Literature Update on
Wheat, Barley, and Triticale

CIMMYT

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Wheat, Barley and Triticale

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The work of John Woolston, Corinne de Gracia, and Laura González in preparing this initial issue is gratefully acknowledged.
## 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.

Roger Rowe
Acting Director General, CIMMYT

Adel El-Beltagy
Director General, ICARDA
Sample Entries

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


b) Sample entry retrieved from AGRIS (journal article)


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


1 Entry number 6 Source
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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. 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.


**B10 AGRICULTURAL ECONOMICS AND POLICIES**


6. Hoffman, WL; Gardner, BL; Just, RE; Hueb, BM. (1994) [The impact of food aid on food subsidies in recipient countries]. American Journal of Agricultural Economics. 76(4):733-743. English. [ENVIRONM WORKING GRP WASHINGTON, DC USA]. A model in which policy makers maximize a weighted welfare function of producer, consumer, and taxpayer groups is applied to explain the effects of food aid receipts on food policies in the countries receiving food aid. Consumer subsidies for wheat in nine countries receiving food aid are examined during the 1955-83 period. Econometric results indicate food aid increases domestic food subsidies in the recipient countries, but that other factors (development, country-specific factors) are more important in determining subsidy level. [References: 15].


**B21 AGRO-INDUSTRY**


11. Meusser, F. (Technische Univ. Berlin (Germany)); Pahe, N. (1993) [Possible changes in the conceptions of starch extraction]. Moglichkeiten konzeptioneller Veranderungen bei der Starchgewinnung. 2. Symposium Nachwachsende Rohstoffe - Perspektiven fuer die Chemie; Frankfurt am Main (Germany); 5-6 May 1993. (Symposium on "Renewable Resources. Perspectives of Chemistry." Proceedings). Bundesministerium fuer Ernahrung, Landwirtschaft und Forsten, Bonn (Germany). Schriftenreihe des Bundesministers fuer Ernahrung, Landwirtschaft und Forsten, Reihe A. Angewandte Wissenschaft (Germany), spec. no. p. 171-144. Landwirtschaftsverlag. 4 ill., 10 graphs, 7 tables. Spec. ref. German. (AGRIS 94-105286).


**B70 TRADE, MARKETING AND DISTRIBUTION**

be well characterized by the hyperbola. This lower limit was determined in 96% of the maximum value of hyperbolas. That was the lowest seed rate, which did not give a considerable yield loss.


The investigations of the soil protection project (promoted by the Federal Ministry of Research and Technology) were conducted on the area 'Ahluim' of the Federal Biological Research Centre for Agriculture and Forestry (BBF) in the east of the town of Wollenzell. From October to March a positive climatic water balance can be observed, but in the main vegetation period deficiencies up to 100 mm can be found. From 11 soil units the rendztane, pure-brown earths and colluviae (especially at bottom slope) predominate in this location. The properties of the soils are heterogenous altogether. As an exception there is a decomposition of limestone in the surface soil in plot 3. Six years before the investigations started the area had been subdivided into three equal parts of 12 ha each. Sugar beet, winter-wheat and winter-barley were cultivated in this area successively. Each of these crops was cultivated in three, later in four intensities (I-13). The agricultural and plant cultivation measurements were conducted on principles of regular and practical agricultural cultivation. The tillaged soil, the basic dressing, the seeding as drilling and the technique of seeding were conducted in the intensities in the same way. Whereas the seed density of sugar beet was generally equal, there was a difference of 280 to 450 grains/m2 in the cereals according to the intensities. There was a stronger variation between the particular intensities in nitrogen fertilizing and the management of plant protection products. The soil samples were taken in areas which were divided into 40 plots (5 parallel lines with 8 repetitions in each of them). One soil sample was taken in each of these plots and they were united to a mixed sample. In the part-projects of soil zoology the scheduled sampling had to be taken in a different way.

22 Beege, G. (Saxisches Landesanstalt fuer Landwirtschaft (Germany)); Luehe, W. (1994) [Results of the land sort trial 1993 of the new federal states: Malting barley]. Ergebnisse der Landessortenversuche 1993 der neuen Bundeslaender: Braugerste. Neue Landwirtschaft (Germany) (no.1) p. 31-33. 3 tables. German. (AGRS 94-115946)


24 Belcheva, S.; Nenkov, D.; Ivanova, I. (Baza za Razvitie i Vnedryavane na Biologichno Aktivni Veshchestva pri Selskostopanska Akademnya, Sofia (Bulgaria)); Ivanova, V. (1993) [Variation in the productivity potential of the soft wheat varieties as affected by some growth regulators]. Promeni v produktivnite vremenhnosti na sortove meta pshenitsa pod vliyanie na rastezhni regulatori. Selskostopanska Akademnya, Sofia (Bulgaria). Rastenie 'dni Nauki (Bulgara); Plant Science; 305/5-6) p. 24-27. 3 tables; 1 ref. Bulgarian. (AGRS 94-105941)


31 Dunitrov, L. (Opitna Stantsiya po Sortoizipivane, s. Kapitanovtsi, Oblast Montana (Bulgaria)) (1993) [Testing foreign winter barley cultivars]. Izpivane na chuzhdhestrani sortove zimechn echemik. Selskostopanska Akademiya, Sofia (Bulgaria). Rastenier'dni Nauki (Bulgaria); Plant Science v. 30(5-6) p. 35-36. 3 table; 6 ref. Bulgarian. (AGRIS 94-105668).


The participation of the studied factors in yield formulation was (in percent) for: rye - corecrops - 8.5-46.5, sowing time - 10.2-19, soil complex - 12.1, sowing density - 10.1, location - 6.3, participation of cereals - 1, fertilization - 0.5-4.3; for wheat: corecrops - 10.5-32, sowing time - 8.3-16.3, sowing density - 13.0, location - 7.8, participation of cereals - 4.4, soil complex - 4.1, fertilization - 1.2-2.2.


The present investigation was carried out during the 1990/91 and 1991/92 seasons to determine the optimum planting date for maximizing wheat production under Al-Qassim conditions. The experiments were conducted at the Agricultural experimental Station, College of Agriculture and Veterinary Medicine, King Saud University, Al-Qassim Branch, Saudi Arabia. Two high-yielding spring wheat cultivars, Yecora Rojo and West Bread, were planted in six dates; November 16, December 1 and 16, January 1 and 16 and February 1. The experiments were set up in a split plot design with four replications. Results revealed that planting dates had significant effects on all studied traits. Significant cultivar x planting date, planting date x season and cultivar x planting date x season interactions existed for grain yield and its components, plant height and days to heading. The best planting date for Yecora Rojo cultivar was January 1st and for West Bread cultivar was December 16 in the first season while the first of December was the best planting date for both cultivars in the second season for maximizing grain yield. Spikes per square meter and kernels per spike significantly increased while kernel weight non-significantly decreased as planting date was delayed from November to December. It could be concluded that the optimum period for planting date in Al-Qassim region lies within the first two weeks of December. Expanding planting to January 1st could be possible, while planting after this period would result in yield reduction.


This report deals with the research of an EC-project for the cooperational development of DSS by using information models for wheat cultivation. It is the target of this project - still being developed - to cooperate internationally concerning the development of DSS-software. We, the German team also aim at constructing models that can be adapted to the national needs of the different EC-countries. At the time being, these models are checked and tried out with the help of different test methods. e.g. field tests. The first test results will be expected by the end of this year. It is the task of the German team to develop a DSS for the cultivation and the field management of winter wheat. Already existing Decision support models for this area are hereby being implemented and adapted to the needs of our project partners. With FUNGI, the model for fungicide choice, we are now able to close a gap concerning the development of the DSS.


The polycrossing field experiments were conducted at the Crop Production Department, Research Base, University of Agriculture, Nitra, during the two time periods, in 1985 to 1990 with the varieties of winter wheat Livia, Roxana, Zdar and in 1991 to 1993 with the varieties Barbara, Blava, Livia, Torsya, Vlada. The aim of the experiments was to discuss an influence of three fertilization combinations: a - zero fertilization control, b - fertilization based on standard designated for the yield of 8 t of above-ground biomass per hectare (in 1991 to 1993 50% of NPK nutrients applied per hectare were in organic form), c - rational fertilization determined according to the soil nutrient dynamics [in 1991 to 1993 according to the methodology by Michalík, Lozek (1985)] at two seed rates (3.5 mil. and 5.5 mil. grains per hectare) and three ways of drilling (coulter drilling, strip drilling and disc drilling) on soil structure and resulted grain yield. The fertilization had statistically significant influence on the yield in both time periods. Varieties Livia and Roxana achieved the maximum yields at the fertilization level based on fixed standard (yield increase from 10.6 and 6.9%, resp.) and variety Zdar at rational fertilization (yield increase of 9.4%). The differences between two fertilization combinations were statistically insignificant (1.1%) and from economical point of view after subtracting fertilizer costs the rational fertilization dose was more advantageous, what saved 146 kg NPK per hectare and coefficient of economic effectiveness achieved 1.29. In 1991 to 1993 in all tested varieties, except Torsya, the maximum yield at fertilization 50% of NPK per hectare in commercial fertilizers was determined and 50% of NPK per hectare in organic manures, where the yield increase range from 8.1% (Vlada) to 16.4% (Barbara) compared to the control. From the economic point of view, the rational fertilization according to the methodology (KEE 2.11) was found to be more advantageous. In 1985 to 1990 trials, the seed rate 5.5 mil. grains per hectare was demonstrated as a definitely more advantageous (statistically significantly) and the yield increase range from 4.6% (Zdar) to 8.4% (Livia). The influence of various types of drilling (coulter, strip, disc) on the yield was found statistically insignificant, moreover, the way of drilling influenced the yield structure (number of plants, number of spikes and number of grains per square meter) where coulter drilling was the best.


Adopting water-conserving irrigation practices on the Canadian prairies will protect the soil against erosion while conserving soil water. The use of tall-standing stubble to conserve water creates a dilemma for producers because maximum yields can only be obtained with narrow rows, and tall stubble may limit the use of narrow row spacings. A 4-yr study on a thin Black clay soil investigated the effects of three row spacings (10, 20 and 30 cm), six seedings rates (34, 67, 100, 134, 168 and 202 kg ha-1) for wheat and 27, 54, 81, 108, 134 and 161 kg ha-1) for barley) and two rates of N (low and high) in hard red wheat (Triticum aestivum L.), durum (Triticum durum L.) and barley (Hordeum vulgare L.) using a continuous cropping, zero-till production system. The yields of cereals were maintained with 30-cm row spacing over a wide range of growing conditions under zero-till management. Durum had a 5.8% yield advantage over barley and 2.4% advantage over the 30-cm row spacing. The number of plants established and the number of spikes produced decreased as row spacing increased for all crops. But wider row spacing resulted in more kernels produced per spike, which, in the case of barley and durum, more than compensated for the lower number of spikes. Increasing seeding rates significantly improved grain yield in all crops and years because more spikes were produced. Grain yield was related to the reciprocal of seeding rate. The few row spacing x seeding rate interactions observed in 2 of 12 cases suggest that seeding rates need not be adjusted for changes in row spacing. The results obtained have important implications for equipment design and the ability to more easily handle high-crop-residue situations. (References: 27).


47 Logu, G. de (Istituto Sperimentale per la Cerealicoltura, Rome (Italy)) (1994) [The valid alternative of barley in spring seeding]. La valida alternativa dell'orzo in semina primavertile. Informatore Agrario (Italy) v. 50(5) p. 47-49. 2 tables; 4 graphs. Italian. (AGRIS 94-105969).


49 Lukopudis, S. (D'zhravna Sortova Komisiya, Sofia (Bulgaria)) (1993) [Productivity and variety testing of winter soft wheat under semimountainous conditions]. Sortizipitane i produktivnost na zimna meka pshenitsa pri poluplaninski ulovitvi. Selskostopanska Akademija, Sofia (Bulgaria). Rasteniot 'dni Nauki (Bulgaria); Plant Science v. 30(5-6) p. 10-13. 3 tables; 7 ref. Bulgarian. (AGRIS 94-105993).

50 Lukopudis, S. (D'zhravna Sortova Komisiya, Sofia (Bulgaria)) (1993) [Winter soft wheat under the conditions of Srednogoria]. Zimna meka pshenitsa pri uloviyata na Srednegorieto. Selskostopanska Akademija, Sofia (Bulgaria). Rasteniot 'dni Nauki (Bulgaria); Plant Science v. 30(5-6) p. 29-31. 1 table; 13 ref. Bulgarian. (AGRIS 94-105942).


Date of sowing experiments were established under irrigation in Ludhiana, in the Indian state of Punjab, from 1985 to 1992, using a total of 66 spring wheat (Triticum aestivum L) cultivars and 10 sowing dates. To study interactions among cultivars, sowing dates and years and to estimate losses with delayed sowing for grains m(-2) and grain yield, an orthogonal subset of four years, three cultivars (PBW 34, PBW 154 and PBW 226) and seven sowing dates was used. To study the relationship between temperature and radiation, and yield and yield components, the same three cultivars were used with all the available years and sowing dates for each. The optimum sowing dates for yield were 5 November for PBW 34 (long-season) and 15 November for cultivar PBW 154 (medium-season) and PBW 226 (short-season). The combined effect of pre-heading radiation and temperature, referred to as the photothermal quotient (PTQ), was a better predictor of grains m(-2) than was either variable alone. The sole effect of post-heading temperature was the best predictor of individual kernel weight. Yield and grains m(-2) were maximized for all cultivars when exposed to the highest PTQ between 20 days before to 10 days after heading. Hence, the optimum heading date was the same for all three cultivars and, for the years studied, was in mid-February. After the optimum sowing date, there was a 0.8, 0.7 and 0.7% day(-1) yield reduction for PBW 34, PBW 154 and PBW 226, respectively. The optimum heading date is earlier than observed for several other important areas of irrigated spring wheat. This may be explained by the rapid increase in temperature from February onwards at Ludhiana. We discuss the use of PTQ and temperature to determine optimum heading dates and, therefore, sowing dates for different cultivars. [References: 36].


55 Pankov, Zh.; Dzelelovp, K. (Institut po Pshenitsata i St'nochogleda "Dobrudza", Geheral Tosevo (Bulgaria)) (1993) [Effect of gamma irradiation on M1 soft wheat pollen and gametophyte]. Efekt na v'i'deystvieto na gama-l'i'chi v'ykhoo gametofita i polena na meka pshenitsa v M1. B'tgarska Akademuya na Naukite, Sofia (Bulgaria). Genetika i Selektiya (Bulgaria); Genetics and Breeding v. 26(5-6) p. 370-377. 3 tables; 14 ref. Bulgarian. (AGRIS 94-105943).


61 Royo, C.; Insa, J.A.; Boujenna, A.; Ramos, J.M.; Montesinos, E.; Delmoral, L.P.G. (1994) YIELD AND QUALITY OF SPRING TRITICALE USED FOR FORAGE AND GRAIN AS INFLUENCED BY SOWING DATE AND CUTTING STAGE. Field Crops Research. 37/3:161-186. English. [CTR UDL IRTA AREA CONREUS EXTENSUS ROVIRA ROURE 177 E-25006 LLEIDA SPAIN]. Six field experiments involving two sowing times at each of three sites across Spain to study the response of three spring triticales to forage removal at early stages. Forage dry matter harvested at the first-node-detectable stage (31) doubled or tripled forage harvested at the pseudostem-erect stage (30). Sowing date affected forage production only when cutting was delayed until stage 31, and had a significant effect on the subsequent grain yield and test weight. Forage quality was not affected by sowing date, and forage removal did not affect grain protein content. Grain yield was reduced by about 15% when forage was removed at stage 30 and by nearly 30% at stage 31. At the northern sites, grain-yield reductions following forage removal may be attributed to grain-weight decreases caused by a prolonged cycle to anthesis. At the southern site, forage removal did not affect the life cycle, probably due to the longer photoperiods, greater irradiation, and higher temperature during spring. [References: 33].


64 Schoonderbeek, D.; Schoute, JFT. (1994) ROOT AND ROOT-SOIL CONTACT OF WINTER WHEAT IN RELATION TO SOIL MACROPOROSITY. Agriculture Ecosystems & Environment. 47(1-2):89-98. English. [DLO WINAND STARING CTR INTEGRATED LAND SOIL & WATER R POB 125 6700 AC WAGENINGEN NETHERLANDS]. Large thin sections and image analysis techniques were used to understand the relation between macroporosity and root development in two different farm management systems. Samples of 8 cm X 15 cm were collected at three different depths from two fields, one under a conventional and one under an integrated farm management system. Macroporosity was measured on vertically oriented thin sections, whereas root parameters were quantified on horizontal thin sections. Macroporosity was quantified using porosity photograms. Roots were quantified directly on the thin sections using a microscope with several light sources. The micromorphometric measurements were performed with a Quantamet 970 image analyser. Two hypotheses were tested: (a) different farm management systems are responsible for different soil macroporosities; (b) a relationship exists between macroporosity and root-soil contact in the topsils of conventional and integrated farm management systems. [References: 25].

65 Sheaffer, CC.; Rasmussen, DC.; Simmons, SR. (1994) FORAGE YIELD AND QUALITY OF SEMIDWARF BARLEY. Crop Science. 34(6):1652-1665. English. [UNIV MINNESOTA DEPT AGRON & PLANT GENET ST PAUL, MN 55108 USA]. Semidwarf barley (Hordeum vulgare L.) with enhanced lodging resistance has been developed for feed grain production. Its potential as a forage crop has not been evaluated. Our objective was to determine forage yield, forage quality, and grain yield of semidwarf barley compared with conventional barley cultivars developed for malting and feed grain production. Three semidwarf experimental barley lines were compared with two conventional height malting barley cultivars in the field at St Paul, MN on a Waukegan silt loam (fine-silty over sand) or sandy skeletal, mixed, mesic Typic Hapludoll) and at Crookston, MN, on a Wheatville loam (coarse-silty over clayey, frigid Aeric Calcicuoll) Semidwarf barleys averaged 24% less stem and 29% greater florescence proportion than conventional barleys. Leaf blade and leaf sheath proportion for semidwarf and conventional height barley were similar. Semidwarf barley averaged 11% less whole plant acid detergent fiber


Carbon fluxes in the rhizosphere of barley (Hordeum vulgare L) and wheat (Triticum aestivum L) were studied under field conditions with conventional management (CONV) and integrated management (INT) using C-14-CO2 pulse labelling. As estimated by a model rhizodeposition technique, the bulk of the C-14 soil/root respiration during a 3 week period after pulse labelling originated from root respiration and only a minor part was due to microbial activity. Root C-14 losses during washing from soil were considerable (up to 40%) and were corrected for. Most of the carbon transfer to the roots of barley and wheat occurred in the early developmental stages, with a maximum flux after sowing. Over the entire growing season, the amount of carbon transferred to the above-ground portion of the plant was only 52% of the lower total root net carbon loss. Over the entire growing season, about one-half was found to be decayed by the end of the growing period. Compared with CONV, in INT a lower transfer of carbon to the roots, a lower root growth and a lower total rhizodeposition was found. In winter wheat this was mainly due to a lower overall plant production, and not a different C distribution pattern. Total rhizodeposition constituted 29-50% of the carbon translocated below ground and was 1.5-2.1 times the amount of roots left at crop harvest. Microbial respiration of rhizodeposits was higher in CONV than in INT. [References: 35].


Based on results of small-plant experiments and balance feeding tests with laboratory rats, a level of the feeding value and grain production in 14 released cultivars and new breeding lines of spring and two-row winter barley grown in the Czech Republic were studied. The results showed significant differences for the values of all parameters regardless of the growth habit (winter-spring) in individual entries. The parameters which characterize the grain protein value (coefficient of true protein digestibility Ks, protein biological value BHB, net protein utilization NPU, and protein unsable content UP) showed up to three-times higher variability as compared to energetic ones (coefficient of energetic digestibility KSE and digestible energy content SE - Tab. I). The best level of digestible energy was assessed in the two-row winter barley cultivar Marinka (89.2%) which differed highly significantly from the other entries evaluated. In feeding the grain of this cultivar the highest values of Ks (86.8%) were also determined, while considering the parameters of protein quality the best entry was the line of non-malting barley KM 1628 (BHV = 80.0 and NPU = 65.9). Among malting cultivars, Jarek and Ladik were much better than the control cultivar Akcent in these parameters (Tab. II). A number of significant relationships were found among the balance parameters investigated (Tab. IV). UP values were dependent on protein content (r = 0.68xx) which positively correlated with a level of Ks (r = 0.53xx). A highly significant correlation was also found between SE and Ks (r = 0.74xx), protein content and BHV (r = 0.85xxx) and NPU (r = 0.73xx). The entries tested differed not only in the content and feeding value of grain nutrients, but they also reached different levels of productivity (Tab. III). Considering grain yield as one of agronomic value parameters actual levels of feeding value parameters were partially confused (Figs 2 to 4) especially in high-yielding cultivars (Novum and Akcent). However, the grain yield itself within the whole set of entries evaluated did not significantly correlate with any of the parameters studied. The results obtained enabled us to screen the set of barleys depending on different purposes of their utilization. Fig. 1 illustrates the entries showing the best protein content and nutritional value which are suitable for special feeding diets. Taking into account both feeding value and grain productivity the best cultivar was winter barley Marinka. Ladik cultivar, malting spring barley, is expected to contribute to the combination of yield and grain energetic value. Jarek, Orbit and Sladko cultivars were intermediate in most parameters investigated. In contrast, cultivars of malting spring barley, Rubin and Perun, and new breeding lines of winter barley, KM 770 and KM 1490, showed the lowest level. The results confirmed the necessity and rightness of evaluating grain feeding value even in currently grown spring and winter barleys for effective differentiating the commercial end use of grain production.
Production of structural root material of sugar beet and winter wheat was quantified by analysis of root growth and decay in a time series of mrnhuizoton images, combined with a single sugar sampling. Cumulative root production of winter wheat was about 1700 kg ha(-1) for conventional crop management and 1600 kg ha(-1) for integrated (less pesticides and mineral fertilizer, less intensive soil tillage and more organic manure) crop management: in 1990 the difference between the two management systems was statistically significant. At harvest time 85% and 68% (in 1986 and 1990, respectively) of this structural root production remained as intact roots in the soil in both management systems. For sugar beet total fine root production was estimated at 1150 kg ha(-1) in 1987 and 1989, with a significantly lower amount on the field on which minimum tillage was introduced in 1986; on average 47% of total root production remained as intact roots at harvest. Winter wheat root decay was studied with litter pots after crop harvest and in the following growing season. Initially, the N concentration in remaining roots increased while dry weight decreased. No net immobilisation or mineralisation of N and P during autumn was evident. During the next growing season net mineralisation was proportional to loss of root weight in an exponential decay with a half-life of 600 degree days (daily temperature sum). This N release pattern during the next growing period thus contributes to the synchrony between N demand and supply, but no difference between the two management systems was found. [References: 34].

77 Wang Fahong; Zhao Junshi (Shandong Provincial Academy of Agricultural Sciences, Junan (China)). Inst. of Crops; Qin Yueqiu (1993) Effect of density of winter wheat basic seedling on grain yield in condition of chemical manipulation. Journal of Laiyang Agricultural College (China) v. 10(3) p. 183-187. 2 tables, 10 ref. Chinese. (AGRIS 94-115969).


86 Zimmermann, H. (Verein zur Förderung des Braugerstenanbaus Nord Ost e.V. (Germany)) (1994) [Trends of the cropping of malting barley in Germany: Maintain the malting barley market]. Tendenzen der Entwicklung des Braugerstenanbaus in Deutschland: Den Braugerstenmarkt erhalten. Neue Landwirtschaft (Germany) (no.1) p. 29-30. 1 ill., 2 tables. German. (AGRIS 94-115945).

**F2 Plant Propagation**


88 Dananov, D. (Institut za Introduktivski na Rastitelnите Genetichki Resursi, Sadovo (Bulgaria)) (1993) [Embryogenic calli induction and plant regeneration in wheat (Triticum aestivum L) and rice (Oryza sativa L) under unified culture conditions]. Embriogenno induzirane na kalusi i regeneriranje na rastenjata pri pahenista (Triticum aestivum L) i oriz (Oryza sativa L) u. unifisiranim kulturalni usloviya. Diagnosis Press Ltd., Sofja (Bulgaria). Biotekhnologiya i Biotehnika (Bulgaria); Biotekhnologiya i Biotechnologicheskie Veshchestva v 8(1) p. 44-49. 6 ill., 2 tables. 10 ref. English. (AGRIS 94-106283).

A culture medium, inducing regenerative callus formation (medium 3) by cultures of mature and immature embryos of five wheat genotypes and mature embryos of two rice genotypes has been optimized. An unified culture medium for plant regeneration from callus of both wheat and rice species (medium 13) has been established. An efficient system for regenerative callus induction and subsequent plant regeneration from immature and mature embryos of five wheat genotypes has been developed.

basis for the establishment of routine procedures for transformation of wheat by direct gene transfer into protoplasts. [References: 32].


We have developed a system for the biolistic transformation of barley using freshly isolated microspores as the target tissue. Independent transformation events led, on average, to the recovery of one plant per 1x107 bombarded microspores. Putative transformants have been regenerated using phosphinothricin as a selective agent. R(0) plants have been transferred to soil approximately 2 months after bombardment. Integration of the marker genes bar and uidA has been confirmed by Southern analysis. The marker genes are inherited in all progeny plants confirming the expected homozygous nature of the R(0) plants. [References: 41].

92. Jang, G.W. (Chungnam Junior College, Gokseong (Korea Republic)); Min, K.S. (Chonnam National University, Kwangju (Korea Republic); College of Agriculture) (1993) Effects of plant growth substances on variation of chromosome number in callus cells derived from wheat (Triticum aestivum L. leaf). Korean Journal of Plant Tissue Culture (Korea Republic) v. 20(2) p. 87-102. 1 illus.; 6 tables; 16 ref. Korean. [AGRIS 94-106258].


New methodological approaches to culturing the cells of wheat (Triticum aestivum L) and maize (Zea mays L) were advanced. These approaches comprise the alternation of nutrient media differing in hormonal composition and the reduction of the time periods between passages. This allowed considerable prolongation of the ability of long-term cultured calluses to plant regeneration. The production of suspension cultures enriched in embryogenic cells capable of regeneration became possible. From these suspensions the isolated protoplasts of wheat and maize that regenerated whole plants were obtained. A polyepitide characteristic of in vitro morphogenesis of cereals was found. An in vitro response of wheat cells to space flight was studied. When the flight lasted longer than 10 days, the population was characterized by the predominance of cells tolerant to some stresses, photocoxin-induced stress in particular. [References: 16].


Inactivation and activation of mitochondrial and chloroplastic pyruvate dehydrogenase (PDH; EC 1.2.4.1) have been studied in isolated organelles and protoplasts from barley leaves. The pyruvate dehydrogenase complex (PDC) from barley leaf mitochondria was inactivated by ATP (65% at 4 mM ATP) while the chloroplastic PDC was stimulated (75% at 4 mM ATP). MgCl2 inhibited the mitochondrial complex with increasing concentrations while the chloroplastic PDC was stimulated. MnCl2 had a stimulatory effect on both PDCs. ATP-inactivated mitochondrial PDC could be reactivated by MnCl2 but not by MgCl2 or CaCl2. The major part of the PDC was located in the chloroplast. The in vivo mitochondrial PDC activity could be determined after removal of the chloroplastic isomer by subcellular fractionation. This activity was sensitive to AT inhibition confirming the mitochondrial origin. The in vivo PDC activity as well as the ATP sensitivity did not change when protoplasts were incubated in darkness or illuminated in photoreceptors or photoresponsive enzymes. This was taken as an indication of an unchanged activation state of the enzyme under the conditions tested. [References: 25].


The effect of temperature on seed set and embryo development in reciprocal crosses of barley and wheat was assessed in crosses involving two spring barley varieties (Betzes, Martonvasari 50) and one wheat variety (Chinese Spring). Detached tillers placed in nutrient solution were pollinated in controlled soilless environments at constant day-night temperature regimes (12, 15, 18, 21 degrees C) with a light intensity of 30,000 lux and a relative humidity of 80%. When barley was used as the female, lower temperatures (12 and 15 degrees C) produced the maximum seed set, whereas for the reciprocal cross, the highest temperature (21 degrees C) produced the best seed set in the Chinese Spring x Betzes combination. Low temperature retarded the embryo development. The highest numbers of hybrid plants were produced at 18 degrees C and 21 degrees C in the barley x wheat cross and in the wheat x barley cross, respectively. Embryos of about 1.5 mm length in the barley x wheat cross, and of about 1.0 mm length in the wheat x barley cross germinated successfully. The smallest embryo giving rise to hybrid plants was 0.57 mm in the barley x wheat cross and 0.51 mm in the wheat x barley cross. [References: 30].


Southern blot analyses of DNA from microspore cultures of the barley variety Alexis suggested that plastid genome deletions/rearrangements causing albinoism occur primarily during regeneration. The Alexis variety responded to microspore culture largely by production of ill-defined embryoids and callus from which plants could be regenerated with a low frequency. Only 0.06 green and 0.61 albino plants were regenerated per anther in contrast to the Igri variety, which formed well-defined embryoids that readily regenerated 11.7 green and 0.1 albino plants per anther. In Alexis, the plastid genomes appeared to remain intact during the microspore culture but started to break down in the structures that underwent regeneration. This development accelerated in parallel with differentiation and leaf formation. In Igri microspore cultures, callus and albino plant formation could be induced by elevated temperatures and in particular during the first 10 days of culture and during the regeneration phase. [References: 36].


We report regeneration of fertile, green plants from wheat (Triticum aestivum L. cv. Aura) protoplasts isolated from an embryogenic suspension initiated from somatic early-embryogenic callus. The present approach combines the optimization of protoplast culture conditions with screening for responsive genotypes. In addition to the dominant effect of the culture media, the increase in fresh mass and the embryogenic potential of somatic cell cultures varied considerably between the various genotypes tested. Establishment of suspension cultures with the required characters for protoplast isolation was improved by reduction of the ratio between cells and medium and by less frequent (monthly) transfer into fresh medium. A new washing solution was introduced to avoid the aggregation of protoplasts. However, the influence of the culture medium on cell division was variable in the different genotypes. We could identify cultures from cultivar Aura that showed approximately a 9% cell division frequency and morphogenic response. The protoplast-derived microcolonies formed both early and late-embryogenic callus on regeneration medium and green fertile plants were obtained through somatic embryogenesis. The reproducibility of plant regeneration from protoplast culture based on the cultivar Aura was demonstrated by several independent experiments. The maintenance of regeneration potential in Aura suspension cultures required establishment of new cultures within a 9-month period. [References: 40].

8


In a field experiment in a Mediterranean climate (474 mm annual rainfall, 325 mm (69%) falling in the May to October growing season) on a deep sandy soil near Koajierup, south-western Australia, the residual value of superphosphate was measured relative to freshly-applied superphosphate. The grain yield of five successive crops (1988-1992) was used to measure the residual value: barley (Hordeum vulgare), barley, oat (Avena sativa), lupin (Lupinus angustifolius), and barley. There was no significant yield response to superphosphate applied to the first crop (barley, cv. Moondyne). There was no yield increase for the second crop (barley) due to weeds or the fourth crop (lupin) due to severe wind erosion which damaged the crop. The residual value of superphosphate was measured using grain yields of the third crop (oat, cv. Mortlock) for superphosphate applied one and two years previously, and the fifth crop (barley, cv. Onslow) for superphosphate applied one, two, three and four years previously. In February 1992, before sowing the fifth crop, soil samples were collected to measure bicarbonate-extractable phosphorus (P) (soil test P) which was related to the subsequent grain yields of that crop. This relationship is the soil test P calibration used to estimate the current P status of soils when providing P fertilizer recommendations. The residual value of superphosphate declined markedly. For the third crop (oat), it was 6% as effective as freshly-applied superphosphate one year after application, and 2% as effective two years after application. For the fifth crop (barley), relative to freshly-applied superphosphate, the residual value of superphosphate in successive years after application was 46%, 6%, 3%, and 2% as effective. The soil has a very low capacity to sorb P, and P was found to leach down the soil profile. The largest yield for P applied one and two years previously in 1990, and two, three and four years previously in 1992, was 35 to 50% lower than the maximum yield for freshly-applied P. Soil test P was very variable (coefficient of variation was 32%) and mostly less than 8 mg P/g soil. The calibration relating yield (y axis) to soil test P (x axis) differed for soil treated with superphosphate one year previously compared with soil treated two, three and four years previously. The top 10 cm of soil was used for soil P testing, the standard depth. P was leached below this depth but some of the P leached below 10 cm may still have been taken up by plant roots. Consequently soil test P underestimated the P available to plants in the soil profile. The soil test P calibration therefore provided a very crude estimate of the current P status of the soil.


118 Engel, RE; Eckhoff, J; Berg, RK. (1994) GRAIN YIELD, KERNEL WEIGHT, AND DISEASE RESPONSES OF WINTER WHEAT CULTIVARS TO CHLORIDE FERTILIZATION. Agronomy Journal. 86(5):891-896. English. [MONTANA STATE UNIV SOC AGR RES CTR HUNTLEY, MT USA].

Wheat yields in the Great Plains are frequently improved by potash (0-0-60 N-P-K) application on soils with seemingly adequate supplies of available K. The CI component in this fertilizer may cause many of the observed yield responses. Field research was undertaken to determine the effects of CI on grain yield, plant CI, kernel weight and growth rate, and folic acid disease and/or disease-like symptoms of winter wheat cultivars. Two sites with five CI levels (0, 22, 45, 90, and 135 kg ha-1) and two cultivars (Redwin, Crea) were used in 1988. Seven sites with two CI levels (0 and 45 kg ha-1) and six cultivars (Redwin, Crea, Weston, Manning, QT542, Neeley) were used from 1991 to 1992. Chloride increased yield by an average of 267 kg ha-1 (7%) at seven responsive sites. Size of yield response to CI was generally not affected by cultivar selection, but differed greatly with location. Whole-plant CI analyses were useful in discriminating between yield response (less-than-or-equal-to 3.0 g kg-1 and nonresponsive (>3.0 g kg-1) sites to CI fertilization. Improved CI nutrition enhanced plant development, increase immature kernel weights, and accelerated kernel growth during the grain-fill period. Fertilizer CI increased mature kernel weights, up to 17%, at eight sites. Kernel weight was the most important yield component affected by CI. Physiological leaf spot in Redwin and Manning, flag leaf sequence in Weston and QT542, powdery mildew (Erysiphe graminis DC. f. sp. tritici Em. Marchal), and leaf rust (Puccinia recondita Roberge ex Desmaz. f. sp. tritici) were suppressed by fertilizer CI. These phenomena may explain in part the yield responses to CI; however, yield response to CI occurred even without foliar disease and disease-like suppression. [References: 19].


Relying more on biological N2 fixation has been suggested as a way to meet one of the major challenges of agricultural sustainability. A N-15 study was conducted to compare the fate of applied legume and fertilizer N in a long-term cropping systems experiment. Nitrogen-15 labeled red clover (Trifolium pratense L.) and (NH4)2SO4 were applied to microplots within the low-input and conventional cropping systems of the Farming Systems Trial at the Rodale Institute Research Center in Pennsylvania. The N-15 was applied to soil and traced into corn (Zea mays L.) in 1987 and 1988. Residual N-15 was also traced into second-year spring barley (Hordeum vulgare L.). Legume and fertilizer N-15 remaining in soil was measured and loss of N was calculated by difference. More fertilizer than legume N was recovered by crops (40 vs. 17% of input), more legume than fertilizer N was retained in soil (47 vs. 17% of input), and similar amounts of N from both sources were lost from the cropping systems (39% of input) over the 2-year period. More fertilizer than legume N was lost during the year of application (38 vs. 18% of input), but more legume than fertilizer N was lost the year after application (17 vs. 4% of input). Residual fertilizer and legume N-15 was distributed similarly among soil fractions. Soil microbial biomass was larger in the legume-based system. A larger, but not necessarily more active, soil microbial biomass was probably responsible for the greater soil N supplying capacity in the legume-based compared with fertilizer-based system. [References: 30].

122 Jin Shaoqing; Ma Yongtao (Gansu Provincial Academy of Agricultural Sciences, Lanzhou (China); Inst. of Soil and Fertilizers) (1993) A study on the results of potassium dihydrogen phosphate foliar application for winter wheat. Soils and Fertilizers (China) (no. 3) p. 16-19. 5 tables. Chinese. (AGRS 94-116620).
DETERMINATION OF A CRITICAL NITROGEN DILUTION CURVE
[INRA AGRON STN BP101 F-02004 LAON FRANCE] 
A set of N-fertilization field experiments was used to determine the 'critical nitrogen concentration', i.e. the minimal concentration of total N in shoots that produced the maximum annual dry matter, at a given time and field situation. A unique 'critical nitrogen dilution curve' was obtained by plotting these concentrations N(et) (% DM) vs. accumulated shoot biomass DM (t ha-1). It could be described by the equation: N(et) = 5.35 DM - 0.442 when shoot biomass was between 1.55 and 12 t ha-1. An excellent fit was obtained between model and data (r2 = 0.98, 15 d.f.). A very close relationship was found using reduced N instead of total N, because the nitrate concentrations in shoots corresponding to critical points were small. The critical curve was rather close to those reported by Greenwood et al. (1990) for C3 plants. However, this equation did not apply when shoot biomass was less than 1.55 t ha-1. In this case, the critical N concentration was independent of shoot biomass: the constant critical value N(re) = 4.4% is suggested for reduced-N. The model was validated in all the experimental situations, in spite of large differences in growth rate, cultural and climatic conditions; shoot biomass varying from 0.2 to 14 t ha-1. Plant N concentration was found to vary by a factor of four at a given shoot biomass level. In the heavily fertilized treatments, shoot N concentration could be 60% higher than the critical concentration. Most (on average 80%) of the extra N accumulated was in the form of reduced N. The proportion of nitrate to total N in shoot mainly depended on the crop stage of development. It was independent of the nitrogen level. [References: 47].


The effect of N fertilization on seasonal dynamics of wheat leaf area, LAI, LAD and through these values on the development of yield was studied in 1991 at Keszthely on Ramann's brown forest soil, at Szegynagyvolgyo, on pseudeleyd brown forest soil. In the experiment four N-levels (87, 174, 261, 348 kg/ha) were included. In addition to the N-doses each plot received basic fertilizer of 140 kg/ha P2O5 + 140 kg/ha K2O active agent. The leaf area was measured by apparatus type Li-3000.

The N fertilizer increased significantly the individual leaf area (LA) at each date of measurements. At Keszthely the correlation between the N-dose and the individual leaf area could be characterized by the function y = a - bx - cx2, while at Szegynagyvolgyo by function y = a + bx. Authors assume that these functions can be explained by the different N-demand and different climatic conditions of the two sites. As the N-doses increased there was a parallel rise in LA and LAD values. A close positive linear correlation was observed between LA(max) and ear mass; LAD and ear mass. At Keszthely the r values of the correlations between LA(max) and ear mass at the four sampling dates were 0.99**, 0.96**, 0.99**, at Szegynagyvolgyo 0.94**, 0.83**, 0.92**, 0.86**. The r values of correlation between integrated leaf area (LAD) and ear mass were the followings: at Keszthely 0.89**, 0.91, 0.99, 0.98**, at Szegynagyvolgyo 0.92**, 0.88*, 0.94**, 0.92**.

127 Lorenz, F. (1992) [Effect of slurry application with additional inorganic-N-fertilizer application on achievement optimum yields on the condition of low nitrate loss]. Guellieduengung mit ergaenzenden Mineral-N-Gaben zur Erzielung optimaler Ertrage bei niedrigem Nitratatrag. Goettingen Univ. (Germany). Inst. fuer Bodenwissenschaften. Goettinger bodenkundliche Berichte (Germany); no. 99


We studied the interactions between nitrogen (N) inflow (uptake rate per unit root length) and root growth in the capture of nitrate by soil-grown wheat (Triticum aestivum L. cv. Wembly). [N-15]-nitrate was applied locally to soil overlying seminal roots of 42-old plants that had previously received N fertilizer (N +) or not (N0). [S-35]-sulphate was also applied to check the specificity of the plant's responses to nitrate. NO plants had exhausted soil nitrate by day 42. Over the next 7 days, inflow was stimulated in soil to which [N-15]-nitrate was supplied in the NO plants. NO plants increased their root length densities throughout the root system, not only around the point of [N-15]-nitrate application. Root length density did not change in the N + plants. NO plants captured 73% of the [N-15]-nitrate in 7 d; N + plants captured only 13%. There was no evidence that the plants' responses to the localized application of nitrate had an effect on the uptake of sulphate. The dominant influence on the capture of nitrate was inflow, rather than root growth. [References: 26].


