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Jim Wills, Secretary, Dept. Agronomy, Purdue Univ., typed and collated the information for the printing of this volume.

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Instructions for Oat Newsletter, Volume 44, to be published in 1996

Persons involved in any aspect of the oat industry and research including production and breeding, pathology, milling and processing, and biotechnology are encouraged to contribute to the 1996 Oat Newsletter.

Contribution to Volume 44 should be mailed to:

Mike McMullen
Chairman, Editorial Committee
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Contributions of articles for Volume 44 of the Oat Newsletter may be mailed at any time, but must be received no later than 15 February 1996. It is preferred that articles for the Oat Newsletter be mailed on computer diskette (WordPerfect or ascii text file) or by email (address: mmcmulle@plains.nodak.edu).

Members of the newly established Oat Newsletter Editorial Committee are: Mike McMullen (Chairman), James Chong, David Hoffman, and Sam Weaver.

Announcement for the 5th International Oat Conference and
the 7th International Barley Genetics Symposium

Saskatoon, Saskatchewan, Canada July 30 - August 6, 1996.

The University of Saskatchewan, Saskatoon, Canada is pleased to host these International meetings from July 30 through August 6, 1996. The meetings will consist of combined sessions to as great a degree as possible with those of greatest interest to Oat workers running from July 31 through August 6th. The meetings will feature oral sessions with invited speakers, volunteer poster sessions, lots of time for one-on-one interaction, field and research facility tours and social functions. A refereed Proceedings will be published.

The meeting venue will be at the University of Saskatchewan campus, noted as one of the most beautiful in Canada, situated in the heart of Saskatoon, a small but vibrant city of 180,000 people on the banks of the South Saskatchewan river in the heart of western Canada's cereal production area. That cereal production annually includes 3.5 - 4.0 million acres of oat and 10.0 million acres of barley. Saskatoon is also recognized as an International Centre of Excellence in plant biotechnology with many associated Institutes and Companies situated right on the campus.

Everyone at the Crop Development Centre and the Department of Crop Science is looking forward to hosting all of our international colleagues and to an excellent set of joint meetings. Please note that accommodation and associated expenses in Canada and especially here in Saskatoon are very reasonable as the Canadian dollar is currently valued at less than $0.72 per US dollar, thus the meetings should be affordable for everyone.

We wish to acknowledge the tremendous support of the Oat industry for the Conference to date and to especially recognize the major contribution of the Quaker Foundation, USA and Quaker Oats Canada towards the operation of the Oat Conference.

For further information please contact Brian Rossnagel, Crop Development Centre, University of Saskatchewan, Saskatoon, Canada, S7N 5A8, FAX 306-966-5015 or Email Rossnagel@sask.usask.ca . Our second mailing of information and registration forms and details will be going out in the spring of 1995.

DR. IRVIN MILBURN ATKINS, 1904-1995 -- IN MEMORIAM

Dr. I. M. Atkins, Professor Emeritus, Texas A&M University, died February 13, 1995, in Hereford, TX. He enjoyed good health until near the time of his death at age 90. Dr. Atkins had many aliases in his long and distinguished career as a small grain and flax breeder. To many of his associates he was simply "Doc," while others addressed him as "I.M.," "Milburn," or "Atty". Each "handle" was used with deep respect and affection, for he was a remarkably accomplished research worker and administrator who left his indelible mark on four crops -- oats, wheat, barley and flax.

Dr. Atkins was in the first group to be honored with the award for Distinguished Service to Oat Improvement (1970). In the citation for that award, Dr. Atkins' extensive publication record and his prolific research output (numerous improved cultivars of oats, wheat, barley and flax) - were noted. Some of his oat cultivars, particularly 'Bronco' and 'Mustang' greatly improved winterhardiness of oats adapted for production in Texas, while one of his last oat releases, 'Coronado,' had unusual "staying-power" in Texas, and also has had international impact as both a commercial cultivar and as a breeding line in Latin America.

Dr. Atkins was born July 24, 1904, in Corning, KS. He married Mary Loveless of Denton, TX, in 1932. He graduated from Kansas State University and began his career as a Junior Agronomist with the USDA at the Texas A&M University Field Station at San Antonio, in 1928. In 1930, he became Associate Agronomist with the USDA at the Texas A&M Station at Denton, TX, where he remained until 1954. He received his M.S. degree from Kansas State University and his Ph.D. from the University of Minnesota. He was promoted to the USDA rank of Agronomist in 1946, and in 1954 was transferred to Texas A&M University, where he became Professor and Leader of the Small Grains Section. After retirement in 1968, Dr. Atkins worked as a consultant with several seed companies, and developed three winter wheat cultivars and four spring wheat cultivars. Few, if any, other small grain breeders can claim the development and release of seven cultivars after "retirement."

Dr. Atkins had always been interested in history, and published "A History of Small Grain Crops in Texas, 1582-1969", "Flax in Texas, 1718-1976", "Old Number 6 and the Texas Small Grains Program, 1889-1969" (a history of the Texas Agricultural Experiment Station at Denton), "The Autobiography of a Plant Breeder", and "Some Things Remembered", all after his retirement at Texas A&M. Following the death of his beloved wife, Mrs. Mary Atkins, Dr. Atkins established the Irvin M. Atkins and Mary Ruth Atkins Fellowship at Texas A&M University. Recognizing the hardship that graduate school represents, Dr. Atkins endowed this fellowship to provide deserving students in small grain research studies with additional support to reduce their financial burden. This endowment has been supplemented by contributions from some of Dr. Atkins' scientific and commercial associates, and by his wheat cultivar royalties; current assets approach $90,000.00

ARGENTINA

Some Problems Of Oats Crop

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In Argentina it is estimated oats is grown in about 2 to 3 million hectares. This area is distributed in a large geographic region, with own particularities (climatic, cultural practices, diseases, different uses, etc.). The oats crop has different uses (pasture, forage, grain), the most important one being as a forage crop. However, there are few cultivars in our country, and 3 or 4 are planted in all areas. Therefore, it is impossible to think that one cultivar can be suitable for all purposes in different environments.

The major oats diseases in Argentina are stem rust (*Puccinia graminis*) and crown rust (*Puccinia coronata*). The efforts of breeders to develop cultivars with genetic tolerance on resistance, are ruined by new races of these pathogens. For example, the last cultivars released with an excellent behavior at the beginning are now affected by a new race of stem rust. However, the development of Improved cultivars is the most economic way to solve this problem.

The economic benefit of oats is low considering the net return per hectare of production, but it is planted because of its multipurposes. There are some cultural practices of wheat that are applied in oats, but research in cultural management is necessary for oats.

There is a large difference between the area planted and the area harvested for grain. Approximately 20% is harvested, and in lots of cases, this occurs after having been grazed.

Weeds And Their Control in Oats: Situation in Argentina

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The principal characteristic of oats in Argentina is the flexibility they offer to the farming systems. They constitute the main forage resource for the autumn-winter period, not only for the winter pastures but also for milk production. It also constitutes the double purpose crop (forage or grain), of a higher relevance in the whole country. The production of oats for grain presents characteristics that are well differentiated according to their use for grazing or hay, the time and densities of sowing, fertilization, weed control, and harvest have the same importance as in other winter cereal crops, with which oat can compete if the income-yield capacity margins are made equal.

The primary area for oat grain production is concentrated in the South of BUENOS AIRES province. The species of latifoliate weeds dominant in the winter cereal crops in this area are: *Polygonum aviculare; P. (Dilderdykia) convolvulus*; *Rapistrum rugosum*; *Raphanus sativus*; *Brassica spp.*; *Cirsium vulgare*, *Carduus acanthoides*; *Stellaria media*; *Centaurea solstitialis*; *Veronica arvensis*; *Viola sp.*; *Ammi spp.*; *Sillene galica*; *Chenopodium album*; *Anthemis cotula* and *Anagallis arvensis*. We can add to these the gramineae *Lolium multiflorum* and *Avena fatua*.

The handling strategies of weed populations in the different winter cereals have some aspects in common: a correct preparation of the seed bed, the use of seeds that are free from weeds, proper densities and distribution, the right plowing time for each cultivars, rotations with crops and pastures. Nevertheless, the higher impact over weed populations is obtained by the use of herbicides. It is right here, that some questions arise in connection with other winter cereals. The choice and application of herbicides may play an important role in oats production. Their selection will depend on the species present, the crops condition, sensitivity and cost.

The aim of this report is to present the information developed in CHACRA EXPERIMENTAL INTEGRADA BARROW (M.P.-INTA) in relation to the applications times and the herbicides sensivity that have demonstrated their effectiveness in the control of the same species of weeds in other winter cereal crops.

Groat Percentage In Oats By NIRS

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Oat milling industry considers groat percentage as an important grain quality criteria. Groat/hull ratio is a quantitatively inherited trait, positively correlated with milling yields. The work reported here indicates that NIRS is a good method for estimating groat percentages in oat grain. NIRS does not use corrosive chemicals and has proven to be simple, rapid, non-polluting and economical.

We selected 44 samples representing a range of oat percentages between 58.6% and 77.3%. The samples ere grown in CHEI Barrow during 1988/89, 1989/90, 1990/91 and 1993/94 crops. Moisture range was 11-13%. The NIRS instrument was an InfraAlyzer 400 (Technicon, New York), that measures the reflectance of 19 different wavelengths in the near infrared spectrum. Each sample was rotated 90ℵ from its position. No differences were found. The samples were ground in a Casella mill (EBC MILL, London), with a o.5 mm screen, during 1 minute. For the development of the standard curves, two portions of the same sample were dehulled by hand.

Statistical analysis was based on the Stepwise procedure. Only six reflected energy levels were chosen. Groat percentage was well predicted by a correlation coefficient of R>=0.88. To determine whether the equation obtained was representative, 10 additional samples were analyzed with satisfactory results.

ALBERTA

A Method For Determining Aluminum Tolerance Of Oats

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The existence of wide genetic variation for aluminum tolerance have been reported for many of the cereal crops including oats. However, breeding for aluminum tolerance has been hindered by a lack of suitable screening methods.

The scientific literature indicates that four methods have been used by plantbreeders to screen for aluminum tolerance. These four methods include: (1) comparing the relative growth of plants grown in pots filled with aluminum-toxic soils with the relative growth in limed (control) soils (Foy et al. 1987); (2) the hematoxylin staining method (Polle et al. 1978); (3) the eriochrome cyanine RC staining method (Aniol, 1984); and (4) comparing the relative root length of plants grown in aluminum-toxic and aluminum-free nutrient culture solutions (Reid et al., 1971). Each of these four methods have been found unsatisfactory for screening a large number of lines as required by plant breeders. For example, the method of Foy et al. (1984) is laborious and time consuming because it requires the seedling roots to be washed out of the soil, dried, and weighed in order to assess the degree of aluminum tolerance. An additional problem with this method is that it is very difficult to control the concentration of aluminum in the control and aluminum-toxic soils. The hematoxylin (Polle et al., 1978) and the eriochrome cyanine RC (Aniol 1984) staining methods are unsatisfactory because the stains bleach, and also because individual plants of the same genotype show variations in staining intensity and regrowth pattern after being subjected to toxic concentrations of aluminum. The relative root length method (Reid et al . 1971) produces highly repeatable data, but is unsatisfactory because it entails pre- germinating the seed in a germinator, transferring individual seedlings into foam holders, transferring the foam holders (with the seedlings) into tanks containing the nutrient culture solutions; checking and adjusting the pH of the nutrient culture solution on a daily basis; measuring and calculating mean root length of each genotype in aluminum-toxic and aluminum-free nutrient culture solutions; and calculating the aluminum tolerance index (ATI) of each genotype.

We have developed a modified hydroponics method that can be used to screen a large number of genotypes. The new method entails growing 16 seedlings of each genotype in each of two 125cm x 250cm flowtrays. One of the two flowtrays is designated for treatment with aluminum-toxic nutrient culture solution while the second flowtray is used for treatment with aluminum-free nutrient culture solution. The basic nutrient culture solution contains the following concentrations (in uM) of major and minor elements: Ca, 1000; Mg, 300; NO3, 2900; NH4, 300; SO4, 100; Cl, 34; Na, 20; Fe, 10; B, 6; Mn, 2; Zn, 0.5; Cu, 0.15; and MO, 0.1. Since aluminum precipitates in the presence of phosphate and/or high pH, the aluminum-toxic nutrient culture solution contains 300 uM of Al, no phosphorus, and a pH of 4.5; the aluminum-free solution contains 0 uM of Al, 100 uM of PO4 and a pH of 6.5. Distilled water is used for preparing the nutrient culture solutions and for compensating the solutions for evaporational losses in the greenhouse. Each 125cm x 250cm flowtray accommodates 10 Spencer-Lemaires rootrainer trays (Spencer Lemaires Industries Ltd., Edmonton, Alberta, Canada) and each rootrainer tray accommodates 4 genotypes, each genotype represented by 16 seedlings. A 125cm x 250cm flowtray can hold as many as 120 genotypes.

The rootrainers are filled with perlite, and seeds of the test entries are planted directly into the perlite. To ensure adequate plant nutrition, and to improve aeration, the flowtrays are flooded and drained every 15 minutes. Unimpeded by soil as will be the case in potting media, or by poor aeration as would be the case in hydroponics tanks, the roots of each genotype grow to their full length and thickness in this modified hydroponics system; poor root development is observed in genotypes that are not aluminum tolerant. After 14 days of growth, the roots of each seedling are measured using a ruler. The root length of 10 seedlings with the longest roots from each treatment combination are averaged, and the relative root length of each genotype calculated as [(mean length of the 10 longest roots in aluminum-toxic nutrient culture solution / mean length of the 10 longest roots in aluminum-free nutrient culture solution) x 100] is used as an index of aluminum tolerance.

In comparison to the four methods that were described above (viz. Foy et al. 1987; Polle et al. 1978; Reid et al. 1971; and Aniol, 1984), the new method is relatively inexpensive and rapid, and can be used to screen a large number of genotypes. The main advantages with the new system will be time saved in not having to transfer seedlings to foam holders, and then to hydroponics tanks; the screening of as may as 120 genotypes in the same flowtray rather than in several separate tanks - thus providing uniform experimental conditions; the ability to screen a minimum of 240 genotypes each month compared with only 30 using the method of Reid et al. (1971); and saving time in adjusting the pH and nutrient concentration in one large tank rather than several small ones as is the case with the previous methods. In addition, the new method appears to have high repeatability and lower experimental error compared with the old methods. We believe the new method will reduce the time and expenses required to evaluate potential aluminum tolerant cultivars in field trials, thus increasing the number of genotypes that can be evaluated in a breeding program. At present, we are using the new method to screen the World Oat Collection for aluminum tolerance.

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MANITOBA

Oat Crown Rust In Canada In 1994

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Crown rust (caused by *Puccinia coronata* Cda. f. sp. *avenae* Eriks.) in oat (*Avena sativa* L.) was severe and widespread in Manitoba in 1994, making this the worst outbreak of the disease in recent years. In early July, rust severities ranged from trace amounts to 50% in wild oat (*A. fatua*) and susceptible oat lines, and trace amounts to 20% in cultivars with resistance genes *Pc38* and *Pc39* combined. Oat crown rust increased rapidly in the following weeks in the Red River Valley. By late July, moderate to heavy infections (up to 100% severities) were observed in cultivars in nurseries and farm fields. One late-sown field of Robert oat had infections up to 100% severities at the early milk stage, and likely suffered significant losses to crown rust. Crown rust also was widespread in eastern Saskatchewan in 1994. Rust severities of up to 100% were observed in plots of susceptible oat cultivars in Saskatoon in late July.

Collections of crown rust from wild oat and from susceptible and resistant oat lines and cultivars were obtained to determine physiologic specialization of *P. coronata*. Single-pustule isolates, established on the susceptible cultivar Makuru, were evaluated for high or low infection types on 18 differentials, each carrying a different designated *Pc* gene, and two single-gene lines (Table 1). Gene *PcA* was derived from an *A. sativa* accession from the National Research Council Germplasm Institute, Italy. Gene *PcS42* was derived from an *A. strigosa* accession.

The frequencies of virulence of the isolates to individual *Pc* gene lines are shown in Table 1. Oat lines with *Pc45* and *PcS42* were resistant to all 202 isolates from Manitoba and Saskatchewan. Lines with *Pc48, Pc58, Pc68*, and *PcS42* were resistant to all 101 isolates from Ontario. Populations of *P. coronata* in Ontario and western Canada differed in frequencies of virulence to *Pc39. Pc40, Pc46, P56, Pc59, Pc60, Pc61* and *Pc63*.

From Manitoba and Saskatchewan. 134 virulence phenotypes were identified from 202 isolates from wild oat and susceptible oat lines. Ninety isolates, comprising 50 virulence phenotypes, were virulent on lines having both resistance genes *Pc38* and *Pc39*. All the cultivars currently recommended for Manitoba have the two genes. From Ontario, 38 virulence phenotypes were identified from 101 isolates. Twenty-one phenotypes (69% of the isolates) had virulences to lines with *Pc38* and *Pc39* combined. Virulence to *Pc68* has been detected in trace levels in Manitoba in recent years. In 1994, an isolate with virulence to the gene combination *Pc38, Pc39* and *Pc68* was isolated from oat in Manitoba for the first time.

Twenty-eight virulence phenotypes were identified from 36 isolates from commercial oat fields and selected resistant lines in Manitoba. Most of the isolates were virulent on lines with genes *Pc38* and *Pc39* combined. One isolate had virulences to genes *Pc38, Pc39* and *Pc68* combined. but differed from the above *Pc68*-virulent isolate in virulences to the other *Pc* genes. Several isolates were found with virulences to lines with genes *Pc38, Pc39* and *Pc48* combined. Cultivars with the resistance gene combination. *Pc38, Pc39, Pc48* and *Pc68*, are being developed at the Winnipeg Research Centre.

Table 1. Frequency and distribution of *Puccinia coronata* isolates virulent on differential lines of *Avena sativa* with single-genes (*Pc*) for crown rust resistance in Canada in 1994.

Resistance *Pc* gene line	Ontario		Manitoba/Saskatchewan	
	# isolates	%	# isolates	%
Pc35	31	30.7	91	45.0
Pc38	84	83.2	143	70.8
Pc39	81	80.2	106	52.5
Pc40	4	4.0	86	42.6
Pc45	1	1.0	0	0
Pc46	7	6.9	70	34.7
Pc48	0	0	1	0.5
Pc50	1	1.0	17	8.4
Pc54	2	2.0	6	3.0
Pc56	41	40.6	37	18.3
Pc58	0	0	12	5.9
Pc59	4	4.0	50	24.8
Pc60	3	3.0	86	42.6
Pc61	2	2.0	42	20.8
Pc62	9	8.9	7	3.5
Pc63	84	83.2	121	59.9
Pc64	9	8.9	10	5.0
Pc68	0	0	1	0.5
PcA	8	7.9	5	2.5
PcS42	0	0	0	0
Total	101		202	

SASKATCHEWAN

Oat In Saskatchewan 1994

B.G.Rossnagel & R.S.Bhatty
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Oat acreage in Saskatchewan continued at a strong level of 1.45 million acres in 1994, well above the 10 year average of 1 - 1.1 million acres. Low wheat prices, the attractive US milling market and good beef prices all account for this. The 1994 growing season was excellent across most of the province resulting in yields 15% greater than normal. Excellent harvest conditions, especially in comparison with those of 1992 and 1993, led to premium quality oat production as well. Given relatively high ending oat stocks however, we expect to see a significant reduction in oat acreage to more average levels in 1995.

The Crop Development Centre cultivar Calibre released in 1983 is still the major cultivar grown, however. Derby, released by the Centre in 1988 has also become very popular. Both cultivars also dominate oat acreage in the province of Alberta. The Centre released a new cultivar in 1994 called CDC Boyer, which we hope will become popular especially in our more northern regions since it combines the performance and quality of Calibre and Derby with earlier maturity. Certified seed of CDC Boyer will not be widely available until the spring of 1996 and 1997.

