRIS 2000-024649).

1684 Zeghida, A; Hamrit, S.; Kouchi, M.L. (Institut Technique des Grandes Cultures, (ITGC), El Khroub (Alg@7erie). Ferme experimentale) (1997) **Integration grandes cultures-elevages Ovin, r@7esultats d' experimentation** *C@7er@7ealicuture (Alg@7erie). Revue Technique et Scientifique (no.30) p.5-10*12 tableauxFrench(AGRIS 2000-024646).

L20 ANIMAL ECOLOGY

1685 Dvorak, J. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)) (1999) **Seasonal attractivity of field crops for game.** Mendel Net 99: Conference of graduate students at the Faculty of Forestry and Wood Technology of Mendel University of Agriculture and Forestry Brno. Brno (Czech Republic). 1999. *Mendel Net 99: Conference of graduate students at the Faculty of Forestry and Wood Technology of Mendel University of Agriculture and Forestry Brno 64 p. p. 3-6.* Mendelova Zemedelska a Lesnicka Univ. 18 ref. Czech. (AGRIS 2000-018786).

L51 ANIMAL PHYSIOLOGY-NUTRITION

1686 Alawa, JP. (1999) **Rumen protein degradation and nitrogen cycling on the nutritive value of low quality roughage diets: A review [Review].** *Discovery & Innovation. 11(3-4):131-136.* English. [Ahmadu Bello Univ, Dept Anim Sci Zaria Nigeria].

1687 Chaudhry, AS. (2000) **Rumen degradation in sacco in sheep of wheat straw treated with calcium oxide, sodium hydroxide and sodium hydroxide plus hydrogen peroxide.** *Animal Feed Science & Technology. 83(3-4):313-323.* English. [Univ Newcastle Upon Tyne, Dept Agr Newcastle Upon Tyne NE1 7RU Tyne & Wear England].

This split unit study involved two sheep, seven incubation times and four test straws to compare with untreated straw the effect, kg(-1) straw dry matter (DM), of CaO (160 g CaO plus 2 1 of water), NaOH (80 g NaOH in 3 1 of water) and alkaline hydrogen peroxide (NaOH

plus 132 g H2O2 in 3 1 of water, AHP) treatments on composition and rumen degradation in sacco of wheat straw in sheep. After 14 days of storage, each straw was mixed with molasses, dried, ground, weighed into nylon bags and incubated ruminally for various hours in sheep fed daily 1 kg dried grass cubes. After removal, the residues within bags were washed together with unincubated samples (0 h) of straws, dried and analysed for DM, organic matter (OM) and neutral-detergent fibre (NDF) to estimate nutrient disappearance from straws. The data on nutrient disappearance were fitted exponentially to estimate quick- (a), slow (b) and predicted (P-0.025) degradable fractions and degradation rate (c) for b. NDF and hemicellulose were reduced in treated compared with untreated straw ($p < 0.001$). Disappearance of nutrients from treated straws was significantly greater than that from untreated straw at almost all incubations ($p < 0.001$). The a, b, c and P-0.025 estimates were significantly increased by all treatments ($p < 0.001$). AHP treatment increased straw degradation more than NaOH and CaO treatments. Although, CaO improved rumen degradation less than NaOH, its use to increase straw digestion even moderately may be more desirable because it is readily available, cheap and less dangerous for the users and the environment. [References: 20].

1688 Danicke, S.; Bottcher, W.; Jeroch, H.; Thielebein, J.; Simon, O. (2000) **Replacement of soybean oil with tallow in rye-based diets without xylanase increases protein synthesis in small intestine of broilers.** *Journal of Nutrition. 130(4):827-834.* English. [Univ Halle Wittenberg, Fac Agr, Inst Anim Nutr & Planned Crop Storage Halle Germany].

We examined the effects of dietary fat type (10% of either soybean oil, S, or beef tallow, T)(3) and xylanase supplementation (-, without; +, with 1 g of Avizyme 1300 per kg diet) in rye- based diets (56%) on tissue protein synthesis in male broilers. Birds were injected with a large flooding dose of a phenylalanine solution (150 mmol/L, 38 atom percentage excess [(15) N] phenylalanine) and tissues were obtained after a 10-min incorporation period. [(15) N]-enrichment in tissue free phenylalanine and tissue protein bound phenylalanine were measured by gas-chromatography mass-spectrometry and by gas-chromatography combustion isotope ratio mass-spectrometry, respectively in order to calculate tissue specific fractional rates of protein synthesis (k(s). The k, (%/d) in (S-), (S+), (T-) and (T+)-fed birds were 56, 64, 84 and 61 (SEM = 3.7) in duodenum, 51, 52, 75 and 58 in jejunum (SEM = 3.1), 66, 67, 105 and 68 (SEM = 7.0) in jejunal mucosa cells, 53, 56, 68 and 50 (SEM = 3.7) in ileum and 52, 45, 118 and 39 (SEM = 20.2) in pancreas, respectively. Significant fat, enzyme or interaction effects in these tissues were mainly caused by the elevated k(s) in (T-)-fed birds which was closely associated with intestinal viscosity. We conclude that the effect of soluble nonstarch polysaccharides (NSP) and of NSP-hydrolyzing enzymes may be explained partially by modification in tissue protein synthesis of the intestinal tract. [References: 36].

1689 Gill, BP.; Mellange, J.; Rooke, JA. (2000) **Growth performance and apparent nutrient digestibility in weaned piglets offered wheat-, barley- or sugar-beet pulp-based diets supplemented with food enzymes.** *Animal Science. 70(Part 1):107-118.* English. [Meat & Livestock Commiss POB 44, Winterhill House, Snowdon Dr Milton Keynes MK6 1AX Bucks England].

Pig studies on non-starch polysaccharides (NSPs) have mainly focused on finishing and breeding animals because their digestive capacity and ability to ferment fibre are considered greater than piglets. In this study, growth and nutrient digestibility, with particular reference to NSP constituent monomers, were evaluated in piglets offered contrasting sources of NSPs. The potential for enhancing growth performance and digestibility with exogenous food enzymes (xylanase, amylase, pectinase and beta-glucanase) teas investigated. A total of 240 piglets weaned at 28 days of age, in groups of six, were allocated to six treatments in a 3X2 factorial design, diet type (W, B and SEP) by enzyme supplementation (-v. +). Diet W was wheat based and formulated to supply 14 MJ digestible energy (DE) per kg. In diets B and SEP, DE was reduced to 13.25 MJ/kg by replacing wheat with barley (708 g/kg) or with 185 g/kg dried unmolassed sugar beet pulp. Growth was monitored over 4 weeks. Digestibility of diets B-, B+, SBP- and SBP+ was evaluated in 16 piglets, in groups of four, using a 4 X 4 Latin-square design. In the growth study, mean initial and final piglet weights were 8.1 (s.e. 0.09) and 18.0 (s.e. 0.21) kg. Piglet health remained satisfactory and food intake averaged 523 (s.e. 6.7) g/day There were no consistent and significant effects of diet type on food intake, live-weight gain or food conversion, except in week 1 when gain on diet W was higher than on diets B and SEP, 191 v. 150 v. 125 g/day, respectively (s.e.d. 20.0, $P < 0.05$). Enzyme supplements enhanced the conversion of food to gain over 4 weeks (1.56 v. 1.50:1, s.e.d. 0.030, $P < 0.05$). Piglets given diet SBP produced faeces with a lower dry-matter content (181 v. 246 g/kg, s.e.d. 10.8, $P < 0.001$) but with no visual evidence of a nutritionally induced diarrhoea. There were no significant differences in apparent faecal digestibility coefficients (AFDC) for dry matter, crude protein and gross energy between diets B and SEP. AFDC for soluble, insoluble and total NSP constituent monomers were higher ($P < 0.001$) in diet SEP. Soluble uronic acids were the most readily digested NSP constituents in diet SEP, showing a mean AFDC of 0.96 (s.e. 0.005). Apparent faecal digestibility was not an appropriate indicator for supplementary enzyme activity in the intact digestive tract of piglets given diets rich in fermentable NSPs. Piglets given the diets supplemented with enzymes excreted increased concentrations of urinary pentoses, especially arabinose (0.113 v. 0.136 mg/ml, s.e.d. 0.0107, $P < 0.05$). Urinary arabinose and xylose concentrations were also increased ($P < 0.001$) with feeding SEP, indicating that some of the microbially released NSP sugars escaped fermentation and were directly absorbed. In conclusion, piglets were able to use simple diets, containing high and contrasting sources of NSPs to support satisfactory rates of live-weight gain. Supplementation with NSP degrading enzymes enhanced the conversion of food to live-weight gain. Urinary NSP derived sugars provided indirect evidence of NSP hydrolysis by supplementary enzymes and gut microbes. [References: 32].

1690 Giri, SS.; Sahoo, A.; Pathak, NN. (2000) **Feed intake, digestibility, plane of nutrition and live weight gain by crossbred growing bulls fed on grainless diets containing different nitrogen sources.** *Animal Feed Science & Technology. 83(3-4):195-203.* English. [Cent Inst Freshwater Aquaculture, Fish & Shellfish Nutr Div Bhubaneswar 751002 Orissa India].

Twenty five growing crossbred bulls (Bos indicus x Bos taurus) were used in a randomised block design experiment for 196 days to determine the effect of grainless concentrate containing different supplemental nitrogen sources along with wheat straw based diet on feed intake, nutrient digestibility, plane of nutrition and daily live weight gain. The animals in control group received barley 30% in the concentrate mixture (Cm-1) as a source of grain, where as other concentrate mixtures contained only wheat bran (Cm-2) or wheat bran supplemented with 2.5% urea (Cm-3), 21.5% groundnut oil cake (Cm-4) or 27% mustard ail cake (Cm-5) as source of supplemental nitrogen. Fortnightly live weight gain was recorded and a metabolism trial of 6 days duration was conducted after 120 days of feeding trial in order to assess nutrient utilisation and retention as well as plane of nutrition; The mean dry matter (DM) intake and digestibility of the nutrients except crude protein (CP) were similar in all the groups. CP digestibility was significantly higher ($P<0.05$) in urea fed animals. A positive nitrogen balance was recorded in all the groups. Though gross energy (GE) and digestible energy (DE) intake were not affected, the urinary loss of energy (UE) was significantly lower ($P<0.05$) in animals fed Cm-2. A positive calcium and phosphorus balance was observed in all the treatments though phosphorus balance in Cm-2 fed animals was significantly higher ($P<0.05$). Average daily live weight gains were 443, 344, 370, 435 and 423 g in Cm-1, Cm-2, Cm-3, Cm-4 and Cm-5 fed animals, respectively. A marginal less daily live weight gain was recorded in Cm-2 fed animals and the results were non-significant among the treatments. Active growth could be obtained in animals fed grainless concentrates having wheat bran as its main component: at an amount or 1% of the live weight daily without showing significant influence on nutritional status and growth of growing bulls. [References: 24].

1691 Jondreville, C.; van, den, Broecke, J.; Grosjean, F.; Van, Cauwenberghe, S.; Gatel, F. (2000) **Ileal true digestibility of amino acids in wheat milling by-products for pigs.** *Annales de Zootechnie. 49(1):55-65.* English. [Inst Tech Cereales & Fourrages 8 Ave President Wilson F-75116 Paris France].

Ten batches of wheat milling by-products - 3 of wheat middlings (WM), 4 of wheat feed (WF), 3 of wheat bran (WB) - were analysed and studied for their protein and amino acid ileal true digestibility (ITD). Each batch was tested on four castrated male pigs weighing between 35 and 95 kg, and fitted with an end-to-end ileo-rectal anastomosis. In all types of by-products, lysine and threonine were among the least digestible amino acids, whereas methionine was among the most digestible ones. N and all amino acids ITD decreased significantly ($P < 0.05$) from WM to WF and to WE. In WM, the average N, lysine, threonine and methionine ITD values were 93.6, 90.8, 90.4 and 95.1%, respectively. They decreased to 85.5, 86.6, 83.3 and 91.5%, respectively in WF and down to 70.1, 68.3, 68.4 and 78.9%, respectively in WE. N and all amino acids ITD was predicted according to either the ratio of the feedstuff fibre to amino acid concentrations, or the proportion of total N bound to the NDF (neutral detergent fibre) residue, or both. For most amino acids, the use of CF (crude fibre), ADF (acid detergent fibre) or ADL (acid detergent lignin) as fibre criteria provided accurate equations with coefficient of determination higher than 90%. [References: 31].

1692 Kalra, S.; Joad, S. (2000) **Effect of dietary barley beta-glucan on cholesterol and lipoprotein fractions in rats.** *Journal of Cereal Science. 31(2):141-145.* English. [Haryana Agr Univ, CCS, Dept Food & Nutr Hisar 125004 Haryana India].

The flours of three barley cultivars, namely Dolma (hull-less), DL-88 (hull-less) and BH-331 (hulled), containing 6.23, 4.60, 2.18% total beta-glucan and 5.39, 2.06, 1.08% soluble beta-glucan contents, respectively, were used in the diets of rats to compare their hypocholestrolaemic effects. Comparison was also made with a standard casein diet. After 40 days of feeding trial, feed intake and weight gain were found to Ire the highest for the casein diet and differed significantly from those of the barley diets. Dolma (hull-less) based diet, fed to rats caused significant ($p<0.05$) reductions in the levels of total cholesterol (39%), LDL-cholesterol (61%) and triglyceride (21%), and significant elevation in the level of HDL-cholesterol (34%) in serum compared with the casein diet. Similar changes were observed in liver also. There was a significant increase in the HDLc/TC ratio and decrease in the LDLc/HDLc ratio in the serum and livers of Dolma diet-fed rats. The casein group had the highest total serum protein and liver protein compared with other test groups. Among the test diets, DL-88 had ail intermediate and BH-331 the lowest cholesterol-lowering effect. Total and soluble P-glucan appeal-ed to be strong predictors of the cholesterol-lowering in serum and liver of rats. The viscous property of soluble beta-glucan may result in reduced absorption, or reabsorption of lipids. (C) 2000 Academic Press. [References: 29].

1693 Mathison, GW.; Hsu, H.; Soofi-Siawash, R.; Recinos-Diaz, G.; Okine, EK.; Helm, J.; Juskiw, P. (1999) **Prediction of composition and ruminal degradability characteristics of barley straw by near infrared reflectance spectroscopy.** *Canadian Journal of Animal Science. 79(4):519-523.* English. [Univ Alberta, Dept Agr Food & Nutr Sci Edmonton AB T6G 2P5 Canada].

