1989

OAT NEWSLETTER

Vol. 40

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May 1990

Sponsored by the National Oat Conference

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VOLUME 40

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Michael S. McMullen, Editor

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NEWSLETTER ANNOUNCEMENTS AND INSTRUCTIONS

Persons interested in oat improvement, production, marketing, or utilization are invited to contribute to the Oat Newsletter. Previous issues may be used as a guide, but remember that the Newsletter is not a formal publication, and therefore that manuscripts suitable or planned for formal publication are not desired.

Specifically, but not exclusively, we would like to have:

1. Notes on acreage, production, varieties, diseases, etc. especially if they represent changing or unusual situations.

2. Information on new or tentative oat cultivars with descriptions. We want to include an adequate cultivar description, including disease reactions and full pedigree if possible.

3. Articles of sufficient interest to be used as feature articles.

4. Descriptions of new equipment and techniques you have found useful.

Material may be submitted at any time during the year. Please send all contributions and correspondence to:

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Please Do Not Cite The Oat Newsletter in Published Bibliographies

Citation of articles or reports in the Newsletter is a cause for concern. The policy of the Newsletter, as laid down by the oat workers themselves, is that this letter is to serve as an informal means of communication and exchange of views and materials between those engaged in oat improvement and utilization. Material that fits a normal journal pattern is not wanted. Each year's call for material emphasizes this point. Oat workers do not want a newsletter that would in any way discourage informality, the expression of opinions, preliminary reports, and so forth.

Certain agencies require approval of material before it is published. Their criteria for approval of material that goes into the Newsletter are indifferent from criteria for published material. Abuse of this informal relationship by secondary citation could well choke off the submission of information. One suggestion that may help: If there is material in the Newsletter that is needed for an article, contact the author. If he is willing, cite him rather than the Newsletter. This can be handled by the phrase "personal communication".

RETIREMENT

LELAND W. BRIGGLE

Leland (Lee) W. Briggle, research geneticist, U.S. Department of Agriculture, Agricultural Research Service, retired November 3, 1989 after 40 years of Federal service. Born and raised in North Dakota, he received his B.S. degree in 1942 at Jamestown College (ND). Following 3 1/2 years of military service in World War II, he taught high school for one year, then obtained a B.S. (Agronomy) degree in 1949, and an M.S. degree in 1951 from North Dakota State University (NDSU), while serving on the staff of the Agronomy Department. After receiving his PhD. degree from Iowa State University in 1954, he joined the Crops Research Division, USDA, at NDSU, Fargo, ND.

Dr. Briggle conducted studies on durum and hard red spring wheat at Fargo until 1955 when he became Eastern Wheat Improvement leader at Beltsville. In 1969 he was named Leader of Oat Investigations for ARS, a position he held until the the Agency's reorganization in 1972. After 3 years at the University of Minnesota, St. Paul, conducting oat research for ARS. Dr. Briggle was reassigned to Beltsville as National Research Program Leader for Cereal Crops (Small Grains) on the National Program Staff. In 1982, he moved to the National Small Grains Collection staff at Beltsville on special assignment until his retirement. During that time, he has overseen the small grains germplasm evaluation program and the relocation of the collection to Aberdeen, ID.

Dr. Briggle has authored or co-authored more than 65 scientific publications, including four book chapters. Besides coordinating and overseeing wheat and oat research and evaluation at the national and regional levels, he was instrumental in releasing the distribution of classes and varieties of wheat surveys of the U.S. which became a standard for knowledge of the varietal shifts throughout the nation. His research contributions have been principally through breeding and genetic studies involved with disease resistance and end-use quality factors in wheat and oats. Perhaps, his main interest has been working with wild related species as donors of useful attributes in improvement of small grain cultivars. He has served on the Plant Variety Protection Board, the Amer. Assoc. of Seed Certifying Agencies Small Grain Variety Review Board, the National Wheat Improvement Committee and numerous other boards and review teams.

Dr. Briggle is a Fellow of ASA, CSSA, and AAAS. He is a member of Sigma Xi, Phi Kappa Phi, Alpha Zeta, and Gamma Sigma Delta.

Oat Crop Advisory Committee

January 23 and 24, 1990

Madison, Wisconsin

The meeting was held on the evening of January 23 and all day January 24. Those present were Bob Forsberg, Dave Peterson, Allan Stoner, Deon Stuthman, Sam Weaver, Darrell Wesenberg, and Greg Shaner (presiding).

1. Miscellaneous business.

   A. Harold Bockelman, curator the the National Small Grains Collection, was added as an ex officio member of the Oat CAC.

   B. Shaner reported that the National Seed Storage Laboratory at Ft. Collins will begin using cryogenic storage for oats and other plant species with seeds as small or smaller than oats. This is necessary because of space, but the director points out that this method of storage works very well and is at least as good as conventional cold storage for most seeds.

2. Review of Oat Evaluation Plan of January 1987

   A. Wesenberg reported on progress of evaluation of oat lines at Aberdeen (see attached report). No routine agronomic evaluations were made at Aberdeen during 1989 because multiplication of lines that were of low inventory was given higher priority. About 11,000 accessions have been evaluated for agronomic characters in the field at either Aberdeen or Maricopa. Panicle evaluations have not been completed on all of these. Wesenberg asked for advice about duplicate data for the same accession, specifically panicle characteristics that were evaluated in the field and then evaluated again in the laboratory on harvested panicles. Examples would be awn frequency and color. He felt that field evaluations were more reliable, and the committee advised that only one data type be entered into the system, and that the choice be left to the evaluator who can judge which is most reliable.

   B. Evaluation of lines for ß-glucan percentage

      Peterson reported that the fluorometric assay is not correlating as well with the slower and more costly enzymatic assay as was hoped. The lab is working now to improve the reliability of the fluorometric procedure. They are also investigating a new enzymatic procedure that is much cheaper ($.05 per sample instead of $1.25). The goal is to process 30 samples per day. Before beginning routine evaluation of the entire collection, a genotype x environment experiment will be conducted. This will involve evaluation of lines grown at 12 different locations, with four replicates per location, and will permit estimation of nongenetic variance for ß-glucan.

      The priorities for ß-glucan evaluation are to first complete the genotype x environment experiment, then evaluate lines in the Uniform Early and Uniform Midseason Nurseries, and finally the *Avena* collection, starting with the most recent accessions.

   C. Protein evaluation

      i. Evaluation of *Avena* collection for total protein: Dave Peterson reported that before doing this, he will complete the experiment on genotype x environment interactions on ß-glucan content.

      ii. Evaluation of the collection for genetic variance for relative amounts of prolamines and globulins: There does not seem to be a compelling reason to evaluate the entire collection for this. There is no economic incentive to produce oats with a particular mix of storage protein. It might be worthwhile to evaluate some lines that represent extremes in total protein concentration.

   D. Crown rust evaluations

      i. Wesenberg reported that about 9,250 accessions of *A. sativa* and another 2,000 accessions of *A. sterilis* have been evaluated for crown rust resistance at Iowa State. This work has been suspended since Marr Simons' retirement.

      ii. Stuthman opined that evaluation of accessions for seedling resistance to specific races of *Puccinia coronata* was not worth the effort, given the magnitude of the task if a reasonable diversity of virulence in the fungus were to be sampled, and the ephemeral protection afforded by such resistance once it is used in cultivars. He recommended the effort be put into evaluation of adult-plant resistance. He suggested that the buckthorn nursery at St. Paul would be an excellent place to conduct these evaluations because of the diversity of pathogen genotypes that exist in this sexual population of the fungus. Evaluation of material in the buckthorn nursery could be an economical and effective alternative to an international rust nursery, reasoning that this one site would contain as much pathogen diversity as might be encountered in several geographical test locations.

E. Yellow dwarf

i. Barley yellow dwarf tolerance evaluation in the *Avena* collection is proceeding at Urbana, IL, under the direction of Anna Hewing and Fred Kolb.

ii. Shaner suggested that systematic evaluation of all *Avena* lines in the NSGC by ELISA would not be a good use of time and money. The symptomatic evaluations already made by Jedlinski and others could be used to select lines with possible resistance, and these could be evaluated by ELISA to determine if they do in fact have tolerance or resistance.

iii. There was discussion about continuation of an international BYD nursery now that Andre Comeau will no longer be doing this. Could Dr. Hewing take responsibility for this?

F. Stem rust

The world oat collection has not been evaluated for resistance to NA27, which is still by far the predominant strain of *Puccinia graminis avenae* in North America. Stuthman suggested that Chapingo, Mexico would be a good test site for adult-plant resistance evaluation. Don Harder of Agriculture Canada is a good source of information about seedling reactions of non *sativa* lines. Forsberg mentioned that line X1588 has good resistance. It is not immune like CI 9221, but has better kernel quality.

G. Septoria (*Stagonospora avenae* and *Septoria tritici f. avenae*)

This has low priority with the committee. At this time the problem does not appear to be nearly as serious as are rusts and BYD.

H. Smut

Stuthman said that smut resistance evaluation is part of Howard Rines' responsibilities. Roy Wilcoxson and Howard are inoculating lines with genetically diverse smut cultures before planting them in the buckthorn nursery for crown rust resistance evaluation, making it possible to evaluate the same plant material for resistance to both crown rust and smut.

I. Status of taxonomic evaluation of the *Avena* collection

i. Wesenberg reported that Harold Bockelman has been checking the accuracy of origin records for accessions in the small grains collection by referring back to the original card indexes. This should correct errors that have crept into the system over the years and will assist in developing a core collection.

ii. Dallas Western spent some time at Aberdeen last summer checking the species identity of the approximately one-third of the *Avena* collection that was designated simply as "*Avena* sp." He examined accessions from CI 1 to CI 6087. Most of these proved to be *Avena sativa*. In many cases, the *sativa* designation may have been left off because at the time of accession it was deemed obvious that the line was common oats. For example, cultivar Ogle was entered as *Avena* sp. Wesenberg thought that Dallas could complete this work during the summer of 1990. The committee expressed appreciation to Dallas for this work, and asked the chairman to write to him in this regard. The committee concurred with Wesenberg that accuracy of origin and species name are critical.

The committee also recommended that *A. byzantina* not be regarded as a species separate from *A. sativa*, but that accessions already in the collection designated *A. byzantina* be left that way. *A. byzantina* can be used for new accessions that have the morphology, growth habit, kernel color and morphology, and origin consistent with this taxon.

Wesenberg reported that Lee Briggle is interested in completing work on characterizing the *Avena fatua* collection. Darrell and Allan Stoner will explore ways this might be handled. (Note -- Dr. Briggle presently plans to spend about two weeks at Aberdeen in April, 1990, with possibly an additional tour later in the summer.)

J. GRIN system

i. As of November 1, 1989 all of the available data for oats, wheat, and barley were keypunched and ready for loading on the GRIN system. Wesenberg was not sure how much of the data have been actually loaded on the system at this time.

ii. Education of oat researchers in use of GRIN. The committee recommended that staff from GRIN set up a demonstration at the American Oat Workers Conference in Jackson Hole this summer. They should perhaps also be asked to present a paper at the conference to introduce everyone to the system, and then those with particular interest could visit the booth for more details. Stoner said he would speak to his staff about this.

3. Review of Oat Germplasm Enhancement Plan of January 1987

   The Oat Germplasm Enhancement Plan of 1983, revised in 1987, was gone over point by point. Since the plan was written, there have been several changes in personnel. The five objectives are still valid, but some changes in work assignments were recommended. Wesenberg will send an electronic version of the report to Shaner, who will incorporate the changes discussed by the committee, and send the revised version to the committee for final review. We also discussed the budget in the original report, suggested revisions, and these will be incorporated in the revised version.

4. Status of Coker oat germplasm

   Sam Weaver reported that Howard Harrison grew as much of his winter oat collection as he could last year, and harvested seed from each line by collecting panicles. These panicles are now in bags, stored in drums sealed with plastic tops and containing insect repellent. The drums are in a warehouse in South Carolina. Thus, the seed is in reasonably good condition but will not retain viability for a long time in this environment. The main collection of Coker's *Avena* germplasm is in cold storage.

   Weaver approached Northrup-King, as a representative of The Quaker Oats Company, with an offer to pay for threshing, bagging, labelling, and shipping this material to the NSGC if Northrup-King would be willing to donate this germplasm to the USDA. As of the time of the Oat CAC meeting, he had not received a reply to this offer. Shaner reported that Paul Fitzgerald spoke to him about this collection and asked the Oat CAC to discuss the desirability of having this germplasm in the NSGC. The committee did so, and urged USDA to negotiate the donation of this germplasm to the NSGC. After the meeting, Shaner sent a letter to Paul Fitzgerald about this. Note -- We now expect most of this material to be shipped to Aberdeen and possibly planted in the spring of 1990.

5. Status of *Avena* lines collected in Turkey

   Forsberg reported species names were assigned to all of the material he had collected, and the seed was sent to Aberdeen. Fourteen accessions of *A. barbata* and 123 accessions of *A. sterilis* are being grown in the greenhouse at Maricopa, and 43 accessions of *A. sativa* are being grown in the greenhouse at Aberdeen. The 133 accessions of *A. fatua* are being held until earlier *A. fatua* collections can be evaluated by Lee Briggle.

   Seed from up to 20 plants per accession, depending on seed availability in the original stocks, will be planted in the field at Aberdeen this spring. Forsberg will help harvest this material in August. At that time decisions on bulking seed will be made, and PI numbers will be assigned.

6. Assignment of PI numbers

   Stoner reported that he is coordinating assignment of PI numbers. There have been some delays and he is trying to improve the situation. In the whole germplasm system there are about 70,000 items that do not yet have a PI number. Stoner's goal is to have everything in the working collections backed up at the NSSL, to have everything in the NSSL in the working collections, and for everything to have a PI number.

7. The core concept in oats

   The committee meeting concluded with a discussion about the core collection idea. Inasmuch as the oat collection is being systematically evaluated for a number of traits, the committee recommends that this work be completed before creating a core collection. Once descriptors are available for the entire collection, species identifications have been made on everything, and accession origin data have been checked, the information will be available to create a core that represents the greatest possible genetic diversity in a group of about 2,000 lines.

REPORT OF NOIC LEGISLATIVE COMMITTEE

Deon D. Stuthman

The Legislative Subcommittee of the National Oat Improvement Committee (now also known as the Legislative Research Committee of the American Oat Association) made its 13th successive annual visit to Washington, D.C. January 30 through February 2, 1990. Members of this year's team included Paul Murphy, North Carolina State University; Herb Ohm, Purdue University; Sam Weaver, The Quaker Oats Company; Pat Henderson, new executive director of the American Oat Association (AOA); and Deon Stuthman, University of Minnesota. Ms. Henderson, with the assistance of Gene Moos, AOA Washington representative, arranged the Congressional visits. Dr. C.F. Murphy arranged the remainder of the group's itinerary including the visits with various USDA people both in Washington and in Beltsville, Md. The group gratefully acknowledges the financial support of the AOA for the legislative research effort.

The primary goal of the AOA continues to be increasing U.S. production of oats by modifying U.S. farm program legislation to reduce the disincentives for oat production and by increasing USDA-ARS oat research to make the crop more productive and more useful. Success in either would ultimately make oats a more attractive crop for producers. As in past years, the focus of our group is increased oat research.

Last year's effort resulted in a $100,000 appropriation of a $200,000 initial request toward a USDA cereal chemist position at Fargo, N. Dak. and a $100,000 appropriation of a $200,000 initial request for oat germplasm enhancement to be coordinated from Aberdeen, Idaho. We also supported the request for construction of additional space at the National Seed Storage Laboratory (see page 7 of last year's ONL for more details).

Our first priority this year is full funding for the cereal chemist position in Fargo followed by a request for additional support for oat germplasm enhancement. We also continue to support the NSSL construction request. Our final request, new this year, is for a USDA-ARS scientist to be located at the Cereal Crop Research Unit at Madison, Wis., to do basic research on beta glucan in both oats and barley. This request is also supported by the American Barley Workers and was addressed during their 1990 annual legislative trip.

We presented our requests to key staff members of the Agriculture Subcommittee of Appropriations in both houses of Congress and to Senate and House Agriculture Committee staff members. Because the NSSL request has been included in the President's budget recommendation, there was general agreement that this request would likely receive favorable consideration. It is too early to know how our specific requests for oat research will fare.

Many of our conversations both with Congressional staff and with USDA administrators included discussion of the new Agricultural Research Initiative. Partial funding of this request with new money has also been included in the President's budget recommendations; the recommendation included some shifting of money within the current USDA budget as well. Hatch funds, an important source of funding for oat research, are proposed to continue at this year's level. In our meeting with Dr. Charles Hess, Assistant Secretary of the USDA and the primary advocate for the Initiative, we learned about the current status of the proposal and the short and long term goals for its funding. One significant component of the Initiative is the plant genome mapping project which will emphasize important economic traits of crop plants. Funds would be allocated on a competitive basis.

The quarterly inventory of oat stocks has been reinstated by the National Agricultural Statistical Services group. This information is critical to the U.S. oat industry. We also learned from NASS administrators that, beginning this year, the oat planting intention survey will ask producers to divide their acreage between grain and non-grain usage. This separation becomes more meaningful as the proportion of the crop which is harvested for grain declines.

The USDA administrators, including the National Program Staff, continue to be supportive of our group efforts to maintain federal oat research within limits of fiscal constraints. The oat community greatly appreciates this support and our group looks forward to continued interaction at this level.

We welcome suggestions for other issues that our group should pursue.

THE RUST OF OATS IN THE UNITED STATES IN 1989

A. P. Roelfs, D. L. Long, D. H. Casper and M. E. Hughes

Cereal Rust Laboratory

Oat stem rust - In late March, 5% stem rust severities were reported in plots from southern Texas to southern Louisiana. In early May rust was severe in southern Texas while only traces were found in north Texas plots on susceptible cultivars. By mid-May overwintering centers of stem rust were found in test plots at Raymond, Mississippi. Many of the cultivars were killed by stem rust. Dry weather restricted stem rust development in the central Great Plains. During the first week in June traces of oat stem rust were found in southeastern Kansas fields. By mid-July stem rust was severe in fields from central Iowa to southeastern Minnesota and south central Wisconsin to southwestern Michigan. Although many fields escaped serious losses some fields were seriously damaged. In the spring oat growing area of western Minnesota and the eastern Dakotas rust was very light and losses were only reported in late maturing fields. In the same area only traces of oat stem rust were found on wild oats (*Avena fatua*).

Race NA-27, virulent on Pg-1, -2, -3, -4, and -8, remains the predominant race in the stem rust population (Table 1). In California, NA-27 was not found while NA-5 and NA-10 were isolated, which follows the pattern of previous years. In the area from Louisiana to Florida NA-16, virulent on Pg-1, -3, -8, was commonly identified. We are receiving insufficient collections from many areas to be sure other races in low frequency are not present. In part this may be due to the limited areas planted to oats.

Oat crown rust - Crown rust was more severe and widespread by early April than it was in the last three years from southern Texas to southern Georgia. In southern Louisiana plots, crown rust killed the susceptible cultivars. By mid-May crown rust was severe in southeastern Arkansas fields while no crown rust was observed in Oklahoma and Kansas.