Special areas of oat research activity in 1994 continue to focus on improvements in groat protein concentration in high quality well adapted milling oat and more recently on evaluation of groat breakage and other grain quality traits. Continued selection pressure to lower hull content appears to have been successful with lines with consistently 2 - 3 % less hull than Derby now in our program. Preparations are also underway for the co-hosting of the 5th International Oat Conference and the 7th International Barley Genetics Symposium at Saskatoon from July 30 through August 6th, 1996.

We wish to acknowledge the financial support of the Quaker Oats Co., Canada and USA; Cargill Canada; General Mills Inc. and the Saskatchewan Agriculture Development Fund for our 1994 oat R&D activities.

CZECHOSLAVAKIA

1st European Oat Disease Nursery Workshop

J. Sebesta 1/, B. Zwatz 2/, L. Corazza 3/, D.E. Harder 4/, H.W. Roderick 5/

The 1st European Oat Disease Nursery Workshop took place at the University of Agriculture in Prague in July 13-14, 1993. The European Oat Disease Nursery (EODN), initially established by the first author in 1969 as a oat Rust Nursery and in 1976 enlarged into the EODN, was in 1990 included into the European System of Cooperative Research Networks in Agriculture of FAO (ESCORENA).

The main purpose of the Workshop was to create a forum in which further development of the EODN in the near future was discussed.

In the introductory lecture of J. Sebesta, B. Zwatz, L. Corazza and S. Stojanovic the importance of the EODN for disease resistance breeding of oat and the monitoring of the incidence of oat diseases in Europe, especially in the last three years were reviewed. The programme of the meeting consisted of the 19 contributions dealing with 1/epidemiology of oat diseases and its nature (10). 2/ control of oat diseases (2), 3/ special topics on the pathogenic microflora on seed of naked oat (Avena sativa var. Nuda) and the influence of environment and field management factors on black grain occurrence in naked oat and 4/ breeding oat for disease resistance (6).

On the basis of very rich discussion the following conclusions were made:

1/ The participants in the 1st EODN Workshop appreciated the establishment of the Project and concluded that the cooperation on the EODN should continue. The monitoring of disease incidence and the testing of the effectiveness of resistance sources to important diseases create good basis for resistance breeding of oat in Europe. Furthermore, such sources of resistance are immediately available and after assessment for the other traits they can be appropriately used in breeding programmes.

2/ The growing of the resistant cultivars is the most effective biological control of diseases in general and in oat in particular. Such a control is highly economic and ideal from ecological point of view. According to the latest results of Canadian colleagues the breeding for disease resistance vs. Chemical control is favoured by a cost factor of at least 20:1. Disease resistant cultivars are the basic assumption for successful sustainable (organic) agriculture.

3/ Oat grain was indicated to be of great value especially for its favourable effects on the health of human being and animals. But food and feed industry can utilize only fully developed and faultless oat grain that can be harvested from healthy, unattacked plants. Cultivating disease resistant cultivars seems to be an optimum alternative.

4/ The EODN enables to determine priorities of respective diseases from point of view of resistance breeding. At present time crown rust, barley yellow dwarf virus (BYDV) and powdery mildew seem to be widely distributed and destructive. Occasionally, stem rust can cause high losses. Fungi Pyrenophora avenae (Helminthosporium avenae), Leptosphaeria avenaria (Septoria avenae) and Fusarium diseases are in progress.

5/ The necessity to create plant pathologic and genetic bases for resistance breeding to Pyrenophora avenae, Leptosphaeria avenaria and Fusarium diseases was emphasized (the development of inoculation techniques, evaluation of germplasm etc.).

6/ Screening tests of the wild oat germplasm (Avena sterilis) for disease resistance and other traits are very desirable. Resistant derivatives should be included into the EODN.

7/ In Canada (see Harder and Haber 1992) there were created food conditions for the successful smut resistance breeding. Therefore, this is proposed to be included into breeding programmes, if suitable.

8/ The research of the occurrence of mycotoxins as a genotypic specific trait was proposed to be studied in some oats of the EODN.

9/ To facilitate the processing of primary data the assessment keys for respective oat diseases prepared by the coordinator should be used for the evaluation of diseases in the EODN.

10/ Participating countries should submit the seed of resistant lines to the nursery to provide disease evaluation in a range of environment.

11/ The cooperators in the EODN are asked, if possible, to prepare a photographic record of a new disease of oat to be available to all the members of the Project. About thirty plant pathologists and breeders of oat from Austria, Bulgaria, Canada, Czech republic, Germany, Greece, Israel, Italy, Poland, Slovakia, Sweden and the United Kingdom participated in the Workshop.

The proceedings of the Workshop will be published as a Supplement in the Italian Journal for Plant Pathology 'PETRIA.'

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GERMANY

Oat Production And Cultivars In Germany

DL Kurt Muller
Seed Growing Association, Brandenburg

The following survey (Table 1) shows the development of cultivation of oats in recent years. qq 1987-1993.

	Year	Area, ha	Yield, dt/ha	Production tons
Germany	1987/92	500 291	41.6	2 081 005
	1990	472 721	44.8	2 105 259
	1991	379 678	49.2	1 866 974
	1992	357 508	36.8	1 314 113
	1993	358 639	48.3	1 730 605
Western Germany	1987/92	384 319	42.8	1 644 682
	1990	338 846	45.3	1 534 958
	1991	314 662	50.3	1 582 178
	1992	300 551	39.0	1 170 799
	1993	297 359	48.3	1 436 705
East Germany	1987/92	115 973	37.6	436 323
	1990	133 875	42.6	570 301
	1991	65 016	43.8	284 796
	1992	56 957	25.2	143 314
	1993	61 100	48.1	293 900

According Statistisches Bundesamt, 1993.

In the united Germany 358 639 hectares of oats were grown in 1993, the yield per hectare came to 48.3 dt and the whole yield were 1 730 605 tons. Oat production diminished from 1990 to 1993. Especially this trend is stronger pronounced in the Eastern part of Germany, because the introduction of market economy was accompanied by low prices for cereals, above all in oats. The low yields in 1992 were caused by the hot and dry summer.

The Federal lands with the largest oat area are: Baden-Württemberg, Bayern, Niedersachsen and Nordrhein-Westfalen (all in Western Germany) and in Mecklenburg-Vorpommern (East Germany). The most important oat cultivars according to the seed growing area 1994, having more than 1 000 hectares, are tabulated in Table 2.

Table 2. The most important oat cultivars according to the seed growing area.

Cultivar	Breeder	Released
Jumbo	Nordsaat	1991
Alfred	Semundo	1980
Alf	Breeding St. Petkus, now Lochow-Petkus	1990
Gramena	Breeding St. Granskevitz, now Nordsaat	1989
Flamingsnova	Lochow-Petkus	1976
Lutz	Nordsaat	

Source: Blatt für Sortenwesen 1994, Heft 9, S. 406.

Besides the mentioned breeding firms there are still six plant breeders working on oats. In the Lochow-Petkus breeding programme are involved winter oats and in Salzmünde Breeding station (Saale Saaten Halle) naked oats. Since 1994, the economy is influenced by the Common Market of the European Union. This means for plant breeding firms to work still more effectively. It is possible that oat breeding programmes will be reduced.

HARYANA

Forage Quality Of Oats Under Black Siris And Shisham Plantations.

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The area under forage production is limited because of competition with other food crops. Thus there is deficit in forage production for the livestock population in India. In order to overcome this situation alternatives like growing of the forage under agro-forestry systems have been undertaken. The quality of the forage so produced is the main purpose of this report.

A field experiment on oats was conducted during 1986 and 1987 in interspaces of black siris (Albizzia lebbek) and shisham (Dalbergia sissee). These trees were planted during 1983 with a spacing of 5x5 m. Oat cultivar OS-7 was sown in November during both years, using a seeding rate of 75 kg/ha with 25 cm. Row-spacing in a randomized block design having three replications in 80m2 plots. The crop was fertilized with 40 kg N/ha at sowing and was harvested fro forage at 50% flowering stage. Samples were dried, ground and analyzed for crude protein content and in vitro dry matter digestibility (IVIMD).

Crude protein and in-vitro dry matter digestibility percentages were higher during 1986 under both the plantations (Table-1). Average percentages of crude protein and in vitro dry matter digestibility were 5.57 and 49.80, and 6.05 and 50.27 when oat was raised in interspaces of black siris and shisham respectively. The percentages of both the quality characters during 1987 decreased under both the plantations. Thus, the age of the tree had a negative effect on the quality of the oat forage.

Crude protein as well as digestible dry matter yields of oat were higher in 1986 in comparison to 1987 under both the plantations. Decline in yields under both the plantations reveal antagonistic relationship between the yield and age of trees. It was also observed from the data in Table-1 that oats produced more crude protein yield as well as digestible dry matter yield under shisham plantation. Thus, it is concluded that quality forage of oats can be raised under three or four year old plantation of black siris and shisham. However, the better results were obtained under shisham plantation.

Table 1. Yield and chemical composition of oat forage under Black siris and shisham plantation.

Year	Crude Protein %		ICIMD %		Crude protein yield (g/ha)		DDM yield (g/ha)	
	Black siris	Shisham	Black siris	Shisham	Black siris	Shisham	Black siris	Shisham
1986	6.12	6.85	51.60	51.20	3.26	4.97	27.50	37.12
1987	5.03	5.25	48.00	49.35	2.03	3.07	19.39	28.87
Average	5.57	6.05	49.80	50.27	2.64	4.02	23.44	32.99

ICIMD = In vitro dry matter digestibility
IMD = Digestible dry matter

RAJASTAN

Breeding Autoseeding Oats For Pasture

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Improved strains required to be introduced in pasture situation must have capacity either to regenerate or reseeding ability in order to its continuance. Keeping in view the requirement of pasture land, a large number of interspecific crosses were attempted at Indian Grassland & Fodder Research Institute, experimental farm, between A. sativa and A. fatua. A. sativa, cultivar Kent, a well adopted, bold seeded, high yielding fodder cultivar (450q/ha) in India, whereas A. Fatua, commonly known as wild oat is early, poor fodder yielding (150-200q/ha) with shattering seeds at maturity were used as parents.

F1 seeds were harvested and planted in the subsequent season for further studies and advancement of generation. F2 population of A. sativa x A. fatua cross was studied for vegetative and floral characters. Seed germination in F2 was poor and only about 30% seed grew into adult plants. Considerable variations in respect of growth parameters as well as pollen size and fertility were observed. Segregation for contrasting parental traits in respect of floral seed characters was met with. F3 progenies were raised and advanced to F4 generation. The presence of chlorina plants was observed in F2, F3, and F4 generations in varying frequency. However lines segregated for chlorina cross did not show any significant difference from those that gave rise to normal plants. Considerable variation with respect to germination percentage was detectable in both these lines. In the F4 generation some of the lines threw higher proportion of chlorina plants in the progenies. Both single plants and lines selections were practiced in F3 and F4 generations to secure free seeding lines. The plants and lines which were identified for high yielding, early type and shattering seed traits, combining early flowering and shattering seed characters of the fatua parent and good fodder yield of Kent. Desired material was advanced to F6 stage and selections were made to finally secure high yielding, early and seed shattering types.

UTTAR PRADESH

Characterization And Classification Of Oat Germplasm

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Non-Hierarchical cluster analysis was done to study genetic divergence among 2576 germplasm lines of oat. The results obtained are as follows.

The 2576 germplasm lines studied were grouped in 12 non-overlapping clusters. Appropriateness of these clusters arrangement was the most appropriate for this set of material. The maximum number of genotypes (279) were found in cluster 9 followed by cluster 2 (264) and cluster 10 (230). The minimum number of genotypes were grouped in cluster 11 (151). These 12 non-overlapping clusters consisted of genotypes of different origin clustered together as well as into different clusters. Conversely, genotypes of the same geographical origin were also found in different clusters.

Different selection of the cross involving same parentage distributed together as well as into different clusters. Selection belonging to different crosses also clustered together.

Those genotypes requiring longer duration for 50 percent heading $\left(\overline{X} = 120.15 \pm 0.34\right)$ were grouped in cluster 6 while cluster 9 contained the early heading genotypes $\left(\overline{X} = 101.36 \pm 0.31\right)$. Cluster 11 consisted of genotypes having the Longest leaf length $\left(\overline{X} = 48.62 \pm 0.49 \text{ cm}\right)$ whereas genotypes of cluster 2 had shorter leaf length $\left(\overline{X} = 33.56 \pm 0.32 \text{ cm}\right)$. The genotypes with maximum leaf width were grouped in cluster 12 $\left(\overline{X} = 260 \pm 0.02 \text{ cm}\right)$ while cluster 2 grouped the genotypes having minimum leaf width $\left(\overline{X} = 1.73 \pm 0.01\right)$. The tallest genotypes $\left(\overline{X} = 133.4 \text{ cm} \pm 0.86\right)$ were grouped in cluster 4 while dwarf types $\left(\overline{X} = 95.41 \text{ cm} \pm 0.71\right)$ were grouped in cluster 5. Late maturing genotypes $\left(\overline{X} = 156.23 \pm 0.26\right)$ occupied cluster 6 whereas early maturing $\left(\overline{X} = 139.23 \pm 0.28\right)$ lines in cluster 9. Cluster 4 consisted of genotypes possessing long panicle $\left(\overline{X} = 38.91 \pm 0.27\right)$, whereas, the genotypes with shorter panicle length were grouped in cluster 5 $\left(\overline{X} = 24.09 \pm 0.26\right)$. The genotypes with more number of grains per panicle $\left(\overline{X} = 96.26 \pm 1.05\right)$ were grouped in cluster 8 while genotypes having less number of grains per panicle $\left(\overline{X} = 46.68 \pm 0.77\right)$ were grouped in cluster 5. The genotypes grouped in cluster 3 had highest seed length $\left(\overline{X} = 15.06 \text{ mm} \pm 0.07\right)$ whereas in those cluster 1 while those with lower seed width $\left(\overline{X} = 12.55 \text{ mm} \pm 0.07\right)$. The genotypes having higher seed width $\left(\overline{X} = 3.43 \text{ mm} \pm 0.03\right)$ fell in cluster 1 while those with lower seed width $\left(\overline{X} = 2.44 \text{ mm} \pm 0.22\right)$ came under cluster 6. The genotypes of cluster

11 had more 100-grain weight $\left(\bar{X} = 4.78 \text{ gm} \pm 0.04\right)$. The groats having highest weight occurred in cluster 11 $\left(\bar{X} = 3.54 \text{ gm} \pm 0.04\right)$ and those with lowest occurred in cluster 6 $\left(\bar{X} = 2.07 \text{ cm} \pm 0.03\right)$.

Coefficients of variation were computed to know the actual magnitude of variation within each cluster for all the traits, which helped to assess the dispersion of genotypes around the respective cluster mean.

No regular or linear pattern was shown by the observed values of coefficients of variation which indicated that variation scattered throughout the clusters. However, a generalized consideration revealed that grains per panicle had highest coefficient of variation within and over the clusters followed by 100-groat weight, 100-grain weight, length and width of third leaf from apex, penicle length, seed width and plant height. Attributes like days to maturity, days to 50 percent heading had lower value of coefficient of variation within and over the clusters.

IRELAND

'Oat Mosaic' and Oat Virus Problems in Ireland

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In Ireland the 'oat mosaic' complex in winter sown oats is associated with infection by Oat Mosaic Virus (OMV) and Oat Golden Stripe Virus (OGSV). Dual infection by both viruses occurs generally. In a survey of 62 winter crops in mid-March 1992 in S.E. Ireland 97% were infected by one or both viruses but only 23% of crops showed symptoms; 77% were infected by both viruses and 20% by OGSV only.

Symptoms include a mosaic mottling, flecking, striping of foliage and stunting of plants. The striping in the mid-rib of the flag leaf associated with OGSV in the U.K. occurs infrequently and late in the winter oat season in Ireland. A more general yellow striping has been observed and was often associated with high levels of OGSV, although most plants infected by OGSV alone were symptomless. A bright orange/red striping of leaves progressing to a brown coloured necrosis has been observed very late in the season in winter oats containing high levels of OGSV.

These symptoms have also been observed in 1991 in spring oats heavily infected with OMV-like particles, 720 x 11 nm, which may be Oat Necrotic Mottle Virus (ONMV), and low levels of OGSV, and also in spring crops containing high levels of OGSV and OMV-like particles. In 1992 (July - August) however, only OGSV was found in the foliage of spring oats showing similar brown-red necrotic symptoms at sites in Cos. Wexford, Waterford and trial plots at University College Dublin. Spring sown oats when infected by OMV and OGSV generally do not show symptoms. Further investigations on the incidence and causes of these diseases are required and researchers interested in collaborating in this are requested to contact us.

Polymyxa graminis, the biotrophic plasmodiophoromycete fungus, the vector of OMV and probable vector of OGSV, was found in oat roots and there is evidence to suggest that oat cultivars vary in their susceptibility to this fungus. Cvs. Nuptiale and Pewi are susceptible; cv. Barra the most widely cultivated cultivar in the south east moderately susceptible, and cvs. Kynon, Image and Lustre resistant.

Both OMV and OGSV are widely distributed and have been found in Cos. Cork, Dublin, Galway, Kilkenny, Meath, Waterford, Wexford, Wicklow and in Northern Ireland. At most sites crops were symptomless and the viruses were present at lower levels in areas were oat cultivation was less intensive.

OMV and OGSV are mainly spread by the movement of infested soil on machinery etc. And also possibly by wind-blown dust. Preliminary investigations with seed, taken from severely infected (stunted) crops of cvs. Pewi and Nuptiale at a heavily infested site and grown in sterile soil for 3 months have yielded OMV in the roots of cv. Pewi and OGSV in the symptomless leaves of cv. Nuptiale. This seed-borne infection may originate from infested soil particles on the seed surface but further investigations to confirm these results are required.

Cultivars vary in their resistance to 'oat mosaic'. Cvs. Kynon, Solva, Lustre, Craig and Image are resistant; Barra, Aintree, Integrale and Mirabel moderately susceptible, and cvs. Pewi and Nuptiale susceptible.

At farm level outbreaks of 'oat mosaic' have been observed in land in which oats had not been grown for up to 8 years and this suggests that a high incidence of this disease had occurred earlier at these sites. This may have resulted from the persistence of viruliferous cysts (resting spores) of *P. Graminis* which may remain viable for 10 years of more in soil.

Preliminary observations on the performance of winter oat cultivars at a heavily infested site indicate that cultivars in a rotation cycle have less severe foliar symptoms, are less stunted and are less heavily infected by *P. Graminis* than in a continuous oat cultivation cycle.

While the control of 'oat mosaic' by chemicals e.g. soil sterilisation is not practical, the following measures to alleviate crop losses are recommended: (I) avoid heavily OMV and OGSV infested land; (ii) prevent the movement of soil from infested to 'non-infested' sites; (iii) reduce the risk of virus 'build-up' by less intensive cultivation of oats e.g. oats in a one in four year cycle that includes non-cereal crops in the rotation; (iv) use resistant cultivars at heavily infested sites.

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ITALY

Research On Natural Hybrids Between *Avena sativa* L. And *A. sterilis* L.

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Wild oats are more and more studied also for their increasing use in oat breeding by the interspecific cross. On the other side the overlapping of the A.fatua and A.sterilis areals with those of the A.sativa crops and the fertile crosses among these hexaploid species, make it necessary to increase our knowledge of the wild F1 hybrids. Studying the F1÷F5 progenies of seventeen forms, collected in 1990, with intermediate characters between A.sativa and the wild type, we assumed their own origin from spontaneous hybridization. The considered material, in addition to its large genetic variability derived from the interspecific cross and then susceptible of selection, showed the importance of preparing suitable methods of *in vivo* germplasm maintenance.

Genotypes (female parents) from which the 17 intermediate forms are derived; they are labelled with 'A'..'Q' letters.