The usefulness of near infrared reflectance spectroscopy (NIRS) for the prediction of the nutritive value of straw was examined with 195 samples of barley straw. Excluding lignin, NIRS technique explained 84 to 94% of the variation in chemical components in the validation set. From 69 to 84% of the variation in ruminal degradability characteristics, excluding rate of degradation, was explained by NIRS. With the exception of neutral detergent fiber, accuracies of prediction were nor improved when NIRS calibrations were based upon calibration sets containing straw only in contrast with when barley hay and barley silage were included with straw in the calibration set. We conclude that near infrared reflectance spectroscopy is a useful method for predicting chemical composition of straw and estimating its ruminal degradability characteristics. [References: 15].

1694 Monsma, DJ.; Thorsen, PT.; Vollendorf, NW.; Crenshaw, TD.; Marlett, JA. (2000) **In vitro fermentation of swine ileal digesta containing oat bran dietary fiber by rat cecal inocula adapted to the test fiber increases propionate production but fermentation of wheat bran ileal digesta does not produce more butyrate.** *Journal of Nutrition. 130(3):585-593.* English. [Univ Wisconsin, Dept Nutr Sci 1415 Linden Dr Madison, WI 53706 USA].

This experiment evaluated three hypotheses: i) production of propionate is increased during fermentation of substrate containing oat bran (OB)(6); ii) production of butyrate is increased during fermentation of substrate containing wheat bran (WB) and iii) results of in vitro fermentations using physiological substrates and inocula agree with in vivo data. Ileal digesta collected from swine fed OB and WE were the substrates. Digesta was fermented for 0-96 h in an anaerobic in vitro system using inocula prepared from ceca of rats fed the same fiber sources. Carbohydrate and short-chain fatty acid (SCFA) contents in the fermentations were measured by gas chromatography. Fermentation of WE digesta did not produce more n-butyrate ($P > 0.05$) and was significantly slower ($P < 0.05$) than fermentation of OB digesta. OB digesta fermentation produced a significantly greater ($P < 0.05$) molar proportion of SCFA as propionate, Bacterial mass increased more and was maintained longer during fermentation of OB digesta than the WE digesta. Our results indicate that dilution of undigested WE fiber and not n-butyrate production is one mechanism by which WE may protect colonic mucosa; propionate production is increased during fermentation of P-glucan in OB; and an in vitro system using physiological sources of inoculum and substrate containing WE and OB yields results that agree with in vivo findings in humans and rats. [References: 46].

1695 Susmel, P.; Spanghero, M. (Udine Univ. (Italy). Dipartimento di Scienze della Produzione Animale) (1998) **Rumen fermentation characteristics - digestibility and excretion of purine derivates in cows fed with different starch sources.** *Zootecnica e Nutrizione Animale (Italy) v. 24(1) p. 3-16.* 4 tables; 4 graphs; 27 ref. Italian. (AGRIS 2000-024951).

1696 Varadyova, Z.; Zelenak, I.; Siroka, P. (2000) **In vitro study of the rumen and hindgut fermentation of fibrous materials (meadow hay, beech sawdust, wheat straw) in sheep.** *Animal Feed Science & Technology. 83(2):127-138.* English. [Slovak Acad Sci, Inst Anim Physiol Kosice 04353 Slovakia].

The influence of both rumen and hindgut inocula of sheep on fermentation of fibrous materials in vitro has been investigated. Different fibrous materials (meadow hay, beech sawdust, wheat straw) and cellulose were used as substrates. The study was carried out to compare: (1) fermentation of substrates with rumen and hindgut inocula, (2) fermentation of meadow hay (reference substrate) and other substrates, (3) fermentation of the two types of cellulose (amorphous and crystalline), and (4) fermentation of treated fibrous materials (treated beech sawdust by defibration and impregnation and fungal treated wheat straw) and untreated fibrous materials. Hindgut fermentation of fibrous materials was associated with decreased dry matter and neutral detergent fibre degradabilities, and also methane and total gas production. The calculated hydrogen recoveries with hindgut inoculum showed a tendency to lower values as compared to the rumen inoculum. Significant differences were found between meadow hay and other fibrous materials, between both celluloses and between treated and untreated fibrous materials. The positive correlation between hydrogen recoveries and methane production of untreated wheat straw with a hindgut inoculum suggested the presence of reductive acetogenesis with the hindgut inoculum. It can be concluded that reductive acetogenesis with a hindgut inoculum instead of methanogenesis may increase the energetic yield from VFA per substrate, and to some extent also the energetic yield for the host animal. [References: 32].

1697 Yang, WZ.; Beauchemin, KA.; Rode, LM. (2000) **Effects of barley grain processing on extent of digestion and milk production of lactating cows.** *Journal of Dairy Science. 83(3):554-568.* English. [Agr &

Agri Food Canada, Res Ctr, Livestock Sci Sect Lethbridge AB T1J 4B1 Canada].

Effects of barley processing on site and extent of digestion and milk production in dairy cows were evaluated in a 4 x 4 Latin square design with four lactating cows with ruminal and duodenal cannulas. Barley grain was steam-rolled to four thicknesses: coarse, medium, medium-flat, and flat. The processing index (PI), measured as volume weight of barley after processing expressed as a percentage of its volume weight before processing, was 81.0, 72.5, 64.0, and 55.5% for the four treatments, respectively. Diets consisted of 53% concentrate (dry matter basis) containing one of the four processed barleys. Cows mere offered ad libitum access to a total mixed ration three times daily. Dry matter intake was quadratically increased with decreasing PI, with maximum intake for cows fed medium-flat barley. Although ruminal digestibilities of organic matter, starch, and crude protein were not affected by grain processing, intestinal and total tract digestibilities were linearly increased as PI of barley was reduced. Milk yield was quadratically increased (25.6, 28.1, 30.8, and 29.0 kg/d) with decreasing PI, and maximum milk yield was for cows fed medium-flat barley. Milk fat and lactose contents were similar, but milk protein content was increased with decreasing PI. These results indicate that the optimal extent of barley processing for dairy cows fed diets supplying adequate fiber was medium-flat, corresponding to a processing index of about 64%. Coarsely or flatly rolled barley is not recommended, because extensive processing did not further improve intake of digestible nutrients, and coarsely processed barley resulted in the lowest intake of digestible organic matter; hence, lowest milk production. Processing index is a reliable and practical method to quantitatively measure extent of steam rolling. [References: 37].

1698 Yin, YL.; McEvoy, DG.; Mcevoy, JDG.; Schulze, H.; McCracken, KJ. (2000) **Studies on cannulation method and alternative indigestible markers and the effects of food enzyme supplementation in barley-based diets on ileal and overall apparent digestibility in growing pigs.** *Animal Science. 70(Part 1):63-72.* English. [Queens Univ Belfast, Dept Agr & Environm Sci Newforge Lane Belfast BT9 5PX Antrim North Ireland].

Two different cannulation procedures (simple ileal 'T' cannula v. The post valve 'T' caecal cannula (PVTC)) and two indigestible markers (TiO2 v. Cr2O3) were studied with six male littermate pigs fitted with PVTC or simple ileal 'T' cannulae. Six diets were used, of which two were based on wheat and wheat bran and the other four were based on two barleys of different bushel weight without and with exogenous enzymes (beta-glucanase/xylanase). Proportional TiO2 and Cr2O3 recoveries in faeces were less than 1.00, the mean values for the six diets being 0.858 for TiO2 and 0.811 for Cr2O3. With both markers, recovery in faeces was lowest for the most digestible wheat-based diet (A). The ileal apparent digestibility (IAD) coefficients of dry matter (DM), crude protein (CP), energy and amino acids measured with Cr2O3 were significantly ($P < 0.001$) lower than those measured with TiO2. There was no difference in overall apparent digestibility of DM, CP and energy measured with simple ileal 'T' cannula and PVTC techniques. However, IAD of DM, energy and CP measured with the PVTC method were significantly higher than those measured with the simple ileal 'T' cannula method. The data also showed that the standard errors with the simple ileal 'T' cannula method were greater than when using the PVTC method. Diet significantly affected ileal and overall digestibility of nutrients ($P < 0.001$) with values being highest for diet A and least for the wheat bran-based diet (B). Overall digestibility (OD) of DM and energy were higher for the higher bushel weight barley-based diet (C) than for the normal bushel weight barley-based diet (E). Enzyme inclusion improved OD for both barley diets and ileal digestibility of energy (0.060) and CP (0.057) for the normal bushel weight barley. [References: 40].

1699 Yosef, E.; Ben-Ghedalia, D. (2000) **Changes in the alkaline-labile phenolic compounds of wheat straw cell walls as affected by SO2 treatment and passage through the gastro-intestine of sheep.** *Animal Feed Science & Technology. 83(2):115-126.* English. [Agr Res Org, Volcani Ctr, Inst Anim Sci, Metab Unit IL-50250 Bet Dagan Israel].

Sheep were fed two rations based on untreated (WS) and SO2-treated (SO2-WS) wheat straw and the effect of chemical treatment and passage through the gastro-intestine on the composition and degradation of ester and ether-linked cell wall (CW) phenolics was studied. The SO2 treatment reduced the content of total ferulic acid (FA) and p-coumaric acid (PCA) by 35% while tripling the level of vanillin and increasing by 40% the concentration of protocatechuic acid. In WS most of the phenolic compounds were CW-bound, but 37% of the vanillic and 88% of the protocatechuic acids were in the alcohol soluble (AS) fraction. The solubilising effect of the treatment was expressed in releasing the phenolics from the CW mainly as AS-lignins. Most of the FA (62%) was ether-linked, whereas most of the PCA (78%) was eater-linked in the CW of WS, The other minor components were either entirely or mostly, etherified units. The SO2 treatment was more effective in cleaving the ester than the ether bonds of the cinnamic acids, Ester-linked FA was more extensively degraded in the rumen than ester-linked PCA, Ester-linked FA and PCA were more extensively degraded in the rumen than the respective ether-linked compounds, Nevertheless, substantial amounts of ether-linked FA, PCA and other phenolics were removed from CW in the rumen, most likely as oligolignols. Phenolic compounds were determined in rumen liquor of sheep fed the WS and WS-SO2 rations. FA was not detected and PCA was at a very low (20-40 CIM) concentration. Phenylpropanoic acid (PPA) was the major monomeric phenolic compound detected, at concentrations of 580 and 380 mu M in the rumen of WS and WS-SO2 sheep, respectively. It is suggested that hydrogenation of PCA and combined hydrogenation and demethoxylation of FA were responsible for the production of PPA in the rumen. (C) 2000 Elsevier Science B.V. All rights reserved. [References: 41].

P10 WATER RESOURCES AND MANAGEMENT

1700 Al Shaibani, N.; Soumi, G. (1997) **[The economic and technical effects of water resources management improvement project on exploitation of irrigation water use in Syria].** Directorate of irrigation and water use, Damascus (Syria). Directorate of irrigation and water use. 9 ref.; 21 tables. 118 p. Arabic. (AGRIS 2000-020278).

1701 Eberbach, P. (Charles Sturt Univ., Wagga Wagga, NSW (Australia)); Pala, M. (ICARDA, Aleppo (Syria)) (1999) **Row spacing and partitioning of evapotranspiration into components under winter grown wheat in northern Syria.** 6. International Conference on the Development of Dry Lands. Cairo (Egypt). 22-27 Aug 1999. *Desert development: challenges beyond the year 2000, abstracts. International Center for Agricultural Research in the Dry Areas, Aleppo (Syria); UNEP, Cairo (Egypt); Ministry of Agriculture and Agrarian Reform, Cairo (Egypt) p. 38-39.* ICARDA. Only abstract. English. (AGRIS 2000-020366).

P30 SOIL SCIENCE AND MANAGEMENT

1702 Damodar Reddy, D.; Subba Rao, A.; Takkar, P.N.(Indian Institute of Soil Science, Bhopal (India). Phosphorus Laboratory). (1999) **Phosphate adsorption behaviour of a Typic Haplustert in relation to long term use of fertilizer phosphorus and manure under soybean-wheat rotation.** *Journal of the Indian Society of Soil Science (India) v. 47(3) p.425-430.* 2 figs., 4 tables, 4 ref. English. (AGRIS 2000-026208).

1703 Karamat Ali, Ch.; Javed, M.; Javaid, M.A.(Directorate of Land Reclamation, Lahore (Pakisthan). Irrigation and Power Department) (1999) **Growth promotion of wheat by potassium application in saline.** *Journal of the Indian Society of Soil Science (India) v. 47(3) p.510-513.* 4 tables, 17 ref. English. (AGRIS 2000-026266).

1704 Patiyal, S.S.; Verma, T.S.(Himachal pradesh Krishi Vishvavidyalaya, Palampur (India). Department of Soil Science) (1999) **Effect of phosphorus on cro yields in wheat-soybean cropping sequence in acid Alfisols amended with lime and gypsum.** *Journal of*

the Indian Society of Soil Science (India) v. 47(2) p.377-379. 1 table, 9 ref. English. (AGRIS 2000-026265).

1705 Singh, M.; Barman, K.K.; Kundu, S.; Tripathi, A.K.(Indian Institute of Soil Science, Bhopal (India)). (1999) **Transformation of soil organic pools of N as influenced by integrated use of organic manure and fertilizer nitrogen under soybean-wheat system in Vertisol.** *Journal of the Indian Society of Soil Science (India) v. 47(3) p.483-487.* 1 fig., 2 tables, 10 ref. English. (AGRIS 2000-026210).

P31 SOIL SURVEYS AND MAPPING

1706 Sharma, R.C. (Central Soil Salinity Research Institute, Karnal (India)) (1999) **Soil suitability of reclaimed salt affected soil for wheat.** *Agropedology (India) V. 9(10) p.59-62.* 2 tables, 13 ref. English. (AGRIS 2000-026283).

P33 SOIL CHEMISTRY AND PHYSICS

1707 Boerresen, T. (Agricultural Univ. of Norway, Aas (Norway). Dept. of Soil and Water Sciences) (1999) **The effect of straw management and reduced tillage on soil properties and crop yields of spring-sown cereals on two loam soils in Norway.** *Soil and Tillage Research (Netherlands) v. 51(1-2) p. 91-102.* 25 ref. English. (AGRIS 2000-026301).

1708 Bogdevich, I.M.; Tarasyuk, S.V.; Karpova, I.S.; Dovnar, V.A. (Belarus Research Inst. for Soil Science and Agrochemistry, Minsk (Belarus)) (1999) **[Effect of soil acidity on zinc content and its removal by grain crops].** *[Soil Researches and Use of Fertilizers]. Bogdevich, I.M.; Lapa, V.V.; Levitan, T.V. (eds) 269 p. (vol. 25) p. 164-173.* BRISSA. 4 tables; 6 ref. Russian. (AGRIS 2000-020448).

In a field experience on a sod-podzolic loamy sand underlying beds from depth 0, 6-0, 8 m with maraine loam is revealed the negative influence of lowered soil acidity on the zinc supply of grain crops. The zinc content in plants and its removal is directly connected with soil reaction.