In Minnesota and Wisconsin 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, however, most of the crown rust inoculum originated from southern sources. In some fields in southern Wisconsin losses to crown rust occurred. Crown rust was light to absent in northern South Dakota, North Dakota and Montana. In western New York and southern West Virginia fields crown rust was more severe than in recent years and significant losses were reported (Table 2).

Rust losses - Acreage harvested and yield production records are based on 1989 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, Plant Protection Programs of the Animal and Plant Health Inspection Service, Agricultural Research Service and the Cereal Rust Laboratory. Losses for 1989 are shown in Table 2. 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 are indicated as a trace when the disease was present but no fields were known to have suffered significant losses. If a few fields suffered measurable losses this is reflected as a percent of the state's production. Zeros indicate the disease was not reported in that state during the season.

Table 1. Races of Puccinia graminis f. sp. avenae identified from oats in 1989.

State	Source of collection	Number of collections	Number of isolates	NA-5	NA-10	NA-12	NA-16	NA-25	NA-27
				Percent of isolates of each race[1]					
AL	Nursery	1	3				33		67
AR	Nursery	1	3						100
CA	Nursery	2	6	50	50				
	Wild Oats	1	3		100				
FL	Wild Oats	1	3				100		
GA	Wild Oats	11	28						100
IA	Field	1	3						100
	Nursery	6	18						100
IN	Nursery	1	3						100
KS	Field	1	3						100
	Nursery	6	18						100
LA	Nursery	14	41						100
MI	Field	3	9						100
MN	Field	32	96						100
	Nursery	12	33				3		97
	Wild Oats	2	6						100
MS	Nursery	3	7				29		71
ND	Field	1	1						100
	Nursery	1	3						100
	Wild Oats	2	6						100
SD	Field	2	6						100
	Nursery	3	9						100
	Wild Oats	1	1						100
TX	Field	1	3				33		67
	Nursery	62	185				1		99
WI	Field	29	87						100
	Nursery	6	18						100
WV	Field	6	16						100
USA	Field	76	224						100
	Nursery	118	347	1	1		1		97
	Wild Oats	18	47		6		6		87
	Total	212	618		1		1		97
CAN	Field	2	4			75			25
	Nursery	3	10					10	90

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

Table 2. Estimated losses in oats due to rust in 1989.

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
Alabama	25	55.0	1,375	Trace	Trace	1.0	13.9
Arkansas	52	73.0	3,796	Trace	Trace	0.5	19.1
California	45	70.0	3,150	1.0	32.1	1.0	32.1
Colorado	55	55.0	3,025	0.0	0.0	0.0	0.0
Georgia	70	59.0	4,130	Trace	Trace	1.0	41.7
Idaho	60	68.0	4,080	0.0	0.0	0.0	0.0
Illinois	200	85.0	17,000	0.5	87.2	2.0	348.7
Indiana	95	72.0	6,840	0.5	34.5	0.5	34.5
Iowa	750	72.0	54,000	Trace	Trace	1.0	545.4
Kansas	200	45.0	9,000	Trace	Trace	Trace	Trace
Kentucky	8	60.0	480	0.0	0.0	Trace	Trace
Michigan	300	67.0	20,100	1.0	205.1	1.0	205.1
Minnesota	850	55.0	46,750	Trace	Trace	Trace	Trace
Missouri	60	60.0	3,600	0.0	0.0	Trace	Trace
Montana	145	46.0	6,670	0.0	0.0	0.0	0.0
Nebraska	240	36.0	8,640	0.0	0.0	Trace	Trace
New York	155	59.0	9,145	0.0	0.0	3.5	331.7
North Carolina	55	57.0	3,135	0.0	0.0	1.0	31.7
North Dakota	650	31.0	20,150	Trace	Trace	Trace	Trace
Ohio	250	63.0	15,750	0.0	0.0	Trace	Trace
Oklahoma	60	34.0	2,040	Trace	Trace	Trace	Trace
Oregon	70	98.0	6,860	0.0	0.0	Trace	Trace
Pennsylvania	255	54.0	13,770	0.0	0.0	Trace	Trace
South Carolina	40	59.0	2,360	0.0	0.0	Trace	Trace
South Dakota	1,100	40.0	44,000	Trace	Trace	Trace	Trace
Texas	200	33.0	6,600	Trace	Trace	Trace	Trace
Utah	17	74.0	1,258	0.0	0.0	0.0	0.0
Virginia	9	55.0	495	0.0	0.0	Trace	Trace
Washington	45	63.0	2,835	0.0	0.0	0.0	0.0
West Virginia	6	50.0	300	1.0	3.0	Trace	Trace
Wisconsin	710	66.0	46,860	1.0	473.3	Trace	Trace
Wyoming	30	47.0	1,410	0.0	0.0	0.0	0.0
Total of above	6,807		369,604		835.2		1,603.9
Average		54.3		0.22		0.43	
U.S. Totals	6,874	54.4	373,778				

VIRULENCE OF OAT CROWN RUST IN THE UNITED STATES IN 1989

J. Y. Chong and K. J. Leonard

Isolates of *Puccinia coronata* were obtained from 72 collections of oat crown rust received at the Cereal Rust Lab. Bulk urediniospore cultures were established on Marvelous oats, and a duplicate set of cultures was sent to the Agriculture Canada Research Lab for virulence testing. Two single pustule isolates were obtained from each bulk culture at the Cereal Rust Lab and five were obtained at the Agriculture Canada Research Lab. Isolates at the Cereal Rust Lab were tested for virulence on a set of differentials including Ukraine (*Pc-3c,4c,6c,9c*), Santa Fe (*Pc-6,7,8,9c,21*), Saia (*Pc-15,16,17*), Alpha (*Pc* genes unknown), Omega (*Pc* genes unknown), as well as single *Pc* gene differentials with *Pc-35*, *-36*, *-38*, *-39*, *-40*, *-45*, *-46*, *-48*, *-50*, *-51*, *-52*, *-54*, *-55*, *-56*, *-57*, *-58*, *-59*, *-60*, *-61*, *-62*, *-,64*, and *-67*. Isolates at the Agriculture Canada Research Lab were tested for virulence on the Canadian set of single *Pc* gene differentials with *Pc-35*, *-38*, *-39*, *-40*, *-45*, *-46*, *-48*, *-50*, *-54*, *-55*, *-56*, ___ *-58*, *-59*, *-60*, *-61*, *-62*, *-63*, *-,64*, *-67*, and *-68*.

Data from the virulence tests at the Cereal Rust Lab and the Agriculture Canada Research Lab were combined for presentation in Fig. 1, which shows the frequency of virulence on each of the differential oat lines tested at either or both locations. Collections from individual states were grouped according to location and similarity of virulence patterns among isolates from different states (Table 1). There appeared to be four distinct populations of *P. coronata* on oats in the United States. Only 14 single pustule isolates from two collections from California were tested, but the lack of virulence among these isolates on Santa Fe as well as several other differentials sets these isolates apart from those from other regions of the United States. Virulence patterns of isolates from the East Coast (North Carolina, West Virginia, Pennsylvania, and New York) were similar to those from the Eastern Gulf Coast (Alabama, Georgia, and Florida), but differed in several respects from those of the Lower Mississippi Valley (Arkansas, Louisiana, and Mississippi). Isolates from Minnesota appeared different from those from the rest of the United States; in particular, genes for virulence corresponding to *Pc-36*, *Pc-38*, and *Pc-39*, which were rare in the other regions, occurred at 50-60% frequency in Minnesota. Isolates from the six collections from Texas tended to resemble the Lower Mississippi Valley isolates, although they shared some characteristics with Minnesota isolates.

Table 1. Distribution of crown rust collections from which isolates were obtained.

Region	State	Number of collections
California	California	2
East Coast	North Carolina	1
	West Virginia	7
	Pennsylvania	5
	New York	3
Eastern Gulf Coast	Alabama	7
	Florida	1
	Georgia	6
Lower Mississippi Valley	Arkansas	1
	Louisiana	11
	Mississippi	5
Texas	Texas	6
Minnesota	Minnesota	16

Among the genes for resistance that we tested, only _Pc-68_ was effective against all isolates of _P. coronata_ collected in 1989. _Pc-52_ was effective everywhere except Minnesota. _Pc-57_ and _Pc-62_ were effective in the East, although a low frequency of virulence to differential lines with these genes occurred in Louisiana or Texas. One of the most notable results of the survey was the identification of high frequencies of isolates from Minnesota virulent on popular oat cultivars with Pc-38 and Pc-39. These genes were still effective in Texas and the lower Mississippi Valley, but their future usefulness in the East seems limited because of the virulence that already exists there.

The crown rust population continues to be extremely diverse. Among the isolates tested at the Agriculture Canada Research Station on the standard Canadian set of differentials, there were 79 different pathogenic races. Total numbers of isolates with combinations of 1, 2, 3, 4, 5, 6, and 7 virulence genes corresponding to resistance genes in this set of 19 differentials were: 31, 40, 23, 28, 26, 33, and 19, respectively.

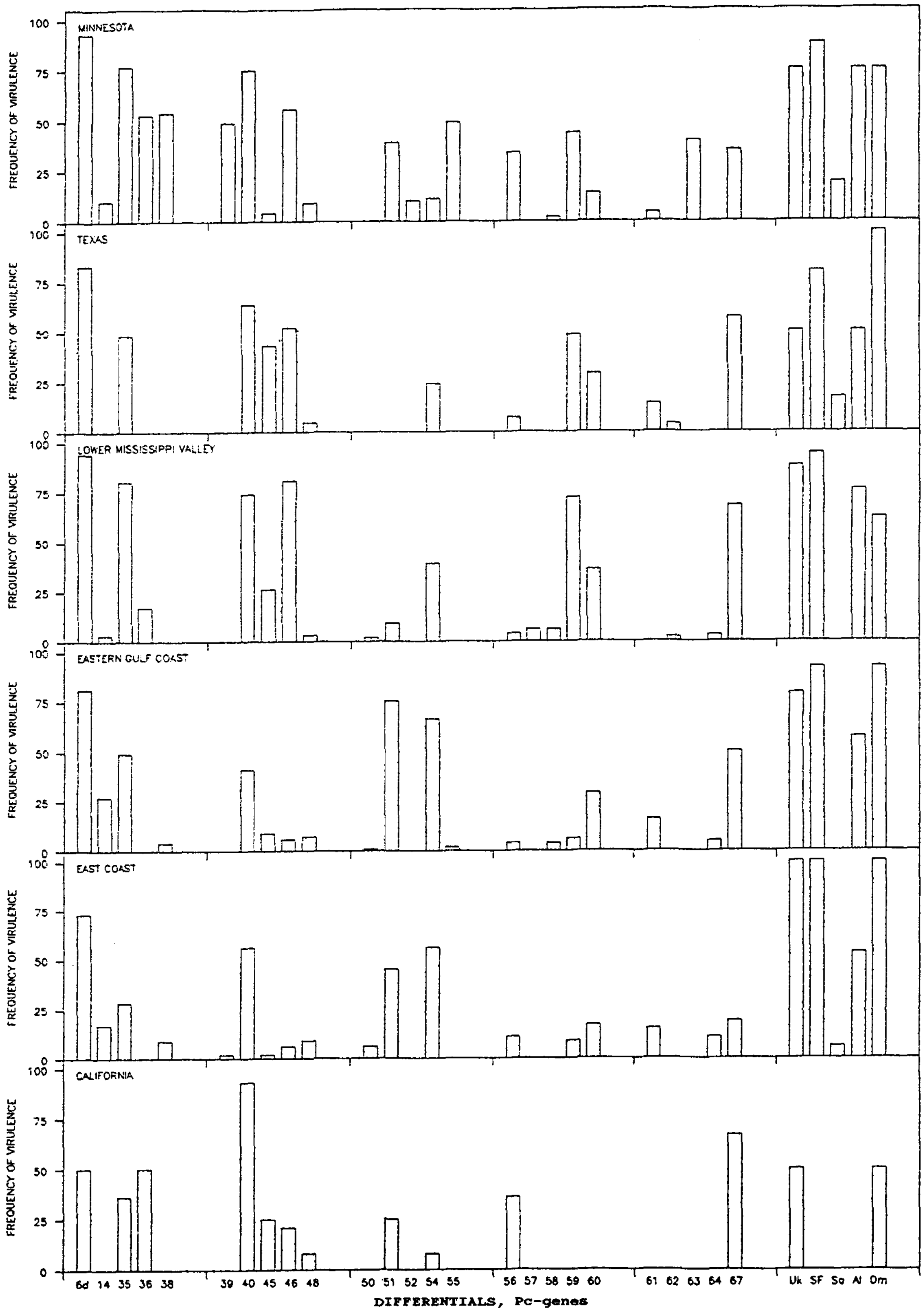

Fig. 1. Virulence of Oat Crown Rust Isolates in the United States in 1989 by Region.

Occurrence and Virulence of Oat Crown Rust in Canada in 1989

J. Chong and D. Galway

Occurrence. Oat crown rust (causal agent Puccinia coronata f. sp. avenae) was first observed in trace amounts on wild oat in Manitoba in the last week of July. The subsequent hot and dry conditions during August restricted the development of the rust. Only trace levels of infection were found on wild oat and on oat in farm fields and rust nurseries in Manitoba in late August. Crown rust was not detected in Saskatchewan in 1989.

In Ontario the incidence of crown rust ranged from moderate in most of the oat growing areas to moderately-heavy in areas where oats and buckthorn occurred in close proximity.

Virulence. From Manitoba, 56 virulence combinations were identified from 162 isolates, 30 of which were detected only once. The most common virulence combinations are shown in Table 1, and the frequency of virulence to individual Pc gene lines is shown in Table 2. Isolates with virulences to gene Pc46 (8.0%) or to both genes Pc35 and Pc46 (16.7%) were the most common (Table 1), but there was an abundance of isolates with virulences to both genes Pc38 and Pc39. The isolates with virulence to Pc38 and Pc39 were first detected (0.01%) in Manitoba in 1987. In 1989, 36 isolates (21.7%) with virulences to lines with genes Pc38 and Pc39 were detected in Manitoba. Many of these isolates were also virulent on Dumont, which carries a third unidentified gene for crown rust resistance. The recent widespread use of oats (cultivars Dumont, Robert, and Riel) with resistance genes Pc38 and Pc39 has caused a major increase in virulence to these genes.

From Ontario and Quebec, 35 virulence combinations were identified from 223 isolates, 16 of these occurred only once. The crown rust population in these provinces is distinct in virulence from the Manitoba population. As in the two previous years, isolates with virulence to Pc39 were the most prevalent (Table 1). Virulence to this gene appears to be strongly associated with virulence to Pc55; all the Pc39 virulent isolates were also virulent to Pc55 (Table 2), including those from previous years. The increased virulence to Pc39 in the eastern population in recent years is likely due to the widespread use of the cultivar Woodstock, which carries Pc39 for crown rust resistance.

Table 1. Distribution of the prevalent virulence combinations of oat crown rust isolates in Canada in 1989.

Virulence combination (ineffective Pc genes)	Percent of isolates	
	Ontario/Quebec	Manitoba
/	9.9	6.2
/35	6.3	2.5
/40	-	2.5
/46	-	8.0
/35,46	-	16.7
/39,55	22.9	-
/46,56	-	2.5
/40,46	-	8.0
/35,39,55	17.9	-
/35,40,46	-	3.1
/39,55,56	14.3	-
/35,39,55,56	7.6	-
/35,40,46,59	-	3.7
/35,40,46,59,60	-	3.7
/35,38,39,40,46,55,63	-	3.1

Pc differentials: Pc35, Pc38, Pc39, Pc40, Pc45, Pc46, Pc48, Pc50, Pc54, Pc55, Pc56, Pc58, Pc59, Pc60, Pc61, Pc62, Pc63, Pc64, Pc67.

Table 2. Frequency of virulence of oat crown rust isolates on differentials containing single genes for crown rust resistance.

Resistance gene line	Ontario/Quebec		Manitoba	
	No.	% virulent	No.	% virulent
Pc35	90	40.4	82	50.6
Pc38	1	0.4	39	24.1
Pc39	177	79.4	36	21.6
Pc40	7	3.1	70	43.2
Pc45	2	0.9	6	3.7
Pc46	9	4.0	102	63.0
Pc48	0	0.0	0	0.0
Pc50	5	2.2	3	1.9
Pc54	8	3.6	5	3.1
Pc55	177	79.4	36	21.6
Pc56	72	32.3	8	4.9
Pc58	0	0.0	1	0.6
Pc59	1	0.4	22	13.6
Pc60	0	0.0	18	11.1
Pc61	0	0.0	0	0.0
Pc62	14	6.3	3	1.9
Pc63	0	0.0	34	21.0
Pc64	15	6.7	12	7.4
Pc67	1	0.4	14	8.6
Total	223		162	

OAT STEM RUST IN CANADA IN 1989

D.E. Harder, Agriculture Canada Research Station, Winnipeg, Manitoba

Oat stem rust did not appear in wild oats or in susceptible nurseries in Manitoba until late July. Very warm and dry weather during most of the growing season limited further spread, and infections on susceptible wild oats or lines in nurseries remained light. All commercial cultivars grown in Manitoba are resistant. No oat stem rust was found in Saskatchewan. Infections in Ontario were light to moderate, and no crop losses were reported.

The races identified in Canada in 1989 are shown in Table 1. Race NA27 continued to predominate in Manitoba, and was also the dominant race in Ontario, supplanting race NA25 as the most common race in this region. Race NA26, notable for its virulence to gene Pg13, has also become a significant portion of the Ontario/Quebec oat stem rust population. Gene Pg13 is the main source of resistance in Canadian oats.

Table 1. Distribution of races of _Puccinia graminis_ f.sp. _avenae_ in Canada in 1989

Race	Avirulence/virulence formula (Pg genes)	Ontario/Quebec No.	Ontario/Quebec Percent	Manitoba No.	Manitoba Percent
NA 9	1,3,8,13,16,a / 2,4,9,15	5	8	0	0
NA 12	1,8,13,16,a / 2,3,4,9,15	1	2	0	0
NA 18	2,4,9,13,16,a / 1,3,8,15	1	2	1	1
NA 20	3,8,13,16,a / 1,2,4,9,15	1	2	0	0
NA 25	8,13,16,a / 1,2,3,4,9,15	15	25	0	0
NA 26	8,16,a / 1,2,3,4,9,13,15	10	17	0	0
NA 27	9,13,15,16,a / 1,2,3,4,8	24	41	93	85
NA 29	9,13,16,a / 1,2,3,4,8,15	0	0	7	6
NA 30	13,16,a / 1,2,3,4,8,9,15	0	0	4	4
NA 32	1,8,16,a / 2,3,4,9,13,15	2	3	0	0
NA 74	1,2,8,13,16,a / 3,4,9,15	0	0	1	1
NA 80	13,15,16,a / 1,2,3,4,8,9	0	0	3	3
Total		59		109	

The University of Sydney
Plant Breeding Institute

Oat Rust Survey 1988-89

J.D. Oates
Plant Breeding Institute, Castle Hill

Mild temperatures and abundant rainfall characterized the cereal belt of Eastern Australia during the autumn and winter months. An economically serious leaf rust epidemic commenced in Queensland and spread down through New South Wales, across Victoria and into the eastern cereal belt of South Australia. The large number of samples from Queensland and New South Wales is a reflection of the increasing importance placed on the oat rust problem by the Queensland Department of Primary Industry and the NSW Department of Agriculture. Also, the program is not attracting enough funds to allow structured surveys into other areas when epidemics occur as in Victoria and South Australia in this past season.