A greenhouse experiment was conducted to evaluate the effect of Se contained in calcium nitrate, top-dressed at different growth stages, on the Se concentration in wheat (Triticum aestivum L.). Selenium as sodium selenate was added to Ca (NO3)2 and NPK (21:4:10) during the manufacturing process. A silty clay soil with soil pH of 6.1 was used. For selenium treatments incorporated in Ca(NO3)2 were top-dressed at both the tillering and heading growth stages at rates of 0.15, 30, and 45 mg kg-1 of Ca(NO3)2 fertilizer equivalent to about 0.003, 0.007, 0.01 mg Se kg-1 soil, respectively. A fifth treatment of 20 mg Se kg-1 of NPK (21:4:10) equivalent to 0.007 mg Se kg-1 soil was basal dresssed at the time of sowng. Calcium nitrate with or without Se was top-dressed at the rate of 35 mg N kg-1. In addition all plots received a basal dose of N at the rate of 7 mg N kg-1 through a NPK (21:4:10) fertilizer. The Se-enriched Ca(NO3)2 increased the uptake and concentration of Se in wheat significantly (p<0.05) with increasing concentration of Se in the fertilizer applied. The
Se concentration in wheat grain increased from <1.1 to 468 mg Se kg⁻¹ in the first year when the concentration in the Se-enriched Ca (NOS)₃ was increased from 0 to 45 mg Se kg⁻¹ but the corresponding increase in the second and third year was lower. The Se concentration in the grain was more than twice that of the straw. The uptake and concentration of Se in wheat, except in the second year, was generally higher when Se was top-dressed at heading as compared to that when it was top-dressed at tillering but the concentration differences between time of application were not statistically significant (p>0.05). Basal application of Se-enriched NPK (0.007 mg Se kg⁻¹ soil) was only half as effective as an equivalent rate of Se in top-dressed Se-enriched Ca (NOS)₃ in increasing the Se concentration in wheat and the concentration levels among these treatments were significantly (p<0.01) different. It was concluded that topdressing of Se-enriched Ca (NOS)₃ at 30 mg Se kg⁻¹ is an effective method of application to increase the Se concentration in wheat grain to a level, > 100 mg Se kg⁻¹ dry matter, considered adequate for human consumption.


The valorographic parameters (valorographic index, water absorption capacity, dough development time, stability, softening, extension) of grain yield of two winter wheat varieties were studied for 2 years in an NPK fertilization experiment set up at the Trial Station of the Cereal Research Institute at Fülöpszállás on highly calcareous meadow soil rich in humus. Based on the results the valorographic parameters of the wheat varieties depended in different degrees on the weather conditions of the year and the fertilization treatments. The effect of the year was the most remarkable on valorographic index, stability, softening and extensibility of dough, it was slight on the water absorption capacity of the flour, and non-significant on the swelling time. The effect of fertilizer treatments frequently varied depending on the variety and year, the interaction of year x variety x fertilizer was strong. The N fertilization without PK in general increased each valorographic parameter, apart from softening of dough, which in fact decreased. The highest N dose (240 kg/ha) frequently failed to cause further improvement in quality. The PK treatments without N had a varying effect depending on variety and year. The valorographic index, stability, the extensibility of quality wheat GK Kata rose in 1990 as the results of higher PK doses, while the same parameters decreased in 1991 as affected by higher PK doses. The joint application of N and PK fertilizers changed the parameters of GK Csuros to a lesser extent than those of GK Kata. The highest valorographic index was achieved in GK Kata in both years by 240 kg/ha N treatment, in GK Csuros in 1990 by 90 kg P, 180 kg K and 120 kg N, and in 1991 by the treatment of 60 kg P, 120 kg K and 120 kg N active agent/ha.


In the experiment the SDS and Zeleny sedimentation values, falling number, raw protein content and loaf volume of two wheat varieties were tested in 2 years at 16 different fertilizer levels. In each 5 characteristics of the effect of all three factors (year, variety, fertilization) were observed, often even strong interactions (year x variety x fertilization) were found. In general it was observed that the PK fertilization without N fertilizer caused a decrease in sedimentation tests, falling number, protein content and loaf volume. The N fertilization had an improving effect on each characteristics. The joint PK and N fertilizations weakened the contrasting effects mentioned, but the improving effect of N - depending on variety and year - countered the marring effect of PK.


A field investigation was carried out on a sandy-loam soil during summer seasons of 1986-88 to find out the residual effect of different phosphatic fertilizers applied to wheat (Triticum aestivum L. emend. Fourn & Paul) on succeeding crop of greengram (Phaseolus radiatus L). Rock phosphate alone or in combination with cattle-dung compost did not increase the grain yield of greengram. Supersulfate alone and in combination with pyrite or mixing of rock phosphate with supersulfate showed significant residual response in terms of grain yield and phosphorus uptake. Mixtures of rock phosphate + supersulfate (75% + 25%) and rock phosphate + pyrite (1:3) were more effective than other sources at 60 kg and 90 kg doses of P2O5 ha respectively for grain yield and net return. Residual effect of various phosphatic fertilizers did not affect the straw yield significantly.


140 Xue Jian; Zhao Bingqiang; Li Fengchao (Shandong Agricultural Univ., Taian (China)) (1993) A long term study of direct return of straw to the field. *Soils and Fertilizers (China)* (no. 2) p. 27-29. 2 tables. Chinese. (AGRIS 94-116570).


144 Zhang Musang; Zhang Yuju; Zhao Xueyun (Chinese Academy of Agricultural Sciences, Beijing (China). Inst. of Soil and Fertilizers) (1993) The suitable soil moisture for wheat straw returned to the field. *Soils..."
Fungicide had no effect on grain and straw yields and no interaction between fungicide and tillage system occurred thus indicating that fungal diseases controllable by propiconazole did not limit yields during this study. Tillage system significantly affected grain and straw yields in approximately one-third of the site-years studied. Grain yields averaged over 5 yr ranged from 2.55 to 4.27, 2.61 to 3.93, 2.51 to 4.08, and 2.63 to 3.99 Mg ha\(^{-1}\) for 2T, MT, C2 and C1, respectively. Straw yields averaged over 5 yr ranged from 2.56 to 4.32, 2.61 to 3.90, 2.48 to 4.08, and 2.59 to 4.07 Mg ha\(^{-1}\) for 2T, MT, C2 and C1, respectively. In general, grain and straw yields of barley under 2T were equal or superior to yields obtained under C1, C2 and MT systems. Straw yields followed closely the trends observed for grain yields. Zero tillage grain yields significantly exceeded those of C1, C2 and MT in 30-50% of the site-years when growing season precipitation was below normal. This is believed to be related to better soil water conservation and greater water use efficiency under 2T compared with other tillage systems in years with below normal precipitation and particularly when June and July precipitation was low. [References: 30].


Straw of small-grain cereal is an important source of feed for maintenance of ruminant livestock. Information on the nutritional quality of wheat (Triticum aestivum L.) straw under conservation tillage system is limited. Grain and straw (leaves and stem) samples were obtained from a previous tillage by cultivar field study conducted on a Bethany silt loam (fine, mixed, thermic Pachic Paleustoll) from 1984 to 1987 near El Reno, OK, to determine the straw quality of 10 hard red winter wheat cultivars grown under conventional (moldboard plow) and no-till systems. Straw was analyzed for neutral-detergent fiber (NDF), acid-detergent fiber (ADF), lignin (LIG), crude protein (CP), and in vitro dry matter digestibility (IVDMD). Fiber (ADF and NDF) and LIG concentrations of straw from the early-maturity cultivars were higher (P less-than-0.05) than medium and late maturity cultivars. Crude protein (5 to 12 g kg\(^{-1}\)) and IVDMD (25 to 39 g kg\(^{-1}\)) concentrations were lower in early-maturing than in medium- and late-maturing cultivars among years. Neutral-detergent fiber and ADF concentrations of all cultivars were not affected by tillage system; however, LIG of early-maturing cultivars (Chisholm and Vona) grown under a no-till system was 9 to 24 kg g\(^{-1}\) lower in 1985 and 1986 than in conventionally tilled plots. In vitro dry matter digestibility of all cultivars was not consistently affected by tillage system; no significant difference in 1984, while straw IVDMD from no-till plots of all cultivars averaged 9 kg g\(^{-1}\) lower in 1985 and 13 g kg\(^{-1}\) lower in 1986, compared with conventionally tilled plots. Straw quality of the 10 wheat cultivars varied among maturity groups, but the effect of tillage system on straw quality was minimal. [References: 18].


F08 CROPPING PATTERNS AND SYSTEMS


A long-term field experiment was conducted during 1977-78 to 1990-91 on medium black soil to evaluate the effect of continuous sorghum [Sorghum bicolor (L.) Moench]-wheat (Triticum aestivum L. emend. Florio and Paoi.) cropping and manuring on sustainability. The yield of both the crops, energy output and net returns increased with an increase in level of each nutrient during all the years. The response per unit nutrient applied and benefit : cost ratio drastically declined with increased levels of nutrients. The total nutrient energy productivity increased only up to an 80 kg N/ha. However, energy intensiveness showed the reverse trend. Application of P and K decreased the energy use efficiency and energy productivity but increased the energy intensiveness.

159 Hadjicristodoulou, A. (1994) SELECTION OF DRY PEA (PISUM SATIVUM) VARIETIES AND THEIR PERFORMANCE BY COMPARISON WITH BARLEY AND WHEAT IN MEDITERRANEAN ENVIRONMENTS. Experimental Agriculture. 30(4):477-481. English. [AGR RES INST NICOSIA CYPRUS]. The possibility of growing dry peas in the semi-arid areas of Mediterranean countries was assessed by comparing dry pea (Pisum sativum L.) varieties with the highest yielding barley and durum wheat varieties under rainfed conditions and with supplementary irrigation in Cyprus. The yield of barley cv. Kantara was greater than that of the best pea variety selected, PS 210713, especially under the driest conditions, but the differences between cereals and dry pea varieties were smaller when grown in areas where there was more rain or where supplementary irrigation was supplied. The protein content of the dry seeds and straw of the peas was higher than those of the cereals. It is concluded that selected varieties of dry peas could be grown in dry Mediterranean areas, particularly in rotation with barley or wheat. [References: 8].

160 Hughes, D.; Butcher, W.; Jaradat, A.; Penaranda, W. (1995) ECONOMIC ANALYSIS OF THE LONG-TERM CONSEQUENCES OF FARMING PRACTICES IN THE BARLEY CROPPING AREA OF JORDAN. Agricultural Systems. 47(1):39-58. English. [LOUISIANA STATE UNIV DEPT AGR ECON & AGRIBUSINESS BATON ROUGE, LA 70803 USA]. The sustainability of agricultural practices is an important determinant of the ability to meet the growing food needs of future generations in developing countries. But sustainable agricultural practices will not be adopted by farmers unless current farm income levels are maintained. The Erosion Productivity Impact Model (EPIC), a whole-farm model, and budget analysis are used to evaluate both the short-run profitability and the long-run sustainability of a number of agricultural practices in the Madar region of Jordan. While only a few technologies exceed current practices in terms of short-run benefits, a number of technologies provide long-term benefits due to enhanced soil productivity. A combination of technologies, such as no-till, reduced tillage, and use of fertilizers (instead of the traditional barley-weedy fallow rotation), may provide the most feasible means of maintaining current farm incomes while also enhancing the sustainability of area agriculture. [References: 13].

161 Jasper, J. (Giesen Univ. (Germany)). Inst. fuer Pflanzenbau und Pflanzenzuechtung, Gruenlandwirtschaft und Futterbau (1993) [Temporary land diversion - effects of green cover grasses and legumes on preceding crops]. Ackerrotationsbrache - Verfruchtettefe bei differenziertter Begrenzung. 37. Jahrestagung der Gesellschaft fuer Pflanzenbauwissenschaften; Giessen (Germany); 30 Sep - 02 Oct 1993. Mitteilungen der Gesellschaft fuer Pflanzenbauwissenschaften (Germany) v. 6 p. 345-348. 5 graphs; 3 ref. German. (AGRIS 94-116848).

162 Karpenstein Machan, M. (Kassel Univ. (Germany)). Fachbereich Landwirtschaft; Maschke, R. (1993) [Winter oats in cropping seeds mixture with rye and triticale as protection and compensation from winter killing]. Winterhafer im Gemengebau mit Roggen und Triticale zum Schutz und Ausgleich bei Auswinterung. 105. VDLUFA-Kongress; Hamburg (Germany); 20-25 Sep 1993. (Quality and hygiene of foods in production and processing). VDLUFA, Darmstadt (Germany). VDLUFA-Schriftenreihe (Germany); no. 37 p. 265-268. VDLUFA 3 ill: 1 ref. German. (AGRIS 94-106822).

163 Leteman, P.; Manichon, H.; Rogerestrade, J. (1994) YIELD ANALYSIS OF WHEAT GROWN IN AN ON-FARM FIELD NETWORK IN THYMERALIS (FRANCE). Agronomie. 14(6):341-361. French. [INRA BP 29 F-35560 LE RHEU FRANCE]. This paper presents a methodology of analysing yield variations of wheat grown in on-farm fields. The study takes place in 'Thymerais', a region at about 80-100 km in the west of Paris. The wheats studied were grown after 2 groups of previous legumes (wheat or non-wheat). The soils are silty and the fields may be stony. In many fields, we can notice an early reduction of crop growth, before spring stem elongation, mainly for sanitary reasons. During the stem elongation, the main limiting factor is water nutrition. At present, the environmental effect is more important than that of cropping systems. Nevertheless, the latter exists mainly by its crop rotation component the sanitary state of the wheat behind wheat is often deficient. Drought prevails in summer, during grain filling, with larger consequences when there are other limiting factors (soil structure, stem and root sanitary states, and lodging). We observe that wheat as a precedent induces higher risks of yield limitation, these risks being increased by late sowings and stony fields. In conclusion, we notice that there is not an exact relationship between yields and cropping systems and/or environment characteristics. However, we can say that these induce different levels of risk, whose exteriorisation depends on weather and sowing date.


165 Michel, D. (Halle Wittenberg Univ., Halle (Germany)). Inst. fuer Allgemeinen Pflanzenbau (Ackenberg) (1993) [Precoming crop value alfaflax with regard to yield, mineral nutrients and protein quality of following crops potatoes and winter wheat]. Verfruchtewert des Luzernebaus hinsichtlich Ertrag, Mineralstoffe und Eiweissqualitat der Nachfrucht Kartoffeln und Winterweizen. 105. VDLUFA-Kongress; Hamburg (Germany); 20-25 Sep 1993. (Quality and hygiene of foods in production and processing). VDLUFA, Darmstadt (Germany). VDLUFA-Schriftenreihe (Germany); no. 37 p. 257-260. VDLUFA 5 tables. German. (AGRIS 94-106843).


168 Orphanos, P.; Metochis, C. (1994) THE WATER RELATIONS OF BARLEY GROWN CONTINUOUSLY OR AFTER FALLOW UNDER SEMI-ARID CONDITIONS. Experimental Agriculture 30:4: 431-439 English. [AGR RES INST NICOSIA CYPRUS]. Grain barley was grown either continually or in rotation with fallow in a 12-year experiment. Annual rainfall ranged from 120 to 297 mm. As the water requirement of the crop is 240 mm, growth in most seasons occurred
under water stress. The amount of water conserved under fallow was only significant (75-100 mm) in three of the 12 years and only once did the water conserved increase barley yield in the following year. The total grain yield over the experimental period was twice as high in the barley-barley sequence as in the barley-fallow sequence. [References: 16].


An experiment was conducted during 1987-88 and 1988-89 to investigate the effect of organic and inorganic fertilizers, slune and in combination, on nutrient uptake, yield and the extent to which farmyard manure, crop residue and green organic matter could supplement nitrogen for sorghum (Sorghum bicolor (L.) Moench)-wheat (Triticum aestivum L.) rotation. Poon and Poojai crop sequence grown on a medium black soil. The results indicated the possibility to save N at least 25-50% by applying farmyard manure or green crop residue or green organic matter to sorghum. For optimum economy, organic manure was applied to rainy season crops rather than to the winter crop, as their decomposition and assimilation were better during rainy season. Similarly, residual effect of organic manures was pronounced leading to increased average grain yield of wheat for 2 years (46.95 q/ha) in the treatments receiving 50% of recommended dose through farmyard manure + 50% through chemical fertilizer. Rainy-season treatment of 75% of recommended dose of NPK through fertilizer + 25% N through farmyard manure or through green organic matter gave grain yield of 45.44 and 45.08 q/ha of wheat as compared with 43.77 q/ha through chemical fertilizer applied in both rainy and winter seasons. Treatments where no fertilizer was applied in both seasons by any source of organic and inorganic gave only 14.81 q/ha of sorghum and 18.89 q/ha of wheat grain (average of 2 years). yields.


Two cereal cropping systems are described which, through the introduction of a leguminous intercrop, increased productivity, nitrogen output and ground cover of the systems in the absence of added nitrogen fertilizer. Nitrogen-fixing legumes were cultivated between rows of wheat or barley grown at low levels of soil nitrogen, and mostly under rainfed conditions, in Mexico between 1989 and 1992. None of the legumes tested reduced yields of the cereal crop in comparison to controls where cereal yields were in the range of 14t/ha, while the extra total biomass from legumes in some cases more than doubled productivity. Different legume crops were tested to demonstrate the adaptability of the system to the varying needs of farmers. The intercropped legumes achieved dry biomass yields as high as 6.5 t/ha in the case of a sequentially cropped forage crop of hairy vetch, or 1.4 t/ha of dry beans plus 3.5 t/ha of green residue in the case of Vicia faba. Total biomass in the intercropped situation gave land equivalent values as high as 1.34. Light measurements inside the crop canopy indicated that the intercropped systems intercepted a higher proportion of the incident solar radiation than the cereal monocrop, presumably accounting for the large differences in total biomass produced. In addition, with leaf nitrogen levels of 3.8%, it is assumed that the intercropped legumes fixed considerably more nitrogen than was removed by the wheat crop. The potential of the system to stabilize erodible soils by increasing ground cover as well as by raising inputs of soil organic matter is discussed. [References: 31].


Double-cropping of soybeans and wheat is often promoted by extension personnel. This paper seeks to explain how the decision to adopt double-cropping is made, using a Tobit regression model. Tobit makes use of more of the information in the data set than do logit or probit and explains not only the decision to double-crop but also the rate of adoption. The paper considers factors such as profit and risk perceptions and risk which have not been included in the past models used to explain adoption of technology. The results show that risk perception is important. Contrary to the findings of some other adoption studies, this decision is not influenced by human capital factors. The farmers who double-crop are more highly leveraged and appear to do so both to achieve higher income and as part of a risk diversification strategy. This is consistent with the importance of the location factor, measured as the average number of growing degree days at the farm's location. Growing degree days is a proxy for the actual distribution of returns from double-cropping and is the main factor explaining this decision. Extensive adoption of double-cropping in cooler regions of the Midwest must await technological advances that can increase the profitability of double-cropping by reducing the growing season for wheat and/or beans.

F30 PLANT GENETICS AND BREEDING


Triticum timopheevii and related species T. mutitanea (2n = 28, A.G) and T. zhukovskyi (2n = 42, Atm) were hybridized. In the amphidiploid T. timopheevii x T. tauschii (all 2n = 42, At(TGD)), T. fungidum (ABA) and T. unonovum (2n = 56, A10) were analyzed using the C-banding technique. Chromosomes of the Atm and A10 genomes in the karyotype of T. zhukovskyi differed in their C-banding pattern. Partial substitutions of A(t)-genome chromosomes and a complete substitution of the C-genome chromosomes by homoeologous chromosomes of an unidentified tetraploid wheat species with an A10 genome composition were found in the T. unonovum karyotype. A(t)- and C-genome chromosomes in the karyotypes of all studied species had
sitional C- banding patterns and were characterized by a low level of polymorphism. The comparative stability of the A(t) and G genomes is determined by the origin and specificity of cultivation of studied species. [References: 23].


Evaluation of random pairs of near isogenic tall (Tt) and dwarf (Rht) lines under late sown conditions indicated that the Rht1, Rht2 and Rht3 dwarfing genes were associated with 22.25%, 14.19% and 26.73% reduction in grain yield, respectively. The negative effect of each of the three Rht genes on grain yield was due to significant reduction in biological yield. In turn, the poor biological yield in Rht1 and Rht2 lines was due mainly to reduced number of lighter tillers while in Rht3 lines it was due to lighter tillers, less number of grains per floret and grains per spike and reduced 100 grain weight. The mechanisms, involved in grain yield reduction in the lines containing different Rht genes were, thus, different. It is suggested that the poor grain yield and biological yield of the Rht lines may arise due to their greater sensitivity to stress factors, particularly warm conditions, associated with late sowings.


An experiment was conducted during 1992 to study the sensitivity of 7 varieties (IC 79574; IC 79596; IC 82560; IC 82637; DL 3; DL 100 and (Ratma) of barley (Hordeum vulgare L s. sensu lato) to streptomycin. There was a marked reduction in seed germination in different varieties treated with various concentrations of streptomycin. Streptomycin 2 500 ppm caused the maximum reduction in seed germination (61.9%) in 'Ratma', whereas 3 000 ppm showed the minimum reduction (25.1%) in 'DL 100'. Similarly, a significant reduction in the growth of the seedlings (length of root and shoot) was observed, which was directly proportional to the increase in the concentration of streptomycin. 'DL 3' showed the maximum reduction, whereas IC 79574 the minimum. Based on the number of chlorophyll mutations (albinos, stripe 1 and stripe 2) in the treated populations, 'DL 100' and 'Ratma' showed maximum resistance, indicating their usefulness as stress-tolerant phenotypes, which may be useful in somatic hybridization for somaclonal selection.


Due to the ever greater requirements which must be satisfied by cultivated plant varieties and hybrids, breeders have made great efforts to incorporate the most efficient genes determining important agronomic properties, environmental stress resistance and quality into new genotypes. There is, however, a danger that the wide-ranging use of genetic sources of indential origin will lead to an ever greater similarity between new plant varieties developed in various countries, with a consequent reduction in genetic diversity and a genetic impoverishment of the cultivated varieties. There is thus every justification for the development of a wheat species collection in the Agricultural Research Institute of the Hungarian Academy of Sciences. In recent years, genetic, biochemical and physiological experiments have already been conducted in the institute on species belonging to the Triticum genus. Hybridisation using wild species bearing traits useful in wheat breeding also has a long tradition. The institute's gene bank currently contains not only 3150 varieties, but also 1299 wheat genotypes and other cereal species (Agropyron, Hordeum, Avena, Secale, Elymus, etc.) . Together, with genetically valuable stocks developed in the institute or obtained for research purposes from foreign gene banks. In addition to collecting and storing gene sources and to indentifying and classifying cereal species, the gene bank is involved in the preparation of a catalogue containing the major morphological and economic properties of the species, together with spike photographs and the electrophoretic spectra of the storage proteins.


Breeding has been very successful in generating cultivars that favor environmental conditions, and together with large use of fertilizer and chemical control of weeds, pest and diseases, have increased agricultural production several fold. Today the environmental impact of high input agriculture in more favorable environments causes growing concern. By contrast, the impact of breeding in marginal environments has been elusive. Thus, superior genotypes and genotypic-environmental principles developed for, and successfully applied, in favorable environments may be the main reason for the lack of breeding progress in marginal environments. Very little breeding work has actually been done in marginal environments, although the theory of correlated responses to selection indicates that selection conducted in good environments or in well-managed experiment stations is not expected to be very efficient when genotype by environment interactions of a cross-over type exist. The assumptions that heritability is higher under good conditions and that there is a carry-over effect of high yield potential are not supported by experimental evidence. If the target environment is below the cross-over point, selection has to be conducted for specific adaptation to that environment. The concept of wide adaptation has more to geographical than an environmental meaning, and it reduces genetic diversity and increases genetic vulnerability. Eventually the issue of genetic heterogeneity versus genetic uniformity is discussed in relation to specific adaptation to marginal environments. [References: 65].


Genetic variation among wheat (Triticum aestivum L) parents is necessary to derive superior progeny from crossing and selection. However, crosses are often performed among elite lines with similar agronomic and end-use characteristics. Thus, the potential exists for an undesirable narrowing of the germplasm base for any particular class of wheat. The relative genetic diversity within hard red spring wheat was determined in comparison to a sample of wheat accessions representing an array of types and geographic origins. Three groups of accessions were assayed for the frequencies of DNA polymorphism using a total of 38 sequence-tagged-site primer sets with polymerase chain reaction. Group I contained 10 elite hard red spring wheat cultivars under production in North Dakota and North Central Montana. Group II included 15 hard red spring wheat cultivars and lines from the North American Great Plains, and Group III contained 20 accessions representing a wide range of collection and morphological types. Twenty-four of 38 primer sets (63%) and 31 of 76 primer–enzyme combinations (41%) revealed polymorphisms. The range of genetic similarity estimated by percentage of shared restriction fragments varied from 0.65 to 0.99 among all pairwise comparisons among the 45 lines. Average genetic similarity was 0.81. Genetic similarity among the hard red spring wheats was 0.88, whereas genetic similarity among the broadly based Group III was 0.78. Our results showed that the breeding pool for hexaploid hard red spring wheat is narrow related to levels of diversity among and within classes in hexaploid wheat. [References: 25].


A non-radioactive digoxigenin-labelled DNA method was used successfully to identify RFLP markers in 54 Triticum aestivum cv 'Chinese Spring' - Agropyron cristatum (2n=28, genome PPpP) F-gene monosomic addition lines. Southern analysis using a set of 14 DNA probes identifying each homoeologous chromosome arm, combined with two restriction enzymes HindIII and EcoRI, indicated that six A. cristatum chromosomes (1P, 2F, 3P, 4P, 5P and 6P) and five A. cristatum chromosome arms (2PS, 2PL, 5PL, 6PS and 6PL) have been individually
added to the wheat genome. The added chromosomes of three lines were Agropyron translocated chromosomes. It was also found that two addition plants possessed an Agropyron-wheat translocation. These results showed that RFLP analysis using the set of assigned wheat probes was a powerful tool in detecting and establishing homology of alien A. cristatum chromosomes, or arms, added to wheat, as well as in screening the alien addition material. The creation of the monosomic addition lines should be useful for the transfer of disease-resistance genes from A. cristatum to wheat. [References: 26].


RFLP-based genetic maps of chromosomes 6A and 6B of Triticum turgidum have been constructed using data obtained by the study of Triticum turgidum var 'durum' cv 'Langdon'-t. var 'dicoccoides' recombinant substitution lines (RSLs) supplemented with data obtained from F3 families derived from 'Langdon'-dicoccoides 6A and 6B disomic substitution lines. The average RFLP frequencies detected for the two chromosomes in a test of 45 DNA clones with six restriction enzymes were 56% and 53%, respectively, and a subset of 32 clones gave frequencies of 73% and 72%, respectively. Seventeen loci were mapped in 6A and 18 in 6B. With the possible exception of 5 loci in the centromeric region of 6A, all of the mapped 6A and 6B loci are located in the same arm as are homologous loci in hexaploid wheat, and the linear order of the loci is the same in the two chromosomes, except possibly close to the centromeres. Major differences in genetic distances exist between homologous loci located in the proximal regions of the 6AL and 6BL linkage groups, however, the distances being much larger in the former than in the latter. The 6B maps that were constructed using data from both the RSL and the F2 populations and using data from the RSL population alone closely resemble one another, indicating that the 6B RSL population, composed of 85 lines, can be reliably used for genetic mapping. Additional studies must be conducted before the utility of the 6A RSL population, composed of 66 lines, can be adequately assessed. [References: 24].

201 Chong, K.; Wang, LP.; Tan, KH.; Huang, HL.; Liang, HG. (1994) MOLECULAR CLONING AND CHARACTERIZATION OF VERNALIZATION-RELATED (VR) GENES IN WINTER WHEAT. Physiologia Plantarum, 92(3):511-515. English. [ACAD SINICA INST BOT BEIJING 100044 PEOPLES REPUBLIC OF CHINA].

The enriched cold-induced cDNA library of 1 x 10^{14} plaque-forming units (pfu), was prepared using cDNAs derived from cold-inducted winter wheat, subtracted with mRNA of the control (non cold-induced). Results of the hybridization in situ of differential screening with probes of the control, the vernalized and devernalized wheat cDNAs showed that ver17 (verc: vernalization-related cDNA clone) is specific for the vernalization. The insert of lambda gt 10 recombinant was subcloned into the sites between BamHI and HindIII in a pUC 19 plasmid. Analysis by northern blotting with a probe from ver17 indicated that the ver17 has negative signals for the control and the devernalized mRNA, but a positive signal for the mRNA of vernalized wheat at about 1.8 kb. The sequence had 20 restriction sites, covered by 17 enzymes. The ver17 gene showed some homology with the P. yeolii major merozoite surface-antigen gene. [References: 17].


AC Sterling is a two-row, spring feed barley (Hordeum vulgare L.) cultivar developed by the Eastern Canada barley Breeding Group, Agriculture and Agri-Food Canada. It has high yield, high protein content, low acid detergent fibre content, high 1000-kernel weight, and resistance to powdery mildew. AC Sterling is well adapted to Eastern Canada.


204 Clarke, JM.; Depauw, RM.; Meleod, JC.; Mceag, TN. (1994) VARIATION FOR PREHARVEST SPROUTING RESISTANCE IN DURUM WHEAT. Crop Science. 34(6):1632-1635. English. [AGR & AGRIFOOD CANADA BOX 1030 SWIFT CURRENT 59H 3X2 5K CANADA].

Preharvest sprouting may reduce end-use quality and is thus an important grading criterion in all market classes of wheat (Triticum spp.). There are few reports in the literature of genetic variation in preharvest sprouting resistance in durum wheat (T. turgidum L. var durum), and the only apparent attempts to breed sprouting resistant durums have been to transfer resistance from red common wheat (T. aestivum L.). Use of resistance sources within the durum species would be easier, so this study was undertaken to assess the variation for sprouting resistance in durum. Sprouting resistance of 185 durum genotypes was evaluated in 1990. Unreplicated samples of 10 spikes from each genotype were evaluated in an artificial rain chamber. Sixty of these genotypes were re-evaluated in a replicated study in 1991. The 1990 study indicated that the durums had a similar range in sprouting score (spikes out of 10 showing visible sprouts) to the common wheat checks. The sprouting scores of the red (5.6 + 3.7, n = 30) and white (6.5 + 3.0, n = 149) genotypes were not different (P < 0.05). Sprouting score measured in 1991 was correlated with that of 1990 (r = 0.55, n = 60). We conclude that there is considerable genetic variation in sprouting resistance in durum that can be more easily exploited by durum breeders than common wheat sources of resistance. [References: 26].


207 Depauw, RM.; Meleod, JC.; Clarke, JM.; Mceag, TN.; Fernandez, MR.; Knox, RE. (1994) AC EATONIA HARD RED SPRING WHEAT. Canadian Journal of Plant Science. 74(4):821-825. English. [AGR & AGRIFOOD CANADA RES STN SWIFT CURRENT 59H 3X2 5K CANADA].

AC Eatonia is a very hard red wheat (Triticum aestivum L.) has several improved traits relative to Leader: increased stem solidness and resistance to cutting by the wheat stem sawfly, resistance to common bunt, common root rot and seed shattering, and higher grain yield potential. It is adapted to the Brown and Dark Brown soil zones. [References: 2].

208 Deverall, BJ.; Saverimuttu, N.; Cantrill, LC.; McIntosh, RA. (1994) GENETIC CONTROL OF RESPONSIVENESS OF WHEAT TO ELICITORS IN INTERCELLULAR WASHING FLUIDS FROM LEAF RUST-INFECTED LEAVES. Physiological & Molecular Plant Pathology 45(3):189-194. English. [UNIV SYDNEY DEPT CROP SCI SYDNEY NSW 2006 AUSTRALIA].

Recurrent crosses were made between the cv. Cappelle Desprez, which is highly responsive to elicitors in intercellular washing fluids from leaf rust-infected leaves, and the non-responsive cv. Little Club. Analyses of F-2 and F-3 generations showed that responsiveness was conferred by a single dominant gene. Studies of recombinant lines for chromosome 5A and its long arm from Cappelle Desprez indicated that the gene must be
located in the long arm of 5A. It is proposed that the gene encodes for a receptor of the elicitors, which are considered to be glycoprotein(s) from the walls of rust fungi. The action of the gene for expression of resistance is observed when the elicitors are introduced into the intercellular spaces but not during infection by the rust hyphae, suggesting that the elicitors on fungal walls are not presented to the receptor in the normal infection process. [References: 16].

209 Devis, KM.; Chao, S.; Li, QY.; Simonietti, MC.; Gale, MD. (1994) RELATIONSHIP BETWEEN CHROMOSOME 9 OF MAIZE AND WHEAT HOMELOGOUS GROUP 7 CHROMOSOMES. Genetics. 138(4):1287-1292. English. [JOHN INNES CTR PLANT SCI RES NORWICH RES PK NORWICH NR4 7UH NORFOLK ENGLAND].

Comparison of the genetic map of maize chromosome 9 with maps of wheat chromosomes has revealed a high degree of colinearity between maize chromosome 9 and the group 4 and 7 chromosomes of wheat. The order of DNA markers on the short arm and proximal region of the long arm of the genetic map of maize chromosome 9 is highly conserved with the marker order on the short arm and proximal region of the long arm of the genetic maps of the wheat homeologous group 7 chromosomes. A major part of the long arm of the genetic map of maize chromosome 9 is homeologous with a short segment in the proximal region of the long arm of the genetic map of the wheat group 4 chromosomes. Evidence is also presented that maize chromosome 9 has diverged from the wheat group 7 chromosomes by a pericentric and a paracentric inversion. The paracentric inversion is probably unique to maize among the major cereal genomes. [References: 24].

210 Donald, RGK.; Jackson, AO. (1994) THE BARLEY STRIPE MOSAIC VIRUS GAMMA-B GENE ENCODES A MULTIFUNCTIONAL CYSTEINE-RICH PROTEIN THAT AFFECTS PATHOGENESIS. Plant Cell. 6(12):1593-1606. English. [UNIV CALIF BERKELEY DEPT PLANT BIOLOGY BERKELEY, CA 94720 USA].

Barley stripe mosaic virus contains seven genes, one of which specifies a 17-kD cysteine-rich protein, gamma b, that is known to affect virulence. To further characterize the role of gamma b in pathogenesis, we mutagenized sequences encoding amino acids within two clusters of cysteine and histidine residues in the cysteine-rich domain and a group of basic amino acids located between the clusters and determined the effects of these mutations on the symptom phenotype in barley. Three single amino acid substitutions in cluster 1 and two amino acid exchanges in the basic region caused bleached symptoms associated with pronounced elevations in accumulation of gamma b protein. In contrast, three single amino acid substitutions in cluster 2 and a mutation in the basic motif resulted in attenuated ("null") symptoms typical of those produced when the gamma b gene is deleted. Tissue infected with these "null" mutants accumulated slightly elevated amounts of the gamma b protein but significantly lower levels of coat protein and the putative movement protein beta b. Genetic complementation tests revealed that cluster 1 mutations are dominant over the wild-type gamma b gene, whereas those in cluster 2 are recessive. These results highlight the pivotal role of gamma b in pathogenesis and suggest that the two cysteine-rich clusters are functionally distinct and that they affect different aspects of disease development. [References: 43].


Three methods of phylogenetic inferences on polyploid plants employing variation in restriction sites in repeated nucleotide sequences were compared. Allotetraploid Triticum species of well-established origin were used as a model. Methods based on determination of the proportion of restriction fragments shared between a polyploid and its diploid relatives generated biased results because of uneven numbers of restriction fragments among diploid species and presence of common bands in phylogenetically related diploid species. A method employing restriction fragments unique to a diploid species (marker bands) was not affected by either factor and generated results consistent with cytogenetic inferences. It is shown that the latter method can be used to investigate the origin of a polyploid species even when one of its progenitors is extinct or when the polyploid and its diploid progenitors have diverged. [References: 47].


Accession 8404 of Triticum turgidum ssp. dicoccoides was shown to have excellent resistance to leaf rust. Genetic analysis of the F3-3 of 8404 and RL6089, a leaf rust susceptible durum, indicated that 8404 had three genes for leaf rust resistance. Two of these genes were transferred to haploxipid wheat (Thatcher) by a series of backcrosses. One of the genes transferred was the same as L23 (RL6057). The second gene, which gives a high reaction to avirulent P. recondita races, appears to be fully incorporated into the haploxipid where it segregated to fit a one-gene ratio. Backcross lines with this gene give excellent resistance to leaf rust, although race MBG is virulent to this gene. This may be a previously unidentified leaf rust resistance gene and should increase the genetic diversity available for wheat breeders. [References: 6].


An attempt was made to transfer leaf rust resistance from diploid Triticum monococcum, an autotetraploid of the T. monococcum accession, and durum cultivars Medora and Stewart to haploxipid wheat cultivars Thatcher and RL6058 (L34). A single gene for leaf rust resistance which was the same as L23 (RL6057) was transferred from the durum cultivars to haploxipid wheat. The gene transferred in crosses involving autotetraploid T. monococcum was also L23, but since L23 is on chromosome 1B, it was probably not from T. monococcum. This gene was not the same as the T. monococcum-derived gene in RL637 (Tc"Tm"/TMR5-J14-12-24). Using RL6058 (L34) as the recurrent parent appeared to facilitate the interspecific transfer of resistance since resistance was expressed in the first backcross generation involving RL6058 but not Thatcher. [References: 15].


The two most commonly used dwarfing genes of bread wheat (Triticum aestivum L.) are Rht1 and Rht2. The Rht3 gene is also a potent dwarfing gene. Information in the literature is limited as to the comparative effects of these genes on transpiration efficiency (TE) and water-use efficiency (WUE). Carbon isotope discrimination (Delta) has been proposed as a criterion to select for improved TE. Four near-isogenic lines, RhtRht, Rht1Rht1, Rht2Rht2, and Rht3Rht3, in 'Marina' bread wheat background and their near-isogenic F-1 hybrids derived from crossing the original lines were used to determine the effects of dwarfing genes on plant height, root dry matter, shoot dry matter including grains, grain yield, total dry matter (TDM), TE (TDM/water transpired), WUE (grain yield/water used), and Delta in well-watered and droughted pot experiments in the glasshouse. The near-isogenic lines and their six F-1 hybrids were also grown in well-watered and droughted field conditions. Plant height ranged from 60 to 124 cm and from 53 to 121 cm in well-watered and droughted pot experiments, and it varied from 50 to 94 cm and from 49 to 90 cm in well-watered and droughted field experiments, respectively. Total dry matter, grain yield, TE, and WUE declined with plant height in well-watered glasshouse conditions. No significant relationships were found between plant height and these traits in droughted glasshouse conditions. Carbon isotope discrimination was negatively correlated with TE, but significantly so only in the well-watered pot experiment. Plant height was negatively associated with Delta in both well-watered and droughted pot and field experiments. Grain yield and shoot dry matter also declined with plant height in field conditions. Negative correlations were observed between Delta and grain yield and Delta and shoot dry matter in well-watered field conditions. In most cases, the dwarfing genes reduced shoot dry matter more than grain yield and, therefore, harvest index of the semidwarf and dwarf lines was higher than...
that of the tall standard line. The dwarfish caused by Rht1, Rht2, and Rht3 genes had, in general, depressing effects on TE, WUE, TDM, and grain yield. [References: 24].


To determine the anther culture response of spring bread wheat, 44 cultivars and lines, and 14 F1 were cultured. Genotypes showed significant differences especially in callus induction and green plant proportion compared to plant regeneration. The results from F1 suggested that additive genetic effects predominated for callus induction. In addition, epistasis and heterosis were also observed in some crosses. Some cultivars had dominant or masking genes suppressing callus induction, which were functional in F1 crosses as well; however, probably because of minor genes or gene interactions their functions were some altered positively in their crosses. On the other hand, additive, epistasis and heterosis genetic effects were observed for plant regeneration and green plant proportion as well. In contrast to callus induction, the genotypes with low green plant proportion did not drastically reduce green plant proportion in their crosses. Insignificant correlation coefficients calculated between anther culture components (callus induction, plant regeneration, and green plant proportion) indicated that these are under the control of different genetic mechanisms.


Girman C-banding allows for the identification of all 21 chromosome pairs of hexaploid wheat. However variation in banding patterns of individual chromosomes and structural rearrangements exist between different cultivars making chromosome identification more difficult. The paper summarizes the available data on C-band polymorphism and structural rearrangement present in wheat cultivars and germplasms. [References: 18].


A critical evaluation of the digital data of 250 barley metaphase spreads obtained by image analysis revealed the instability of the chromosomal morphology during the mitotic metaphase stage. Both the relative length (RL) and arm ratio (AR) of the chromosomes, which are the two major numerical parameters in karyotype analysis, varied in the different chromosomal spreads. The ranking of the chromosomes for the respective parameters within a complement changed accordingly. The data indicated that karyotype analysis based merely on the numerical parameters RL and AR may lead to the misidentification of chromosomes, causing a muddertreatment of the data from different chromosomes when averaging several data. Thus, most of data of the RL and AR which have so far been reported may need reexamination except for the cases where chromosomes were identified based on other critical parameters, e.g., banding pattern, condensation pattern, in situ hybridization, etc. Differential condensation between the chromosome arms may be the cause of the instability of the karyotype. [References: 20].