1709 Brar, B.S.; dhillon, N.S.; Vig, A.C.(Punjab Agricultural University, Ludhiana (India)). Department of Soils). (1999) **Integrated use of farmyard manure, biogas slurry and inorganic phosphate in P nutrition of wheat crop.** *Journal of the Indian Society of Soil Science (India) V. 47(2) p.264-268.* 1 fig., 4 tables, 12 ref. English. (AGRIS 2000-026352).

1710 Sarkar, S.; Rana, S.K.(Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal (India). AICRP on Water Management) (1999) **Role of tillage on productivity and water use pattern of rice-wheat cropping system.** *Journal of the Indian Society of Soil Science (India) V. 47(3) p.532-534.* 3 tables, 4 ref. English. (AGRIS 2000-026307).

1711 Yao Kuiyuan; Meng Xianyue; Liu Shumei (Tianjin Inst. of Meteorological Sciences, (China)) (1998) **A study on monitoring and predicting of soil moisture in Tianjin farmland [China].** *Acta Agriculturae Boreali-Sinica (China). Huabei Nongxuebao (China) v. 13(1) p. 117-121.* 1 tagble; 5 ill., 3 ref. Chinese. (AGRIS 2000-020533).

P34 SOIL BIOLOGY

1712 Brimecombe, MJ.; De, Leij, FAAM.; Lynch, JM. (1999) **Effect of introduced Pseudomonas fluorescens strains on soil nematode and protozoan populations in the rhizosphere of wheat and pea.** *Microbial Ecology. 38(4):387-397.* English. [Univ Surrey, Sch Biol Sci Guildford GU2 5XH Surrey England].

Previous studies have shown that inoculation of pea seeds with Pseudomonas fluorescens strains F113lacZY or F113G22 increased mineralization of organic nitrogen in the rhizosphere. In contrast, inoculation of the same strains onto wheat seeds reduced mineralization of N from organic residues incorporated into soil. In the present study, we report on a likely explanation of this phenomenon, which appears to be governed by the effect of plant-microbe interactions on bacterial-feeding nematodes and protozoa. In soil microcosm tests, inoculation of pea seeds with Pseudomonas fluorescens strains F113lacZY or F113G22 resulted in an increase in the number of nematodes and protozoa in the rhizosphere as compared to noninoculated controls. This trend was repeated using a model sand system into which the bacteriophagous nematode Caenorhabditis elegans was introduced. It was subsequently found that non-inoculated germinating pea seeds exerted a nematicidal effect on C. elegans, which was remedied by inoculation with either strain F113lacZY or F113G22. This suggests that nematicidal compounds released by the germinating pea seeds were metabolized by the microbial inoculants before they affected nematode populations in the spermosphere or rhizosphere of pea. In contrast, inoculation of wheat plants resulted in significantly lower nematode populations in the rhizosphere, whereas protozoan numbers were unaffected. No nematicidal effects of inoculated or noninoculated wheat seeds could be found, suggesting that microfaunal populations were affected at a later stage during plant growth. Because of their key roles in accelerating the turnover of microbially immobilized N and organic matter, plants that support a larger microfaunal population are likely to benefit from a higher availability of inorganic nitrogen. Therefore, an understanding of plant-microbe interactions and their effects on soil microfaunal populations is essential in order to assess the effects of microbial inocula on plant mineral nutrition. [References: 55].

1713 Panek, JA.; Matson, PA.; Ortiz-Monasterio, I.; Brooks, P. (2000) **Distinguishing nitrification and denitrification sources of N2O in a Mexican wheat system using N-15.** *Ecological Applications. 10(2):506-514.* English. [Univ Calif Berkeley 151 Hilgard Hall Berkeley, CA 94720 USA].

Irrigated wheat systems in the Yaqui Valley of Sonora, Mexico, receive high nitrogen inputs and large discrete inputs of irrigation water, with extended drying periods between irrigation events. We used this system to determine the contribution of the separate processes of nitrification and denitrification to the total N2O flux from the soil and to link each process with important driving variables. At the beginning of the wheat cycle, in an experimental wheat field, we established and maintained replicated, paired soil plots labeled with 25% atom excess (a.e.) (KNO3)-N-15 and ((NH4)-N-15)(2)SO4 at a rate of 7% of the existing pool of NO3- and NH4+, respectively, and measured the evolution of (N2O)-N-15 in each over the course of an irrigation/fertilization cycle. Denitrification losses of N2O predominated over nitrification in the two days following irrigation, and continued for six days. The duration of denitrification was corroborated by measures of N-15(2) flux. Nitrification became increasingly important as soils drained, Each process contributed equally to total N2O losses over the 4-wk period after the wheat cycle began. [References: 34].

P35 SOIL FERTILITY

1714 Ao Liwan; Ku Jianwei; Zhang Yichun (Hubei Academy of Agricultural Sciences, Wuhan (China)) (1998) **Potash status and applying potash fertilizer in wheat field.** *Hubei Agricultural Sciences (China). Hubei Nongye Kexue (China) (no. 6) p. 3-6.* 10 tables; 4 ref. Chinese. (AGRIS 2000-020655).

1715 Badalikova, B.; Hruby, J. (Vyzkumny Ustav Picninarsky, Troubsko u Brna (Czech Republic)) (1999) **Changes of quality of humus in soil by continuous growing of winter wheat.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 57-60.* Mendelova Zemedelska a Lesnicka Univ. 1 table; 12 ref. Czech. (AGRIS 2000-020656).

P36 SOIL EROSION, CONSERVATION AND RECLAMATION

1716 Li Lianqing (Shanxi Agricultural Univ., Taigu (China)) (1998) **Study on the fertilization technique of fly ash and nitrate phosphate**

fertilizer for improving wheat yield on clay soil in south Shanxi. *Journal of Shanxi Agricultural University (China). Shanxi Nongye Daxue Xuebao (China) v. 18(3) p. 232-235.* 5 tables; 1 ill., 3 ref. Chinese. (AGRIS 2000-020685).

Q01 FOOD SCIENCE AND TECHNOLOGY

1717 Maralov, A.B. (Kazakh Research Institute of Fruit Growing and Viniculture, Almaty (Kazakhstan)) (1998) **[An investigation of grain grinding process efficiency in milling production].** Kazakh Research Institute of Fruit Growing and Viniculture (Kazakhstan). 6 app.; 156 ref. 186 p. Russian. (AGRIS 2000-026547).

Reduced modes of grinding are recommended to provide high efficiency of grinding process for wheat grain reduction milling on the main systems of break process. It is established that grinding efficiency on break 2 is independent on grinding mode of the earlier break 1 system.

Q02 FOOD PROCESSING AND PRESERVATION

1718 Badocha, E. (Instutut Biotechnologii Przemyslu Rolno Spozywczego, Warszawa (Poland)); Zbiec, M.; Piasecka Jozwiak, K.; Mois, A.; Szkudzinska Rzeszowiak, E. (1999) **Trial on the determination of correlation between acrolein contents in high wines and microbial purity during processing.** *Prace Instytutow i Laboratoriow Badawczych Przemyslu Spozywczego (Poland) v. 54 p. 50-67.* 11 ref. Polish. (AGRIS 2000-026646).

Determination of the influence of microbial purity during processing, carried on in the domestic distilleries, on the acrolein contens in high wines was the aim of carried out work. Presence of the acrolein producing bacteria (bacteria producing 3-hydroxypropionaldehyde) in distillery raw materials (rye, triticale, maize), sweet mashes, distillery beers and distillery yeast was analysed. Contents of acrolein in the high wines obtained from examined distillery beers was detected. On the basis of research results it was stated that the acrolein contents in high wines is influenced both by the microbial purity of raw materials and by the proper management of processing.

1719 Bondarciuc, L.; Nicolaeva, D. (1999) **[The wheat embryo as biologically active additive for the food products].** Institute of Food Industry, Kishinev (Republic of Moldova). *Buletin informativ (Republic of Moldova) (no. 43) p. 1-8.* Russian. (AGRIS 2000-020991).

1720 Corbellini, M. (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)) (1992) **[The processing [wheat - Italy]].** *Terra e Vita (Italy) v. 39(suppl.37) p. 55-58.* 4 tables. Italian. (AGRIS 2000-020938).

1721 Dreyfus, O. (Ecole Nationale Superieure de Meunerie et des Industries Cerealieres, Paris (France)) (1999) **[Characteristics of French wheat in 1999].** 50. Journees Techniques. Paris (France). Nov 1999. *Industries des Cereales (France) (no 115) p. 18-23.* French. (AGRIS 2000-021010).

Les qualites etudiees sont les suivantes: teneur en proteines, indice de Zeleny, force boulangere, hydratation des farines en panification, activite amylasique, avec une etude particuliere des varietes: ble panifiable superieur: Soissons, Isengrain, Shango, Aztec, Sideral, Charger et ble panifiable courant: Texel.

1722 Mustafa, AF.; McKinnon, JJ.; Christensen, DA. (2000) **Chemical characterization and in situ nutrient degradability of wet distillers' grains derived from barley-based ethanol production.** *Animal Feed Science & Technology. 83(3-4):301-311.* English. [Univ Saskatchewan, Dept Anim & Poultry Sci 72 Campus Dr Saskatoon SK S7N 5B5 Canada].

A study was conducted to characterize the carbohydrate and protein fractions of barley-based distillers grains (BDG) derived from a mix of 70% barley, 20% wheat and 10% rye/triticale. Amino acid composition, ruminal escape protein and amino acid values, and ruminal nutrient degradability of BDG were determined relative to wheat-based distillers';:rains (WDG) derived from 100% wheat. On a dry matter (DM) basis, BDG contained 743 g kg(-1) neutral (NDF) and 311 g kg(-1) acid (ADF) detergent fibre, and 154 g kg(-1) crude protein (CP). More than 50% of BDC. protein was associated with NDF while 17% was associated with ADE Glutamic acid was the most abundant amino acid in both distillers grains and was lower ($p < 0.05$) in BDG (184 g kg(-1) of amino acids) than WDG (243 g kg(-1) of amino acids). The concentration of lysine was higher ($p < 0.05$) in BDG than in WDG while that of methionine was similar in both byproducts. Ruminal escape protein value was greater ($p < 0.05$) for BDG than for WDG. However., the ruminal escape values for most of the amino acids were not different between BDG and WDG. Ruminal degradability of NDF from WDG (454 g kg(-1) of NDF) was higher ($p < 0.05$) than that from BDG (360 g kg(-1) NDF). The results of this study showed that fibre and protein fractions of BDG are less degradable in the ruminal than the corresponding fraction from WDG. However, data of amino acid composition and ruminal undegradability suggest that the quality of amino acids of BDG reaching the small intestine of ruminants is equal or better than that from WDG. [References: 29].

1723 Rukshan, L.V.; Danilova, L.N. (Mogilev Technological Inst., Mogilev (Belarus)) (1999) **[Vitamin content in barley grain and in products of its processing].** Mogilev Technological Inst., Mogilev (Belarus). *Mezhdunarodnyj agrarnyj zhurnal (Belarus) (no.7) p. 58-59.* 2 tables; 4 ref. Russian. (AGRIS 2000-026553).

Vitamin distribution in barley grain, grown in different soil-climatic regions has been studied. The vitamin content in the flour, obtained under different systems of the technological process of milling has been determined.

1724 Rzepka, E. (Instytut Biotechnologii Przemyslu Rolno Spozywczego, Warszawa (Poland)); Badocha, E.; Stecka, K.M. (1999) **Selected kinetic aspects of the alcoholic fermentation of mashes prepared under atmospheric pressure.** *Prace Instytutow i Laboratoriow Badawczych Przemyslu Spozywczego (Poland) v. 54 p. 32-49.* 17 ref. Polish. (AGRIS 2000-026549).

Investigation of the influence of selected processing parameters (amount of yeast inoculum, mash density, addition of non-amylolytic enzymatic preparations) on kinetics of alcoholic fermentation of mashes prepared under atmospheric pressure was the aim of carried out work.

1725 Vareli, G.; Demertzis, PG.; Akrida-Demertzi, K. (2000) **Effect of regeneration thermal treatment of cellulosic and starchy materials on their capacity to separate water and ethanol.** *Journal of Cereal Science. 31(2):147-154.* English. [Univ Ioannina, Dept Chem, Food Chem Lab POB 1186 GR-45110 Ioannina Greece].

Inverse gas chromatography was used to study the adsorption of water and ethanol on to a starchy (wheat flour) and a cellulosic (wheat straw) substrate, in the temperature range 50 90 degrees C, before and after their regeneration by thermal treatments at 140 and 170 degrees C, for 12 and 21 h each. From the chromatographic retention data it was possible to calculate the separation factor (s) of the two solutes and to obtain values for Gibb's free energy (Delta Gs) and enthalpy (Delta Hs) of adsorption. The results showed that water was adsorbed more strongly than ethanol by both substrates, at all temperatures, before and after their regeneration. In addition, it was found that, for both untreated and thermally treated materials, the adsorption of both solutes was stronger at lower temperatures. Thermal treatment had no effect on the adsorption of ethanol on either substrate. In contrast, the adsorption of water was weaker for both substrates regenerated at 140 degrees C and even weaker for the substrates treated at 170 degrees C, irrespective of the duration of the regeneration process. Furthermore, at both regeneration temperatures, the decrease in water sorption was approximately the same for both materials, irrespective odf regeneration time. The separation factors followed, in general, the same trend observed for water sorption. They had lower values for materials regenerated at 170 degrees C for 24 h. Both materials were equally affected by the regeneration process. [References: 27].

Q03 FOOD CONTAMINATION AND TOXICOLOGY

1726 Hariri, G.; Williams, PC.; El-Haramein, FJ. (2000) **Influence of pentatomid insects on the physical dough properties and two-layered flat bread baking quality of syrian wheat.** *Journal of Cereal Science. 31(2):111-118.* English. [POB 7441 Aleppo Syria].

Field investigations were carried out of the incidence of pentatomid insects at different stages of development, as well as development of the maturing wheat plant, and revealed that the insects can cause damage to the wheat grain while in both nymphal and adult stages. The influence of pentatomid infestation on quality characteristics of bread and durum wheats is described. The influence of pentatomid-infested kernels on physical dough characteristics and two-layer flat br ead baking quality was studied. As little as 5% damaged kernels changed the physicochemical properties of the wheat. Farinograph development and stability times were reduced by 60% and 85%, respectively, while the mixing tolerance index was increased by 300% (from 50 to 310 Brabender units), Two-layered flat bread baking quality was rather more tolerant of small amounts of damaged kernels, but additions of 10% or more had a significant effect on bread quality, and the presence of 20% damaged kernels made it impossible to produce satisfactory two-layered flat bread. Dough-handling properties were affected to the extent that the dough could not Ire moulded or sheeted, and the bread burned during the short (45 s) baking time. (C) 2000 Academic Press. [References: 23].