A.sativa cv Astra	A, E, F, L, N, O, P.
A.sativa cv Ava	C, D, G, J.
A.sativa cv Lidia	B.
A.sativa cv Manoire	H, I, K, M.
A.sterilis	Q.

Sufficient quantities of F4, F5 and F6 seeds of such hybrid populations are free available upon request to the authors specifying this contribution to Oat Newsletter.

MEXICO

Mexicana Oat Crown Rust Survey-1994

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The 1994 summer crop in Mexico was affected by a severe drought in northern Chihuahua, 200 mm of rain felt during the growing season. The crown rust appeared at the end of the season. In the southern Mexico (Jalisco state) enough rain was obtained and the crown rust was obseved by mid-September. In Chihuahua State where 200, 000 hectars are seeded each year crown rust seems to take more importance than stem rust. There were sites with 90 % of severity in old late cultivars. In southern Mexico crown rust is more important than stem rust. Here the cown rust caused severe rust damage in the fields.

Thanks to the Cereal Rust Laboratory, 23 samples were processed to identify virulence in the differential oat lines used at St, Paul Minnesota. The percentage of isolates virulent are indicated in Table 1. In this table indicates that there were more virulent isolates in samples collected in northern Chihuahua than there were in those collected in southern Mexico. A sample collected South of Cd. Cuauhtemoc, Chihuahua was virulent to 14 differential oat lines of 35 tested. Virulence on lines Pc 45, Pc 54, Pc 59, Pc 64 and cultivar Dane occured at high frequencies. Virulence to Pc 45, Pc 54 and Dane in the United States occurs at low frequencies (Ochochi personal communication).

Table 1. Virulence in percentage of crown rust samples collected from Mexico in 1994.

	Percentage of isolates virulent to oat differential lines	
	Northern Mexico(Chihuahua)	Southern Mexico (Jalisco)
Differential		
Pc 14 D504	7	0
Pc 35	7	0
Pc 36 D515	7	0
Pc 38	0	0
Pc 39	7	0
Pc 40	7	0
Pc 45	86	89
Pc 46	21	0
Pc 48	7	0
Pc 50	0	0
Pc 51 x434	0	0
Pc 52 x421	7	0
Pc 53 H441	7	0
Pc 54	71	67
Pc 55	7	0
Pc 56	7	0
Pc 57 (H555)	33	0
Pc 58 TAM-o-301	7	0
Pc 59 TAM-o-312	86	43
Pc Coker 227	7	0
Pc Coker 234	0	0
Pc 62	0	0
Pc 63	0	0
Pc 64	29	0
Pc 68	0	0
Pc 70 H547	7	0
Pc 71 Y345	7	0

H-548	0	0
Marvellous	100	100
Dane	93	89
Wi X-43619	14	56
TAM-O-386	0	0
TAM-O-386R	0	0
TAM-O-393	0	0
Amagalon/Ogle	0	0

MOROCCO

Genetic Variability Of Root Growth In Some Wild Oat Species

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Root growth of 22 wild oat accessions (3 *A. Longiglumis*, *3 A. Maroccana*, 3 *A. Occidentalis and* 13 *A. Sterilis*) and 2 cultivated oats (Ogle and Lamar) was studied using a hydroponic system in a controlled environment. An important genetic variability was found among and within species for the following characters: root length at 20 and 38 days after sowing, root growth rate and the root:shoot ratio. Most of the *Avena sterilis* and some *A. Occidentalis* showed high rates of root growth. Compared to the cultivated oat Ogle, the *A. Sterilis* CAV3604 had twice the root length and root growth rate. The root:shoot ratio measured on fresh tissue at 38 days after sowing, was generally higher for the wild oats (≥ 1.0 for most wild oat and ≈ 0.4 for the cultivated oat). The wide genetic variability, demonstrated on a limited number of genotypes, indicated the need for further characterization of root biodiversity in wild oat genotypes. Interspecific crosses could potentially improve drought tolerance in difficult climates such as in Morocco, as rapid root growth rate has a good adaptive value in semi-arid areas. We are testing some interspecific hybrids realised by B. Landry in Quebec (Lamar x *A. Sterilis* CAV3604 and CAV3604) in an attempt to improve root characteristics of cultivated oats.

Pathogenicity Of *Puccinia Coronata f. Sp. Avenae* In Morocco And Screening For Resistance In Wild Oats

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Surveys of oat crown rust were conducted in the Doukkala, the Gharb and the Tangier areas of Morocco in 1993. Samples of crown rust were collected from cultivated and wild oats. Single uredia from these samples were tested on 23 differential lines. Among the tested resistance genes, only *Pc*58, 71 and 36 were resistant to most isolates of *Puccinia coronata f. Sp. Avenae*. The other genes were highly susceptible. The average numbers of virulent genes per isolate were 11, 12, and 13 for the rust samples collected from the Tangier, the Gharb and the Doukkala areas, respectively. This indicates a high level of virulence in these populations. We screened 300 entries of wild oats for their resistance to *P. Coronata f. sp. avenae*. Only five entries with different ploidy levels were found to be resistant to the tested isolates of the pathogen.

RUSSIA

Evaluation Of Wild And Cultivated Species Of Oats From VIR Collection.

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Wild species. There is a wide collection of wild and weedy species in Vavilov Institute of Plant Industry (Russia). They are: diploids *A.clauda, A.pilosa, A.bruhnsiana, A.ventricosa, A.wiestii, A.hirtula, A.longiglumis, A.canariensis, A.amascena, A.prostrata, A.atlantica; tetraploids A.barbata, A.vaviloviana, A.magna, A.murphyi, A.agadiriana* and perennial *A.macrostachia; hexaploids A.ludoviciana, A.sterilis, A.fatua, A.occidentalis.*
In 1994 the study of the collection of wild and weedy species of oats was continued. On the experimental Station VIR in Pushkin (near St. Petersburg) in the field experience 300 accessions of all species were evaluated. The purpose of the study was continuation of the creation of character collections with selection of the forms with contrasting morphological and agronomic traits for using of the genofund of wild growing species for expansion of genetic potential of cultivated species of oats.

Duration of vegetative period. Accessions with very short vegetative period (95-100 days) and with period till heading 58-68 days were: *A.hirtula* from Spain, Palestine, Morocco; *A.wiestii* from Egypt and *A.canariensis* from Spain; among tetraploids - *A.magna* from Morocco; *A.barbata* from Spain and Ethiopia; *A.vaviloviana* from Ethiopia. Among hexaploids species these parameters were a little less, especially, on *A.fatua* from Osetia (Russia), Ukraine, Azerbaijan, Armenia, Poland, Bulgaria and Argentina, on *A.ludoviciana* such parameters were had only three accessions from Armenia. In this year some accessions had a longer period till tillering. They belong to species *A.clauda* from Azerbaijan and Iran; *A.pilosa* from Azerbaijan and Iraq; *A.bruhnsiana* from Azerbaijan; *A.hirtula* from Turkey, Tunisia and Spain; *A.longiglumis* from Morocco; among tetraploids *A.barbata* from Portugal, Turkey and Greece. Many accessions of *A.ludoviciana* from Azerbaijan had vegetative period longer than in previous ones. Next year accessions with long duration of vegetative period will be checked in joint evaluation with the Department of Physiology on reaction of vernalization and on photoperiodism.

Plant height. The collection had very rich diversity on plant height. This parameter was from 60 cm up to 200 cm. The accessions, having short straw, concerned to species *A.pilosa* (all samples), *A.clauda* from Azerbaijan and Iran; *A.hirtula* from Spain; *A.wiestii* from Azerbaijan, Egypt and Israel; *A.canariensis* from Spain; among tetraploids such forms are not found out, and among hexaploids - individual samples of *A.sterilis*. The maximum parameters on plant height more than 190 cm had forms of species *A.longilumis* and *A.barbata*.

Resistance to diseases. In field conditions with infection of crown rust in the second half of vegetation, many samples have confirmed resistance to this disease, shown in other years. There were more resistant (0-1) forms: diploids *A.hirtula* from Tunisia, Crete, Turkey and Spain; *A.longiglumis* from Morocco; *A.canariensis* form Spain; tetraploids *A.magna* (all samples), *A.barbata* from Krasnoyarsk region (Russia), Italy, Cyprus, Spain, Portugal, Israel, Iran, Ethiopia, Greece and Turkey and perennial *A.macrostachia* form Algeria; hexaploids *A.ludoviciana* from Ukraine, Syria, Lebanon, Tunisia and all samples form Ethiopia; *A.sterilis* from Israel, Morocco, Iran, Libya, Tunisia and Algeria; *A.fatua* resistant forms are not found.

BYDV. In field conditions were more tolerant to BYDV among diploid species accessions of *A.hirtula* from Tunisia; *A.longiglumis* from Morocco; *A.canariensis* from Spain; among tetraploid species *A.magna* from Morocco; *A.barbata* from Italy, Portugal, Israel and Turkey and perennial *A.macrostachia* from Algeria; among hexaploid species *A.sterilis* form Algeria.

<u>Cultivated species</u>. There is very rich diversity (more than 100 accessions) of naked oats (*A.sativa* ssp.nuda), sandy oats (*A.strigosa*)(about 150 accessions) and *A.abyssinica* (60 accessions) in collection of Vavilov Institute. From this year we started evaluation of these accessions in contrast condition of VIR stations for different morphological and agronomic traits. Now we have forms with yields comparable with covered oats, very short period till harvest, resistance to lodging, to crown rust and very height protein content (19% 20%). These cultivars originated from France, Austria, Czech Republic and some landraces from Russia.

SERBIA

Varietal-Practice Management Of Certain New Yugoslav Spring Oat Cultivars

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In the last several years five spring oats cultivars *(Avena sativa L. var. mutica)* were released by Centre for small grains: Slavuj, Rajac, Lovcen, Labud and Mediteran. The most important traits of studied cultivars Rajac, Slavuj and Lovcen were showed here.

Table 1. Varietal-practice management traits and grain yield of spring oat cultivars

Cultivar	Seeding rate	Nitrogen fertilization (kg/ha)					Seed Weight	Hectolitre weight
		0	30	60	90	mean		
Slavuj	450	5475	5660	6990	6871	6249	32.4	52.7
	500	5260	5472	6770	6858	6090	31.9	51.2
Rajac	450	5285	5457	6995	6743	6120	32.9	53.0
	500	5039	5298	6820	6627	5946	32.6	52.8
Lovcen	450	5198	5379	6870	6901	6087	32.0	51.8
	500	5097	5280	6720	6665	5940	31.7	50.9

Investigation was carried out in the field trial. Soil type was vertisol. The preceeding crop was soybean. The highest grain yield had cvs. Rajac and Slavuj at the seeding rate of 450 grains/m2 and nitrogen rate of 60 kg N/ha. Cv. Lovcen had the highest grain yield at the seeding rate of 450 grains/m2 and nitrogen rate of 90 kg N/ha. All studied cultivars had the highest grain yield at the seeding rate of 450 grains/m2. The highest values of hectolitre weight and seed weight also obtained at the seeding rate of 450 grains/m2 in average. Cv. Slavuj had higher grain yield compared to cvs. Rajac and Lovcen (136-156 kg/ha grains).

Arkansas

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Production. According to the Arkansas Agricultural Statistics Service, acreage planted to oats in 1994 was 25,000 acres compared to 35,000 acres in 1993 and 25,000 acres in 1992. Approximately 20,000 acres were harvested for grain with an average yield of 77 bu/A, resulting in a total production of 1,540,000 bushels.

Breeding and Genetics. The experimental line, AR FOB30, is being increased for possible release. It has yielded well in the state Small Grains Performance Tests, having a higher three-year average yield than 'Bob' at both the Stuttgart and Marianna locations. In 1993, it also yielded higher than Bob at Keiser. It is similar to Bob in test weight, maturity and plant height.

A composite population of naked oats is also being increased for release as germplasm. The original population consisted of F2 seed from 38 crosses, many of which had one naked parent. It has been grown as a bulk for 4 years and after harvest the seed has been hand-selected to remove any hulled seed.

IDAHO

Evaluation Of National Small Grain Collection Germplasm
Progress Report - Oat

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National Small Grains Germplasm Research Facility, Aberdeen,

Systematic evaluation of accessions in the USDA-ARS National Small Grains Collection (NSGC) is coordinated by National Small Grains Germplasm Research Facility staff at Aberdeen, Idaho. Cooperative evaluations continued for reaction to Russian Wheat Aphid; Hessian fly; barley yellow dwarf virus; barley stripe rust; barley stripe mosaic virus; spot blotch, net blotch, and rust diseases of barley; stripe, leaf, and stem rust of wheat; crown rust of oats; smut of oats; dwarf bunt; beta-glucan, protein, and oil content of oats; beta-glucan, protein, and oil content of barley; and ploidy analysis of *Triticum* species. In addition to the ongoing evaluation program and entry of NSGC evaluation data into the Germplasm Resources Information Network (GRIN) system, the Aberdeen staff has recently been involved in the evaluation of nearly 1,000 oat entries representing the last head row series selected by Howard Harrison and associates of the Coker Pedigreed Seed Company; growth habit evaluations of NSGC barley, oat, and wheat accessions; grow out and taxonomic evaluation of wheat accessions; taxonomic classification of NSGC oat accessions; quarantine and field grow out of new accessions of *Avena sativa* from a collection made in Turkey in 1986; initiation of cooperative evaluations of NSGC barley accessions and other elite germplasm for reaction to stem rust race Pgt-QCC in North Dakota and Puerto Rico; initiation of cooperative evaluations of NSGC barley accessions and other elite germplasm for reaction to barley stripe rust race 24 in Bolivia under the direction of Colorado State University staff; and increase and evaluation of a spring wheat germplasm collection derived from a series of interspecific crosses completed by Mr. William J. Sando in the 1930s and previously last grown in the 1960s. Cooperative ploidy analysis of *Triticum* species were conducted by Dr. Gordon Kimber and staff, Columbia, Missouri. Dr. Lee Briggle completed the documentation and organization of his *Avena fatua* collection and the material has now been assigned PI numbers and entered in the NSGC. Location funds were also used to partially support the evaluation of Pioneer Seed Company developed hard red winter wheat germplasm at Manhattan, Kansas.

Descriptors appropriate for each of the principal small grain crop species - wheat, barley, oats, and rice - have been established in collaboration with the appropriate Crop Advisory Committees. Special nurseries are grown for that purpose at Aberdeen, Idaho and Maricopa, Arizona, with grain being harvested from each field evaluation nursery to replenish NSGC seed stocks as needed. Field evaluation data are recorded on such descriptors as growth habit, number of days from planting to anthesis (heading), plant height, spike or panicle density, lodging, straw breakage, shattering, and awn and glume characteristics, including color. Spikes or panicles are collected from each evaluation or nursery plot at maturity to facilitate detailed laboratory analysis for seed characters and for more precise spike or panicle descriptors than can be obtained under field conditions. Yield data are also recorded for each accession.

Evaluations of oat accessions for beta-glucan and protein were initiated in 1988 in cooperation with Dr. David M. Peterson, Keith D. Gilchrist, and associates at the USDA-ARS Cereal Crops Research Unit, Madison, Wisconsin. The evaluations focused on a diversity of NSGC and other oat germplasm for these important quality traits. Beta-glucan and protein content data have been obtained for 2,871 NSGC oat accessions to date. In addition, oat entries grown in the Uniform Midseason Oat Nursery, the Uniform Early Oat Nursery, the Uniform Northwestern States Oat Nursery, and other cultivars or advanced lines grown in various trials in 1988, 1989, 1990, 1991, and 1992 at Aberdeen and Tetonia, Idaho have been submitted for beta-glucan and protein evaluations. Approximately 2,200 NSGC oat accessions were grown in the field at Aberdeen in 1990, primarily for evaluation of beta-glucan, protein, and oil content, but also for taxonomic and other descriptor classification. An additional 490 NSGC oat accessions were grown at Tetonia in 1991 for similar evaluations.

Oat descriptors with data entered in the GRIN system are summarized below. No evaluations have been conducted to date for descriptors such as awn type, panicles per row, groat percent, winterhardiness, *Helminthosporium avenae*, leaf Septoria, stem Septoria, powdery mildew, stem rust, Green bug, and cereal leaf beetle.

Nearly 900 *Avena sativa* accessions collected by Dr. R.A. Forsberg in Turkey in 1986 were grown in five-hill rows in the field at Aberdeen after an initial 1989-90 greenhouse seed increase at Aberdeen, Idaho. These accessions were evaluated in the field by Dr. Forsberg and the Aberdeen staff during the summer of 1990. These accessions are now included in the NSGC. Additional lines of *Avena sterilis* from the same Turkish collection were increased in the greenhouse at Maricopa, Arizona during the 1989-90 season. Increase of the *A. sterilis* collection continues in the greenhouse at Maricopa and Aberdeen.

Nearly 1,000 oat selections developed by the Coker Pedigreed Seed Company and donated to ARS by the Northrup King Company were evaluated in nonreplicated single-row plots at Aberdeen in 1991. The seed was not available until relatively late in the season, and planted on May 29-30. Despite the relatively late planting date, grain was harvested from all entries, with yields ranging as high as 212.6 bu/A. Twelve selections yielded 175.0 bu/A or higher in the series of 980; however, most selections yielded less than 125.0 bu/A. Maximum test weight was 43.0 lbs/bu among the *Avena sativa* types. The series included over 260 hulless selections, with yields ranging from 33.1 to 168.5 bu/A. Expression of the hulless character was not evaluated, but test weights ranged from 28.3 to 48.7 lbs/bu in the hulless series. Yield and test weight data for the entire series of 980 selections are available from the authors upon request.

In related efforts, cooperative funding for the project entitled "Coordination and Conduct of National Oat Germplasm Enhancement" was put in place through Specific Cooperative Agreements or direct fund transfers during since FY 1990 in cooperation with the Oat Crop Advisory Committee. Progress reports for this project are available in the CRIS system.

NATIONAL SMALL GRAINS COLLECTION
EVALUATION DATA ON GRIN - OATS

Descriptor	Location	No. Accessions
Awn Frequency	Aberdeen, ID; Mesa & Maricopa, AZ	8393
Beta-Glucan	Madison, WI & Aberdeen, ID	2871
Bundle Weight	Aberdeen, ID	4075
Barley Yellow Dwarf Virus	Davis, CA	108
Barley Yellow Dwarf Virus	Urbana, IL	9172
Chromosome Number	Columbia, MO	4430
Crown Rust (264A)	Ames, IA	10480
Crown Rust (264B)	Ames, IA	10486
Crown Rust (202)	Ames, IA	1442
Crown Rust (Pc59)	Ames, IA	1827
Crown Rust (Mult. I)	Ames, IA	4574
Crown Rust (Mult. II)	Ames, IA	1974
Crown Rust (Mult. III)	Ames, IA	2450
Crown Rust (Mult.)	St. Paul, MN	2614
Growth Habit	Aberdeen, ID	3555
Heading Date	Aberdeen, ID	8397
Hull Cover	Aberdeen, ID	6566
Kernel Weight	Aberdeen, ID	4812
Lemma Color	Aberdeen, ID	8305
Oil/Lipids	Urbana, IL	4498
Panicle Density	Aberdeen, ID	8410
Panicle Length	Aberdeen, ID	4513
Panicle Type	Aberdeen, ID	8397

Plant Height	Aberdeen, ID; Mesa & Maricopa, AZ	8295
Protein Madison, WI & Aberdeen, ID	2869	
Red Oat Classification	Aberdeen, ID	1115
Seeds Per Spike	Aberdeen, ID	4511
Shattering	Aberdeen, ID; Mesa & Maricopa, AZ	4195
Spikelets Per Panicle	Aberdeen, ID	6350
Straw Breakage	Aberdeen, ID; Mesa & Maricopa, AZ	6570
Straw Color	Aberdeen, ID; Mesa & Maricopa, AZ	6624
Straw Lodging	Aberdeen, ID; Mesa & Maricopa, AZ	8387
Smut St. Paul, MN	2788	
Test Weight	Aberdeen, ID	6516
Yield Aberdeen, ID	6539	

* The authors wish to acknowledge the important contributions of the NSGGRF staff in this effort, with special thanks to Glenda B. Rutger, Dave E. Burrup, Kay B. Calzada, Vicki Gamble, A. Lee Urie, Santos Nieto, John F. Connett, Kathy E. Burrup, Fawn R. Buffi, Evalyne McLean, Judy Bradley, Carol S. Truman, L.W. Briggle, Dallas Western, and Mark A.Bohning.