A new inhibitor of insect alpha-amylase, designated RDAI-1, has been purified from rye (Secale cereale L.) endosperm. RDAI-1 is homologous to wheat homodimeric inhibitors. This homology is supported by their similar N-terminal amino-acid sequences, inhibitory actions towards amylases from Tenebrio molitor (Coleoptera) and human saliva, and aggregative properties in gel-filtration chromatography. The gene encoding RDAI-1, IdhaRI, is located on the short arm of chromosome 3R, which is homoeologous with wheat chromosome arms 3BS and 3DS, where the genes for homodimeric inhibitors have been previously mapped. [References: 16].


222 Graf, C. (ed.) (1993) [Papers on breeding research on barley, Triticale and soybean. Dedicated to the memory of Prof. em. Dr. habil. Ernst Keppeler]. Beiträge zur Zuchtforschung bei Gerste, Triticale und Sojabohnen. Dem Gedenken an Prof. em. Dr. habil. Ernst Keppeler gewidmet. Landwirtschaftliche Untersuchungs- und Forschungsanstalt Thueringen, Jena (Germany). Fachbereich Pflanzenproduktion; Verband fuer Agrarforschung und -bildung Thueringen, Jena (Germany). Schriftenreihe VAFF Thueringen (Germany); no. 1 69 p. VAFF, ill., graphs; ref. German. (AGRIS 94-117023).


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Analysis of transcript accumulation and splicing in plastids of four nuclear mutants of barley revealed that the ribosomal protein L2 (rp2) gene transcripts containing a group II intron remained entirely unspliced, whereas the intron of the ribosomal protein L16 (rp16) gene (linked with the rp2 gene in the same operon) was removed in the mutant plastids. Also, the transcripts of other genes containing group II introns (ribosomal protein S16 gene, rp16; NADH dehydrogenase ND2 gene, ndhB; cytochrome f gene, petD; and intron-containing reading frame 170, irf170) and of the tRNA for leucine, trnL (UAA), possessing the only chloroplast group I intron, were found to be spliced. The mutants used in this investigation are considered to be nonallelic; this excludes the possibility that a single nuclear gene is responsible for the impaired splicing of rp2 transcripts. The mutants, however, have a severe deficiency in chloroplast ribosomes in common; this deficiency is evident from the very low steady state level of plastid rRNAs. From these results, we conclude that a functioning translational apparatus of the organelle is a prerequisite for splicing of the chloroplast rp2 class II intron but not for splicing of at least five other group II intron-containing transcripts. This provides genetic evidence for a chloroplast DNA-encoded component (e.g., a matraverse) involved in the splicing of rp2 pre-rRNA. [References: 51].


Huang Jianhua: Lu Ruiju; Zhang Yuhua (Shanghai Municipal Academy of Agricultural Sciences, Shanghai (China). Inst. of Crop Breeding and Cultivation) (1993) Embryo-like structure formation and green plant regeneration of barley genotypes with low responsiveness to anther culture. Acta Agriculturae Shanghai (China) v. 9 (4) p. 19-22. 2 ill. 3 tables, 10 ref. Chinese. (AGRIC 94-117022).


An electrophoretic procedure was developed to obtain patterns of water soluble proteins from the endosperm halves of seeds to detect the 18/1R translation in wheat cultivars. The water soluble proteins were precipitated with Coomassie Brilliant Blue R-250 and separated in a 10% polycrylamide gel with sodium dodecyl sulfate. This procedure extracted protein bands (Mr 40,000, 44,000 and 45,000) corresponding to the omega-secalins of the rye parent which were present only in the wheat cultivars carrying 18/1R translation. By simplifying extract preparation and providing clear band resolution this procedure facilitates large scale screening of wheat lines for the rye translation. Proteins with properties of overlapping solubilities are also discussed. [References: 18].


F-1 plants between two intervarietal chromosome substitution lines of European spring wheat varieties, 'Sicco' ('Chinese Spring 58') and 'Highbury' ('Chinese Spring 58'), were used to produce 114 doubled
haploid lines, 45 by the Hordeum bulbosum technique and 69 by another culture. These two sets of lines were characterized for variation at a range of morphological, isozyme and RFLP marker loci, and genetic maps were developed with emphasis on chromosome 6B, 7A, 7B and 7D. A subset of lines, scored for production traits in field trials in 1986 and 1987, were analysed for the quantitative trait loci (QTL). The performance of the lines for the quantitative traits studied showed no overall differences due to the method of production of the lines. QTL were located on the linkage map for ear emergence time, height, tiller weight, yield and 50-grain weight using four analytical methods. Many of these effects showed genotype x
year interaction. [References: 15].

240 Innes, RL; Kerber, ER (1994) RESISTANCE TO WHEAT LEAF RUST AND STEM RUST IN TRITICUM TAUSCHII AND INHERITANCE OF HEXAPOID WHEAT OF RESISTANCE TRANSFERRED FROM T-TAUSCHII. Genome. 37(5):613-622. English. [DEKALB CANADA INC RR 2 GLANWORTH NOL 110 ON CANADA].

Twelve accessions of Triticum tauschii (Coss.) Schmal. were genetically analyzed for resistance to leaf rust (Puccinia recondita Rob. ex Desm.) and stem rust (Puccinia graminis Pers. f.sp. tritici Erik. & E. Henne.) of common wheat (Triticum aestivum L.). Four genes conferring seedling resistance to leaf rust, one gene conferring seedling resistance to stem rust, and one gene conferring adult-plant resistance to stem rust were identified. These genes were genetically distinct from genes previously transferred to common wheat from T. tauschi and conferred resistance to a broad spectrum of pathogen races. Two of the four seedling leaf rust resistance genes were not expressed as a hexaploid wheat, produced by combining tetraploids with the resistant T. tauschi accessions, probably owing to the action of one or more intergenomic suppressor loci on the A or B genome. The other two seedling leaf rust resistance genes were expressed at the hexaploid level as effectively as in the source diploids. One gene was mapped to the short arm of chromosome 2D more than 50 cM from the centromere and the other was mapped to chromosome 5D. Suppression of seedling resistance to leaf rust in synthetic hexaploids derived from three accessions of T. tauschi allowed the detection of three different genes conferring adult-plant resistance to a broad spectrum of leaf rust races. The gene for seedling resistance to stem rust was mapped to chromosome 1D. The degree of expression of this gene at the hexaploid level was dependent on the genetic background in which it occurred and on environmental conditions. The expression of the adult-plant gene for resistance to stem rust was slightly diminished in hexaploids. The production of synthetic hexaploids was determined to be the most efficient and flexible method for transferring genes from T. tauschi to T. aestivum, but crossing success was determined by the genotypes of both parents. Although more laborious, the direct introgression method of crossing hexaploid wheat with T. tauschi has the advantages of enabling selection for maximum expression of resistance in the background hexaploid genotype and gene transfer into an agronomically superior cultivar. [References: 31].


Vernalization responses are known to differ among spring wheat (Triticum aestivum L.) genotypes. Three crosses were made to determine the inheritance of vernalization response in the spring wheat cultivars Cajeme 71, Yecora 70, Glenclea, Pitic 62 and Neepawa. Segregation analyses of days to anthesis were made of the F2 generation in a growth room (25±15 degrees C, 16% humidity). Segregation analysis of the F2 generation was made in a greenhouse. Reciprocal crosses between Neepawa and Pitic 62 indicated an early/late/late transgressive ratio of 12:3:1 in the F3 generation. The F3 generation results fitted an early/late/late transgressive ratio of 4:1:1:1. Based on the segregation of transgressively late types from both crosses, it was concluded that the genes for spring habit in Pitic 62 and Neepawa were different and not maternally inherited. The Glenclea/Pitic 62 cross produced one transgressively late segregant in an F2 population of 97 plants. The data fitted an early/late/late transgressive ratio of 60:3:1, indicating that Glenclea may differ from Pitic at three Vrn loci. Therefore, either Glenclea or Pitic 62 may carry two dominant Vrn alleles. The reciprocal crosses between Yecora 70 and Cajeme 71 did not segregate transgressively late types in the F2 generation. Therefore, those cultivars

had a Vrn allele in common. Selection for vernalization response might be useful when introducing exotic germplasm into spring wheat breeding programs and in manipulating maturity responses. [References: 24].


Nonisotopic in situ hybridization (ISH) was introduced in plants in 1985. Since then the technique has been widely used in various areas of plant genome mapping. ISH has become a routine method for physical mapping of repetitive DNA sequences and multicopy gene families. ISH patterns on somatic metaphase chromosomes using tandemly repeated sequences provide excellent physical markers for chromosome identification. Detection of low or single copy sequences were also reported. Genomic in situ hybridization (GISH) was successfully used to analyze the chromosome structure and evolution of allopolyploid species. GISH also provides a powerful technique for monitoring chromatin introgression during interspecific hybridization. A sequential chromosome bending and ISH technique was developed. The sequential technique is very useful for more precise and efficient mapping as well as cyogenetic determination of genomic affinities of individual chromosomes in allopolyploid species. A critical review is made on the present resolution of the ISH technique and the future outlook of ISH research is discussed. [References: 92].


In this study cluster analysis was used to estimate the phenotypic diversity in quality components among 17 winter wheat cultivars. The presence of wheat varieties from different quality classes and groups in the same cluster was observed. Also, wheat varieties of the same quality group could be found in different clusters. For breeders these cases mean that crosses among the varieties of the same quality class could give good possibility for recombinations of genes if parents were chosen correctly. High-quality parents from different clusters are expected to increase allelic diversity for hybridization and selection of new wheat lines.


Dynamic changes in the morphology of barley chromosomes during the mitotic metaphase stage were observed and attributed to the differential condensation of the chromosome arms. The mitotic stage of the 250 metaphase spreads was classified into five sub-stages: from early metaphase to late metaphase stage. At each sub-stage, the relative length (RL) and the arm ratio (AR) of the chromosomes were examined and the ranking of the chromosomes for the two parameters was also determined for the respective chromosomal spreads. As a result, the RL and AR values of some of the chromosomes as well as their ranking for the two parameters were found to vary with the progression of the metaphase stage. The dynamic changes in the RL and AR values were closely related to the differences in the condensation rate of the chromosome arm. Factors involved in the differential chromosome condensation are discussed. [References: 11].

Two series of progenies were developed from hybrids between octoploid (AABBDDRR) and tetraploid triticale ([AAB] (AB)RR). One arose from the successive selfing of the F1(1), while the second was established after one backcross of the F-1 hybrids with the respective 8 x triticale parent. Altogether, 250 F-3 and BC1F2 lines were developed, of which 112 were karyotyped in the F-4/F-5 or in BC1F3/BC1F4 generations using C-bandning and SDO-PAGE. The 112 lines represented 61 different karyotypes, of which 39 appeared to be stabilized, having pairs of homologous wheat chromosomes only, while 22 karyotypes exhibited 1-3 heterologous pairs. The frequency of karyotypically stabilized lines originating from the series with one backcrossing was much higher (79.5 %) than those derived from the successive selfing of the F-1 hybrids (51.7 %). Six lines had the pure hexaploid triticale chromosome constitution. The frequency of disomic substitutions of D genome chromosomes for their homoeologous A and/or B genome chromosomes ranged from one to six per line with an average of 1.7. Except for 3B and 6B all possible D(A/B) substitutions were obtained. Chromosomes 1D and 3D substituted for their homoeologues with the highest frequency, while the substitution of chromosome 4D for 4A or for 4B was the least frequent. D(R) substitutions were found in eight lines only. A complete set of 6x triticale lines was established in which chromosome 1D was present in all possible combinations, i.e. single 1D(1A/1B/1R) disomic substitutions as well as disomic 1D addition. [References: 20].


248 Kuznietsov, M. (Institut po Pshenista i Slnchogleda "Dobrudzha", General Toshevo, Bulgaria) (1993) [Sources of cytoplasmic male sterility produced at Institute for wheat and sunflower "Dobrudzha"]. Izotechniia na tiestoplazmena m'zhka sterilnost, proizvedeni v Institutu po pshenista i slnchogleda "Dobrudzha". Diagnostis Priv Ltd., Sofia (Bulgaria); Biotehnologia i Biotehnika (Bulgaria); Biotechnological Equipment v. 7(4) p. 132-135; 3 tables; 4 ref. English. (AGRIS 94-107164).

Fourteen sources of male sterility (MS) in sunflower are produced at Institute for wheat and sunflower "Dobrudzha", General Toshevo, Bulgaria for the period of 1984-1992. Eight sources originate from hybrid materials produced in hybridization between wild annual species of Helianthus and cultivated sunflower. For seven of them it is found that they are of cytoplasmic type. From the investigation regarding the plant fertility restoring in these cytoplasmic male sterility sources are detected and the sterilizing cytoplasmic do not exert a negative effect on the morphology and productivity of the hybrid plants.


The proximal regions of wheat chromosomes rarely undergo recombination and thus it is difficult to determine if some 50 per cent of the DNA of this species has any measureable effect. The genetic effects of the proximal regions of the chromosomes of two cultivars (Chinese Spring and Hope) are investigated using the double-discriminants of Chinese Spring and the Hope substitution series to produce lines in which only the proximal or distal region of a single chromosome is introduced into an otherwise uniform background.

250 King, J.P.; Purdie, K.A.; Liu, C.J.; Reader, SM.; Pittaway, TS.; Orford, SE.; Miller, TE. (1994) DETECTION OF INTERCHROMOSOMAL TRANSLocations WITHIN THE TRITICaceAE BY RFLP ANALYSIS. Genome. 37(5):882-887. English. [UNIV READING DEPT AGR BOT READING RG6 2AS BERKS ENGLAND].

Twenty-three wheat/ alien addition or substitution lines were screened using restriction fragment length polymorphisms for the presence of absence of 4/5 and 4/7 reciprocal translocations in the alien chromosomes. Such translocations have previously been identified in wheat and rye.


Many genes have been located in wheat chromosomes, yet little is known about the location of genes introduction for resistance to Ustilago tritici, which causes loose smut. Crosses were made between the loose smut susceptible alien substitution lines Cadet 6AG(6A) and Rescue 6AG(6A) lines in which Agropyron chromosome 6 is substituted by wheat chromosome 6A and four cultivars resistant to U. tritici race T19: 'Caden', 'Kota', ' Thatcher' and 'TD18'. The segregating progeny were tested for reaction to race T19 and for the level of binding with a monoclonal antibody specific to a chromosome 6A-coded seed protein. The antibody, which does not bind to seed protein extracts in the absence of the 6A chromosome, was used as a chromosome marker. An association was established between resistance to race T19 and the presence of chromosome 6A for each of the cultivars tested, indicating that resistance to race T19 resides in chromosome 6A. Ustilago tritici race T19 resistance in 'Caden' appears to be located in the short arm of chromosome 6A, based on the evaluation of the Cadet 6A long distotelosomic stock, which was susceptible, and the Cadet 6A-short: 6-Agropyron-short alien translocation stock, which was resistant. [References: 28].


A study was initiated in 1990 to determine the genetic variation and adaptation of all registered Canadian barley (Hordeum vulgare L.) cultivars. Seventy-six cultivars were tested at five locations across Canada (Charlottetown, Ottawa, Brandon, and Bentley) in 1991 and 1992. These cultivars were grouped into 10 classes and classes were compared in five categories: eastern vs. western, doubled-haploid (DH) vs. conventional, feed vs. malting, two-row vs. six-row, and hulless vs. covered. These 76 cultivars showed remarkable variation in yield, test weight, kernel weight, plant height, and maturity and responded differently to the environments. Among them, Albany and Chapaids had the highest yield and they also yielded well in both Eastern and Western Canada. Thus, some barley cultivars were widely adapted across the whole country. Two-row cultivars had higher test weight and higher kernel weight than six-row, and appeared to be more stable in yield over the environments. Eastern two-row cultivars were superior in yield, test weight, and kernel weight than western two-row. Eastern two-row, in general, performed well across Canada. Several western six-row cultivars performed well in both Western and Eastern Canada. Therefore, greater exchanges of breeding materials between the two regions are recommended in order to fully exploit the genetic potentials of new cultivars. DH cultivars yielded as well as conventional cultivars and responded similarly to the environments. This substantiates that complete homozygosity and homogeneity have very little effect on the performance of DH cultivars. Among the western two-row, feed cultivars yielded either higher than or the same as malting cultivars in the eight environments. Hulless cultivars had lower yield, higher test weight and lower kernel weight than covered cultivars. [References: 10].


varieties with dry environment at the Mixteca Alta, Oaxaca State. Interacción de variedades de trigo con ambientes secos de la Mixteca Alta Oaxaquena. *Re vista Fitotecnia Mexicana* (Mexico) v. 15(1) p. 40-50. 2 ilus; 5 tablas; 16 ref. Spanish. (AGRIS 94-117159).


The karyotypes of Elymus dentatus from Kashmir and E. glaucescens from Tierra del Fuego, both carrying genomes 5 and H, were investigated by C- and N-banding. Both taxa had 2n = 4x = 28. The karyotype of E. dentatus was symmetrical with large chromosomes. It had 18 metacentric, four submetacentric and six satellite chromosomes. The karyotype of E. glaucescens resembled that of E. dentatus, but a satellitised chromosome pair was replaced by a morphologically similar, non-satellite pair. The C-banding patterns of both species showed from one to five conspicuous and a few inconspicuous bands per chromosome. N-banding differentiated the chromosomes of the constituent genomes by producing bands in the H genome only. The 5 genomes of both species were similar with five metacentric and two satellitised chromosomes having most conspicuous C-bands at telomeric and distal positions. They resembled the 5 genome of the genus Pseudodeseraina. The H genomes had four similar metacentric and two submetacentric chromosomes. The seventh H genome chromosome of E. dentatus was satellitised, that of E. glaucescens nonsatellitised, but otherwise morphologically similar. The C-bands were distributed at no preferential positions. The H genome of E. dentatus resembles the H genomes of some diploid Hordeum taxa. [References: 36].


Wheat (Triticum aestivum L., 2n = 6x = 42, AABBDD) florets were emasculated and pollinated using two apomictic wheatgrass (Elymus rectusficus (Nees in Lehm.) A. Love and Connor, 2n = 6x = 42, SSSYYWW) accessions, one of which produces 2n pollen. A 2n = 42 (B-II) hybrid and four 2n = 63 (B-III) hybrids were obtained. The spike morphology of the B-II hybrid was intermediate to that of its parents. The pollen mother cells (PMCs) of this hybrid contained on average 58.36 I and 1.62 II, which was consistent with its disparate genome composition (ABDSYW). Its pollen failed to stain and no BC1 progeny was obtained. The B-III hybrids (reduced egg fertilized with unreduced sperm) were grasslike and had a full complement of E. rectusficus chromosomes, the synapton of which was slightly irregular by chromosome. Some gametes contained cytoplasts. Their PMCs contained an average 16.50 II, 25.72 I, and 1.54 multivalents (II plus IV), Pollen stainability in these hybrids was low (<1%), and when they were used as females, one 54- and 60-chromosome BC1 were obtained. A mean of 13.25 II was observed in PMCs of the 54-chromosome BC1 and pollen stainability was 10%. Pollen stainability in the 60-chromosome BC1 was only 5%. The use of 2n-pollen-producing E. rectusficus accession hybrid and BC1 formation and may accelerate the ultimate transfer of apomixis to wheat. [References: 18].


260 Ma, ZQ.; Sorrella, ME.; Tanklesy, SD. (1994) RFLP MARKERS LINKED TO POWDERY MILDEW RESISTANCE GENES PM1, PM2, PM3, AND PM4 IN WHEAT. *Genome*. 37(5):871-875. English. [CORNELL UNIV DEPT PLANT BREEDING & BIOMETRY 252 EMERSON HALL ITHACA, NY 14853 USA].

Near-isogenic lines (NILs) and their recurrent parent Chancellor (Cc) were used to identify restriction fragment length polymorphic markers linked to powdery mildew (Blumeria graminis (DC.) E.O. Saper f.p. triticis) resistance genes Pm1, Pm2, Pm3, and Pm4 in wheat (Triticum aestivum L. em. Thell). By mapping these polymorphic markers in F2 progenies from crosses of the NILs with Cc, it was found that Pm1 cosegregated with a polymorphic locus detected by DNA probe CDO347; Pm2 was linked to a locus detected by probe BCD1871 with a distance of 3.5 cM; Pm3b was linked to a locus detected by probe BCD1434 with a distance of 1.3 cM; Pm4a cosegregated with Xbcd1231-2A(2) and Xcdo678-2A, and was closely flanked by Xbcd1231-2A(1) and Xbcd292-2A both with a distance of 1.5 cM. Aneuploid mapping of these markers indicated that locus Xcdo347-7A is on 7AL, Xbcd1871-SD on 5DS, Xbcd1434-1A on 1A5, and loci Xbcd292-2A and Xcdo678-2A are on 2AL. The same polymorphic fragments detected in the Pm3b NIL by Xbcd1434-1A were found in Pm3a NIL using several enzyme digestions [References: 42].

261 Mac Key, J. (Swedish Univ. Uppsala (Sweden). Dept. of Plant Breeding) (1992) Use of near-isogenic lines in analysing racespecific pathogen interrelations. 188. NJF Seminar; Aas (Norway); 11-14 Feb 1991. Disease resistance in agricultural crops. NJF Seminar no. 188. Elen, O.; Tronsmo, A.M. (eds.). Scandinavian Association of Agricultural Scientists (NJF). *Norwegian Journal of Agricultural Sciences* (Norway); no. 7(suppl.: p. 63-76. Statsens Faggeneste for Landbruket. 9 tables; 33 ref. English. (AGRIS 94-117104).


Karyotype analyses based on staining by acetocarmine followed by Giemsa N-banding of somatic metaphase chromosomes of Hordeum vulgare L. were carried out on 61 reciprocal translocations induced by X-irradiation. By means of computer-based karyotype analyses all of the 122 breakpoints could be localized to defined sites or segments distributed over the seven barley chromosomes. The pre-definition of translocations with respect to their rearranged chromosome arms from other studies rendered it possible to define the break positions even in translocations having exchanged segments equal in size and the breakpoints located distally to any Giemsa band or cytological marker. The breakpoints were found to be non-randomly spaced along the chromosomes and their
arms. All breaks but one occurred in interband regions of the chromosomes, and none of the breaks was located directly within a centromere. However, short and long chromosome arms recombined at random. An improved tester set of translocations depicting the known break positions of most distal location is presented. [References: 65].


Wheat x maize and wheat x pearl millet crosses have proved efficient for haploid production using various genotypes of wheat: 22 and 27% of florets produced embryos. In favourable conditions 6-9 haploid plants per spike were produced. The following simplifications or improvements in technique are recommended: 1. Only a single treatment with an aqueous solution of dicamba or 2, 4-D (50-100 ppm) for embryo stimulation in vivo; 2. Application by spraying or dipping the spikes; 3. Application time two to four days after pollination; 4. Embryo rescue 15 to 18 days after pollination; 5. Crosses without emasculation are possible if pollination occurs 1-2 days before anthesis. More than 450 haploids and some doubled haploid (DH) lines (after colchicine treatment in vitro) were produced using these methods. No hybrid plants, chromosome additions or substitutions were found. [References: 17].


Isolates of Erysiphe graminis s. sp. hordei derived from barley conidia and progeny of specific crosses were screened for random amplified polymorphic DNA (RAPD) variation detected with 10-base primers. Using two DNA samples, 58 of 76 primers yielded good amplification products. Twenty-seven primers were screened further on a test set of 16 E.g. hordei isolates collected from throughout Europe. Approximately 119 resolvable bands were reproducibly amplified, 56 bands were variable, and each primer yielded at least one polymorphism. A subset of 10 of these primers detected 30 polymorphisms in the European test set but only 19 variable bands in 48 isolates collected with a stationary microscope. In addition to the RAPD markers, we developed six sets of specific primers that detected variation. five of which detected multiple alleles, one detected the presence and absence of a band, and a seventh was monomorphic. These polymerase chain reaction markers, in conjunction with virulence and fungicide sensitivity, are being used to investigate evolutionary processes and genetic linkage in the barley powdery mildew pathogen. [References: 38].


AC Copia, a cultivar of spring triticale (X Tritiscosole Wittmack), was developed at the Research Station, Research Branch, Agriculture and Agri-Food Canada, Swift Current, SK. It is widely adapted to the Prairie Provinces of Western Canada. AC Copia represents an improvement in test weight over other currently available Canadian cultivars of triticale. It is very resistant to the prevalent races of leaf rust, stem rust and common bunt, and moderately resistant to common root rot.


Genomic in-situ hybridization (GISH) was used to determine the amount of wheat-rye chromosome pairing in wheat (Triticum aestivum) x rye (Secale cereale) hybrids having chromosome 5B present, absent, or replaced by an extra dose of chromosome 5D. The levels of overall chromosome pairing were similar to those reported earlier but the levels of wheat-rye pairing were higher than earlier determinations using C-banding. Significant differences in chromosome pairing were found between the three genotypes studied. Both of the chromosome-5B-deficient hybrid genotypes showed much higher pairing than the euploid wheat hybrid. However, the 5B-deficient hybrid carrying an extra chromosome 5D had significantly less wheat-rye pairing than the sample 5B-deficient genotype, indicating the presence of a suppressing factor on chromosome 5D. Non-homologous/non-homoeologous chromosome pairing was observed in all three hybrid genotypes. The value of GISH for assessing the level of wheat-allelic chromosome pairing in wheat/ alien hybrids and the effectiveness of wheat genotypes that affect homoeologous chromosome pairing is demonstrated. [References: 18].


The endosperm starch of the wheat grain is composed of amylose and amylopectin. Genetic manipulation of the ratio of amylose to amylpectin or the amylose content could bring about improved texture and quality of wheat flour. The chromosomal locations of genes affecting amylose content were investigated using a monosomic series of Chinese Spring (CS) and a set of Cheyenne (CNN) chromosome substitution lines in the CS genetic background. Trials over three seasons revealed that a decrease in amylose content occurred in monosomic 4A and an increase in monosomic 7B. Allelic variation between CS and CNN was suggested for the genes on chromosomes 4A and 7B. To examine the effects of three Waxy (Ws) genes which encode a granule-bound starch synthase (Wx protein), the Ws proteins from CS monosomics of interest were analyzed using SDS-PAGE. The amount of the Wx protein coded by the Wx-B1 gene on chromosome arm 4AL was reduced in monosomic 4A, and thus accounted for its decreased amylose content. The amounts of two other Wx proteins coded by the Wx-A1 and Wx-D1 genes on chromosome arms 7A5 and 7DS, respectively, showed low levels of protein in the monosomics but no effect on amylose content. The effect of chromosome 7B on the level of amylose suggested the presence of a regulator gene which suppresses the activities of the Wx genes. [References: 21].

To identify homoeologous group-3 chromosomes that carry genes for vernalization, day-length responses, and earliness per se, a series of aneuploid lines (monosomics and tetrasomics) and chromosome-substitution lines in 'Chinese Spring' (CS) were surveyed under different vernalization and day-length regimes in controlled environments. The results indicated that genes on all three chromosomes of group 3 can have striking effects on ear-earliness time. The replacement of CS 3B by its homologues in 'Lutescens 62' and 'Cheyenne' produced an increased insensitivity to vernalization, while 3B homologues from 'Ceska Presvikova' gave CS a remarkable sensitivity to vernalization. This provided evidence for multiple alleles at a new Vrn locus on chromosome 3B. A negative association between gene dosage and day-length response was found in CS 3D which was thought to carry a gene for promoting insensitivity to daylength. The behaviour of CS monosomic 3A and CS (Tsimanstein 3A), in reducing numbers of days to heading independently of environmental stimuli, suggested the presence of earliness per se genes on this chromosome. [References: 31].


The transmission of a structurally-hypervariable fraction of the mitochondrial genome has been studied in 42 F1 progenies obtained from reciprocal crosses between self-pollinated allopolyploid wheat plants regenerated after long-term somatic embryogenesis. This fraction of the genome is maternally and stoichiometrically inherited. In contrast, some additional restriction fragments specific to regenerated plants display a more complex mode of sexual transmission: one of the additional fragments was stoichiometrically and systematically inherited whereas the others were detected only in certain F1 hybrids. Assuming that the detection, by Southern analysis, of such a fragment in regenerated plants is due to the amplification of a pre-existing substoichiometric molecule generated by the activation of a rare recombination event, our results suggest that the probability of detecting a novel fragment in the F1 hybrids could be determined by the length of the repeated sequence at which recombination occurs. [References: 35].


A genomic (prb1) and two cDNA clones (PRb1-2 and PRb1-3) corresponding to two new barley basic PR-1 proteins (prb1-2 and prb1-3) were isolated from Hordeum vulgare. Genomic analysis of DNA suggests that the barley genome contains at least 6 members corresponding to the gene family encoding PR-1 proteins. Expression of these genes was induced in primary leaf tissues of the H. vulgare cv. Fl14 (F114) Man. carrying Mip resistance genes (cv. Mlp) and the near-isogenic susceptible cvl. After inoculation with Erysiphe graminis f.sp. hordei. [References: 10].


279. Odomouhoge, LS; Bennett, MD. (1994) DURUM WHEAT HAPLOID PRODUCTION USING MAIZE WIDE-CROSSING. Theoretical & Applied Genetics. 89(5):559-566. English. [AGR CANADA RES BRANCH CENT EXPTL FARM BLDG 50 OTTAWA K1A 0C6 ON CANADA].

While anther culture or pollinations with Hordeum bulbosum have provided suitable methods for haploid production in bread wheat, they have been largely unsuccessful in durum wheat. Pollinations with maize were used in an attempt to produce haploid seedlings and, from these, fertile doubled haploids of durum wheats. Moreover, the effect of various concentrations and combinations of a synthetic auxin, 2, 4-dichlorophenoxyacetic acid (2, 4-D) on hybridization, silvery (AgN03), on hybrid recovery were also investigated. Haploid seedlings were recovered from Triticum turdivum spp. turgidum cv 'Rampton Rivet' pollinated with maize following in-vivo treatment of ovaries with 2, 4-D for 2 weeks and subsequent embryo culture. The recovery of haploid seedlings from T. turdivum cv. 'Wakona' pollinated with maize necessitated the addition of AgN03, to the 2, 4-D treatment. Overall, haploid seedlings were produced in 1.7% and 3.3% of pollinated florets for 'Rampton Rivet' and 'Wakona' respectively. The success of the present work represents a significant breakthrough for haploid production in durum wheats. Wide hybridization with maize followed by in-vivo treatment of ovaries with 2, 4-D alone, or in combination with AgN03, may provide a widely-applicable method of haploid production in tetraploid wheats. [References: 35].


Thirty-three winter wheat hybrids produced using a chemical hybridizing agent, and their 27 parents, were compared for bread-making quality. Samples of kernels used for technological tests were obtained in a multilocational experiment, but the 'genotype x environment' interactions appeared negligible for grain hardness, the Pshenke test and alveograph measurements. Heterosis did not occur, either for these 3 tests or for the protein content, and the F1 was intermediate between the 2 parents. For protein content, this could indicate a 'source-sink' relationship between the two parents, and it is more favourable for hybrids than for inbred lines. This is because the protein content was maintained in spite of a significant heterosis for grain yield. In fact, there was a significant heterosis for protein yield. From all these results, it appears that breeding hybrid wheats with good quality characteristics should not be a major problem.


283. Persaud, RR.; Lipps, FE.; Campbell, KC. (1994) IDENTIFICATION OF POWDERY MILDEW RESISTANCE GENES IN SOFT RED WINTER WHEAT CULTIVARS AND OHIO BREEDING LINES. Plant Disease. 78(11):1072-1075. English. [UNIV GUYANA FAC AGR TURKUEN CAMPUS POB 101110 GEORGETOWN GUYANA].

Eight-day-old seedlings of seven soft red winter wheat cultivars and four elite breeding lines were tested for the presence of powdery mildew resistance genes with 14 isolates of Blumeria graminis f. sp. tritici. These isolates were characterized for their virulence on differential wheat cultivars and lines with single genes for powdery mildew resistance. Phenotypic reactions of the cultivars and lines to each isolate were assessed 8 days after inoculation. Differential reactions and pedigree information were used to determine the presence of putative powdery mildew resistance genes. The B. g. tritici isolates detected powdery mildew resistance gene Pm3a in AGRA brand GR915 and pedigree information indicated that Freedom contained Pm8. No Pm genes were detected in Cardinal, Clark, Dynasty, or Titan. The gene Pm3a was present in breeding lines OH470 and OH492-1, and gene Pm17 was detected in OH64. OH490 contained gene Pm2 or Pm6, or both isolates; could not differentiate these two genes. [References: 35].


Genetic variability of cultivated and wild barley, Hordeum vulgare ssp. vulgare and spontaneum, respectively, was assessed by RFLP analysis. The material consisted of 13 European varieties, single-plant offspring lines of eight land races from Ethiopia and Nepal, and five accessions of ssp. spontaneum from Israel, Iran and Turkey. Seventeen out of twenty-one studied tDNA and gDNA probes distributed across all seven barley chromosomes revealed polymorphism when DNA was digested with one of four restriction enzymes. A tree based on genetic distances using frequencies of RFLP banding patterns was estimated and the barley lines clustered into five groups reflecting geographical origin. The geographical groups of land-race lines showed less intragroup variation than the geographical groups of spontaneous lines. The group of European varieties, representing large variation in agronomic traits, showed an intermediate level. The proportion of gene diversity residing among geographical groups (F-ST) varied from 0.19 to 0.94 (average 0.54) per RFLP pattern, indicating large diversification between geographical groups. [References: 23].


The accumulation of abscisic acid (ABA) by detached and partially dehydrated wheat leaves is known to be inherited in a quantitative manner. The location of genes having a major effect on drought-induced ABA accumulation in wheat was determined using a set of single chromosome substitution lines and populations derived from a cross between a high-ABA- and a low-ABA-producing genotype. Examination of a series of chromosome substitution lines of the high-ABA genotype ‘Ciano 67’ into the low-ABA recipient ‘Chinese Spring’ showed that chromosome 5A carries gene(s) that have a major influence on ABA accumulation in a drought test with detached and partially dehydrated leaves (DLT). A similar DLT was used to examine ABA accumulation in a population of F2 plants and doubled haploid (DH) lines derived from the cross between ‘Chinese Spring’ (low-ABA) and ‘SQ71’ (high-ABA) in which the F2 population (150 plants) and DH lines (96 lines) were also mapped partially with molecular markers. Analysis of variance of ABA accumulation between and within marker allele classes in the F2 confirmed the location of a gene(s) regulating ABA accumulation on the long arm of chromosome 5A. MAPMAKER-QTL showed the most likely position for the ABA quantitative trait locus (QTL) to be between the loci Xpsr575 and Xpsr426, about 8 cm from Xpsr426. A similar trend for high ABA accumulation was found in DH lines having the ‘SQ1’ allele at marker loci in the same region of chromosome 5A, but the QTL effect was not significant. The function of the QTL is discussed. [References: 34].

gliadin markers of higher frost resistance and of stem rust resistance were discussed.


Mitochondria derived from Triticum timopheevi have a chimeric gene, orf256, immediately upstream from coxl. Antibodies to a peptide corresponding to a part of the encoded amino acid sequence of orf256 detect a 7 kDa protein on western blots of mitochondrial proteins from cytoplasmic male-sterile (ems) wheat (T. aestivum nucleus, T. timopheevi mitochondria) but not in mitochondrial proteins from T. aestivum, T. timopheevi, or ems plants restored to fertility by introduction of nuclear genes for fertility restoration. The 7 kDa protein appears to serve as a marker for ems wheat. Its occurrence as an integral protein of the inner membrane may indicate a ems effect through an influence on mitochondrial membrane function. References: (30).


Trigeneric hybrids with genomes of Triticum, Secale and Hordeum were produced by hybridization of hexaploid Triticale and hexaploid forms of Tritordeum. The meiosis in PMC's revealed disorders typical for distant hybrids - univalents in metaphase I, underdeveloped chromosomes in anaphase I and micronuclei in telophase II. The hybrids of F1 have a long ear with a great number of small spikelets and florets and 56 to 69 seeds per man ear.

298 Straub, PF.; Shen, QX.; Ho, THD. (1994) STRUCTURE AND PROMOTER ANALYSIS OF AN ABA- AND STRESS-REGULATED BARLEY GENE, HVA1. *Plant Molecular Biology*. 26(2):617-630. English. [WASHINGTON UNIV DEPT BIOL DEPT BIOL & BIOMED SCI PLANT BIOL PROGRAM CAMPUS BOX 1137 ST LOUIS, MO 63130 USA]. A single-copy barley gene, HVA1, encoding a class 3 late embryogenesis-abundant protein, can be induced by either treatment with abscisic acid (ABA) or by stress conditions such as drought, cold, heat and salinity. We have isolated an HVA1 genomic clone containing about 400 bp of 5'-upstream sequence, a single 109 bp intron, and the full coding sequence. Linker scan mutagenesis and transient expression studies were used to test the function of four HVA1 promoter elements conserved in ABA-responsive genes. Mutations in two of these elements, the C box and the putative ABRE 1 (ABA-responsive element) containing an ACCG core, resulted in no significant change in transcription level or ABA induction. In contrast, mutations of the other two elements, putative ABRE 2 and 3 cause the level of transcription to drop to 10-20 % of that obtained with the wild-type promoter indicating that the high level of expression of HVA1 is dependent on both pABRE 2 and 3. Interestingly, despite their low level of expression, the mutated promoters still gave more than 20-fold induction in response to ABA treatment. We suggest that the ABA induction of barley HVA1 gene is governed by a complex consisting of pABRE 2 and 3 working together to regulate the absolute level of expression, and either of these elements or a possible third element may regulate ABA inducibility. Phylogenetic analysis by parsimony indicates that the barley HVA1 and wheat pMA2005 sequences share a recent common ancestor. These two genes are closely related to the carrot D3 and cotton D-7 genes with which they share a similar structural gene organization. References: (48).


Barley mild mosaic virus is a member of the Bromoviruses, a genus of the family Bromoviridae. The virus consists of two types of flexuous rod-shaped particles. Each of them contains one single-stranded polyadenylated RNA in plus orientation of approximately 7.6 kb (RNA1) and 3.6 kb (RNA2). Complementary DNAs of both RNAs have been synthesised and cloned. The nucleotide sequence of RNA2 has been determined. It is 3524 nucleotides in length, excluding the 3' poly(A) tail, and contains one large open reading frame (2679 nts), coding for a polyprotein of approximately 98 kDa. There are indications that a putative proteolytic activity in the N-terminal part can cleave the polyprotein autocatalytically into a 25 kDa protein (putative polypeptide) and a 73 kDa polypeptide of unknown function. References: (22).


positive correlations between SOD activity in infected and uninfected calli and blooming spikes and resistance to scab in wheat varieties. The resistant variety Wangshubai had two more bands in SOD isozyme pattern than the susceptible one Alondra-5S. New bands appeared in isozyme patterns of the two varieties 24 hs after being inoculated. SOD may play an important role in resistance to scab in wheat. It was suggested that SOD activity as an index of resistance to scab might be useful in screening wheat varieties for their resistance to scab.


The interaction between varieties and environment can make the prediction of crop performance difficult. The farmer is obviously interested in achieving optimum production within the particular growing environment of his farm, thus, this paper investigates if crop performance predictions can be improved by taking information from other locations into account. The investigation is based on yield data from winter wheat resulting from official German variety-performance tests. The predictors are based on the single location (control), unweighted means, principal components, and weighted means, produced using regression coefficients as weights. These predictors were rested on an independent data set from another year. For the given yield data in winter wheat, the overall mean proved to be the best, which suggests that prediction for all locations should be the same, and predictors for specific locations cannot, therefore, be recommended. The main reason for this is the relatively small interaction between genotype and location, in comparison to the second-order interaction between genotypes and years. [References: 30].


Biologist J. Troy Weeks reports on a protocol for producing transgenic wheat lines. [References: 5].


Alpha-Amylases are the key enzymes involved in the hydrolysis of starch in plants. The polymerase chain reaction (PCR) was used to detect polymorphisms in the length of amplified sequences between the annealing sites of two primers derived from published alpha-amy1 gene sequences in barley. These two primers (Bsw1 and Bsw7), flanking the promoter region and the first exon, amplified two PCR fragments in barley. One of the amplified products, with the expected length of 820 bp appeared together with another shorter PCR band of around 750 bp. Thus 750-bp fragment seems to be derived from an alpha-amy1 gene not reported previously. Both of the PCR products could be amplified from the two-rowed barley varieties tested, including cv Himalaya from which the sequence information was obtained. Five of the six-rowed barley varieties also have the two PCR fragments whereas another two have only the long
hybridization and by expression of molecular markers to determine its chromosome constitution. All progeny of this line had three pairs of L. pentcutum chromosomes from homoeologous chromosome groups 3, 5, and 6 and the 2n = 47 progeny had an additional L. pentcutum monosome. The pairs from groups 3 and 6 were in the added state, while the group 5 pair was substituted for wheat chromosome 5D. Several wheat-wheat translocations with respect to the parental wheat genotype occurred in this line, presumably owing to the promotion of homoeologous chromosome pairing by L. pentcutum chromosomes. It was hypothesized that homoeologous recombination results in homoeologous duplication-deletions in wheat chromosomes. An aberration 3:1 disjunction creates the potential at each meiosis for replacement of these wheat chromosomes by homoeologous L. pentcutum chromosomes. Wheat chromosomes 3A and 6A appeared to be in intermediate stages of this substitution process. [References: 27].