1727 Trucksess, MW. (2000) **Mycotoxins.** *Journal of AOAC International. 83(2):442-448.* English. [US FDA, Div Nat Prod 200 C St SW Washington, DC 20204 USA].

Q04 FOOD COMPOSITION

1728 Akerberg, C.; Zacchi, G.; Torto, N.; Gorton, L. (2000) **A kinetic model for enzymatic wheat starch saccharification.** *Journal of Chemical Technology & Biotechnology. 75(4):306-314.* English. [Univ Lund, Dept Chem Engn 1 POB 124 SE-22100 Lund Sweden].

A kinetic model describing the enzymatic saccharification of wheat starch by a mixture of ol-amylase and amyloglucosidase has been developed. The model describes the influence of pH, glucose inhibition and starch and enzyme concentration, The results of experimental saccharification under different physical conditions, eg pH and temperature, were used to determine the parameters in the model. The dominant enzyme in the mixture was amyloglucosidase and the maximum rate of saccharification due to this enzyme was found to be optimal at pH 5, and increased Five-Fold when the temperature was increased from 30 to 55 degrees C, Saccharification due to the action of amyloglucosidase was inhibited by the glucose produced and simulation showed that the maximum rate of saccharification decreased by 58% at a starch concentration of 140gdm(-3) compared with a starch concentration much less than 110 gdm(-3) where the effect of glucose inhibition was negligible, (C) 2000 society of Chemical Industry. [References: 28].

1729 Al-Saqer, JM.; Sidhu, JS.; Al-Hooti, SN. (2000) **Instrumental texture and baking quality of high-fiber toast bread as affected by added wheat mill fractions.** *Journal of Food Processing & Preservation. 24(1):1-16.* English. [Kuwait Inst Sci Res, Dept Biotechnol POB 24885 Safat 13109 Kuwait].

The effect of bran type, level of addition, particle size, addition of wheat germ, as well as other additives like improvers and dough conditioners, on the instrumental texture and baking quality of high-fiber toast bread (white pan bread) has been investigated. The specific loaf volume decreased significantly (3.45 cc/g) when the bran level was raised to 30%, but at 20% bran addition, the specific loaf volume was superior to that of the control bread. The specific loaf volume of test breads remained higher than the control bread up to a level of 7.5% wheat germ addition. Additives like ascorbic acid (50ppm) and sodium stearoyl-2-lactylate (0.5%) further improved the baking quality of test bread samples. The objective texture values (measured as compression force, kg) indicated that the test bread with bran addition up to 20% and germ up to 7.5% possessed a softer texture (0.80 kg) than the control bread (1.02 kg). In comparison with control bread, the panelists gave higher sensory scores for all attributes of test bread samples containing up to 20% red coarse bran or up to 30% red fine bran. A similar trend in sensory quality of test samples containing up to 7.5% wheat germ was also observed. High-fiber toast bread made from white flour, equal proportions of coarse and fine bran at 20%, wheat germ at 7.5%, plus sodium stearoyl-2-lactylate at 0.5% levels, was found to possess softer texture and improved sensory quality than the whole wheat flour bread. [References: 16].

1730 Ammar, K.; Kronstad, WE.; Morris, CF. (2000) **Breadmaking quality of selected durum wheat genotypes and its relationship with high molecular weight glutenin subunits allelic variation and gluten protein polymeric composition.** *Cereal Chemistry. 77(2):230-236.* English. [Oregon State Univ, Crop & Soil Sci Dept Crop Sci 225 Corvallis, OR 97331 USA].

Twenty-seven durum wheat genotypes originating from different geographical areas, all expressing LMW-2 at Glu-B3, and five bread wheats were evaluated for flour mixing properties, dough physical characteristics. and baking performance. Gluten polymeric composition was studied using size-exclusion HPLC of unreduced flour protein extracts. As a group, durum wheats had poorer baking quality than bread wheats in spite of higher protein and total polymer concentrations. Durum wheats exhibited weaker gluten characteristics, which could generally be attributed to a reduced proportion of SDS-unextractable polymer, and produced less extensible doughs than did bread wheats. However, substantial variation in breadmaking quality attributes was observed among durum genotypes. [References: 38].

1731 Barrett, AH.; Cardello, AV.; Mair, L.; Maguire, P.; Lesher, LL.; Richardson, M.; Briggs, J.; Taub, IA. (2000) **Textural optimization of shelf-stable bread: Effects of glycerol content and dough-forming technique.** *Cereal Chemistry. 77(2):169-176.* English. [USA, Soldier & Biol Chem Command, Natick Soldier Ctr Natick, MA 01760 USA].

The effects of glycerol content and dough-forming method on the physical, textural, and sensory characteristics of shelf-stable bread were determined. Bread dough was produced with 0, 2, 4, and 6% nominal glycerol content, and formed into rolls by either dough-dividing or extrusion-forming methodologies. Baked products were evaluated by uniaxial compression and fitting of stress-strain data to a three-parameter mathematical model. A trained sensory panel quantified textural attributes using magnitude estimation methodology. Selected characteristics were also judged by an untrained consumer panel. Sensory-instrumental relationships were determined. Products were tested instrumentally after different storage intervals to determine effects of glycerol level and dough-forming process on degree of fuming. Results showed that extrusion-forming produced, on average, relatively more dense and less deformable products than did the dough-dividing method; extrusion-formed samples also had greater sensory firmness and were less similar to an ideal sensory texture. However, high glycerol concentrations in extrusion-formed products gave sensory profiles that were substantially closer to the ideal. Sensory firmness and chewiness were closely correlated with parameters of power law functions that described compression behavior. Glycerol reduced ultimate firmness after storage. [References: 25].

1732 Bettge, AD.; Morris, CF. (2000) **Relationships among grain hardness, pentosan fractions, and end-use quality of wheat.** *Cereal Chemistry. 77(2):241-247.* English. [Washington State Univ, USDA ARS, Western Wheat Qual Lab, Food Sci & Human Nutr Facil E E202 POB 646394 Pullman, WA 99164 USA].

Grain texture (hardness) in wheat (Triticum aestivum L.) is a major determinant of end-usage. Variation in grain texture can be conceptually assigned to the two major hardness classes that result from the action of one major gene (Hardness) or to as-yet undetermined factors contributing to residual variation within hardness classes. Identifying the physicochemical basis of both sources of texture variation could provide a means of better controlling or manipulating this quality trait. Pursuant to this

objective, the role of pentosans was examined. Pentosan fractions (membrane-associated, total, and soluble) were isolated from 13 hard and 13 soft wheat samples and their flours. Among the hard wheat samples, pentosans had a minimal role in modifying grain hardness. However, among the soft wheat samples, pentosans appeared to have a significant hardness-modifying effect that carried over into end-use quality. Among the soft wheat samples, pentosan fractions, along with wheat protein, accounted for 53-76% of the variation in grain texture, depending on the method used to quantify texture. Membrane-associated pentosans were the most influential single parameter in modeling grain texture for the soft wheat samples. Membrane-associated pentosans were most influential in accounting for variation (69%) in alkaline water retention capacity. Total pentosans, together with flour protein, accounted for 87% of the variation in cookie diameter for soft wheat samples, with the total pentosan fraction being the more influential. [References: 27].

1733 Capocchi, A.; Galleschi, L.; Saviozzi, F. (2000) **Isolation of wheat high molecular weight glutenin subunits from durum wheat.** *Cereal Chemistry. 77(2):105-106.* English. [Univ Pisa, Dept Bot Sci Via L Ghini 5 I-56126 Pisa Italy].

1734 Chrenkova, M.; Ceresnakova, Z.; Sommer, A.; Galova, Z.; Kral'ova, V. (2000) **Assessment of nutritional value in spelt (Triticum spelta L.) and winter (Triticum aestivum L.) wheat by chemical and biological methods [Slovak].** *Zivocisna Vyroba. 45(3):133-137.* Slovak. [Res Inst Anim Prod Hlohovska 2 Nitra 94992 Slovakia].

The nutritional value of two Varieties of spelt wheat (Triticum spelta L.) was compared with the conventional variety of winter wheat (Triticum aestivum) grown in Slovakia and Sweden. The chemical analysis shows that T. spelta has a significantly higher content of crude protein, proteins ($P < 0.001$), more nonessential amino acids and significantly less lysine (16 g N, $P < 0.05$). The assessed values show that with an increasing content of crude protein the content of proteins does not increase proportionately. The representation of individual protein fractions, with different digestibility, changes with the variation of total N content. We did not find any significant differences between the varieties on the basis of biological test of growth in rats. The highest biological value of proteins (BVP) was assessed for the German variety of spelt wheat grown in Slovakia (75.6%) out of the tested wheats, however, the differences between the varieties were not significant. We found significant differences in excrement N output from N uptake, and it manifested itself in significant differences in digestibility of crude protein which was higher in the samples of spelt wheat (80.5 and/or 85.1%). The quality of proteins in spelt wheat is higher than in winter wheat Samanta, which is also demonstrated by higher NPU and UP values. [References: 22].

1735 Deguchi, T.; Yoshimoto, M.; Ohba, R.; Ueda, S. (2000) **Antimutagenicity of the purple pigment, hordeumin, from uncooked barley bran-fermented broth.** *Bioscience Biotechnology & Biochemistry. 64(2):414-416.* English. [Fac Engn, Kumamoto Inst Technol, Dept Appl Microbial Technol 4-22-1 Ikeda Kumamoto 8600082 Japan].

The novel purple pigment hordeumin, an anthocyanin-tannin pigment, was produced from barley bran-fermented broth. The mutagenicity or antimutagenicity of hordeumin was Investigated according to the Ames method, an indication of the safety of food, using Salmonella typhimurium TA98. Despite the presence of S-9 mix, hordeumin was not mutagenic. On the other hand, hordeumin effectively decreased a reverse mutation from Trp-P-1, Trp-P-2, IQ, and B[a]P. Furthermore, hordeumin also decreased the reverse mutation from dimethyl sulfoxide extracts of grilled beef. [References: 29].

1736 Denery-Papini, S.; Samson, MF.; Autran, JC. (2000) **Anti-peptide antibodies directed against omega-gliadins for the detection of sequences from bread and durum wheats.** *Food & Agricultural Immunology. 12(1):67-75.* English. [INRA, Unite Biochim & Technol Prot Rue de la Geraudiere, BP 71627 F-44316 Nantes 3 France].

This paper presents the characterisation of polyclonal antibodies directed against two different N-terminal sequences of omega-gliadins. Both antisera recognised specifically the corresponding omega-gliadin fractions but showed different reactivities again s omega-gliadins extracted from bread and durum wheats. Antibodies directed against the 'SRLL' type (omega 5 type) recognised several omega-gliadin components in brad and durum wheat extracts whereas antibodies directed against the 'AREL' type (omega 2 type) reacted specifically with an omega-gliadin component from bread wheat. The narrow specificity of this antiserum made it potentially interesting for the detection of bread wheat additions in durum wheat pasta. Moreover, the reactivity of this antiserum was not modified by an increase in drying temperature of pasta. [References: 14].

1737 Dhanasekharan, M.; Huang, H.; Kokini, JL. (1999) **Comparison of observed rheological properties of hard wheat flour dough with predictions of the Giesekus-Leonov, White-Metzner and Phan-Thien Tanner models.** *Journal of Texture Studies. 30(6):603-623.* English. [Rutgers State Univ, Cook Coll, Dept Food Sci, Ctr Adv Food Technol 221 65 Dudley Rd New Brunswick, NJ 08901 USA].

The measured rheological behavior of hard wheat flour dough was predicted using three nonlinear differential viscoelastic models. The Phan-Thien Tanner model gave good zero shear viscosity prediction, but overpredicted the shear viscosity at higher shear rates and the transient and extensional properties. The Giesekus-Leonov model gave similar predictions to the Phan-Thien Tanner model, but the extensional viscosity prediction showed extension thickening. Using high values of the mobility factor, extension thinning behavior was observed but the predictions were not satisfactory. The White-Metzner model gave good predictions of the steady shear viscosity and the first normal stress coefficient but it was unable to predict the uniaxial extensional viscosity as it exhibited asymptotic behavior in the tested extensional rates. It also predicted the transient shear properties with moderate accuracy in the transient phase, but very well at higher times, compared to the Phan-Thien Tanner model and the Giesekus-Leonov model. None of the models predicted all observed data consistently well. Overall the White-Metzner model appeared to make the best predictions of all the observed data. [References: 35].

1738 Dowell, FE. (2000) **Differentiating vitreous and nonvitreous durum wheat kernels by using near-infrared spectroscopy.** *Cereal Chemistry. 77(2):155-158.* English. [ARS, USDA, Grain Mkt & Prod Res Ctr Manhattan, KS 66502 USA].

The vitreousness of durum wheat is used by the wheat industry as an indicator of milling and cooking quality. The current visual method of determining vitreousness is subjective, and classification results between inspectors and countries vary widely. Thus, the use of near-infrared (NIR) spectroscopy to objectively classify vitreous and nonvitreous single kernels was investigated. Results showed that classification of obviously vitreous or nonvitreous kernels by the NIR procedure agreed almost perfectly with inspector classifications. However, when difficult-to-classify vitreous and nonvitreous kernels were included in the analysis, the NIR procedure agreed with inspectors on only 75% of kernels. While the classification of difficult kernels by NIR spectroscopy did not match well with inspector classifications, this NIR procedure quantifies vitreousness and thus may provide an objective classification means that could reduce inspector-to-inspector variability. Classifications appear to be due, at least in part, to scattering effects and to starch and protein differences between vitreous and nonvitreous kernels. [References: 15].

1739 Ehrenbergerova, J.; Zimolka, J.; Nemejc, R. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)); Vaculova, K. (1999) **The quality of hull-less barley.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 261-265.* Mendelova Zemedelska a Lesnicka Univ. 1 graph, 3 tables; 8 ref. Czech. (AGRIS 2000-021224).

1740 Francakova, H.; Hrubcova, S. (Slovenska Polnohospodarska Univ., Nitra (Slovak Republic)) (1999) **Effect of variety on malt quality.** Plant Nutrition, Quality of Production and Processing. Brno

(Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 297-299.* Mendelova Zemedelska a Lesnicka Univ. 6 tables. Czech. (AGRIS 2000-021225).

1741 Gaines, CS.; Finney, PL.; Andrews, LC. (2000) **Developing agreement between very short flow and longer flow test wheat mills.** *Cereal Chemistry. 77(2):187-192.* English. [Ohio State Univ, Ohio Agr Res & Dev Ctr, USDA ARS, Soft Wheat Qual Lab Wooster, OH 44691 USA].