471 samples were received, 23% were identified as being on wild oats species. 53 samples failed to germinate.

Oat Stem Rust (*Puccinia graminis* f.sp. *avenae*).

127 viable stem rust accessions yielded 197 identified isolates. The International races and Local strains recovered during the1988-89 survey are listed in Table 1, which also lists their Virulence Pattern, Frequency and Area form which each was recovered.

Two isolates from N.Z. have a Virulence Pattern of Pg. 4,9,13 a pattern not recognised, as far as I know, in the lists of International Races.

Generally, the range of isolates recovered is consistent with that found in recent years. Only two races virulent on the sand oat cv., Saia, were recovered viz. four isolates of 2 + Sa from eastern Australia and one isolate of 24 + Sa from Western Australia. Race 14 + pg 13 was again found from New Zealand, five other races have been recognised with virulence for pg. 13. Nevertheless, for the first time, five races continue to dominate the Survey (1,2,20,22,24).

Oat Leaf (Crown) Rust (*Puccinia coronata* f.sp. *avenae*)

From 286 viable accessions of leaf rust, 530 viable accessions were identified. The epidemic through eastern Australia was dominated by Race 216; also common were Races 203, 226, 230 and 295. Seven races not previously recognised were recovered (* in Tables 2 and 3), in total 39 races were identified on the International Set of differential varieties (Table 2).

Table 3 lists the Frequency of each race and the area from which each was isolated through the Survey Period, April, 1988 to March, 1989.

By use of the supplemental differential lines Pc 38, 39, 45, 48, 50, 55, 56, Ascencao, TAM301, TAM312, Swan and Mortlock, a further 41 strains of the above races were identified, totalling 285 isolates (54% of all isolates). Line Pc45 was susceptible to 53% and Pc38 to 1% of all isolates. In Table 4, the geographic spread of the virulent isolates on the supplemental differential lines and their frequency is illustrated.

Table 1. Frequency and Distribution of Oat Stem Rust Races Identified During the 1987-88 Australasian Oat Rust Survey.

Race	Virul Pg	Qld	N.NSW	S.NSW	Vic	SA	WA	TAS	NZ	TOTAL
1	-	3	14	4		1	1			23
2	3	2	14	13	2	4	3	1	1	40
2 + Sa	3,Sa		1	1			2			4
4	1,2		2						1	3
5	(3)			1						1
6	1,2,3		1	1						2
8	2,3	3		2						5
11	2		1							1
14 + pg13	4,13								1	1
16	1,4		1							1
18	1,2,4	1	3	1						5
20	1,2,3,4	12	15	8	1		2	2		40
20 + pg13	1,2,3,4,13		1	1						2
22	2,3,4	3	6	7	3	3	11	3		36
24	2,4	5	8	5		2	4			24
24 + Sa	2,4,Sa						1			1
24 + pg13	2,4,13		1							1
76 + pg13	9,13								1	1
89 + pg13	2,3,4,9,13								4	4
Pg4,9,13	4,9,13								2	2
		29	68	44	6	10	24	6	10	197

Table 2. Oat Leaf Rust Races Identified during the 1988-89 Australasian Oat Rust Survey on a standard International Set of Differential Varieties

DIFFERENTIAL VARIETY*

Race	1	2	3	4	5	6	7	8	9	10	No.
201	-	-	S	S	-	-	-	-	-	-	4
202	S	-	S	S	-	-	-	-	-	-	1
203	S	-	S	S	-	-	S	-	-	-	67
211	-	-	S	S	-	-	S	-	-	-	12
216	S	S	S	S	-	-	S	-	-	-	134
226	S	-	S	-	-	-	S	-	-	-	54
227	S	-	S	-	-	-	S	-	-	S	2
228	-	-	-	-	-	-	S	-	-	-	1
230	-	-	S	-	-	-	S	-	-	-	45
231	S	-	-	-	-	-	S	-	-	-	1
237	S	-	S	-	-	-	-	-	-	-	6
238	-	-	S	-	-	-	-	-	-	-	2
247	-	-	S	S	-	-	S	S	S	-	1
259	S	S	S	-	-	-	S	-	-	-	14
260	S	-	S	-	S	-	-	-	-	-	1
264	S	S	S	S	S	S	S	S	S	-	17
272	-	-	S	-	-	-	S	-	-	S	1
274	-	S	S	S	-	-	S	-	-	-	12
276	S	-	S	S	S	S	S	S	S	-	18
278	-	-	S	-	S	S	S	S	S	-	8
279	-	S	S	S	-	-	-	-	-	-	2
283	-	S	S	-	-	-	-	-	-	-	9
286	S	-	S	-	S	S	S	S	S	-	5
290	S	-	S	S	S	S	-	-	-	-	2
294	-	-	S	S	S	S	S	-	-	-	15
295	S	-	S	S	S	S	S	-	-	-	45
309	S	S	S	S	S	S	S	S	-	-	1
326	S	S	S	S	S	S	S	-	-	-	2
332	S	S	S	S	-	-	S	-	-	S	2
359	S	-	S	S	S	S	S	S	-	-	2
384	-	-	S	S	S	S	S	S	S	-	16
413	-	-	S	-	S	-	-	-	-	-	1
416	-	-	S	-	S	S	S	-	-	-	5
422	-	S	S	-	S	S	S	-	-	-	3
427	S	-	S	-	S	S	S	-	-	-	13
458	S	S	S	-	S	S	S	-	-	-	1
459	S	S	S	S	S	-	S	-	-	-	5
											530

* 1 Anthony 2 Victoria 3 Appler
4 Bond 5 Landhafer 6 Santa Fe
7 Ukraine 8 Trispernia 9 Bondvic
10 Saia

Table 3. Frequency and Distribution of Oat Leaf Rust Strains Identified During the 1988-89 Australasian Oat Rust Survey

Race	QLD	N.NSW	S.NSW	VIC	SA	WA	TAS	NZ	CH	TOTAL
201		2						2		4
202								1		1
203	11	26	19	4	4	1	2			67
211	1	6	3			1	1			.12
216	26	66	26	5	6	1	2	3		134
226	2	11	9	8	7	17				54
227			1			1				2
228			1							1
230	2	10	14	4	6	9				45
231		1								1
237	1				1	4				6
238								2		2
247*	1									1
259	1	10	3							14
260		1								1
264	8	5	3	1						17
272			1							1
274	8	1	3							12
276	7	4	7							18
278	1	6		1						8
279	2									2
283	2	6	1							9
286	1	2	2							5
290	1		1							2
294	6	7	1			1				15
295	27	11	5		1	1				45
309*		1								1
326*			2							2
332*		2								2
359	2									2
384	8	8								16
413		1								1
416		2	3							5
422*	1	2								3
427	2	5	3		3					13
458*			1							1
459*	1	2	2							5
	122	197	111	23	28	36	5	8		530

Table 4. Frequency and Distribution of Isolates Virulent on Differential Lines used in the 1988-89 Australasian Oat Rust Survey

Lines	QLD	N.NSW	S.NSW	VIC	SA	WA	TAS	NZ	TOTAL
Pc38			1			1			2
Pc(45)		1			2				3
Pc45	61	99	65	18	12		1	1	257
Pc38,45		1				2			3
Pc45,48		1							1
	61	102	66	18	14	3	1	1	266

Virus Diseases in Oats in Manitoba in 1989

Steve Haber, Agriculture Canada, Winnipeg

As in previous years, in 1989 the most serious economic virus disease problem ln oats in Manitoba was aphid-borne barley yellow dwarf (BYD). Viruliferous aphids were detected in suction traps as early as May 28. Late-season outbreaks of BYD were widespread in Manitoba in 1989, and although there were local incidences of severe losses, the overall losses in oats due to BYD were less than in 1987; in 1988, severe drought over much of the Canadian Prairies obscured the losses specifically attributable to BYD.

Among BYDV isolates obtained in the surveyed areas of Manitoba in 1989, approximately 80% were identified by transmission and serological tests as 'PAV-like' in that they were most efficiently transmitted by the oat bird-cherry aphid but also transmitted by the English grain aphid. The English grain aphid, as in previous years was the most commonly observed vector cereal aphid. For this reason, a virulent PAV-like isolate continues to be used for the purpose of selecting BYD-tolerant lines in disease nurseries.

'Flame Chlorosis' in Oats Observed for First Time in 1989

Flame chlorosis (FC), a new soil-transmitted virus-like disease has recently been described in barley and wheat in Manitoba. The disease is characterized by striking symptoms unique among cereal diseases, a characteristic cytopathology, and a distinct set of double-stranded (ds) RNA species. In 1989, FC was observed for the first time in oats, in a row of the cultivar Riel at Glenlea, Manitoba. Analysis of the cytopathology and the set of dsRNAs isolated from diseased and control healthy seedling tissues confirmed that the oat seedlings with FC symptoms were infected with an agent very similar to the one identified in association with FC of barley or wheat.

New Potyvirus Variant From Oats at Indian Head, Saskatchewan

There was a severe outbreak in 1989 of wheat streak mosaic potyvirus (WSMV) in part of the increase plots of barley and wheat at the Indian Head Research Farm of Agriculture Canada. Adjoining cover crops of the oat cultivar Vicar was also found to be infected with a potyvirus. However, this potyvirus reacted only to antiserum of oat necrotic mottle potyvirus (ONMV) and not to that of WSMV. The potyvirus isolated from the Vicar oats differed from type-ONMV in two important respects: a) type-ONMV has a host range limited to the genus *Avena*, while the 'Indian Head'-ONMV's host range includes wheat and barley; b) the particle size is 15 x 650-700 nm, similar to WSMV, while that of type-ONMV is 11 x 720 nm.

SOIL-BORNE VIRUSES OF OATS

J.A. Kavanagh
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Both oat mosaic virus (OMV) and oat golden stripe virus (OGSV) (syn. oat tubular virus OTV) were found at various locations throughout Ireland in winter oat variety trials of the Department of Agriculture and Food in 1988. Both viruses were found in oat cultivars with severe and mild mosaic symptoms and also in symtomless plants at sites in Co. Waterford in April/May. Both OMV and OGSV can be readily distinguised in leaf and root dip preparations stained with uranyl acetate and using transmission electron microscopy. OMV has flexuous rod-shaped particles, 650-700 x 13 nm and OGSV has straight tubular rod-shaped particles, 150 + 300 x 20 nm.

Most of the cultivars examined were infected by both viruses and in 1989 severe mosaic symptoms were seen in the winter cvs. Aintree and LP86/06, and in the spring cvs. Barra, Brady, Leanda and Major sown in autumn 1988. Mild mosaic symptoms were observed in winter cvs. Cigale, LP86/8, LP86/13, Lustre and Solva and the spring cv. Dula. The cv. Craig had roots infected with OMV but appeared symptomless, and neither OMV nor OGSV were found in the winter oats cv. Image at the trial site in Co. Waterford.

The widespread location of both viruses in Ireland should be a matter of concern to all growers of winter oats, particularly at low lying sites where *Polymyxa graminis*, OMV and/or OGSV, occur and when cold wet winters prevail.

The cooperation of the Department of Agriculture and Food, Dublin is gratefully acknowledged.

OAT ANTHER CULTURE

L. Polsoni and D. E. Falk

The utilization of doubled haploids in oat breeding programs is presently limited by the lack of an efficient anther culture system. Rines at Minnesota has shown that it is possible to produce oat haploids in anther culture, although frequencies were very low. Oat haploids have been produced from crosses with maize pollen but frequencies are also quite low. Efficient haploid plant production via androgenesis through anther culture is the ultimate goal in the Guelph oat anther culture program.

The anther culture process involves the excision of anthers from florets of surface sterilized immature oat panicles. The anthers are then placed on an induction medium which serves to redirect the gametophytic pathway of the microspores to a sporophytic one. Although this process may appear to be a simple one, anther culture of all crop species have been plagued with genetic, physiological and environmental factors which affect the outcome.

The initial strategy included surveying numerous genotypes using established cereal anther culture media. It was found that a modified White's basal medium with maltose and soluble starch supported some level of embryogenesis for all genotypes tested.

From this starting point, other aspects of the system could be refined. It has been determined that 30 °C is an appropriate incubation temperature for induction. Anthers incubated at 25 °C did not appear to respond. A full range of temperatures has not yet been tested to date. The medium was further modified by the elimination of all exogenous hormones and the addition of nitrogen in the form of l-glutamine and ammonium nitrate. The structures which resulted from cultures on this newly modified medium resembled proper globular embryos and not callus. Many structures were well differentiated and closely resembled zygotic embryos.

Liquid NLN in which the sucrose was replaced with maltose has been found to support the induction and further development of embryo-like structures. Microspore shedding into the liquid medium allowed for observation of the early stages of embryogenesis. Once shed into the medium, the microspores equilibrate for several days, then develop trans-vacuolar strands of cytoplasm which appear to channel the cellular components into the centre of the cell in preparation for division. The vacuole is no longer prominent. Cell divisions eventually lead to the bursting of the exine and the establishment of a globular embryo. Files of cells are readily laid down in an organized fashion. When the pro-embryo attains a certain size, it will either establish polarity or begin to de-differentiate. Although large numbers of well developed embryos have been produced to date, it has not been possible to regenerate plants from them. Further system refinements and regeneration studies are in progress.

LOCATION OF GENES CONDITIONING COLD TOLERANCE?

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The north American variety Kentucky has proved to be one of the most cold tolerant accessions for the winter conditions prevalent in the UK, but yields are low in comparison with UK bred material. In order to establish which chromosome(s) carries the gene(s) conditioning the expression of cold tolerance, Kentucky was crossed to the monosomic series (I - XVIII) of spring oats (var. Sun II).

The F_2 generation of these crosses were subjected to freezing temperatures of -8° to -10°C in an ethylene glycol freezing tank, and then grown on in the glasshouse. Preliminary data suggests that two of the monosomic x Kentucky hybrid lines survive low temperatures at a higher frequency than the remainder, indicating that these two monosomic lines contain a gene(s) which enhances the cold tolerance of winter susceptible hybrid plants. Interestingly, the two chromosome lines are thought to be homoeologous chromosomes. Limited field trials are underway at present and further testing should confirm the preliminary results.

If these two chromosomes from Kentucky can be substituted into high yielding cold susceptible UK varieties with no agronomically detrimental background effects, then we should be able to improve the cold tolerance of those varieties very quickly.

PERFORMANCE OF HEXAPLOID AVENA PILOSA X A. SATIVA BACKCROSS LINES

H.-D. Hoppe and M. Kummer

Induction and increase of genetic variability is a basic requirement for crop plant improvement. Crosses were initiated between *Avena pilosa* M. Bieb., CAV 0128 (2n = 14) and *A. sativa* L. cv. Solidor (2n = 42) in order to transfer resistance to powdery mildew from the wild into cultivated oats (cf. 1987 OAT NEWSLETTER, 38, 16-17). Lines were developed using cv. Solidor as the recurrent parent in continuous backcrossing. The pedigree breeding applied resulted in hexaploid progenies during BC2F3 to BC2F5. Solidor and the resistant cultivar Mostyn, used as controls, were compared with BC2 derivatives at two locations in 1988 (BC2F6) and at three locations in 1989 (BC2F7). The experimental design was a randomized block with four replications at each location. The harvested plot area was 5 m^2 in 1988 and on an average 12 m^2 in 1989. Based on ten characteristics the agronomic performance and grain quality were analyzed (Table 1).

All hybrid derivatives showed a high level of adult plant resistance to powdery mildew under field conditions, which correspond with results after artificial infection in greenhouses. The grain yield of only two lines was significantly less than Solidor. The grain yield of APR 122 was equal to Solidor while simultaneously producing a hull percentage significantly lower and a grain protein concentration significantly higher. Other lines also differed from Solidor in grain quality traits. Five lines (APR 162, 166, 167, 171 and 211) were significantly higher in grain protein concentration than the recurrent parent. In the first four of these lines the high grain protein concentration was combined with a high thousand kernel weight.

These results demonstrate that two backcrosses were sufficient to eliminate most of the undesirable attributes of the resistant wild oat. In comparison with the recurrent parent some of the traits were transgressively expressed, including resistance to powdery mildew, thousand kernel weight and grain protein percentage. Thus, evidence is given that useful genes from the diploid species *A. pilosa* can be introgressed into *A. sativa* via common crossing/backcrossing procedures, starting with an octoploid *pilosa/sativa*-*amphidiploid*.

References

Kummer, M. 1984. Neue Resistenzquellen bei Echtem Mehltau fur die Zuchtung des Saathafers. Tag.-Ber., Akad. Landw.-wiss. DDR, Berlin, 225, 191-199.

Kummer, M.; H.-D. Hoppe, J.-Chr. SCHMIDT, J. Sebesta. 1988. Avena pilosa M. Bleb. - A source for mildew resistance useful in oat breeding. 1987 Oat Newsletter, 38, 16-17.

Table 1. Performance of Avena pilosa x A. sativa backcross lines (1988, 1989, two-year average)

Trait / Genotype	Heading[1] 1988	Heading[1] 1989	Lodging[2] 9-1	Plant height cm	Resistance to mildew[2] 9-1	Grain yield kg/ha	1000 kernel weight g	Hull percentage %	Grain protein percentage %	Groat yield kg/ha	Grain protein yield kg/ha
Solidor	16	10	7.4	86.0	4.8	2828	33.46	28.73	13.02	2020	371
Mostyn	18	13	8.0	82.0	8.2	2359	31.79	29.25	14.07	1672	332
APR 2	18	11	7.9	82.0	8.2	2720	30.41	30.63	13.52	1895	372
7	17	12	7.9	81.0	8.2	2578	30.54	29.74	13.23	1824	339
23	17	11	8.0	82.0	8.1	2675	31.94	28.98	13.05	1911	349
122	13	9	7.5	92.0	8.2	2842	29.55	25.69	13.75	2121	381
162	14	9	6.9	91.0	8.2	2702	36.36	28.37	14.14	1947	377
166	14	9	6.8	90.0	8.2	2700	36.66	28.68	14.03	1944	368
167	14	10	7.1	88.0	8.2	2435	37.55	29.80	14.22	1718	347
171	15	10	7.2	88.0	8.0	2452	36.60	32.17	14.01	1676	342
211	13	10	7.1	85.0	8.2	2674	35.00	29.22	14.16	1907	380
LSD (0.05)				3.58		318	2.46	2.38	0.61	237	42

[1] 1 = June 1st
[2] 9 = no lodging: highly resistant

EFFECT OF *AVENA SATIVA* GENOTYPE JHO-801 ON THE FERTILITY AND CHROMOSOMAL STABILITY IN AMPHIPLOID *A. SATIVA* X *A. MAROCCANA*

S. N. Zadoo, R. N. Choubey and S. K. Gupta

Out of three experimental varieties of *Avena sativa* (2n = 6x = 42) viz. OS-6, UPO-94 and JHO-801, selected as female parents for crossing with *A. maroccana* (2n = 4x = 28), the pentaploid F_1 hybrid (2n = 5x = 35) involving *A. sativa* JHO-801, as one of the parents showed the highest frequency of bivalents. The average chromosomal associations in this pentaploid hybrid were 1.4 IV + 0.7 III + 11.3 II + 4.6 I. The low frequency of univalents and high bivalent frequency in the pentaploid hybrid favors gene transfer from *A. maroccana* to *A. sativa*.