#40 PLANT ECOLOGY


The objectives of this paper are to establish the climatically determined potential grain yields of wheat for different locations of India, to quantify the gap between actual and potential yields and to determine the optimal levels of irrigation and N required for given productivity levels. The analysis is based on simulations made with the crop growth model WGRROWS. Simulated potential grain yields, determined by solar radiation and temperature, varied between 2.56 and 8.25 t ha(-1) for 128 locations spread throughout India. In general, yields increased with latitude and inland locations had greater yields than the coastal locations at the same latitude. These trends were related to mean temperature differences over latitude/location. The results indicate a strong linear decline in grain yield as mean temperature increased. Late sowings had smaller yields as well as increased variability. The decrease for each day's delay in sowing was more when potential yield was high. The yield gap was at least 2 t ha(-1) irrespective of location and a significant portion of this was due to delayed sowing. Crop simulation with different amounts of nitrogen and irrigation inputs showed significant interaction between water and N availability as well, as inter-seasonal climatic variability, particularly with low input of water. The optimal N application depended on the amount of water availability. Yield variance of stressed wheat crops is moderated greatly by irrigation but reduced N fertilizer application may modify the response. [References: 16].


A mechanistic crop growth simulation model, WGRROWS, is developed for use in analyzing effects of climatic variables and crop management on productivity of wheat in tropical and sub-tropical wheat regions of India. The model, written in CSMP and FSE, simulates daily dry matter production as a function of radiation and temperature, and water and nitrogen availability. Crop aspects of the model are arranged in submodels covering development, photosynthesis, respiration, carbohydrate partitioning, dry matter production, leaf area, grain growth and transpiration. A soil water balance model is attached to simulate water uptake and to determine water stress. Another submodel determines nitrogen uptake, distribution and N stress. Water and nitrogen stresses, depending upon their severity, affect various physiological processes. The model requires inputs relating to site, daily weather, soil...
physical characteristics and crop management. Switches allow water and/or nitrogen stresses to be terminated to establish climatically determined potential grain yield. Various aspects of the model were validated using a large number of independent experiments. Comparison of simulated and measured quantities indicated satisfactory performance of the model in reference to water and nitrogen uptake, dry matter growth and grain yield in potential as well as Water- and N-limited environments. The model appears useful as a tool for optimizing use of water and nitrogen. [References: 67].


Fields of winter wheat on organic and conventional farms were sampled for weeds and invertebrates in June/July in 1990 and 1991. Organic fields were paired with adjoining conventional ones and their invertebrate fauna compared with a D-vac vacuum suction sampler. Weed counts showed greater percentage cover of broad-leaved weeds in organic fields than in conventional ones, with three times as many species present where herbicides were not used. Significantly higher densities of nematoceran and acalypteran Diptera, Hemiptera (especially aphids), aphid-specific predators, parasitic Hymenoptera and cryptorchid Coleoptera were found in conventionally grown fields. Significantly higher densities of weevils, spiders, springtails, plant hoppers and sawfly larvae were found in organic fields. Reasons for these differences or the lack of them are discussed. [References: 33].


F50 PLANT STRUCTURE


F60 PLANT PHYSIOLOGY AND BIOCHEMISTRY


DIMBOA (2, 4-dihydroxy-7-methoxy-1, 4-benzoazoxin-3-one) glucoside in wheat has been suggested to play a role in plant resistance to cereal aphids. Thus there is considerable interest in trying to breed modern wheat varieties with increased concentrations of this compound. To further such work we assessed the effects of light intensity on DIMBOA glucoside production in wheat seedlings under both indoor and outdoor conditions. Light had a marked effect on DIMBOA-glucoside concentrations, with levels in plants being negatively related to light intensity. Our findings suggest that breeding aimed at increasing levels of DIMBOA-glucoside would be most effective if tests for selection were to be grown under weak light conditions. [References: 6].


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The phospholipase C (PLC; EC 3.1.4.3) activity in isolated plasma membranes of light-grown wheat (Triticum aestivum L. cv. Freude) leaves was investigated. The activity against the polyphosphoinositides was strongly dependent on Ca2+. and was affected by the anionic detergent deoxycholate (DOC). In the presence of 20 mu M Ca2+ the PLC activity preferred phosphatidylinositol 4, 5-bisphosphate (PIP2) over phosphatidylinositol 4-monophosphate (PIP) as a substrate. Instead, with 1 mM Ca2+ the enzyme clearly favoured PIP. In addition, the PIP2-PLC activity was increased by Mg2+ and in the presence of GTP, guanosine 5- (guanino-thio)-triphosphate as well as ATP, CTP, guanosine 5-diphosphate and guanosine 5-(beta-thio)-diphosphate. Further analysis showed that a molybdate-sensitive phosphatase activity catalysing the dephosphorylation of inositol 1, 4, 5-triphosphate (Ins(1, 4, 5)P3) is also associated with the plasma-membrane vesicles. Dephosphorylation of Ins(1, 4, 5)P3 was reduced in the presence of GTP or by inclusion of the unspecific phosphatase inhibitor molybdate. The results indicate the presence of a PIP2-PLC activity and the presence of a molybdate-sensitive phosphatase activity in wheat plasma-membrane vesicles. [References: 38].


Tolerance of wheat (Triticum aestivum) to chronic heat stress and the subsequent effect on growth and yield are largely mediated by the plant carbon balance at high temperatures. Seed endosperm utilization for seedling growth in the dark can be a simple model for studying tolerance to chronic heat stress in terms of the carbon balance. Seed endosperm utilization efficiency (EUE) was defined as the ratio of gain in seedling (shoot and radicle) dry mass to loss in seed dry mass during germination. This study was designed to evaluate heat tolerance in terms of EUE and its relations to heat tolerance in the autotrophic plant. Endosperm utilization efficiency was measured by periodic sampling of germinating seed in the dark under normal (25 degrees C) and high (35 degrees C) temperatures in 18 wheat cultivars. Heat tolerance of the autotrophic juvenile plant was measured in the same cultivars in terms of plant growth rate (GR) between 17 to 24 days after emergence under normal (15 degrees C to 25 degrees C) and high (25 degrees C to 35 degrees C) night/day temperatures. Mean final seedling dry mass in the dark was greater at low than at high temperature. Total dry matter loss from the seed did not differ much between temperatures, indicating that the lower seedling dry mass under high temperature was probably due to a relatively greater loss of carbon to respiration. Averaged over 18 cultivars, EUE was reduced by chronic heat stress from 0.64 g/g(-1) at 25 degrees C to 0.53 g/g(-1) at 35 degrees C. There were significant differences among cultivars in EUE at both low and high temperatures and there was a very significant (P less than or equal to 0.01) temperature by cultivar interaction for EUE. Endosperm utilization efficiency at high temperature ranged from 0.30 g/g(-1) to 0.55 g/g(-1) among cultivars and was independent of cultivar seed mass. Percent GR reduction from 15 degrees C to 25 degrees C to 35 degrees C ranged from null to 53% in the different cultivars. Mean relative growth rate (GR = 0.92), P less than or equal to 0.05; df = 16) was found between EUE at 35 degrees C and the rate of GR reduction from low to high temperature, indicating an association across cultivars between heat tolerance in carbon utilization during seed germination and heat tolerance in growth of the autotrophic plant. The common mechanism underlying the variation among cultivars in heat tolerance at both stages could be in catabolic processes affecting carbon use efficiency. [References: 13].


Alcohol- and cytosolic aldolases were purified from green leaves of barley (Hordeum vulgare L. cv. Salome) to almost homogeneity on DEAE- Fractogel, P-Cellulose and Fractogel AX 300 (HPCL). The two homotetrameric aldolases have molecular masses of the subunits of 29 and 38 KDa respectively, and Km(FBP) values of 10 mu M and 2 mu M.
respectively. Both enzymes were extremely unstable. Loss of activity could partly be prevented by the addition of the protease inhibitors leupeptin or PMSF. In white leaf tissue of the plastome mutant <i>chlA</i> the activity of the plastidic isoenzyme is strongly reduced while the activity of the cytosolic isoenzyme was little affected. Western and Northern blot analyses indicated a strong reduction in protein content and in mRNA level of the plastidic but not of the cytosolic aldolase. The protein content and mRNA level of the cytosolic aldolase were similar in white and green leaf tissue. The results support the hypothesis that a plastidic signal causes the repression of the nuclear-encoded plastidic aldolase on a transcriptional level but does not affect the expression of the cytosolic aldolase. [References: 30].

332 Bruix, M.; Jimenez, M.A.; Santoro, J.; Gonzalez, C.; Colilla, F.J.; Mendez, E.; Rico, M. (1993) Solution structure of gamma-1-H and gamma-1-P thiomics from barley and wheat endosperm determined by 1H-NMR: a structural motif common to toxic arthropod proteins. *Biochemistry (USA)* 32(2): p. 715-724. References. *AGRICIS 94-118067*. The complete assignment of the proton NMR spectra of the homologous gamma 1-hordeinol and gamma 1-epoxide (47 amino acids, 4 disulfide bonds) from barley and wheat, respectively, has been performed by two-dimensional sequence-specific methods. A total of 299 proton-proton distance constraints for gamma 1-H and 285 for gamma 1-P derived from NOEGER spectra have been used to calculate the three-dimensional solution structures. Initial structures have been generated by distance geometry methods and further refined by dynamical simulated annealing calculations. Both proteins show identical secondary and tertiary structure with a well-defined tripeptide antiparallel beta-sheet (residues 1-3, 31-34, and 39-47), an alpha-helix (residues 16-28), and the corresponding connecting loops. Three disulfide bridges are located in the hydrophobic core holding together the alpha-helix and the beta-sheet and forming a cysteine-stabilized alpha-helical (C) moiety. Moreover, a clustering of positive charges is observed on the face of the beta-sheet opposite to the helix. The three-dimensional structures of the gamma-thionins differ remarkably from plant alpha- and beta-thionins and crombin. However, they show a higher structural analogy with scorpion toxins and insect defensins which also present the C motif.


Antioxidant enzyme activities are inductive of oxidative stress and decrease during senescence. To determine if the age-dependent decrease of superoxide dismutase (SOD) activities is due to decreased sensitivity to oxidative stress, we have investigated the changes in steady-state levels of transcripts and activities of mitochondrial Mn-SOD (SOD1), chloroplastic Fe-SOD (SOD2), and cytoplasmic Cu-Zn-SOD (SOD3) in young and mature-senescent barley leaves (Hordeum vulgare L.) in response to incubation in darkness, growth light (20 W m-2), and photoinhibitive stress conditions (100 W m-2) with 21 or 100% O-2. For a comparison, changes in the mRNA for ribulose biphosphate carboxylase were also measured. After leaf detachment, the abundance of all three son mRNAs increased, then decreased and eventually stabilized after 6 h of incubation. After 20 h of incubation under darkness SOD transcripts decreased in both young and mature-senescent leaves. While under strong photoinhibitive stress the decreases in the three SOD transcripts significantly increased in young leaves; in mature-senescent leaves SOD2 and, to lesser extent SOD1 and SOD3 transcripts decreased. Generally, SOD activity changes were similar to those of mRNAs. It is proposed that oxidative damage during senescence could be favored by the inability of senescing leaves to modulate the steady-state level of SOD mRNA, and probably those of other antioxidant enzymes, concomitant with the rate of extracellular formation. [References: 33].


Many difficulties exist in studying rhizosphere carbon flows in situ because of limited methodologies. Current photosynthesis allocation to root respiration, rhizosphere microbial respiration and soluble root exudates in the rhizospheres of winter wheat (Triticum aestivum L.) T. turgidum (Festuca rubra L. and Schreb.) and buffalo gourd (Cucurbita foetidissima HBK) were investigated using an isotopic trapping procedure. Plants were grown in containers with 165 g of sandy clay loam soil for 3 wk before the time of C-14 pulse labeling. Most root exudates were utilized by the microbes in the immediate rhizosphere and released as (CO2)-C-14. Only a small amount of exudates was found in the bulk soil (2.7, 2.5, and 3.7% in the control treatments of wheat, tall fescue, and buffalo gourd respectively). The isotopic trapping mechanism was valid for all three species even though the patterns of total rhizosphere respiration (measured as total (CO2)-C-14 rates during the initial 8 h of tracing for the three plant species were different in peak time and peak height. The isotopic trapping procedure can be used in rhizosphere studies for various plant species in principle. Some modifications to the procedure may be needed for different plant-soil systems. [References: 25].


Wheat, rye, and barley prolamins were separated using optimized elution conditions by cation exchange FPLC on an analytical Mono-S column. Wheat gliadins were resolved into a larger number of peaks than has been obtained hitherto. Most fractions contained a mixture of components that were determined by SD-SDS-PAGE and A-PAGE. At least one fraction was obtained for each group of gliadins that contains only one major component with minimal contamination by other components. Only omega-gliadins occurred in five of the fractions. A preparative S-Sepharose Fast Flow column, run under similar chromatographic conditions, was used to isolate omega-gliadins. This procedure could be used as the first step for the purification of individual gliadin components. Chromatography on the Mono-S column was highly reproducible and showed promise as a means of differentiating wheat cultivars. Furthermore, FPLC was applied to fractionate prolamins from barley and rye. [References: 19].


Abscisic acid (ABA)-induced foliar senescence was examined using detached leaf segments of light-grown Hordeum vulgare L. cv. Dyan seedlings, incubated with or without exogenous ABA in either total darkness or under continuous illumination. In darkness, the chlorophyll (Chl) content declined rapidly. ABA levels increased sharply whereas carotenoid levels were sustained, and declined gradually during the course of senescence. By comparison, untreated leaf segments exposed to continuous illumination displayed enhanced loss of Chl and carotenoids and slower rates of ABA accumulation. In response to exogenous ABA, Chl and carotenoid content of light-incubated leaf segments declined markedly and the rate of decline increased with an increase in exogenous ABA concentration. In dark-incubated leaf segments, exogenous ABA, in the range 0.1-100 mM, had little or no significant effect on the rate of Chl loss, and calculation of the Chl: carotenoid ratio revealed that dark-incubated leaf segments were insensitive to exogenous ABA. At 1 mM ABA, Chl loss was delayed. It is proposed that the inability of exogenous ABA to accelerate Chl breakdown in dark-incubated leaves was caused by a transient accumulation of carotenoids, and in particular xanthophylls, possibly related to the rapid elevation in endogenous ABA levels. Furthermore, it is suggested that retardation of carotenoid breakdown is a

The light-assembly of light-harvesting complex (LHC II) has been followed during the biogenesis of the plastid. Seedlings grown in intermittent light (IML) accumulate only small amounts of chlorophyll b. The major LHC II apoproteins are present; however, the apoprotein reveals of the major LHC II complex, LHC IIB, are severely depresed after exposure to IML. The levels of all LHC II apoproteins increase rapidly upon exposure to continuous illumination. The 25-kD, type 3 LHC IIB subunit appears to be more abundant during the early hours of greening in relation to its level in mature thylakoids. The LHC IIB apoproteins are initially associated with pigments to form monomeric pigment-protein complexes. The abundance of monomeric LHC IIB complexes gradually decreases during exposure to continuous light and a concomitant increase occurs in the amount of the trimeric and higher-order oligomeric forms. Pulse-chase experiments verify that labeled LHC IIB monomeric complexes are intermediates in the formation of trimeric and higher-order oligomeric LHC IIB-pigmented complexes. Therefore, the assembly of LHC II occurs via the initial pigmentation of the apoproteins to form monomeric complexes and proceeds in a sequential manner. [References: 67].


Photosystem I (PSI) holocomplexes were fractionated to study the organization of the light-harvesting complex I (LHC I) pigment-proteins in barley (Hordeum vulgare) plastids. LHC Ia and LHC Ib can be isolated as oligomeric, presumably trimERIC, pigment-protein complex. The LHC Ia oligomeric complex contains both the 24- and 21.5-kD apoproteins encoded by the Lhca3 and Lhca2 genes and is slightly larger than the oligomeric LHC Ib complex containing the Lhca1 and Lhca4 gene products of 21 and 20 kD. The synthesis and assembly of LHC I during light-driven development of intermittent light-grown plants occurs rapidly upon exposure to continuous illumination. Complete PSI complexes are detected by non-denaturing Deriphat (dissodium N-dodecyl-beta-mimonidopropionate-160)-PAGE after 2 h of illumination, and their appearance correlates with that of the 730- to 740-nm emission characteristic of assembled LHC I. However, the majorities of the newly synthesized LHC I apoproteins are present as monomeric complexes in the thylakoids during the early hours of greening. We propose that during development of the photochloroplast the LHC I apoproteins are first assembled into monomeric pigment complexes that then aggregate into trimers before becoming attached to the pre-existing core complex to form a complete PSI holocomplex. [References: 42].


A simple and rapid method was developed separating phosphoserine, phosphothreonine, phosphoyscine, phosphoric acid, and ATP by one-dimensional cellulose thin-layer chromatography, using a freshly prepared solvent system of 1-butanol-formic acid-water (5:2:1). This system was applied to determine phosphoamino acid (phosphoserine) of wheat elongation factor I beta phosphorylated by casein kinase II from the wheat embryo. [References: 9].

341. El Faham, S.Y.; Saleh, A.I.; Abd El Haleem, A.K. (National Research Centre, Cairo (Egypt)). Food Technology Dept. (1994) THE CHEMICAL COMPOSITION OF WHEAT GRAINS AS AFFECTED BY NITROGEN AND POTASSIUM FERTILIZERS AND WATER REGIME. *Monatufya Journal of Agriculture Research* (Egypt) ; v.19(1) p. 17-34. 2 ill. 5 tables; 27 ref. English. [AGRS 94-107758].


Thionin are low-molecular-weight proteins (Mr ca. 5000) occurring in seeds, stems, roots and leaves of a number of plant species. The different members of this family of plant proteins show both sequence and structural homology, and are toxic to bacteria, fungi, yeasts and various naked cells in vitro. Toxicity requires an electrostatic interaction of the positively charged thionin with the negatively charged phospholipids in the cell membrane, followed by either pore formation or a specific interaction with a certain lipid domain. This domain might be composed of phospholipids, which mediate transduction of environmental signals in eukaryotes. In vitro toxicity to plant pathogenic bacteria and fungi could reflect a direct role in plant defence, although, in view of the many divergent activities displayed by thionin both in vitro and in vivo, a biological role other than inhibition of microbial growth is equally plausible. [References: 104].


The plant growth substance jasmon acid and its methyl ester (JA-Me) induce a set of proteins (jasmonate-induced proteins, JIPs) when applied to leaf segments of barley (Hordeum vulgare L. cv. Salome). Most of these JIPs could be localized within different cell compartments by using a combination of biochemical and histo chemical methods. Isolation and purification of various cell organelles of barley mesophyll cells, the separation of their proteins by one-dimensional polyacrylamide gel electrophoresis and the identification of the major abundant JIPs by Western blot analysis, as well as the immunogold labelling of JIPs in ultrathin sections were performed to localize JIPs intracellularly. JIP-23 was found to be in vacuoles, peroxisomes, and in the granular parts of the nucleus as well as within the cytoplasm; JIP-37 was detected in vacuoles and in the nucleoplasm; JIP-66 is a cytosolic protein. Some less abundant JIPs were also localized within different cell compartments: JIP-100 was found within the stromal fraction of chloroplasts; JIP-70 is present in the peroxisome and the nucleus; JIP-50 and JIP-6 accumulate in vacuoles. The location of JIP-66 and JIP-6 confirms their possible physiological role deduced from molecular analysis of their cDNA. [References: 57].

344. Horak, O. (Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria)); Herger, P.; Benecka, E. (1993) [Studies about transfer of some trace elements in winter wheat]. Untersuchungen zum Transfer einiger Spurenelemente in Winterweizen. 105. VDLUFA-Kongress; Hamburg (Germany); 20-23 Sep 1993. [Quality and hygine of foods in production and processing]. VDLUFA, Darmstadt (Germany). VDLUFA Schriftenreihe (Germany); no. 37 p. 721-724. VDLUFA. 2 ill., 2 tables; 5 ref. German. [AGRS 94-107846].


346. Jackson, GD.; Berg, RK.; Kushnak, GD.; Blake, TK.; Yarrow, GL. (1994) NITROGEN EFFECTS ON YIELD, BETA-GLUCAN CONTENT, AND OTHER QUALITY FACTORS OF OAT AND WAXY HULLESS BARLEY. *Communications in Soil Science and Plant Analysis*, 25(17-18):3047-3055. English. [WESTERN TRIANGLE AGR & RES CTR POB 1474 CONRAD, MT 59425 USA].

Oat (Avena sativa L.) and waxy hulless barley (Hordeum vulgare L.) are important sources of water soluble plant fiber (beta-glucan) needed in human diets to lower serum cholesterol. Recent studies have shown grain
beta-glucan content is influenced by soil type and environment, however, nitrogen (N) response data for oat and waxy barley is lacking. In this study, we evaluated N effects on grain beta-glucan content and yield; grain yield, protein content, and test weight; and total dry matter production and N utilization of oat and waxy barley. Rates of applied N were 0, 34, 67, and 101 kg N/ha at three field environments in central Montana during 1989 and 1990. Nitrogen increased all variables except test weight and beta-glucan content. Waxy barley grain yields fluctuated from 0.82 to 4.11 Mg/ha, beta-glucan content from 62 to 76 kg/g, and beta-glucan yields from 51 to 354 kg/ha. Oat yields ranged from 0.83 to 3.83 Mg/ha, beta-glucan content from 37 to 51 kg/g, and beta-glucan yields from 35 to 178 kg/ha. Oat beta-glucan content was positively related to grain protein content, and waxy barley beta-glucan content was positively related to test weight. beta-glucan content appeared more related to environmental factors other than N. [References: 19].


A modification of a published procedure has been developed to allow the estimation of ester-ether bridges involving hydroxycinnamic acids in unfragmented walls of grasses. The modified procedure involves the use of a soluble catalyst, chloroform-triphenylphosphate) rhodium, for the conversion of the propanoic to propionic sidechains, and lithium triethylborohydride for reduction of ester-linked propionic acids. The reaction conditions for hydrogenation are severe and tests with a synthetic feruloyl-arabinoxylan showed that significant cleavage of ester-linked hydroxycinnamic acid results. Nevertheless, it was shown that 40% of ether-linked ferulic acid in whole internode walls is involved in ester-ether bridges. If these values are corrected, based on the loss of feruloyl ester linkages during the hydrogenation reaction, the proportion of ester-ether-linked ferulic acid in the walls approaches 100%. On the other hand, the occurrence of ester-ether bridges through p-coumaric acid appears to be low. [References: 29].

349 Lim, U.K.; Lee, K.H. (Seoul National University, Suwon (Korea Republic). College of Agriculture and Life Sciences); Pei, U.M. (Doosan Technical Center, Yongin (Korea Republic)) (1993) Comparison of eleven cultivars of barley (Hordeum vulgare L) for SOD activity of seeds and seedlings. Journal of Agricultural Sciences-Seoul University (Korea Republic) v. 18(2) p. 119-126. 2 illus.; 3 tables; 53 ref. English. (AGRIS 94-107772).


Photosynthetic electron transport drives the carbon reduction cycle, the carbon oxidation cycle, and any alternative electron sinks such as nitrogen reduction. A chlorophyll fluorescence method allows estimation of the total electron transport rate while a gas-exchange-based method can provide estimates of the electron transport needed for the carbon reduction cycle and, if the CO2 partial pressure inside the chloroplast is accurately known, for the carbon oxidation cycle. The gas-exchange method cannot provide estimates of alternative electron sinks. Photosynthetic electron transport in flag leaves of wheat was estimated by the fluorescence method and gas-exchange method to determine the possible magnitude of alternative electron sinks. Under non-photorrespiratory conditions the two measures of electron transport were the same, ruling out substantial alternative electron sinks. Under photiorespiratory conditions the fluorescence-based electron transport rate could be accounted for by the carbon reduction and carbon oxidation cycle only if we assumed the CO2 partial pressure inside the chloroplasts to be lower than that in the intercellular spaces of the leaves. To further test for the presence of alternative electron sinks, carbon metabolism was inhibited by feeding glyceraldehyde. As carbon metabolism was inhibited, the electron transport was inhibited to the same degree. A small residual rate of electron transport was measured when carbon metabolism was completely inhibited which we take to be the maximum capacity of alternative electron sinks. Since the alternative sinks were small enough to ignore, the comparison of fluorescence and gas-exchange based methods for measuring the rate of electron transport could be used to estimate the mesophyll conductance to CO2 diffusion. The mesophyll conductance estimated this way fell as wheat flag leaves senesced. The age-related decline in photosynthesis may be attributed in part to the reduction of mesophyll conductance to CO2 diffusion and in part to the estimated decline of ribulose 1, 5-bisphosphate carboxylase amount. [References: 18].

351 Ma, BL; Dwyer, LM; Smith, DL. (1994) EVALUATION OF PEDUNCLE PERFUSION FOR IN VIVO STUDIES OF CARBON AND NITROGEN DISTRIBUTION IN CEREAL CROPS. Crop Science. 34(6):1584-1588. English. [AGR CANADA RES BRANCH CLARKR CENT EXPTL FARM OTTAWA X1A 0C6 CANADA].

Peduncle perfusion, a recently developed technique for delivery of N solution into hollow-stemmed crops, may be useful for various studies of nutrient allocation within the plant. The objectives of this study were to assess whether peduncle perfusion was suitable for in vivo studies of N and/or C distribution in cereal crops and to determine how N, growth regulator, or sucrose solutions altered C and N accumulation and partitioning in barley (Hordeum vulgare L) and wheat (Triticum aestivum L. emend. Thell.). Ten treatments [25 and 50 mM N, 30 mM M chloride (2-chloroethyl)-N, N, N-trimethyl ammonium chloride], 15 mM M ethephon [2-(chloroethyl)phosphonic acid]. N + chloride or ethephon, ethephon, diethylamino + N, 250 mM sucrose, distilled water and non-perfusion] were evaluated in four greenhouse experiments (two for barley, two for wheat). Treatments containing N were enriched with 5% atom N-15. Perfusion lasted 30 d beginning 5 to 8 d after spike emergence. The total volume of solution taken up ranged from 30 to 178 mL for barley, and 8 to 129 mL for wheat. The N-15 tracer showed that peduncle-perfused N was transported and incorporated into all plant tissues. Applying N increased grain N concentration an average of 9.5 kg kg(-1) for barley and 18.1 g kg(-1) for wheat with levels as high as 36 and 55 g kg(-1), respectively. Nitrogen levels in flag leaves and non-grain tissues of the spike were two- to eightfold higher in N perfused plants. Perfusion with sucrose or growth regulators did not affect C or N content in grain or non-grain tissues. The data indicate that peduncle perfusion delivers substances in solution into both barley and wheat plants. Nitrogen supplied after spike emergence can substantially increase grain N accumulation without restricting C deposition. [References: 20].


High initial NH4+ depletion rates were measured immediately after exposure of N-free grown and NH4+-induced barley to NH4+. We provide evidence that this rapid initial NH4+ depletion was due primarily to the filling of the Apparent Free Space of the root cell wall. The high initial depletion rates depended on the NH4+ concentration of the uptake solution and on the degree of prior NH4+ saturation of the Apparent Free Space. N-free grown barley seedlings were able to take up NH4+-constitutively with a V-max of 3.7 mmol (g root FW) (-1) h(-1) and a k-5 of 153 mmol m. However, an induction of NH4+ uptake by the NH4+ reserves of the grain (105 molne per dry grain; 74% of which was stored in the dormant seed) during early germination cannot be excluded. Exposure of N-free grown seedlings to external NH4+ (< 1 mM) resulted in an induction of NH4+ uptake after a 80 min lag; the rates were higher (V-max = 6-8.3 mmol g root FW) (-1) h(-1)) than the constitutive rates, but k-5 remained unchanged (154 to 166 mmol M after induction and 153 mmol M prior to induction). This indicates that the same NH4+ uptake system (low-capacity uptake system) was operating in N-free and NH4+-induced barley and that during induction the amount of transport proteins was increased. A linear uptake component (high-capacity system) was measured at high external (> 1 mM) NH4+ concentrations with NH4+-induced and N-free grown plants. The steady-state rates were about 10-
fold higher than that of the low-capacity system although no additional protein synthesis was required. [References: 23].


Pyrophosphate-fructose-6-phosphate 1-phosphotransferase (PPF; EC 2.7.1.90) was purified 260-fold from leaves of etiolated barley seedlings. The purified enzyme consisted of two subunits, with apparent molecular masses of 65 (alpha) and 60 (beta) kDa. Polyclonal antibodies were raised against the denatured PPF protein eluted from an SDS-polyacrylamide gel. The antibodies recognized both denatured and native PPF. Western blots of crude extracts showed that the activity of PPF in barley leaves is correlated to the amount of PPF protein, and that both the alpha- and the beta-subunits are present in near stoichiometric amounts in all investigated tissues. The apparent molecular mass of the holoenzyme, as determined by gel filtration chromatography, was dependent on the presence of pyrophosphate. In absence of pyrophosphate, barley PPF elutes as a heterotetramer whereas it elutes as a heteroctomer in the presence of 20 mM pyrophosphate. Pure PPF obtained by gel filtration chromatography in the presence of 20 mM pyrophosphate reached a specific activity of 28 U mg(-1). Barley PPF was characterized with respect to kinetic properties in the forward direction (use of PPI) and in the reverse direction (formation of PPI). The affinity for the activator Pfr-2, 6-P-2 was very high, with an estimated K-s of 2.8 nM when PPF activity was assayed in the forward direction. [References: 30].


Extracts of endosperm of developing grains of Triticeum aestivum (cv Mavis Huntman) were analysed by GC-MS and found to contain a previously known synthetic compound, 1 beta-hydroxyGA(5), now named GA(92). The structure of a new GA metabolite, 2 beta-hydroxyGA(60), was confirmed by comparison with a synthetic sample prepared in nine steps from GA(3) methyl ester and assigned the trivial name GA(91). [References: 14].


Highly purified plasma membranes were isolated by aqueous two-phase partitioning from wheat roots. The superoxide generation was studied by EPR technique with Tiron as the spin trap. Ca2+-calmodulin could stimulate the TH signal, while SOD and several calmodulin antagonists, La3+ , EGTA and CPZ could inhibit the TH signal. Stimulation of TH signal by Ca2+-calmodulin was dependent on NADD and calmodulin. The above results provided direct evidence for the connection of calmodulin to the redox system of plasma membranes. Similarly, catalase and KCN could also inhibit TH signal. No stimulation of superoxide production was observed when Ca2+ and calmodulin were added separately. NADPH could not elicit TH signal in the study of the stimulation of superoxide by Ca2+-calmodulin. Triton X-100 (0.05%) could not cause a significant increase in TH signal. [References: 22].


The rates of incorporation of various metabolites into starch by isolated amyloplasts from developing endosperm of spring wheat (Triticum aestivum L. cv. Axona) were examined. Of the metabolites tested that were likely to be present in the cytosol at concentrations sufficient to sustain starch synthesis, only glucose-1-phosphate (Glc1P) supported physiologically relevant rates of starch synthesis. Incorporation of Glc1P into starch was both dependent on the presence of ATP and intact organelles. The rate of incorporation of hexose into starch became saturated at a Glc1P concentration of less than 1 mol m(-3) in the presence of 1 mol m(-3) ATP. Starch synthesis from 5 mol m(-3) ADP-glucose supplied to the organelles occurred at rates 15-fold higher than from similar concentrations of Glc1P, but it is argued that this is probably of little physiological relevance. The net incorporation of hexose units into starch from Glc1P was inhibited 50% by 100 mmol.m(-3) carboxyatroctylsride. Carbohydrate oxidation in the amyloplast was stimulated by the addition of 2-oxoglutarate and glutamine, and in such circumstances incorporation of C(14)-labelled metabolites into starch was reduced. It is suggested that the 6-phosphate of glucose-1-phosphate is oxidised by oxidative pentose phosphate pathways rather than Glc1P. Our results suggest that Glc1P is the primary substrate for starch synthesis in developing wheat endosperm, and that ATP required for starch synthesis is imported via an adenylate translocator. [References: 23].


Resting seeds of several plant species, including barley grains, have been reported to contain aspartic proteinase (EC 3.4.23) activity. Here, the expression of the Hordeum vulgare L. aspartic proteinase (HvAP) was studied in developing and germinating grains by activity measurements as well as by immunocytological and in-situ hybridization techniques. Southern blotting suggests the presence of one to two HvAP-encoding genes in the barley genome, while Northern analysis reveals a single 21-kb mRNA in grains and vegetative tissues. Western blotting with antibodies to HvAP shows the same subunit structure in different grain parts. In developing grains, HvAP is produced in the embryo, aleurone layer, testa and pericarp, but in the starchy endosperm HvAP is present only in the crushed and depleted area adjacent to the scutellum. During seed maturation, HvAP-encoding mRNA remains in the aleurone layer and in the embryo, but the enzyme disappears from the aleurone cells. The enzyme, however, remains in the degenerating tissues of the testa and pericarp as well as in resting embryo and scutellum. During the first three days of germination, the enzyme reappears in the aleurone layer cells but is not secreted into the starchy endosperm. The HvAP is also expressed in the flowers, stem, leaves, and roots of barley. The wide localization of HvAP in diverse tissues suggests that it may have several functions appropriate to the needs of different tissues. [References: 55].


361 Vanbeekum, JMM.; Wang, M. (1994) EFFECT OF SHORT CHAIN FATTY ACIDS ON PHYSIOLOGY OF BARLEY GRAINS CV. TRIUMPH WITH A DIFFERENT LEVEL OF DOMANCY. Plant Science
There have been few studies conducted with the objective of investigating comprehensively the greenhouse effect on wheat growth using field-grown crops and even less on the effects on the lipid composition of harvested grains. Therefore, the aim of this study was to define any changes in wheat grain acyl lipids which could result from alterations in environmental growth conditions predicted to mimic the greenhouse effect. Quantitative changes were recorded for both the non-starch and starch lipids. When supplied with low concentrations of nitrogen fertilizer, plants showed increased amounts of total grain lipids when grown under an elevated (700 μl CO₂) carbon dioxide atmosphere. Increasing the amount of CO₂ by 4 degrees C, however, reduced the total lipid content of grains. Wheat plants treated with high concentrations of nitrogen fertilizer accumulated less lipid compared to low nitrogen controls. Qualitative changes were also observed in the proportions of non-starch and starch lipids classes. However, changes in total acyl composition were limited to starch grain acyl lipids, as a result of changes in atmospheric carbon dioxide, growth temperature and nitrogen fertilizer application. The alterations in wheat lipids observed are likely to affect the properties of the flour produced from the grains. [References: 32].


365 Zoric, D. (Faculty of Agriculture, Belgrade (Yugoslavia)) (1993) Structure and relationships between protein fractions in the grain of Yugoslav high-yielding wheat cultivars. Review of research work at the Faculty of Agriculture (Yugoslavia) v. 38(1) p. 61-66. 5 tables, 13 ref. English. (AGRIS 94-107759).

The paper presents the investigation result of total wheat proteins, amounts of certain protein fractions and their relative relationships in the content of major protein groups (albumins, globulins, gliadins, glutelins) in the grain of high-yielding wheat cultivars sown at various locations. It also presents the effects of agroecological conditions on the relationships between protein fractions in dependence on the cultivars grown under uniform and controlled environment. The following cultivars were studied: Partzanka, Novosadska Rana-2, Krajvejevca-56, Krajvejevca-56, Krajinka, Zalma Dojna, Balkan, Orasanka, Posavka-2, Bezojasta.

E51 PLANT PHYSIOLOGY-NUTRITION


This study was conducted to characterize soft red winter wheat (Triticum aestivum L.) cultivars for nitrogen (N) utilization efficiency and to determine which traits were most affected and the predictive value of these traits. Grain yield, number of spikes per m², kernels/m², kernels/spike and 1,000 kernel weight (TKW) were measured at maturity. Data were collected for three growing seasons from field plots grown on a silt loam and one growing season on a sandy loam. Results indicated that N utilization efficiency was not associated with grain yield. Kernels/m² had the highest correlation with grain yield (r = 0.50) of the yield components. Kernels per spike had a correlation of 0.45 with grain yield. However, TKW was not correlated with grain yield. There was variation among cultivars as to how the yield components produced final grain yields. Path coefficients indicated a strong positive direct effect for kernels/spike on grain yield and N utilization efficiency. Kernels/spike was found to be the most effective trait to be used as a predictive value for grain yield and N utilization efficiency. [References: 20].


371 Loch, J. (Agrarwissenschaftliche Univ., Debrecen (Hungary)) (1993) [Effect of varying fertilizer on sulphur uptake of winter wheat]. Die Wirkung einer variieren Düngung auf die Schwebefallaufnahme von Winterweizen. 105. VDLUFA-Kongress; Hamburg (Germany); 20-25 Sep 1993. (Quality and hygiene of foods in production and processing). VDLUFA, Darmstadt (Germany). VDLUFA-Schriftenreihe (Germany); no. 37 p. 87-90. VDLUFA. 3 ill., 1 table; ref. German. (AGRIS 94-108472).


Yield losses due to boron deficiency are becoming common in the warmer subtropical regions into which wheat has been expanding. This study evaluated the B response of two wheat (Triticum aestivum) genotypes (SW41 and Sonora 64) in Chiang Mai, Thailand. A sand culture experiment imposed six B levels in nutrient solution (0, 0.1, 0.2, 0.5, 1.0 and 10 mM B). A series of field experiments in a sandy loam (Typic Ustossol) under rainfed conditions imposed four levels of borax application (0.0, 0.5, 1.0, and 2 kg B ha(-1)) over three successive years. In sand culture, B deficiency depressed the number of grains per spikelet in both genotypes (more strongly in SW41 than in Sonora 64). At 0 mM B, SW41 had no grain in any spikelet. In the field, B deficiency depressed grain number and grain yield of SW41 but not Sonora 64. Flag leaf B at boot stage of both genotypes grown in sand culture was closely related to the number of grains per spikelet at maturity; the critical level was determined to be 3 mg B kg(-1). For field-grown plants, the data suggest that, at the boot stage, flag leaf B concentrations of <5 mg kg(-1) are deficient, and >7 are sufficient. Boron deficiency can depress wheat yield through grain set failure, but susceptibility to B deficiency varies with genotype. Sensitivity to B deficiency should be included as a criterion for breeding programs for low-B soils. [References: 24].


Wheat (Triticum aestivum L. cv. 9733) seedling (10 day) root length was decreased 60% when plants were watered with 0.01M sodium acetate (NaAc) pH 4.5 in comparison to plants exposed to the same NaAc concentration at pH 6.0. 3-indoleacetic acid (IAA) (10(-6) and 10(-9)M) (incorporated into the sand potting medium) reversed the excess hydrogen ions (H+) influence. [References: 5].


F62 PLANT PHYSIOLOGY-GROWTH AND DEVELOPMENT


Tillering is important in establishing the yield potential of spring barley (Hordeum vulgare L.). Two field experiments were conducted for 3 yr to test if early season shifts in the red/far-red ratio (R/R) modulate barley tillering patterns. Experiments were designed to determine (i) the extent to which shifts in light quality associated with the presence of neighboring plants modulate barley tillering patterns in the absence of shading and competition for soil resources, (ii) barley responses to sudden changes in light quality during the tillering phase, (iii) the influence of plant spacing on response to shifts in light quality, and (iv) the impact of the response to shifts in light quality on productivity. Plants within treatment rows were grown 18 cm from densely sown border rows of barley. Barners set into the soil assured negligible competition between border and treatment rows for soil resources during the early growing season. The borders functioned to reflect light, especially far-red (FR), which reduced R/R within the treatment rows without shading them. Tillering production was reduced in bordered plants relative to unbordered controls. The removal of borders at 20 d after emergence (DAE) caused an increase in treatment row tiller production, whereas the imposition of borders at 20 DAE halted tillering. Shoot survival was increased by the presence of borders. Border effects on final spike number, biomass production, and grain yield per plant were inconsistent during the experiments. We conclude that early season shifts in light quality associated with FR reflection from
neighbors plants contribute to modulating barley tillering under field conditions. [References: 26].


Vegetation evaporation ratio was here defined as the ratio of actual vegetation evaporation rate to potential vegetation evaporation rate. The accuracies of 5 different yield formulae based upon 5 different ways of combining vegetation evaporation ratio simulated for the different growth stages of wheat were compared. Additive, multiplicative and exponential combination methods were tested on wheat grown under 29 different water stress treatments. The multiplicative model proved most accurate, closely followed by the additive and exponential models and a model utilizing a single vegetation evaporation ratio for the entire season, in that order. Mean absolute errors ranged from 9 to 12% of the mean of the measured values. This accuracy is acceptable for decision support purposes. [References: 26].

381 Delgado, E; Mitchell, RAC; Parry, MAJ; Driscoll, SP; Mitchell, VJ; Lawlor, DW. (1994) INTERACTING EFFECTS OF CO2 CONCENTRATION, TEMPERATURE AND NITROGEN SUPPLY ON THE PHOTOSYNTHESIS AND COMPOSITION OF WINTER WHEAT LEAVES. Plant Cell & Environment. 17(11):1205-1213. English. [AFRC INST ARABLE CROPS RES DEPT BIOCHEM & PHYSIOL ROTHAMSSTD EXPT STN HARPENDEN AL5 2QJ HERTS ENGLAND].