National Small Grains Collection Activities

H.E. Bockelman
USDA-ARS, Aberdeen, Idaho

PI Assignments in *Avena*, 1992-94. A total of 272 PI numbers were assigned to *Avena* accessions during the period 1992 to 1994 (see Table 1). In addition to a number of cultivars and breeding lines from programs in the U.S. and Canada the new numbers included: cultivars and landraces from the N.I. Vavilov Institute of Plant Industry, St. Petersburg, Russia; newer cultivars from Australia; landraces from Turkey collected by R. Forsberg; and landraces collected in Georgia in the 1980s.

Cultivar Name Clearance. Breeders are encouraged to have proposed names for new cultivars checked for duplication, trademark, and other possible conflicts. Send your proposed name to me (Harold E. Bockelman, USDA-ARS-NSGC, P.O. Box 307, Aberdeen, ID 83210). If desired, more than one name (up to four) may be submitted, listed in order of preference. This will save considerable time if a conflict is found with the first name. Available records (GRIN, CI/PI cards, cultivar files, etc.) at Aberdeen are checked for conflicts with the proposed name. If a conflict (e.g. previous use of the name for a barley cultivar) is found, the breeder is requested to submit a different name. If no conflicts are found at Aberdeen, the requested name is forwarded to the Federal Seed Laboratory, Agricultural Marketing Service (USDA-AMS) where it is checked for possible conflicts in trademarks, etc. USDA-AMS does not guarantee that its findings are the final word since their files may not be complete and/or there may be unregistered trademarks. The entire clearance procedure generally requires about four weeks.

Elite Germplasm Requested. Breeders are encouraged to submit their elite lines for inclusion in the National Small Grains Collection. Of special interest are lines that have been extensively, e.g. in uniform nurseries, but are not to be released as cultivars. Historically, uniform nurseries have been the testing grounds for the most advanced, elite germplasm from the various public and private breeding programs. Entries in uniform nurseries and other breeding materials that are never released as cultivars are still of potential value to breeders, pathologists, entomologists, and other researchers. Breeders should submit 200-500 g of untreated seed to the NSGC (address: P.O. Box 307, Aberdeen, ID 83210). Seed from outside the United States should be sent to the USDA Plant Germplasm Quarantine Center (address: Bldg. 580, BARC-East, Beltsville, MD 20705) with forwarding directions. Include a description of the germplasm, including: donor (breeder, institution); botanical and common name; cultivar name and/or other identifiers; pedigree; and descriptive information (of important traits and special characteristics).

Assignment of a PI number and inclusion in the NSGC makes the germplasm available for research purposes to bona fide scientists in the U.S. and worldwide.

Please note that a different procedure applies if you are obtaining Crop Science registration. Follow directions provided by the registration committee.

Guidelines for Exporting Seed. All seed sent to a foreign country should be inspected and receive a phytosanitary certificate. Packages of four pounds or less can be routed through the USDA Plant Germplasm Inspection Station, Building 580, BARC-East, Beltsville, MD 20705, but must be accompanied by a check for $19 payable to APHIS (Animal & Plant Health Inspection Service) to cover the cost of the pc. Alternatively, you may wish to work with APHIS personnel in your state or your State Department of Agriculture to obtain aphytosanitary certificate. Also, please be aware of any import permits and additional declarations that certain importing countries may require to accompany the shipment.

Guidelines for Importing Seed. Any scientist importing seed should be aware of any restrictions that apply. USDA-APHIS personnel can provide current information on applicable restrictions.

Table 1. PI Assignments in *Avena*, 1992-94.

PI 559368 sativa	FLORIDA 502	United States	Florida
PI 559721 sativa	PRAIRIE	United States	Wisconsin
PI 560776 fatua	TU86-01-02	Turkey	Van

PI 560777 sterilis	TU86-20-01	Turkey	Siirt
PI 562640 sativa	CEAL	United States	Alaska
PI 562641 sativa	TORAL	United States	Alaska
PI 562656 sativa	INO9201	United States	Indiana
PI 562657 sativa	P7971A1-15-3-6	United States	Indiana
PI 564244 sativa	ARMOR	United States	Ohio
PI 564444 sativa	ABRITUS 2	Bulgaria	Plovdiv
PI 564445 sativa	DUNAV 1	Bulgaria	Plovdiv
PI 564446 sativa	OBRASZOV TCHIFLIC 4	Bulgaria	Plovdiv
PI 564591 sativa	YEATS	United States	North Carolina
PI 564722 nuda	NUSSO	Germany	
PI 564723 sativa	91-Bol-7	Bolivia	Cochabamba
PI 564724 sativa	ARGENTINA	Italy	
PI 564725 sativa	LIDIA	Italy	
PI 564726 sativa	OMBRONE	Italy	
PI 570656 sativa	BRAWN	United States	Illinois
PI 572288 sativa	871	United States	
PI 572547 sativa	IN09201	United States	
PI 572571 sativa	BAY	United States	Wisconsin
PI 573530 abyssinica	WIR 11670	Ethiopia	
PI 573531 abyssinica	WIR 11671	Ethiopia	
PI 573532 abyssinica	WIR 4585	Ethiopia	
PI 573533 brevis	WIR 5255	Portugal	
PI 573534 nuda	USPEH	Russian Federation	
PI 573535 nuda	WIR 8317	Russian Federation	
PI 573536 nuda	WIR 1926	China	
PI 573537 sativa	TAJOZNIK	Russian Federation	
PI 573538 sativa	KOLPASEVSKIJ	Russian Federation	
PI 573539 sativa	DRUG	Russian Federation	
PI 573540 sativa	MIRNYJ	Russian Federation	
PI 573541 sativa	KRUPNOZERNYJ	Russian Federation	
PI 573542 sativa	NARYMSKIJ 943	Russian Federation	
PI 573543 sativa	ISIM	Russian Federation	
PI 573544 sativa	KORMOVOJ 2	Russian Federation	
PI 573545 sativa	ODNOGRIVYJ	Russian Federation	
PI 573546 sativa	WIR 2137	Russian Federation	
PI 573547 sativa	WIR 2131	Russian Federation	
PI 573548 sativa	WIR 4953	Armenia	
PI 573549 sativa	SIBIRSKIJ	Russian Federation	
PI 573550 sativa	WIR 9602	Belarus	
PI 573551 sativa	WIR 10796	Russian Federation	
PI 573552 sativa	VAINAGS	Russian Federation	
PI 573553 sativa	ISETSKIJ	Russian Federation	
PI 573554 sativa	MUTIKA 169	Russian Federation	
PI 573555 sativa	WIR 3741	Uzbekistan	
PI 573556 sativa	WIR 9860	Latvia	
PI 573557 sativa	PRIKARPATSKIJ 6	Russian Federation	
PI 573558 sativa	URAL	Russian Federation	
PI 573559 sativa	WIR 2134	Russian Federation	
PI 573560 sativa	WIR 8101	Russian Federation	
PI 573561 sativa	UZBEKSKIJ SIROKOLIST	Russian Federation	
PI 573562 sativa	TRIO	Sweden	Uppsala
PI 573563 sativa	ZALALOVOI	Russian Federation	
PI 573564 sativa	GEREL	Russian Federation	

PI 573565 sativa	PECORSKIJ	Russian Federation	
PI 573566 sativa	WIR 10599	Moldova	
PI 573567 sativa	WIR 10950	China	
PI 573568 sativa	WIR 4798	Israel	
PI 573569 sativa	WIR 4784	Syria	
PI 573570 sativa	WIR 4743	Algeria	
PI 573571 sativa	SAO FRANCISCO	Russian Federation	
PI 573572 sativa	WIR 4873	Cyprus	
PI 573573 sativa	BUG	Russian Federation	
PI 573574 sativa	BELOZERNYJ	Russian Federation	
PI 573575 sativa	GORIZONT	Russian Federation	
PI 573576 sativa	SKAKUN	Russian Federation	
PI 573577 sativa	CERKASSKIJ I	Russian Federation	
PI 573578 sativa	L'VOVSKIJ I	Russian Federation	
PI 573579 sativa	SINEL'NIKOVSKIJ 29	Russian Federation	
PI 573580 sativa	CERNIGOVSKIJ 126	Russian Federation	
PI 573581 strigosa	WIR 4487	United Kingdom	England
PI 573582 strigosa	WIR 4483	United Kingdom	England
PI 573583 strigosa	WIR 4489	United Kingdom	England
PI 573584 strigosa	WIR 5200	Spain	
PI 573585 strigosa	WIR 5201	Spain	Lugo
PI 573651 sativa	A Ave 2400/85	Georgia	
PI 573652 sativa	A Ave 2401/83	Georgia	
PI 573653 sativa	A Ave 2646/86	Georgia	
PI 573654 sativa	A Ave 2676/89	Georgia	
PI 573655 sativa	A Ave 2677/87	Georgia	
PI 573656 sativa	A Ave 2680/89	Georgia	
PI 573657 sativa	A Ave 2687/89	Georgia	
PI 573721 nuda	BANDICOOT	Australia	New South Wales
PI 573722 sativa	PANFIVE	Australia	New South Wales
PI 573723 sativa	AMBY	Australia	Queensland
PI 573724 sativa	CULGOA	Australia	Queensland
PI 573725 sativa	NOBBY	Australia	Queensland
PI 573726 sativa	YILGARN	Australia	Western Austral
PI 573755 nuda	96	China	Nei Monggol
PI 573756 sativa	NSGC 578	Kazakhstan	
PI 574396 sativa	MAGNUM II	United States	
PI 577852 hybrid	90Ab-108	Turkey	Sinop
PI 577853 hybrid	90Ab-100	Turkey	Sinop
PI 577854 hybrid	90Ab-103-2	Turkey	Sinop
PI 577855 hybrid	90Ab-103-1	Turkey	Sinop
PI 577856 sativa	2a-1	Turkey	Eskisehir
PI 577857 sativa	2a-2	Turkey	Eskisehir
PI 577858 sativa	2a-3	Turkey	Eskisehir
PI 577859 sativa	2b	Turkey	Eskisehir
PI 577860 sativa	5a-1	Turkey	Ankara
PI 577861 sativa	5a-2	Turkey	Ankara
PI 577862 sativa	5a-3	Turkey	Ankara
PI 577863 sativa	5a-4	Turkey	Ankara
PI 577864 sativa	15a-1	Turkey	Kastamonu
PI 577865 sativa	15a-2	Turkey	Kastamonu
PI 577866 sativa	20e	Turkey	Kastamonu
PI 577867 sativa	28c-1	Turkey	Sinop
PI 577868 sativa	28c.2	Turkey	Sinop

PI 577869 sativa	28c.3	Turkey	Sinop
PI 577870 sativa	28c-2	Turkey	Sinop
PI 577871 sativa	28c-3	Turkey	Sinop
PI 577872 sativa	28c-4	Turkey	Sinop
PI 577873 sativa	28c-5-1	Turkey	Sinop
PI 577874 sativa	28c-5-2	Turkey	Sinop
PI 577875 sativa	29a-1-1	Turkey	Sinop
PI 577876 sativa	29a-1-2	Turkey	Sinop
PI 577877 sativa	29a-2-1	Turkey	Sinop
PI 577878 sativa	29a-2-2	Turkey	Sinop
PI 577879 sativa	29a-2-3	Turkey	Sinop
PI 577880 sativa	29a-2-4	Turkey	Sinop
PI 577881 sativa	29a-3-1	Turkey	Sinop
PI 577882 sativa	29a-3-2	Turkey	Sinop
PI 577883 sativa	29a-3-3	Turkey	Sinop
PI 577884 sativa	29a-4-1	Turkey	Sinop
PI 577885 sativa	29a-4-2	Turkey	Sinop
PI 577886 sativa	29a-4-3	Turkey	Sinop
PI 577887 sativa	29a-4-4	Turkey	Sinop
PI 577888 sativa	29b-1	Turkey	Sinop
PI 577889 sativa	29b-2	Turkey	Sinop
PI 577890 sativa	29b-3	Turkey	Sinop
PI 577891 sativa	30d-1	Turkey	Sinop
PI 577892 sativa	30d-2	Turkey	Sinop
PI 577893 sativa	30d-3	Turkey	Sinop
PI 577894 sativa	30d-4	Turkey	Sinop
PI 577895 sativa	30e-1	Turkey	Sinop
PI 577896 sativa	30e-2	Turkey	Sinop
PI 577897 sativa	31b-1	Turkey	Sinop
PI 577898 sativa	31b-2	Turkey	Sinop
PI 577899 sativa	31c-1	Turkey	Sinop
PI 577900 sativa	31c-2	Turkey	Sinop
PI 577901 sativa	37c-1-1	Turkey	Corum
PI 577902 sativa	37c-1-2	Turkey	Corum
PI 577903 sativa	37c-1-3	Turkey	Corum
PI 577904 sativa	37c-1-4	Turkey	Corum
PI 577905 sativa	37c-1-5	Turkey	Corum
PI 577906 sativa	37c-2-1	Turkey	Corum
PI 577907 sativa	37c-2-2	Turkey	Corum
PI 577908 sativa	46b-1	Turkey	Corum
PI 577909 sativa	46b-2	Turkey	Corum
PI 577910 sativa	46b-3	Turkey	Corum
PI 577911 sativa	57a-1	Turkey	Tokat
PI 577912 sativa	57a-2	Turkey	Tokat
PI 577913 sativa	57a-3	Turkey	Tokat
PI 577914 sativa	67a-1	Turkey	Samsun
PI 577915 sativa	67a-2	Turkey	Samsun
PI 577916 sativa	67a-3	Turkey	Samsun
PI 577917 sativa	67a-4	Turkey	Samsun
PI 577918 sativa	67a-5	Turkey	Samsun
PI 577919 sativa	69	Turkey	Ordu
PI 577920 sativa	70-1	Turkey	Ordu
PI 577921 sativa	70-2	Turkey	Ordu
PI 577922 sativa	70-3	Turkey	Ordu

PI 577923 sativa	70-4	Turkey	Ordu
PI 577924 sativa	70-5	Turkey	Ordu
PI 577925 sativa	71-1	Turkey	Ordu
PI 577926 sativa	71-2	Turkey	Ordu
PI 577927 sativa	71-3	Turkey	Ordu
PI 577928 sativa	71-4	Turkey	Ordu
PI 577929 sativa	71-5	Turkey	Ordu
PI 577930 sativa	72-1	Turkey	Ordu
PI 577931 sativa	72-2	Turkey	Ordu
PI 577932 sativa	72-3	Turkey	Ordu
PI 577933 sativa	72-4	Turkey	Ordu
PI 577934 sativa	72-5	Turkey	Ordu
PI 577935 sativa	72-6	Turkey	Ordu
PI 577936 sativa	74c-1	Turkey	Ordu
PI 577937 sativa	74c-2	Turkey	Ordu
PI 577938 sativa	87a-1	Turkey	Sivas
PI 577939 sativa	87a-2	Turkey	Sivas
PI 577940 sativa	87a-3	Turkey	Sivas
PI 577941 sativa	87a-4	Turkey	Sivas
PI 577942 sativa	87a-5	Turkey	Sivas
PI 577943 sativa	89c-1	Turkey	Ordu
PI 577944 sativa	89c-2	Turkey	Ordu
PI 577945 sativa	89c-3	Turkey	Ordu
PI 577946 sativa	117a-1	Turkey	Erzurum
PI 577947 sativa	117a-2	Turkey	Erzurum
PI 577948 sativa	117a-3	Turkey	Erzurum
PI 577949 sativa	117a-4	Turkey	Erzurum
PI 577950 sativa	117a-5	Turkey	Erzurum
PI 577951 sativa	117a-6	Turkey	Erzurum
PI 577952 sativa	117a-7	Turkey	Erzurum
PI 577953 sativa	127c.1	Turkey	Kars
PI 577954 sativa	127c.2	Turkey	Kars
PI 577955 sativa	127c.3	Turkey	Kars
PI 577956 sativa	127c.4	Turkey	Kars
PI 577957 sativa	127c-1	Turkey	Kars
PI 577958 sativa	132a-1	Turkey	Kars
PI 577959 sativa	132a-2	Turkey	Kars
PI 577960 sativa	132a-3	Turkey	Kars
PI 577961 sativa	132a-4	Turkey	Kars
PI 577962 sativa	135b-1	Turkey	Kars
PI 577963 sativa	135b-2	Turkey	Kars
PI 577964 sativa	135b-3	Turkey	Kars
PI 577965 sativa	135b-4	Turkey	Kars
PI 577966 sativa	135b-5	Turkey	Kars
PI 577967 sativa	139b-1	Turkey	Kars
PI 577968 sativa	139b-2	Turkey	Kars
PI 577969 sativa	139b-3	Turkey	Kars
PI 577970 sativa	139b-4	Turkey	Kars
PI 577971 sativa	139b-5	Turkey	Kars
PI 577972 sativa	139b-6	Turkey	Kars
PI 577973 sativa	144c-1	Turkey	Kars
PI 577974 sativa	144c-2	Turkey	Kars
PI 577975 sativa	144c-3	Turkey	Kars
PI 577976 sativa	144c-4	Turkey	Kars

PI 577977 sativa	144c-5	Turkey	Kars
PI 577978 sativa	151c-1	Turkey	Artvin
PI 577979 sativa	151c-2	Turkey	Artvin
PI 577980 sativa	157c-1	Turkey	Erzurum
PI 577981 sativa	157c-2	Turkey	Erzurum
PI 577982 sativa	157c-3	Turkey	Erzurum
PI 577983 sativa	157c-4	Turkey	Erzurum
PI 577984 sativa	157c-5	Turkey	Erzurum
PI 577985 sativa	169-1	Turkey	Sivas
PI 577986 sativa	169-2	Turkey	Sivas
PI 577987 sativa	169-3	Turkey	Sivas
PI 577988 sativa	170c-1	Turkey	Sivas
PI 577989 sativa	170c-2	Turkey	Sivas
PI 577990 sativa	172b-1	Turkey	Sivas
PI 577991 sativa	172b-2	Turkey	Sivas
PI 577992 sativa	175b-1	Turkey	Sivas
PI 577993 sativa	175b-2	Turkey	Sivas
PI 577994 sativa	175b-3	Turkey	Sivas
PI 577995 sativa	175b-4	Turkey	Sivas
PI 577996 sativa	175b-5	Turkey	Sivas
PI 577997 sativa	175b-6	Turkey	Sivas
PI 577998 sativa	176b-1	Turkey	Sivas
PI 577999 sativa	176b-2	Turkey	Sivas
PI 578000 sativa	176b-3	Turkey	Sivas
PI 578001 sativa	176b-4	Turkey	Sivas
PI 578239 sativa	76Ab7215	United States	Idaho
PI 578240 sativa	78Ab3965	United States	Idaho
PI 578241 sativa	80Ab988	United States	Idaho
PI 578242 sativa	80Ab4725	United States	Idaho
PI 578243 sativa	86Ab4219	United States	Idaho
PI 578244 nuda	88AbC301	United States	Idaho
PI 578245 nuda	88AbC321	United States	Idaho
PI 583358 sativa	CHARISMA	New Zealand	
PI 583735 sativa	CELSIA	Netherlands	
PI 583812 sativa	811	United States	Arkansas
PI 584341 sterilis	47a	Turkey	Corum
PI 584342 sterilis	47b	Turkey	Corum
PI 584343 sterilis	48a	Turkey	Corum
PI 584344 sterilis	50a	Turkey	Yozgat
PI 584351 sterilis	3a	Turkey	Ankara
PI 584352 sterilis	3c	Turkey	Ankara
PI 584353 sterilis	8a	Turkey	Bolu
PI 584354 sterilis	9a	Turkey	Bolu
PI 584355 sterilis	17c	Turkey	Kastamonu
PI 584356 sterilis	44a	Turkey	Corum
PI 584783 sativa	POTOROO	Australia	
PI 584824 nuda	PENDRAGON	United Kingdom	Wales
PI 584825 sativa	MELYS	United Kingdom	Wales
PI 584826 nuda	KYNON	United Kingdom	Wales
PI 584827 sativa	GERALD	United Kingdom	Wales
PI 584828 sativa	CHAMOIS	United Kingdom	Wales
PI 584829 sativa	ABERGLEN	United Kingdom	Wales
PI 584830 sativa	BETTONG	Australia	

A New Access To The Germplasm Resources Information Network(GRIN) Of The National Plant Germplasm System

Mark Bohning

The National Plant Germplasm System (NPGS) is a cooperative effort by public (federal and state) and private industry. The NPGS preserves the genetic diversity of over 8000 plant species through acquisition, maintenance, evaluation, documentation and distribution.