Amphiploids (2n = 10x = 70) produced from sterile pentaploid hybrids involving different genotypes, i.e. OS-6, UPO-94 and JHO-801, as expected showed restoration of fertility. *A. sativa* (AACCDD) and *A. maroccana* (AACC) have two genomes in common and hence in the amphiploid (AAAA CCCC DD) the genomes A and C occur in a tetrasomic condition. The high frequency of bivalents observed in the amphiploid indicated only restricted pairing between A and C genomes of the two parental species. Chromosomal stickiness was, however, noted in amphiploids involving *A. sativa* OS-6 as one of the parents. A few multivalent associations like hexavalents in an otherwise predominantly bivalent pairing amphiploid may result in some interspecific gene recombination at the decaploid level.

Amphiploids involving three different genotypes of *A. sativa* showed differential fertility. The amphiploids involving JHO-801 had more than 50 percent seed set while those involving UPO-94 and OS-6 had about 40 percent and less than 1.0 percent, respectively. The role of the *Avena sativa* genotype was also evident in chromosomal stability. The cytological analysis of the C_5 generation revealed that 73.68 percent of plants involving JHO-801, 70.00 percent of plants involving UPO-94 and only 25.0 percent plants involving OS-6 as one of the parents had a euploid chromosomal constitution of 2n = 10x = 70. The differences in chromosomal stability appear to be directly correlated with the cytological behavior of the pentaploid F_1 progenitors.

NAKED OATS - THE FIRST COMMERCIAL CROPS IN THE UK

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Welsh Plant Breeding Station

The 1980's saw the development of two naked oat varieties bred at WPBS. The first was the spring cultivar, Rhiannon, added to the UK National List in 1984, the second was the winter oat cultivar, Kynon, added to the UK National List in 1986. Initial marketing of these varieties was prevented by the failure of some seed crops to meet official minimum germination standards. This is more a legal rather than an agronomic constraint as it is easy and economically worthwhile to compensate for differences in germination by increasing seed rate. In 1988, a case to the European Commission Standing Committee for the standard to be changed from 85 to 75% was accepted.

As a result, naked oats have been commercialised in high priced specialised markets in the UK. Over 4000 t of naked oats were grown on contract in 1989 on behalf of the Superioat Company, a joint company set up by John Bryants (Romsey) Ltd and George Billingham & Sons Ltd. Grain was purchased at a £25-£30/t premium over barley, which together with lower variable costs makes the crop competitive with ordinary oats, feed barley and second or third wheat crops. For most applications, naked oats are stabilised by heating and flaked.

Feeding trials have shown that naked oats confer a large improvement in racehorse performance, with minimal weight loss after racing, compared to the best Canadian clipped oats. Several race winners have been obtained, and this market should expand.

Naked oats have also been sold for malting for use in food products. This involves germinating and kilning the grain to produce a product of distinctive flavour for use in bread, biscuits, confectionery and breakfast cereals. It is not a viable process with husked oats because mechanical separation of the husk from the groat damages the embryo and activates enzymes causing hydrolytic rancidity.

A significant tonnage has also been successfully used for muesli and oat bran extraction for a variety of new 'health' products.

Other potentially large markets are being investigated by Superioats. Their estimated production for 1990 is 10,000 tonnes with a production of 50,000 tonnes projected for 1991.

A new naked winter oat (79-77Cn9/2/1/1) with improved yield, oil content and agronomic characteristics has been entered into National List trials.

On the negative side, hairs (trichomes) on the naked oat groat have proved irritant and ways are being examined of overcoming the problem, either by efficient methods of exhausting air and dust during processing, or by genetically reducing the number of hairs on the groat.

FERMENTATION OF GROUND OATS AND OAT FLOUR TO ALCOHOL AND RECOVERY OF PROTEIN-RICH AND DIETARY FIBER-RICH PRODUCTS FROM STILLAGE

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Starch from ground whole oats and oat flour was converted to glucose by alpha amylase and glucoamylase, and the glucose was fermented to alcohol in good yield by yeast. After alcohol was distilled, the protein-rich residue (stillage) was separated by screening and centrifugation into distillers' grains, centrifuged solids, and stillage solubles. Oat distillers' grains and centrifuged solids had crude protein contents (nitrogen x 5.83, dry basis) of 19 and 44%, respectively, and contained 67 and 5% of the total nitrogen of oats (distillers' grains and centrifuged solids accounted for 40.4 and 1.4% of oats, respectively). Oat flour distillers' grains and centrifuged solids had 43 and 48% protein, respectively, and accounted for 13 and 58% of the total nitrogen of oat flour (distillers' grains and centrifuged solids were 4.1 and 17.1% of oat flour, respectively). The dietary fiber contents of ground whole oats, oat distillers' grains, oat centrifuged solids, oat flour, oat flour distillers' grains, oat flour centrifuged solids were 26, 57, 20, 4, 18, and 18%, respectively.

For each kg of alcohol produced, 7 L of oat stillage solubles or 5.4 L of oat flour stillage solubles are created. Ultrafiltration combined with reverse osmosis appears practical and economical to process stillage solubles from oats or oat flour. A large volume of dilute solution can yield a small volume of concentrate and a large volume of permeate that can be reused as water.

Distillers' grains and centrifuged solids from oats and oat flour have good quality protein and moderate to high protein and dietary fiber contents, and may provide valuable food-grade products.

CEREAL CROPS RESEARCH UNIT
USDA, AGRICULTURAL RESEARCH SERVICE

David M. Peterson, Cynthia A. Henson, Ronald W. Skadsen
and Keith D. Gilchrist

After preliminary experiments to determine the most efficient method for β-glucan analysis that provides acceptable precision and accuracy, we are now analyzing an experiment to determine genotype X environment interaction for β-glucan in oat groats. Twelve cultivars were grown in replicated randomized complete blocks in 11 locations from New York to Idaho. The data should be complete before the American Oat Workers Conference in August 1990. Then we will commence screening samples from the National Small Grains Collection for β-glucan concentration. This data should be useful to oat breeders who may wish to transfer a high β-glucan trait into adapted cultivars. Protein and oil will also be determined on these samples by NIR reflectance, and all data will be contributed to the GRIN data base.

Dr. James Koch is a postdoctoral research associate working on the mechanism of synthesis of β-glucan in oat. He began his studies in October 1989, and plans to remain for up to 2 years. An objective of his research will be to identify, isolate and purify enzymes responsible for β-glucan synthesis. So far, Dr. Koch has optimized a β-glucan assay using a specific β-glucanase purified from a commercial source. This makes the enzymatic assay for β-glucans considerably cheaper than with use of commercial kits. He has characterized the accumulation of β-glucan in developing endosperm and germinating shoots. The latter is being investigated for its suitability as a model system, because etiolated shoots are much easier to obtain and work with than developing endosperm.

EVALUATION OF IMPROVED OAT STRAINS FOR FORAGE ATTRIBUTES

R. N. Choubey

Development of improved forage oat strains suitable for multicuts is becoming essential for regular and uniform distribution of forage over a period of time. The present study reports the performance of newly developed strains from different intraspecific cross combinations with respect to certain important attributes in a preliminary trial conducted at the Indian Grassland and Fodder Research Institute, Jhansi (India).

During the winter 1988-89, thirty-six new strains along with the check varieties 'JHO-861' and 'JHO-891' were evaluated for plant height, tiller number per meter row length, and green forage yield. The trial was conducted in a randomized complete block design with two replications. The plots consisted of 5 rows 3 meters long with a 30 cm row spacing. The data for forage yield were recorded for four cutting regimes, while observations on plant height and tiller number were taken from all except the initial cut.

The study indicated that the varietal differences were significant for all the attributes except forage yield at the second and fourth cutting (Table 1). Forage yield ranged from 5.67 to 21.73, 8.33 to 19.33, 10.07 to 22.00, and 9.87 to 19.60 t/ha in the first, second, third and fourth cut, respectively. The total yield pooled over the cuts varied from 43.66 to 73.06 t/ha. In the initial cut, the highest forage yield (21.73 t/ha) was obtained from (OS-7/IG-320)-86-3 followed by (OS-7/IG-320)-67-8 with 19.33 t/ha. The maximum yield in the second, third and fourth cuts were produced by (OS-7/IG-320)-113-9, (OS-7/IG-320)-4-1, and (IG-320/JHO-810)-4, respectively. The highest pooled forage yield over the cuts (73.06 t/ha) was produced by (OS-7/IG-320-57-5) followed by the strains from same cross combination, i.e. (OS-7/IG-320)-4-2-2 and (OS-7/IG-320)-183-11 with 68.67 t/ha and 64.93 t/ha, respectively (Table 1). Performance of the strains with respect to forage yield reveals that the cross combination (OS-7/IG-320) appears to be most potent in throwing highly productive genotypes suitable for forage harvest under a multicut system. The performance of these strains after the initial cut with respect to plant height and tillering ability also indicates their high regeneration ability desired for multicuts.

Mean performance of genotypes for plant height ranged from 70.7 to 97.4, 80.5 to 98.7, and 75.5 to 106.4 cm in the second, third and last cut, respectively. The tiller pnumber ranged from 117.5 to 317.5, 105.0 to 303.0 and 101.5 to 258.5 in second, third and fourth cut, respectively. The top performing strains were also found to combine longer plant stature indicating the close association of forage yield with plant height.

The results of the present study reveal that certain cross combinations were found to possess high nicking ability and were superior in generating lines with high forage yielding ability under repeated cutting management systems. These genotypes identified as superior for forage attributes will now be tested in a national varietal trial over locations and years.

Table 1. Mean performance of different oat strains for forage attributes.

Sl		Green forage yield (t/ha)					Plant height (cm)			Tiller no/m row length		
		First	Second	Third	Fourth		Second	Third	Fourth	Second	Third	Fourth
No.	Pedigree	cut	cut	cut	cut	Total	cut	cut	cut	cut	cut	cut
1	(IG-320/JHO-810)-4	5.67	10.27	14.87	19.60	50.41	95.4	90.3	95.5	117.5	105.0	101.5
2	(UPO-94/OS-7)-17-1	6.33	14.67	16.33	15.20	52.53	97.4	97.4	106.4	126.5	119.5	113.0
3	(UPO-94/OS-7)-14-1	9.40	18.87	16.80	12.73	57.80	93.7	93.7	97.2	188.5	170.0	170.0
4	(OS-6/IG-320)-18	13.87	12.60	17.53	13.33	57.33	75.2	83.0	88.5	267.6	238.0	163.5
5	(OS-6/IG-320)-5	16.53	10.07	13.33	11.53	51.46	70.7	81.4	89.2	293.5	202.0	191.5
6	(OS-6/JHO-811)-3	15.87	11.60	18.00	11.20	65.67	83.2	98.7	91.0	212.0	200.5	186.5
7	(OS-7/IG-320)-35-5	14.87	10.07	15.67	11.53	52.14	77.2	82.5	87.2	282.5	261.0	227.5
8	(OS-7/Flemingold)-2-7	10.00	11.13	15.33	13.40	49.86	79.4	89.7	92.0	194.5	186.0	187.5
9	(OS-7/IG-320)-86-15	9.20	16.07	15.00	15.33	56.60	80.5	91.3	88.9	161.0	160.0	159.0
10	" -35-8	13.67	13.47	14.87	14.67	56.68	86.2	89.9	92.5	275.0	246.5	244.0
11	" -204-8	13.20	13.80	14.33	14.00	55.33	82.2	88.0	91.2	236.0	220.5	210.5
12	" -113-7	12.33	15.00	15.00	18.00	60.33	83.5	85.5	87.2	285.0	248.0	238.5
13	" -1-1-6	12.53	11.80	13.00	14.33	51.66	81.7	88.5	95.5	277.5	233.5	192.5
14	(OS-15/IG-1310)-2-3-8	16.40	9.20	20.73	13.40	59.73	81.4	95.9	97.2	242.5	218.5	207.5
15	(OS-7/IG-320)-86-4	18.20	9.07	15.00	11.67	53.94	77.1	90.2	75.5	242.5	225.0	199.5
16	" -1-1-10	11.67	13.87	17.20	15.33	58.70	85.3	92.7	89.8	236.5	228.0	198.0
17	" -67-8	19.33	12.27	16.00	15.87	53.47	87.7	95.9	97.7	252.5	250.0	225.0
18	" -67-31	17.00	10.80	18.33	11.87	58.00	85.7	93.9	89.3	270.0	245.0	235.0
19	" -1-2-5	17.53	12.93	17.00	15.33	62.79	86.7	88.8	99.0	228.0	211.5	187.5
20	" -1-1-2	15.00	14.93	15.87	14.33	60.13	86.0	92.7	97.9	234.0	223.0	201.5
21	" -4-2-2	16.73	15.40	19.87	16.67	68.67	93.2	93.9	93.4	217.0	209.0	188.0
22	" -129-1	13.00	14.53	17.67	14.20	59.40	84.7	91.7	92.5	210.5	207.0	158.5
23	" -156-7	17.20	10.27	15.53	12.33	55.33	74.7	93.7	86.2	244.5	237.0	210.0
24	" -57-7	16.87	10.40	15.58	10.67	53.47	88.2	88.9	86.8	289.5	278.5	211.5
25	" -86-1	18.87	9.60	15.53	11.67	55.67	78.0	94.1	89.9	283.0	275.0	223.5
26	" -35-9	15.80	10.93	15.53	10.67	52.93	83.2	98.5	86.0	233.5	205.0	203.0
27	" -86-3	21.73	11.80	18.87	12.00	64.40	79.0	91.1	82.7	298.5	286.5	227.5
28	" -4-1	12.33	11.73	22.00	15.00	61.06	82.5	96.4	93.9	289.0	280.0	250.0
29	" -57-5	17.33	17.33	19.20	19.20	73.06	91.2	90.0	103.4	272.0	246.5	220.0
30	" -67-4	13.33	8.73	11.73	9.87	43.66	86.3	91.6	91.9	267.5	245.5	196.5
31	" -86-13	14.00	14.93	14.53	14.67	58.13	83.9	89.4	93.2	233.0	225.5	206.5
32	" -4-1-5	15.87	12.47	16.33	13.33	58.00	88.5	98.0	98.9	218.0	201.0	184.5
33	" -113-9	10.00	19.33	14.00	18.20	61.53	93.8	90.4	99.3	274.5	258.5	255.0
34	" -113-19	11.67	15.13	16.87	16.20	59.87	91.5	92.0	98.7	278.0	268.5	250.5
35	" -4-1-8	16.73	10.67	21.20	10.87	59.47	87.5	95.0	93.9	271.5	221.5	148.0
36	(OS-7/IG-320)-183-11	14.53	17.00	17.00	16.40	64.93	82.2	91.2	92.2	317.5	303.0	258.5
37	JHO-861 (Check)	7.07	17.47	16.07	17.40	58.01	76.8	80.5	89.1	227.5	205.0	199.0
38	JHO-891 (Check)	9.67	15.27	10.07	15.00	50.01	80.9	81.5	86.5	166.5	156.0	149.0
CD 5%		5.73	-	3.07	-	8.63	9.35	5.85	10.12	32.86	33.78	30.55

EFFECT OF GRADED LEVELS OF NITROGEN ON THE FORAGE YIELD OF DIFFERENT WINTER CEREALS

M. H. Shah and K. N. Singh

The state of Jannu and Kashmir has a net sown area of 0.729 million hectares out of the total cropped area of 0.101 million hectares or 44% of the net sown area with a cropping intensity of 138.5%. The area under paddy in the temperate zone, one of the four Agro-ecological zones is 0.164 million hectares. This area mostly remains monocropped which is evident from the cropping intensity of 111%, although the irrigation intensity is 56.7%.

With the depletion in forage resources due to increasing livestock populations (7 million) and continued misuse of pastures (0.3 million hectares), farmers have taken to fodder cultivation in pieces and bits, although the impact is negligible because of small and fragmented holdings.

Farmers grow various crops for forage production depending upon seed availability without realizing their true forage production potential. Farmers in remote areas are growing wheat, barley and even triticale as forage crops without realizing that oat can easily outyield these crops, besides being more succulent, palatable and nutritious.

Therefore, the present study was undertaken at Shalimar experimental station, Sher-e-Kashmir University of Agricultural Sciences and Technology with the objectives to demonstrate the forage production potential of oats compared to other winter cereals and to determine their response to graded levels of nitrogen. The experiment was laid out in a randomized block design with four replications. The treatments were four winter cereals (wheat, barley, triticale and oat) and four levels of nitrogen (0, 40, 80 and 120 kg ha^{-1}). The nitrogen was applied in three equal splits to all the winter cereals (1/2 basal + 1/4 at 20 and 40 days) each from the onset of the spring season (March). Forty kg P_2O_5 and 20 kg K_2O ha^{-1} was applied as basal along with the basal application of nitrogen. The crops were sown in rows with an inter row spacing of 30 cm. Seeds were sown on 25 October at a uniform seeding rate of 200 kg ha^{-1}. All cereals were harvested at the heading stage.

Oats ('Kent') significantly outyielded all the winter cereals both on fresh and dry matter basis (Table 1). Oats recorded 445.8 and 467.8 dt ha^{-1} (Fresh forage yield) and 121.3 and 90.4 dt ha^{-1} (Dry matter yield) during 1987-88 and 1988-89, respectively. Oats ranked first followed by barley, triticale and wheat both on a fresh and dry matter basis during the two years of experimentation. The mean yield of oats was greater (9.9, 20.4 and 34.5%) and (17.0, 46.4 and 73.6%) on fresh and dry matter basis relative to barley, triticale and wheat, respectively. The higher forage yield of oats compared to other winter cereals may be attributed to its vigor, leaf area, profuse tillering and height.

Fresh and dry matter yield was significantly affected by the graded levels of nitrogen and response was observed up to 120 kg N ha^{-1}. Increasing levels of nitrogen increased the fresh and dry matter yield gradually and consistently. The highest mean yield recorded was 505.1 and 101.9 dt ha^{-1} on fresh and dry matter basis, respectively, with 120 kg N ha^{-1} applied which produced an increase of 93.9, 34.2 and 12.3% (fresh) and 81.6, 28.9 and 10.0% (dry matter) over 0, 40 and 80 kg N ha^{-1}, respectively.

The higher biomass production through the application of nitrogen may be attributed to the improved growth attributing characters viz., plant height, leaf and tiller number, leaf area and greater physiological activity. These finds support those of Shah, 1988, Lal and Bajpai, 1974.

Table 1. Green and dry matter yield of different winter cereals as affected by varying nitrogen levels (dt ha^{-1}).