Winter wheat (Triticum aestivum L.) (cv. Merida) was grown at two different atmospheric CO2 concentrations (350 and 700 µmol mol(-1)) two temperatures [ambient temperature (i.e. tracking the open air) and ambient +4 degrees C] and two rates of nitrogen supply (equivalent to 489 kg ha(-1) and 87 kg ha(-1)). Leaves grown at 700 µmol mol(-1) CO2 had slightly greater photosynthetic capacity (10% mean increase over the experiment) than those grown at ambient CO2 concentration, but there were no differences in carboxylation efficiency or apparent quantum yield. The amounts of chlorophyll, soluble protein and ribulose-1, 5-bisphosphate carboxylase/oxygenase (Rubisco) per unit leaf area did not change with long-term exposure to elevated CO2 concentration. Thus winter wheat, grown under simulated field conditions, for which total biomass was large compared to normal field production, did not experience loss of components of the photosynthetic system or loss of photosynthetic competence with elevated CO2 concentration. However, nitrogen supply and temperature had large effects on photosynthetic characteristics but did not interact with elevated CO2 concentration. Nitrogen deficiency resulted in decreases in the contents of protein, including Rubisco, and chlorophyll, and decreased photosynthetic capacity and carboxylation efficiency. An increase in temperature also reduced these components and shortened the effective life of the leaves, reducing the duration of high photosynthetic capacity. [References: 35].


Final grain dry weight, a component of yield in spring wheat, is determined by the rate and duration of grain filling. The objective of this study was to compare grain dry weight and rate and duration of grain filling amongst five spring wheat genotypes (Triticum aestivum L.) that differed in time to maturity. Glenlea, Katepwa, PT516, Roblin, and Wildcat were sown in replicated trials on four seeding dates in 1988 and 1989 at Winnipeg, Manitoba. Mean grain dry weight was measured at various intervals from anthesis to maturity. A logistic equation was used to characterize grain filling and estimate final grain dry weight, and the duration and maximum rate of grain filling. Stepwise multivariate analysis indicated that final grain dry weight was the most important variable characterizing the grain filling curves, followed by duration and then maximum rate of grain filling. The highest grain dry weights were produced by Glenlea (40.4 mg) and Wildcat (36.9 mg). Roblin (34.9 mg) was intermediate in grain dry weight while Katepwa (32.4 mg) and PT516 (30.3 mg) produced the smallest grains. Genotypes with the highest grain dry weights had shorter durations and higher maximum rates of grain filling. [References: 27].


Understanding effects of environmental factors on crop phenological development is useful for predicting crop growth stages and scheduling management practices. We evaluated the effect of salinity on the rate of leaf appearance and the duration of critical stages of growth in wheat (Triticum aestivum L.) in terms of both thermal unit (TU) degrees C day and phyllochron intervals. Two hard red spring wheat cultivars, Yecora Rojo and ANCO 92, were grown in two controlled growths in greenhouse sand culture and outdoor field lysimeters. In each case, two salinity treatments were compared with a non saline control. The sand cultures were irrigated with complete nutrient solutions to which NaCl and CaCl2 were added. The electrical conductivities, kappas (iw), were 2.0, 14.3, and 18.1 dS m(-1) in 1989 and 1.7, 12.2, and 15.1 dS m(-1) in 1990. The kappas (iw) for the field lysimeters were 0.9, 10.7, and 17.2 dS m(-1) in 1989 and 0.8, 11.4, and 17.1 dS m(-1) in 1990. Leaf appearance rate was determined by regressing the number of mainstem leaves against cumulative TU. In all treatments, the cultivars differed in both rate and duration of leaf appearance. The phyllochron increased with salinity. Leaves emerged more slowly in the greenhouse than in the field. Durations of the vegetative stages (degrees C day) from sowing to the initiation of the bag leaf and its subsequent appearance were relatively insensitive to salinity inasmuch as increases in leaf phyllochron (TU between the initiation of successive leaves on a culm) and leaf phyllochron were balanced by decreases in leaf number. However, for both cultivars, salinity significantly reduced the thermal time between sowing and the reproductive phenological stages. [References: 29].

384 Huang, BR; Johnson, JW; Nesmith, DS; Bridges, DC. (1994) ROOT AND SHOOT GROWTH OF WHEAT GENOTYPIES IN RESPONSE TO HYPOXIA AND SUBSEQUENT RESUMPTION OF AERATION. Crop Science. 34(6):1534-1544. English. [UNIV GEORGIA DEPT CROP & SOIL SCI GEORGIA STN CRFFIN, GA 30223 USA].

Understanding plant responses to hypoxia and subsequent resumption of aerated conditions for breeding tolerant genotypes. The growth response of six wheat genotypes (Triticum aestivum L.) to hypoxia and subsequent recovery was evaluated. Plants were grown for 14 and 21 d in nutrient solutions flushed with air (aerated control) or with a mixture of O2 and N2 (hypoxia) or hypoxia for 14 d followed by aerated for 7 d (recovery). Shoot and root growth was inhibited by hypoxia, with roots being more sensitive. Stomatal conductance (and) was reduced beginning 5 to 7 d after hypoxia. The converse effect of hypoxia was most severe for Bayles and FL302, intermediate for BR34 and Coker-9766, and least for Gore and Savannah. Hypoxia enhanced formation of aerenchyma in roots, to a greater extent for Gore and Savannah. Aerenchyma became more conspicuous with duration of hypoxia. Seven days after resumption of aeration, shoot growth recovery completely for Gore and Savannah but only partially for Bayles, FL302, BR34, and Coker-9766. The number and length of crown roots increased to the value of the controls for all genotypes, whereas seminal root length was restored only in Bayles, Gore, and Savannah. Stomatal conductance recovered within 5 d for Savannah and 10 d for Gore but never recovered for Bayles, FL302, BR34, and Coker-9766. Breeding for hypoxia tolerance could be facilitated by selecting genotypes that develop more crown roots and more aerenchyma in those roots, maintain stomatal opening under hypoxic conditions, and resume seminal root growth and opening of stomata after termination of hypoxia. [References: 33].


Barley (Hordeum vulgare L. cv. Digger) was grown for 22 d in enclosed chambers with a CO2 enrichment of 35, 155, 400 or 675 µmol CO2 mol(-1). CO2 enrichment increased photosynthetic capacity in the plants grown at either of the two highest levels of pCO2. A CO2 enrichment of 675 µmol CO2 caused a significant increment of shoot dry weight, whereas no changes were observed in fresh weight, chlorophyll or protein levels. At a
light intensity of 860 mol μmol (m-2) s-1 CO2 enrichment caused photosynthetic capacity to increase by 250%, whereas no effect was observed at 800 mol μmol (m-2) s-1. Over time, photosynthesis decreased by 70% independent of CO2. A time-dependent increase in the level of extractable fructose was observed whereas total extractable carbohydrate only changed slightly. [References: 20].


Water stress effects on accumulation of dry matter, carbon and nitrogen in grains were analysed in varieties and species of wheat differing in yield stability. Variable water environments were generated using a line source sprinkler system. Although large fluctuations occurred in the water potentials of the flag leaf and ear, grain growth remained relatively buffered under moisture stress. Developing grains were at a lower moisture level throughout grain growth in plants subjected to moisture stress relative to the unstressed plants. Carbon content decreased more than the nitrogen content in the stressed grains of the species and varieties. Reduction in the duration of grain growth and the rate of dry weight accumulation induced by water stress was more prominent in T. aestivum var. C306 and S. phaeococcum. Grain yield was reduced significantly under water stress, the maximum being in the high yielding cultivar HD2329 Both grain number and grain weight were reduced in response to stress. The reduction being different in different genotypes. [References: 26].


A field experiment was conducted during the winter season (December to April) of 1990-91 and 1991-92 on reclaimed sodic soils to study the effect of irrigation and nitrogen on growth, yield and water-use efficiency of wheat (Triticum aestivum L. emend. Fion and Paul.). The irrigated treatments were superior to the unirrigated one in respect of growth (crop-growth rate and leaf-area duration), yield attributes, yield, harvest index and water-use efficiency. Frequent irrigations at 1.2 IW : CPE ratio (4) gave significantly higher spike length, 1.000 grain weight and grain yield. However, the water-use efficiency was maximum at 0.6 IW : CPE ratio. N 180 kg N/ha resulted in higher growth (crop-growth rate and leaf-area duration), yield attributes and grain yield. The optimum economic dose of N was 156 kg/ha with an expected grain yield of 2.933 kg/ha. Increasing N levels positively influenced the water-use efficiency, maximum being 9.21 kg/ha/m3 at 180 kg N/ha.


Low soil water potential and low or high root temperatures are important stresses affecting carbon allocation in plants. This study examines the effects of these stresses on carbon allocation from the perspective of whole plant mass balance. Sixteen-day old spring wheat seedlings were placed in a growth room under precisely controlled root temperatures and soil water potentials. Five soil water potential treatments were used: -0.03 MPa to -0.25 MPa, and six root temperature treatments, from 12 to 32 degrees C were used. A mathematical model based on mass balance considerations was used, in combination with experimental measurements of rates of net photosynthesis, leaf area, and shoot/root dry masses to determine photosynthetic allocation between shoot and root. Partitioning of photosynthesates to roots was the lowest at 22-27 degrees C root temperature regardless soil water potential, and increased at both lower and higher root temperatures. Partitioning of photosynthesates to the roots increased with decreasing soil water potential. Under the most favourable conditions, i.e. at -0.03 MPa soil water potential and 27 degrees C root temperature, the largest fraction, 57%. of photosynthesates was allocated to the shoots. Under the most stressed conditions, i.e. at -0.25 MPa soil water potential and 32 degrees C root temperature, the largest fraction, more than 80%, of photosynthesates was allocated to roots. [References: 54].


Wheat (Triticum aestivum L. emend. Thell.) grain yields are highly dependent upon the number of spike-bearing tillers produced per plant. Salinity, drought, and other environmental stresses can greatly affect the development and viability of tillers. We determined the effects of soil salinity on the occurrence and rate of tiller development and the incidence of tiller abortion in spring wheat cultivars, Anza and Yecora Rojo. Plants were grown in Pachappa fine sandy loam soil (mixed, thermic, Mollic Haploxeralf) in outdoor lysimeters. Three salinity treatments were imposed by irrigating with waters containing equal weights of NaCl and CaCl2 (electrical conductivities of similar or equal to 1.12, or 16 cS(m-1)). Salinity significantly decreased the number of primary and secondary tillers in both cultivars. Soil water salinities greater than or equal to 7.5 dS(m-1) (mean electrical conductivity of the soil water in the rootzone during tiller development, kappasw) eliminated most of the secondary tillers and greatly reduced the number of T0, T3, and T4 tillers. However, the percentage of tillers producing spikes actually increased at kappasw (up to 8 dS(m-1)). Higher salinities reduced the percentage of tillers with spikes, but not as much as the reduction in tillers. Tiller and spike production per plant decreased about 0.13 to 0.15 organs for each unit increase in kappasw. Of all the potential tillers these cultivars can produce, the primary tillers on Leaves 1 and 2 (i.e., T1 and T2) were the least susceptible to salt stress, partly because they emerged before salinity builds up during the irrigation season. Adjusting planting densities to increase the number of anticipated spike-bearing culms per unit area could help to maintain yields on salt-affected soils. [References: 24].

The main focus of the paper is the comparison of the complex crop growth models AGROSIM-Wheat and CERES-Wheat both for winter wheat with regard to the model structure, the growth and development processes involved and the model accuracy. Data sets (1986/87, 1991/1992, irrigated and non-irrigated) of the two locations Muendberg and Hohenfinow (Federal State Brandenburg) are the base of the performance test. The results of the comparison are presented and discussed.


Field experiments were conducted with modern semidwarf spring wheat cultivars representing a range of yield potential in order to compare their adaptation to levels of interplant competition for resources. Levels of competition were altered, in both leaf canopy and underground, by manipulating rows of plants in eight-row yield plots. Competition for light was decreased by bending adjacent rows away from the central two rows thus permitting greater penetration of light to lower leaves of the central rows (light treatment). Reduced competition underground was realized, simultaneously with reduced competition for light, by uprooting the plants adjacent to the central two rows (root/light treatment). These treatments were implemented at the developmental stage of flag-leaf ligule emergence (FLLE), when interplant competition was assumed to become maximal. While the average yield responses were 25%, and 40% to the light and root/light treatments respectively, there was a significant interaction with genetic material. Low-yield-potential (LYP) lines responded more to reduced competition than high-yield-potential (HYP) lines suggesting that the greater efficiency of the HYP lines, reflected in their higher yield, is related to their better adaptation to interplant competition. Physiological bases for improved performance are examined and discussed in relation to ideas about crop ideotypes and possible implications to breeding. These data appear to support the idea that genes conferring yield potential through improved adaptation to the crop environment are associated with a less competitive phenotype. [References: 33].


The objective of this study was to test the root growth subroutine from the CERES-Wheat model during a growing season. The study involved observation and analysis of root growth and distribution throughout the growing season, and their simulation, using two wheat cultivars of different cycle length and two water regimes. The model accurately predicted crop development and yield, but overpredicted root depth by 90 cm at terminal spikelet and by 50 cm at booting, anthesis and grain filling period. In addition, the model underpredicted root mass, presumably because of the way it handles root shoot partitioning. There was good agreement between observed and simulated values of root length density and soil water content (R2 = 0.66 and 0.86, respectively).

The value of the specific root-length parameter in CERES-Wheat lies closer to data reported from a winter wheat crop experiment than to data from spring wheat reported in this and other studies. The model's ability to predict these attributes is discussed. [References: 32].


This study was conducted to test the hypothesis that photoperiod or its rate of change significantly affects the rate of leaf appearance (RLA) and final number of leaves (FNL) in wheat, as suggested from several time-of-sowing experiments. Two wheat cultivars (Condor and Thatcher) were grown in the field on 2 Sep. 1992 at Melbourne (38 degrees S). Photoperiod was extended artificially to give five treatments up to terminal spikelet initiation (TS) viz.: natural photoperiod (rate of change of photoperiod = 2 min dc(-1)), two faster rates of change (8.5 and 13.3 min dc(-1)) and two constant photoperiods of 14.0 and 15.5 h. After TS, the two constant photoperiods were extended to 15.0 and 16.5 h, respectively, and treatments were randomised. i.e. some plots received different photoperiod regimes before and after TS. The rate of leaf appearance maintained strong linear relationships with thermal time. It was greater for Condor [0.012-0.013 (degrees C dc(-1)) than for Thatcher [0.011-0.012 (degrees C dc(-1)] and did not alter during plant development or in response to the change in photoperiod at TS. Rate of leaf appearance on the main culm was not influenced by the rate of change of photoperiod nor by the average photoperiod. Cultivar and photoperiod significantly affected FNL on the main culm. Condor produced more leaves than Thatcher under long but not under short photoperiods. The rate of change of photoperiod did not affect FNL independently of the effect of average photoperiod. Most of the variation in FNL due to photoperiod resulted from differences in duration of leaf initiation. The lack of effects of the photoperiod treatments on RLA contrast with previous reports of its effects on the rate of phasic development from seedling emergence to double ridge. Therefore, the number of visible leaves on the main culm (NL) at double ridge and at TS were not constant. However, NL on the main culm at double ridge was closely correlated with FNL. [References: 64].


Postanthesis green area duration (GAD) has been associated frequently with yield. The senescence pattern of green organs is a major component of GAD. It has been proposed that delayed or accelerated senescence is strongly controlled by environmental conditions and the level of source or sink limitation on grain growth. In particular, it has been generally reported that the removal of reproductive structures delays the senescence process. However, results reporting this effect in wheat are not conclusive.

A field experiment was conducted at the experimental station of The University of Melbourne comprising a factorial combination of a semidwarf and a standard-height wheat, and two levels of sink strength At anthesis, 20 main shoots were tagged and detasselled. Ten days after anthesis all the spikelets from each side of 10 tagged ears were removed by hand. The experiment was performed under natural and 3 h-extended
photoperiods from seedling emergence to heading. The photoperiod treatments induced differing grain filling environments and differing plant characteristics at onset of grain filling. Green area senescence was similar for both sink size treatments at any combination of cultivar and grain filling condition, indicating that the dynamics of plant senescence was insensitive to a severe reduction in number of grains per spike. Therefore, GAD was not significantly affected by the reduction in sink strength. The number of grains per spike were reduced to ca. 50% due to trimming. Therefore, source-sink ratio was doubled, but no significant changes in individual grain weight were found. There was no relationship between GAD and individual grain weight, confirming that grain growth in field-grown wheat is not limited by the strength of the source. Alternatively, our results confirmed that field-grown wheat is not limited during grain filling and that the likely accumulation of soluble carbohydrates in leaves does not affect the onset or rate of senescence. [References: 31].

401 Valdez Gutierrez, Juan; Serrano Cevarrubias, Luis Manuel; Mendoza Oroño, Leopoldo Ernesto (Universidad Autónoma Chapingo, Chapingo, Mex. (Mexico); Colegio de Postgraduados, Montecillo, Mex. (Mexico)) (1992) [Morphological criteria of physiological maturity in wheat]. Criterios morfológicos de la madurez fisiológica en trigo. Revista Fitotecnia Mexicana (Mexico) v. 15(2) p. 114-124. 1 illus; 5 tables; 11 ref. (in Spanish). (AGRS 94-118572).


The wheat cultivars 'Katya A1' and 'Mexipak 65', grown in pots under field conditions in a Mediterranean climate, differed only slightly in grain yield and water use on a whole-plant basis, although Mexipak had a smaller leaf area. When expressed on a leaf area basis, both cultivars showed minor differences. However, previous gas exchange measurements on the youngest fully expanded leaf showed only minor differences between the two cultivars. The hypothesis that different patterns of leaf ageing contributed to the differences in plant growth and water use was tested by combining leaf demography and gas exchange measurements. Plants were subjected to two moisture treatments: well-watered (frequent watering to initial soil water content) and intermediate drought (five drying-rewetting cycles). Mexipak had, on average, older leaves than Katya in both treatments, but because of fast early growth, which in turn was due to a larger area of individual leaves rather than a faster leaf appearance rate. Stomatal conductance and net photosynthetic rate were nearly the same for the two cultivars, but were considerably reduced by drought and did not fully recover after rewetting. Stomatal conductance and photosynthesis tended to decrease with age, but effects of age or treatment or their interactions were not significant and could not explain the discrepancy between whole plant and leaf observations. One possible explanation is that age effects do exist in leaves older than those investigated. An alternative explanation is that changes in microclimatic conditions caused photosynthesis and transpiration to differ from rates measured under standard conditions. [References: 15].


F63 PLANT PHYSIOLOGY-REPRODUCTION


The antitphotocytic cells have been stepchildren in most investigations of the female gametophyte. In Hordeum vulgare cv. Bomii, three antitphotocytic cells are originally developed chalazally but because of differential growth of the embryo sac they soon become laterally situated and their number increases to 35-50 cells and the shape, size and structure of the cells change in the time before as well as after fertilization. The cells persist until about 60-70 h after pollination. At that time, the embryo consists of about 12-15 cells and a cellularization of the nuclear endosperm has started peripherally. The size of nuclei, and especially nucleoli, in the antitphotocytic cells increases tremendously in the investigated period and the amounts of organelles also change. The walls of antitphotocytic are diversified depending on which cells they are separating, and wall invaginations are developed especially between antitphotocytic cells and surrounding nucellar cells in the placentia region. The mitochondria appear in various shapes in section view, very often as cups or dumbbells with a rim in the ends containing cristae and a thin cristae-free base. These bases are sometimes stretched over as thin parts and at last a simple guttation occurs. Binary fission of the plastids happen especially in the hours before and just after egg fertilization. ER is extraordinarily well developed in the whole period of investigation and many ribosomes are attached to the membranes. Dictyosomes form numerous vesicles, especially in the antitphotocytic near the nucellar cells in the placentia region. These ultrastructural details support the opinion that antitphotocytic cells may play an important role in the embryo sac and are able to be responsible for the supply of nutrition for the whole gametophyte and take part in the supply of nutrition during embryo formation. [References: 34].

H01 PROTECTION OF PLANTS-GENERAL ASPECTS

405 Sues, A. (Biologische Bundesanstalt fuer Land und Forstwirtschaft, Klienamnichow (Germany). Inst. fuer Oekotoxikologie im Pflanzenschutz); John, M.; Klementz, D. (1994) [Model investigations on the influence of rain on the efficiency and on the residue levels of some selected insecticides and fungicides]. Modelluntersuchungen zum Einfluss von Regen auf die Wirksamkeit und das Ruckstandsverhalten ausgewahlter Insektizide und Fungizide. Nachrichtenblatt des deutschen Pflanzenschutzdienstes (Germany) v. 46(5) p. 97-104. 15 illus, 1 table, 28 ref. (in German). (AGRS 94-118884).

In model trials the influence of simulated rainfall on the efficiency of six insecticides against Chilo suppressalis Hrn. and Aphis pomi de Geer on apple leaves and five fungicides against Erysiphe graminis DC. on wheat and barley was investigated. For two insecticides and fungicides respectively, residues were analysed. The rain quantity and the time between application and rainfall were chosen as important factors. With simulated rainfall within 24 hours after application in the registered concentration, there was observed no decrease of efficiency of Decis fluesus, a little decrease of Ultracon 40 Ciba-Geigy, Primor 50 DF and Bi 58 EC and a greater decrease of efficiency of Filtex and Wofatrox-Konzentrat 50 against apple pests. The efficiency of Bayleton fluesus, Tilt 250 EC, Corbel and Sportak 45 EC against mildew on wheat and barley was influenced by simulated rain one hour after application. No significant influences have been observed. Investigations with reduced concentrations showed the importance of the dose-effect-relation with regard to the rainfastness of pesticides.

H10 PESTS OF PLANTS


The application of the concept of committed phloem ingestion (CPI) of aphids was studied for different aphid species feeding on resistant and susceptible plants. Greenbugs, Schizaphis graminum (Rondani) (biotype E), were monitored electronically on wheat, Triticum aestivum L., and Sorghum bicolor (L.) Moench., cultivars, and Russian wheat aphids, Diuraphis noxia Mordv. were monitored on wheat cultivars during the duration of phloem ingestion (PI) events of these aphids was not randomly distributed and almost equal to 53% of the time < 60 min in duration. The minimum PI duration to be considered as committed feeding (threshold of CPI) was determined for each aphid-host combination.

Thresholds varied depending on the aphid species and host plants, indicating the difficulty of assigning a single threshold value that could be useful as a measure of host acceptability. Also, if a given threshold duration is chosen as a criterion for having achieved CPI (e.g., 15 min), the proportion of PI events that continue for a long time period varies from host to host. Therefore, we recommend that use of this parameter be discontinued, and that measurements of the time from the beginning of the experiment to PI and the time from the initiation of a probe to PI be substituted for time to first CPI. [References: 15].

414 Mason, JR; Clark, L. (1994) EVALUATION OF PASTIC AND MYLAR FLAGGING AS REPELLENTS FOR SNOW GEESE (CHEN-CAERULESCENS). Crop Protection. 13(7):531-534. English. [MONELL CHEM SENSES CTR USDA ANIM & PLANT HLTH INSPECT SERV DENVER WILDLIFE RES CTR PHILADELPHIA, PA 19104 USA]. The effectiveness of white flags, black flags and Mylar streamers as visual repellents to snow geese (Chen caerulescens) was evaluated. Five farms in Cumberland and Salem counties, New Jersey served as test sites. At each farm, four 10.12 ha fields were selected randomly, and then assigned to four treatment conditions: (a) white plastic flags (one flag per 0.4 ha); (b) black plastic flags (one flag per 0.4 ha), (c) Mylar streamers (one streamer per 0.4 ha); and (d) stakes only (one stake per 0.4 ha). From 2 December 1992 to 24 March 1993, vegetation samples and goose droppings were collected in all fields. Dropping weights were significantly less in black- or white-flagged fields than they were in fields with Mylar streamers or bare stakes. Although vegetation weights tended to increase in white- or black-flagged fields (and to decrease in fields with Mylar streamers or bare stakes), there were no significant differences. The results show that white or black flags can economically and effectively deter snow geese from agricultural fields, at least when alternative grazing sites are available. [References: 22].

415 Miller, JC; Gerth, WJ. (1994) TEMPERATURE-DEPENDENT DEVELOPMENT OF APhIDius-MATRICARiae (HYMENOPTERA, APhIDIDae), AS A PARASITOID OF THE RUSSIAN WHEAT APHID. Environmental Entomology. 23(5):1304-1307. English. [OREGON STATE UNIV DEPT ENTOmol CORVALLIS; OR 97331 USA]. Temperature-dependent development of a Colorado potato tuber-blight-associated population of the parasitic Aphidus matricariae Haliday was measured at eight constant temperatures between 11 and 31-degrees-C using the Russian wheat aphid, Diuraphis noxia (Mordv.), as a host. Development rate from oviposition to emergence of adult wasps increased linearly with increasing temperature between 11 and 26-degrees-C. No adult wasps emerged from parasitized aphids at 31-degrees-C. Requirements for development from oviposition to adult eclosion were 273.1 +/- 5.9 degrees-days above a threshold of 4.5 +/- 0.4-degrees-C. These results are compared with previously reported data on temperature-dependent development of other populations of A. matricariae and the host, D. noxia. [References: 12].

416 Mortham, AT; Richardson, PE; Campbell, RK; Burd, JD; Eikenbury, RD; Sumner, LC. (1994) ULTRASTRUCTURAL RESPONSES OF RESISTANT AND SUSCEPTIBLE WHEAT TO INFESTATION BY GREENBUG BIOTYPE-E (HOMOPTERA, APhIDIDae). Annual of the Entomological Society of America. 87(6):908-917. English. [USDA ARS PLANT SCI & WATER CONSERV LAB 1301 N WESTERN ST STILLWATER, OK 74075 USA].

Biotype E greenbugs, Schizaphis graminum (Rondani), were allowed to feed for at least 1 h on leaves of resistant and susceptible wheat, Triticum aestivum L. Cellular responses were studied using transmission electron microscopy. Greenbugs caused severe degenerative changes in vascular


The objective of this study was to determine the occurrence of Diatrhus noxia in the areas producing wheat in Serbia, Yugoslavia, to estimate its number and its parasitoids. Investigations were carried out on a number of localities in the period 1989-1991. Small grain plots were examined and aphids were collected from the plant parts above the ground. In south Serbia, Yugoslavia, Diatrhus noxia was detected on wheat and barley plots. In both cases the number of aphids was low. The primary parasitoid Daereetella rapeae and the hyperparasitoid Syrphophagus aphidivorus were obtained from the aphid.


The effect of feeding by the Turkish Metadelphax propinqua on barley was investigated in Finland. The number of M. propinqua nymphs and the length of their feeding period on barley did not have any major effects on the barley plants. M. propinqua males had a greater effect on the properties of barley than did the nymphs. The effect of M. propinqua females on the barley was much greater than that of either the nymphs or males. Their number and the length of feeding time lowered the length and weight of plants, the number of grains, the grain yield and the 1000-grain weight.


The application of different combinations of mineral fertilizers had no significant influence on wheat entomofauna. The insect species in the trial plot detected were uniformly represented except for grain aphids whose number varied significantly. Numerous colonies of Sitobion avenue and Metopolophum dirhodum were estimated following the spring treatment employing the highest nitrogen application amount (285 kg/h/AN). Greatest leaf damage caused by cereal leaf blight (Leuca melanogaster L.) larvae amounted to 21.7 and has been recorded following the use of an optimal NPK application rate, whereby the nitrogen-containing fertilizer had been employed in spring treatment.


The objective of this work was to quantify the antibiotic resistance mechanism of different wheat genotypes to C biotype of the greenbug, Schizaphis graminum (Rondani, 1882) (Homoptera: Aphididae). This test was developed at EMBRAPA/CNPFT, Passo Fundo, RS, Brazil, and 14 wheat lines and 4 cultivars were maintained in a growth chamber having one bug per plant and ten replications. Parameters assessed were: duration of nymph stages, preproduction period, reproduction period, longevity of adults, total cycle, number of nymphs/female, and average weight of adult bugs. The results obtained indicate that all lines and Trigo BR 36 cultivar were unfavorable to the development and reproduction of greenbugs.


Accessions of Hordeum vulgare subsp. spontaneum, the progenitor of cultivated barley, were screened in field and greenhouse trials for resistance to the aphid Rhopalosiphum padi. A few selected lines were furthermore hybridized with a modern barley variety and the resulting populations evaluated. High levels of resistance were found among some of the 'spontaneum' accessions resulting in lower aphid growth rates (maximum reduction 57%). Segregation patterns among siblings in F2 populations were continuous, indicating the presence of several genes with possibly additive effects. The usefulness of H. vulgare subsp. spontaneum for breeding aphid resistant barley is discussed. [References: 18].


The investigations have been done under the field conditions as well as the spring barley or wheat located on the regions near Belgrade (Yugoslavia). According to the four-year investigations, the mixture of active substances and its action is very good as well as the effectiveness of pyrethroides themselves. Chemical Banko SWP is very effective in Lema melanopus L. control, and is based on chemicals. Chemicals which consist of the mixture of two active substances (pyrethroides and organic-phosphat compounds) are very effective and have the great advantage in comparison with the others. It is established that the Lema melanopus L. is very sensitive to all tested insecticides.
H2O PLANT DISEASES


The host range of isolates of Polymixia was tested in mono-fungal sand cultures. Fourteen isolates of P. graminis, obtained from barley, wheat, oats or Poa annua and from several different countries, all infected barley and all but one infected wheat. Rye was also a good host, whereas oats (nine cultivars), Lolium multiflorum and Poa pratensis became only slightly infected. Wheat cultivars differed in susceptibility, with Galahad much more resistant than Avalon. Several common weed and pasture grasses were not infected by the two isolates tested. A range of wild Hordeum spp. were mostly susceptible to P. graminis and/or barley mild mosaic virus, which it transmits. An isolate of P. betae, used for comparison, caused slight infection on oats but not on other cereals. The investigation within and between species of Polymixia needs more detailed investigation. [References: 19].


This research was initiated to determine whether soils suppressive to take-all of wheat caused by Gaumannomyces graminis var. tritici (Ggt) occur in Montana, and to identify the organisms most likely involved in this suppression. From an initial screening of eight soils collected from different wheat growing areas of Montana, two were highly suppressive to take-all. Microbial characterization of these soils indicated that different mechanisms were involved in the suppression. In Larssen soil, mycoparasitism appeared to be the main mechanism. Two different fungi with exceptional ability to reduce the severity of take-all were isolated from this soil. One of these fungi could parasitize the hyphae of Ggt. Field tests with these fungi in Ggt infected soil showed increases of over 100% in both harvestable tillers and grain yield as compared to treatments without these two fungi. In tests with 48 different bacteria and 10 actinomycetes from Larssen soil, none were able to consistently reduce severity of take-all alone, or in mixtures. In Toston soil, antibiotic by actinomycetes and perhaps the involvement of Pseudomonas spp. in production of antibiotics and/or siderophores appeared to be the most likely mechanisms involved in take-all suppression. Increases in shoot dry weight over that in the Ggt infected control using mixtures of pseudomonads and actinomycetes ranged from 25% to 87%. Actinomycetes added individually or in mixtures to soil infected with Ggt consistently reduced the severity of the disease to a greater extent than did mixtures of Pseudomonas spp. [References: 36].


Temperature sensitive resistance to stripe rust in selected Australian wheat cultivars was found to be most strongly expressed at a constant post-inoculation temperature of 19 degrees C and at high light intensities. At 25 degrees C the infection type on the susceptible host was reduced, indicating incompatibility, while at the lower temperature of 13 degrees C all cultivars were susceptible to the rust. At low light intensities there was a movement towards low infection types in cultivars possessing this resistance even at low temperatures. Thus made it essential to use high light intensities to differentiate this resistance to stripe rust. The host-pathogen interaction leading to the low infection types became irreversible after 6 to 7 days exposure to the higher temperatures. As well as affecting disease progress towards the end of the growing season in the warmer areas of the wheat belt, this resistance could have a marked effect on the ability of Puccinia striiformis fsp. tritici to oversummer in the Australian wheat growing areas. [References: 22].

430. Balaz, F. (Faculty of Agriculture, Novi Sad (Yugoslavia)); Toxico, M. (Faculty of Agriculture, Belgrade (Yugoslavia)) (1992) OCCURRENCE OF BARLEY YELLOW DWARF VIRUS ON MAIZE GROWN IN THE VOJVODINA PROVINCE (Yugoslavia) in 1990. 6th Conference on virus diseases on Gramineae in Europe; Torino (Italy); 18-21 Jun 1991. Zasita bilja (Yugoslavja) v. 43(200) p. 129-133. 2 tables; 45 ref. English. [AGRIS 94-109464].

In 1989 and 1990, in addition to the symptoms of maize dwarf mosaic, maize plants in many localities of Vojvodina, Yugoslavia, showed the reddening of lower leaves, severe dwarfing, sterility, as well as undersized and non-functional roots. Leaf tissues necrosis was a frequent accompanying symptom, too. The serological analysis performed by ELISA test showed that the maize plants with such symptoms were infected with Barley Yellow Dwarf Virus. Maize infection by Barley Yellow Dwarf Virus was also investigated in the cv. "Velebit" maize.

The epidemics of Barley Yellow Dwarf Virus on maize was in correlation with the epidemics of the same virus on small grain crops in the same years.


Genes for stem rust resistance were studied in winter wheat cultivars Ilona, Livia, Blava, Torsya, and genes for leaf rust resistance in the cultivars Livia, Blava and Torsya. The reactions of the cultivars were compared with similar reactions of cultivars or lines possessing known resistance genes. Five stem rust races and one leaf rust race were used to study the segregation of rust reaction in the F2 generations in the crosses with cultivars Ilona, Livia and Torsya, and in the F3 generation of crosses with the cultivar Ilona. Cultivar Ilona was shown to possess stem rust resistance gene Sr11. It was susceptible to leaf rust. Cultivar Livia displayed "rye resistance" (IBL/1RS translocation, resistance genes Sr31, Lr26, Yr9, Pm8) and also gene Sr11. From the parental cultivars and the reactions to six leaf rust races it appears that cultivar Blava has gene Lr3 and other resistance gene(s) to leaf rust. The reactions of seedlings of the cultivar Blava to most of the stem rust races was not uniform which does not allow a conclusion on stem rust resistance genes in this cultivar. Leaf rust resistance of the cultivar Torsya seems to be derived from the parental cultivar Mars Marksmans. stem rust resistance from the second parent, the cultivar Vals (Sr29). Cultivar Torsya displayed heterogeneity in reactions to several races of both rusts, like cultivar Blava.


Double-stranded RNA was identified in six isolates of Tilletia indica, the causal agent of Karnal bunt disease of wheat. Double-stranded RNAs ranged from 2.8 to 12.3 kbp in size, similar to sizes reported for double-stranded RNAs from other plant pathogenic fungi. The six isolates revealed diverse double-stranded RNA banding patterns; however, identical patterns were found for two isolates (one from India, one from
Mexico). A random-prime cDNA probe generated from the high molecular weight double-stranded RNA segment of isolate PV-18 hybridized only to double-stranded RNA of isolate PV-18 and not to double-stranded RNA of the other five isolates, indicating a high degree of sequence specificity within the double-stranded RNA from at least one of the isolates tested. This is the first report of double-stranded RNA occurring in any species of Tilletia. [References: 27].


The first results presented are related to numerous wheat materials tested in the field and in the seedling stage with selected international cultures of Puccinia recondita tritici. For genetic differentiation of numerous resistant wheat material, Boolean modeling with series of mathematical functions was applied. Based on this investigations, twenty genetically different winter wheat sources of resistance and sixteen spring wheat sources were selected for the first European Leaf Rust Nursery (ELRNW).


Pretreatment of barley plants with sublethal concentrations of Bayleton WP70 (triazadimefon) before inoculation at the seedling or adult stage with Puccinia boedii Orth resulted in diminished infection severity. The data obtained indicate enhanced efficacy of the fungicide in slow rusting. Fast rusting lines responded to low fungicide dosage by developing symptoms similar to those in untreated slow rusting lines. [References: 21].


A survey of electrophoretic variation in 89 isolates of Rhynchosporium secalis collected from cultivated and wild barley grass in Victoria, New South Wales and Tasmania detected an average of 2.5 alleles at each of 11 loci in 5 enzyme systems. At five loci, two alleles each occurred at frequencies exceeding 0.2. Comparison of the frequency of alleles at these loci showed little association with host or geographic origin, pathogenicity of the isolates or with the allelic state at other loci. Given that this pathogen reproduces asexually only, this lack of association confirms previous suggestions that some means of asexual recombination is important in this pathogen. Furthermore, the results suggest that the most effective means whereby long-term control over R. secalis will be achieved, is through the use of both pathotype-specific and field resistance complemented by other strategies like the use of fungicides and possibly varietal mixtures. [References: 37].


Three antibiotics were isolated from a CH2Cl2 extract of the liquid culture of Pseudomonas fluorescens strain PMF2. Two of the antibiotics were identified as 2, 4-diacetylphloroglucinol and pyoluteuron. The structure elucidation, absolute stereochemistry, synthesis, and biological activities of the new antibiotic (+)-(S)Dihydroergonic acid 1U are reported. [References: 19].


This study quantifies the frequency of simple and complex races (races that can infect two or more components) of Puccinia striiformis in mixtures of wheat cultivars possessing different race-specific resistance genes. Treatments were designed so that the complex race changed depending on the host mixture, thus enabling us to observe the influence of pathogen complexity in different genetic backgrounds. Six cultivars, mixtures and one pure stand of winter wheat were inoculated with three races of P. striiformis at two locations for two seasons. Potted plants of three winter wheat cultivars, each susceptible to one of the three races of the pathogen, were used to sample the pathogen during the field epidemics. Disease incidence on the differential cultivars was used to calculate the proportion of the three races in each treatment. The specific cultivars included in the mixtures influenced the frequencies of the three races. Increasing the number of virulent races in a mixture reduced the frequency of the complex race relative to the other two races. The results suggest that genetic background of the pathogen race, host composition, and interaction among pathogen races may be as important as cost of virulence in determining race frequencies in mixtures. [References: 23].


Polyclonal antisera raised against proteins or peptides corresponding to barley stripe mosaic virus (BSMV) open reading frames were used in immunoblot experiments to investigate the in vivo expression of BSMV-encoded proteins during infection of barley. Six of the seven putative gene products, whose functional roles have been defined in previous genetic studies, were detected at one or more stages of infection in barley tissue sampled at 4, 7, 10, and 14 days postinoculation (DPI). The alpha α, beta β, gamma γ, delta Δ gamma β gene products were observed during the course of infection, but a protein corresponding to the beta c gene could not be detected. The 130-kDa alpha a and the 74-kDa gamma α proteins, which comprise the essential BSMV-encoded replicase components, differed in the time course of their expression and in their subcellular distribution. The highest concentration of the alpha a protein coincided with the appearance of leaf symptoms at 4 DPI and declined gradually as infection progressed. The alpha a protein was found primarily in the soluble protein fraction but some of the protein was also found in the membrane and cell wall fractions. In contrast, the gamma α protein peaked in concentration later at 7 to 10 DPI and was more abundant in membranous fractions. The cysteine-rich 17-kDa gamma β protein was located predominantly in the soluble fraction and its concentration remained relatively constant during the course of infection. The 25-kDa cash protein (beta a) was present in the highest amounts in the soluble fraction at 4 DPI and it continued to increase in abundance throughout the sampling period. The transiently expressed 58-kDa beta c protein, which is required for systemic infection, was most abundant at the onset of symptoms, but declined precipitously in concentration as the infection progressed. Although larger amounts of beta c were present in the soluble fraction, the cell wall fraction contained a substantial...
the parasexual cycle) were found. Taken together, these results indicate that parasexual recombination, if it occurs at all, probably plays at most a small role in generating genetic variability in R. secalis populations in nature. However, there is clear evidence that mutation and migration are very important, and the mutation rate for pathogenicity appears to be very much higher than that for isozymes. [References: 24].


The bird cherry-oat aphid (Rhopalosiphum padi) is an important vector of the barley yellow dwarf luteovirus, BYDV-PAV-IL. Insecticides used to reduce the abundance of the vector on small grains can result in an increase in aphid activity and a subsequent increase in disease incidence. The transmission characteristics of viruliferous wingless (nymphs and apterous adults) R. padi after access to oats treated with different rates of imidacloprid, a seed-treatment insecticide, were compared. After access to treated plants, aphid fecundity was reduced and aphids walked and fed atypically and often abandoned the host plant. The spread of BYDV from a focus of infestation to individual imidacloprid-treated oats planted in a grid was followed by observation of symptoms and by enzyme-linked immunosorbent assay. Aphids transmitted the virus to both treated and untreated plants, but the percentage of infected insecticide-treated seedings was one-half that of untreated seedlings. [References: 36].