The Germplasm Resources Information Network (GRIN) is a centralized computer database designated to facilitate the management and operation of the NPGS, enhance communication with scientists regarding the location and characteristics of plant genetic resources, reduce unneeded redundancy of data and to relate all pertinent information about each accession. The GRIN database provides updates from recognized authorities that are quickly available to everyone.

Information in GRIN consists of:

- o taxonomic classification
- o passport data
    - o collector/developer information
    - o locality data
    - o pedigree
    - o quarantine information
    - o maintenance site
    - o citations about the accession
    - o alternate identifiers, and
    - o general narratives
- o inventory information
    - o availability
    - o germination results
    - o regeneration tracking
    - o distribution quantities
    - o pathogen test results, and
    - o visibility
- o observation data
    - o morphological traits
    - o pest resistance
    - o resistance to abiotic stresses
    - o quality data, and
    - o environmental information
- o cooperator addresses
- o germplasm distribution tracking

The oat collection maintained at the National Small Grains Collection in Aberdeen, Idaho, currently consists of more than 21,000 oat accessions representing 18 species and over 200,000 observation records. A more detailed description of the collection is referenced in the articles by H. Bockelman and D. Wesenberg in this newsletter.

As of January 1995, a new user access to GRIN using the Internet was established. GRIN data can now be obtained in several ways:

1. On Internet's World Wide Web, the URL is:
   http://www.ars-grin.gov/

2. On Internet's gopher server, type:
   gopher gopher.ars-grin.gov

3. On some gopher lists, we are known as
   GRIN, National Genetic Resources Program USDA-ARS

4. On the centralized computer located in Maryland, to connect, do the following:

   o using a mode, dial: 301-504-6227
   o at the connect message, type: Enter
   o at the login prompt, type: grin

5. On a copy of pcGRIN which can be loaded to personal computer with a DOS operating system. To obtain a crop or group of crops for pcGRIN, contact the DBMU, or download them from the Internet.

For additional information on GRIN, contact:

Database Manager
USDA-ARS-PSI-NGRL-GRIN
Building 003, 4th Floor, BARC-West
10300 Baltimore Avenue
Beltsville, MD 20705-2350
(301) 504-5666
FAX: 301-504-5536
email: grin@ars-grin.gov

ILLINOIS

F.L. Kolb, C.M. Brown, L.L. Domier, C. Gourmet, and T.K. Hoffman

Production. The Illinois Agricultural Statistical Service reported that oat production in Illinois was up 20% in 1994 from a record loss in 1993. Illinois farmers produced an estimated 5.5 million bushels of oats in 1994 with an estimated 90,000 acres harvested for grain. Estimated average yield was 61 bu/A in 1994 compared to 51 bu/A in 1993. Harvested acreage in 1993 and 1994 was approximately the same, thus the increase in production in 1994 resulted from higher yields, not increased acreage. In general, 1994 was a favorable season for oat production in Illinois except that hot weather cut grain filling short. Conditions were favorable for early spring planting and the spring was generally cool with sufficient soil moisture. Early season plant development was generally excellent. BYDV was not severe in 1994, and crown rust did not develop until late in grain filling. Test weights were reduced due to hot temperatures which shortened grain filling.

Research. About 25 pairs of near-isogenic lines differing in tolerance to BYDV are under development. One line in each pair is susceptible to BYDV and the other line is tolerant. The lines are currently BC5F6. We are evaluating the differences in BYDV tolerance between the lines in each pair in order to decide which on the lines will be most useful for further studies.

We conducted an experiment studying yield loss due to BYDV and the effectiveness of Gaucho (imidacloprid, a systemic seed treatment insecticide, in controlling BYDV in oat (part of C. Gourmet's Ph.D. thesis research). All insecticide treatments decreased the percentage of infected plants. In inoculated plots planted using insecticide treated seed, disease symptoms were reduced 51-65 % compared to inoculated plots planted from seed not treated with the insecticide. Yield increases were observed with the use of the insecticide with both a susceptible (Don) and a tolerant cultivar (Ogle). The economics of using the insecticide were not calculated by due to the economics of oat production, the cost of the chemical, And the cost of getting the product labeled for commercial use, it is unlikely to be registered for commercial use in U.S. oat production. The insecticide is useful for research by providing a way to produce control plots with very little BYDV infection in experiments on BYDV.

In another experiment evaluating yield loss in oat due to BYDV, we have collected two years of data using 6 cultivars. In the first year of the experiment, yield loss due to BYDV (comparing insecticide sprayed, Cygon, to naturally infected plots) ranged from 19 to 44%. Total biomass was also reduced by BYDV lb/n susceptible cultivars. BYDV infection was not severe in 1994 and no differences in yield due to BYDV were observed. The experiment will be repeated in 1995.

As part of her Ph.D. thesis research Catherine Gourmet used near-isogenic lines to screen 93 RAPD primers for polymorphisms associated with BYDV tolerance. One RAPD primer generated a polymorphic band that was present in the four BYDV tolerant donor parents and most tolerant near-isogenic lines but absent in the BYDV susceptible recurrent parent. Further research is required to determine if this marker is associated with a gene for tolerance to BYDV.

New Cultivar Releases. Brawn is the cultivar most recently released from the University of Illinois. Brown was tested as IL85-6264-1 and was released in 1993. Brawn is high yielding, midseason maturity (about 2 days later than Ogle), slightly shorter than Ogle and has large yellow kernels. The registration of Brawn appears in Crop Science 34:279.

Two experimental breeding lines, IL86-1995 and IL86-2081 will be in preliminary increase in 1995 with intent to release one or both of these lines. IL 86-1995 has high yield but is moderately late. IL86-2081 has yielded somewhat less than IL86-1995 but has better test weight and is several days earlier. The release decision on these two lines has not been finalized.

Personnel. Anna Hewings, USDA-ARS Cereal Virologist located at Urbana, Illinois accepted a position as Associate Director for the Midwest Area, USDA, in Peoria, Illinois. Her position has not been refilled.

Catherine Gourmet completed her Ph.D. under the direction of F.L. Kolb and accepted a postdoctoral position with A. Lane Rayburn at the University of Illinois. Catherine's Ph.D. research was on several aspects of BYDV tolerance in oat and wheat and included two of the experiments describe above.

Air Classification Of High-Protein Oats

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Air Classification of defatted Otee groats (23.4% protein, 6.2% β-glucan, db) produced both a protein concentrate and an enriched β-glucan fraction in a single process. The combined high-protein fine fractions had protein content of 30.2% and accounted for 21% of the weight and 27% of total protein of the defatted groats. The course residue (>30 μm) had 16.9% β-glucan content and accounted for 30% of the weight and 82% of total β-glucan in the original defatted groats. The air-classified fractions had very similar amino acid composition compared with the groats, which maintained the amino acid balance of normal protein groats.

INDIANA

H.W. Ohm, W. Berzonsky, I. Dweikat, H.C. Sharma (Agronomy), G. Shaner, G. Buechley, K. Perry (Botany and Plant Pathology), R. Ratcliffe (USDA-ARS, Entomology)

Production. The Indiana Crop and Livestock Reporting Service estimated oat acreage harvested for grain was 35,000 acres, or 88% of harvested acres in 1993. State average yield was 53.0 bu/acre, compared to 56.0 bu/A in 1993. Total production was 1.855 million bushels, which was 83% of production in 1993. Ogle accounted for 66.2% of the acreage, up substantially from 42.4% in 1993. This was followed by Don at 15.9% and Larry at 7.0%. All other cultivars accounted for the remaining 10.9%.

Season. Generally in Indiana, soil moisture was adequate for oat culture from March to early June, and deficits throughout June and early July were not severe. Oat seeding was ahead of previous years, with 34 percent of the state oat crop seeded in early April. Breeding nurseries at Lafayette were seeded 22 to 24 March. Temperatures were ideal for oat growth from early April until mid June. From mid June, about two weeds after heading until harvest, warm temperatures limited grain fill and yield. Barley yellow dwarf symptoms, although prevalent, developed late in the season. There was little incidence of crown rust.

Breeding. The spring oat line P88122E1-4-5-1-X-5, was released in 1995, has resistance to barley yellow dwarf viruses and crown rust and named "Classic". IN09201 and IN09212 (see section on cultivars for descriptions) are available to farmers for seeding in spring of 1995.

Research. Yellow dwarf. (Ranieri, Shaner, and Lister). Graduate student Roberto Ranieri screened oat accessions from the National Small Grains Collection for resistance (low virus production) and tolerance (low symptom score) when infected with the P-PAV isolate of barley yellow dwarf virus (BYDV). The accessions used were selected as showing relatively mild symptoms when infected with BYDVs, according to information in the Germplasm Resources Inventory Network (GRIN) database. ELISA was used to assess resistance in inoculated oat seedlings which were then transplanted in the field for tolerance evaluation. Positive correlation between tolerance and resistance was recorded in a smaller experiment containing mostly accessions selected in the previous experiments for low ELISA values. Purification experiments confirmed that ELISA values and virus content were highly correlated in Ogle and Clintland 64. Barley isogenics Atlas 57 (Yd2-) and Atlas 68 (Yd2+), and cultivars Centinela and Puebla were used to investigate cross protection between strains of BYDVs. Differences in symptomatology and yield, when Atlas 57 (Yd2-), Atlas 68 (Yd2+), 'Centinela', and 'Puebla' barley cultivars were singly infected with Mexican isolates of barley yellow dwarf viruses, were recorded in field-greenhouse experiments carried out in the Valley of Mexico. Mex-PAV was the most severe isolate, while Mex-MAV was the mildest isolate. Mex-RPV had an intermediate effect. The combination of these isolates in double infections, in which the challenge virus followed the protecting one 9-d after, pointed out that the severe effects of Mex-PAV were enhanced by the presence of Mex-RPV either as protecting or challenge. The effect caused by the mixed infection was also measured in greenhouse experiments using quantitative enzyme-linked immunosorbent assay (ELISA). This confirmed the partial cross protection recorded in the yield trial. The finding that Mex-MAV isolate, the commonest BYDV isolate in the Valley of Mexico, partially protects against Mex-PAV, may have important influences on the epiphytotics of these viruses.

Crown rust. (Shaner and Buechley). Several accessions of *Avena sterilis* proved to have a partial resistance to *Puccinia coronata*, expressed mainly as smaller uredinia, but also as a somewhat longer latent period. These were crossed to the rust susceptible cultivar Clintford. In the fall of 1993, these F1s were raised in the glasshouse and were crossed to either of two advanced breeding lines, or to `Brawn' or Clintford. In the spring of 1994, F1s of these 3-way crosses were inoculated with *P. coronata*, and those that showed a degree of resistance were crossed again to various well-adapted cultivars or breeding lines of *A. sativa*. This procedure was repeated for the F1 progeny of these modified backcrosses in the fall of 1994. By this stage, much of the *A. sterilis* weedy characteristics had disappeared. Many plants showed moderate to high levels of resistance (some of the adapted *A. Sativa* parents also have resistance).

Progeny of the last cycle of crossing will be raised for one generation in the glasshouse, and then grown in the field for selection. A collection of *A. sativa* accessions that are thought to have partial resistance to crown rust (based on reports in the literature) were grown in the field in 1994. Lines that showed a susceptible infection type, but low severity of rust, were selected. These will be crossed to well adapted, but rust susceptible cultivars in the spring of 1995.

Barley yellow dwarf viruses resistance/tolerance (Vanessa Cook, H. Ohm). The F_8 generation of a recombinant inbred population from a cross between two closely related lines, one resistant/tolerant and the other line susceptible/sensitive, has been developed and will be in field tests in 1995 to identify specific phenotypic classes for resistance/tolerance. These lines will be used to identify DNA markers associated with resistance/tolerance.

MINNESOTA

D.D. Stuthman, H.W. Rines, R.L. Phillips, D.A. Somers,
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Oat production in Minnesota in 1994 was estimated to be 25 million bushels, about 22% more than in 1993. Approximately 450,000 acres were harvested out of the 575,000 seeded. These numbers compare to 850,000 and 750,000 acres harvested in 1989 and 1988 and 1.25 million and 1.7 million planted in 1989 and 1988, respectively, The average yield per acre was 55 bu/A, which was 10% more than in 1993. The season began with good topsoil moisture in most areas. The west central region had excessive moisture causing a three- to four-week delay in planting there. Generally, growing conditions were quite favorable throughout the season; however, crown rust development was also favored and in spots was severe. Barley Yellow Dwarf Virus (BYDV) was present in many areas, but on average the season was much better than 1993.

Cultivars. Because of the annual change in crown rust virulence since 1988, many cultivars quickly became obsolete. The primary one surviving, Troy, was also subject to minor infection levels in 1994 causing high concern for 1995 and beyond. Because it occupied most of the Minnesota acreage and thus probably screened the races, those capable of attacking Troy will likely predominate in 1995. Currently we have Ogle, Starter and Premier backcross derivatives with excellent crown rust resistance from two different sources. These lines are in several stages of yield testing and seed increase including during the winter in New Zealand. We are also doing a final increase on MN 89127, which has some resistance to current virulences. It and Milton, newly released and also with some resistance, will hopefully serve as interim stopgaps until the several backcross derivatives are available for release.

Research on recurrent selection. Deon Stuthman presented a paper summarizing the 25+ years of our experience with recurrent selection in oat at the Second South American Oat Conference held at Passo Fundo, Brazil in November, 1994. A proceedings will be available by summer 1995. In November, we intercrossed the 21 C_7 parents to produce the C_7 progeny of the closed system. We also crossed many of these C_7 parents to several lines with at least an MS level of crown rust resistance. Crown rust resistance is lacking in these recurrent selection materials. Given the increased levels of rust infection since 1989, addition of crown rust resistance is necessary to make this germplasm more useful.

Winter nursery. During the winters of 1993-94 and 1994-95, we have successfully grown a second field crop at Gore, New Zealand. Because the latitude there is similar to that of central Minnesota, we intend to do some selection as well as seed increase and generation advance. In additions, BYDV and crown rust infections at Palmerston North should allow for effective disease screening for those two pests.

Personnel. Graduate students and post-doctorals (since the last Oat Newsletter)

Betsy Hill completed her M.S. degree in 1992 and now works for Dekalb. Her thesis research examined differences among oat cultivars for competitive ability with green foxtail. These results have prompted further efforts to enhance the competitive ability and to better understand what attributes of the oat plant contribute to it.

David De Koeyer earned an M.S. in 1992 and is continuing on for a Ph.D. His M.S. research utilized Digital Image Analysis to measure changes in grain size in our recurrent selection material. His Ph.D. research efforts will measure changes in gene frequency for polymorphic molecular markers by comparing C_0 and C_7 parents. Those markers increasing in frequency are prime candidates for marking QTLs for grain yield.

Nick Haugerud finished his Ph.D. in 1992 and is now wheat farming in eastern Washington. His research measured the effectiveness of secondary selection pressure to correct correlated negative factor responses in our recurrent selection material. The results were only modestly successful and led us to begin opening the crossing system to achieve the desired correction.

Kendell Hellewell earned his M.S. in 1994 and in now working on his Ph.D. on the barley project at Minnesota. His research examined whether there was genetic variance for tolerance to heat stress during grain filling. The results suggest that only modest gains in increasing tolerance by selection will be possible.

Dennis Dolan earned his Ph.D. in 1994 and is now working for Coors Brewing Company as a barley breeder. Dennis' research compared double crosses, three-way crosses and backcrosses in our recurrent selection program to determine which kind of cross would yield the best progeny with the combination of important traits. Three-way crosses appear to hold the most promise.

Gilberto Sosa is currently working on his Ph.D. His research has two objectives: 1) practice additional recurrent selection with the double crosses, three-way crosses and backcrosses to empirically determine which cross type will produce the most gain, and 2) compare testing F_4 vs. F_8 progeny to determine whether the cycle time can be reduced to two years.

Bill Rooney completed his Ph.D. in 1992 and is now an alfalfa breeder in the Agronomy Department at Kansas State University. Bill's Ph.D. research characterized the primary genes for crown rust resistance in Amagalon and Obee/Midsouth germplasms and identified RFLP molecular markers linked to them. Backcross derived lines he developed are now an important component of our breeding program. He also conducted a study evaluating rapid cycle recurrent selection for early flowering in oat.

Eric Jellen completed his Ph.D. in 1992 and moved on to do postdoctoral work in wheat molecular cytogenetics at Kansas state University. Rick's research used c-banding patterns to cytologically identify each oat chromosome and the specific one missing in each of various monosomic oat stocks. RFLP markers were used to confirm many of the monosomic assignments.

Doug Davis completed an M.S. in 1992 and has held lab technician positions since including his current one at the University of Missouri, Columbia. His research included identifying melotic restitution as the origin of fertility in oat haploids and a field evaluation of doubled haploid oat lines derived form oat x maize crosses.

Sandra Milach defended her Ph.D. thesis in February and will be returning in late March to Brazil to resume her position at the Federal University of Rio Grande do Sul in Porto Alegre as an assistant professor in small grains breeding. Her Ph.D. research involved a genetics characterization of three dominate dwarfing genes in oat and the identification of associated molecular markers for each as a way to locate them on the oat genetic map.

Oscar Riera-Lizarazu will soon be finishing his Ph.D. research identifying and characterizing maize-chromosome additions in oat lines recovered from oat x maize crosses. Silvia Maquleria is conducting Master's degree research on oat x millet crosses. Nadlya Al-Saady's Master's degree research involves the molecular characterization of the Waxy genes in oat.

Other. Jim Stage retired on August 1, 1994 after 26 1/2 years of dedicated technical assistance to the breeding project. Until very recently, Jim made all of the crosses in our recurrent selection program -- no small accomplishment. We wish him well in retirement.

Roger Caspers, a long-time student worker on the project, has been employed as his replacement. Because Jim has trained him well, the transition has been quite smooth.

Marcello Morelli has been employed at provide technical assistance in our grain quality efforts. Mr. Morelli has a B.S. in Agronomy form the University of Buenos Aires.

Oat Rusts In North America In 1994

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Oat stem rust (*Puccinia graminis* f. Sp. *Avenae*). Light amounts of oat stem rust were found in southern Texas oat plots in mid-April and north central Texas plots in late May. This year in Texas, oat stem rust development was less than normal which relates to the dry conditions.

Oat stem rust was detected in the central plains on June 21 in north central Kansas plots and in a field in southwestern Nebraska. In early July, trace amounts of oat stem rust were found in oat fields in west central Wisconsin. In mid-July, traces of oat stem rust were found in fields in central Minnesota and northeastern South Dakota and in plots in east central Minnesota and east central South Dakota. During the last week in July, light amounts of oat stem rust were found in west central and northwestern Minnesota plots and in central Minnesota fields. Trace to 5% severities were observed on wild oats (*Avena fatua*) growing in a field in north central North Dakota. This year oat stem rust developed late in the northern oat growing area and losses were light except for late maturing fields.