Variations in soft wheat moisture content and kernel texture greatly affected the flour yield produced by a small (short flow) microtest mill (Quadrumat Jr.). An algorithm was developed that adjusted Quadrumat Jr. flour yield to 15% wheat moisture content, precluding the need to temper the wheat before milling. Another algorithm was developed to adjust Quadrumat flour yield relative to a constant softness equivalent (measurement of kernel texture) obtained during the micromilling procedure. Predicting the flour yield of the longer flow Allis-Chalmers mill from Quadrumat Jr. unadjusted flour yield (R-2 = 0.55) was compared with predicting Allis-Chalmers flour yield from the Quadrumat Jr. adjusted flour yield (R-2 = 0.90) across five diverse confirmation data sets. An algorithm to adjust flour yield for softness equivalent was individually developed for soft and hard wheats. Representative micromilling flour yield and softness equivalent data could be produced using as little as 10 g of untempered wheat and approximate to 3 min of operator time. [References: 11].

1742 Gaines, CS.; Raeker, MO.; Tilley, M.; Finney, PL.; Wilson, JD.; Bechtel, DB.; Martin, RJ.; Seib, PA.; Lookhart, GL.; Donelson, T. (2000) **Associations of starch gel hardness, granule size, waxy allelic expression, thermal pasting, milling quality, and kernel texture of 12 soft wheat cultivars.** *Cereal Chemistry. 77(2):163-168.* English. [ARS, USDA, Soft Wheat Qual Lab 1680 Madison Ave Wooster, OH 44691 USA].

Starches were isolated from 12 soft wheat (Triticum aestivum L.) cultivars and were characterized for waxy (Wx) allelic expression, thermal pasting characteristics, and starch granule size. Gels were produced from the thermally degraded starches and were evaluated using large deformation rheological measurements. Data were compared with cultivar kernel texture, milling characteristics, starch chemical analyses, and flour pasting characteristics. Larger flour yields were produced from cultivars that had larger starch granules. Flour yield also was correlated with lower amylose content and greater starch content. Harder starch gels were correlated with higher levels of amylose content and softer kernel texture. The cultivar Fillmore, which had a partial waxy mutation at the B locus, produced the highest peak pasting viscosity and the lowest gel hardness. Softer textured wheats had greater lipid-complexed amylose and starch phosphorus contents and had less total starch content. Among these wheats of the soft market class, softer textured wheats had larger starch granules and harder textured wheats had smaller starch granules. In part, this may explain why soft wheats vary in texture. The smaller granules have larger surface area available for noncovalent bonding with the endosperm protein matrix and they also may pack more efficiently, producing harder endosperm. [References: 32].

1743 Gibney, A.; Butler, F.; Dwyer, E. (1999) **Rheology and adhesion of fish batter coatings made from flour from Irish grown wheat varieties.** *Irish Journal of Agricultural & Food Research. 38(2):241-249.* English. [Univ Coll Dublin, Dept Agr & Food Engn Earlsford Terrace Dublin 2 Ireland].

The suitability of flours milled from six varieties (Brigadier, Hussar, Riband, Rialto, Ritmo and Soissons) of Irish grown soft and hard milling winter wheats as fish batter coating was assessed. Flour samples were tested for their pasting properties using a Brabender amylograph and a constant stress rheometer in which flour suspensions were heated to 93 degrees C at a constant rate. Constant shear rate tests (5, 25, 50, 100 and 150 per s) of 20 min duration were used to determine rheological behaviour. Fish portions were coated with each of the batters and cooked to evaluate adhesion. There was a significant linear relationship ($P < 0.05$) between the weight of coating on the raw fish and the viscosity, at almost all shear rates, of the batter mixture. Coating properties were unaffected by peak paste viscosity of the batters, alpha-amylase activity or protein content. Batters made with a commercial wheat blend and with the hard milling winter variety, Rialto, performed best under the cooking test. [References: 14].

1744 Greiner, R.; Jany, KD.; Alminger, ML. (2000) **Identification and properties of myo-inositol hexakisphosphate phosphohydrolases (Phytases) from barley (Hordeum vulgare).** *Journal of Cereal Science. 31(2):127-139.* English. [Fed Res Ctr Nutr, Ctr Mol Biol Haid & Neu Str 9 D-76131 Karlsruhe Germany].

Two phytate-degrading enzymes (myo-inositol hexakisphosphate phosphohydrolase) have been purified from 4-day-old barley seedlings. One phytase (P2) was identified as a constitutive enzyme, whereas the other one (P1) was induced during germination. Both phytases were successfully separated from the major acid phosphatases. The molecular masses of the native monomeric enzymes were estimated to be about 67 kDa. Both phytate-degrading enzymes belong to the acidic phytases. They exhibit a single pH-optimum at 5.0 (P1) and 6.0 (P2), respectively. Optimal temperature for the degradation of phytate was found at 45 degrees C (P1) and 55 degrees C (P2), respectively. Kinetic parameters for the hydrolysis of Na-phytate are K-M 72 mu M, k(cat) 136 s(-1 ()P1) and K-M 190 mu M k(cat) 43 s(-1) (P2) at 35 degrees C and optimal pH. The barley phytases exhibit a broad affinity for various phosphorylated compounds and hydrolyse phytate in a step-wise manner. With both phytases, the first hydrolysis product was identified as D/L-Ins(1, 2, 3, 4, 5) P-5. (C) 2000 Academic Press. [References: 49].

1745 Horvatic, M.; Vedrina-Dragojevic, I. (2000) **Changes in available methionine and tryptophan contents during cereal flake production.** *Journal of the Science of Food & Agriculture. 80(4):502-506.* English. [Univ Zagreb, Fac Pharm & Biochem, Dept Food Chem A Kovacica 1 Zagreb 10000 Croatia].

The changes in available methionine and tryptophan contents during industrial production of wheat, rye, barley and oat flakes have been investigated. The contents of available methionine and tryptophan were lowered significantly ($p = 0.05$) under conditions of technological processing. The total decrease in available methionine ranged from 13 to 26% and tryptophan from 10 to 20%. Hydrothermal treatment (120 degrees C, 60 min, 1.99 x 10(5) Pa) of whole cereal grain had a considerable impact on the damage to available methionine, but the highest decrease in tryptophan was determined after the flaking process (70 degrees C, 0.3 mm gap). The total decrease in these amino acids correlates significantly ($p = 0.001$) and positively with values for Lipid oxidation products, expressed on a total lipid basis, in cereal flakes as well as in untreated cereal grains. Available methionine and tryptophan contents in proteins of cereal flakes equalled or exceeded requirements for adults recommended by the FAO 1985 reference pattern. (C) 2000 Society of Chemical Industry. [References: 35].

1746 Humphris, ADL.; McMaster, TJ.; Miles, MJ.; Gilbert, SM.; Shewry, PR.; Tatham, AS. (2000) **Atomic force microscopy (AFM) study of interactions of HMW subunits of wheat glutenin.** *Cereal Chemistry. 77(2):107-110.* English. [Univ Bristol, Dept Agr Sci, IACR, Long Ashton Res Stn Bristol BS41 9AF Avon England].

Atomic force microscopy (AFM) has been used to study the non-covalent interactions of alkylated HMW subunit 1Dx5 and a M-r 58, 000 peptide derived from the central repetitive domain. Both protein and peptide align side-by-side to form fibrils, the HMW subunit forming a branched network, and the peptide forming linear rods. The N- and C-terminal domains of the subunit would, therefore, appear to contain regions that interact through noncovalent interactions in the absence of disulfide bond formation. These regions may be of importance in facilitating disulfide bond formation during protein body development. [References: 17].

1747 Imai, T.; Shibata, S. (2000) **Classification of various wheat flour with granule size distribution [Japanese].** *Journal of the Japanese Society for Food Science & Technology-Nippon Shokuhin Kagaku Kogaku*

Kaishi. 47(1):17-22. Japanese. [Minist Agr Forestry & Fisheries, Natl Food Res Inst 2-1-2 Kannondai Tsukuba Ibaraki 3058642 Japan].

Classification of various wheat flour was undertaken on the bases of pattern similarity in the granule size distribution. Four kinds of flour on the market with the different usage -flour for bread making, Chinese noodle making, Japanese noodle making and cake making- were tested along with 60% flour obtained from six different varieties of imported and five different varieties of domestic wheat's. Sixty % flour were prepared by the laboratory scale Buhler Test Mill and granule sizes of all flour were measured with the Coulter Counter. Comparing the four commercial flour, the average granule of bread making flour was the largest in size, followed by Chinese noodle making flour, Japanese noodle making flour and cake making flour. Each showed a distinct granule size distribution pattern. Among the 60% flour prepared by the teat mill, flour from imported hard type wheat (1 CW) showed its peak at the large size portion, nearly 100 mu m, whereas the soft type wheat IWW) showed the peak at the small size portion, nearly 25 mu m. Three domestic varieties showed the peak at both side, the large and small size portion. The granule size distribution pattern of bread making flour was very much similar to that of Chinese noodle making flour. Pattern similarity value (PSV) was 0.999. However, the pattern of bread making four was very different from those of Japanese noodle making flour and cake making flour, the PSV being 0.914, 0.679 respectively The granule size distribution of 60% flour obtained from imported hard type (1 CW) and soft type (WW) wheat differed entirely. Their PSV was 0.808. Among the domestic wheat, Horosiri-komugi showed close resemblance to imported hard type wheat, bread making flour and Chinese noodle making flour, the PSV's being 0.957, 0.994 and 0.992 respectively. PCV's of Chihoku-komugi with the imported soft type wheat and Japanese noodle making flour were 0.954 and 0.995 respectively, bearing similarity. Nohrin-61, Shirogane-komugi and Asakaze-komugi were similar to cake making flour with their PSV's 0.975, 0.971 and 0.969 respectively. The result showed that by preparing 60% flour with laboratory scale Buhler Test Mill and measuring its granule size distribution pattern, the suitable usage of any unknown wheat could be classified. [References: 1].

1748 Kajimoto, G. (2000) **Chemical composition of barley tea [Japanese].** *Journal of the Japanese Society for Food Science & Technology-Nippon Shokuhin Kagaku Kogaku Kaishi. 47(1):9-16.* Japanese. [Kobe Gakuin Univ, Fac Nutr, Nishi Ku Kobe Hyogo 6512113 Japan].

In the previous paper, we assessed the antioxidant activity of barley tea and their composition. In this paper, the chemical composition in barley tea was investigated. Amounts of crude protein, ethyl ether extract, ash, iron, calcium and dietary fiber in barley grain, roasted barley grain and hot-water extract obtained from roasted barley grain (referred to as barley tea hereafter) were measured by Kjeldahl method, extraction with ethyl ether by using Soxhlet apparatus, ashing method, atomic absorption spectrophotometry and AOAC (Association of Official Analytical Chemists) analytical method, respectively. Fatty acid and tocopherol (Toc) composition were analyzed by GLC and HPLC. Barley tea was prepared from barley grain roasted with a coffee roaster for 14 minute, and purchased from market. Crude protein, fiber and Toc contents in barley grain were decreased by roasting, but, there were no consistent differences in calcium and iron contents in ash between the raw and roasted barley grains. On the other hand, contents of ethyl ether extract obtained from roasted barley grain and barley tea were higher than those of the raw barley grain. Fiber content in barley tea was similar to that of raw barley grain. Formative ratio of triacylglycerol and linolenic acid in ethyl ether extract obtained from barley tea was markedly lower than that form roasted barley grain. In addition, HPLC elution profiles and UV absorption patterns of barley, green tea, banaba and Japanese persimmon teas were compared. [References: 27].

1749 Kato, Y.; Watanabe, H.; Matsuda, T. (2000) **Ovomucoid rendered insoluble by heating with wheat gluten but not with milk casein.** *Bioscience Biotechnology & Biochemistry. 64(1):198-201.* English. [Kawasaki Univ Med Welfare, Dept Clin Nutr 288 Matsushima Kurashiki Okayama 7010193 Japan].

The effect of wheat gluten, soybean protein and milk casein on the heat-induced insolubilization of egg white ovomucoid was investigated by using ELISA inhibition and immunoblotting analyses. Heat treatment at 180 degrees C for 10 min of egg white mixed with wheat gluten specifically accelerated the heat-induced change in ovomucoid, Such an effect was weakly brought about by soybean protein, but not by casein. [References: 13].

1750 Kays, SE.; Barton, FE.; Windham, WR. (2000) **Predicting protein content by near infrared reflectance spectroscopy in diverse cereal food products.** *Journal of Near Infrared Spectroscopy. 8(1):35-43.* English. [ARS, USDA, Richard B Russell Agr Res Ctr 950 Coll Stn Rd, POB 5677 Athens, GA 30605 USA].

Simultaneous determination of constituents (e.g. dietary fibre, protein, fat) by near infrared (NIR) spectroscopy would increase the speed and efficiency of nutrient analysis while substantially reducing the cost. Previous work has described the development of NIR reflectance models for the prediction of dietary fibre in a diverse group of cereal food products. While NIR spectroscopy has been used to measure protein content in cereal samples comprised of a single grain type, the utility of the NIR technique would be greatly improved if it could be expanded to cereal products derived from a diverse cross-section of grains and formulations, The present study was conducted to investigate the potential of NIR spectroscopy for the analysis of protein in a data set that included products with numerous grains, such as wheat, oats, rice, rye, corn, millet, buckwheat and with a wide range of fat, sugar and fibre contents. In addition, numerous processing techniques and food additives were represented in the data set. Nitrogen content of dry-milled cereal products was measured by combustion analysis (AOAC Method 992.23) and the range in nitrogen values was from 0.65 to 3.31% of dry weight. Milled cereal products were scanned from 1100 to 2500nm with a scanning monochromator, A nitrogen calibration was developed, using a commercial analysis program, with modified partial least squares as the regression method. The standard error of cross validation and R-2 for nitrogen (n = 147 calibration samples) were 0.090% and 0.973, respectively. Independent validation samples (n = 72) were predicted with a standard error of performance of 0.079% nitrogen and r(2) of 0.984. Because of the diversity of grains in the data set, crude protein was calculated using two nitrogen-to-protein conversion methods and two PLS models were developed for the prediction of crude protein. Crude protein was predicted with a similar precision to nitrogen and the results for both protein models are within the precision required for US nutrition labelling legislation. In conclusion, NIR reflectance spectroscopy can be used for rapid and accurate prediction of nitrogen and crude protein content in a heterogeneous group of cereal products comprised of a wide cross-section of grains and formulations. [References: 27].

1751 Koch, K.; Jane, JL. (2000) **Morphological changes of granules of different starches by surface gelatinization with calcium chloride.** *Cereal Chemistry. 77(2):115-120.* English. [Swedish Univ Agr Sci, Dept Food Sci Box 7051 S-75007 Uppsala Sweden].