**Havis, ND.; Walters, DR.; Martin, WP.; Cook, FM.; Robbins, DJ. (1994) EVALUATION OF THE PUTRESCINE ANALOGUE (E-1, 4-DIAMINOBUT-2-ENE AGAINST POWDERY MILDEW ON SPRING BARLEY. Annals of Applied Biology. 124(Suppl 5):14-15. English.** [SCOTTISH AGR COLL DEPT PLANT SCI AUCHINCLOUKE KA6 5HW SCOTLAND].


CGA 219417 (proposed common name: cyprodinil) is a pyrimidinamine currently being developed as a foliar fungicide for cereals, grapes, vegetable crops and deciduous fruit. It has a new mode of action and shows no cross-resistance to any current market product. On cereals, CGA 219417 exhibits a broad fungidal spectrum with good activity against Pseudocercosporella herpotrichoides, Erysiphe graminis, Pyrenophora teres, Rhynchosporium secalis and Septoria nodorum on ears. The strength of CGA 219417 on grapes, vegetable crops and strawberries is its excellent activity against Botrytis spp. On deciduous fruit the key target pathogen genera are Ventura, Alternaria and Monilinia spp. The fungicide has excellent safety for users, consumers and environment. In addition, its other characteristics, such as not being harmful to beneficial organisms, make it a promising product for flexible integrated disease-control practices. [References: 22].


In wheat and barley plants with conspicuous dwarfinig and leaf yellowing, found in several locations in central Germany, geminivirus parodies were detected using a Swedish antis serum to wheat dwarf virus (WDV) for immunoelectron microscopic trapping. Thus, the occurrence of wheat and barley strains of WDV in Germany is proven.


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According to the results of the investigations it can be concluded that there is a harmful effect of barley yellow dwarf luteovirus on growth and yield of winter and spring wheat and barley in artificial infections under field conditions. Harmful effect of the virus was more severe in fall infection than in spring infection of winter crops. There are very significant statistical differences in reducing the growth parameters of plants and yield per plant. The harmful effect of virus was especially high on yield per plant.

**Jerkovic, Z; Jevic, R; Monolovic, V. (Poljoprivredni fakulteti, Novi Sad (Yugoslavia)) (1992) INCOMPLETE RESISTANCE TO Puccinia recondita tritici in some wheat varieties. Nekompeltna otpornost prema Puccinia recondita tritici nelikih sorti psenice. Zbornik Matice srpske za prirodne nauke (Yugoslavia) (no. 83) p. 91-96. 2 tables; 11 ref. Text in cyrillic.** Serbian (AGRS 94-109444).

A group of very different wheat genotypes, twelve from nine countries from all over the world and seven from Yugoslavia was tested. The infection intensity of Puccinia recondita tritici was estimated on the basis of areas under disease progress curve (AUDPC). A high degree of partial resistance (a type of incomplete resistance) was expressed by the varieties Centurk, Grana, Aurora and Ibarska. Since the varieties Jugoslavija and Zvezda exhibited the intermediate reaction at the seedling stage, their resistance is not partial. It is obvious that incomplete resistance is an active resistance, resulting from the interaction of host and parasite genes in the actual environmental conditions.


Following the discovery of resistance to benzimidazole fungicides in the cereal eyespot pathogen Pseudocercosporella herpotrichoides in the UK in 1981, and an initial in vitro screen to select the fungicides with greatest activity against the pathogen, 40 held experiments were carried out between 1983 and 1986 to evaluate alternative fungicides for control of eyespot. At the majority of experimental sites, benomyl-resistant strains of the pathogen were present, and carbendazim did not control eyespot. Prochorlaz was the most effective fungicide, reducing the eyespot index by 30-60%. There was no extra benefit from adding carbendazim to prochlorlaz. Flusilazole was almost as effective as prochlorlaz, but other fungicides had little or no effect. At sites with a high incidence of eyespot, prochlorlaz, with or without the addition of carbendazim, generally gave the largest yield increase. The mean yield increases each year were in the range 0.3-0.85 t/ha, and the greatest yield increase at any site was 2.27 t/ha. Most other fungicides increased yield, but carbendazim did not from 1984 to 1986. There were also yield increases at many sites with a low incidence of eyespot. Yield increases were associated with increases in thousand-grain weight at the majority of sites, but in only a few instances were there associated increases in specific weight. Prochorlaz application at CS30-31 was cost effective at 71% of sites. At most sites, in regression of
yield on eyepot, eyepot accounted for less than 25% of the variance in yield. The mean relationship between severe eyepot lesions and yield loss was such that each 1% increase in the percentage of tillers affected by severe eyepot was associated with a yield loss of 0.21%. There was a significant positive correlation between eyepot at GS75 and GS50-31, and between yield increase from prochloraz treatment (at GS30) and eyepot at GS75, but not between yield increase and eyepot at GS30-31. The ADAS threshold for fungicide application of 20% tillers affected at GS50-31 was a reliable indicator of the cost-effectiveness of treatment at 60% of sites. [References: 29].

460 Kaysoe, E.; Munk, L. (The Royal Veterinary and Agricultural Univ., Tasstrup (Denmark). Dept. of Plant Biology) (1992) Side-effects of the herbicide isoproturon on the severity of powdery mildew in spring barley and winter wheat. 188. NJF Seminar; Aas (Norway); 11-14 Feb 1991. Disease resistance in agricultural crops. NJF-Seminar no. 188. Elen, O.; Trosmo, A.M. (eds.). Scandinavian Association of Agricultural Scientists (NJF). Norwegian Journal of Agricultural Sciences (Norway); no. 7(supl.). p. 89-94. Satens Fagteneste for Landbruket. 3 tables, 1 figure; 7 ref. English. [AGRS 94-119482].


As a first step towards the development of an in vitro-selection system for septoria nodorum blotch resistance, wheat embryo culture on media containing extracts from Septoria nodorum was established. Extracts prepared from inoculated wheat grains had a toxic activity. Control extracts from un inoculated grains showed at least a 10-fold lower toxic activity. Two wheat breeding lines susceptible to Septoria nodorum showed reduced growth in the presence of the fungal extract when compared to a breeding line known to have good resistance in the field. A test with seven additional wheat lines showed a good agreement between field resistance of the ear and embryo resistance. Mellein is one of the toxins produced by Septoria nodorum and was used in pure form for in vitro-selection. It showed toxic effects at 50 mg/g, a concentration which is about 200-fold higher than the septoria concentration in the diluted extract with embryotoxic activity. This indicates the importance of additional toxic compounds in the crude extract. Mellein acted non-selectively on embryos of the different cultivars. [References: 20].


463 Konc, B. (Institut for Plant Protection (Croatia)) (1993) Effect of Septoria nodorum blotch on yield and size of processed wheat seed. Wheat Information Service (Japan) (no.76) p. 32-34. 2 tables; 7 ref. English. [AGRS 94-119476].

464 Kremb, S. (Technische Univ. Muenchen, Freising (Germany); Lehrstuhl fuer Phytopathologie; Appel, J.) (1993) Profitability of winter barley can be improved. Restabilisierung war der Wirtschaftsteil der alsdeutlich verbesserten. Bayerisches Landeswirtschaftsches Wochenblatt (Germany) p. 183(56): p. 50-51. 2 ill., 1 table. German. [AGRS 94-119483].


The minimum nutrient requirements for growth of Idriella (= Microdochium) bolley in shaken liquid culture were mineral salts, nitrate nitrogen, glucose and thiamine. Typical batch culture kinetics were displayed in this medium and were assessed by culture turbidity when sodium alginate was used to induce growth by dispersed mycelia. Conidia were produced during exponential growth and reached maximum numbers (ca 6 x 107/ml-1) by the deceleration or early stationary phase. Applying the Monod equation to culture parameters at different glucose concentrations, the minimum doubling time in glucose-nitrate-thiamine medium at 25 degrees-C was calculated as between 5.25 and 6.1 h, and 1Ko (limiting substrate concentration at half maximum specific growth rate) was between 0.049 and 0.077% glucose. Conidial germination was oxygen-dependent but did not require nutrients. On water agar or 0.1% glucose agar most spores germinated by germ-tubes, but to up to 15% of spores swelled and produced further conidia (2-9) from one or both poles of the parent spore. This microculture conidiation was suppressed at higher glucose levels. The findings are discussed in relation to production of biocontrol inocula and efficiency of L. bolley in biocontrol on roots. [References: 44].


Prochloraz and Procon were increased to 2.1 and 0.7 ton/ha, respectively, the yield of wheat var. Verano 591 (susceptible to foliar and head diseases caused by Fusarium nivale, F. graminearum, Septoria tritici and Helminthosporium tritici-repentis) in Juchitepec, Mexico. The five fungicides tested did not result in any difference on the var. Temporalera (tolerant to a complex of leaf diseases).

468 Leyer-Mir, Gerardo; Villasenor Mir, Eduardo (Instituto Nacional de Investigaciones Forestales y Agropecuarios, Mexico D.F. (Mexico), Campo Experimental Valle de Mexico, Apdo. Postal 10, Chapungo, Mex. 56230); Rodriguez C. Elias (Universidad Autonoma Chapungo, Chapungo, Mex. (Mexico), Departamento de Parasitologia, Chapungo, Mex. 56230) (1992) (Incidence and control of wheat (Triticum aestivum L) head blight (Fusarium graminearum Schw.) in Juchitepec, Mexico). Incidencia de la rona de la espiga (Fusarium graminearum Schw.) en trigo (Triticum aestivum L) y su combatte quimico en Juchitepec, Mexico. Revista Mexicana de Fitopatologia (Mexico) v. 10(1) p. 75-77. 1 cuadro; 7 ref. Spanish. (AGRS 94-119533).

Fusarium graminearum Schw. was isolated from seed of scabby wheat heads collected in Juchitepec, Mexico. Disease incidence from 54 to 70 occurred on heads of the variety Salamanca. Propiconazole, carbendazim and prochloraz in seed treatments, decreased the disease incidence in 100 percent in the Salamanca 5-7 and Temporalera M87.


The effect of three herbicides on the growth of four and the sporulation of two soil parasitic fungi were studied on potato-dextrose agar. Triasulfuron (Logran), triasulfuron + fluoroglycofen (Satus) inhibited in all concentrations the spore formation of Fusarium moniliforme (Fm), primisulfuron (Tell) stimulated it in the highest concentration. On Trichoderma longibrachiatum (Tl), herbicides exerted different influences. All herbicides inhibited in field concentrations the mycelial growth of Tl Tell and Satus stimulated it with the middle and the lowest concentration Logran and Satus inhibited in field concentrations the mycelial growth of Rhizoctonia solani (Rs), in some concentrations stimulation esp. with Tell was ascertainment. Field concentrations of all herbicides inhibited the mycelial growth of Fm and Sclerotinia sclerotiorum (Ss), particularly also

The movement of barley yellow dwarf luteovirus (BYDV) was evaluated in susceptible and resistant barley and bread wheat genotypes. After leaf inoculation, the virus infected the root system and the growing point of susceptible earlier than resistant barley genotypes. No difference in virus movement occurred in resistant and susceptible wheat genotypes. It was possible to reliably differentiate susceptible from resistant genotypes when root extracts of 41 barley genotypes were tested by DAS-ELISA 3 or 4 days after inoculation at the oneleaf stage. When barley plants inoculated at the two- or three-leaf stage were assayed by tissue blot ELISA on nitrocellulose membrane, virus was detected in the phloem vessels of the growing points of the susceptible, but not of the resistant genotype, 4-6 days after inoculation. Our results thus suggest that screening for BYDV resistance in barley could be done quickly and cheaply especially when assays are made by the tissue-blot test. [References: 14].


Wheat leaf rust disease, caused by Puccinia recondita f. sp. triticii was found every year at the wheat country areas in Hungary during 1990-1992, and became the most important wheat disease. The main races in the population were the races 77 and 61. The proportion of the sporadic races in the population increased from 2.6% to 8.6% in the last three years. From Hungarian leaf rust populations 50 virulence forms (pathotypes) of wheat leaf rust have been isolated, among them 20 pathotypes belong to race 77. More than 70% of the cultures were virulent on lines with genes Lr1, Lr2a, Lr2b, Lr2c, Lr3, Lr3ka, Lr13, Lr14a, Lr14b, Lr16, Lr17, Lr18, Lr20, Lr22, Lr2B and Lr-CIF. Genes for resistance Lr15, Lr23, Lr24 were effective to all survey cultures tested. Resistance genes Lr9, Lr10, Lr12 were effective to 65-75% of isolates in the seedling plants. New pathotypes have been found virulent on the near isogenic backcross lines with genes Lr10, Lr19 and Lr25. The increasing number of sporadic races and the new virulence genes in the population confirmed the increase of virulence of wheat leaf rust pathogen.


Stem rust disease, caused by Puccinia graminis f. sp. tritici occurred sporadically every year in Hungary during 1989-1991. The main races, identified by Stakman method, in the population were the races 1, 11, 34, and 218. Races 17, 21 and 126 were in the population in traces. The stem rust population was stable during this period, new race was not found. From the above races 24 pathotypes have been identified by 23 single genes lines at this time. All the cultures were virulent on lines with gene Sr7b. Single genes for resistance Sr22, Sr24, Sr31, Sr32, Sr33 and Sr36 were effective to all survey cultures tested. Among these resistance genes are Sr31 and Sr36 the most important resistance genes for Hungarian wheat varieties.


In this paper the effect of different fungicides on barley seed germination and germination energy was tested. The obtained results demonstrate that at the most of investigated barley strains, treated by these fungicides, there is no negative effect on seed germination. The increased dosages of some investigated preparations cause the decrease or increase of the germination. The preparations which showed the negative influence on the germination energy of barley seed have in their formulation the active ingredients from the groups of triazol and imidazol.


Cochliobolus sativus is particularly significant since it is attacking most of the plants from the family of grasses and especially wheat and barley. This work dealt with the toxicity of 28 fungicides and their effects on germination of Cochliobolus sativus fumig conidial. According to the results expressed in LD50 values, the toxicity of fungicides is wide in range, from 0.44 mg/L to 10.000 mg/L. As far as toxicity effects on germination of Cochliobolus sativus fumig conidial is concerned, the most prominent are the fungicides with contact properties. The systemic fungicides from the trial group, have demonstrated lower toxicity on the conidia of this fungi, with LD95 values unequalling the applied quantities.

475 Mendoza Zamora, Cecilio; Ponce Gonzalez, Francisco; Carrillo, Armando (Universidad Autonoma Chapingo, Chapingo, Mex., Mexico), Departamento de Parasitologia Agricola, Chapingo, Mex., 56220 (1992) [Chemical control of barley stripe rust (Puccinia striiformis West.) in Hidalgo, Mexico and Tlaxcala States]. Control quimico de la roya linea amarilla (Puccinia striiformis West.) de la cebada en los estados de Hidalgo, Mexico y Tlaxcala. Revista Mexicana de Fitopatologia (Mexico) v. 10(4) 69-71 2 column 5 ref. Spanish. (AGRS 94-119480).

Tebuconazol, Propiconazol and Tetraconazol behaved statistically similar in the control of barley stripe rust in Chapingo, Mex. Tebuconazol and Tetraconazol (125 ml i.a./ha) were the best treatments in Apan, Hidalgo. Only Tebuconazol (125 ml i.a./ha) was effective in La Union, Tlaxcala.

476 Milovanovic, M.; Stojanovic, S. (Institut za izstrazivanje u poljoprivredi Srbije, Krusevac (Yugoslavia)). Centar za stvar zita (1992) [Triticale reaction to some prominent parasites (Erysiphe graminis tritici, Puccinia recondita tritici, Puccinia graminis tritici, Septoria spp. and Fusarium spp.)]. Reakcija Triticale prema vaznijim parazitama (Erysiphe graminis tritici, Puccinia recondita tritici, Puccinia graminis tritici, Septoria spp. i Fusarium spp.). Zasita bija (Yugoslavia) v. 43(202) p. 249-255. 1 table; 35 ref. Serbian. (AGRS 94-109436).

The resistance of the mature plants of 18 Triticale genotypes to pathogens was tested. The obtained results showed that Triticale was more resistant to more diseases than wheat. There were genotypes resistant and the genotypes sensitive to Puccinia recondita tritici and Puccinia graminus tritici. Triticale was less resistant to the causers of leaf rust and leaf spot than to the powdery mildew. A complex resistance to the powdery mildew, leaf and stalk rust was found. As far as the leaf spot is concerned, both the resistant and sensitive genotypes were noticed. There were no genotypes immune to Fusarium spp.


Dynamics of the system of triadimefon fungicide vanishing from a cob and grain wheat has been tested. An average deposit of triadimefon on, in a wheat cob was relatively equal in two years of their investigation and observations: 1.03 - 1.33 mg/kg in micro experiments, i.e. 0.99 - 1.54 mg/kg in macro experiments. In all treated samples, the seventh day after their application the quantity of triadimefon was reduced to 40% in comparison to deposit. The content of this fungicide in samples was below minimally permitted quantity (0.3 mg/kg) fourteen days later. The rests of triadimefon can be seen in wheat during the harvest and are on the level of the discovered quantity in controlled samples.

Gopalanucin, an antifungal antibiotic, was isolated from the cells of two actinomycetes, MSU-625 and MSU-616. Gopalanucin is structurally similar to salbomycin and eioaphylin. Gopalanucin completely inhibited the growth of all pathogenic fungi tested in vitro at 12-16 ppm. Similarly, it was somewhat effective in controlling wheat powdery mildew, grape downy mildew, and rice blast pathogens in greenhouse experiments. Gopalanucin was ineffective against all Gram-positive and -negative bacteria tested. (References: 9).


The effect of autumn climate on the development of resistance to pink snow mold (Microdochium nivale) in winter wheat was estimated in mid-December. Changes in resistance over time under snow cover were also determined. Resistance in December was closely correlated with the accumulated degree-days above 0 degrees C from sowing. The number of days of incubation at which 50% of the plants are killed (LI(50)) was lowest in the cool autumn in 1988 and highest in the warm autumn in 1989. Temperatures below 0 degrees C were also required for expression of resistance. Differences in LI(50) between resistant and susceptible cultivars were most apparent in late autumn. Continuous snow cover was found to reduce resistance to pink snow mold. The rate of decline of the resistance in cv. Nanukomugi during the winters under snow was lower than in cv. PI 172438 and cv. Kitakamikomugi. The resistance to pink snow mold was correlated with the amount of etiolated growth at 25 degrees C. This indicates that exhaustion of food reserves during prolonged snow cover predisposed wheat plants to snow mold diseases. (References: 20).


In 1985-1987, at growth stage 87 (hard dough) and 92 (caryopsis hard) Fusarium-infected grains of two cultivars of durum wheat (Grandur, 'Mondur') from control plots without fungicide treatment of field trials at four locations: Köln-Wahn (North Rhine-Westfalia), Herzsheim (Rhineland-Palatinate), Ludwigsburg (Baden-Wurttemberg), and Hannover (Lower Saxony), were counted; in 1987, the halm bases at stages 87 were also examined. The following Fusarium species were identified. They are listed in order of decreasing frequency: Fusariumavenaceum, F. graminearum, F. nuvalae (= Microdochium nuvalae) and F. culmorum, but only rarely F. poae, F. tricinctum, F. cerealis, F. sporotrichoides, F. equiseti and F. lateritium. In 1985 F. nuvalae, in 1986 F. graminearum, and in 1987 F.avenaceum were the dominating species. Distinct differences in the occurrence of the fungi at the different locations due to temperature, rainfall and previous crop could be recognized. On the halm bases, F. equiseti, F.avenaceum, F. culmorum, F. flocciferum, F. nuvalae, F. graminearum and F. tricinctum occurred most often; F. meristosidoides, F. oxysporum, F. venenatun, and F. solani were recorded in low numbers. No correlation between counts of Fusarium species on infected halm bases and on infected grains could be found. (References: 14).


483 Reglanski, T; Lyon, GD; Newton, AC. (1994) INDUCTION OF RESISTANCE MECHANISMS IN BARLEY BY YEAST-DERIVED


Yeast cell-wall extracts (YE) had high phytoalexin elicitation activity on soybeans and induced resistance against barley powdery mildew in the normally highly susceptible cv. Golden Promise. Following treatment with YE there was rapid stimulation of phenylalanine ammonia-lyase (PAL) activity and faster formation of papillae in response to attempted fungal penetration. The spray adjuvants Agral and LI-700 each had poor phytoalexin elicitor activity and caused a slight enhancement of papilla formation and a low level of mildew control. The addition of the adjuvant to YE did not affect phytoalexin elicitation on soybeans but significantly enhanced the speed and the extent of PAL activity, papilla formation and mildew control. It is proposed that this is due to greater coverage and improved persistence enabling increased uptake of YE into the barley leaves. (References: 35).


Inhibition of lignin biosynthesis in Triticum aestivum L. roots by Mn deficiency has been suggested as the mechanism of reduced resistance of Mn-deficient wheat roots to infection by the take-all fungus (Gaeumannomyces graminis var. tritici). This study evaluated phenolics and lignin accumulation in roots of wheat genotypes differing in Mn efficiency (measured as growth and yield in Mn-deficient soils) and take-all resistance. Seedlings of the Mn-insufficient, take-all sensitive genotype Bayonet and the Mn-efficient, more take-all resistant genotype CBMM were grown in nutrient solution without added Mn for 18 d and then transferred to a Mn-deficient sandy soil fertilized with Mn at 0 or 30 mg kg(-1). Both genotypes had Mn-deficient roots and shoots at the time of transfer to the soil. Roots of both genotypes were inoculated with the take-all fungus 0, 1, 3 and 7 d after transfer. Twenty-four hours after inoculation, take-all fungus penetrated the root stele of take-all sensitive Bayonet but not of more resistant CBMM wheat. Rates of phenolics and lignin accumulation in roots declined steadily during growth in soil for up to 8 d, were higher in mature, fully differentiated parts of the root system compared to distal, younger root tissue, and were higher in Bayonet than in CBMM. Manganese fertilization did not significantly influence rates of phenolics and lignin accumulation but reduced depth of radial penetration by hyphae in both genotypes. The rate of phenolies accumulation was positively (r = 0.91 to 0.96) correlated with the rate of lignin accumulation. Mn-efficient CBMM had a higher rate of lignin accumulation per unit of phenolics than Mn-insufficient Bayonet over a wide range of phenolics synthesis rates. From these we suggest that CBMM has a more efficient mechanism for conversion of phenolics to lignin, the trait which appears related to higher take-all resistance of this genotype. (References: 26).


Stripe rust of barley was recently found in Texas, and the pathogen has been reported to be virulent to U.S. barley cultivars. The stripe rust isolate collected in Texas was used to evaluate the resistance of barley cultivars, germ plasm, and other Hordeum species. Limited sources of resistance were found; most were from two of the five primary barley-growing areas. The resistance traces to Czechoslovakia and Ethiopia land cultivars and to the cultivar Derr Winter of unknown origin. The U.S. cultivars with
seedling resistance were Barsay, Betzes, Boxer, Clayton, Compana, Custer, Hazen, Hudson, Kamiak, Kemate, Keowey, Maury, Norbert, and Vanguard. These cultivars represent a range of types that could be a starting point in breeding for resistance. No resistance was found in the economically valuable six-row spring malting type of the north central states. The two most common wild barleys of the Great Plains, H. jubatum and H. pusillum, were both susceptible to the stripe rust culture used; neither is likely to be a host during the non-crop-growing season. [References: 7].


The fatty acids composition of the polar and non-polar lipid fractions of wheat leaves was affected due to progressive brown rust infection during early stages of pathogenesis, i.e. 0. 12, 24, 36, 48 and 72 h after inoculation. The three races of Puccinia recondita differentially affected the composition of saturated and unsaturated fatty acids and their relative occurrence in wheat leaves. The infection of wheat by race 77 resulted in a relative decrease in fatty acid chain length as measured through C16:C18 fatty acid ratio. An increase in the relative degree of unsaturation (18:2/18:3 acids ratio) was recorded in both lipid fractions. Such changes may be taken as one of the earliest characteristics of disease development.


Pyrenophora tritici-repentis incites tan spot, a common foliar disease of soft white winter wheat in New York. Since seedborne inoculum is suspected of playing a role in the epidemiology of the disease, an assessment was made of the occurrence of P. tritici-repentis among the fungal flora of soft white winter wheat seed in New York in 1990 and 1991. The fungus was recovered from 54% of the seed lots in 1990 and from 36% of the seed lots in 1991. Infecting an average of 2.1% and 0.6% of the seeds, respectively. Seed infection by fungal pathogens was generally low in 1991. Alternaria spp. were the fungus most commonly associated with soft white wheat, both by surface and by internal contamination, and Fusarium spp. were also prevalent, especially in 1990. Mucilaginous of P. tritici-repentis was detected by culturing and light microscopy in all layers of the pericarp of the wheat seed, not in the seed coat or in the embryo. Surface infestation of the seed by conidia and conidiospores was minimal.


The levels of adenine, the adenine nucleotides AMP, ADP, ATP, as well as NAD, NADP protein and chlorophyll were determined in young barley plants of which the primary leaves were infected by Erysiphe graminis DC. f. sp. horden MARCHAL. The largest changes of these metabolite levels, compared to the non-infected control, occurred in the infected leaf and to a lesser degree also in the roots and in healthy younger leaves. The increase in the levels of most metabolites in the primary leaf revealed the sink property of this infected tissue and possible stress or defence reactions of the host, whereas the reductions in the roots showed the impaired supply of this natural sink organ due to the infection. Changes in the healthy leaves were most pronounced in the tertiary leaf and may reflect metabolic stimulation in that healthy organ. The treatment of the adenosine pool, a precursor of the adenine nucleotides, was discussed in terms of translocation and its possible role as a precursor for fungal purine nucleotide synthesis. [References: 41].

492 Shen Xiaorong (Jiangsu Provincial Academy of Agricultural Sciences, Nanjing (China). Inst. of Agrobiological Genetics and Physiology); Zhang Zhongqiu (Shanghai, China. Preliminary report on the use of amplified polymorphic DNA (RAPD) analysis of wheat cultivars resistant and susceptible to scab. *Jiangsu Journal of Agricultural Sciences (China)* 9(4) p. 50-52. 2 ill., 5 ref. Chinese. [AGRS 94-119540].


The complete nucleotide sequences of RNAs 1 and 2 of soil-borne wheat mosaic virus (SBWMV), type member of the furovirus group, were determined. RNA 1 is 7099 nucleotides (nt) and encodes a 150-kDa protein from the 5' end region, the UGA termination codon of which can be partially read through to produce a 206-kDa protein, and a 37-kDa protein in the 3' end region. The C-terminal region of the 150-kDa protein contains an NTP-binding helicase motif and the readthrough region, an RNA polymerase motif, indicating that these two overlapping proteins may form an RNA replication complex similar to those of tobamono- and tombusviruses. The 37-kDa protein has sequence similarity with the cell-to-cell transport protein of dianthoviruses. RNA 2 is 3593 nt and, from the 5' end region, encodes the 19-kDa capsid protein, whose UGA termination codon can be partially suppressed to produce an 84-kDa readthrough protein and, at the 3' proximity, a 19-kDa protein which is rich in cysteine residues. The 28K (kalodaltins, as estimated by SDS-PAGE) protein, previously considered as another capsid readthrough product, is apparently initiated at an in-frame non-AUG codon upstream from the capsid protein gene. In both RNAs 1 and 2, the 3' terminus is capped, and the 3' untranslated region possibly forms internal consecutive pseudoknots as found in tombavirus RNA as well as a terminal rRNA-like structure similar to tymovirus RNA. An amino acid sequence comparison of RNA replicase genes indicates that, phylogenetically, SBWMV belongs to a cluster formed by tobamono-, tobra-, and hordeiviruses. Differences in the 3' end structure and in the cell-to-cell movement protein, and the distant phylogeny of the RNA replicase genes of SBWMV and beet necrotic yellow vein virus, suggest that the furoviruses should be divided into at least two groups.


A study demonstrated the ability of the earthworms Apororotodes rosea and Apororotodes trapezoides (added at an equivalent density of 100 or 300 m-2) to reduce the disease severity of Rhizoctonia solani Kuhn on wheat in the field. In a calcareous sandy loam artificially inoculated with R. solani, the addition of these earthworms caused a significant (P = 0.02) reduction of the Rhizoctonia root disease rating and had a significant (P = 0.01) positive effect on shoot weight. Neither earthworm number or earthworm species had a significant (P < 0.05) effect on root disease rating or shoot weight. In a red-brown earth soil artificially inoculated with R. solani, neither the presence of these earthworms nor earthworm number influenced root disease rating. However, under these conditions the addition of earthworms (P = 0.01) had a significant positive effect upon shoot weight. To our knowledge these results demonstrate for the first time, the potential of earthworms to contribute to the disease suppression of a cropping soil in a field situation. [References: 34].

495 Stejanovic, S. (Institut za istrazivanje i poljoprivred "Srbija", Krupanj (Yugoslavia). Centar za strna zeta); Stojanovic, J.; Jevtic, R.

Investigations have revealed that not all the varieties included in International Winter Wheat Powdery Mildew Program (IWMP) are resistant to powdery mildew. In the three years of investigations (1990-1992) at the two localities in Serbia (Yugoslavia), the number of resistant and susceptible varieties has been approximately the same. The different reactions of individual genotypes that varied from year to year and from one locality to another caused by specific ecological conditions and variability of the parasite population have been established. Effectiveness of the individual Fm resistance genes was not satisfactory.


The dominant pathogens isolated from wheat plants exhibiting prematurity blight in commercial fields in Saskatchewan were Cochliobolus sativus and Fusarium culmorum. Only F. culmorum was obtained from blighted oat plants. In growth chamber tests, wheat plants inoculated at the tillering stage with isolates of each of the fungi developed common root rot. Prematurity blight developed in some of these plants, particularly when they were subjected to moisture stress for 6-12 days at the flag leaf or boot stage. Under comparable conditions, F. culmorum caused a higher incidence of prematurity blight than C. sativus. However, the latter is the prevalent cause of common root rot in the field and consequently both fungi are considered to be important agents of prematurity blight. Cultivars differed in reaction to prematurity blight initiated F. culmorum. Tritium durum cvs. Coulter and Wakomak appeared to be less resistant than Hercules, Pelissier, and Wasana, and the T. aestivum cvs. Columbus, Neepawa, and Sinton were more resistant than Wasana durum wheat. It is concluded that prematurity blight in this region is a severe manifestation of common root rot and that this blight is akin to fusarium crown rot in other areas.


Genes for resistance to incompatibility between Erysiphe graminis f.sp. secalis and wheat cultivars were analyzed using F2 hybrids between E. graminis f.sp. secalis, Sk-1, and f.sp. tritici, Tk-1. The avirulence of Sk-1 on Tritium aestivum 'Norin 4', 'Chinese Spring', and 'Kokeshi-komugi' was controlled by a single gene. The resistance of the three cultivars to Sk-1 was also controlled by a single gene, Pm15, a gene for resistance to E. graminis f.sp. agropyren. Implications of these results were discussed in terms of host-parasite coevolution. [References: 12].

499 Wiedemuth, GB.; McMamara, RB. (1994) TESTING WHEAT SEEDLINGS FOR RESISTANCE TO CROWN ROT CAUSED BY FUSARIUM-GRAMINEARUM GROUP-1. Plant Disease. 78(10):949-953 English. [QUEENSLAND WHEAT RES INST POB 2262 TOOOWOOMBA 4350 AUSTRALIA].

Resistance to crown rot of wheat caused by Fusarium graminearum Group 1 is currently measured in mature plants that have been grown in inoculated soil in the field. This technique is laborious and time-consuming, and a faster technique is desired. Seedlings of different cultivars of wheat were grown in steam-sterilized soil inoculated with a band of wheat-barley grain colonized by F. graminearum. Plants were grown at 13, 19, and 25°C and after 22 days the sheaths of leaves 1, 2, and 3 were rated for the extent of necrotic lesions. At each temperature, this rating was positively correlated with disease ratings of the same cultivars grown in the field. At 25°C, the correlation coefficient between seedling and mature plant ratings of 28 cultivars was 0.78 (P less-than-or-equal-to 0.01). This close relationship gives confidence that seedlings can be used to measure resistance to crown rot. Use of seedlings will speed the selection of resistant progeny in wheat breeding programs where resistance to crown rot is an objective. [References: 17].


Rhizoctonia-like fungi were isolated from the roots of diseased wheat plants sampled from the centre and periphery of three bare patches, and from apparently healthy plants from outside the patches. Of the isolates recovered, 81% were multineculeate and belonged to R. solani anamorph group 8, and peptic zymogram group 1-1; the remaining isolates were bineculeate Rhizoctonia spp. The multineculeate isolates could be grouped into highly virulent, intermediately virulent, and weakly virulent types. The bineculeate isolates were all non-pathogenic. The multineculeate isolates were obtained at a significantly higher frequency from plants within the patches compared with outside the patches, and with the exception of a single isolate, the highly virulent isolates were not found outside the patches. The weakly virulent isolates were present at much lower frequencies than the highly virulent and intermediately virulent forms within the patches. The frequency of occurrence of bineculeate isolates did not vary significantly among the locations sampled. None of the multineculeate isolates contained plasmoids. Some of these isolates contained a prominent single dsRNA species and one or more minor dsRNA species. The distribution of these dsRNAs was not correlated with pathogenicity. [References: 21].


502 Zhang, HS.; Delarosa, R.; Rubiales, D.; Lubbers, HH.; Molenveld, JW.; Niks, RE. (1994) ROLE OF PARTIAL RESISTANCE TO Puccinia HORDEI IN BARLEY IN THE DEFENCE OF BARLEY TO INAPPROPRIATE RUST FUNGI. Physiological & Molecular Plant Pathology. 45(3):219-228. English. [AGR UNIV WAGENINGEN DEPT PLANT BREEDING 6700 A WAGENINGEN NETHERLANDS].

The partial resistance (PR) of barley to Puccinia hordei and the non-host reaction to inappropriate rust fungi are both based on a pre-haustorial barrier. It has been suggested that genes for PR in barley also confer resistance to inappropriate rust fungi. This hypothesis was tested by determining the correlation between the level of PR to P. hordei and the level of resistance to two inappropriate rust species in barley seedlings. The latent period of P. hordei and infectibility by P. recondita f.sp. tritici and by P. hordei-murinus showed continuous segregation among the F8 lines derived from two crosses between barley lines. The significant correlation between these parameters suggests that genes for partial resistance to P. hordei in barley play a role in the resistance to P. recondita f.sp. tritici and for P. hordei-murinus is not associated with the determination of the latent period of P. hordei. Lines with relative susceptibility to P. recondita f.sp. tritici also tended to be relatively susceptible to P. hordei-murinus. These results indicate that some of the genes for resistance segregating in the progenies studied in this work are effective against more than one rust fungal species. [References: 20].

503 Zwitz, B. (Bundesanstalt fuer Pflanzenschutz, Wien (Austria)) (1994) [Minimization of chemical protection by the use of resistant varieties]. Minimierung des chemischen Pflanzenschutzes durch Nutzung
resistenten Sorten. Gnetika i Slechtivost (Czech Republic) v. 30(2) p. 151-156. 2 graph., 2 tables. German. (AGRIS 94-1094653).

There exist realistic possibilities of reducing fungicide application in cereals by using resistant varieties. It has been confirmed that these varieties can guarantee similar high yields and quality as the susceptible ones, but without fungicide application. Resistant - low input - varieties form a basis of the integrated plant production and protection. The situation in plant protection in Austria requires further improvement with regard to its future membership in the European Union.

H50 MISCELLANEOUS PLANT DISORDERS


The interacting effects between topsoil water supply, nitrogen (N) placement and subsoil aluminum (Al) toxicity on wheat growth were studied in two split-root pot experiments. The native nitrate-N (NO3-N) in the topsoil used in each experiment differed and were designated as high (3706 mmol) and low (687 mmol) for experiments one and two, respectively. Water, nitrogen, and shoots that enabled the root system to split so that half of the roots were in topsoil and the other half were in subsoils containing varying concentrations of soluble Al. Treatments were imposed which varied the supply of water to the topsoil (either 'wet' or 'dry'). Placement of applied N in either the topsoil or subsoil had little effect on either shoot or root fresh weight, or on the length of roots produced in the subsoil section of the split pots. When water supply to the topsoil was decreased, both shoot and root growth of wheat declined and the yield decrease increased with subsoil Al. In the high-N experiment, wheat grown in the low Al subsoil with the high native soluble subsoil (NO3: 3002 mmol) was able to exploit the N and subsoil water, hence both shoot and root growth increased considerably in comparison to shoot and root growth of wheat grown in soils containing higher concentrations of subsoil Al. When the native NO3 was lower (i.e. the low-N experiment) inadequate root proliferation restricted the ability of plants to use subsoil N and water irrespective of subsoil Al. The results from this study suggest that wheat, grown on yellow earths with Al-toxic subsoils, will suffer yield reductions when the topsoil dries out (e.g. in the spring when winter rainfall ceases) because subsoil reserves of water and nitrogen are under utilised. [References: 27].


The effects of root and shoot characteristics on the lodging resistance of four cultivars of winter wheat were investigated by combining results from a field trial (set up at Manchester University's Experimental Grounds, Jodrell Bank, in mid-September 1991) with morphological and mechanical measurements on their stems and anchorage systems. Cultivars showed contrasting lodging resistance: Widgeon was most susceptible, followed by Galahad, Riband and Hereward which, alone, did not lodge. Lodging resistance was not related to the strength and stiffness of the stems, which were usually adequate to withstand the forces to which they were subjected. Most plants instead failed in their root system which rotated through the soil. Resistance was associated with short and light stems (and hence on the force applied to the plants by wind and gravity) and with high values of the anchorage strength of the root system (and hence on the force resisting lodging). Lodging occurred during grain filling when the ears were heaviest and when the soil was wet. The anchorage strength of a plant depended on two characteristics of the root system: the bending strength and the angle of spread of the basal coronal roots. Plants with stronger, more widely spread coronal roots produced larger soil cones during anchorage failure and resisted larger forces. Future breeding for lodging resistance, therefore, should continue to select for plants with shorter stems and with stiffer, more widely spread, coronal roots. [References: 15].


Current methods for assessing the potential effects of rhizobacteria on plant growth are tedious and time consuming. A rapid, automated bioassay has been developed using a flatbed scanner and digital image analysis. Comparisons were made between manual measurements of root length and computed values based on an edge discrimination image analysis procedure. The assay consisted of bacterial cultures or filtrates added to 18 mm agar in square petri plates. Seeds were planted along a marked axis and incubated for 4 d at 15 degrees C, and then the roots were measured. Total root length measurements for the two methods, manual and image analysis, were well correlated (r2 = 0.94), and both were equally able to identify bacteria inhibitory to plant growth. Root measurements by the scan method were five times faster than the manual method. Each sample required 53 s to read with the scan method vs. 250 s with the manual method. The scan method provides a quick and accurate method for screening inhibitory activity of rhizobacteria based on seedling root length and has potential in the screening of toxic substances of other origin. [References: 19].


Spring wheat (Triticum aestivum L. cv. Turbo) was exposed to different levels of ozone and water supply in open-top chambers in 1991. Air was charcoal filtered (CF), non-filtered (NF) and CF plus proportional addition of ambient or twice ambient ozone (CF1, CF2). Seasonal means of O3, taken over 24 h, were 2.3, 20.6, 17.3, and 34.5 nl litre(1) for CF, NF, CF1 and CF2 treatments, respectively. A split-split plot design was used to obtain two levels of water supply. one-half of the pots was irrigated sufficiently not to show any symptoms of drought stress, the others were exposed to low water supply and received 30% of these amounts. Using a steady-state porometer approximately 800 measurements of stomatal conductance (gs) were made on flag leaves from 68 to 106 days after sowing. The measurements yielded only small differences of maximum conductance between the two levels of water supply. Therefore, low water supply did not protect wheat plants against ozone injury via reduced stomatal uptake in this experiment. To describe the effects of environmental variables on the stomatal behaviour, boundary-line analysis and non-linear regression analyses was used. Besides microclimatic parameters, the ozone dose of flag leaves was introduced as an independent variable affecting stomatal aperture. A well-defined boundary line for ozone dose was found, suggesting that increasing ozone dose caused stomatal closure in wheat flag leaves. But at high ozone doses, co-acting senescence seems also responsible for the decrease in stomatal conductance. A multiplicative boundary-line model was used to predict stomatal conductance from combinations of environmental variables. In the test carried out with the measurements of stomatal conductance, the model accounted only for 40% of the variation of gs. Generalized stomatal response patterns of the herbaceous growth form, the dependence of the variables' age and ozone dose and the lack of an important factor influencing stomatal response (water status of the plant) in the model, are suggested as explanations of the poor results of the test. [References: 28].


511 Issa, AA.; Abdalla, MH; Mahmoud, ALE. (1994) EFFECT OF BIOLOGICAL TREATMENTS ON GROWTH AND SOME METABOLIC ACTIVITIES OF BARLEY PLANTS GROWN IN SALINE SOIL. *Microbiological Research*. 149(3):317-320. English. [UNIV ASSIUT FAC SCI DEPT BOT ASSIUT EGYPT].