Early oat stem rust development in southern Louisiana was less than last year on the same date. Infection was light in southern Louisiana oat nurseries in early April, but it increased rapidly after that. During the last week in April, oat stem rust was severe on susceptible cultivars in southern Louisiana and southern Alabama nurseries. Although the oat stem rust developed very late, it still destroyed most of the oat cultivar trials in southern Louisiana nurseries. During the first week in May, 5% stem rust severities were observed in oat plots in Quincy, Florida and Fairhope, Alabama at the hard dough stage. By the third week in May, light amounts of oat stem rust were found in southwestern Georgia and northwestern Mississippi nurseries. Stem rust severities were lower in fields than in nursery plots. This year oat stem rust was found in as many locations in the Southeast as in a normal year but losses were light since the rust developed so late in oat fields.

Light amounts of oat stem rust were found in the Central Valley, California plots in late April.

Race NA-27, virulent to *Pg-1*, *-2*, *-3*, *-4* and *-8* remains the predominant race in the U.S. population (Table 1). Race NA-5, virulent to *Pg-3* and *-15* continues to be the predominant race identified in California. Races NA-27 and NA-29, virulent to *Pg-1*, *-2*, *-3*, *-4*, *-8* and *-15* were identified from collections made in north central and central Mexico.

Oat crown rust (*Puccinia coronata*). During the last week in March, crown rust was severe in nurseries and traces were found in fields in southern Texas. During the last week of April, light amounts of crown rust were observed in central Texas plots. The widespread rust development and severities in 1994 were comparable to last year in this area.

In mid-April, oat crown rust was increasing rapidly in Louisiana plots. During the last week in April, rust severities ranged from trace to 30% on susceptible oat cultivars growing in nurseries from southern Georgia to southern Louisiana. By the first week in May, crown rust severities ranged from traces to 70% in oat plots at soft dough from the Florida panhandle to east central Louisiana. During the third week in May, traces of crown rust were found in east central Mississippi and northeastern Arkansas plots.

In the third week in May, oat crown rust was beginning to appear on oats adjacent to buckthorn, the alternate host, in St. Paul, Minnesota. In early June, crown rust was light on oats in southern Wisconsin and southern Minnesota. During the third week in June, trace to 10% crown rust severities were found in oat plots in north central Kansas and southern Minnesota and east central South Dakota plots and fields. Most of the infections were on the lower leaves. In mid-July, trace-10% severities were found on oat flag leaves throughout the eastern Dakotas, southern Minnesota and southern Wisconsin Fields. In east and west central Minnesota and east central South Dakota plots, 80% severities were observed. By mid-July, severe crown rust was found in northeastern North Dakota and northwestern Minnesota. Crown rust was severe and widespread this year. The most severe rust was found in fields where rust occurred early and conditions were conducive for rust development. Buckthorn growing in close proximity to oat fields provided some of the initial inoculum in these areas, i.e. southern Wisconsin and southern Minnesota. Buckthorn bushes appear to be common in southeastern South Dakota and may contribute to oat crown rust in that area. Crown rust was also found on three other hosts *Avena fatua* (40% severity), *Hordeum jubatum* (30% severity) and *Agropyron repens* (20% severity) in eastern North Dakota. This year light to moderate losses to crown rust occurred throughout the northern oat growing area (Table 2).

Isolates of *Puccinia coronata* were obtained from 247 uredinial collections of crown rust from oat fields and nurseries in the United States and Mexico. The isolates were tested on a set of 30 differential lines of oats, which includes lines with 26 different identified *Pc* genes for crown rust resistance. The Mexican isolates of *P. Coronata*, which were collected from Chihuahua and Jalisco are distinctly different from any of the U.S. collections, indicating that there is essentially no exchange of inoculum between Chihuahua and Jalisco in Mexico and Texas or other parts of the United States (Table 3). Populations of *P. coronata* from Texas, the Midwest, and the Southeast have relatively similar virulence frequencies, but there are sufficient differences to indicate that the exchange of inoculum between these areas is somewhat limited. For example, the lower frequencies of virulence to lines with *Pc-50* and *Pc-51* in the Midwest than in Texas or the Southeast cannot be explained by direct selection for virulence, because neither of these genes is known to have been used outside the Iowa multiline program. Similarly, the higher virulence to lines with *Pc-70* in the Midwest population does not relate to any known pattern of use of this resistance gene.

In general the frequencies of virulence observed in collections of P. coronata from 1994 were similar to those from the same areas in 1993. Virulence to lines with Pc-38 and Pc-39 increased somewhat in Texas and the Southeast in 1994 compared with 1993 and previous years. This suggests an influence on these populations by the *P. coronata* population in the Midwest, where *Pc-38* and *Pc-39* have been used extensively in cultivated oats. Virulence to lines with *Pc-68* was found in only 2% of the midwestern isolates of *P. Coronata* in 1993 and was not found in any other part of the country before 1994. In 1994, 20% of the isolates from Texas and 4% from the Southeast were virulent to *Pc-68*. Also, virulence to oat lines with resistance derived form Amagalon was found for the first time outside the St. Paul buckthorn nursery in 1994.

Losses due to rust. Acreage harvested and yield production records are based on 1994 Annual Crop Summary, Agricultural Statistics Board, USDA. Loss data are a summary of estimates made by personnel of the State Departments of Agriculture, University Extension and research projects, Agriculture Research Service, USDA, and the Cereal Rust Laboratory.

Losses were calculated for each rust as follows:

$$\text{Loss(specific rust)} = \frac{\text{(Production) X (Percent loss)}}{\text{(100\%) - (Percent loss due to rusts)}}$$

Losses were indicated as a trace when the disease was present but no fields were know to have suffered significant losses. When a few fields suffered measurable losses this was reflected as a percent of the state's production. Zeros indicate the disease was not reported in that state during the season. Trace amounts were not included in the calculation of totals and averages.

Table 1. Races of *Puccinia graminis* f. sp. *avenae* identified from oats in 1994

State	Source	Number of Collections.	Number of isolates.	Percentage of isolates of each race[1] NA-5	NA-16	NA-27	NA-29
AL	Nursery	3	9			100	
CA	Wild Oats	1	3	100			
FL	Nursery	4	12			100	
KS	Nursery	1	3			100	
LA	Nursery	3	9		33	67	
MN	Field	5	15			100	
	Nursery	6	18			100	
MS	Nursery	1	3			100	
ND	Nursery	2	6			100	
	Wild Oats	2	6			100	
NE	Field	1	1			100	
SD	Field	2	6			100	
	Nursery	2	6			100	
	Wild Oats	1	1			100	
TX	Nursery	7	21		43	57	
USA	Field	8	22			100	
	Nursery	29	87		14	86	
	Wild Oats	4	10	30		70	
	Total	41	119	3	10	87	
MEXICO	Nursery	57	164			87	13

1 See Martens et al., Phytopathology 69:293-294.

Table 2. Estimated losses in oats due to rust in 1994

State	1,000 of acres harvested	Yield in bushels per acre	Production in 1,000 of bushels	losses due to Stem rust Percent	Stem rust 1,000 bushels	Crown rust Percent	Crown rust 1,000 bushels
AL	33	55.0	1,815	0.0	0.0	1.0	18.3
AR	20	77.0	1,540	0.0	0.0	*T	T
CA	35	80.0	2,800	1.0	28.6	1.0	28.6
CO	24	60.0	1,440	0.0	0.0	0.0	0.0
GA	50	67.0	3,350	0.0	0.0	1.0	33.8
ID	20	65.0	1,300	0.0	0.0	0.0	0.0
IL	90	61.0	5,490	0.0	0.0	1.0	55.5
IN	35	53.0	1,855	0.0	0.0	1.0	18.7
IA	430	62.0	26,660	0.0	0.0	1.5	406.0
KS	120	46.0	5,520	0.0	0.0	T	T
LA	†NA	NA	NA	T	T	1.0	-
MI	110	57.0	6,270	0.0	0.0	1.0	63.3
MN	450	55.0	24,750	0.0	0.0	5.0	1,302.6
MO	34	52.0	1,768	0.0	0.0	1.5	26.9
MT	75	48.0	3,600	0.0	0.0	T	T
NE	150	50.0	7,500	0.0	0.0	T	T
NY	110	64.0	7,040	0.0	0.0	T	T
NC	40	65.0	2,600	0.0	0.0	1.0	26.3
ND	550	61.0	33,550	0.0	0.0	2.0	684.7
OH	120	56.0	6,720	0.0	0.0	0.0	0.0
OK	30	37.0	1,110	0.0	0.0	0.0	0.0

OR	45	100.0	4,500	0.0	0.0	0.0	0.0
PA	160	53.0	8,480	0.0	0.0	T	T
SC	40	71.0	2,840	0.0	0.0	1.0	28.7
SD	560	56.0	31,360	0.0	0.0	3.0	969.9
TX	130	40.0	5,200	T	T	T	T0.0
UT	8	75.0	600	0.0	0.0	0.0	0.0
WA	20	58.0	1,160	0.0	0.0	0.0	0.0
WV	5	45.0	225	0.0	0.0	1.0	2.3
WI	470	54.0	25,380	T	T	3.0	784.9
WY	24	56.0	1,344	0.0	0.0	0.0	0.0
Total of above	3,988		227,767		28.6		4,450.5
Average		57.1		0.01		1.92	
U.S. total	4,018	57.2	229,717				

*T = Trace

†Not available, therefore not included in loss totals.

Table 3. Frequency of virulence to specific *Pc* genes in oats among isolates of *Puccinia coronata* collected from oats in North America

	Percentage of isolates virulent			
Differential	Mexico	Texas	Midwest	Southeast
Pc-14 D504	4	94	85	89
Pc-35	4	74	47	50
Pc-36 D515	4	41	43	21
Pc-38	0	35	66	29
Pc-39	4	24	53	21
Pc-40	4	100	87	96
Pc-45	87	6	3	11
Pc-46	13	39	33	7
Pc-48	4	0	4	0
Pc-50	0	28	7	36
Pc-51 X434	0	76	51	71
Pc-52 X421	4	0	3	4
Pc-53 H441	0	2	1	0
Pc-54	70	48	14	18
Pc-56	4	51	48	44
Pc-57 D640	19	27	27	23
Pc-58 TAM-O-301	4	36	11	27
Pc-59 TAM-O-312	67	43	24	38
Pc-60 Coker 227	4	91	82	86
Pc-61 Coker 234	0	85	53	82
Pc-62	0	0	5	0
Pc-64	26	6	6	4
Pc-67	0	63	83	61
Pc-68	0	20	1	4
Pc-70 H547	4	27	38	25
Pc-71 Y345	4	24	51	22
Dane	91	7	27	19
TAM-O-386	0	72	24	56
TAM-O-386R	0	24	8	4
TAM-O-392	0	15	0	0
no. isolates	23	46	150	28

NORTH CAROLINA

Steven Leath, USDA-ARS, Department of Plant Pathology
David Livingston, USDA-ARS, Department of Crop Science
Paul Murphy, Department of Crop Science

Breeding for Resistance to Soilborne Oat Mosaic in Oats. Oat breeding lines generated from crosses of susceptible and resistant cultivars of oats were evaluated in the field at two locations in North Carolina in 1994. Each line was evaluated for disease resistance to oat mosaic virus and oat golden stripe virus, yield and height. At Salisbury and Clayton, the breeding lines were planted in both a disease-infested plot and a noninfested plot to evaluate the effect of disease versus no disease on each oat line. Useful data on levels of disease resistance, yield and height for each breeding line were obtained at both locations. DNA was extracted from each breeding line and is being used to establish molecular markers for resistance genes in oats to both viruses. These markers will allow new oat breeding lines to be screened for resistance genes to soilborne oat mosaic without requiring years of field testing to determine which lines are resistant. This should decrease the amount of time needed to develop new oat cultivars. Markers for susceptibility have been obtained and investigation for markers for disease resistance continues. The second field test of the oat breeding lines is currently being conducted to verify the data from the 1994 field season.

Genetic Control of Isozyme Loci in Hexaploid Oat. We conducted in-depth investigation of the inheritance of diaphorase (DIA) and phosphoglucomutase (PGM) variants in nine F_2 oat populations. Three independent DIA loci--*Dia-1*, *Dia-2*, and *Dia-3*--were hypothesized to determine eight zymogram phenotypes. Three independent PGM loci--*Pgm-1*, *Pgm-2*, and *Pgm-3*--were hypothesized to determine seven zymogram phenotypes.

A broader investigation was conducted on the genetics and linkage relationships of loci controlling 11 enzyme systems [acid phosphatase (ACP), aconitase (ACO), DIA, esterase (EST), isocitrate dehydrogenase (IDH), leucine aminopeptidase (LAP), malate dehydrogenase (MDH), peroxidase (PER), PGM, 6-phosphogluconic dehydrogenase (6-PGD), and shikimate dehydrogenase (SDH)] in three F_2 oat populations. A total of six new loci (*Acp-1*, *Aco-1*, *Idh-1*, *Lap-1*, *6Pgd-1*, and *Skdh-1*) were identified and described.

Evaluation of Turkish *Avena sterilis* L. Through Electrophoretically Detected Isozyme Polymorphism. Turkey has been identified as a center of isozyme variation for *Avena sterilis*. This study was conducted to determine whether this variation has been adequately sampled and to partition the currently available germplasm for the most efficient utilization in introgression studies. Isozyme polymorphism in 41 recent collections was compared with that found in 226 National Small Grains Collection accessions from previous collection trips. Additional variation not previously observed in Turkish accessions was found in the recent collections.

Cluster analysis using the combined data sets of recent and older collections identified four clusters. Two clusters contained materials with a broad geographical distribution in Turkey. The other two clusters were regionalized. Local variation was common. Cultivated germplasm was more closely associated with *A. sterilis* clusters with a broad geographical range.

Oat Winter Hardiness. The oat project at University Park PA (Penn State) was moved to Raleigh, NC in July 1994. Jerry Elwinger and Joan Weaver both stayed in Pennsylvania. The spring oat program was essentially terminated. A few potential white seeded lines are being tested additionally by Penn State for possible release. Bulk populations were split between Cornell and Ohio State. All winter oat germplasm was transferred to Raleigh with the project. Coordination of the Uniform Winter Oat Nurseries will be continued in Raleigh. A new technician, Alan Shepps, was hired in October. His duties will be primarily in the lab but he will help the breeding program when possible.

We have begun freeze-testing material generated by P. Murphy and are performing carbohydrate analyses in a study of S. Leath. A collaborative project with C. Henson (Madison, WI) on purifying fructan hydrolase enzymes from oat is being continued. A study initiated at Penn State, isolating and purifying fructan synthesis enzymes, will be continued. An isothermal calorimeter was transferred from the winter hardiness project in Lansing, MI and will be used to perform thermal analysis on oats to try and identify specific freezing tolerance mechanisms.

Publications.

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NORTH DAKOTA

Michael McMullen, Douglas Doehlert, and Robert Baumann

Production. The North Dakota Agricultural Statistics Service reported 1994 North Dakota oat production was 33.55 million bushels produced from 550,000 harvested acres for an average yield of 61 bushels per acre. This is 7 bushels per acre higher than the 5 year average, but 9 bushels per acre less than the 1993 average yield of 70 bushels per acre. North Dakota farmers planted 860,000 acres of oat and harvested 550,000 acres for grain. Most of the oat acreage not harvested for grain was harvested as a forage crop. In the livestock producing areas of western North Dakota, forage oat production is widely used.

Diseases. Crown rust developed relatively late in the season, but did result in reduced yield and quality in the northeastern quarter of the state. Virulence was observed on 'Troy' for the first time in North Dakota. Other cultivars protected by major genes, such as Don and Hazel, and those cultivars possessing Pc-38 and Pc-39 , such as Dumont, Steele, Riel, Newdak, and Valley, are vulnerable to the prevalent virulence in the crown rust population and developed heavy crown rust infection in areas of the state where crown rust was severe. 'Bay' exhibited effective resistance to crown rust in trials across the state. 'Paul' exhibited good resistance in most areas, but susceptible pustules were observed on Paul in trials in northeastern North Dakota. Breeding lines with Pc-91 were very resistant to crown rust and the leaves remained clean through the entire season. Very little stem rust developed and barley yellow dwarf virus infection was moderate. Head blight (*Fusarium* sp.) was observed in areas where wheat scab was severe. The head blight on oat was minor relative to the severity of wheat scab in these areas.

Breeding. Much of our emphasis has been directed toward development of lines with resistance to virulent pathotypes of crown rust that have appeared in the past 5 years. Few effective sources of resistance are available and recent rapid changes in crown rust virulence seem a harbinger of changes that may render present effective resistance vulnerable in the near future. ND880107 ('Ogle'/Riel) expressed an unexpected high level of crown rust resistance leading to some doubt about the accuracy of its pedigree. However, progeny of this line express good crown rust resistance to the eastern North Dakota crown rust population. Lines have been developed that combine Pc-91 with other sources of crown rust resistance and with stem rust resistance. By pyramiding Pc-91 with other sources of effective resistance, we hope to gain durability of Pc-91 . William Wilson, a graduate student sponsored by the Quaker Oats Company, identified repeatable RAPD markers that provide an efficient method for selection of lines with Pc-91 and aid in implementing a pyramiding approach. One of these markers appears completely linked with Pc-91 . Use of this marker allowed identification of lines that have Pc-91 combined with resistance derived from AOJSS. Although stem rust has been of little concern in recent years, our objective to produce lines with resistance to the prevalent races of stem rust remains a primary concern in our program.

Research. A chromosome interchange difference between Steele and Dumont with Pc-38 in the interchanged segment was used to develop lines with 0 to 4 doses of Pc-38 . The effects of gene dosage from manipulation of the Pc-38 locus were described previously, but gene dosage effects relative to other genes that reside in the interchanged segments was not known. To evaluate the effects of genes in the interchanged segments, we developed through backcrossing, a pair near isogenic reciprocal chromosome segment duplication-deficiency lines, derived from a Steele/Dumont hybrid that was heterozygous for a chromosome interchange, with Pc-38 in one of the interchanged segments. One of the near isogenic pair of lines was duplicate for the chromosome segment with Pc-38 (Dp-38) and the other line was deficient for the Pc-38 segment (Df-38). These lines along with the parents were evaluated in replicated trials at two locations and did not differ significantly from each other for grain yield, test weight, or protein concentration. However, the groat lipid concentration of Dp-38 was 90 g kg^{-1} lower than Df-38 and lower than either parent. This suggested a gene that influences groat lipid content resides on one of the interchanged chromosome segments.

Cultivars. 'Jerry', 'Whitestone', and Paul were released by the North Dakota Agricultural Experiment Station in cooperation with the USDA for the 1994 growing season. Jerry produces exceptionally high test weight in North Dakota; Whitestone produces exceptionally high grain yield; and Paul is a high yielding, disease resistant naked cultivar adapted to North Dakota. Descriptions of these cultivars appear elsewhere in this issue.

Genotypic And Location Effects On Oat Grain Composition In North Dakota

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We have investigated the effects of genotype and environment on oat grain composition, with emphasis on the interaction of grain composition with groat soluble fiber composition and quantity. Twelve genotypes were chosen, based on their divergence in starch, protein, oil, and beta-glucan composition, determined in preliminary analyses. These genotypes were; AC Marie, Bay, Hazel, Jerry, Hytest, Marion, Paul, Riel, Robert, Whitestone, ND880786, and ND880946. They were grown in replicated plots at Fargo, Edgely, Fullerton and Lisbon locations in North Dakota during the 1993 and 1994 growing seasons. Grain has been analyzed for composition (starch, protein, oil, beta-glucan and ash) and for groat characteristics (1000 groat volume, 1000 groat weight, groat density). Non-glucose fiber components were determined from GC analysis of alditol acetate derivatives from flour hydrosylates. Here we report the preliminary results from analyses of 1993 samples. All groat composition components were most strongly dependent on genotype and all except beta-glucan content were affected by the location. In contrast, groat volume and groat weight were more strongly affected by location, although all groat characteristics were significantly affected by genotype. Correlation analyses indicated that increases in beta-glucan, protein and ash were negatively correlated with starch concentration in groats. Protein concentration was also negatively correlated with oil concentration. Groat density was negatively correlated with oil concentration and with several non-glucose fiber components, including arabinose, xylose and galactose. Groat density was positively correlated with protein, groat volume and groat weight. Starch and groat density were correlated with yield. Results indicate that selection for higher beta-glucan concentration in oats should not interfere with other quality characteristics, such as higher protein and lower oil.