Treatment	Green fodder yield 1987-88	Green fodder yield 1988-89	Mean yield	Dry matter yield 1987-88	Dry matter yield 1988-89	Mean yield
CROPS						
Wheat	332.3	346.7	339.5	54.2	67.7	61.0
Triticale	368.7	389.9	379.3	69.2	75.3	72.3
Barley	402.0	428.7	415.4	94.4	86.6	90.5
Oat	445.8	467.8	456.8	121.3	90.4	105.9
SEm±	10.4	8.9	-	1.7	1.3	-
CD (0.05)	30.0	25.9	-	5.1	3.9	-
NITROGEN LEVELS (Kg ha^{-1})						
0	256.2	264.6	260.4	56.4	55.8	56.1
40	367.7	384.5	376.1	79.5	78.4	79.0
80	437.5	461.4	449.5	95.2	90.0	92.6
120	487.5	522.6	505.1	108.0	95.8	101.9
SEm±	10.4	8.9	-	1.7	1.3	-
CD (0.05)	30.0	25.9	-	5.1	3.9	-

CHEMICAL COMPOSITION OF OATS AND SUBABOL UNDER DIFFERENT SPACING

Bhagwan Das and R. S. Dhukia

Oat is the only cereal fodder available during winter which is utilized for feeding animals, often in combination with forage legumes like berseem or lucerne. Recently subabool (Leucaena leucocephala) has been introduced in this area to overcome the deficiency in production of forage for livestock. Growing oats in combination with subabool appeared to be a good intercropping system with the objective of obtaining higher fodder yield along with high quality of fodder. Thus the present experiment was undertaken.

The experiment consisted of three varieties of subabool (Hawaiian Giant, Peru, and Cumminghum), three row spacings (90, 180 and 270 cm) and three intra row spacings (15, 30 and 45 cm) laid out in split plot design with three replications. After initial establishment of subabool, oat variety OS-7 was planted between rows of subabool at a distance of 30 cm. The samples from different treatments were taken at the appropriate stage and analyzed for protein and in vitro dry matter digestibility.

Cunninghum gave the highest protein percentage as well as digestibility (Table 1). The 90 cm row spacing gave the highest crude protein and in vitro dry matter digestibility whereas not much variation was seen in case of intra row spacing.

Crude protein and digestible dry matter yields were highest in Hawaiian Giant and also highest in combination with oats.

The narrow row spacing (90 cm) produced better results than wider row spacings of 180 or 270 cm in case of subabool but a reverse trend was observed in oats. However, crude protein and digestible dry matter yields from subabool and oats were highest in the narrow row spacing of 90 cm.

An intra row spacing of 15 cm produced higher protein and digestible dry matter than wider intrarow spacings in subabool and the reverse trend was observed in oats. Total crude protein and digestible dry matter yields were higher in narrow intrarow spacing (15 cm) in comparison to wider intrarow spacings of 30 or 45 cm when both the crops were taken into consideration.

Thus, Hawaiian Giant when intercropped with oats gave better results. The narrow row spacing of 90 cm and the narrow intrarow spacing of 25 cm showed superior performance.

Table. Chemical composition of oats and subabool.

Treatments	CP %		IVDMD %		CP yield (q/ha)			DDM yield (q/ha)		
	Oats	Subabool	Oats	Subabool	Oats	Subabool	Total	Oats	Subabool	Total
Varieties										
V1-Hawaiian Giant	5.17	23.57	50.44	44.20	0.78	10.25	11.03	7.61	19.22	26.83
V2-Peru	5.34	25.00	48.42	46.66	0.58	5.10	5.68	5.28	9.52	14.80
V3-Cunninghum	5.56	26.17	51.13	50.12	0.75	6.48	7.23	6.94	12.41	19.35
Row spacing										
S_1 - 90 cm	5.80	25.47	52.42	48.11	0.56	10.99	11.55	5.10	20.76	25.86
S_2 - 180 cm	5.37	25.15	50.60	46.11	0.68	7.40	8.08	6.42	13.57	19.99
S_3 - 270 cm	4.90	24.11	46.98	46.78	0.91	4.84	5.75	8.73	9.43	18.16
Intrarow spacing										
T_1 - 15 cm	5.20	24.52	50.87	46.55	0.59	9.02	9.61	5.76	17.13	22.89
T_2 - 30 cm	5.54	24.96	49.82	46.98	0.75	6.76	7.51	6.79	12.73	19.52
T_3 - 45 cm	5.34	25.27	49.31	47.47	0.90	5.43	6.33	8.31	10.20	18.51

CP = Crude protein, IVDMD = *In vitro* dry matter digestibility.

EVALUATION OF GERMPLASM FROM THE PROGRAMME "BREEDING OAT CULTIVARS SUITABLE FOR PRODUCTION IN DEVELOPING COUNTRIES" IN SOUTH AUSTRALIA

ANDREW R. BARR
South Australian Department of Agriculture

Germplasm from the programme "Breeding Oat Cultivars suitable for production in developing countries" (abbreviated to "Quaker" in this report) which is now organised by Messrs Brinkman, McDaniel, Shands, Burnette and Weaver has been introduced into Australia via John Oates at the University of Sydney.

Entries are screened against several Australian races of stem rust and crown rust in Sydney and a rust resistant subset is distributed to oat breeders in other Australian states. From these tests and the annual reports of nursery, it was expected that excellent sources of rust resistance would be forthcoming. Field tests have confirmed this.

The annual reports also present data on BYDV resistance and so it was not surprising that many entries were resistant to BYDV strains prevalent in Australia.

Twenty nine selections from the Quaker nurseries were entered in single replicate trials at 5 sites in South Australia in 1989. An unexpected, but extremely pleasing bonus is that 5 entries have been identified which combine at least moderate resistance to stem rust, crown rust, BYDV, septoria (Leptosphaeria avenaria) and halo blight (Psuedomonas syringae pathovar coronofaciens) - (Table I).

Quaker-84-135 and Quaker-84-155 performed creditably for grain yield while Quaker-84-155 and Quaker-84-43 have good grain quality (Table II). All 5 lines have reasonable straw strength, although inferior to lines carrying DW6. Quaker-82-225 is the only line with a grossly inappropriate time of anthesis for South Australia.

Table I : Entries from Quaker nurseries with multiple foliar disease resistance

LINE	PEDIGREE	84 REPORT	85 REPORT	83 REPORT
Quaker-84-135	C7512/SR cpx/F_2 (T312/C227) 82C6023	84-135	85-80	not present
Quaker-84-155	C7512/SR cpx/F_2 (T312/C227) 81C3643	84-155	not present	not present
Quaker-82-225	Cortez^4/C5-2 CR/1563 cpx/T312/SRcpx	84-46	not present	83-93
Quaker-83-112	1563 CR cpx	84-57	85-40	83-112
Quaker-84-43	CORONADO*2/CORTEX*3/PENDEK/ME1653	84-43	85-30	83-86

TABLE II : Yield and quality profiles of Quaker nursery selections grown in South Australia, 1989

GENOTYPE	Yield (deviation from site mean yield)	Hectolitre Weight (kg)	Screenings Percentage (under 2.0 mm)	1000 Grain Weight (g)
Quaker-84-135	+215	52.3	13.6	28.8
Quaker-84-155	+442	53.5	7.0	33.4
Quaker-82-225	-693	51.9	24.6	29.5
Quaker-83-112	- 6	51.3	29.2	33.2
Quaker-84-43	- 5	55.5	7.6	29.9
Echidna	+321	48.5	17.5	27.4
Mortlock	-	59.2	7.4	37.4
Swan	-	51.3	22.7	31.8
No. trials	5	1	1	1

Although one must be cautious about results from single replicate experiments, this appears to be the first time that resistance to these five important pathogens has been identified in South Australia in single genotypes. These lines should simplify the breeding strategies required to incorporate multiple disease resistance into high-yielding, semi-dwarf (DW6) types. In the past, time-consuming "parent building" strategies involving many donor parents (often carrying many deleterious traits) have been pursued in an attempt to combine resistance to all five pathogens.

The five lines will be entered in multi-location, replicated trials in 1990 to confirm that they are indeed resistant to all five pathogens and to examine further their adaptation to southern Australia.

The willingness of all involved in the "Quaker" nursery programme to share germplasm is gratefully acknowledged.

OATS IN MANITOBA - 1989

P.D. Brown, Agriculture Canada Research Station, Winnipeg, Manitoba

In Manitoba, 236,000 ha of oats were planted, an increase of 9% from 1988. The variety Dumont was planted on 50%, Fidler on 21%, and Riel on 20% of the area planted to oats. The amount of Dumont has reached a plateau, Fidler is declining in area, and the popularity of Riel is increasing. A new cultivar, Robert, has just been released for commercial production, and because of its good yield and lodging resistance, is being well received. Robert is also the most barley yellow dwarf virus tolerant cultivar released in Manitoba to date.

The growing conditions in Manitoba were somewhat improved in 1989 as compared to 1988. Although oats were generally planted into moisture deficient soil, timely rains during the early part of the growing season helped to get the crop off to a good start. However, production was spotty. In parts of the Red River Valley well timed showers and warm temperatures resulted in above average yield and quality. In other regions, particularly the southwest, drought conditions prevailed, reducing considerably an earlier expectation of an above average harvest.

Stephen Fox has completed his M.Sc. degree at the University of Manitoba. One aspect of his research was the study of crown rust resistance in six *Avena sterilis* accessions. Based on reactions to 15 crown rust races and crosses with nine known crown rust resistance genes, three accessions were found to contain new genes for crown rust resistance. Stephen is now shuttling between the University of Minnesota and the University of Manitoba, working toward his Ph.D. on barley stem rust, under the supervision of D. Harder.

OAT IN SASKATCHEWAN - 1988

B.G. Rossnagel and R.S. Bhatty
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Interest in the oat crop continued at a relatively high level in Saskatchewan in 1988. While the extreme drought affected the majority of the provinces cropping region, a large part of the oat crop was fortunately less affected. However, due to the drought an even greater than normal portion of the crop was harvested as oat hay since perennial forage production was greatly reduced. Acreage for 1988 was estimated at over 1.0 million acres which is a small increase over 1987 figures.

The Crop Development Centre variety Calibre, released in 1983, is now the most popular variety. It occupied 33% of the 1988 acreage. Calibre's combination of performance and quality are obviously popular as shown by its increase popularity from 7% of the provincial oat acreage in 1986, to 22% in 1987 to 33% in 1988. Cascade and Harmon each at 20% and Dumont at 15% accounted for the bulk of the remainder of the 1988 crop. Total western Canadian acreage of Calibre was estimated at some 710,000 acres or 20%, second only to Cascade which occupied some 28% of the total acreage.

In addition to being a high-quality grain producer, Calibre has performed quite well in terms of irrigated forage production in 1987 and 1988. Calibre has been grown as a rotational break-crop in an alfalfa center-pivot forage production scheme at Outlook, Sask. In 1987 a 55 hectare field produced 1,072-455 kg oat hay bales or 8,868 kg/ha. In 1988 that same 55 hectare field was planted at 1/2 normal seeding rate of 40 kg/ha and underseeded to alfalfa and produced 729-492 kg oat hay bales or 6,521 kg/ha. A second first break 55 hectare field yielded 910-514 kg oat hay bales or 8,504 kg/ha in 1988.

Our research and breeding program aimed at combining high quality with high productivity continues and as noted in the new varieties section of this Newsletter we have released a second cultivar of the Calibre type which has been named Derby. Derby shows improved grain plumpness and lower hull content compared to Calibre.

We wish to acknowledge the financial support of the Saskatchewan Agriculture Development Fund, the Quaker Oats Co. of Canada and Robin Hood Multifoods for our oat research.

OAT IN SASKATCHEWAN - 1989

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The "born-again" interest in oat in Saskatchewan continued into 1989 with acreage increasing to a ten year high of nearly 1.5 million acres, a 25% increase over 1988. Despite a very dry early season, crops got off to an excellent, if somewhat late start thanks to adequate precipitation in mid-May. However, crops which looked extremely promising at the end of June deteriorated rapidly in the heat and drought of July and August such that production was not much greater than normal. Grain quality of materials harvested by late August was good to excellent, however a wet period from then through late September in many areas led to considerable weathering damage in the remainder of the crop. Nevertheless, significant quantities of premium quality oat were produced and are finding their way into the domestic and U.S. milling and performance oat markets.

The Crop Development Centre's 1986 release, Calibre, now dominates the variety scene, occupying over 720,000 acres in Saskatchewan in 1989 or nearly 50% of the acreage. The combination of grain quality and marketability, as well as performance, in particular its ability to produce high quality grain even when under drought stress, have definitely been a factor in its rapid rise to #1. On a provincial basis Calibre began with 7% of the acreage in 1986 and moved to 22% in 1987, 33% in 1988 and 48% in 1989. It is now the most widely grown variety in all of western Canada, occupying nearly 1.25 million acres or 30% of the acreage. On this basis it has risen from 15% in 1987 to 20% in 1988 and over 30% in 1989. Based on producer and consumer comments, we anticipate further increases in Calibre's popularity in both Saskatchewan and Alberta.

Based on conservative estimates the value of Calibre in additional returns to Saskatchewan producers to date has exceeded $10 million dollars. These figures only account for higher yield at feed oat prices. Allowing for Calibre high quality and its part in helping access export markets, the return to the province to date is likely at least 25% greater than that, and, it is anticipated that the variety will continue to create additional returns for a "lifetime" contribution well over $25 million dollars. This variety is a glowing example of return on investment in research and the necessity of combining selection for marketplace end-use quality with agronomic performance

Our new variety Derby, with improved grain plumpness and even lower hull content, is still in the seed increase stage. Ample supplies of certified seed will be available in 1991.

We wish to acknowledge the financial support of the Saskatchewan Agriculture Development Fund, the Quaker Oats Co. of Canada and Robin Hood Multifoods for our oat research.

SOME CHARACTERISTICS OF ADVANCED GENERATION OAT LINES

K. Pal, S.N , Mishra, and J.S. Verma

Selection of progenies with superior performance derived from hybrid combinations remains an important goal of our oat breeding program. In the present study some characteristics of advanced generation oat lines are reported. The study was conducted on 49 entries consisting of 48 lines extracted from the on-going oat breeding research program and one check cultivar (UPO 94). Out of 48 iines, 38 belonged to two-parent crosses and 10 to four-parent crosses. The experiment was planted on Dec. 2, 1986 in a 7 x 7 simple lattice design with two replications. Each plot consisted of 4 rows, 3m long, spaced 50 cm apart. The two middle rows of each plot of 4 rows were used for recording observations on days to 50% heading (DYH), 100-grain weight (GWT, g), 100-groat weight (GRWT, g), harvest index (HI, %), growth rate (GR, q/ha/day), groat protein (GP, %) and grain yield (GYD, q/ha).

Pedigree-wise group means for seven traits recorded on the lines from various matings are presented in Table 1. The number of lines included in the study within each cross are also shown. The highest number of lines included were 14 from the cross Lang/Swan. When examined on the basis of individual line performance in relation to the check cultivar it appeared that this cross ('Lang'/'Swan') was the best. It showed 14, 13, 9, 11, 5, 1 and 9 lines out of 14 to be superior to the check cultivar in DYH, GW, GRWT, HI, GR, GP, and GYD, respectively. On the basis of group means; that is, on the basis of number of lines evaluated in each cross, it appeared that DYH was lowest and GWT highest in Lang/Swan lines. Highest GRWT, HI, GR, GP and GYD were in the lines of crosses 'Otter'/Swan//'Kota'/'Burt', 'Speer'/Swan, 'Bingham'/Swan//'Sierra'/'Kent', Otter/Swan//Kota/Burt, and 'Portal'/Swan//Kota/Burt, respectively. Most of the lines, were superior to the check cultivar. On an overall basis it appeared that the lines of Lang/Swan were superior to others in most of the traits. Its high grain yield appears to be the result of high growth rate (GR) and harvest index (HI). Similarly high grain yield of the lines from the cross Portal/Swan//Kota/Burt is also due to high growth rate and harvest index. Where GR was high, for example in lines of crosses Bingham/Swan//Sierra/Kent and Otter/Swan//Kota/Burt, and the HI were low, the GYD was also low. The study also revealed that 4-parent crosses were better than 2-parent crosses in improving groat protein.

Some related genetic parameters are presented in Table 2. Genotypic coefficient of variation (GCV) was maximum for GYD followed by HI and GR. It was lowest for DYH. Heritability in the broad sense (Hb) was highest for DYH and as expected lowest for GYD. Genetic advance in percent of mean was highest for DYH followed by HI and GR. Genetic advance thus appeared to be high for traits like DYH, HI and GR and this may well indicate that improvement in these may also improve GYD as it is a function of GR x HI x growth duration. The GCV and GA were minimum for GP and it shows that it is difficult to improve protein content.

The phenotypic and genotypic correlations (Table 2) indicated that early heading lines had higher grain yield. It was further observed that groat protein (GP) was negatively correlated, as expected, with GYD.

Harvest index (HI) was highly significantly correlated with GYD. This further revealed that HI is an important trait which contributes to increased GYD. Growth (GR) was also significantly associated with GYD. It can therefore be concluded that DYH, GR, GRWT, GWt are some important traits which should be given due importance in the selection program to increase grain yield.

Table 1. Pedigree-wise group means for certain important characteristics of advanced generation oat lines.

Pedigree	No. of lines included	DYH (days)	GWT (g)	GRWT (g)	HI (%)	GR (q/ha/ day)	GP (%)	GYD (q/ha)
WA1470/PI292532	4	101	4.24	2.68	16.5	0.58	13.7	10.1
Forward/UPO-94	7	112	3.51	2.69	15.5	0.48	14.6	9.8
Lang/Swan	14	92	5.29	3.48	24.0	0.66	12.8	18.5
Orbit/Swan	8	100	4.77	3.37	18.7	0.64	13.0	14.8
Speer/Holden	1	100	2.52	2.45	20.9	0.43	13.2	11.6
Speer/Swan	4	99	2.11	1.80	25.6	0.40	14.3	13.0
Bingham/Swan// Sierra/Kent	3	110	3.56	2.82	10.2	0.77	15.1	9.5
Kota/Burt// Sierra/Kent	3	100	4.25	3.00	14.5	0.64	14.6	10.8
Otter/Swan// Kota/Burt	3	103	5.05	3.60	10.4	0.74	15.6	8.8
Portal/Swann/ Kota/Burt	1	93	2.89	2.05	22.0	0.72	15.2	19.1
UPO-94(Check)	1	113	3.51	2.87	17.3	0.63	14.4	15.0

Table 2. Genetic coefficient of variation (GCV), heritability (Hb), genetic advance (GA) for seven traits and their phenotypic (rp) and genotypic (rg) correlation coefficients with grain yield in advanced generation oat lines.

Traits	GCV (%)	Hb (%)	GA (% of mean)	r_p	rg
DYH	8.5	94.5	17.4	-.635**	-.646
GWT	24.6	93.2	2.1	.348*	.360
GRWT	19.6	91.4	1.2	.354*	.366
HI	34.6	54.3	13.4	.633**	.635
GR	30.7	45.4	11.4	.364*	.374
GP	12.0	94.3	3.3	-.224	-.231
GYD	36.5	18.1	10.2	-	-

*,** Significant at 5% and 1% probability levels, respectively.

OATS IN CHIHUAHUA, MEXICO-1989

Philip Dyck

The year 1989 was good for oats. Rainfall from January to March was very scattered, therefore very little corn was planted. The rainy season and also the growing season began late (July 25 and not until August 6 in some areas. Therefore, because of the late date, the only alternative was oats which would still be a good forage crop even if it did freeze. Very few field beans, the third crop grown in this area, were seeded. Rainfall was good in August with very little the rest of the season, (66 mm in July, 160 mm in August, 68 mm in September and no rainfall in October). Average yields were 1,230 kg/ha (44.12 bu/a) and yields as high as 2,500 kg/ha (69.75 bu/a). As Drs. Donald Harder, Milton McDaniel, Uriel Maldonado, David Peterson, Dale Reeves and Deon Stuthman will remember, the very early frost on September 23 killed the beans and corn in the low lying areas planted in July. Therefore, oats was practically the only crop harvested for grain. Approximately 250,000 hectares were seeded to oats.