Native starch granules of 11 selected cultivars (potato, waxy potato, sweet potato, normal maize, high-amylose maize, wavy maize, wheat, normal barley, high-amylose barley, waxy barley, and rice) were treated with a calcium chloride solution (4M) for surface gelatinization. The surface-gelatinized starch granules were investigated using light microscopy and scanning electron microscopy (SEM) and differential scanning calorimetry (DSC). In general, those starches with larger granule sizes required longer treatment time to complete the gelatinization. The salt solution treatment of starch was monitored by light microscopy and stopped when the outer layer of the granule was gelatinized. The surface gelatinized starch granules were studied using scanning electron micro-scopy. On the basis of the gelatinization pattern from calcium chloride treatments, the starches could be divided into three groups: 1) starches with evenly gelatinized granule surface, such as normal potato, waxy potato, sweet potato, maize, and high-amylose maize; 2) starches with salt gelatinization concentrated on specific sites of the granule (i.e., equatorial groove), such as wheat, barley, and high-amylose barley; and 3) starches that, after surface gelatinization, can no longer be separated to individual

granules for SEM studies, such as waxy barley, waxy maize, and normal rice. The morphology of the surface gelatinized starch resembled that of enzyme-hydrolyzed starch granules. [References: 35].

1752 Kucerova, J. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)) (1999) **Study on protein fractions of winter triticale.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 311-314.* Mendelova Zemedelska a Lesnicka Univ. 4 graphs, 2 tables; 3 ref. Czech. (AGRIS 2000-021299).

1753 Lefebvre, J.; Popineau, Y.; Deshayes, G.; Lavenant, L. (2000) **Temperature-induced changes in the dynamic rheological behavior and size distribution of polymeric proteins for glutens from wheat near-isogenic lines differing in HMW glutenin subunit composition.** *Cereal Chemistry. 77(2):193-201.* English. [INRA, Ctr Rech Nantes, Lab Physicochim Macromol Rue Geraudiere, BP 71627 F-44316 Nantes 3 France].

Viscoelasticity of hydrated gluten depends on composition of HMW gluten subunits (GS), size distribution of glutenin polymers, and protein-protein interactions. Glutens extracted from four near-isogenic lines with differing HMW-GS were analyzed. Rheological properties were studied by dynamic assay in sheer. Size distribution of prolamins was determined by sequential extraction and size-exclusion HPLC. Assays performed at 20 degrees C confirmed that viscoelasticity was determined by large glutenin polymers. The abundance of large glutenin polymers depended on the HMW-GS composition of the lines. Difference of functionality linked to subunit structure was highlighted by comparing the behaviors of the 1A/1B null and 1A/1D null lines. Glutens were submitted to heating and cooling cycles, with or without an SH-blocking agent (N-ethylmaleimide [NEMI]). At 20-40 degrees C, no irreversible changes of the mechanical properties occurred. Thermal treatment affected chain mobility, and possibly H bonds, but not the chemical structure of the network. At >40 degrees C, irreversible rheological changes were observed without NEMI. Irreversibility was mainly due to chemical modifications affecting the polymer size distribution through SH-SS exchange reactions. The sensitivity of gluten to temperature depended on subunit composition. [References: 27].

1754 Lewandowicz, G.; Janowski, T.; Fornal, J. (2000) **Effect of microwave radiation on physico-chemical properties and structure of cereal starches.** *Carbohydrate Polymers. 42(2):193-199.* English. [Starch & Potato Prod Res Lab Ul Zwierzyniecka 18 PL-60814 Poznan Poland].

Wheat, corn and waxy corn starches of intermediate moisture content (30%) were subjected to microwave processing and the effect of microwave radiation on physico-chemical properties and structure of cereal starches was studied. The experimental starches were examined by the Brabender rheological method, light microscopy, X-ray diffractometry and differential scanning calorimetry. Microwave radiation was evidenced to cause a shift in the gelatinisation range to higher temperatures, and a drop in solubility and crystallinity. The extent and type of these changes depended on the variety of starch. Normal corn and wheat starches underwent pronounced changes, whereas under the same conditions waxy corn starch was almost unchanged. It was concluded that susceptibility of different starches to changes due to microwave irradiation depended not only on their crystal structure, but also on their amylose content. (C) 2000 Elsevier Science Ltd. All rights reserved. [References: 16].

1755 Lindsay, MP.; Skerritt, JH. (1999) **The glutenin macropolymer of wheat flour doughs: structure-function perspectives.** *Trends in Food Science & Technology. 10(8):247-253.* English. [Australian Ctr Int Agr Res GPO Box 1571 Canberra ACT 2601 Australia].

Gluten is the main functional component of wheat, and is the main source of the viscoelastic properties in a dough. Dough properties are primarily governed by the structure of gluten, and interactions within the protein complex. While starch and water are the main components of doughs, the physical properties of a dough arise from interactions between gluten proteins, particularly the disulfide-bonded glutenin macropolymer. The primary structures of glutenin subunits are well characterized, but information on the specificity and pattern on their interactions has been lacking, despite the fact that dough is one of the key food systems where the likely link between molecular protein structure and function is compelling. The structure of polymeric glutenin has been difficult to study since it comprises several dozen different disulfide-bonded polypeptides in the molecular mass range of millions to hundreds of millions. Recently, a range of techniques has been used to help unravel structural information. These include biochemical methods, particularly chromatography and electrophoresis systems which are suitable for examining polydisperse high molecular weight protein complexes of limited solubility; small-scale rheological testing systems, in which the function of individual components (either isolated or from expressed genes) can be determined; and a range of microscopy-based techniques, including confocal light scanning microscopy, transmission electron microscopy, and scanning electron microscopy. Utilizing these techniques, an improved understanding of the relationship between polymeric glutenin structure and dough function has been obtained. It has been proposed that glutenin subunits provide a structural backbone to the glutenin macropolymer through the formation of disulfide bonds that are highly resistant to cleavage [1]. The inherent ability of glutenin subunits to form disulfide bonds is thought to be determined by the primary and secondary structure of the proteins, which determines whether cysteine residues are present and available to form disulfide bonds, the capacity of a subunit to fold in the manner that would be required to form the bond, and the elasticity of the subunit once in the polymer to provide visco-elastic properties to a dough [2]. In this review, we discuss the structure of the glutenin macropolymer of wheat flour and dough. (C) 2000 Elsevier Science Ltd. All rights reserved. [References: 47].

1756 Lu, MQ.; O'Brien, L.; Stuart, IM. (2000) **Barley malting quality and yield interrelationships and the effect on yield distribution of selection for malting quality in the early generations.** *Australian Journal of Agricultural Research. 51(2):247-258.* English. [Univ Sydney, Plant Breeding Inst Narrabri NSW 2390 Australia].

Relationships between malting quality attributes and grain yield in segregating populations can profoundly influence the intensity and sequence of trait selection. Consequently, the interrelationships between malting quality parameters predicted by near infrared transmittance (NIT) spectroscopy, grain weight, and grain yield in unselected populations of F-2, F-3, and F-4 breeding lines from 4 barley crosses were examined. The simple and partial correlations between malt extract, protein content, and diastatic power were similar to those reported in previous studies except for a positive correlation between malt extract and diastatic power in the F-2 and F-3 generations. This positive relationship should enhance selection for improved malting quality in breeding programs. There were no relationships between grain yield and malting quality attributes, which would have an adverse impact on the intensity and sequence of trait selection. The effect of F-2 and F-3 selection for malting quality on F-3 and F-4 yield distributions was estimated by comparing the F-3 and F-4 yield distributions of the entire unselected population with those for the selected populations. Individual selection and sequential independent selection in the F-2 and F-3 generation for malting quality parameters predicted by NIT spectroscopy and grain weight in 4 crosses generally did not alter the nature of the subsequent yield distributions, yet 78-90% of lines could be discarded and there still existed adequate genetic gain for grain yield in the retained population of potentially good malting quality lines. These results indicate that barley breeders could use NIT spectroscopy to efficiently select in the early generations for malting quality prior to the conduct of yield testing and obtain good genetic gain for both malting quality and grain yield. [References: 28].

1757 Luo, C.; Branlard, G.; Griffin, WB.; McNeil, DL. (2000) **The effect of nitrogen and sulphur fertilisation and their interaction with genotype on wheat glutenins and quality parameters.** *Journal of Cereal Science. 31(2):185-194.* English. [Lincoln Univ, Soil Plant & Ecol Sci Div POB 84 Canterbury New Zealand].

The effects and interactions of nitrogen, sulphur and genotype on baking quality parameters have been investigated on 14 New Zealand wheat cultivars or lines. N and S treatments were applied separately, early and late, during the growing season, and late N and S were also supplied together. For each of 168 samples generated by the experiment, we analysed the 'amount of high molecular weight glutenin subunits' (HMW-GS) and the 'amount of low molecular weight glutenin subunits' (LMW-GS), and measured quality parameters such as: grain hardness, protein content. Pelsheuke, SDS sedimentation and mixograph rheology properties. The results show that: (a) genotype has a strong influence on all the tested quality parameters and is the greatest source of quality variation. Genotype is also the only significant source for the quantity variation of HMW-GS and LMW-GS; (b) N application increases all the tested quality parameters. However, late N and S together maximise the Pelshenke values and mid-line peak value of the mixograph; (d) of the 14 tested NZ cultivars, the genotype Kotare has the highest quantity of glutenin, HMW-GS and LMW-GS amounts, flour Pelshenke values, and shorter mid-line peak values; (e) good quality lines are recommended for specific and diverse environments. (C) 2000 Academic Press. [References: 34].

1758 Marconi, E.; Graziano, M.; Cubadda, R. (2000) **Composition and utilization of barley pearling by-products for making functional pastas rich in dietary fiber and beta-glucans.** *Cereal Chemistry. 77(2):133-139.* English. [Univ Molise, DISTAAM Via Sanctis I-86100 Campobasso Italy].

Pearling by-products and the pearled products of two commercial stocks of hulled barley, pearled according to an industrial process consisting of five consecutive pearling steps, were analyzed for beta-glucans, dietary fiber (total, soluble, and insoluble), protein, lipid, ash, and digestible carbohydrate. The data showed that the pearling flour fractions, abraded in the fourth and fifth hullers, contained interesting amounts of beta-glucans (3.9-5.1% db) from a nutritional point of view. These fractions were subsequently enriched in beta-glucans using a milling-sieving process to double beta-glucan content (9.1-10.5% db). Functional pastas, enriched with beta-glucans and dietary fiber, were produced by substituting 50% of standard durum wheat semolina with beta-glucan-enriched barley flour fractions. Although darker than durum wheat pasta, these pastas had good cooking qualities with regard to stickiness, bulkiness, firmness, and total organic matter released in rinsing water. The dietary fiber (13.1-16.1% wb) and beta-glucan (4.3-5.0% wb) contents in the barley pastas were much higher than in the control (4.0 and 0.3% wb, respectively). These values amply meet the FDA requirements of 5 g of dietary fiber and 0.75 g of beta-glucans per serving (56 g in the United States and 80 g in Italy). At present, the FDA has authorized the health claim "may reduce the risk of heart disease" for food containing beta-glucans from oat and psyllium only. [References: 41].

1759 Mills, ENC.; Field, JM.; Kauffman, JA.; Tatham, AS.; Shewry, PR.; Morgan, MRA. (2000) **Characterization of a monoclonal antibody specific for HMW subunits of glutenin and its use to investigate glutenin polymers.** *Journal of Agricultural & Food Chemistry. 48(3):611-617.* English.

A monoclonal antibody, IFRN 1602, has been developed to a synthetic peptide based on the sequence (94)GSVTCPQQV(101) of HMW subunit 1Dx5. The antibody bound strongly to the synthetic peptide based on the cognate sequence of HMW subunit 1Dx2 which contains a serine instead of a cysteine residue. However, it recognized the immunizing peptide by enzyme-linked immunosorbent assay (ELISA) only poorly, probably because the peptide exists as a disulfide-bonded dimer under the assay conditions. From immunoblotting studies against a wide range of wheat varieties, IFRN 1602 was shown to primarily recognize x-type HMW subunits of glutenin encoded on chromosomes 1A and 1D, cross-reacting weakly with the 1A and 1D y-type subunits. It did not bind to any of the 1B-encoded subunits. The Mab also recognized a small number of polypeptides of greater mobility than HMW subunits which were not visible on the stained gels and occurred only in the presence of specific IA and ID x-type HMW subunits. Such polypeptides were not present in a preparation of recombinant subunit 2, suggesting that they are modified forms of the subunits which arise in the seed perhaps by processing of the associated subunits. When used to probe partially reduced glutenin; IFRN 1602 bound to 1Dx5-1Dy10 dimers. As the Mab reacted primarily with Cys(97) of 1Dx5 in a reduced form, these data suggest that this residue is not involved in either intra- or intermolecular disulfide bond in the HMW subunit dimers. Thus, Cys(97) of 1Dx5 may be present in gluten in a reduced form, involved in intramolecular disulfide bonds, or linking of the HMW subunit dimers into larger polymers. [References: 48].

1760 Moudry, J.; Dvoracek, V. (Jihoceska Univ., Ceske Budejovice (Czech Republic). Zemedelska Fakulta) (1999) **Comparison of utilization ability of spelt wheat (Triticum spelta) and wheat (Triticum aestivum) under low input conditions.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 293-296.* Mendelova Zemedelska a Lesnicka Univ. 4 graphs, 2 tables; 5 ref. Czech. (AGRIS 2000-021301).

1761 Munoz, MAB.; Gomez, AM.; de, la, Ossa, EM. (1999) **Optimisation of the extraction process of tocopherol from wheat germ by liquid and supercritical carbon dioxide.** *Grasas y Aceites. 50(4):275-279.* Spanish. [Univ Cadiz, Dept Ingn Quim Tecnol Alimentos & Tecnol Med Ambi Apdo 40 E-11510 Puerto Real Cadiz Spain].

In this work the extraction of tocopherol from wheat germ by liquid and supercritical carbon dioxide has been studied. It has been analysed the operative conditions as well as the row material pre-treatment. At the optimum operating conditions, the yield of supercritical extraction is similar to the conventional extraction by hexano as solvent. So, this technique can be competitive respect of the conventional technique because the solvent removal by distillation is not necessary. [References: 13].

1762 Nicolas, Y.; Denery-Papini, S.; Martinant, JP.; Popineau, Y. (2000) **Suitability of a competitive ELISA using anti-peptide antibodies for determination of the gliadin content of wheat flour: Comparison with biochemical methods.** *Food & Agricultural Immunology. 12(1):53-65.* English. [INRA, Unite Biochim & Technol Prot Rue de la Geraudiere, BP 71627 F-44316 Nantes 03 France].