OHIO

R.W.Gooding, K.G. Campbell
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Growing Conditions and Production. Air temperatures were higher than normal throughout the month of April. Cooler than normal soils, however, delayed emergence. From mid April through mid June, precipitation was much below normal which resulted in little tillering and short plants. Rainfall was above normal throughout the latter half of June but was far below normal throughout July. The Ohio Agricultural Statistics Service estimated oat grain yields in Ohio averaged 59 bu. per acre. Acres harvested for grain in Ohio totaled 120,000. Overall production therefore was just over 7 million bushels, the lowest on record.

Cultivars. Based on acres of certified seed produced, Armor has become the leading cultivar being produced in Ohio. Armor is followed by Ogle, Noble, and Hercules. Other cultivars being produced by certified seed producers in Ohio include Brawn, Don, Hamilton, Newdak, and Porter.

Two experimental lines are undergoing seed increase while being considered for release. They are OH1039 and OH1055. In Ohio tests, OH1039 has shown yields competitive with Ogle and Armor while being approximately two and three days earlier, respectively, in maturity. OH1055 has shown improved test weight while being similar in yield to Armor and Ogle.

Research. Digital Image Analysis (DIA) was used in conjunction with various seed sizing techniques to develop a fast and efficient method for screening populations and experimental lines for improved kernel quality. A mechanical means of hull-groat separation was devised using a Precision Machine Co. Thresher in conjunction with a Micro-cleaner developed by the USDA Soft Wheat Quality Lab located at Wooster. Both machines were coupled with Variac rheostats for motor speed control and accurate dehulling and cleaning times were determined for consistent results.

Ten gram samples of all entries grown in the 1994 Uniform Midseason and Uniform Early Oat Performance Evaluation Nurseries grown at Wooster, Ohio in 1994 were dehulled and reweighed to determine groat percentage.

Two high groat percentage and two low groat percentage cultivars from the 1994 oat uniform nurseries were identified. High groat percentage lines were Mo 9098-21 and WI X6161-2. Low groat percentage cultivars were AC Preakness and MN92102. Each of the four cultivars were divided into three samples by seed size; large, medium, and small. Sizing was done using a modified Carter Day Dockage Tester provided by the USDA Soft Wheat Quality Lab. Each seed sample was further divided into two classes based on seed density using a Carter Day Fractionating Seed Aspirator.

This resulted in four cultivars by three seed sizes per cultivar by two density fractions per seed size for a total of 24 samples. Each sample was divided into 3 replicates for analysis.

Kernel perimeter, area, feret diameter, shape factor, compactness, major axis length, and minor axis length were determined using DIA. One-thousand kernel weight was also determined and a kernel density factor was calculated (1,000 kernel weight/kernel area * 100). Test weight was also determined for each sample using a 206 ml micro-test weight apparatus supplied by the USDA Soft Wheat Quality Lab.

Results. 1. Groat percentage in the cultivars tested appears to be correlated with kernel weight, kernel area, and kernel density factor. To a lesser extent, groat percentage is also correlated with kernel perimeter, kernel length, and kernel width.

2. The small kernel fraction showed the highest average groat percentage followed by the medium kernel and the large kernel fraction.

3. High density kernels showed higher average groat percentage than low density kernels.

4. The highest groat percentages were found in small-seeded, high-density fractions of Mo8098-21 and WIX6161-1. Groat percentages for the two samples were 80.7 and 80.4, respectively. The lowest groat percentage samples were small-seeded low density AC Preakness and large-seeded low density MN92012 showing groat percentages of 66.7 and 64.4, respectively.

Conclusion. This work indicates that DIA in conjunction with 1,000 kernel weight may be used as an excellent rapid screening method for high groat percentage in oats
Further Research:

Research in 1995 will focus on the relationship between seed shape and groat percentage. At this time, crosses are being made between parents having high and low groat percentage. Populations of progeny from these crosses will be studied using DIA to determine the correlation between kernel shape, kernel weight, and groat percentage. DIA methodology will be further studied to determine its usefulness as a tool in recurrent selection to increase groat percentage in oat experimental lines being developed by the Ohio Agricultural Research and Development Center Spring Oat Breeding Program. Field studies will be undertaken to determine the relationship between seed sizing and density and field performance including grain yield and grain quality.

Personnel. Because of funding cutbacks in the small grains breeding program, two technicians have been lost to the program. This makes it necessary to downsize our oat breeding effort. At this time we will attempt to keep the overall program viable while eliminating our hull-less oat breeding effort and cutting back on the number of outlying testing sites in Ohio.

OREGON

Russ Darow, Corvallis
Randy Dovel, Klamath Falls
Oregon State University

Oregon oat acreage has stabilized at the 50,000 acre level. Oats are rapidly becoming a minor crop in the state. The only areas with significant production are Klamath Falls, a high-evaluation, spring grain growing area, and in the north Willamette Valley where oats are grown in rotation with clovers and wheat. Yield levels continue to be high - 100 bu/a in 1994 - even under dryland production. Cultivar evaluation is the sole research activity at this point in time. The Western Regional spring Oat Trial is being grown, experimental lines introduced by private companies from Australia and New Zealand are being evaluated, and oats research efforts.

SOUTH DAKOTA

D. L. Reeves and Lon Hall

Production. Oat yields were good in 1994 with an average yield of 56 bushels/acre. This is 4 bushels above the previous year, but 10 bushels below 1992. Acreage has continued to decline with only 750,000 acres planted each of the last 2 years. There was warm, dry weather in early spring but the rest of the year was favorable. Crown rust was evident in the eastern part of the state, but developed too late for maximum injury.

Cultivars. Troy is currently the most popular cultivar due to its crown rust resistance...Settle generally performs well, but is showing increasing amounts of crown rust. Don does well if crown rust is not prevalent. The last 3 years have almost eliminated it from the east part of the state due to crown rust. Newdak has been a steady performer in the northern part of the state.

Research. Major emphasis in the breeding program currently is resistance to crown rust and grain quality. Barley Yellow Dwarf also continues to be emphasized although it wasn't a problem this year. We've cooperated with Dale Gallenberg the last three years as he looked at the possible benefits of a foliar fungicide on oats. In 1992 there was no benefit. However, in 1993 Don had crown rust disease ratings of 63 and 16% for untreated and mancozeb. Yields were 37 and 60 bu. While test weights increased from 27.7 to 33.1 lb/bu respectively. In 1994, disease ratings were 93 and 8% while yields increased form 83 to 107 bu/A respectively. These were yield increases of 63 and 28% for these two years at Brookings.

Two graduate students are currently on the project. Mehmet Cakir is working on a RFLP study where hull percentage is a primary factor of interest. John Golden is looking at segregating populations of crosses between high, medium and low oil percentage parents.

For the past two years, we've looked at X and XX rates of Harmony Extra on oat cultivars. Injuries were more severe in 1993 with grain yield reductions up to 90%. In the 16 cultivars examined, Ogle, Porter and Premier were much more sensitive than other cultivars both years. These sensitive cultivars were greatly shortened in height by the Harmony Extra.

UTAH

R.S. Albrechtsen

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Production. Utah's oat acreage harvested for grain continues to decline. Only 20 percent of the 1994 planted acreage was harvested for grain. Yields per acre remain quite constant, but our acreage is small.

Losses from diseases are generally minimal. Infestations of the Cereal Leaf Beetle have been sporadic in recent years.

Oat Program. Our small oat acreage does not justify an oat breeding program. Well adapted culitvars are identified from the Uniform Northwestern States Oat Nursery, which we grow at Logan. Ajay and Monida appear to be the best named cultivars available at the present time.

WISCONSIN

R. D. Duerst, E. S. Oplinger, D. M. Peterson, and A. H. Ellingboe (Plant Pathology)

Production. Wisconsin farmers planted about 700,000 acres of oats in 1994 and harvested about 475,000 for grain and straw. Most of the remaining acres were harvested at early heading stage for forage. The statewide grain yield average was about 54 b/a compared with 46 b/a for 1993.

Planting conditions were favorable around the state allowing farmers to get the oat crop planted earlier than average. Although most oats had a good start, mixed weather conditions and severe weed problems caused the crop to deteriorate as the season progressed. Even though crown rust was widespread throughout the southwest portions of the state, damage was variable due to the rather late date of infection.

Cultivars. Based on acreages of Certified Seed produced by Wisconsin seed growers in 1994, Prairie, Dane, and Bay should be the leading cultivars grown in 1995. Appreciable acreages of Hazel, Ogle, and Ensiler are also expected in the state. Bay, a recently released dual purpose cultivar, and Ensiler are expected to make up the majority of the acreage planted for oat forage purposes.

A major increase of Wisconsin oat selection X5673-2 was grown in 1994 and will be available for Certified Seed growers in spring of 1995.

ABEL

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Abel is a new cultivar of the naked oat recently bred out at the Krukanice Plant Breeding Station of SELGEN Company. It comes from crossings of the naked oats bred in Bohemia nearly 50 years and the cv. Adam with husked oats Dragon (Poland) and Carstens Phonix (Germany). Abel was tested in the State varietal trials in the Czech Republic for three years as the line SG-K 8122.

From the cv. Adam, cultivated in the Czech Republic since 1988 the cv. Abel differs first of all with the shorter stem by 9 cm and the higher grain yield by 9% (average of the State varietal trials in 1991-1993). Abel has an increased number of grains in panicle. It has slightly decreased lodging resistance but this quality does not seem to be of importance. The naked oats are in lodging, namely, in average by 1-2 points better in comparison with the husked oats. Judging according to the time of heading and the length of the growing period Abel belongs to the midseason oats. Its big grain is resembling to that of the cv. Adam, similarly its rough protein, fat and the fibre. The percentage of the genetically established husked grains is slightly higher if compared to that in the cv. Adam and varies by about 1% of weight. However, this is influenced by the harvest conditions and the threshing.

If assuming the oat flakes production from the cv. Abel 85% and from the good quality husked oats 55%, the cv. Abel gives by 8 up to 16% higher yield of oat flakes per ha (judged according to grain yield in the State varietal trials in the Czech Republic in 1991-1993.

The cv. Abel is one of the most resistant oats to Heterodera avenae on territory of the CR. Under artificial contamination f soil on the cv. Abel 0-2 (max. 4) white cysts were recorded per plant whereas on the cv. Rhiannon 28 cysts.

In 1992-1994 the cv. Abel was tested in official trials in the Federal Republic of Germany and proposed for the registration under the name Mozart.

Table 1. Comparison of the cv. Abel with some cultivars of naked oats at Krukanice in 1993.

Cultivar	Country	Grain yield	Date to head	Height	Lodging * resistance	Maturity	TGW	Husked grains
		t/ha		cm	9-1	date	g	%
Abel	CZ	5.12	12.6	94	7.0	10.8.	28.7	0.8
		=100%		Deviation form Abel				
Adam	CZ	92	0	+8	+0.5	0	-0.3	-0.7
Salust	D	94	-2	-4	-0.7	-2	-3.3	-0.4
Salomon	D	92	0	+8	+0.6	0	-0.8	-0.3
Salvius (=Magda)	D	89	-2	+6	-1.0	-2	-1.8	+6.0
Nuprime	F	93	0	+8	-1.8	0	-2.5	+4.0
Rhiannon	GB	95	+3	-5	+0.8	+1	-2.0	-0.2
TO258	CA	94	-1	-2	-1.0	0	-0.5	+8.0

BONAERENSE PAYE

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TRES ARROYOS - PCIA. DE BUENOS AIRES - ARGENTINA

This cultivar released by Chacra Experimental Integrada Barrow in 1991 has its origin in the International Oat Breeding Project (University of Wisconsin-Texas A&M University - Quaker Oats Co.).

It derives form the crossing between 72C1648 and SRcpx by Dr. M. McDaniel in College Station in 1978. Being received in F6 was reselected in Barrow, in 1982. Both parents, inedit lines of the international program, have complex pedigrees with intervention of many parents.

The period of yield trials for grain and forage extends from 1986/87 to its inscriptions in the cycle 1990/91, mainly in Barrow and some other locations of the Argentine cereal region.

Paye is a simiprecocious cultivar, with excellent productivity, for grain and forage, and good adaptation to different environments. Its vegetative behavior is intermediate, with abundant and vigorous tillering. The cycle to heading, in winter seedings, varies between 90 to 100 days, similar to Suregrain. Its height, more than one meter, exceeds the rest of the cultivars diffused, but the notable resistance to lodging makes much easier the management for grain or hay harvest, and allows its seeding in soils, natural or chemically fertiles.

Respect to rust, at the moment of releasing in 1991, Paye was semiresisting, in field, to the main races of Puccinia coronata diffused in our country. In greenhouse was resistant to 7 races and susceptible to 5 of the ones studied here. About stem rust (Puccinia graminis) it was at that time the only commercial cultivar resistant to Puccinia graminis in field and greenhouse. However, changes in the races of stem rust became Bonaerense Paye in susceptible after only one year.

Its grain production is excellent, the hectoliter weight and size of grain are important too.

Another important character is the percentage of groat which exceeds 68%, the higher of all the cultivars diffused. Meanwhile its protein content is medium (13%).

CARROLUP

R. McLean and A. Tarr
Dept. Agriculture, Western Australia

Carrolup was bred by the Dept. of Agriculture, Western Australia, and was released to registered seed growers in 1993. It was tested under the code 81Q:346. Carrolup was selected at the F5 generation from the cross Mortlock/5/Kent/Ballidu//Curt/3/Cortez/4/TAM0-312/2*West.

Carrolup is a mid-season, spring grain oat with high yield, and excellent quality. It should replace the current Western Australian milling oat cultivar Mortlock in most recommendation areas. It has similar plant type, good straw strength, and maturity to Mortlock. Carrolup will not replace the higher yielding, but poorer quality semi-dwarf (DW6) oat cultivar Dalyup for on-farm feed.

Overall Carrolup is potentially a high quality milling oat. It has better hectolitre weight and groat percent than Mortlock, and has a similar large grain size.

Carrolup outyields Mortlock by 7%, averaged over the state. It shows its best yield advantage over Mortlock in the southern, high rainfall areas of Western Australia. This is the region with the longest growing season. Its yield advantage declines in the shorter growing season environments in the low rainfall and northern regions.

Carrolup is susceptible to stem and crown rusts, and moderately susceptible to barley yellow dwarf virus.

CDC BOYER

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CANADA

CDC Boyer, a new oat cultivar developed at the Crop Developemnt Centre, was Registered for sale in Canada in June, 1994.

CDC Boyer was developed from the cross SO82030 x W80094. SO82030 is a Crop Development Centre breeding line from the cross Cascade/Hudson and W80094 is an Agriculture and Agri-Food Canada Winnipeg Research Station breeding line with a complicated pedigree of rust resistant material built on a Harmon base. CDC Boyer was selected using a modified pedigree process with emphasis on selection for field performance, milling quality and earliness.

CDC Boyer combines the field performance and milling quality of previous releases from the program Calibre and Derby with three days earlier maturity similar to Cascade. In addition it demonstrates plumper grain and better rust resistance. Its test weight is lower than Derby being only equal to that of Cascade. While best adpated to the non-rust areas of western Canada, CDC Boyer has good stem rust resistance and fair crown rust resistance and should be acceptable for growing in south-eastern Saskatchewan if planted early to avoid late crown rust epidemics.

The Crop Development Centre oat R&D program is funded by the Saskatchewan Agriculture Development Fund and recieves additional support from the Quaker Oats Co. and Cargill Canada.

INO9201

H. Ohm, G. Shaner, G. Buechley, W. Aldridge, D. Bostwick, R. Ratcliffe

INO9201(PI 562656) is a spring oat (*Avena sativa* L.) developed cooperatively by the Purdue University Agricultural Research Programs and the USDA-ARS, and released in 1992. INO9201 originated from the multiple cross: P7135A1-1-8-4/'Lang'//P74120B13-6/3/Lang/4/MO.06328// P74120B13-6/P73109B7-1-5-132-1, of which the final cross was made in 1979. The parental line P7135A1-1-8-4 carries resistance to barley yellow dwarf viruses (BYDV). The parental line P74120B13-6 carries resistance to crown rust transferred from CI 8454. The parental line P73109B7-1-5-132-1 carries resistance to BYDV as well as resistance to crown rust from IowaX434-1. The parental line MO.06328 has resistance to BYDV, and its parentage is 'Pettis'/'Florida 500'.

Subsequent to the final cross, INO9201 was developed by a modified pedigree method of breeding with plant selections made in F2, F4, and F9 generations. The name of INO9201 during testing and seed increase was P7941D7-10-15-96. INO9201 was released because of its high yield potential, early maturity, lodging resistance, and resistance to barley yellow dwarf viruses and crown rust. INO9201, derived from a single F9 plant, has been uniform and true breeding during testing, and no variants have been recognized or rogued during seed increase.

Grain yield of INO9201 averaged 4,978 kg ha^{-1}, 1% higher than Ogle and 25% higher than Noble, in replicated yield nurseries at Lafayette, IN over 5 years, 1989 to 1993.
INO9201 is similar to Noble for general plant type, but has averaged 2% higher test weight, heads 1 d earlier, and is 7 cm shorter. INO9201 has resistance to BYDV; and has resistance to races *Pc59*, *264B*, and *Pc62* of *Puccinia coronata* f. sp. *avenae*. Juvenile growth habit is erect. The glumes and lemma are yellow at maturity. Awns are infrequent, nontwisted, and are up to 17 mm long. Glumes are nonfluorescent under ultraviolet light.

Breeder seed is maintained by the Purdue University Agricultural Research Programs. West Lafayette. IN 47907. INO9201 is licensed through Ag Alumni Seed Improvement Association. Inc., P.O. Box 158, Romney, IN 47981. Cultivar protection under the Plant Cultivar Protection Act (Public Law 91-577) is pending.

INO9212

H. Ohm, G. Shaner, W. Aldridge, G. Buechley, R. Ratcliffe

INO9212 (PI 562657 was developed by the Purdue University Agricultural Experiment Station in cooperation with the USDA-ARS. INO9212 was selected from the cross: P74122A6-2-1/4/P74112A4-4-34/Ill.75-1062/3/Lang/Mo06328//P74120B13-6/P73109B7-5. P74122A6-2-1 is a Clintford type with improved resistance to barley yellow dwarf viruses (BYDV) and resistance to crown rust from CI8454; P74112A4-4-34 is a Noble type with crown rust resistance from CI8454; Illinois 75-1062 has large kernels and resistance to BYDV; Lang and Mo06328 have resistance to BYDV; P74120B13-6 has resistance to crown rust from CI8454; and *P73109B7-5 is a Noble type with improved resistance to BYDV,and resistance to crown rust from IowaX434-1.

Subsequent to the final cross, INO9212 was developed by a modified pedigree method of breeding with plant selectons made in F2, F3, and F7. INO9212 has been tested in replicated performance trials and disease nurseries under the name P7971A1-15-3-6 at Lafayette, Indiana since 1987, in the regional Uniform Early Oat Performance Nursery in 1990 and 1991, and in Indiana replicated drill plot trials since 1990.

INO9212 has very good yield potential combined with resistance to BYDV, crown rust, and prevalent races of loose smut. INO9212 is similar to cultivar Noble for general plant type, but it has higher yield potential, higher test weifght, and higher percentage groat protein. INO9212 has resistance to races *Pc58*, *Pc59*, *Pc62*, and 264B of *Puccinia coronata avenae*, the causal organism of crown rust.