'Paramo', a stem rust susceptible variety, was the principal variety seeded, but because of cool temperatures during most of the growing season, stem rust infestations did not occur. The kernel quality of oats was good. Paramo, which has had a low kernel weight the last few years because of the rust infestations, had a good groat content. It displayed its ability to grow well in cool climates. Other varieties seeded were 'Guelatao' 'Cuautemoc' and few hectares of 'Diàmante R-31'.

Farmers planted seed increase plots of 'Cusi' which is earlier than Paramo; 'Babicora', the high groat and kernel weight variety and 'Papigochi', the high yielding forage variety. All of these varieties produce higher grain yields and are more rust resistant than Pararmo.

The aforementioned research scientists were speakers at the second Oats Conference held here in Mexico.

The papers they presented were:

1. Dr. Dale L. Reeves. The Time Required to Develop a New Variety, The use of 2,4-D Amine.

2. Dr. David M. Peterson. Oats and Human Nutrition.

3. Dr. Donald E. Harder. Oats Diseases With Emphasis on Stem Rust.

4. Dr. Milton E. McDaniel. Experiments to Obtain Disease Resistant Varieties.

   Applying Fungicide on Oats.

Other speakers and their papers were:

5. Jose Rodriguez Vallejo. The Importance of Seeding Certified Seed.

6. Rodolfo Moreno Galvez. The Genetic Improvement of Cereal Grain Crops and Future Perspectives.

7. Carlos Jimenez Gonzalez. The Use and Perspective of Hulless Oats (*Avena nuda* in Mexico.

8. Philip Dyck. Comparison of the Gravimetric Bulk Selection Method and the Pedigree Plant Selection Method in Producing Quality Oats.

9. Dr. Juan Salmeron Zamora. Reaction of Some Oats Varieties to Stem Rust.

10. Manuel Ramirez Legarrte. Two Year Preliminary Analysis of *Puccinia graminis* f sp. *avenea* Epidemics.

This conference was attended very well by professors, research scientists, farmers, business men and students.

OAT BREEDING IN MOROCCO

Chaouki Al Faiz

In Morocco oat is used as a forage crop. It is the most common forage crop in the nonirrigated areas where 59,000 ha consist of oat/vetch mixtures and 64,000 ha of pure oat in 1989. The only two cultivars used today, selected already in the 1960s, are Av 153 and Av 095. They are highly susceptible to many diseases and not well adapted to all areas of Morocco.

The selection of new cultivars started in 1980 with American material mainly from universities, and Quaker Oats Co. The objectives of selection are as follows:

- dry matter yield
- grain yield
- resistance to the most common diseases: BYDV, Crown rust, Powdery mildew and Septoria and
- lodging resistance

The earliness criteria depends on the target region. In the south where the wet season is short, earliness is desirable, but in the North this is not a priority. The experimental sites are not sufficient to cover all edaphoclimatic conditions. Table 1 shows the results of some lines considered to be better than the old variety Av 153 during two years (1988 and 1989). These lines have been submitted for approval to the National Varieties Catalog.

The breeding program is carried on with the same goals. We evaluate some new accessions each year, mainly from Quaker Oats Co. and select the best lines for variety trials in the subsequent years.

The program includes the evaluation of wild oats which have been collected in MOROCCO. These ecotypes may be an important source for BYDV and crown rust resistance.

ACKNOWLEDGEMENTS

I sincerely thank Dr. D. Stuthman and Dr. McDaniel for their help in getting the seeds.

Table 1. Results of varietal trials (1987-88 and 1988-89).

Genotype	Dry Matter** yield(T/ha)	Grain yield*** (Q/ha)	Days to 100% heading	BYDV**** (1-9)	Crown rust	Powdery mildew	Septoria
Coker 79-17	7.58	30.05	133	3	2	5	2
Il 3411	7.91	30.70	148	3	1	2	1
MO 6425	8.08	30.34	133	5	3	2	2
Il 75-5681	7.18	30.93	148	7	9	5	3
C 7512SR/cpx	7.09	30.81	133	7	3	3	3
BULBAN *	7.97	31.39	133	7	5	5	3
Av 153*	6.76	20.24	120	5	7	5	5

* The checks
** 7 locations (tanger, Fes, Settat, Merchcouch, Rabat, El Jadida, Oulmes)
*** 2 locations (Fes and Merchouch)
**** Diseases score: 1 to 9 (1 = resistant, 9 = succeptible)

OATS IN SR CROATIA

R. Mlinar

1989 Spring Oat Production

About 26,800 hectares of oats were harvested for grain in SR Croatia (Yugoslavia) in 1989. Statewide oat yields in 1989 averaged 2.22 t/ha, while the average yield was 2.16 t/ha in 1988. Mean yield in the 1980-1989 period was 3.34 t/ha on state farms and 1.85 t/ha on private farms. Seeded areas are down from 1981 (Table 1).

The 1988 and 1989 crop seasons were relatively favorable for oat production in Croatia. The last two years spring oats have increased in yields slightly. The major areas of production are in the high elevation districts.

Varieties

Information from seedsmen suggest that 'Flamingsnova', 'Flamingsregent', and 'Leanda' were the leading varieties in Croatia. 'Condor', 'Astor', 'Flaminegstreue' continue to be grown on signficiant acreage, particularly on private farms. New varieties becoming quite popular are 'Slatinka' and 'Zlatna Grana'.

Breeding

Oat breeding efforts at the Institute for Breeding and Production of Field Crops have intensified since 1986 but the program remains small. Conventional breeding procedures are being used to develop varieties with improved yield and physical characteristics of the grain. We now have two promising lines Bc-Z-183 and Bc-Z-345 in the 3rd year of official trials in Yugoslavia.

Table 1

OAT PRODUCTION IN SR CROATIA

Year	STATE FARMS		PRIVATE FARMS		TOTAL	
	ha	t/ha	ha	t/ha	ha	t/ha
1980	2.886	3.21	30.523	1.69	33.409	1.82
1981	3.424	3.35	32.272	1.79	35.696	1.94
1982	2.565	3.70	29.995	1.69	32.560	1.89
1983	3.260	3.17	28.753	1.77	32.013	1.91
1984	1.674	3.45	27.365	1.93	29.039	2.02
1985	2.629	3.40	25.630	1.88	28.259	2.02
1986	3.799	3.20	25.031	1.85	28.830	2.03
1987	1.223	3.35	22.013	1.82	23.236	1.90
1988	2.720	3.39	21.369	2.00	24.089	2.16
1989	3.473	3.17	23.336	2.07	26.809	2.22
Average	2.765	3.34	26.628	1.85	29.394	1.99

SOURCE: STATISTICAL REPORTS

ARKANSAS

R.K. Bacon and E.A. Milus
University of Arkansas

Production

According to the Arkansas Agricultural Statistics Service, acreage planted to oats in 1989 was 50,000 acres compared to 40,000 acres in 1988 and 22,000 acres in 1987. Approximately 44,000 acres were harvested for grain with an average yield of 73 bu/A, resulting in a total production of 3,212,000 bushels. Growing conditons were generally favorable although some winterkill was observed and unseasonable rains during harvest probably reduced yields.

Breeding and Genetics

Foundation seed of AR 102-5 was released in the summer under the name 'Ozark'. This cultivar was selected for its improved winterhardiness as well as high yield potential under Arkansas conditions. Production has been particularly favorable on soils heavier than the silt loams of the Arkansas Grand Prairie where oat production is currently centered. A more detailed description of Ozark is given in this volume of the Oat Newsletter.

Vernalization:

Mr. Steve King, working on his M.S. degree, has initiated studies on vernalization in oat. A greenhouse experiment was established to evaluate the length of cold treatment required to obtain a vernalization response in spring and winter oat genotypes. Twenty-five winter and five spring oat genotypes received four cold treatments: 24-d, 12-d, 6-d, and a non-vernalized control. Preliminary results indicate that none of the five spring oat cultivars responded to any of the vernalization treatments for days to heading, plant height, or panicle number, while all of the winter oats evaluated responded to the vernalization treatments for days to heading with the exception of 'Brooks', which had a great deal of plant to plant variability. Thirteen genotypes were fully vernalized by the 12-d vernalization treatment, while eleven had a significant reduction in days to heading with the 24-d treatment when compared to the 12-d treatment. A second experiment is currently underway that is utilizing a 48-d cold treatment to see if any of this latter group will respond to additional days of vernalization. Only one winter cultivar, 'Dubois', responded to all three measured variables, while four other winter oat genotypes responded to the cold treatments for panicle number.

In a field experiment to evaluate the effects of vernalization on yield components, each of 30 genotypes received two treatments: 28-d and no vernalization. The preliminary results are too inconclusive thus far for any general statements; however, the seed weight generally increased in all genotypes with vernalization treatment, although the actual yields were generally lower than the non-vernalized entries. Stand establishment from transplanting appears to have been the primary factor limiting yields, and stands tended to be thinner in the plots with cold-treated seeds as indicated by the lower yields. A second year's trial will be planted in March, and efforts have been made to avoid the stand establishment problems.

Another field experiment has been undertaken to evaluate the yields of spring-planted oat in Arkansas. Eleven winter oat cultivars and nine spring oat cultivars were planted in the spring of 1989 at two locations. Preliminary results indicate that the five spring oat cultivars 'Don', 'Ogle', 'Starter', 'Larry', and 'Noble', had the highest yields along with the winter oats 'Bob', 'Citation', '833', and 'Ozark'. A third location and a fall planting have been added for the second year, which is currently underway. A cold December, with temperatures ranging from 0 to -13° F has killed almost all of the fall planted spring oats at all locations, but most of the winter oats have survived.

A fourth experiment is being conducted to examine the maternal influences on a vernalization requirement. Dubois and 'Madison' appear to be the most responsive to vernalization of the oats tested. These two cultivars were crossed with the spring oats Starter and Ogle, which were among the least responsive cultivars tested. Once we have a sufficient number of F_1 seed, each cross will be divided in half, with half receiving a vernalization treatment and the other half being used as a control. The seed will be planted in the greenhouse and evaluations similar to those of the earlier greenhouse experiment will be made.

Gibberellic acid has been shown to play a role in flowering by inducing stem elongation. A fifth experiment has been established to determine the role of gibberellic acid in the response of oat to vernalization. Dubois was chosen to be tested because of its extreme response to vernalization. Seeds were germinated on one of five gibberellin A_3 concentrations and then received one of six vernalization treatments. Currently the seeds have been planted in the greenhouse.

2,4-D/Diclofop-methyl Interaction:

This experiment was originally established to select for diclofop-methyl resistance in oat, but it was soon found that 2,4-D, which is commonly used to initiate callus in oat, appears to be antagonistic to diclofop-methyl. Therefore, an experiment is being conducted to evaluate this interaction by testing callus production of oat with various molarities of 2,4-D and diclofop-methyl in the media.

GEORGIA

P. L. Bruckner, J. P. Wilson, P. L. Raymer,
J. W. Johnson, B. M. Cunfer, and J. J. Roberts
University of Georgia and USDA-ARS

Production: Georgia oat producers planted 90,000 acres in 1988-89 and harvested 70,000 acres at an average of 59 bushels per acre for a total production of 4,130,000 bushels. Production in 1988-89 was 46% higher in the state than the previous year, and continued an upward trend in Georgia oat production from a low of 1,365,000 bushels in 1985-86.

Breeding: A limited breeding effort continues at the Coastal Plain Experiment Station in Tifton. Currently oat populations are carried in bulk to the F_4 generation, with gravametric mass selection after the F_2 and F_3 generations, and derivation of lines in the F_4 generation. F_2 populations are also screened for winter survival in Griffin and Blairsville, GA with selection of surviving plants for advance. A high yielding, semidwarf line, GA-T81-1249 (Coker 234/CMB-3//Coker 70-14/NC2469-2), developed by Dr. D. D. Morey, was entered into state and regional testing and preliminary seed increase in 1989. Cooperative advanced-generation oat screening and early-generation oat population exchange programs were initiated among oat breeders in the southern region in 1989.

Powdery mildew: A rare occurrence of powdery mildew (Erysiphe graminis f. sp. avenae) in 1989 at Tifton, GA provided an opportunity to evaluate entries in the 1989 combined Uniform Southern and Central Winter Oat nursery for resistance. Plots were rated 14 and 18, April 1989 for mildew infection (% of foliage) and infection type (0 to 4 scale, 0 = no infection, 4 = heavily sporulating colonies). Average infection for the 14 April and 18 April evaluations were 29.2 and 32.9%, respectively. All genotypes were infected. Percent infection and infection type ranged from 7.5 to 59.4% and 1.4 to 4.0, respectively, and were highly correlated (R = 0.91). Lines showing the highest levels of resistance were Coker 86-10, Coker 716, Coker 227, and Simpson. PA8014-608 was the most susceptible line. Field resistance ratings are being confirmed in greenhouse studies in cooperation with Dr. S. Leath, Raleigh, NC.

Forage studies: Forage yield, seasonal distribution, and forage yield stability of 3 oat, 3 wheat, 3 triticale, 1 barley, and 3 rye cultivars were compared over a 3 year period at four Georgia locations. Oat cultivars were superior to other species for forage production in a Hessian fly infested environment, but lacked adequate cold tolerance to produce high and stable forage yields over the entire range of test environments. Oat cultivars produced significantly less forage than other species during the January-February period, likely because of a higher temperature requirement for growth. 'Simpson' was higher yielding and better adapted for forage production in Georgia than 'Florida 501' or 'Madison'.

Publications:

Bruckner, P. L., and W. W. Hanna. 1990. In vitro digestibility of fresh leaves and stems of small-grain species and genotypes. Crop Sci. 30:196-202.

Bruckner, P. L., and P. L. Raymer. 1990. Factors influencing species and cultivar choice of small grains for winter forage. J. Prod. Agric. 3: (in press).

ILLINOIS

F. L. Kolb, C. M. Brown, W. L. Pedersen,
University of Illinois

and A. D. Hewings,
USDA-ARS

Production:

About 200,000 acres of oats were harvested for grain in Illinois in 1989. The state average yield was 85 bu/a which was 7 bu/a above the previous record. Thus, total oat production in Illinois in 1989 was 17 million bushels.

In general, conditions were favorable for oat production with temperatures somewhat cooler than normal during much of the growing season. In some areas, severe thunderstorms caused extensive lodging prior to harvest.

Release of Germplasm lines:

Seven germplasm lines with excellent tolerance to barley yellow dwarf virus (BYDV) have been developed and released. These lines resulted from several cycles of selection for BYDV tolerance and other desirable traits, followed by intermating of selected genotypes. Based on visual symptoms in artificially infected hills, all seven of the germplasm lines are more tolerant to BYDV than Ogle. Further description of these lines is found elsewhere in this newsletter.

Personnel:

C. M. Brown retired in 1989 but remains active. Following his official retirement, Charlie served as Acting Head of the Agronomy Department from August, 1989 to April, 1990.

Les Domier recently joined the Illinois small grain research group as a molecular virologist with the USDA-ARS working on BYDV.

Norman Smith also joined the group as a research specialist. Norm, a graduate of the University of Illinois, provides technical support for the breeding program.

Ellen Bauske began work on a Ph. D. Ellen is in plant pathology and is conducting research on BYDV. F. L. Kolb and A. D. Hewings are serving as co-advisers.

Catherine Gourmet began work on a M. S. degree with F. L. Kolb. She is conducting research on BYDV screening in the greenhouse.

IOWA

K. J. Frey, A. H. Epstein, R. K. Skrdla

In 1989, oat production in Iowa rebounded with 700,000 acres being harvested for grain and a yield of 72 bushels per acre. Production was more than double that in the drought year of 1988. The season was good for oat production with moderate temperatures and timely rains. Crown rust, stem rust, and barley yellow dwarf diseases occurred in 1989, but generally they developed late in the season and did not cause reduction in oat yields.

Test weight is a trait that has been neglected during the past 15 years as new sources of germplasm were utilized for increasing the yield potential of newer oat varieties. During the past several years, much emphasis has been put upon studying the inheritance of test weight and breeding strategies for improving this trait in oat varieties. In a recently completed study, test weight was shown to be determined largely by additive gene action, to have a high heritability, and to interact little with years and testing sites. In another study, recurrent selection was successful in increasing test weight 1.4 pounds per bushel over three cycles of selection. In this line of descent, the yield was decreased by 2.3% per cycle. In another line of descent where an index composed of functions of test weight and yield, both traits were increased significantly. This latter study is continuing with a modified index being used to select for both test weight and yield simultaneously.

New personnel joining the Iowa oat research program in 1989 to undertake several new thrusts in oat research are: (a) Dr. W. Allen Miller, a molecular biologist who has joined the Department of Plant Pathology, will work upon the barley yellow dwarf virus, (b) Dr. Roger Wise, a molecular biologist employed by the ARS/USDA, will work on the molecular basis of host resistance to fungal pathogens of small grains, (c) Dr. Michael Lee, a plant breeding-molecular biologist who came to the Agronomy Department three years ago, will join fellow researchers at Cornell University, Agricultural Canada, and the University of Minnesota to construct a restriction fragment length polymorphism map of oats, and (d) Dr. Pam White, Foods and Nutrition Department at Iowa State, is doing a germplasm survey of 500 oat lines for beta glucan content and to contribute to the development of oat varieties with high and low beta glucan contents.

In 1989, Peter Lynch finished his M.S. degree and he is continuing to work on a Ph.D. Currently, he is doing Ph.D. dissertation research at the International Crops Research Institute for the Semi-Arid Tropics at Hyderabad, India. Bryce Abel, Jim Lehmann, and Dan Currier completed Ph.D. degrees in 1989. Bryce is a plant breeder with Mike Brayton Seeds in Ames, Iowa; Jim Lehmann is a plant breeder with the American Amaranth Institute, Inc. in Bricelyn, Minnesota; and Dan Currier is a corn breeder with Ciba-Geigy Seed Division at Algona, Iowa. Mohammad Al-Ajlouni, a graduate student from Jordan, joined the project to work on his Ph.D. degree.

LOUISIANA

S. A. Harrison
Agronomy Department, LSU

Production: The 1988-89 growing season was characterized by a warm, moist winter, an average to somewhat dry spring, and a wet early-summer. Harvest was delayed in some parts of the state by heavy rainfall following maturity, and as a result, test weights and quality were not as high as in 1988. Although no official estimates are available, grain was probably harvested from only about 20,000 acres, with additional acreage devoted to pasture mixes. Stem rust (*Puccinia graminis*) was heavier in north than in south Louisiana. Crown rust (*Puccinia coronata*) was extremely heavy in south Louisiana. The average ratings for crown and stem rust in the Uniform Oat Nursery at Baton Rouge was 57 and 26%, respectively. The heavy disease pressure was reflected in yields, which ranged from 1.4 bu/acre for the susceptible variety, Brooks, to 138 bu/acre for a resistant line (Coker 87-11). Halo blight (*Pseudomonas coronafaciens*) was also a problem in the test.