Gliadin and glutenin contents are known to affect gluten functional properties. ELISA tests, which are rapid and easy to perform, can provide very convenient methods for industrial quality control. The purpose of this study was to develop a competitive ELISA for quantification of gliadins in wheat flour and compare the results with those obtained by nitrogen and reverse-phase high-performance liquid chromatography (RP-HPLC) determination of gliadin content after sequential extraction. As alpha beta-gliadin and total gliadin contents are highly correlated, polyclonal antibodies directed against the C-terminal peptide of alpha beta-gliadins were used in a sequential competitive ELISA to quantify total gliadins. In 21 flour samples, the results with ELISA were closely correlated with those obtained by nitrogen and RP-HPLC determinations ($r > 0.82$, $P < 0.001$), indicating that the ELISA test based on detection of alpha beta-gliadins allowed fairly accurate quantification of total gliadins. Immunoblotting analysis after acid-PAGE showed that some beta-gliadin components were poorly detected or undetected by the antiserum, which could account for differences between the immunochemical and biochemical values observed for a few cultivars. [References: 17].

1763 O'Brien, CM.; Grau, H.; Neville, DP.; Keogh, MK.; Reville, WJ.; Arendt, EK. (2000) **Effects of microencapsulated high-fat powders on the empirical and fundamental rheological properties of wheat flour doughs.** *Cereal Chemistry. 77(2):111-114.* English. [Natl Univ Ireland Univ Coll Cork, Dept Food Sci & Technol Cork Ireland].

Microencapsulated high-fat powders are a healthy and convenient alternative to fats normally used in cereal-based products. In powder form they are easier to use than block fat. Microencapsulation involves dispersion of the fat using homogenization. The globules are then fixed by spray-drying. Empirical and fundamental rheological tests were conducted on doughs containing commercial vegetable fat and

four microencapsulated high-fat powders. The doughs were compared with a standard dough containing no fat. The powders contained 70% vegetable fat or milk fat. The encapsulating agent used was either sodium caseinate or whey protein concentrate (5-10%). Sucrose or lactose were also present in the powders (20-25%). The powders were manufactured at low- or high-pressure homogenization. Farinograph and extensigraph tests were performed on all doughs. Dynamic oscillation tests were conducted in the linear viscoelastic region of the dough. Addition of fat and microencapsulated high-fat powders produced using low-pressure homogenization reduced the complex modulus of the doughs. The results showed an increase in phase angle with incorporation of commercial fat and the microencapsulated high-fat powders. Scanning electron microscopy was conducted to examine the effects of the additives on dough structure. This study demonstrated that microencapsulated high-fat powders, especially powders produced using low-pressure homogenization, had some beneficial effects on dough rheology when compared with doughs produced with commercial fat. [References: 24].

1764 Ornebro, J.; Nylander, T.; Eliasson, AC. (2000) **Interfacial behaviour of wheat proteins [Review].** *Journal of Cereal Science. 31(2):195-221.* English. [Univ Lund, Ctr Chem & Chem Engn POB 124 SE-22100 Lund Sweden].

The interfacial properties of wheat proteins have received little attention in the past, and it is, thus, difficult to obtain a coherent overview of this area. Although this is the case for the whole area, it is particularly true regarding the role of interfacial properties of wheat proteins in baking. The review presents a comprehensive survey of the achievements regarding wheat proteins at interfaces. This includes the behaviour at both liquid interfaces and solid surfaces. For the liquid interfaces, issues such as tensiometry, foam formation and stability, and surface reactions are discussed. The properties at solid surfaces deal with protein adsorption and surface forces. Further, aspects of wheat proteins at interfaces are discussed from a general surface and colloid point of view. Several experimental techniques, relevant for studies of the behaviour of wheat proteins at interfaces, are briefly described, including tensiometry, ellipsometry and surface force measuring techniques. Finally, other applications than baking related to the interfacial properties of wheat (gluten) proteins are reviewed. (C) 2000 Academic Press. [References: 131].

1765 Pelikan, M. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)); Prokes, J.; Hruby, J. (1999) **Triticale and possibilities of its utilization in food production.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 251-255.* Mendelova Zemedelska a Lesnicka Univ. 4 tables; 8 ref. Czech. (AGRIS 2000-021298).

1766 Pereira, PM.; Oliveira, JC. (2000) **Measurement of glass transition in native wheat flour by dynamic mechanical thermal analysis (DMTA).** *International Journal of Food Science & Technology. 35(2):183-192.* English. [Sociedade Portuguesa Inovadao Edf Palaces, R Julio Dinis, 242-S208 P-4050 Porto Portugal].

This work describes a method to study glass transition on native starch powders, based on dynamical mechanical thermal analysis using compression tests, and was applied to wheat flour (13.5% water content). This method will allow the determination of Tg in native (unprocessed) starchy materials, with minimal disturbance of the natural structures. The influence of the test conditions (heating rate, frequency and strain) on the glass transition measurements was determined using factorial designs. The values of Tg determined as the maxima of the energy dissipation (peaks in E ") of native flour and of freeze-dried pre-gelatinized flour were not statistically different (around 64 degrees C). The heating rate did not affect the measurements in the range tested (0.25 to 1 degrees C min(-1)). An interactive effect of the strain amplitude and the frequency was detected. The significance of this interaction can be caused by differences in mechanical energy dissipation, which would indicate that not only temperature but also the total energy input may affect this transition. Slight effects of phase separation between gluten and starch were found on native flour. [References: 18].

1767 Psota, V. (Vyzkumny Ustav Pivovarsky a Sladarsky, Brno (Czech Republic)) (1999) **Varietal composition and quality of malt barleys.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 256-260.* Mendelova Zemedelska a Lesnicka Univ. 9 ref. Czech. (AGRIS 2000-021223).

1768 Rao, VK.; Mulvaney, SJ.; Dexter, JE. (2000) **Rheological characterisation of long- and short-mixing flours based on stress-relaxation.** *Journal of Cereal Science. 31(2):159-171.* English. [Int Food Network Inc 95 Brown Rd Ithaca, NY 14850 USA].

Mixing characteristics, descriptive rheological measurements, and stress relaxation behaviour of flour water doughs from a diverse range of Canadian hard common wheat cultivars were investigated. When mixed in a mixograph, flours from two varieties and two breeding lines in the Canada Western Extra Strong (ES) breeding trials required longer rime (6-8 min) and higher work input (270 350 Arbitrary Units) to mis to peak dough resistance PDR than moderately strung to strong bread wheats (MS) (2.5 min and 110 120 AU). Extensigraph maximum resistance to extension (R-max/E ratio) and alveograph P/L (tenacity to length ratio) values were higher for doughs from ES cultivars than for MS cultivars. Flour-water doughs from ES cultivars exhibited higher G' and G ", and lower tan delta values than those from MS cultivars at all frequencies. Doughs from ES cultivars exhibited slower relaxation rates than exhibited by MS. Doughs from ES cultivars exhibited characteristic bimodal relaxation spectra, which appeared to represent two discrete spectra separated by time. In contrast, doughs from MS cultivars exhibited only one prominent peak at about 0.1 s, with the second peak reduced it, a shoulder. Adding cysteine (30 ppm) to flour-water mixtures of two ES cultivars reduced mixograph mixing times to 2.5 min. The ES doughs with added cysteine exhibited relaxation behaviour similar to that of MS doughs without added cysteine. This suggests that high molecular weight glutenins are primarily responsible for the longer mixing times of ES cultivars, and the characteristic second peak in their relaxation spectra. Relaxation behaviour of all doughs examined was positively correlated with mixograph mixing time. extensigraph R-max/E, alveograph P/L, and mixing energy and mixing time obtained by a long and a short bread-making process. However, the stress relaxation data demonstrated Ilo simple correlation to loaf volume, because all of the cultivars had sufficient strength to produce high quality bread when dough was optimally developed. The stress relaxation measurements differentiated between overly strong (ES) cultivars, and cultivars that have mixing requirements that are more suitable for overall bread-making performance (MS). Stress relaxation results also appeared to reflect expected qualitative differences in the underlying molecular weight distribution of glutenin polymers which relate to dough strength. (C) 2000 Academic Press. [References: 40].

1769 Rinaldi, VEA.; Ng, PKW.; Bennink, MR. (2000) **Effects of extrusion on dietary fiber and isoflavone contents of wheat extrudates enriched with wet okara.** *Cereal Chemistry. 77(2):237-240.* English. [Michigan State Univ, Dept Food Sci & Human Nutr E Lansing, MI 48824 USA].

Okara is the residue left after soymilk or tofu production. In North America, okara is used either as animal feed, fertilizer, or landfill. The purpose of this study was to use wet okara to produce and enrich extruded cereal products and to study the effects of extrusion on the dietary fiber and isoflavone contents. Wet okara was combined with soft wheat flour to produce two different formulations (33.3 and 40% okara) and extruded using four combinations of two screw configurations and two temperature profiles. Various physicochemical properties, dietary fiber by enzymatic-gravimetric method, and isoflavone content by HPLC were analyzed. The radial expansion ratio decreased as fiber content increased. On the other hand, both bulk density and breaking strength increased as fiber content increased. Combining okara with soft wheat flour resulted in increased protein, dietary fiber, and isoflavone contents compared with soft wheat flour alone. Extrusion of the formulations resulted in decreased insoluble

fiber (less than or equal to 25.5%) and increased soluble fiber (less than or equal to 150%) contents of extrudates. Extrusion decreased the total detectable isoflavones (less than or equal to 20%) and altered the distribution of the six detected isoflavones. [References: 25].

1770 Roubroeks, JP.; Andersson, R.; Aman, P. (2000) **Structural features of (1 - 3), (1 - 4)-beta-D-glucan and arabinoxylan fractions isolated from rye bran.** *Carbohydrate Polymers. 42(1):3-11.* English. [Swedish Univ Agr Sci, Dept Food Sci POB 7051 SE-75007 Uppsala Sweden].

A water unextractable fraction from rye bran was isolated by means of a sequential extraction. Gel filtration revealed a homogeneous beta-glucan and at least two different arabinoxylans. H-1 and C-13 NMR spectroscopy were used to identify the structural units in both polysaccharides. The isolated arabinoxylan contained a relatively high amount of unsubstituted xylose residues (56.7%). The molar ratio of cellotriosyl to cellotetraosyl units and the ratio of (1 --> 4) to (1 --> 3)-linkages in beta-glucan were determined using high performance anion-exchange chromatography with pulsed amperometric detection (HPAEC-PAD) and H-1 NMR, respectively. The molar ratio of cellotriosyl to cellotetraosyl was found to be 1.94. From this, the ratio of (1 --> 4) to (1 --> 3)-linkages was calculated to be 2.34, as compared to 2.31 obtained by H-1 NMR, showing that the results from both methods are in close agreement. (C) 2000 Elsevier Science Ltd. All rights reserved. [References: 42].

1771 Shand, PJ. (2000) **Textural, water holding, and sensory properties of low-fat pork bologna with normal or waxy starch hull-less barley.** *Journal of Food Science. 65(1):101-107.* English. [Univ Saskatchewan, Dept Appl Microbiol & Food Sci 51 Campus Dr Saskatoon SK S7N 5A8 Canada].

All ultra-low-fat (< 1%) pork bolognas had similar cook yield and composition. Addition of 4% hull-less waxy barley flour or meal to formulations provided the greatest purge control; 4% normal starch barley, wheat flour and potato starch were intermediate; 0.25% kappa-carrageenan or 1% soy protein concentrate had little effect on water holding and texture. Expressible moisture and purge were significantly correlated to moisture content and batter viscosity. Formulations with wheat flour and waxy barley meal were scored the firmest, while bologna with potato starch required the most force to compress. For most sensory properties, barley fractions performed similarly to wheat flour; however, waxy barley provided superior water holding during storage. [References: 43].

1772 Skore, D. (Latvian Univ. of Agriculture, Jelgava (Latvia). Faculty of Food Technology) (1999) **[The influence of oat and buckwheat flour on wheat flour baking properties].** Zinatnes nakotne musu rokas. Jelgava (Latvia). 26-28 May 1999. *[The future of science is in our hands. Conference papers of the candidates for the doctor's degree]. Latvian Univ. of Agriculture, Jelgava (Latvia) 290 p. p. 179-182.* Latvian University of Agriculture. 2 tables; 3 ill., 5 ref. Latvian. (AGRIS 2000-021206).

As the soluble fibre of oat and buckwheat is of a high nutritive value, the flour of oat or buckwheat can be added to wheat flour to increase the nutritive value of wheat bread. In the given research the changes in mixed flour dough parameters have been determined. Kneading time, dough elasticity, breakdown stability of the mixed flour dough samples have been compared with the control samples of wheat flour dough. The results of the research show that: 1) by adding 10 % of oat and buckwheat flour the changes in the baking properties of wheat flour the changes in the baking properties of wheat flour depend on the quality of wheat flour; 2) the addition of buckwheat flour decreses the dough mixing time and increases the water absortion ability of the flour.

1773 Tanada-Palmu, P.; Helen, H.; Hyvonen, L. (2000) **Preparation, properties and applications of wheat gluten edible films.** *Agricultural & Food Science in Finland. 9(1):23-35.* English. [Univ Helsinki, Dept Food Technol POB 27 FIN-00014 Helsinki Finland].

Edible films from wheat gluten were prepared with various amounts of glycerol as a plasticizer. Water vapor permeability, oxygen permeability, tensile strength and percentage elongation at break at different water activities (a(w)) were measured. Films with low amounts of glycerol had lower water vapor and oxygen permeabilities, higher tensile strength and lower elongation at break. Wheat gluten coatings reduced weight loss during two weeks of storage for cherry tomatoes and sharon fruits compared to uncoated controls. A bilayer film of wheat gluten and beeswax significantly lowered weight loss from coated cheese cubes compared to single layer coating of wheat gluten. [References: 29].

1774 Vyhnanek, T.; Bednar, J.; Provaznikova, E. (Mendelova Zemedelska a Lesnicka Univ., Brno (Czech Republic)) (1999) **Determination of baking quality of wheat (Triticum aestivum) using electrophoresis of reserve proteins.** Plant Nutrition, Quality of Production and Processing. Brno (Czech Republic). 29-30 Jun 1999. *Plant nutrition, quality of production and processing. Proceedings of a conference 351 p. p. 343-346.* Mendelova Zemedelska a Lesnicka Univ. 1 graph, 1 table; 7 ref. Czech. (AGRIS 2000-021309).

1775 Wesley, IJ.; Uthayakumaran, S.; Anderssen, RS.; Cornish, GB.; Bekes, F.; Osborne, BG.; Skerritt, JH. (1999) **A curve-fitting approach to the near infrared reflectance measurement of wheat flour proteins which influence dough quality.** *Journal of Near Infrared Spectroscopy. 7(4):229-240.* English. [CSIRO, Plant Ind POB 7 N Ryde NSW 1670 Australia].