The ability of different microorganisms to alleviate the noxious effect of salinity was tested. Barley grains were planted under salt stress and were inoculated with cyanobacteria, *Pseudomonas* fluorescens and *Dunaliella tertiolecta*. All tested microorganisms improved growth of barley plants as indicated by dry weight, photosynthetic pigments and vitality of the plants. Cyanobacterial inoculant was the most effective and significantly diminished the adverse effect of salinity. Results of the present study hold promise for use of such microorganisms to cultivate plants in saline soils.


Relative activities of superoxide dismutase (SOD) and pigment contents have been determined in crude extracts of wheat seeds and leaves treated with the herbicide alachlor (0.05 to 50 ppm). The contents of all pigments in leaves of 21-day-old plants were lowered by the action of alachlor and in dependence on its concentration. As compared to the controls, the contents of chlorophyll a, chlorophyll b and carotenoids decreased to 63.5%, 69% and 95%, respectively. While SOD activity decreased to the half in swollen seeds at the highest alachlor concentration, in leaves of 21-day-old plants the activity reached the fivefold value at an intermediate concentration (5 ppm) and dropped to the control level at the highest concentration (50 ppm). Using native polyacrylamide electrophoresis, SOD isoenforms were separated and determined in different tissues. Inhibition studies revealed the existence of two Cu/Zn enzymes and one Mn containing enzyme. Incubation of germinating seeds with alachlor as well as a 21-day treatment of young plants did not alter the isoenzyme pattern of SOD in seeds and green leaves.


The ratio of Na+/Cl- in roots was higher than that in leaves of two barley varieties with different salt tolerance under NaCl, Na+ and Cl-stresses of the same osmotic potential. Na+ content in leaves was lower and Cl- content in leaves was higher than that in roots. Ionic damage to plant cells under Na+ stress was greater than that under Cl- stress. The lethal Cl- content of leaf cells was 4.2-4.8 mg/mol. DW. Under NaCl stress, Cl- content in roots of the two varieties was about 20% of that in whole plant. Cl-content in roots and shoots of Tanyin No.2 was lower than that of Keping No.7 due to less Cl- uptake in Tanyin No.2.


10-d-old wheat seedlings were grown hydroponically in presence and absence of 100 mM NaCl for 7 d. Salt stress decreased growth of shoots and roots of both cultivars; fresh mass of sensitive cultivar being more affected. NaCl increased membrane permeability to urea, methyurea and ethyurea and decreased membrane partiality in root cortex cells of sensitive cultivar. Neither parameter changed by NaCl in resistant cultivar. NaCl treatment decreased water permeability and osmotic potential in both cultivars; sensitive cultivar was more affected. The results extend our previous data that cell membrane properties are different in salt sensitive and resistant genotypes and so cell permeability could be a potential trait indicating salt tolerance.


A highly enriched plasma membrane fraction was isolated by two phase partitioning from wheat roots (*Triticum aestivum* L cv. Vivant) grown with and without 100 mM NaCl. The lipids of the plasma membrane fraction were extracted and characterized. Phosphatidylcholine and phosphatidylethanolamine were the major phospholipids with lesser amounts of phosphatidylinositol, phosphatidylglycerol, diphasphatidylglycerol, phosphatidic acid and phosphatidylethanolamine. NaCl decreased the total phospholipids and the phosphatidylcholine portion of the plasma membranes. Salt treatment had no effect on total sterols and glycolipids, but the relative abundance of the free sterols was altered: cholesterol, stigmasterol and brassicasterol were significantly increased. Salt treatment resulted in an increase of the more planar/less planar ratio of the free sterols and in introduction of a double bond in the C-22 position in the side chain of stigmasterol and brassicasterol. The degree of fatty acid saturation of total phospholipids, phosphatidylcholine and phosphatidylethanolamine was increased after salt treatment. These lipid changes are discussed in relation to the salt tolerance mechanism. [References: 36].


Growth and yield were reduced but C-14 translocation velocity was not affected by increasing levels of ozone in spring wheat exposed in open top chambers to the following treatments: charcoal filtered air (CF), non-filtered ambient air (NF), or NF with addition of 30 mu l liter(-1) ozone, 8 h daily (NPO). Destructive harvests were performed at anthesis and at maturity. Farts of the flag leaf or the second leaf were exposed to (CO2)-C-14 in small cuvettes for 5 min before, during and after anthesis. The translocation velocity was followed by autoradiography and scintillation counting of the plants frozen and lyophilized at different times after labelling. The label was transported at the same velocity in all the treatments. Ozone induced changes in carbon allocation or partitioning should probably be explained as amounts of carbon transported (mg s(-1)), rather than as translocation velocity (mm s(-1)). The amount translocated may be governed by source conditions under O-3 stress: reduced healthy green biomass and photosynthesis, but perhaps also by impairment of phloem loading because of membrane damage. [References: 30].


High temperature stress limits productivity of winter wheat (*Triticum aestivum*) in many environments. Identification of thermal tolerant germplasm is needed to improve plant productivity under heat stress. In this study we used 2, 3, 5-triphenyltetrazolium chloride (TTC) reduction, an indicator of mitochondrial activity, to characterize cultivar differences for acquired thermal tolerance in winter wheat. Seven-day-old seedlings of six hard red winter wheat cultivars grown at 25 degrees C were acclimated at 37 degrees C for 24 h followed by a 50 degrees C incubation for 2 h. Leaf sections sampled after each temperature treatment were infiltrated with TTC and the resultant formazan was ethanol-extracted for optical density.

Germination is a developmental stage extremely sensitive to salinity. We studied the effects of three regimes of salinity (50, 100 and 150 mM NaCl) on polyamine (PA) metabolism during the germination of seeds of three wheat (Triticum aestivum L.) cultivars. These three genotypes exhibited inhibition of germination by salt, in the following order: Ardenica > Agnus > Daqi. The presence of salt decreased the putrescine (Put) level, especially in roots. On the contrary, the levels of spermidine (Spd) and spermine (Spm) were increased by salt with a greater effect in shoot. A positive correlation with the growth inhibition of the three cultivars was observed for the level of Spd and Spm and, even better, for the PA/diamine ratio. Feeding experiments with [C-14]Put showed that, in the presence of 150 mM NaCl, Ardenica tissues synthesize more PAs than Daqi tissues. The effect of salinity on PA metabolism and the use of PAs as markers of salt sensitivity in wheat seedlings are discussed. [References: 23].


Six varieties of spring and winter wheats of Czech and Slovak origin (Regina, Sparta, Sida, Maja, Ilona, Linda) were tested at a high level of soluble aluminum (40 ppm) at low pH (4.5) by the method of hemotoxylin staining of roots. The aim was to compare the results obtained at two experimental sites in two different environments (growth chamber and room growth conditions). A high tolerance was confirmed in the check variety Atlas 66 and, on the other hand, a high degree of susceptibility was found in Maja. The intermediate degrees of tolerance achieved by Regina, Ilona, Sparta and Sida varied to some extent. Hydroponic cultivation in small plastic containers filled with fine-grained quartz sand, with a stressed and a non-stressed variant, and hydroponic cultivation in glass cylinders (also filled with fine grained sand) were carried out. These two complementary tests were performed to find out potential differences in the reaction of genotypes to the mentioned stress factors at different growth stages. In both of them, the highest tolerance degree was shown by Atlas 66, the most sensitive variety in the plastic containers test was Linda, and in the test with glass cylinders Maja, but the difference between them was not significant. The intermediate levels of tolerance showed certain variability.


The frost tolerance of winter wheat is one component of winter hardiness. If seedlings are frost resistant, it means that they can survive the frost effect without any considerable damage. To study the genetic control of frost tolerance, an artificial freezing test was used. Frost tolerance is controlled by an additive-dominance system. The results of diallel analyses indicate the importance of both additive and non-additive gene action in the inheritance of this character. The dominant genes act in the direction of lower frost tolerance and the recessive genes in the direction of a higher level of frost tolerance. The results of monosomic and substitution analyses show that at least 10 of the 21 pairs of chromosomes are involved in the control of frost tolerance and winter hardiness. Chromosomes 5A and 5D have been implicated most frequently. The gene F1 (Frost 1) was located on the long arm of chromosome 5A. Crosses between cultivars, chromosome manipulation and the induction of somaclonal variation may be suitable methods for broadening the gene pool for frost tolerance. [References: 19].


Several recent reports have suggested that boron (B) may alleviate the toxic effects of aluminum (Al) on plant growth, providing improved plant performance on acid soils. To test this hypothesis, an Al-sensitive cultivar of Triticum aestivum L. (cv. Neepawa) was grown in solution culture with 10 concentrations of Al (0-500 mu M), in the presence of deficient (60 mu M), sufficient (60 mu M), and toxic (750 mu M) concentrations of B. The effects of both Al and B on the response of roots to Al were accurately modeled (R2 < 0.99) using a modified Weibull function. Comparison of best fit function parameters for the response to Al under varying conditions of B supply failed to reveal any evidence of B amelioration of Al toxicity. The combined effects of Al and B were adequately explained by a multiplicative model. Although formation of stable Al-berate complexes could occur in growth solutions under our experimental conditions, varying the supply of B had little effect on accumulation of Al in roots and leaves. In contrast, increasing Al concentrations in solution resulted in increased immobilization of Al in roots and decreased accumulation of Al in leaves. Growth of plants with elevated B supply resulted in higher concentrations of B in roots and leaves without improving growth. We suggest that previous reports of B amelioration of Al toxicity reflect the unique characteristics of soil-based media, and (or) differences among species in internal requirements for B and the effects of Al on B nutrition. [References: 15].


About 450, 000 hectares arable land in the foothill and mountain region, and some flat and hilly location of North and South Bulgaria are characterized by acid soil and low yields have been obtained by wheat, barley, maize, sunflower. It has been established that the cultivar of triticale "Vihren" shows a marked tolerance to the soil acidity. According to the data of State Varietal Testing on the average for three years (1984-1986) cv. "Vihren" yielded 13, 3% more than cv. "Sadovo 1", winter common wheat, in Vrahevo and Lesnovo regions with acid soils (pH=4.0-4.5). In laboratory conditions, the first depression in the root development was found at considerably higher concentration of Al3+ (30 ppm) in nutrient solution, where as in cv. "Sadovo 1" it was between 10-15 ppm. Our data indicated that the tolerance of cv. "Vihren" to the soil acidity was expressed in a weak depressive effect of aluminum-female compounds on the uptake of P-32. It may grow in the regions mentioned above and could significantly increase grain yields.


A method to evaluate potential crop damage from multi-species weed infestations is presented. The method is based on the hyperbolic relationships between density of a single weed species and crop yield loss. When considering a mixed weed population, the density of each species is transformed into a Density Equivalent, defined as the density that is equal to the density of a reference species giving the same yield loss. A hypothetical species with i and a parameters both equal to 100 was adopted to describe the relationship between yield and reference density. The method has been evaluated with data from a 2-year experiment on soybean (Glycine max (L.) Merrill) grown in mixtures with Xanthium strumarium L. subsp. italicum, Polygonum persicaria L. and Pannicum miliaceum L. The mixtures included seven weed densities with different proportions of the three weed species. The model described the data well, but it showed an average 7.5% overestimation of crop damage. The reasons for this overestimation and the utility of the model in weed management is discussed. [References: 18].


534 Darwent, AL.; Townley-Smith, L.; Lefkovitch, LP. (1994) COMPARISON OF TIME AND DEPTH OF LAST TILLAGE ON THE GROWTH OF CANADA THISTLE (CISTUS ARVENSE) IN SUMMERFALLOW AND ITS RESPONSE TO GLYPHOSATE. Canadian Journal of Plant Science. 74(4):867-873. English. [AGR & AGRFood CANADA RES STN POB 29 BEAVERTON T0J 0C0 AB CANADA]. Field studies were conducted at a sumafallow site in 1990 and 1991 at Beavan, Alberta Oot. 55 degrees 14'N, long. 118 degrees 22'W, and Melfort, Saskatchewan Oot. 52 degrees 52'N, long. 104 degrees 36'W, to compare the development of Canada thistle [Cistus arvense (L.) Scop.] shoots following the discontinued of normal tillage at three times (19 July, 30-31 July and 9-12 Aug.), at three depths (0, 10 and 20 cm), and its response to glyphosate applied at 0.9 kg ha(-1) 40 d after the last tillage (DALT). The tillage treatments had no consistent effect on shoot density when measured at 40 DALT at either location. At Beavan, small increases (<5%) in shoot density occurred between 20 and 40 DALT where tillage was conducted at the shallowest depth, but increases of approximately 20-90% occurred during the same period following tillage at the 10 or 20-cm depth. The proportion of emerged shoots remaining as rosettes at 40 DALT increased as the time of discontinuing tillage was delayed. At Beavan, the proportion of emerged shoots remaining as rosettes at 40 DALT increased from 0.17 +/- 0.05 to 0.59 +/- 0.02 when the time of discontinuing tillage was delayed from mid-July to early August, while at Melfort an increase from 0.47 +/- 0.04 to 0.93 +/- 0.02 occurred for a similar delay in time of discontinuing tillage. Increasing the depth of last tillage increased the proportion of emerged shoots remaining as rosettes at 40 DALT at Beavan, but at Melfort the depth of last tillage had no effect on this proportion. The proportion of shoots remaining as rosettes declined between 20 and 40 DALT when measured at Beavan. Factors causing an increase in the proportion of shoots remaining as rosettes appeared to be associated with exposure of emerged shoots to reduced daylengths. At both Beavan and Melfort, shoot density measured 1 yr after tillage-glyphosate treatments was similar in all plots. Thus, the proportion of shoots remaining as rosettes at the time of glyphosate application did not appear to influence the response of Canada thistle to the herbicide. [References: 19].

535 Grover, R.; Smith, AE; Cessna, AJ. (1994) FATE OF BROMOXINYL N-BUTYRATE AND ISO-OCANOATE APPLIED AS A MIXTURE TO A WHEAT FIELD. Journal of Environmental Quality. 23(6):1304-1311. English. [AGR CANADA RES STN ENVIRONM CHEM & APPLICAT HERBICIDES SECT REGINA 541 3A2 5K CANADA]. Dissipation of bromoxynil (3, 5-dibromo-4-hydroxybenzonitrile), applied as a 1:1 mixture of the n-butyrate and iso-ocanoate esters, in the air, crop, and soil components was measured in a spring wheat (Triticum aestivum L.) field, both during and following its application. Drift losses during spraying were < 1% of the amount applied, with no phenol derivative being detected in air samples collected during application. Following application, cumulative vapor loss for the n-butyrate and iso-ocanoate esters (phenol equivalent, p.p.m.) over the 5-6 postapplication period were estimated to be 16 and 7%, respectively. Little or no free phenol residues were detected in the air above the treated field. The canopy intercepted approximately 20% of the application. Ester deposits on plant surfaces were rapidly dissipated with > 75% of the total ester residues on the crop being lost or hydrolyzed 24 h after treatment. There were no detectable residues in the seed or straw at harvest. In the soil, the half-lives of the n-butyrate and iso-ocanoate were < 1 and similar to 4 d, respectively. Hydrolysis was, however, more rapid under moist soil conditions, with the n-butyrate being converted more rapidly to phenol than the iso-ocanoate. Phenol breakdown was also moisture dependent but much slower, with > 95% dissipation occurring only after 6 wk. [References: 22].


Greenhouse experiments investigated wild oat (Avena fatua L.) control, and crop tolerance of spring and winter wheat (Triticum aestivum L.), and durum wheat (T. turdium L.) to applications of imazamethabenz and fenoxaprop. Both regression technique and Colby's analysis showed the interaction between imazamethabenz, liquid concentrate (LC) or suspension concentrate (SC) formulation, and fenoxaprop to be antagonistic. The antagonism was stronger with imazamethabenz-SC than with imazamethabenz-SC. The effect was greater with higher rates of fenoxaprop or imazamethabenz-SC. A 2 h interval between imazamethabenz-SC application followed by fenoxaprop application overcame the antagonism. The sequence of the split application was important in determining the interaction of these two herbicides. Norstar winter wheat was tolerant to imazamethabenz alone at all rates up to 600 g ha-1 active ingredient (a.i.) but a rate of 600 g ha-1 reduced shoot dry weight of Kyle durum wheat and Katepwa spring wheat. All crop varieties tested were injured by fenoxaprop alone at 100 g a.i. ha-1. Combinations of imazamethabenz and fenoxaprop reduced crop phytotoxicity compared with fenoxaprop alone. [References: 24].


This paper deals with hormone herbicides and their influence on different sorts of winter wheat. It has been shown that all varieties are mainly tolerant on applied herbicides. The advantage in application should be given to herbicides with wide spectre of influence on weeds, such as the following combinations: mecoprop + 2, 4-D, dihydroprop + mecoprop + MCPA, and 2, 4-D + MCPA + mecoprop. Production of wheat with herbicide application is economically justified although the yield of the examined varieties on land treated by herbicides is considerably bigger in relation to the control. The yield is less on plots of land where the weeds have been removed in mechanic way (weeding control).


The fate of imazamethabenz-methyl was studied in a sandy loam soil after application in spring to winter wheat (Triticum aestivum L. Imazamethabenz-methyl and its metabolite 2 (2,4-D, 5-hydroxy-4-methyl-1 (1-methyl)-5-oxo-H-1-imidazol-2-y1)-4-methylbenzoic acid, in mixture with the 5-methylbenzoic acid isomer) were further transformed into the metabolites 3 (2,4-D, 5-hydroxy-4-methyl-1 (1-methyl)-5-oxo-H-1-imidazol-2-y1)-1,4-benzedicarboxylic acid, in mixture with the 1, 5-benzedicarboxylic acid isomer, and 4 (1, 2, 4-benzetenicarboxylic acid, in mixture with the 1, 2, 5-isomer). Metabolites 3 and 4 reached maximum concentration levels in the 10-15 cm layer corresponding to 16-17% and 9-16% of the imazamethabenz-methyl dose, respectively. These maxima were reached between 165 and 177 days after application. Imazamethabenz-methyl metabolism was slower in plots treated with organic fertilizers than in untreated plots. After 196 days the concentrations of all metabolites in the 0-13 cm layer had declined to, at most, 0.01 mg kg(-1). There was no carry-over of residues that could be phytotoxic to the next crop. [References: 8].


The effect of zinc nutritional status on the time course of phytosiderophore release, and uptake of iron and translocation of iron to the shoot, was studied in nutrient solution cultures for two cultivars of wheat (Triticum aestivum, cv. Arona; T. durum, cv. Durati) differing in their susceptibility to zinc deficiency. In the zinc-efficient cultivar Arona, under zinc deficiency translocation of iron from roots to shoot was significantly decreased in 13- and 15-day-old plants, whereas release of phytosiderophores was enhanced when the plants were 16 days old. As zinc deficiency became more severe in older plants, translocation of iron to the shoot was further decreased and release of phytosiderophores was further enhanced. Resupplying zinc in nutrient solution to zinc-deficient plants significantly increased the translocation of iron to the shoot after 48 and 72 h. Concomitantly, the release of phytosiderophores was repressed. The other cultivar Durati, classified as zinc-insufficient in field observations, differed from cv. Arona, by showing a lower rate of phytosiderophore release under zinc deficiency, and a less impaired translocation of iron to the shoot. Foliar application of iron citrate to zinc-deficient Arona plants repressed the release of phytosiderophores and increased iron concentrations in shoot and roots. Application of Fe-55 to the leaves demonstrated that retranslocation of iron from the shoot to the roots was not affected by the zinc nutritional status. It is concluded that enhanced release of phytosiderophores in zinc-deficient wheat plants was induced primarily by impaired translocation of iron to the shoot. [References: 33].

J11 HANDLING, TRANSPORT, STORAGE AND PROTECTION OF PLANT PRODUCT


Three aerated commercial stores of 5000-10,000 t of wheat in England were discovered to have surface infestations of Stophalus granarius in
mid-winter when the grain temperature was 4-9 degrees-C. The infestations were monitored using pitfall and probe traps and catches dropped to zero after the application of etrinfos or pirimiphos-methyl 2% dust into the top 0.3 m at 50g/m². The effects of surface treatments in 20 lms of wheat, were each aerated at 10 m³/h/1 with an 0.02 kW fan and infested with 1/kg each of S. granarius and Oryzaephilus surinamensis and 0.5/kg of Cryptolestes ferrugineus as well as the mines Glycophagus destructor and Acurus siro. The surface of three bins were treated with 45 g/m² of 2% pirimiphos-methyl dust. Insect numbers, as determined by pitfall traps and probe traps at the above, 1 and 2 m, fell in all bins during the winter as temperatures fall to 5-degrees-C. As the bins warmed up in the spring, numbers of O. surinamensis rose again in the untreated bins. In the second year, S. granarius reached peak numbers in the untreated bins in mid-winter. The much lower numbers of insects trapped in the treated bins were a result of the surface treatment and the few found may have been attributable to migration from the untreated bins. A. siro and G. destructor, together exceeded 1500/kg at the surface of untreated bins, but were less than 10/kg in treated bins. In the second year, few if either species were found and the predatory mite, Cheyletus eruditus, reached 200/kg in all bins, before declining. The experiment showed some of the shortcomings of an integrated pest management system for stored grain, based on cooling, storage at 15% m.c. and monitoring of pest numbers. These were surface populations of mites in the first winter, spring surface re-occurrence of O. surinamensis and surface populations of S. granarius in the second winter. These were overcome by adding surface admixture to the other elements of the IPM system. The IPM program cost less than half of the cost of fumigating the bulk with the cheapest insecticide and used 10% of the insecticide. [References: 36].

548 Hagstrum, DW; Dowdy, AK; Lippert, GE. (1994) EARLY DETECTION OF INSECTS IN STORED WHEAT USING STICKY TRAPS IN BIN HEADSPACE AND PREDICTION OF INFESTATION LEVEL. Environmental Entomology. 23(5):1241-1244. English. [USDA ARS GRAIN MKT RES LAB MANHATTAN, KS 66502 USA].

Insect populations in 14 bins of newly harvested wheat on eight farms in Kansas were monitored with sticky traps in the bin headspace and with grain samples. Sticky trap catches during the first 3 wk of storage were used to provide an estimate of the species and densities of insects that were present in the headspace. Grain samples were taken every 2 wk during the first 3 mo of storage to provide an estimate of population growth under the grain temperature and moisture conditions in the bins. The sticky traps correctly predicted whether lesser grain borers, Rhyzopertha dominica (F.), and rusty grain beetle, Cryptolestes ferrugineus (Stephens), would be found in the grain samples in 85.8 and 78.6% of the bins, respectively. Traps were less reliable for foreign grain beetles, Ahasverus adversus (Wall.), and hairy fungus beetle, Typhaea sternicornis (L.), with correct predictions in 57.1 and 42.9% of the bins, respectively. Indianmeal moth, Plodia interpunctella (Hubner), was found in both traps and grain samples in only one bin and red flour beetle, Tribolium castaneum (Herbst), and sawtoothed grain beetle, Oryzaephilus surinamensis (L.), were not found in both traps and grain samples in any of the bins. The traps in the center of the bin caught 4.7-14.2 times more beetles than those on the bin walls, but only 1.3 times more P. interpunctella adults. The total numbers of C. ferrugineus adults in the grain samples could be predicted better from the product of mean grain temperature times maximum grain moisture than from sticky trap catch. [References: 12].


LO2 ANIMAL FEEDING


552 Damme, K. (Lehr und Versuchsanstalt fuer Kleinsteinzucht, Kitzingen (Germany)) (1994) [27th Bavarian Feed Value Performance Test for complete feed and supplementary concentrate for layers]. 27. Bayerische FWLP fuer Legehennen-Alleenfuttermittel und Ergaenzer. Deutsche Geflügelwirtschaft und Schweineproduktion (Germany) v. 46(12) p. 6-8. 3 tabs. German. (AGRIS 94-110781).


557 Martinez Ch., Luis Herman (1993) [Levels of maize replacement for nodule oat for broiler raising and fattening]. Niveles de reemplazo de maiz por cebada desnuda en cez y angorda de pollos de carne. Concepcion Univ., Chilun (Chile). Fac. de Agronómia. 34 ref. 56 p. Spanish. (AGRIS 94-110752).

The purpose of the trial was to evaluate the productive behavior of the broiler chickens in relation to body weight variations, food consumption and feed conversion, when hull-less barley, in different levels was included to replace corn in the ration. Four hundred Hubbard one day old chickens were used, distributed in five treatments in a completely randomized design. The concentrated mixtures were treatment I: 0%; treatment II: 25%; treatment III: 50%; treatment IV: 75% and treatment V: 100%, of hull-less barley substituting corn. Other ingredients in the diet were: soybean meal, wheat middling, fat animal, fish meal, oyster shell, salt, vitamins, minerals, methionine and coccidiostat. Total average of feed intake per chicken was: 4.228 g, 4.096 g, 4.009 g, 3.933 g and 3.383 g in treatments I, II, III, IV and V, respectively. The average body weight gain for the chickens were: 1.747 g, 1.628 g, 1.572 g, 1.454 g and 1.250, 8 g in treatments I, II, III, IV and V, respectively. Significant differences (P< 0.0) were observed among all treatments. Food conversions were: 1.42; 2.51; 2.54; 2.7 and 2.7 kg/kg for treatments I, II, III, IV and V, respectively. Significant differences (P< 0.05) in treatment III, IV and V. Chickens skn
and tarsus pigmentation decreased when increasing amount of hull-less barley in the ration was included and only chickens with 0 and 25% of hull-less barley had a satisfactory pigmentation. The cost for the rations per kg body weight varied between S 172 and S 181, 2. The lowest value correspond to treatment without hull-less barley. It can be concluded that the inclusion of hull-less barley in the feed formulation for broilers promoted a decrease in the food consumption, in the body weight gain and the feed conversion.


557 Ball, BC.; Robertson, EAG. (1994) EFFECTS OF SOIL WATER HYSTERESIS AND THE DIRECTION OF SAMPLING ON AERATION AND POR Function IN RELATION TO SOIL COMPACTION AND TILLAGE. Soil & Tillage Research. 32(1):51-60. English. [SAC DEPT SOIL SCI W MAINS RD EDINBURGH EH9 3JG SCOTLAND].


Cereals grown under irrigated conditions in the Canadian prairies produce large amounts of residues and proper management of these residues is required to produce good crop yields and maintain soil quality. Field studies from 1986 to 1990 assessed the effect of straw-tillage treatments on plant growth of irrigated cereals on a Dark Brown Chernozemic Lethbridge (Typic Boroll) loam in southern Alberta. The crop sequence was wheat (Triticum aestivum L.)-wheat-oats (Avena sativa L) wheat. Straw was retained on the plots or removed by baling. Tillage treatments were autumn mouldboard ploughing, spring mouldboard ploughing or direct seeding. Grain yield was greater in the autumn plough compared with the spring plough treatments (4536 kg ha-1 vs. 3763 kg ha-1, respectively) in 1 year (1989) out of 4. Grain yield was greater in the no straw-spring plough than the straw-spring plough treatment (4245 kg ha-1 vs. 3791 kg ha-1, respectively) in 2 years out of 4. Spring plough treatments...

had the advantage of ground cover over winter compared with autumn
ploughing treatments. The problems associated with straw incorporation in
the spring could be alleviated by removing the straw by baling but this
practice removed 16.0 kg N ha⁻¹ year⁻¹ and 1600 kg C ha⁻¹ year⁻¹ from the
soil system. Grain N concentration was decreased by 10% if straw was
incorporated in the spring compared with autumn incorporation. Straw N
centration was decreased with spring ploughing compared with autumn
ploughing when straw was incorporated and also when straw was
removed by bailing. Total plant N was decreased by spring ploughing
compared with autumn ploughing if straw was incorporated. Incorporation
of straw also decreased total plant N compared with removing the straw with spring but not with autumn ploughing. Under a
non-straw direct-seeding treatment, grain yield and plant N uptake were
generally less than the no straw-direct-seeding systems. Straw-tillage treatment
effects on grain yield and plant N uptake were attributed to differences in
seedbed quality and mineral N levels. Lower spring and autumn soil NOS-
N levels in the straw-spring-plough and direct seeding treatments throughout the 4 crop years were attributed to great N immobilisation
compared with the autumn plough and no straw-spring-plough treatments. This field study showed that although spring incorporation of
straw and direct seeding treatments encountered seedbed problems and
lower N availability, these treatments with added N could be as
productive and be more sustainable systems than other treatments as they
enjoy advantages in terms of better soil conservation and less harmful
environmental impacts. [References: 29].

AND TILLAGE MANAGEMENT EFFECTS ON SOIL PROPERTIES OF
A TYPIC CRYOBOROLL UNDER CONTINUOUS BARLEY. Soil &
Tillage Research. 32(2-3):117-133. English. [UNIV ALBERTA DEPT SOIL
SCI EDMONTON T6G 2E3 AB CANADA].

Adoption of reduced or no-tillage practices on a large scale depends on
the maintenance of a favorable soil environment for crop growth in
addition to providing a sustained protection against soil erosion. We
evaluated the changes in soil aggregation status (0-5 cm) and in other
physical and chemical properties (0-15 cm) of a Malmo clay loam (Typic
Cryoboroll, Black Chernozem) subjected to three tillage and residue
management systems after nine years in central Alberta with a subhumid
temperate climate. The soil was cropped to spring barley (Hordeum
vulgare L.) each year. The treatments included: no tillage, straw retained
on the surface; tillage, straw incorporated into surface soil; and tillage,
straw removed. Tillage consisted of two rotocultivations to a depth of 10
cm, one in late fall and another in spring before seeding. In the no till +
straw treatment, the crop was directly seeded with a hoe drill. The no till +
straw treatment provided 70 to 99% residue cover, followed by till + straw
(41 to 85%) and till + no straw (6 to 14%). Tillage significantly increased
the soil surface roughness, while seasonal rainfall greatly reduced it.
Although the no till + straw treatment had a smaller surface roughness, it
would provide more effective and sustained runoff and erosion control
owing to its greater residue cover and a greater amount of larger water-
stable aggregates. This treatment had significantly greater organic carbon
content, lower pH, lower particle density and greater electrical
conductivity in the 0-5-cm soil depth interval compared with the tilled
treatments. The differences among treatments became less pronounced
with depth. For the surface soil of the no till + straw treatment, the
proportion of wind erodible (< 1 mm) and water-slabakle micro-
aggregates (< 0.25 mm) was also smaller, and mean weight diameter and
geometric mean diameter greater compared to the tilled treatments. Soil
structural stability increased due to straw addition and a better aggregate
size distribution occurred due to a reduction in soil disturbance.
[References: 34].

P33 SOIL CHEMISTRY AND PHYSICS

570 Yan Huijun; Wei Youqing; Zuo Yubao (Chinese Academy of
Agricultural Sciences, Beijing (China). Inst. of Soil and Fertilizers) (1993) A
preliminary approach to investigation of wheat straw incorporated into
the field with soil-affected soils. Soils and Fertilizers (China) (no. 5) p.15-17.

571 Zhang Yousheng; Nie Wei (Chinese Academy of Agricultural
analysis of soil moisture in the land under summer and autumn grain
crops in Dingxi Region, Gansu (China). Soils and Fertilizers (China) (no. 2)

572 Zhao, F.; Megath, SP. (1994) EXTRACTABLE SULPHATE AND
ORGANIC SULPHUR IN SOILS AND THEIR AVAILABILITY TO
PLANTS. Plant & Soil. 164(2):243-250. English. [APRC INST ARABLE
CROPS RES DEPT SOIL SCI ROTHAMSTED EXPKL STN HARPENDEN
AL5 2QJ HERTS ENGLAND].

Ten soils collected from the major arable areas in Britain were used to
test the availability of soil sulphur (S) to spring wheat in a pot
experiment. Soils were extracted with various reagents and the extractable
inorganic SO₄²⁻ and total soluble S(SO₄²⁻ + total fraction of organic S)
were determined using ion chromatography (IC) or inductively-coupled
plasma atomic emission spectrometry (ICP-AES), respectively. Water,
0.016 M KH₂PO₄, 0.01 M CaCl₂ and 0.01 M Ca(H₂PO₄) (2) extracted
similar amounts of SO₄²⁻, as measured by IC, which were consistently
smaller than the total extractable S as measured by ICP-AES. The amounts
of organic S extracted varied widely between different extractants, with
0.5 M NaHCO₃ (pH 8.5) giving the largest amounts and 0.01 M CaCl₂ the
least. Organic S accounted for approximately 30-60% of total S extracted
with 0.016 M KH₂PO₄ and the organic S:Ca ratio in this extract varied
typically between 50 and 70. The S fraction decreased in soils without added S after two months growth of spring wheat,
indicating a release of organic S through mineralisation. All
methods tested except 0.5 M NaHCO₃ - ICP-AES produced satisfactory
results in the regression with plant dry matter response and S uptake in
the pot experiment. In general, 0.016 M KH₂PO₄ appeared to be the best
extractant and this extraction followed by ICP-AES determination was
considered to be a good method to standardise on. [References: 33].

573 Zhou Lingyun (Academia Sinica, Nanjing (China). Nanjing Inst. of
Soil Science) (1993) Water supply and potential productivity in rainfed
wheat field in Fenggou Region, China. Acta Pedologica Sinica (China)

P34 SOIL BIOLOGY

574 Bloem, J.; Lebbink, G.; Zwart, KB.; Bouwman, LA.; Burgers, SLGE;
Devos, JA.; Deruiter, PC. (1994) DYNAMICS OF MICROORGANISMS,
MICROBIVORES AND NITROGEN MINERALISATION IN WINTER
WHEAT FIELDS UNDER CONVENTIONAL AND INTEGRATED
MANAGEMENT. Agriculture Ecosystems & Environment. 51(1-2):129-143
English. [IL0 AB AGROBIOL & SOIL FERTIL RES INST POB 129 9750
AC HAREN NETHERLANDS].

To reduce environmental problems, integrated farming has been
proposed, which may involve a considerable reduction of fertiliser-N input. A reduced fertiliser-N input must be compensated for by a higher N
mineralisation from organic matter. To reduce losses and to facilitate optimal use of the N mineralised for crop growth, knowledge of the effects of
management on soil organisms and on their role in N cycling is needed.
Therefore, biomass and activity of bacteria, biomass of fungo,
bacteriovorus amoebae, flagellates and nematodes, and in situ N
mineralisation were monitored during a full year in a winter wheat field
under conventional management (CONV) and integrated management
(INT). Pungal biomass was about 100-fold lower than bacterial biomass.
The average bacterial biomass was not significantly higher in INT than in
CONV, whereas amoebae and nematodes were 64% and 22% higher,
respectively. Average N mineralisation was 30% higher in INT. The
differences are attributed to the approximately 30% higher organic matter
content of INT. Bacterial biomass and frequency of dividing-divided cells
(FDDC) were relatively low in December and January, probably owing to
temperatures just above 0 degrees C. At about 5 degrees C in February and
March, relatively high FDDC values and a doubling of bacteria occurred.
During summer, FDDC values were relatively low and bacterial numbers
were stable, probably owing to nutrient limitation. After harvest and skum
ploughing, rapid increases in FDDC and bacteria were found. In the non-
fumigated INT field, protozoan peaks coincided with the bacterial peak,
wheras in CONV bacteriovorous fauna were drastically reduced by soil
fumigation. Nevertheless, the bacterial peaks were similar in CONV and
INT, indicating that bacteria were not controlled by bacterivores. Nitrogen
mineralisation was relatively low in winter. The increased bacterial
growth in February and March, and in September appeared to enhance immobilisation rather than mineralisation of N. During the growing season from April to the end of August, bacterial growth was relatively low and N mineralisation was relatively high. This probably resulted from bacterivore feeding and from substrate- or nutrient-limited bacteria with a low growth efficiency. Considerable mineralisation rates after harvest confirmed the need for measures to stimulate immobilisation during periods without crop uptake. [References: 47].


Crop management strategies that alter the tuning, placement, quantity, and quality of crop residue input can affect the size, turnover, and vertical distribution of the active and passive pools of soil organic matter (SOM). Our objectives were to quantify long-term changes in soil organic, soil microbial biomass (SMB), and mineralizable C and N in continuous wheat (Triticum aestivum L.), continuous wheat-soybean [Glycine max (L.) Merr.], and wheat-soybean-sorghum [Sorghum bicolor (L.) Moench.] sequences under conventional tillage (CT) and no tillage (NT) with or without N fertilizer. Soil classified as a Weswood silty clay loam (fine, mixed, thermic Fluventic Ustochrept) located in southern Texas was sampled shortly after planting, during flowering, and following harvest of wheat. Soil microbial biomass C (SMBC) increased by 18% and mineralizable C increased by 37% from planting to flowering when averaged across crop sequence, tillage, and N fertilization regimes. At harvest, SMBC and mineralizable C had returned to the amount at planting. After all crop sequences, except in continuous wheat on which decomposition proceeded without C input during the long fallow. Mineralizable C was 64, 28, and 15% greater at flowering compared to planting under NT and 45, 38, and 29% greater under CT at depths of 0 to 50, 50 to 125, and 125 to 200 mm, respectively. The greater increase in mineralizable C near the surface may be related to the abundance of crop roots, rhizosphere products, and more optimal air-filled porosity. With N fertilization, mineralizable N followed the same seasonal pattern as SMBC and mineralizable C. Without N fertilization, mineralizable N did not change during the growing season, despite increased SMBC and mineralizable C at flowering, indicating greater immobilization of N at flowering. Seasonal inputs of crop roots, rhizosphere products, and crop residues significantly altered SMBC and mineralizable C and N of this soil, illustrating the dependence of N dynamics on short-term C inputs. Seasonal changes in the active C and N pools of SOM depended upon (i) crop sequence for the quantity, quality, and frequency of C input, (ii) tillage for the depth distribution of added substrates, and (iii) N fertilization for the quantity and quality of substrates. These seasonal changes can alter N availability and conservation. [References: 27].


The paper deals with the effect of different quantities of saturation mud and nitrogen on the frequency of individual groups of microorganisms in soil. The soil was used for growing wheat in a greenhouse. The frequency of microorganisms depended both on the quantity of saturation mud and dose of nitrogen. The highest frequency of microorganisms was achieved with the highest quantity of saturation mud. The application of nitrogen decreased the frequency of microorganisms, while in combination with saturation mud it increased the frequency of microorganisms.


Soil nematode communities were studied in wheat and potato fields in South Bohemia during 1966-1987. A total of 71 species were found, 53 in the wheat and 20 in the potato fields with their mean abundance 0.58 x 10(6) ind.m(-2) and 0.73 x 10(6) ind.m(-2), respectively. Bacteriophages were the dominant group of nematode communities. Mean biomass of nematodes was 0.22 g.m(-2) in the wheat field, and 0.46 g.m(-2) in the potato field, the highest biomass had omnivores. Two peaks were found in the seasonal changes of nematode abundance in both years.


The effects of a graded intensity of agricultural cultivation on Collembola were recorded from 1987 to 1989 on the experimental field 'Ahlem' of the Federal Biological Research Centre for Agriculture and Forestry. The crop rotation followed the order winter-wheat, winter-barley, sugar beets. The four intensities of cultivation differed mainly in the application of pesticides and N-fertilizer, and therefore also in the density of vegetation and of cultivated crops and accompanying weeds. Within the period of research, a total of 40 species of Collembola were recorded: Isotoma notabilis, Isotomurus palustris and Folsomia fimetaria were almost always the dominant species. The mean density of individuals of the collembola was 230 ind./0.01 g. The effects of the different intensities of cultivation showed up mainly in two opposed trends: the effects of the frequency of application of herbicides and the influence of the supply of nutrients. In the more extensive variant, with a large proportion of weeds and low density of cultivated crops, Anurida pygmaea and Sphaeridia pusilla had significantly higher densities of individuals in every investigation period than in the variants with high intensities of cultivation. The function of these two species as biondicators was discussed in this context. In addition, in the variants treated less intensively with pesticides, the proportion of the main phytophagous species of the total number of collembola was greater, as weeds were available as resource of food. The increased supply of nutrients in the muddle variants led to a better coverage of plant of both cultivated crops and weeds, and thus, especially under moister conditions of weather, to an increase in the number of species of collembola.
The coenoses of mites in agricultural soils and their influence by different crops and intensities of cultivation were investigated. Soil samples were taken in 100 cm large square in each of four intensities in all of the three crops (winter-wheat, winter-barley, sugar beet) in intervals of four weeks. In each of the intensities seven samples were taken two sample parts. Each sample was in a diameter of 5 cm. The samples were taken in the horizontal line separated into the parts 'in the seed-row' and 'between the seed-row'. And in the vertical line they were divided into two horizons of 0-5 and 5-10 cm. The 49 taxa (species to families) of 23 families found in the field the ones in the sugar beet were clearly less than in both of the cereals. Four taxa (Alliphus suluks, Bakerdania blumenmtn., Tectocephus velatus, Tydeidae) were very abundant and also four taxa (Arctosedus cetratus, Bakerdania sellnickii, Hisistomata stenzekii, Tarsomenus sp.) were dominant. All the other taxa were less than dominant. The distribution to the intensities of the soil showed 75-85% of all mites living in the upper soil layer. Divided into horizontal lines there were found twice the density of individuals in the seed-rows than between the seed-rows. The density of individuals/qm was 10000-20000 in average and changes from the crops with barley, to catch crop they increased to 100000 individuals/qm in average. The influence of cultivation was very different - no effect was found on the number of taxa in the different intensities. - No or only little influence was found in most of the very dominant or dominant taxa. - A few of the subdominant taxa a strong influence was observed: Tyrophagus infestans. Tectocephus velatus, Sertoripus granimum and Dendrobacon foelovatius.