INO9212 is a common spring oat, *Avena sativa* L. Juvenile growth habit is erect. Glumes and the lemma are yellow at maturity and the dorsal surface of the lemma is hairless. Awns occur infrequently, are nontwisted, and are up to 17 mm long. Seeds do not floresce under ultraviolet light and basal hairs are absent.

Breeder seed is maintained by the Purdue University Agricultural Research Programs, West Lafayette, IN 47907. INO9212 is licensed through Ag Alumni seed Improvement Association, Inc., P.O. Box 158, Romney, IN 47981.

ISTRA

R. Mlinar

Institute for Breeding and Production of Field Crops, Zagreb

Istra is a mid-season oat released by the Bc Institute for Breeding and Production of Field Crops, d.d. Zagreb in 1993. It was selected from the cross CI-9310/Dakota, made in 1985. Istra was evaluated in the cultivar tests under the acession number 8010.

Regional trials in Zagreb - Botinec from 1992-1994 indicate that Istra outyileds cultivars Leanda and Condor by 5% and 10% respectively, but it is 1 to 2 days later than Leanda.

The kernels of Istra are white and range from off-white in some environments to cream in others. Istra is a good quality oat with high test weight, medium plump, protein and oil percentages are in the upper medium range (Table 1). Some of the florets may have awns with a dark base that usually separate from the kernel during threshing.
Istra is moderately resistant to crown and oat stem rusts and moderately susceptible to BYDY, oat powdery mildew and Septoria avenae.

The recommended planting rate is 450-500 germinable seeds per m2. Nitrogen rate should be 70-90 kg N/ha.

Table 1. Productivity and technological characteristics of oat cultivars Istra and Leanda for the years listed in the table

Characteristics	Year of Investigation	Mean	
		Istra	Leanda
Grain yield, kg/ha	1991-1993	5643	5464
Location Zagreb			
Highest grain Yield, kg/ha	1991	6160	
	1993		5900
Test weight, kg/hl	1991-1993	50.0	50.1
1000 kernel weight, g	1991-1993	30.3	29.8
Moisture, %	1993	9.87	10.27
Kernel mineral matter, %	1993	2.94	3.05
Kernel protein, %	1993	8.97	11.05
Kernel crude lipids, %	1993	4.54	3.65
Kernel crude cellulose, %	1993	11.27	11.47
Groat content, %	1991-1992	70.3	72.1
Plant height, cm	1991-1993	88	85

JAAK

H. Küüts, I. Tamm

Jôgeva Plant Breeding Institute, Estonia

'Jaak' is a new spring oat cultivar developed in Estonia, at the Jôgeva Plant Breeding Institute. The new cultivar is included into the List of recommended cultivars of Estonia from 1995. Jaak is obtained from the crossing 'Flämingsnova' x 6.1S ('Fraser' x ('Vigor' x 'Seisukindel')).

Jaak is a medium late cultivar having high yield capasity, large seed size and high protein and fat content. In three years of main trials at Jôgeva the average grain yield of Jaak was 15 and 14% greater than the standard cultivars 'Alo' and 'Selma', respectively. The average 1000 kernel weight of Jaak was 40.5 g. It exceeded Alo by 17% and Selma by 10%. The average growing period of Jaak was 4 days shorter than that of Alo an d3 days shorter than Selma.

Lodging resistance of Jaak did not differ considerabely from that of Alo and Selma. Jaak is resistant to root nematode and loose smut, medium resistant to crown rust and medium susceptible to stem rust.

Due to high yield capasity, high 1000 kernel weight, gook resistance to disease and shorter growing period, Jaak is well suitable for cultivation for both peruposes - for food and feed.

Table 1. Some characteristics of cultivars Jaak, Alo and Selma in the main trails at Jogeva (means of 1992...1994).

Characteristic		Jaak	Alo	Selma
Grain Yield	kg/ha	4145	3604	3653
Lodging resistance	1...9p*	8.0	8.6	8.0
Plant height	cm	93	89	88
Growing period	days	103	107	106
1000 kernel weight	g	40.5	34.6	36.7
Husk	%	24.8	24.9	24.5
Volume weight	g/l	549	553	556
Protein	%	13.6	13.3	12.4
Fat	%	4.7	6.0	3.8

* 1 = no lodging; 9 = severe lodging

JERRY

Michael McMullen, Douglas Doehlert, James D. Miller, and Robert Baumann

Jerry is a spring oat developed at the North Dakota Agricultural Experiment Station in cooperation with the USDA-ARS from a cross made in the fall of 1984 with the pedigree Valley/3/RL3038/Kelsey//M22/Kelsey. Jerry was released in 1994. The line that became Jerry was designated ND870952 during development and evaluation. Selection and advance of generations of Jerry occurred following the same procedures as those described for 'Whitestone'. An F 4:5 line harvested 1986 as the bulked seed of a single hill-plot was the source of the line that became Jerry. Breeder seed of Jerry was produced by roguing plants atypical of the Jerry phenotype from an F 10 plot grown in 1991. Jerry has been tested in replicated yield trials since 1989 and was tested in the 1992 Uniform Midseason Oat Performance Nursery. Jerry produced higher test weight than any line evaluated in North Dakota at cultivar trials during the period of 1991-1993, averaged over 36 location years, with the exception of 'Hytest'. Its grain yield was not as high as 'Newdak', or 'Whitestone' but was 20% greater than Hytest, the only other cultivar with a similar test weight. Jerry is similar to Newdak in heading date and height, and is more lodging resistant than 'Valley'. Percent whole oat protein and groat percentage of Jerry was higher than Dumont, but not as high as Hytest.

Jerry possesses crown rust resistance genes Pc-38 and Pc-39 and the stem rust resistance gene Pg-13 . Moderate crown rust resistance expressed by Jerry was observed to provide a useful level crown rust protection each season since 1990. Jerry exhibited moderate tolerance to barley yellow dwarf virus (BYDV) when tested in replicated hill plots infested with viruliferous aphids. The hulls of Jerry are white and lemmas are fluorescent when illuminated with UV light.

Jerry provides North Dakota oat growers with a disease resistant, relatively early cultivar, that produces consistently high test weight yet produces grain yields greater than Hytest and competitive to other high yielding cultivars grown in North Dakota.

The name Jerry was chosen to recognize the contributions to oat research of retired Lamoure County Extension Agent, Gerald Buck. Jerry will be protected under the US Plant Cultivar Protection Act.

LOVCEN

Dragoljub Maksimovic, Miodrag Krstic, Desimir Knezevic, Branka Ponos
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Institute for Small Grains deals with new spring oat cultivars creation. Yugoslav Cultivar Approvement Commission recognised to institute in 1992 fifth new spring oat cultivar named Levvcen. Dr. Dragoljuh Maksimovic and Mlodgrag Krstic created it by crossing of high yielding and qualtiy swedish cultivars Turbo and Slodon.

New cultivar Lovcen has been investigated in six localities in Yugoslavia during 1988-1990 period. Field trials were performed as complete randomised black system in replications with 5m2 plots. Grain qualtiy was estimated by standard methods. Results were processed by analysis of variance.

Table 1. Some characteristics of new spring oat cultivar Lovcen and check cultivar Condor in cultivar trials of Yugoslavia Approvement Commission.

CHARACTERISTIC	LOVCEN cultivar	CONDOR (check cv.)
Main grain yield (kg/ha)	4.637	4.465*
Highest grain yield (kg/ha)	7.800	7.520
Mean 1000 kernels weight (g)	30.18	27.88
Mean grain test weight (kg)	42.62	40.33
Mean plant height (cm)	109.90	114.20
Grain dry matter content (%)	91.90	91.60
Grain organic matter content (%)	97.10	96.75
Grain nonnitrogen matter content (%)	61.60	59.55
Crude proteins content in grain dry matter (%)	12.80	12.10
Crude fiber content in grain dry matter (%)	10.00	11.50
Crude lipids content in grain dry matter (%)	3.80	5.20
Mineral matter content in grain dry matter (%)	2.90	3.26

* average from six localities and three years

According to the results shown in Table 1. Lovcen has 172 kg/ha greater mean grain yield and 0.7 crude proteins content in grain dry matter than standard cultivar Condor. It gave 800 kg/ha which was highest grain yield in Yugoslav Commission trials in Kragujevac 1988, while standard cultvar Condor had 7520 kg/ha. Mean 1000 kernel weight and mean grain test weight of Lovcen were higher than those of Condor New cultivar Lovcen has higher resistance to crown rust. lower resistance to stem and same to powdery mildew as standard cultivar Condor.

MILTON

D. Stuthman, J. Stage, H. Rines, and D. McVey

Milton spring oat was released by the Minnesota Agricultural Experiment Station in 1994. It was tested under the experimental designation MN 86231. Its pedigree is Wisc 1961-1/Noble/5/Benson/4/Jaycee//Garland/PI267989/3/Noble.

Wisc 1961-1 was obtained from Dr. R.A. Forsberg, Univ. Of Wisconsin-Madison in the summer of either 1974 or 1975. PI267989 is a crown rust resistant selection of A. sterilis from the Oat World Collection.

Milton was selected using a modified pedigree system as a bulk from our F_4 micro-plot nursery in the summer of 1984. The F_1 cross was made in the fall 1981 greenhouse and the F_1 plant grown in the following winter-spring greenhouse Jan.-April 1982. The F_2 generation was grown as a 35 ft row in St. Paul and was harvested by plant. The F_3 generation was grown as 10 ft plant-rows and 10 panicles randomly taken from selected rows. The seed from individual panicles was sown in the 1984 F_4 nursery. Mn 86231 was tested in a multiple-location replicated yield test in 1986 (1 year, in state cultivar trials (8 years) beginning in 1987, and in the Uniform Oat Performance Nursery (3 years) beginning in 1990. Grain yield and quality and lodging resistance were traits of emphasis during the selection phase.

In Minnesota, Milton heads 1.5 days earlier than Troy and is 4.5 inches shorter. Milton has a medium stem which is yellow at maturity and hairless at the upper culm nodes. The leaf margins and sheaths are also hairless. A ligule is present. The panicle is equilateral and mid-broad. The rachis of Milton is erect and the second floret rachilia segment is hairless. The spikelet separates by semiabscission and the florets by heterofracture. The glumes are yellow at maturity. The lemma is yellow and awnless. The seeds are non-florescent and have about 17.0% protein (groat basis). Test weight is medium and groat percent is high. Milton has good field resistance to smut and some resistance to crown rust.

The lot of breeders was constituted in 1991 by bulking about 400 F_{11} rows which were selected for uniformity. Since then there have been only infrequent (less than 1 in 10,000) tall or off-type plants observed and these have been removed before harvest.

PAL

D. Stuthman, J. Stage, S. Simmons and H. Rines

Pal spring oat was released by the Minnesota Agricultural Experiment Station in 1994 solely for companion cropping for alfalfa establishment. It was tested under the experimental designation Mn90202. Its pedigree is Marathon//OT207/Wisc.2687-1/3/Mn83225/5/St39/4/Mn79117/3/OT 207/Froker/Noble.

Wisc. 2787-1 was obtained from Dr. R.A. Forsberg, University. Of Wisconsin-Madison in the summer of either 1974 or 1975. TO 207 is a dwarf mutant of Harmon obtained from Doug Brown, Winnipeg, Manitoba. Mn 83225 is TO 207/Lyon, St 39 is a sativa-sterlils derivative, and Mn 79117 is Noble/Clintland 64.

The initial cross for Pal was made in the greenhouse in 1985, the F_1 plant grown in the spring (Jan.-April) greenhouse in 1986 and the F_2 generation in 35 ft rows in the field in summer 1986. An individual F_2 plant was harvested and six F_3 seeds were planted in the 1986 fall greenhouse, harvested as individual plants, and planted as F_4 hills in summer of 1987. The bulk F_6 was planted as two 10 ft rows in 1988 and multiple location replicated yield testing began in 1990. Bulk F_8 seed was increased in Arizona in winter 1990-91 and that bulk increased in Northern Minnesota in summer 1991. Pal was included in state-wide yield testing in 1992-3-4 and tested for forage yield and quality at two sites in 1993. Shortness, lodging resistance and forage traits were traits of emphasis during the selection phase.

In Minnesota Pal heads 3.5 days earlier than Troy and is 11.5 inches shorter. It has a better lodging resistance score but is 6 lb/bu poorer in test weight. Pal has a thick, coarse stem which is yellow at maturity and hairless at the upper culm nodes. The base of the peduncle is usually only 2-3 cm above the flag leaf sheaf. Leaf margins and sheaths are hairless and a second floret rachilla segment is hairless. The spikelet separates by semiabscission and the awnless. The seeds are non-florescent and have about 20% protein (groat basis). Test weight is poor and graot percent is only average. Pal has good resistance to smut, but is susceptible to crown rust.

The lot of breeders seed was constituted in 1990 by heavily roguing replicated yield trial plots of F7 plants. During the seed increase of summer 1992, 1/2 of a 16-acre field was heavily rogued and the remainder less intensely so. No difference in the frequency of tall off-type were observed in the grow-outs of the two lots in New Zealand. In the 1993-94 greenhouse 932 plants were planted; 78 were marked as off-types gave non-uniform progeny. However, 11 more or a total of 24 of 932 (2.5%) gave off-type progeny in the field. Of the 13 which were off-type in greenhouse and field, four had major chromosomal aberrations. The remaining appeared normal cytologically. We will continue to rogue seed fields.

PALLINUP

R. McLean and A. Tarr

Pallinup was bred by the Dept. of Agriculture, Western Australia, and was released to registered seed growers in 1994. It was tested under the code 81Q:359. Pallinup was selected at the F5 generation from the cross Mortlock/5/M127/Curt//Cortez/4/IORN78.45/3/D.Palestine/Swan// M127/Curt.

Pallinup is an early season, spring grain oat with excellent yield and high grain quality. It will should the current Western Australian milling oat cultivar Mortlock in all recommendation areas. It is a taller oat than Mortlock, with poorer straw strength, and is 6 days earlier flowering than Mortlock. Its grain filling period is slightly longer than Mortlock, reducing the difference between the cultivars at maturity. Pallinup will not replace the higher yielding, but poorer quality semi-dwarf (DW6) oat cultivar Dalyup for on-farm feed.

Pallinup has a yield advantage of up to 24% above Mortlock, depending on recommendation area. Pallinup is well adapted across all rainfall regions, and increases its yield advantage over Mortlock in shorter season conditions. Pallinup and Carrolup are complementary cultivars being best adapted to later and earlier sowing times respectively.

Pallinup is considered to have high potential as a milling oat cultivar. It has hectolitre weight and groat weight similar to Mortlock and Carrolup, better groat percent, and slightly smaller grain.

Pallinup is resistant to Western Australian races of stem and crown rust, is moderately tolerant to barley yellow dwarf virus, and resistant to stem nematode.

PAUL

Michael McMullen, Douglas Doehlert, James D. Miller, and Robert Baumann

Paul is a spring naked oat developed at the North Dakota Agricultural Experiment Station in cooperation with the USDA-ARS and released by the NDAES in 1994. The line that became Paul was designated ND862915 during development and evaluation. It was developed from a cross made in the fall greenhouse season of 1983 with the pedigree CI9221/Hudson//RL3038/Dal/3/RPB120-73/RL3038//Noble/4 /O 2998-22/5/O 22557A6-100-5/3/RL3038/Dal//Noble. The F 2 was grown in the field at Fargo, North Dakota during the summer of 1984 and panicles were selected based on expression of the naked character and resistance to natural infection of stem rust, crown rust, and barley yellow dwarf virus. F 3 plants were advanced in the fall greenhouse season using a modified single-seed descent procedure accompanied by seedling selection for resistance to composites of stem rust and crown rust races. F 4 plants were grown in a nursery near Yuma, AZ during the January-April season. Panicles harvested from F 4 plants produced panicle-rows during the summer of 1985. An F 4:5 line harvested in 1985 as the bulked seed of a single panicle-row was the source of the line that became Paul. The F 6 was evaluated in an unreplicated trial with repeating checks in 1986. Paul has been tested in replicated yield trials since 1987 and has been tested in North Dakota Oat Cultivar Trials since 1990. The line that became Paul was tested in the 1992 Uniform Midseason Oat Performance Nursery and in the Cooperative Naked Oat Trial from 1991 through 1993.

The comparative grain yield (groat basis) of Paul in North Dakota Oat Cultivar Trials during 1990-1993 averaged over 25 location years was higher than Dumont, but not as high as Newdak. Compared to the naked cultivar, Tibor, Paul produced 18% higher naked grain yield, higher test weight, later heading, shorter plant height, similar percent whole oat protein content, and lower lodging scores. Under most conditions, Paul produces more than 95% groats threshed from the lemma and palea.

Paul exhibited excellent resistance to stem rust, crown rust, and barley yellow dwarf virus. Evaluation with critical stem rust races indicate Paul possesses stem rust resistance conferred by Pg-13 and the pg-a complex. The name Paul was chosen to recognize USDA-ARS Plant Pathologist, Paul G. Rothman who identified the pg-a source of stem rust resistance incorporated into the cultivar Paul.

Paul will be protected under the US Plant Cultivar Protection Act.

WHITESTONE

Michael McMullen, Douglas Doehlert, James D. Miller, and Robert Baumann

Whitestone is a spring oat developed at the North Dakota Agricultural Experiment Station (NDAES) in cooperation with the USDA-ARS and released by the NDAES. Whitestone was developed from a cross made in fall of 1984 with the pedigree Porter/4/M23/RL3038//Otana/3/Froker/RL3038//Hudson. The line that became Whitestone was designated ND870258 during development and evaluation. The F 2 was grown in the field in 1985 and panicles were selected based on resistance to natural infection of stem rust and crown rust. The F 3 and F 4 were advanced in the greenhouse using a modified single-seed descent from seedlings resistant to a composite of stem rust and crown rust races. The F 5 lines derived from resistant F 4 seedlings were grown in hill plots in 1986 with selection for stem rust and crown rust resistance. An F 4:5 line harvested in 1986 as the bulked seed of a single hill-plot was the source of the line that became Whitestone. The F 6 was grown in an unreplicated nursery with repeating checks in 1987. This nursery was severely damaged by hail late in the season so that little selection could be done. The F7 was evaluated in 1988 in a nursery similar to the 1987 nursery. Severe drought and heat stress in 1988 limited disease development and production,but allowed selection under conditions of extreme stress. Breeder seed of Whitestone was produced by removing plants atypical of the Whitestone phenotype from an F 10 plot grown in 1991.

Whitestone has been evaluated in the 1992 Uniform Midseason Oat Performance Nursery and in replicated yield trials in North Dakota since 1989. Whitestone produced the highest average grain yield of lines tested in North Dakota Oat Cultivar Trials averaged over 36 location years during the years 1991-1993. In these trials test weight of Whitestone was higher than Dumont, but not as high as Valley. Whitestone has medium size, white kernels that fluoresce when illuminated with ultra violet light. Its heading date is similar to Dumont, height is similar to Valley, percent whole oat protein was slightly lower than Dumont, percent groat was slightly lower than Dumont, and lodging scores were less than Dumont, but were not as low as Valley.

Whitestone possesses crown rust resistance genes Pc-38 and Pc-39 and the stem rust resistance gene Pg-13 . Pg-13 provides resistance to the prevalent races of stem rust. Pc-38 and Pc-39 are not effective in conferring resistance to crown rust virulence observed in North Dakota since 1989. However, moderate resistance expressed by Whitestone was observed to provide a useful level crown rust protection each season since 1990. Whitestone exhibited moderate tolerance to barley yellow dwarf virus (BYDV) when tested in replicated hill plots infested with viruliferous aphids. Whitestone provides North Dakota oat growers a very high yielding, crown rust and stem rust resistant cultivar with moderately high kernel quality.

Whitestone will be protected under the US Plant Cultivar Protection Act.

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