Breeding, Genetics, and Variety Evaluation: The LAES oat breeding effort is fairly small scale and has the objective of developing adapted cultivars for Louisiana and surrounding states. Emphasis is being placed on the development of hull-less oats for non-ruminant feed. Most of the crosses evaluated in 1988 were material that came from Dr. Phil Bruckner at Tifton, Georgia. F2 and F3 lines were selected for resistance to leaf and stem rust. Very heavy rains following planting will force a virtual standstill of the oat breeding effort at Baton Rouge for 1989. Remnant seed were planted at Alexandria (central Louisiana, Red River Valley) and will be selected and harvested. It is anticipated that a southern regional cooperative oat breeding project that is currently under development will play a significant role in future variety development and breeding efforts.

MINNESOTA

D.D. Stuthman, H.W. Rines, R.D. Wilcoxson,
S.R. Simmons, L.L. Hardman, and K.J. Leonard
University of Minnesota

Oat production in Minnesota in 1989 was estimated to be 46.8 million bushels, about 89% more than in 1988. Approximately 850,000 acres were harvested out of the 1,250,000 seeded. These numbers compare to 550,000 and 800,000 acres harvested in 1988 and 1987 and 1,700,000 and 2,100,000 planted in 1988 and 1987, respectively. The average per acre yield was 55 bushels, which was 22 more than in 1988. The season began with cool temperatures and generally adequate top soil moisture, which caused a slight delay overall in planting. Subsoil moisture was never adequate in the important oat producing areas except for the extreme north central part of the state. By early May, the crop had reached a normal development schedule and maintained it throughout the remainder of the season. Timely precipitation provided adequate top soil moisture for much of the state during most of the season. However, parts of the west central and the southwest districts were quite dry most of the summer and yields were depressed in these regions. The rusts, both crown and stem, were more prevalent than in recent years and Barley Yellow Dwarf Virus (BYDV) continued to be somewhat of a problem.

Variety survey

The Minnesota Agricultural Statistical Services conducted a variety survey among Minnesota oat producers in 1989, the first one since 1985. Steele was the leading variety (18% of the acreage) followed closely by Starter (17%) and Don (15%). Other varieties with 5% or more of the acreage included Fidler, Preston, and Moore. These three varieties were ranked fourth, second, and first in the 1985 survey. Thus, there has been a major turnover in varieties in the last four years.

Research in recurrent selection

The yield gains produced by our recurrent selection system are greater than 2% per year. Cycle 5 parents exceed the original parents in grain yield by nearly 40%. Unfortunately, these increases have been accompanied by some undesirable changes in other important traits including heading, height, lodging susceptibility, and bushel weight. Secondary selection pressure for earliness and reduced plant height was somewhat successful for heading but not height. In an effort to improve these traits, all C_4 parents were also crossed to Starter and Ogle. Progeny from these crosses yielded similar to the regular C_4 progeny but were still taller than desired. Seven Starter and seven Ogle progeny lines selected for yield, heading, height, and seed quality have been intercrossed to produce 49 "double crosses." The Starter and Ogle selections have also been crossed to Hazel and IL 83-8037 to produce 28 "three-way crosses." The Starter selections have also been backcrossed to Starter. F_6 lines will be extracted from each of these three groups of populations and evaluated to assess which kind of population produces lines with the best combination of all traits of interest.

Personnel

Dr. Gary Fulcher, formerly at the Plant Research Center, Agriculture Canada, Ottawa, has been appointed to the General Mills Land Grant Chair in Cereal Chemistry and Technology in the Department of Food Science and Nutrition at the University of Minnesota. The chair position is funded jointly by the General Mills Foundation and the University of Minnesota. Dr. Fulcher's main interests are the improved characterization of value added traits of grains and oil seed crops. Recently he has concentrated on the application of quantitative imaging (image analysis and microspectrophotometry) to increase speed and precision of evaluation of important traits in grains and their products. He arrived on campus August 1, 1989. We look forward to his continued interaction with oat workers, especially those of us at the University of Minnesota.

Dr. Don Lee, who was a post doctorate for about a year at Minnesota, left in July to accept a position in the Department of Agronomy at the University of Nebraska, Lincoln. There he has primary responsibility for teaching undergraduate genetics. During his post doctorate at Minnesota, Don initiated several molecular studies in oats including attempts to clone a gene for lipoxygenase.

Dr. Lynn Dahleen has completed her Ph.D. and is now a USDA-ARS research geneticist at the Northern Crop Science Laboratory at Fargo, North Dakota, working on barley germplasm and genetics. Her thesis research dealt with evaluating the amount and value of somaclonal variation in oat plants regenerated from tissue culture.

Several new graduate students have joined our breeding and genetics group. Mr. William Rooney began a Ph.D. program in August after earning his M.S. at Texas A & M. His research will involve identification of restriction fragment length polymorphisms (RFLPs) associated with crown rust resistance genes and an analysis of the use of RFLP markers to facilitate introgression of useful genes from exotic germplasm sources. Mr. Doug Davis joined us in June from Oklahoma State to begin an M.S. program. He will be deriving and characterizing aneuploid oat lines produced by oat haploids. The oat haploid plants were recovered by embryo rescue following application of maize pollen to emasculated oat florets. The derived aneuploid oat lines will be especially valuable for locating genes to chromosome as part of our major effort to develop an RFLP genetic map for oats. Ms. Elizabeth Hill began her M.S. program in August 1989. Her research will address whether oat cultivars differ in their ability to compete with foxtail. Grassy weeds have become a greater problem in oat production in recent years as broadleaf weeds have been eliminated, but herbicide options to control grassy weeds are limited.

MISSOURI

J. E. Berg, A. L. McKendry, and D. N. Tague

Production: Oat production in Missouri in 1989 was increased over the drought year of 1988. 110,000 acres were seeded with 60,000 acres harvested for seed, up 20,000 acres from 1988, in which a comparable amount of acreage was planted. The average state yield was 60 bu/a resulting in the production of 3.6 million bushels, representing a 150 % increase over the 1988 value. Spring moisture was adequate for planting. Rainfall was average for the duration of the season in the central and southern regions of the state, but below normal in the north where subsoil moisture was severely deficient throughout the growing season.

At Columbia, in the central part of the state, where rainfall was adequate and temperatures were cool during the grain-filling period, a 104 bu/a average was obtained in the 1989 Missouri Oat Performance Test. The top lines (over 120 bu/a) included two Missouri experimental lines (MO 8054 and MO 8139), an Illinois experimental line (IL 81-1882) and Ogle.

Both crown and stem rust moved into the crop late in the season but were not thought to significantly affect yield.

Breeding and Genetics: Conventional breeding procedures are being used to develop varieties with improved test weight and lodging resistance under conditions prevalent in Missouri during the oat growing season. Efforts are also underway to improve tolerance to barley yellow dwarf virus in Missouri lines.

NEBRASKA

T.G. BERKE AND P.S. BAENZIGER

Production:

Oat production in Nebraska in 1989 was about 10 million bushels, the smallest crop in recorded history. The acreage harvested for grain, 310,000 acres, was similar to last year but the average state grain yield per acre was lower (31 bushels/acre versus 37 bushels/acre in 1988). Dry weather in the spring allowed for early planting of oats throughout the state. The eastern half of the state received only scattered showers after planting which were enough to keep the crop going but limited the yields. High temperatures and dry conditions throughout the spring and early summer reduced yields and decreased the test weight of the grain as well. Spring oat performance data are summarized in the table which follows.

Variety Test Results:

Average performance of spring oat entries at Mead, NE in 1989.

Entry	Yield (bu/ac)	Test wt (lbs/bu)	Date Headed	Height (in)
Bates	50	35	May 26	23
Burnett	51	32	May 27	28
Don	46	35	May 29	22
Hamilton	39	31	May 27	24
Hazel	41	33	May 29	20
Horicon	51	31	May 31	23
Hytest	51	36	June 3	31
Kherson	35	27	June 6	27
Nodaway 70	44	36	May 27	28
Ogle	64	32	May 30	25
Pennuda	23	41	May 31	22
Pierce	44	31	June 9	25
Proat	50	31	June 8	26
Sandy	51	33	June 3	30
Starter	44	35	May 27	23
Steele	45	30	June 6	28
Trucker	49	36	June 4	29
Webster	39	31	May 26	23
PA 8494-4099	57	32	June 2	26
P7869 D1-5-17-3	52	31	May 31	24
MO 8054	54	31	May 30	24
Average	47	33	May 31	25
LSD 0.05	7	--	1	2

NEW YORK

Mark E. Sorrells and G. C. Bergstrom
Cornell University

1989 Spring Oat Production: The 1989 oat crop for New York State averaged 59 b/a on 155 thousand acres harvested, 7 b/a higher yield and 10 thousand more acres than for 1988. The yield increase was probably due to above average precipitation in May and June. Ogle and Porter continue to dominate the acreage planted.

Cultivar Development: It appears now that we will not release the backcross-derived line of Ogle with the non-yellow lemma color. This line is similar to Ogle except for the hull color which is grey and similar in color to Porter. Yield of this line is approximately 3% below that of Ogle; however, other selections from the backcross 4 generation appear to yield more than Ogle. Forty additional selections were tested in 1989 and 24 will be tested in regional trials in 1990. North Dakota State and Cornell have agreed to co-release ND810104 developed by Dr. Mike McMullen. It has been named Newdak. Newdak has been tested for 4 years in New York. Grain yield is averaging 2% more than Ogle and test weight is 0.5 lb/b higher.

Genetic Relationships Among Avena Sterilis Accessions: In collaboration with Dr. Paul Murphy, we are assessing the genetic variability ina sample of *Avena sterilis* accessions from the National Small Grains Collection (NSGC). We recently evaluated relationships among 174 accessions using 48 low copy number probes. The probes produced a total of 230 bands that could be scored or an average of 4.8 bands per probe. Four of the probes were monomorphic for all 174 accessions.

The number of RFLP phenotypes ranged from 1 to 16 with an average per probe ranging from 2.48 for Ethiopia to 3.69 for Iran. Nucleon diversity as defined by Nei, may be considered to be an estimate of average genetic diversity with higher numbers indicating more diversity. This estimate was relatively similar across countries and ranged from 0.281 for Ethiopia to 0.685 for Morocco. Probe band diversity ranged from 0.0 to 0.89. Principle component analysis of Nei's similarity index indicated that 82.7% of the variation could be explained by the first principle axis. The diversity was relatively homogeneously distributed with the exception of Iran and Iraq accessions. Several of those accessions exhibited unique banding patterns compared to the rest of the countries. Based on RFLP analyses we conclude that breeders wishing to sample variation in *Avena sterilis* should select one group of dissimilar accessions from the Iran-Iraq cluster and a second group made up of diverse accessions from the rest of the countries. The data will be further analyzed for correlations between other available passport data and agronomic and morphologic traits.

Publications:

Souza, E., and M. E. Sorrells. 1988. Coefficients of Parentage for North American Oat Cultivars released from 1951 to 1986. Search: Agriculture. Ithaca, NY: Cornell Univ. Agric.Exp. Sta. No. 33, 102 pp.

Souza, E. , and M. E. Sorrells. 1989. Pedigree analysis of North American oat cultivars released from 1951 to 1985. Crop Sci. 29:595-601.

Souza, E., and M. E. Sorrells. 1989. Inheritance and frequency of a null allele for diaphorase activity in North American oat cultivars. J. Hered. 80:501-503.

Souza, E., and M. E. Sorrells. 1989. Inheritance and distribution of variation at four avenin loci in North American oat cultivars. Genome. Accepted

Fritz, S. E., and M. E. Sorrells. 1990. Mass selection for seed density in populations of *Avena abyssinica x A. sativa* amphidecaploids. Euphytica. In Press.

NORTH CAROLINA

Ron Jarrett, Steve Leath and Paul Murphy
North Carolina State University

Production and Growing Season

There were 110,000 acres (a 10 percent increase) of oats planted in North Carolina in the 1988-89 season. Fifty percent of the acreage (55,000) was harvested for grain while the remaining half of the acreage was grown for cover crops, hay silage, etc. The 1988-89 season was poor for growing oats and other small grains. The season was characterized by unseasonable periods of warm weather, excess precipitation, damaging freezes, late applications of management practices, and severe increases in diseases and insects.

Production was 3.14 million bushels, 18.5 percent less than in 1988 although acres harvested remained the same. The state average yield per acre was 57 bushels compared to 70 bushels in 1988. The value of the 1989 grain production was $3.45 million, while the total value of the entire crop was $6.9 million.

The interest in quality oats continues to be good, particularly by recreational and pleasure horse owners. The future widespread use of oats grown in North Carolina for human consumption appears to be uncertain for the next several years.

The disease situation was different from normal this past season. Crown rust was at the highest level in recent years. Oat powdery mildew also was present at unusually high levels. Oat mildew was observed in breeding plots in the lower piedmont and in the coastal plain.

A composite isolate was used to evaluate the entries in the winter oat nurseries under controlled conditions. Of the 32 lines evaluated, there was a range from highly resistant to highly susceptible. The most resistant lines were: AR 820B-669, Coker 87-11, Bob, PA 7915-1342, and Coker 86-10. The most susceptible lines in these growth chamber studies were: Coker 227, Coker 820, PA 8014-599, GA-T81-1249-1, and Coker 86-8.

NORTH DAKOTA

Michael S. McMullen

The 1989 growing season was similar to 1988 with higher than normal temperatures and less than normal precipitation. These conditions resulted in lower than normal grain yield and test weight.

Production

The USDA National Agricultural Statistics Service reported 1.15 million acres of oats planted and 0.65 million acres harvested for grain in North Dakota in 1990. Average grain yield increased from 18 bu/a obtained in 1988 to 31 bu/a in 1989 which is still well below the 5 yr average of 45 bu/a.

Diseases

Due to the dry environmental conditions, development of fungal diseases was minimal during the growing season. Crown rust infection producing susceptible type pustules was observed on 'Steele', 'Dumont', and 'Valley' indicating the presence of virulence on the crown rust resistance genes *Pc-38* and *Pc-39* occurs in the pathogen. The presence of this new virulence, also observed at other locations in the USA and Canada, suggests the resistance gene combination in these cultivars may not provide crown rust resistance in commercial fields.

The occurrence of natural infection of barley yellow dwarf virus (BYDV) was less than in past years. Good symptom expression was obtained in artificially infested nurseries allowing good evaluation of BYDV tolerance in breeding lines.

Breeding

'Newdak', tested under the experimental disignation ND810104, was co-released by the North Dakota and Cornell Agricultural Experiment Stations for the 1990 growing season. A description of Newdak appears in the new variety section.

Because of apparent changes of virulence in the crown rust population, additional sources of crown rust resistance are being incorporated into North Dakota germplasm lines. Plants with additional doses of *Pc-38* (1988 Oat Newsletter, p. 108) did not exhibit more resistant infection types when inoculated with crown rust isolates virulent on *Pc-38* than plants homozygous for *Pc-38* at one locus.

Hull-less lines did not seem to tolerate the stress conditions of 1988 and 1989 as well as hulled lines. This became more apparent when evaluating populations with both hull-less and hulled lines derived from the same cross.

Ohio

O.A.R.D.C./O.S.U

R.W.Gooding and H.N. Lafever

Growing Conditions in Ohio

The oat crop in Ohio was rated fair to good overall in 1989. Subnormal temperatures and wet soils in early spring delayed planting. By May 1st, oat planting was 23 percent behind the previous year and 10 percent behind normal. Abnormally high precipitation amounts continued to be a problem throughout the growing season with precipitation from April through June 115% to 181% of normal depending on location. Temperatures were at or above normal throughout the state for the entire growing season. As a result of these unusual climactic conditions and delayed planting, oat in Ohio headed and was harvested one to two weeks later than customary. Lodging was severe in places and diseases such as crown rust and stem rust were observed in oats at Wooster for the first time since the inception of this program in 1984. BYDV was also more prevalent than usual, but no single disease severely affected oat yields or quality in 1989.

Across the state, 300,000 acres of oat were planted of which 250,000 acres were harvested. An average yield of 63.0 bu/a resulted in total oat production in Ohio of 15,750,000 bushel, an increase of 75 percent over 1988 levels.

Breeding Program

Because of unusual climactic conditions in 1989, disease pressure and lodging were abnormally high. It was possible, for instance, to get good crown rust and stem rust readings in breeding plots for the first time since 1984. BYDV susceptibility in certain breeding lines was also more discernable this year than in most. Lodging scores were quite unpredictable as lines and varieties with known resistance appeared to be as prone to lodging as those breeding lines and varieties with a history of lodging susceptibility. All lodging at Wooster occurred as the result of a single thunderstorm in late June just after heading and plots were more affected by position in the field than by genotype. This was evident by very high coefficients of variation and a lack of significant differences between test lines.

Nurseries sown at Southern Branch (Ripley, OH) and Western Branch (S. Charleston, OH) suffered from flooding damage just after planting in 1989. Flooding was so severe at Southern Branch that we were forced to abandon the DPYT nursery at that location. Flooding at Western Branch was less severe but nurseries were adversely effected and data from that location is of little value. Wet soils also delayed planting at our N.W. Branch site (Hoytville, OH). However, excellent growing conditions subsequent to planting allowed us to collect much valuable data from this location. Lodging was severe at N.W. Branch but CV's were low and a good indication of genotypic response to lodging pressure was obtained.

Generally, yields, test weights and the overall quality of the crop from Wooster and N.W. Branch while far from outstanding could be rated as fair to good.

A total of 11,392 plots were evaluated in the Ohio oat breeding and evaluation program in 1989. This was an increase of nearly 39 percent over 1988. New nurseries included the Preliminary Drilled Plot Yield Trial (Prelim. DPYT), grown at one location and the 3 ft. Purification and Increase Nursery (3ft P&I), the latter being the first step in our purification and increase procedure for release of new varieties. Also new in 1989 was a Hulless Single Rod Row (Hulless SRR) and a Hulless Yield Test. Most nurseries experienced moderate increases in size but a few were up substantially (DPYT: +22%, ARR's: +71%, Plantrow: +136%, Headrow: +22%, F3 populations: +190%). At this time, the program has reached the upper limits of growth under present funding and personnel levels and will need to be downsized somewhat in the upcoming season unless additional sources of funding are found.

We feel that excellent progress, despite the weather, was made during the 1989 season. Several experimental lines continue to look promising for release in the near future and we appear to have some hulless material that qualifies for advanced testing. New equipment acquired this year included a lab-sized gravity table. There were no changes in personnel in 1989.

OREGON

Russ Karow, Patrick Hayes, Randy Dovel
Crop Science Department
Oregon State University

Oats were planted on 105,000 Oregon acres in 1989 and harvested as grain from approximately 70,000 acres with an estimated grain yield of 98 bushels per acre. Both harvested acreage and yield are similar to 1988 levels. Unusual late spring and summer rains again contributed to high yields.

Spring oats continue to dominate with "Cayuse" still the most commonly grown cultivar. "Monida" and "Otana" acreages have increased in response to a local demand for milling oats.

Research efforts are confined to Western Regional trial evaluations and to a two-year, two-site (Corvallis and Klamath Falls) agronomic study which includes four cultivars, seeding rate and nitrogen fertilizer rate and timing differentials. Agronomic work with oats has not been done in Oregon for many years. The goal of this study is to identify production packages that best utilize the genetic potential of newer oat cultivars. Future research efforts will focus on refining production practices to produce grain better suited for the milling industry and on identification of cultivars from breeding programs both domestic and international that are suited to Oregon's many production environments.