In the project of 'Ahlum' the population of earthworms were investigated in each of four intensities of crop rotation (winter-wheat, winter-barley, sugar beet) when cultivated in different intensive ways. Therefore the method of electric catching according to Thielemann (1986) was used. The efficiency of this method was tested in comparison with the method of formalin before. The results were similar, so that the method of electric catching could be considered as equivalent. On an area of 0.25 ha eight electrodes with a depth of catching of 50 cm were prosecuted for 30 minutes with a voltage of 60 V. This was done in intervals of four weeks during the vegetation period in eight repetitions of each date, culture and intensity. The repetitions of electric catching had a distance of 5 m in minimum. Altogether nine species of earthworms were caught. The genera of Allolobophora, Lumbricus and Octolasion were found. Except for the 'main species' Allolobophora caliginosa, Allolobophora rosea, Allolobophora longa and Lumbricidae terresres five accompanying species with less activity abundance were found. In comparison to other arable areas a relatively high number of species was caught. On one hand it corresponded with the high number of repetitions and one large area in it was correlated with the particular conditions in the area which were similar to grassland before the investigation. The dries had a great influence and showed negative effects especially on the species of endogae earthworms in 1988. The influence of the crop had no effect on the number of species, but there were significant differences in the activity abundance.

584 Leinhos, V. (Jena Univ. (Germany). Inst. fuer Umwelt und Ernaehrung); Vacek, O. (1994) Biosynthesis of auxins by phosphate-solubilizing rhizobacteria from wheat (Triticum aestivum) and rye (Secale cereale). Czechoslovak Academy of Sciences, Prague (Czech Republic). Inst. of Microbiology. Microbiological Research (Germany): v. 149/1: p. 31-35. 2 ill., 3 tables: 17 ref. English. (AGRIS 94-123785).

585 Leliveld, B. (Biologische Bundesanstalt fuer Land und Forstwirtschaft, Muenster (Germany). Inst. fuer Nematologie und Wirbelwerkunde); Sturhan, D. (1994) Studies on the impact of different...
The aim of the investigations was to analyse the negative effects of agricultural management of varying intensity on important microbial parameters in the soil and to find out how these effects can be evaluated and reduced. The effect of graded pesticide intensities (no pesticides on one hand, maximum pesticides applied on the other hand) in a crop rotation of winter-wheat, winter-barley and sugar beet was studied in a field trial over three years. In addition, the effects of weediness were studied in 1989 within the untreated control plots in sugar beets. The microbial parameters studied were: dehydrogenase activity (TTC-reduction as an indicator of overall microbial activity), the biomass-related glucose-induced short-term respiration, some enzyme activities, which can be related to certain nutrient cycles (arylsulfatase and alkaline phosphatase), and the hydrolytic enzymes (esters, amides and lipids). Moreover the decomposition of straw (indicator of the decomposition of plant substances) was determined. In plots without pesticide applications (I0) the dehydrogenase activity was higher than in those with pesticide applications (I1-13). In sugar beets no great differences occurred among the three systems of pesticide treatment. In winter cereals a gradation of dehydrogenase values with highest activity in I0 and lowest activity in I1-13 was often found. The higher activities in I0, at least as far as sugar beets are concerned, were induced by a positive effect of weediness and by an inhibitory effect of the cropping systems in the higher intensities.


An attempt was made to determine if wheat and maize radicles can be a carbon and energy source for Azospirillum dinitrogen fixing bacteria. The results show that the compounds from crushed wheat and maize radicles were not an optimal source of carbon and energy for Azospirillum. The most effective dinitrogen fixation by these bacteria was on control malt medium.

590 Umrow, MM.; Shabayev, VP.; Smolin, VY.; Mamedov, NM. (1994) RHIZOSPHERE NITROGENASE ACTIVITY AND TRITICALE YIELD IN MIXED CULTURES OF NITROGEN-FIXING MICROORGANISMS. Eurasian Soil Science. 26(6):64-72. English. [MOSCOW V LOMONOSOV STATE UNIV FAC SOIL SCI MOSCOW 117214 RUSSIA]

Five different mixed-fixing cultures were isolated, and their effect on nitrogenase activity in the triticale rhizosphere, grain yield, soil nitrogen content, and nitrogen removal from soil was studied in greenhouse experiments on Gray Forest Soil. Application of a mixture of bacilli and yeasts to the soil in the presence of potassium phosphate fertilizer resulted in higher yield and self-supporting nitrogen balance. Nitrogenous fertilizers significantly inhibited associative nitrogen fixation in the majority of the studied mixed cultures, the microorganisms themselves inducing nitrogen gas release from N15-fertilizers. [References: 30].


The influence of conventional and biological farming on microbial biomass-carbon (Bio-C) and nitrogen (Bio-N) of agriculturally used fields was compared. The fields were located on luvisols of the Friedberg plains and tillled according to each system for many years. Bio-C and Bio-N were measured using the chloroform-fumigation-extraction technique. During early spring and autumn (1990) Bio-C [% Corg] and Bio-N [% N(total)] were slightly lower in sites of conventional farming than on fields tilled by biological farming. During the vegetation period Bio-C and Bio-N increased continuously in both systems. Thus increase, however, was higher on conventional than on biological fields and may be ascribed to a higher C-input (rhizodeposition) and availability of mineral nutrients. In the soil of the biological farming system N-deficiency apparently decreased Bio-N (but not Bio-C) in spring time. Consequently the Bio-C/N ratio increased. It seems as if plant growth affects the quality of microbial Bio-C/N. The average turnover-time of Bio-N was about 1 year in all soils. However, the
OVER BARLEY. Agricultural & Forest Meteorology. 71(3-4):227-245. English. [INRA BIOCLIMATOL STN BP 81 F-33883 VILLENAVE DORNON FRANCE].

It has been suggested in Part I of this paper that, after a dryland-to-irrigated transition, the surface sensible and latent heat fluxes may exhibit little change with downstream distance from the leading edge. It was argued that such step changes in surface fluxes could be caused by a feedback mechanism between surface resistance and changing saturation deficit. A simple model was derived for describing the streamwise change in surface resistance leading to such a step change in flux. The aim of the present paper is to experimentally confirm the data acquired specifically for this purpose. Measurements were performed over a transition between dryland and irrigated barley. Eddy covariance determinations of sensible heat flux at a height of 1 m showed little variation downstream of the transition and, once corrected from the footprint effect, exhibited patterns roughly compatible with a step change in surface flux. Transects of radiative temperature, and air temperature and humidity above the crop, also showed downwind changes in good agreement with the expected variation. The most convincing results were obtained from measurements of stomatal and canopy resistance, whose downwind variation was close to that required by a step change in evapotranspiration. [References: 21].


A method of forecasting rainfall and mean temperature is shown, which is based on plant phenology and probability distribution of both random variables. This method has been applied for yield forecasting of spring wheat using Exponential Polynomial Model (EPM) - modified version including weights of phenological periods. Presented method makes it possible to give forecast for each recorded phenological stage; the time horizon of the longest of them exceeds 100 to 110 days. Evaluation of method has been made by relative prediction error mean and deviation for absolute error of prediction. A verification test based on data from different regions of Poland proved the method to be very efficient comparing to prediction using sample average.


Monthly rainfall was correlated with share wheat yields across the Australian wheat belt and an average correlation coefficient determined for each month. Based on this varying usefulness of rainfall throughout the year, a rainfall index that weights district rainfall over the wheat belt was found strongly to relate to state and national wheat yields. Accuracy of the model was improved by filtering out insignificant and excess rainfall according to the broad scale water holding capacities of regional soils. As one moves clockwise around Australia from the east the soil is less able to store water and truncated winter rainfall is a major problem on poorer soils. Assuming actual rainfall up to the forecast date and average rainfall beyond, hindcasted yields in 1988 and 1989 were within 10% of the final figure 3 months in advance of harvest. A marked trend to early sowing and higher yielding varieties, coupled with increased inputs caused the model to underestimate in 1990, 1991 and 1992. However, at the end of the
year model predictions equalled, or were more accurate than official predictions in 4 out of 5 years. Large-area Australian yields appear to be a function of both rainfall amount and distribution, as well as the time of sawing and extent of frost in critical periods. [References: 36].

Q01 FOOD SCIENCE AND TECHNOLOGY


Wheat starch-gluten mixture was converted into a bioplastic-like material (bioplastics) under processing at an elevated temperature. The density of the bioplastic was 1.24-1.26 g/cubic cm depending on the ratio of starch to gluten. The color difference of the bioplastic was altered with the starch-gluten ratio. Endothermic peak by differential scanning calorimetry was considerably decreased with the increase of the ratio of gluten to starch. It was revealed that the physical characteristics of the bioplastics were dependent on the starch-gluten ratio and that wheat starch and gluten interact at their interface with the increase of the glass-transition temperature.


Two winter wheat varieties were treated with 11 different herbicides (Belgrano, Aztech D, Banvel M, Lorgan, Assert, Puma, Illoxsan, IP-Flo, Starane, Dikamun D and Dikotex 40) in field trials. The baking properties of their grain yields (wet and dry gluten content, gluten spreading, valoographic value and water absorption, falling number (FN), SDS sedimentation volume) have been determined. Treatments with double doses of herbicides modified the dry gluten content, gluten spreading, water absorption, FN and the SDS sedimentation volume, respectively. Considering the properties except for dry gluten, the interaction between varieties and herbicides seemed to be reliable, namely the quality of varieties was changed by the herbicide treatment. This variety specific effect of herbicides was different for every quality parameter. Out of the 11 herbicides Logran and Assert were found to be the most favourable ones because the baking parameters have not been significantly damaged by them. moreover they were in some cases favourably influenced.

Q02 FOOD PROCESSING AND PRESERVATION


A variety of biotechnological tools have been applied to improve the ingredients of the brewing process. Using these tools agricultural materials have been developed that are free of viruses, have improved agronomic yields, or are resistant to disease. Brewer's yeasts have been constructed with novel properties such as the ability to ferment normally unfermentable carbohydrates, chill-proof beer, or degrade beta-glucans. Yeasts have also been developed that produce less diacetyl, have altered flocculation properties, or are resistant to contamination. Although there are many advantages to biotechnologically improved agricultural materials and yeast, these advantages must be weighed against regulatory, legal and consumer concerns.


607 Becker, H.G.; Lobitz, R. (ed.) (1994) [Buckwheat, spelt, barley, oats, millet, maize, rice, Muesli]. Buchweizen, Dinkel, Gerste, Hafer, Hirse, Mais, Reis, Muesli. Auswertungs- und Informationsdienst fuer Ernahrung, Landwirtschaft und Forsten, Bonn (Germany). AID Verbraucherdienst informiert (Germany); no. 1194 30 p. AID. 38 ill. 1 table; 7 ref. German. (AGRIS 94-124077).


If the influence of wheat varieties and fermentation conditions (i.e. durations of initial and final fermentation, storage of the dough at +1 degree-C for 18 h) on the volatile compounds content and on the odour of bread crumb were studied in an experiment involving breads made according to 3 reference methods with the floors from two varieties of Wheat (Rectal and Soissons). Volatile compounds were analysed by gas chromatography and the odour of bread crumbs was rated by 30 subjects. Correlations were found between the compounds and the results of the sensory evaluation. The content in volatile compounds of the bread crumb and the strength of the olfactory flavour called "spicy" were affected by the refrigeration of doughs under controlled growth. Bread crumb made from flour of Rectal variety was riper in volatile compounds than those made with the flour from Soissons variety. Hypotheses are proposed which might explain these differences.


4 p. 513-524 Centro de Investigacion Regional del Noroeste. 4 tablas; 11 ref. 2o. tomo. Spanish. (AGRIS 94-124179).


626 Zlateva, D; Bratanova, P. (Vissh Institut po Khraniitelina i Vkusova Promishlenost, Plovdiv (Bulgaria)) (1994) [Freeze-dried yeasts from milk-acid Streptococci for the wheat bread production]. Prilozenie na liofilizirani zakvaski ot mlechniski streptokoki pri prizvodstvoto na peshichen khlyab. Firma Nikolov-Internesh'nt, Sofia (Bulgaria). Institut po Liofilizirata i Kiobiologiya na Selskostopanska Akademija S'yu po Khraniitelina-vkusova Promishlenost. Khraniitelina Promishleni (Bulgaria); Food Industry v. 43(3) p. 25-27. 2 ill.; 5 tables; 7 ref. Bulgarian. (AGRIS 94-113350).

Q96 FOOD CONTAMINATION AND TOXICOLOGY


An additional extraction/floatation method for the determination of light filth in whole wheat flour was validated through a collaborative study. A 50 g test portion is boiled in a 3% HCl solution. The mixture is washed with hot tap water on a No. 230 sieve. Then the residue is boiled in isopropanol, transferred to a No. 230 sieve, and washed again. The residue is transferred to a Wildman trap flask using 40% isopropanol. The filth is isolated by flotation in mineral oil and a mixture of Tween 80 and NaCl EDTA in 40% isopropanol. Average recoveries by 8 collaborators were 88.8 and 91.7% for insect fragments and rat hairs, respectively. The extraction/floatation method for determination of light filth in whole wheat flour has been adopted first action by AOAC INTERNATIONAL as an additional procedure to the AOAC Official Method 941.16. Filth in Gran Products. [References: 1].

638 Manev, M.; Kostkanova, E.; Stenh, Z. (Vyzkumný Ustav Rostlinné Výroby, Prague Ruzyně (Czech Republic)) (1994) Indicators of baking quality in some cultivars and advanced lines of spring wheat. Ustav Rostlinné Výroby, Prague Ruzyně (Czech Republic) v. 30(2) p. 133-149. 10 tables; 11 ref. Czech. (AGRIS 94-113724).

Two selected collections of spring wheat were investigated in order to determine the technological quality of grain, dry matter and crude protein yields per 1 ha, 1000-grain weight and plant height. Technological analyses involved crude protein content, microsizedimentionalization value of grains, wet gluten content in flour, gluten swelling and extensibility. In the three-year trial, the crude protein content was highest in the Tr. durum cultivar Arcour from France (16.5 g per 100 g grain dry matter), followed by the Czechoslovak cultivar Maja (15.5 g) and Lobo (15.2 g). The Ventura cultivar had the highest microsizedimentionalization value (81.1 ml). Grain and crude protein yields per 1 ha were highest in the Czechoslovak cultivars Maja (5.3 t and 857.7 kg), Saxana (5.3 t and 763.7 kg), Sandra (5.3 t and 760.9 kg), Jara (5.1 t and 759.3 kg) and the Polish cultivar Eta (5.1 t and 746.3 kg). In the two-year trial, the American cultivar Treasure had the best quality, as well as good yields. In the three-year trial the 1000-grain weight was highest in the advanced line Pato (45.2 g) and in the Sigma cultivar from Poland (43.7 g). In the two-year trial, the highest 1000-grain weight was determined in the Messa pia cultivar of Tr. durum from Italy (46.0 g). In both trials, the values were influenced by individual years.


Hyposalientic wheat products in the form of pasta-like noodles and bread were fabricated. Wheat flour was added with a 0.6-fold weight of water dissolving collagenase to obtain hyposalientic flour batter. Methods for producing hyposalientic pasta-like noodles and bread from the batter were designed. In the noodle making, the batter was mixed with an oligosaccharide with a mild sweetness, a surfactant, and salt, and the mixture was extruded under heating. Both retorting and refrigerating processes were applied to the noodles. In the bread making a mixture of the batter, glucose, citric acid, sodium hydrogen carbonate and salt was baked at 180 degrees C. The addition of glucose contributed to generation of favorable flavor and color. [References: 7].

650 Balcheva, L.; Marnov, V.; Stefanov, G. (Institut po Z'meni Khirani i Pashazha Pomushenost, Kostnabrod (Bulgaria)) (1994) [Mill properties of wheat; with different structural and mechanical endosperm characteristics]. Mlven svojstva na pshenitsi s razlicni strukturo-mekhanichni karakteristikii na endosperma. Firma "Nikolov-President"n, Sofia (Bulgaria). Institut po Liofilizatsiya i Kriobiologiya na Selskoostopanska Akademiya. S'vaz po Khritanitel'no-vkusova Pomushenost. Khritanitelnata Pomushenost (Bulgaria); Food Industry v. 43(2) p. 21-24. 2 ill., 4 tables; 8 ref. Bulgarian. (AGRIS 94-113725).


The effect of ammonia treatment and supplementation of barley straw with increasing levels (0, 200, 400 and 600 g day-1) of meadow grass hay (H), rolled barley (B) or pelleted sugar-beet pulp (P) on ruminal characteristics and straw degradation was studied using eight adult ewes, divided in two groups, receiving either untreated (US) or ammonia treated (TS) straw, supplemented with H, B or P consecutively. Urea (50 g kg-1 straw) was added to US 24 h before feeding. Sheep fed US showed higher ammonia-N (NH3-N) concentration than those fed TS, either as the only feed (17.5 and 12.5 mg per 100 ml) or supplemented (15.0 and 12.7 mg per 100 ml). The rumen liquor over ammonia-N was not at all or only partly for total volatile fatty acid (VFA) concentration. Supplementation with B or P depressed pH and enhanced VFA concentration, whereas H did not have any great effect. Extent of straw rumen degradability was enhanced by ammoniation (maximum degradation of 593 and 741 g kg-1 for US and TS), but rate of degradation and lag time remained unaffected. Both rate and extent of straw degradation were decreased to a similar extent when supplemented with B or P, while with H this effect was only noticeable when it was included in the diet at 600 g day-1. [References: 42].


Three experiments were conducted to determine the effect of different alkali solutions on in vitro degradation and in vivo digestibility of wheat straw. In Exp. 1, ground wheat straw was treated with 15 different alkali solutions grouped as NaOH, NH4OH, urea, and Ca(OH)2 (2). The greatest (P < 0.05) 48-h in vitro NDF degradability was obtained with 5% NaOH and the combination of 2.5% NaOH + 2.5% Ca(OH)2 (2). In Exp. 2, chopped wheat straw was treated with one of the following: 1) untreated; 2) 2.5% NaOH; 3) 5% NaOH; 4) 2.5% Ca(OH)2; 5) 2.5% Ca(OH)2; 6) 0% NaOH; 7) 5% Ca(OH)2; and 8) 2.5% Ca(OH)2 (2) all on DM basis. A significant interaction (P < 0.05) was observed between chemical and pH for lag, rate, and extent of NDF degradation in vitro, which reflected the varying magnitude by which straw treated with different alkali sources was affected at the more acidic pH. No mechanism was determined for the effect of Ca(OH)2 (2), but it seems that Ca(OH)2 (2) enhances fiber degradation at low pH in vitro. [References: 31].


The effects of treating cereal straws with NaOH and ammonia on methane production by sheep are reported. One, two, and two barley straws were either untreated or treated with NaOH (45 kg t-1 dry matter (DM)), and ammonia (35 kg t-1 DM). The straws were supplemented with urea and sodium sulphate as appropriate to provide a dietary N/S ratio of 14:1 and given ad libitum to mature wether sheep. Methane production was measured in open circuit respiration chambers following a 20 day period on each diet. The digestibility of various feed fractions was measured both in vitro and in vivo. Methane production as a proportion of gross energy intake (range 0.047-0.067) was not significantly affected by treatment, although the volume of methane produced per animal was significantly (P < 0.001) increased (Control, 17.8; NH3, 26.2; NaOH 30.11 per animal per day). However, when methane production was expressed relative to intake of digestible organic matter, treatment significantly (P < 0.001) reduced production (Control, 55.0; NH3, 45.7; NaOH, 48.11 kg per organic matter apparently digested). The significance of these findings in relation to reducing methane emissions to the atmosphere is discussed. [References: 56].


In the treatment of gram straw hydrochloric acid had a more significant (P < 0.01) effect than sulphuric acid in lowering the loss of ammonia nitrogen from 45.88% in control to 16.28% using 7.5% urea at a 40% (F4) fixation level as compared with 30% (F3), 20% (F2) and 10% (F1). Treatment of gram straw (Cicer anetum) for 28 days with 7.5% urea having 44.88% moisture at F4 could significantly (P < 0.01) check the loss of ammonia and enhance the crude protein (CP) content to 19.37%. In Experiment 2, the loss of nitrogen was effectively reduced from 35% (T0) to 22% (T1) and 21% (T2) by means of sulphuric acid (10.18 kg kg-1 dry matter (DM)) and green sorghum (Sorghum vulgairis) mixed with wheat straw in the ratio of 1:2 at the time of storage. The relative retention of nitrogen (g day-1) in male buffaloes was significantly (P<0.05) superior in T-1 (53.31) and T-2 (45.58) than T-0 (35.42). The digestible CP (DCP) and total digestible nutrient (TDN) values of urea treated wheat straw were 7.10%, 8.33%, 6.49%, 57.90%, 55.64% and 62.58% in respective treatments. During Experiment 3, untreated wheat straw plus concentrate mixture, 20% CP (T-3), urea (7.5%) treated straw US (T-4), urea treated straw plus acid (23 kg kg-1 DM) (T-5), and urea treated straw plus germinated barley 24% (T-6) were fed to buffalo calves in four groups. The daily body weight gain (g day-1) was significantly (P<0.01) greater in T-6 (64.15) followed by T-5 (55.80), T-4 (49.99), T-3 (45.82). Cost per kg gain in body weight (Rs.) was minimum in T-6 (12.47) followed by T-4 (11.15), T-5 (14.99) and T-3 (23.45). The loss of nitrogen was considerably lowered from 51.3% (T-4) to 19.07% (T-5) using sulphuric acid at farm scale. The treated straw with 24% germinated barley, containing 13.39% CP, 8.33% DCP and 58.54% TDN, may be an economical complete ration...
Q54 FEED COMPOSITION


Two trials were conducted with laying hens heavier body type (Hisek Brown) and lighter body type (Shaver 579). Each of three groups comprised 90 laying hens and they were administered complete loose feed mixture intended for laying hens (169 g of protein, 11.3 M J ME/kg) in control groups and experimental groups were fed with loose concentrate 1 (200 g of protein, 10.4 M J ME/kg), or concentrate II (269 g of protein, 7.5 ME J ME/kg) in combination with whole wheat grain (60% of concentrate I + 40% of wheat), respectively, or 32% of concentrate II + 68% of wheat). Calculated content of nutrients in these combinations ranged from 165 to 170 g of protein and from 10.8 to 11.2 M J ME/kg. In an independent group of one of trials the daily supplement of whole grain wheat to the complete feed mixture in ratio 900 g of mixture + 100 g of whole-grain wheat. Experimental interventions had no effect on egg production of hens. The weight of eggs increased (trial I statistically significantly, P<0.05), feed consumption per day and egg (trial II statistically significantly, P<0.05) in reduction of efficiency of feed. The supplement of whole-grain wheat to the complete feed mixture had no statistically significant effect on eggs indicators. Experimental interventions had no different effect on egg quality (Haugh's units of egg white). Energy intake in experimental groups increased by 3 to 6%, the weight of gizzard increased numerically. The costs of feeds in experimental groups decreased by 7.4 to 17.6%, that is due also to savings of 75% of electric energy for grinding of wheat. Combined admnistration of loose concentrates and whole-grain wheat may be considered as an alternative system of feeding of laying hens by which the breeder utilizes his own sources of cereals in production of heavier eggs particularly from genetically heavier body types of hens.

652 Nahashen, SN.; Nakaue, HS; Snyder, SP.; Murosh, LW. (1994) PERFORMANCE OF SINGLE COMB WHITE LEGHORN LAYERS FED CORN-SOYBEAN MEAL AND BARLEY-CORN-SOYBEAN MEAL DIETS SUPPLEMENTED WITH A DIRECT-FED MICROBIAL. Poultry Science 73(11):1712-1723. English. [ORECON STATE UNIV DEPT ANIM SCI CORVALLIS, OR 97331 USA].

An experiment was conducted with Single Comb White Leghorn (SCWL) layers to determine the effect of feeding either corn-soybean meal (C-S) or barley-corn-soybean meal (B-C-S) diets with or without condensed cane molasses solubles (CCMS) or with or without CCMS-1, 100 mg Lactobacillus (Lacto)/kg (ppm) diet on performance, nutrient retentions, digesta passage rate, and histological changes of the gastrointestinal (GI) tract. Six dietary treatments were fed for eight 28-d periods and consisted of C-S (control), C-S + CCMS, C-S + CCMS-1, 100 ppm Lacto (4.4 x 107 cfu/g), B-C-S (control), B-C-S + CCMS, and B-C-S + CCMS-1, 100 ppm Lacto. The CCMS served as the carrier for the Lacto, and the CCMS-Lacto premix (55 g Lacto/kg) was incorporated at 2% of the diets. Lactobacillus supplementation in C-S diets improved (P<0.05) egg weight, egg mass, egg size, and body weight gains, and in B-C-S diets improved body weight gains. There were no differences in feed consumption, feed conversion, internal egg quality, and egg specific gravity among the dietary treatments. Passage rates of digesta were increased (P<0.05) when either C-S or B-C-S layer diets were supplemented with Lacto. Lactobacillus supplemented the C-S and B-C-S diets increased (P<0.05) fat and calcium, and fat, phosphorus, copper, and manganese retentions, respectively. Increased cellulosity of Feyer's patches in the ileum indicated a stimulation of the mucosal immune system that responds to antigenic stimuli by secreting immunoglobulin (IgA). [References: 44].


USGEN 10 triticale was compared with maize as a feed grain in a digestibility trial, a milk production trial and a fattening trial. Apparent digestibilities were determined with eight Holstein steers, in two blocks of a balanced cross-over design. The grain component of the four diets contained triticale and maize in the ratios 100:0, 66:34, 34:66 and 0:100, respectively. Digestibility coefficients were unaffected by level of dietary triticale substitution for maize. Milk production was not affected by triticale and Holstein cattle were also allocated to three blocks of two animals each and fed the four treatment diets in four consecutive periods. Cows received forage consisting of 20% lucerne hay, 15% wheat straw and 65% oat silage (dry matter basis) ad libitum and a concentrate at 0.5 kg kg-1 milk produced. The grain component of the four concentrates was the same as in the digestibility trial. Milk fat percentage and 4% fat corrected milk production per kg concentrate consumed was lower (P<0.05) on the dietary treatments containing only triticale grain compared to that on the treatments containing different levels of maize grain. For the fattening trial 30 steers were randomly allocated to the five dietary treatments by stratified sampling. The steers received complete diets for 100 days. The grain portion of the five fattening diets consisted of 100% maize, 75% maize:25% triticale, 50% maize:50% triticale, 25% maize:75% triticale and 100% triticale. The calculated triticale steers tended to perform better than steers on diets containing only maize or triticale grain. Feed conversion ratio (carcass) was better (P<0.05) for steers on the 50% maize:50% triticale diet than for steers on the 100% triticale diet. [References: 17].


An experiment with six rams of the Caucasian Merino breed was carried out to study the effect of introduction of various treated wheat grain into the complete feed mixture on their digestibility. The mixture contained 20% of wheat, 33% of lucerne flour, 32% of barley straw and 5% of molasses. In addition 26 g of urea was added per 1 kg of mixture and 15 g of NaCl in treatments without application of NaOH. Within balance nine-day periods the effect of four experimental interventions (I to IV) was compared; i.e. treatments with the whole untreated wheat grain (I), ground grain (II), whole grain treated with sodium hydroxide (III) and hydrothermally treated grain (IV). For treatment of wheat with NaOH (experimental intervention III) 4 kg of NaOH, dissolved in 7 l of water, was applied per 100 kg of wheat. After NaOH application urea was added to wheat, and wheat treated in this way was stored for three days in closed plastic sac before the proper stirring in the mixture. The whole wheat grain (experimental intervention I) was processed by the same technological procedure except for an application of 7 l of water without NaOH. Pressed steamed wheat (experimental intervention IV) was prepared in thermal flocculating device for cereals and legumes made by the firm BOCCHI. All treatments were shaped in the preforming press for preforms ø4 cm in diameter. Dosing of dry matter of feed mixture was chosen on the nutrition level of 1.5. Intake of nutrients per 1 kg W0.75/day and average live weight are in Tab. II. The coefficients of balance digestibility and energy value of mixtures found are presented in Tab. III. Regarding the fact that identical technology of forming was used in all experimental interventions, it may be presupposed that the differences found in digestibility of organic nutrients were caused exclusively by corresponding treatment of wheat grain included in the experimental feed mixtures. Significantly highest digestibility of dry matter, crude protein, fat, nitrogen-free extract (BNVL) and organic matter was found in experimental treatment with grain treated with NaOH (III) and fibre in the experimental treatment with hydrothermally treated grain (IV). On the contrary, significantly lowest values of digestibility were found in experimental intervention with ground wheat. The significance of
Q55 FEED ADDITIVES


The effect of adding 1 g kg-1 of a commercial enzyme preparation (containing beta-glucanase, hemicellulase, cellulase and pectinase activities) to diets containing 300 and 600 g kg-1 of wheat or each of three varieties of triticale (Lasko, Purdy and Proteus) was assessed in a feeding trial with male broiler chicks from 10 to 24 days of age. Also the TMEn value of diets was determined using adult cockerels. At inclusion rates of 300 or 600 g kg-1 the TMEn (true metabolizable energy) values and the productive responses of chicks (feed intake, weight gain and feed efficiency) were similar for all four diets, except that the weight gain for triticale Proteus at 300 g kg-1 was lower (P < 0.05). Increasing the content of cereals from 200 to 600 g kg-1 improved the TMEn of the diets (P < 0.05) and decreased the feed intake (P < 0.05), but did not affect the weight gain of birds, except the diet with triticale Proteus which decreased (P < 0.05). These results confirm that the nutritive value of some cultivars of triticale (i.e. Lasko and Purdy) for birds is similar to that of wheat, and that these varieties can be used at high inclusion rates in poultry diets. The enzyme supplementation of diets did not modify their TMEn value or feed intake of chicks, but the enzyme preparation improved (P < 0.05) feed efficiency of all diets and weight gain at the highest rate of inclusion of triticales. In this study, the best results with enzyme supplementation were obtained with the cereals with lowest nutritive value and when the inclusion rate of cereals was the highest. [References: 14].


The effect on microbial N (MN) supply of supplementation of straw with a mixture of maize starch and ground barley was examined. Urinary excretion of purine derivatives (PD) was used as an index of microbial protein supply. Six wether sheep of 42-48 kg with rumen cannales were offered ad libitum either barley straw with 5% molasses, or barley straw with 15.5 or 31.0% of a mixture of maize starch and ground barley (1:2:1:0), and 9 and 15% molasses respectively. All sheep received all three diets for periods of 21 days. Excreta being collected during the last 7 days. Digestible organic matter intake (DOM) increased with starch inclusion as 435, 750 and 1045 (SED 47) g day-1 for the diets respectively. Total PD excretion was 7.0, 12.3 and 21.1 (SED 0.92) mmol day-1, and the estimated MN supply was 5.7, 10.5 and 18.2 (SED 0.84) g day-1. Expressed as per unit DOM, MN supply was 12.8, 14.1 and 17.5 (SED 1.3) g kg-1 DOM. Rumen liquid and solid outflow rates (fraction of rumen volume h-1) were 0.047, 0.054 and 0.073 (SED 0.0074) and 0.078, 0.105 and 0.130 (SED 0.0085) respectively. MN supply per unit DOM increased probably due to a greater rumen outflow rate. The practical implication is that with low quality straw, supplementation of starch concentrate up to 31% of the whole diet increased both voluntary food intake and the supply of microbial protein per unit of DOM. [References: 29].

Q60 PROCESSING OF NON-FOOD OR NON-FEED AGRICULTURAL PRODUCTS


Q70 PROCESSING OF AGRICULTURAL WASTES


Thermogrammetric analysis in oxidizing atmosphere has been used to characterize composts prepared from wheat straw with different organic and mineral additives. After a wide range of classical parameters were determined for the chemical maturity of composts, plant yield improvement was studied in a greenhouse experiment. It was found that most chemical and agrobiological maturity indices paralleled peak area values in the differential thermogrammetric curves. In particular, the weight loss corresponding to compost material destroyed between 360 and 540 degrees C showed a very significant correlation with the germination index and the plant yield of the soils amended with compost. As expected, the extent of such thermal effects reflected also the H/C, O/C, and C/N ratios and the lignin content of the composts. Experiments during the methodological optimization of thermogrammetric analyses have shown the importance of removing the compost water-soluble fraction to prevent spurious results, probably due to the effect of salts on thermal decomposition in the lignocellulosic substrate. [References: 19].

660 Camarero, S; Galletti, GC; Martinez, AT. (1994) PREFERENTIAL DEGRADATION OF PHENOLIC LIGNIN UNITS BY TWO WHITE ROT FUNGI. Applied & Environmental Microbiology. 60(12):4509-4516. English. [CSIC CTR INVEST BIOL VELAZQUEZ 144 E-28006 MADRID SPAIN].

The differential biodegradation of phenolic and nonphosphoric (C-etherified) lignin units in wheat straw treated with the white rot fungus Pleurotus eryngii and Phanerochaete chrysosporium was investigated under soil-free fermentation conditions. Two analytical techniques applied to permethylated straw were used for this purpose, i.e. alkaline CuO degradation and analytical pyrolysis (both followed by gas chromatography mass spectrometry for product identification). Despite differences in the enzymatic machinery produced, both ligninolytic fungi caused a significant decrease in the relative amount of phenolic lignin units during the degradation process. Nevertheless, no differences in the biodegradation rates of phenolic and etherified cinnamic acids were observed. Changes in lignin composition and cinnamic acid content were
also analyzed in the phenolic and nonphenolic lignin moieties. The results obtained are discussed in the context of the enzymatic mechanisms of lignin biodegradation. [References: 29].

501 HUMAN NUTRITION-GENERAL ASPECTS


T01 POLLUTION

663 Kula, C. (Biologische Bundesanstalt fuer Land und Forstwirtschaft, Braunsweg (Germany). Fachgruppe fuer Biologische Mollteppfruefung (1994) [Effects of different intensity of plant production on carabid beetles (Coleoptera: Carabidae)]. Auswirkungen abgestufter Intensitat der Pflanzenproduktion auf Laufkaefer (Coleoptera: Carabidae). Effects of a long-term application of plant protection products used in different intensities and development of assessment criteria. Bartels, C.; Kampmann, T. (comps.). Mitteilungen aus der Biologischen Bundesanstalt fuer Land-und Forstwirtschaft Berlin-Dahlem (Germany); no. 295 p. 385-400.
Blackwell. 4 Ill.; 3 tables; 11 ref. German. (AGRIS 94-125414).

From 1984 to 1986 the effects of different intensities of plant production on carabid beetles were studied within an interdisciplinary program of the 'Deutsche Forschungsgemeinschaft'. The investigation took place in the research area 'Ahlem' several years before the BMFT project started. Possible interactions between the degree of weed cover and the activity and density of carabid beetles were of special interest. The interactions between field margins and artificially sown strips with grass or Phacelia tanacetifolia were also studied. The research area was structured as in the BMFT project, but the 10-part was missing. The agricultural practice was comparable to the BMFT project taking into account the special situation of these years. To enable comparison and evaluation of the species combination in the different treatments a nearby situated bio-farm was also investigated. Different types of pitfall traps were used to investigate the activity abundance of the carabid beetles and their occurrence in the different treatments. From 1984 to 1986 in total 62 carabid species were found. Eleven of these species occurred every year and in every treatment. Some carabid species were more abundant in the lower intensity of plant production, especially the species of the genus Amara, which are known to be predominantly herbivorous. Activity density of these species was much greater in weedy plots with Stellaria media and Poa annua than in weed-free plots. In only a few cases relationships between application of pesticides and activity abundance of carabid beetles were evident. The application of the fungicide 'Aflagan reduced the number of beetles in the traps significantly.


Levels of lead were determined for soil, maize, wheat and milk collected from sites close to heavily used roads, and compared to levels in control samples taken away from the roads. In soil samples, lead levels decrease exponentially from values of about 3 ppm at the edge of the road to values typically around 1 ppm. 80 metres away from the road. At the control site lead levels in soil have a value of 0.6 ppm. Maize cultivated close to the road had lead values of between 0.13 and 0.25 ppm, while maize grown at the control site had 0.06 ppm lead. Wheat cultivated close to the road had lead values ranging from 0.04 to 0.22 ppm, compared to a value of 0.05 ppm at the control site. Milk from cows that graze close to the roads had lead values ranging from 0.1 ppm to 0.5 ppm, as compared to a value of 0.1 ppm in milk from cows that graze away from the roads. All the results indicate significant differences in lead content for samples from near the roads compared to samples in the control site at the 95% confidence level. By extrapolating the exponential decay curves obtained in this study, the maximum distance away from the road which farming activities can take place is deduced to be about 200 metres, in order for effects of vehicular emissions to be minimised.

665 Wadye, P.; Shaw, G.; Bell, JN; Minski, MJ. (1994) RADIONUCLIDE TRANSPORT ABOVE A NEAR-SURFACE WATER TABLE 2. VERTICAL DISTRIBUTION OF GAMMA ACTIVITIES WITHIN SOIL PROFILES IN RELATION TO WHEAT ROOTING DENSITY AND SOIL-TO-PLANT TRANSFERS. Journal of Environmental Quality. 23(6):1330-1337. English. [UNIV LONDON IMPERIAL COLL SCI & TECHNOVL CTR ANALYT RES ENVIRONM SILWOOD PK ASCOT SL5 7BE BERKS ENGLAND]

Radiochemical results are described from a replicated field lysimeter experiment to investigate the upward migration of radionuclides in vegetated soils above near-surface contaminated groundwater. Water tables were maintained at depths of 35 cm (shallow) and 65 cm (deep), below which a cocktail of radionuclides including Cs-137, Cd-109, Co-60, and Na-22 was introduced. Results of the vertical migration and plant uptake are presented from the first 2 yr of an ongoing experiment with winter wheat (Triticum aestivum L.). As expected, Cs-137, (Co)C-60, and Cd-109 proved to be highly sorbed to the soil solid phase in the regions of the water table and exhibited a lesser degree of up-profile transport than Na-22 in shallow lysimeters. However, in deep lysimeters, Cs-137 and Cs-60 appeared to be preferentially accumulated at the soil surface: a biological translocation mechanism is postulated to account for this observation. It is also clear that radioactive Cs-137 and Cs-60 were observed in the same plant organs as was the case in the experiments with other radionuclides. Therefore, the model that is currently used for the prediction of radionuclide migration and uptake in the experimental lysimeters should be further developed.


U10 MATHEMATICAL AND STATISTICAL METHODS


The technique of classification has been used to summarize relationships among test environments, based on the way they discriminate among genotypes, in multi-environment trials. However, once environments have been grouped, at a specified truncation level, there is generally no indication of the 'stability' and hence validity of the grouping. Further, there is currently no way to determine whether or not an adequate number of genotypes was used to give a robust assessment of the similarities among the environments. A procedure is presented which
allowed a determination of whether an adequate number of genotypes was used to assess similarities among the environments considered. The procedure also highlighted the effect of experimental error on environmental classifications. It was demonstrated using three genotype X environment data sets with pooled genetic correlations ranging from low to high. The process used for investigating the 'stability' of the classifications involved choosing increasing proportions of the total number of genotypes available in the data set, and classifying the environments based on each of the resultant genotypic subsets. The grouping of environments was then investigated at a particular truncation level. The process was repeated 100 times for each subset size and the number of different partitions of the environments, and the frequency of each partition determined. These frequencies were compared with those that were obtained, using the same procedure, but applied to data sets (of equivalent dimensions) containing random numbers. Based on the differences between the experimental and random data an assessment of the number of genotypes necessary to provide a 'stable' classification was made. Results indicated that a 'stable' classification of environments could be reached for the two data sets with moderate and high pooled genetic correlations with relatively few genotypes. However, the data set with a low pooled genetic correlation, a 'stable' classification was not reached even when almost all of the genotypes were included. Based on the results for these three data sets the working hypothesis that the 'stability' of an environmental classification is related to the strength of the pooled genetic correlation for the data set, is advanced. [References: 24].


U30 RESEARCH METHODS


Although test weight is highly heritable in wheat (Triticum aestivum L. em. Thell.), selection for this important trait is limited in the early generations of a breeding program by the availability of seed. In winter wheat, the weight of seed discharged by the Balfour Seed Dispenser or BSD was highly correlated (r = 0.97 to 0.99) with test weight measured using the Dickey John Grain Analysis Computer. The BSD required less labour and less sample (25-80 g) than either the GAC II or Cox Funnel drop methods (300-1000 g) but was also less accurate. Nonetheless the lower confidence interval (P < 0.025) of a measurement on the BSD was only about -0.75% which is equivalent to a negative deviation of about 0.6 kg hl(-1). This degree of accuracy should identify most lines of wheat with low test weight in any breeding program. [References: 12].
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