A curve-fitting approach to the problem of measuring the gliadin and glutenin content of flour is presented. Theoretical spectra for 100% pure gliadin, glutenin and starch are derived based on the analysis of partially purified materials and are shown to have unique characteristics. Spectral differences at 2306 nm and 2350 nm were attributed to the presence of lipid in the glutenin component and a least squares curve-fitting procedure over the range 2050-2220 nm has been used to calculate the proportion of each component present in the spectrum of a flour. High r(2) values were achieved when the results were compared with the actual values as measured by size exclusion high pressure liquid chromatography, The results for gliadin (r(2) = 0.73) and glutenin (r(2) = 0.76) suggest that the curve-fitting methodology offers a simple alternative to partial least squares (PLS) and multiple linear regression (MLR) techniques for ranking samples by gliadin and glutenin content. Although there was a large bias between the actual and uncorrected predicted values for gliadin and glutenin content, the results provided a clear justification for assuming that robust calibrations for gliadin and glutenin content can be developed using both curve-fitting and PLS calibration techniques, The least squares methodology can be used as a simple technique for estimating the gliadin and glutenin content of flours where the development and maintenance of a full calibration is either impractical or not desirable. [References: 24].

1776 Yamauchi, H.; Ichinose, Y.; Takata, K.; Iriki, N.; Kuwabara, T. (2000) **Simple estimation of breadmaking quality of wheat flour by modified expansion test under reduced pressure [Japanese].** *Journal of the Japanese Society for Food Science & Technology-Nippon Shokuhin Kagaku Kogaku Kaishi. 47(1):46-49.* Japanese. [Hokkaido Natl Agr Expt Stn, Upland Agr Res Ctr Memuro Hokkaido 0820071 Japan].

We developed a modified expansion test under low pressure for simple estimation of breadmaking quality (specific loaf volume). The expansion volume was highly correlated with specific loaf volume (r=0.849). This correlation coefficient was significantly higher than those derived from protein content and SDS sedimentation volume at the one side 1% level. Our new testing method will be useful to evaluate the exact breadmaking quality of breeding lines at early breeding stage. [References: 4].

1777 Zarco Hernandez, J.; Michelena, A.; Royo, C. (Institut de Recerca i Tecnologia Agroalimentaries, Lerida (Espana). Area de Cultivos Extensivos) (1999) **[Hard wheat quality in Spain].** *Vida Rural (Espana) (no.92) p. 22-24.* 2 graf. Spanish. (AGRIS 2000-021217).

1778 Zheng, GH.; Rossnagel, BG.; Tyler, RT.; Bhatty, RS. (2000) **Distribution of beta-glucan in the grain of hull-less barley.** *Cereal Chemistry. 77(2):140-144.* English. [Cargill Inc 3201 Needmore Rd Dayton, OH 45414 USA].

Nine hull-less barley (HB) containing waxy (0-7% amylose), normal (approximate to 25g amylose), or high amylose (approximate to 42% amylose) starch with normal or fractured granule make-up and 4-9% (1-->3)(1-->4)-beta-D-glucans (beta-glucan) were pearled to remove 70% of the original grain weight in 10% intervals. The pearled fractions were analyzed for beta-glucan distribution within HB grain. Protein content of the pearled fractions indicated that the three outermost fractions contained pericarp and testa, aleurone, and subaleurone tissues, respectively For all HB, beta-glucan and acid-extract viscosity were very low in the outermost 20% of the kernel. For low beta-glucan HB, beta-glucan content was the greatest in the subaleurone region and declined slightly toward inner layers. For high beta-glucan HB, however, more than 80% of grain beta-glucan was distributed more evenly throughout the endosperm. Acid extract viscosity was significantly ($P < 0.01$) correlated with total ($r = 0.75$) and soluble ($r = 0.87$) beta-glucan content throughout the kernel of all HB. Growing conditions, location and year, had significant effects on the concentration of protein, starch and beta-glucan. However, protein, starch, and beta-glucan distribution patterns were not affected by growing conditions. The difference in beta-glucan distribution between low and high beta-glucan HB may explain the difference in milling performance of HB with low or high beta-glucan. [References: 22].

Q52 FEED PROCESSING AND PRESERVATION

1779 Mollenhauer, S.; Peschke, H.; Flatter, A. (1999) **Decomposition of wheat straw treated with fungicids.** *Agribiological Research-Zeitschrift fur Agrarbiologie Agrikulturchemie Okologie. 52(3-4):271-279.* German. [Humboldt Univ Invalidenstr 42 D-10115 Berlin Germany].

The ordinary fungicid treatment of growing cereals raise the question whether the treated straw would rot more slowly than the untreated one after being ploughed into the soil as an organic fertilizer. An incubation experiment was carried out using straw samples varying in fungicid treatments. These different straw samples of the fungicid trials were incubated in a reference soil under a controlled temperature and moisture regime to discriminate between rates of decomposition measured by the CO2-exhalation. [References: 16].

Q53 FEED CONTAMINATION AND TOXICOLOGY

1780 Chan, DY.; Black, W.; Hale, B. (2000) **Bioaccumulation of cadmium from durum wheat diets in the livers and kidneys of mice.** *Bulletin of Environmental Contamination & Toxicology. 64(4):526-533.* English. [Univ Guelph, Dept Land Resource Sci Guelph ON N1G 2W1 Canada].

1781 Pietri, A. (Universita Cattolica del Sacro Cuore, Piacenza (Italy). Istituto di Scienze degli Alimenti e della Nutrizione) (1998) **[*Mycotoxins*. The present situation in Italy [food contamination - aviculture]].** [World Poultry Science Association. Italian section. Technical meeting]. Bologna (Italy). [nd]. *Rivista di Avicoltura (Italy) v. 67(1-2) p. 32-38.* 3 tables; 2 graphs. Italian. (AGRIS 2000-026907).

Q54 FEED COMPOSITION

1782 Berzina, N.; Apsite, M.; Basova, N.; Valiniece, M.; Smirnova, G. (University of Latvia, Salaspils (Latvia). Inst. of Biology) (1999) **[Biological efficiency of enzyme compositions applied in complex with PVMA "Stimovit" for broilers diet based on barley-wheat].** 7. Baltic Poultry Conference. Riga (Latvia). 9 Sep 1999. *7. Baltic Poultry Conference. Part 1. Research works. Part 2. Papers. Nudiens, J. (World Poultry Scientific Association, Riga (Latvia). Latvia Branch) (Ed.). Ministry of Agriculture, Riga (Latvia); World Poultry Scientific Association, Riga (Latvia). Latvia Branch; Latvia Univ. of Agriculture, Sigulda (Latvia). Research Centre "Sigra" 132 p. p. 10-14.* [Ministry of Agriculture]. 6 tables; 8 ref. Russian. (AGRIS 2000-026919).

The aim of the research was to prove the efficiency of multienzyme compositions MEK-CGAP-1 and MEK-CGAP-2 (produced in Lithuania by the company "Biosinteze") applied in broilers feed on the base of PVMA "Stimovit". The test results showed that the supplement of the mentioned enzyme compositions in the diet containing 35 % of barley and 33 % of wheat ensured more economic use of feed for breeding broilers. The biochemical parameters of blood, liver and muscles were in accordance with normal indices. The analyses of protein, lipids and glicogen in muscles proved the high quality of meat.

1783 Chabaca, R.; Larwence, A.; Paynot, M.; Tisserand, JL. (2000) **Effect of treatment of wheat straw with ammonia under different conditions on p-coumaric and ferulic acid content and on "in situ" nitrogen degradability.** *Annales de Zootechnie. 49(1):29-38.* French. [ENSIA, SIARC BP 5098 F-34033 Montpellier France].

The main aim of our work was to study under various conditions, the effects of ammonia-treated wheat straw on p-coumaric ApC) and ferulic acid content (AF) as well as the nitrogen degradability (dtN) and their relation to understand the abnormally high amounts of faecal nitrogen in the ruminant fed ammonia treated straw. 16 straws were submitted to different conditions of ammonia (3 and 5%), duration (15, 30, 45 and 75 days) and temperature (15 and 35 degrees C). Ammoniac increased the nitrogen matter from 2.1 to 11.3% of dry matter (DM). The FA and ApC contents were respectively 3.89 g and 2.94 g/kg DM for untreated straw (PNT). After treatment, FA and ApC content decreased respectively of 7 and 22% ($P < 0.05$ and $P < 0.001$). The degradability of PNT is very low (15%). It increased with the treatment, particularly with the temperature: 63% at 15 degrees C and 71% at 35 degrees C. This result is explained by the increase of model parameters a (+15%) and c (+27%). The correlation established between dtN, kinetic points of nitrogen degradation and FA, ApC and FA + ApC were low. They were only high ($P < 0.001$), during the first 8 h of incubation. 30 to 37% of the nitrogen degradability were explained by FA and ApC respectively. It is concluded that neither FA and ApC contents nor an irreversible fixation of nitrogen of the treatment on the straw can explain satisfactorily the abnormally high amounts of faecal nitrogen excretion observed in ruminants fed ammonia-treated straw. The synthesis and the release of indigestible nitrogenous compounds, probably made of nitrogen and phenolic acids, explain this phenomenon indeed these compounds could capture in an irreversible way a part of the nitrogen of treatment. [References: 38].

1784 Liponi, G.B.; Colombani, B.; Cianci, D. (Pisa Univ. (Italy). Dipartimento di Produzioni Animali); Xing, J.J. (1997) **Chemical compositions and ruminal degradability of some feedstuffs for ruminants from Qinghai province of China [ewes].** *Annali della Facolta' di Medicina Veterinaria di Pisa (Italy) v. 50 p. 141-156.* 7 tables; 2 graphs; 17 ref. English. (AGRIS 2000-026918).

1785 Mustafa, AF.; McKinnon, JJ.; Ingledew, MW.; Christensen, DA. (2000) **The nutritive value for ruminants of thin stillage and distillers' grains derived from wheat, rye, triticale and barley.** *Journal of the Science of Food & Agriculture. 80(5):607-613.* English. [Univ Saskatchewan, Dept Anim & Poultry Sci 72 Campus Dr Saskatoon SK S7N 5B5 Canada].

A study was conducted to determine nutrient degradabilities of thin stillages and distillers' grains derived from wheat-, rye-, triticale- and barley-based ethanol production. In vitro protein degradabilities of wheat, rye, triticale and barley thin stillages were determined using a protease enzyme assay. One ruminally fistulated cow was used to determine ruminal nutrient degradabilities for wheat, rye, triticale and barley distillers' grains. Results of the ill vitro study showed that the soluble protein fraction was highest for rye thin stillage and lowest for barley thin stillage. The degradation rate of the slowly degradable protein fraction was higher for wheat and triticale thin stillage than rye thin stillage and was higher for rye than barley thin stillage. Effective degradability of crude protein followed the order rye (659 g kg(-1)) > triticale (632 g kg(-1)) > wheat (608 g kg(-1)) > barley (482 g kg(-1)) thin stillage. Ruminal degradability of dry matter was highest for rye and lowest for barley distillers' grains. Ruminal degradability

of dry matter was also higher for wheat than triticale distillers' grains. Crude protein from barley distillers' grains had a lower ruminal degradability relative to crude protein from wheat and rye distillers' grains. Ruminal degradability of neutral detergent fibre was highest for rye distillers' grains (470 g kg(-1)), intermediate for wheat and triticale distillers' grains (average 445 g kg(-1)) and lowest for barley distillers' grains (342 g kg(-1)). It was concluded that thin stillage and distillers' grains derived from barley had a lower nutritive value for ruminants compared with those derived from wheat, rye and triticale. (C) 2000 Society of Chemical Industry. [References: 32].

1786 Nia, SAM.; Wittenberg, KM. (1999) **Use of forage inoculants with or without enzymes to improve preservation and quality of whole crop barley forage ensiled as large bales.** *Canadian Journal of Animal Science. 79(4):525-532.* English. [Univ Manitoba, Dept Anim Sci Winnipeg MB R3T 2N2 Canada].

The effects of forage additives, applied to bales wrapped at either 2 or 10 h post-baling, on preservation and quality of whole barley crop ensiled as large bales were investigated. Forage was cut at the early milk stage and allowed to wilt over a 24-h period to 47% DM. Bales were allocated on the basis of baling sequence to one of three additives treatments: without inoculant (Control); treated with a microbial inoculant, Lactobacillus plantarum and Pediococcus cerevisiae (LpPc); or treated with Lactobacillus plantarum and Pediococcus cerevisiae, plus cellulase and pectinase (LpPcE). An equal number of bales (n = 18) representing each treatment group were wrapped at either 2 or 10 h past-baling. All bales were core sampled at baling and on days 1, 2, 3, 6, 9, 13, 17, 29, 64, 92, 252 and 308 post-baling. Bales were weighed prior to being wrapped and when removed from storage to measure DM and nutrient losses during storage. During wrapping, a thermocouple wire was inserted in each bale to monitor bale temperature. Time of wrapping did not affect nutrient composition or ensiling characteristics of silage. Application of forage additives had no effect on nutrient profile or recovery, however, silage treated with LpPc inoculant had lower ($P < 0.05$) ammonia N compared with untreated or treated with LpPcE silage. Storage temperature of bales representing all treatments did not exceed 28 degrees C but were approximately 2 to 3 degrees C higher in the Control than treated silage for the first 3 d post-ensiling. Silage treated with forage additives had a lower ($P < 0.05$) pH and an increase ($P < 0.05$) in concentrations of lactic and total acids. Ethanol and 2, 3 butanediol levels were higher ($P < 0.05$) in untreated silage compared with inoculated silage. Silage treated with forage additives were more stable and took 5, 9 and 12 d to heat after exposure to air for Control, LpPc and LpPcE silage, respectively. Results from this study indicated that treatment with microbial inoculants was beneficial in preserving whole crop barley ensiled as large bales. Addition of enzymes to microbial inoculant did not have further beneficial effect on quality of large bale silage. [References: 26].

T01 POLLUTION

1787 Li Ying; Ou Ziqing; Sun Tieheng (Academia Sinica, Shenyang (China). Inst. of Applied Ecology) (1998) **Transportation and transformation of 14C-phenanthrene in a controlled nutrient solution-lava-wheat system.** *Chinese Journal of Applied Ecology (China). Yingyong Shengtai Xuebao (China) v. 9(3) p. 318-322.* 1 table; 4 ill., 6 ref. Chinese. (AGRIS 2000-021592).

1788 Xiao Ling; Liang Quanshe; Wang Qinghua (Northwestern Agricultural Univ., Yangling, Shaanxi (China)) (1998) **Investigation on the effect of arsenic on wheat seed germination.** *Acta Universitatis Agriculturalis Boreali-Occidentalis (China). Xibei Nongda Xuebao (China) v. 26(6) p. 56-60.* 6 tables; 6 ref. Chinese. (AGRIS 2000-021593).

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