PENNSYLVANIA

OAT BREEDING AND PHYSIOLOGY
USDA-ARS, UNIVERSITY PARK, PENNSYLVANIA

David P. Livingston, III, Joan C. Dietz, and Gerald F. Elwinger

Production: In 1989, 260,000 acres of oats were harvested at an average of 61 bu/acre (ave. yield was up 22% from 1988). Ogle and Noble were the two main cultivars grown. Moisture levels were high early in the season with a short dry spell during grain filling. At University Park, BYDV, Helminthosporium, Head Scab, and Leaf Rust were observed in most experimental plots.

Breeding: Four hulless and three hulled spring-oat composite germplasms were released in March 1989. PA-1500 and PA-11717 are both white seeded cultivars with a grain yield not significantly different from Ogle in Pennsylvania. One more year's data will be collected before deciding on a cultivar release. A new technician (Gerald Elwinger) was hired in January 1990 to manage the breeding program.

Physiology: It was found that winter oat crowns contained much lower amounts (per gram dry weight of tissue) of high Degree of Polymerization (DP) Fructan than other winter cereals. A study of fructan accumulation in rye, wheat, barley, and oat crowns over time has been completed. Plants are being grown and hardened in growth chambers, and crowns are being ground with a grinder developed in this lab specifically for grinding cereal crowns (a description of the device will be in the May-June issue of Crop Sci.). Carbohydrates are being extracted with ethanol and water and separated and quantified using HPLC. Three analytical columns arranged in series has allowed us to separate different sized fructan up to DP9. Experiments to determine what is limiting the production of high DP fructan in oat and if/how fructan composition and distribution within the crown is related to winter survival are being planned.

BYDV: Preliminary data suggested that the Barley Yellow Dwarf Virus may reduce the activity of an enzyme involved in fructan synthesis in crowns of winter oat. A cooperative agreement was initiated with Dr. Fred Gildow (Penn State Dept. of Plant Pathology) to investigate the possibility. Studies have begun to confirm the results and to measure enzyme activities in infected and non-infected plants. If the virus does inhibit activity of the enzyme, it may explain how winter survival and spring regrowth are affected by the virus. It is possible that the virus may affect barley and wheat in a similar manner. It was also found that the virus may be translocated into crown tissue (from leaves) to a different extent in some cultivars.

SOUTH DAKOTA

D. L. Reeves and Lon Hall

Production: On a relative scale we had a great year. Compared to 1988, harvested acres were up 300,000 acres, yield was up 15 bushel/acre and production was more than doubled. In spite of these numbers, it was not a good oat year for the state. Planted acres increased slightly to 1,450,000 acres, but most of the state had a dry spring with rains generally too small and too late. The average yield was 40 bu/A which is not very good considering the previous 10 years averaged 47 bu/A. Total production was 44,000,000 bushels which was only the fourth time in 50 years less than 45 million bushels. There were no disease or insect problems this year.

Varieties; The major change in 1989 has to be the big increase in Don even though there was no formal survey. Don has continued to perform quite well across the state. Other non-proven changes are likely a decline in Steele and an increase in Hytest. The variety Settler was released in 1989 and is described in another section.

Research: The importance of local environmental conditions on herbicide effects was very evident in 1984. A half pound rate of 2,4-D amino caused yield reductions from 0 to 22% at 4 locations when averaged over 6 varieties. The doubled rate (which would be typical of sprayer overlap) at the most severe location reduced yields 40%. MCPA continues to be the safest recommended herbicide as it shows no reduction at even doubled rates.

Omar Kafawin completed his Ph.D. where he tried to make directional shifts in the early generations of single seed descent. Using the 'Charlie Brown' procedure, F_2 and F_3 generations had varying plant density, temperatures, and crown rust. No shift for yield was detected by the various stresses.

Mark Brinkman completed his M.S. and is now working on his Ph.D. with Michael Lee at Iowa State University. Mark looked at the allelopathic effect of aqueous extracts of corn residue on oat seedlings. High concentrations had reductions of 24% for root and shoot dry weight, 29% for shoot length and 50% for radicle length over the low concentration.

UTAH

R.S. Albrechtsen

Utah State University

Production. Utah's 1989 oat acreage harvested for grain was up roughly 20 percent over that of the previous year. Average yield per acre was also up slightly, resulting in the highest total production in more than two decades. An acreage slightly larger than that harvested for grain was grazed or harvested for silage.

Losses from diseases and insects are generally minimal. Grasshoppers and the Cereal Leaf Beetle are serious at times. Heavy infestations of the Russian Wheat Aphid were present in winter wheat and barley plantings in some areas of the state in the late fall of 1988. Apparently winter and spring environmental conditions were unfavorable for increase and development of the aphid and resulting injury was generally light-to-absent. Some heavy infestations were noted again in the fall of 1989. Fields will require close monitoring during the 1990 season.

Oat Program. Our oat program consists primarily of growing the Uniform Northwestern States Oat Nursery to identify cultivars adapted to our growing conditions.

WISCONSIN

R. A. Forsberg, M. A. Brinkman, R. D. Duerst, J. B. Stevens
E. S. Oplinger, D. M. Peterson, C. A. Henson, R. W. Skadsen, H. L. Shands,
and K. D. Gilchrist (Agronomy) and A. H. Ellingboe (Plant Pathology)

Production: Wisconsin farmers planted about 1,000,000 acres of oats in 1989 and harvested 710,000 acres for grain and straw. The statewide grain yield average was estimated at 66.0 bu/a, up 26.0 bu/a from the drought-caused low yield in 1988. Although most areas of Wisconsin experienced moisture deficits during the 1989 growing season, rainfall received was relatively timely, and grain yields and test weights were at respectable levels. In Wisconsin, most of the nongrain oat acreage is harvested as forage, and acreage devoted to this purpose is gradually increasing.

For the second year in a row, crown rust was of minor importance; prevalence and severity were low. Oat stem rust was widely prevalent but in most fields severity was low and economic losses were minimal. In some fields, however, the stem rust caused stem breakage, reduced grain filling, and low test weight. All stem rust collections were identified as race NA-27.

Varieties: Acreages of oats grown by Certified Seed growers in 1989 indicate that Hazel, Horicon, and Ogle will be the leading varieties grown in Wisconsin in 1990. Performance data reveal that Ogle and Horicon responded more favorably to the drought conditions in 1988 and 1989 than did Hazel. Horicon was released and distributed in 1989 (see page 122, 1988 Oat Newsletter).

A major increase of X4872-1-3 was produced in 1989, and seed was released and distributed with the name DANE in February 1990. Dane is an early oat that has stiff straw, good crown rust resistance, and high grain yields. A description of DANE appears in the "new varieties" section of this newsletter.

A major increase of SN404 was produced in 1989, and seed was released and distributed with the name ENSILER in February 1990. Ensiler is a tall, late, vegetatively vigorous cultivar to be used as a forage oat either alone or in an oat-pea mixture. A description of ENSILER appears in the "new varieties" section of this newsletter.

Research:

A. Mr. M. A. Moustafa completed his Ph.D. program in December 1989 and returned to Egypt where he has a small grain breeding/research position. His thesis research, under the supervision of R.A. Forsberg, involved genetic and cytogenetic studies (a) of inheritance for reaction to crown rust (*Puccinia coronata* Cda. f. sp. *avenae* Eriks. and E. Henn.) and (b) of chromosome pairing in three Wisconsin oat translocation lines and in F_1, F_2, and F_3 progenies of translocation-line x *Avena sativa* L. crosses. Translocation lines N569-42-52 and N770-105-1 were derived from the Wisconsin 6x-amphiploid program, while DCS 1789 was a product of the derived-tetraploid program. Reactions to race 264B were determined in field and greenhouse tests, and chromosome pairing in metaphase and anaphase I and II was determined via PMC staining with acetocarmine.

Despite chromosome loss during meiosis, the translocation lines always had 42 chromosomes and showed continuous resistance to crown rust, suggesting that male and female gametes did not function unless they had the haploid chromosome number (21) and contained the chromosome carrying the gene for resistance to crown rust. A common meiotic abnormality was that termed "mispositioned bivalents" at metaphase I where one or more bivalents moved away from the main group at the time of centromere orientation. Mispositioned bivalents may be the result of homoeologous translocations induced by irradiation.

All F_1 plants of all seven crosses and their reciprocals were resistant to crown rust indicating that genes for resistance are dominant and are transferred through the pollen as well as through the egg. Quadrivalents in F_1 plants indicated the presence of reciprocal translocations. Rod bivalents and univalents at metaphase of F_1 plants demonstrated lack of complete homology between translocation-line and _sativa_ chromosomes. Chromosome rearrangements which occurred during the development of the translocation lines must be the cause of the lack of homology. Meiotic abnormalities in F_1 plants, i.e. mispositioned bivalents, bridges, and chromosome lagging, led to chromosome deficiencies which affected segregation ratios for resistance to crown rust in F_2 populations. Segregation ratios were inconsistent from test to test because of fewer-than-expected resistant F_2 plants. However, data from some tests conformed to 3R:1S ratios indicating that a single gene is controlling the resistance to crown rust in the translocation lines. Certation or selective elimination of eggs or zygotes containing a chromosome deficiency would lead to normal (3R:1S) rather than abnormal ratios. Fewer meiotic abnormalities were observed in F_2 plants than in F_1 plants, however, they were observed in both resistant and susceptible plants indicating that chromosome loss is not limited to the chromosome carrying the gene for resistance. Chromosome loss in F_2 plants led to fewer-than-expected resistant F_3 plants. Cytological observations showed that plants in abnormal segregating F_3 lines had a higher percentage of meiotic abnormalities than in plants in normal segregating F_3 lines. Meiotic abnormalities decreased sharply from F_1 to F_3 suggesting that crossing the translocation lines to _Avena_ _sativa_ followed by selfing will lead to improved chromosomal balance and a decrease in meiotic abnormalities in successive generations.

B. Mr. Louis Chapko is in the final stage of his Ph.D. program. His thesis research, under the supervision of M.A. Brinkman, focused on selection methodology for grain yield improvement in oats via two studies. The primary objective of one study was to evaluate the affect of selection for panicle weight in the F_5 generation on grain yield in later generations. Four groups (high, medium, low, and random panicle weight) were evaluated in each of three populations in 1989. In all three populations the low panicle weight group had the lowest average grain yield. In two populations the high, intermediate, and random groups were similar in grain yield. In the third population, the intermediate group had the highest grain yield, and the high and random groups were again similar in grain yield. These results indicate that it is possible to eliminate genotypes that are low in grain yield if they have low panicle weight, but selection intensity should remain modest since genotypes having high grain yield may not be easily identified by their panicle weight. Furthermore, the intensity of the relationship between F_5 panicle weight and grain yield in the yield trials was population specific. The objective of the other study was to estimate additive, additive-by-additive, and dominance genetic components of variance and to use these components to identify appropriate generations for applying selection in oats. In 1989, 325 entries from each of two populations were grown in hill plots at Madison, WI. Heading date, height, biological yield and grain yield were measured, and results are being tabulated.

C. Mr. Mohammed Cole, a student from The Gambia under the supervision of M. A. Brinkman, completed his M.S. studies in 1989. His thesis research dealt with seeding rates in oat-pea mixtures. Adding peas to oats when establishing alfalfa and harvesting the oat-pea forage at early oat heading has recently become a common practice among Wisconsin farmers. The objectives of Mr. Cole's study were to evaluate the effects of seeding rate (a) on forage yield and quality of oat and oat-pea mixtures, and (b) on alfalfa establishment. The study was conducted at Arlington, Wisconsin from 1986 to 1988. 'Porter' oats and 'Trapper' field peas were seeded in April of each year. Four oat seeding rates (10,15,10, and 25 seeds/ft^2) and five pea seeding rates (0,4,8,12, and 16 seeds/ft^2) were seeded in all possible combinations. The nursery was underseeded with 'Blazer' alfalfa at a rate of 16 lb/a. The oat-pea forage was harvested at early oat heading, and dry matter yield and forage quality were determined. Concentrations of crude protein, acid detergent fiber, and neutral detergent fiber were determined on a percent of dry matter basis, and protein yield per acre was also calculated. Alfalfa was harvested in August of the establishment year and also in early June following the establishment year. The oat-pea forage dry matter yield and quality increased as pea seeding rate increased in oat-pea mixtures, when compared to oats alone. Higher oat and pea seeding rates produced higher forage dry matter yields, but lodging increased as pea seeding rate increased from 0 to 16 seeds/ft^2. Alfalfa yield in August of the establishment year was reduced moderately by high pea rates, but not by high oat rates. Neither oat nor pea seeding rate affected growth or yield of alfalfa after the establishment year. The results showed that a seeding rate combination of 10 to 15 oat and 8 pea seeds/ft^2 produced the most desirable balance between oat-pea forage yield and quality with minimal effect on alfalfa growth and yield in August of the establishment year. Increasing pea seeding rate had a greater positive effect on forage yield and quality at lower oat seeding rates than at higher oat rates, and increasing pea seeding rate had a greater effect on forage quality than on forage yield.

D. Mr. Andreas Katsiotis, from Greece and who received the B.S. and M.S. degrees from the University of Missouri, has initiated a Ph.D. program involving studies of crosses between octaploid (2n=8x=56) and tetraploid (2n=4x=28) oat lines. The goal will be to acquire knowledge concerning (a) chromosome pairing, (b) the frequency and function of 2n gametes, (c) the breeding behavior of progenies from these crosses, and (d) interploidy gene transfer.

Guidelines for Exporting and Importing Seed

Harold E. Bockelman, USDA-ARS, National Small Grain Collection, Aberdeen, Idaho
David Manning, USDA-ARS, Plant Germplasm Quarantine Center, Beltsville, Maryland

Exporting

All seed sent to a foreign country should be inspected and receive a phytosanitary certificate. For large shipments of seed Animal and Plant Health Inspection Service (APHIS) personnel in your locality should be contacted. For small, research-sized samples the seed should be routed through the USDA Plant Germplasm Quarantine Center (address: USDA-ARS, Plant Germplasm Quarantine Center, Attn: David Manning, Bldg. 320, BARC-East, Beltsville, MD 20705). Both APHIS and ARS personnel are located at the PGQC. All necessary customs requirements are handled at the PGQC. There is no charge for this service.

Address the package to the PGQC. Inside, place a second unsealed package containing the seed, addressed to the recipient. Also include: two copies of a listing of materials enclosed; a copy of your transmittal letter or form or a copy of the original request from the foreign scientist; and any import permits or special shipping instructions. Failure to include necessary import permits can delay shipments by weeks since it will be necessary to request such a permit from the foreign scientist or country.

Importing

Any scientist importing seed should be aware of any restrictions that apply. APHIS can provide current information on applicable restrictions.

Of particular importance to oat researchers are restrictions related to *Avena sterilis*, which is classified as a Noxious Weed. Any importation or movement across state lines requires a permit from APHIS.

Elite Germplasm for the National Small Grain Collection

Harold E. Bockelman, USDA-ARS, National Small Grain Collection, Aberdeen, Idaho

Breeders are encouraged to submit their elite lines for inclusion in the National Small Grain Collection. This includes entries submitted to uniform nurseries, which have historically 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. The procedure for submission of lines is as follows:

The breeder should submit 500 g of untreated seed to the NSGC Curator (P.O. Box 307, Aberdeen, ID 83210) along with a description of the germplasm, including: donor (breeder, institution, etc.); botanical and common name; other identifiers (breeder line or selection designation, PVP number, etc); pedigree; descriptive information (of important traits and special characteristics); and growth habit (spring, winter, facultative).

The request is then forwarded to the Plant Introduction Officer. Upon assignment of a PI number the Plant Introduction Officer returns documentation (PI card) to the NSGC Curator and the originating scientist. The NSGC Curator then forwards 3000 seeds to the National Seed Storage Laboratory (NSSL) and places the remaining seed in the NSGC.

Assignment of a PI number and inclusion in the NSGC makes this 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 (see Crop Science 28: 716, 1988).

PI Assignments in *Avena* since vol. 39 (1988)

Harold E. Bockelman, USDA-ARS, National Small Grain Collection, Aberdeen, Idaho
George A. White, USDA-ARS, Plant Introduction Office, Beltsville, Maryland

PI	Genus	Species	Cultivar	Origin	Organization
527933	Avena	sativa	ENSILER	U. S., Wisconsin	UW AES
531187	Avena	sativa	SETTLER	U. S., South Dakota	SDSU AES
532793	Avena	sativa	ALFRED	France	Verneuil Semences
532794	Avena	sativa	AVESTA	France	Verneuil Semences
532795	Avena	sativa	CORY	France	Verneuil Semences
532796	Avena	sativa	SIRENE	France	Verneuil Semences
536045	Avena	sativa		Canada, Alberta	Agriculture Canada
536549	Avena	sativa	MARION QC	Canada, Quebec	Agriculture Canada
536612	Avena	sativa		U. S., Pennsylvania	USDA-ARS & PSU AES
536613	Avena	sativa		U. S., Pennsylvania	USDA-ARS & PSU AES
536614	Avena	sativa		U. S., Pennsylvania	USDA-ARS & PSU AES
536615	Avena	nuda		U. S., Pennsylvania	USDA-ARS & PSU AES
536616	Avena	nuda		U. S., Pennsylvania	USDA-ARS & PSU AES
536617	Avena	nuda		U. S., Pennsylvania	USDA-ARS & PSU AES
536618	Avena	nuda		U. S., Pennsylvania	USDA-ARS & PSU AES

Please note that assignment of a PI number does not guarantee immediate availability.

Cultivar Name Clearance

Harold E. Bockelman, USDA-ARS, National Small Grain Collection, Aberdeen, Idaho

Breeders are encouraged to submit proposed names for new cultivars for clearance in order to avoid duplication and possible trademark and other infringements. The clearance procedure is as follows:

The breeder should submit the proposed name to the NSGC Curator (P.O. Box 307, Aberdeen, ID 83210). If desired, more than one name may be submitted, listed in order of preference. This will save considerable time if a conflict is found with the first name.

The NSGC Curator checks available records (GRIN, CI/PI cards, etc.) for conflicts with the proposed name. If a conflict is found, the originating scientist is requested to submit a different name. If no conflicts (previous use of the name for that crop species) are found in the available records, the requested name is forwarded to the Variety Specialist, Agricultural Marketing Service.

The Variety Specialist checks the proposed name against possible conflicts in trademarks, etc., and then reports his findings and approval or disapproval of the proposed name to the NSGC Curator. If a conflict is found (including the previous use of the name for that crop species) the name should not be used. The Plant Introduction Officer receives copies of the correspondence.

The NSGC Curator then responds to the breeder.

EVALUATION OF NATIONAL SMALL GRAIN COLLECTION GERMPLASM PROGRESS REPORT

D.M. Wesenberg, L.W. Briggle, H.E. Bockelman, and M.A. Bohning

Systematic evaluation of accessions in the USDA-ARS National Small Grain Collection (NSGC) was initiated in 1983 under the direction of L.W. Briggle. The NSGC was transferred from Beltsville, Maryland to Aberdeen, Idaho in September and October of 1988. The NSGC evaluation program was largely under the direction of L.W. Briggle during a transition period from October 1988 to October 1989. Dr. Briggle retired effective November 3, 1989 and the coordination of the NSGC evaluation program has now been transferred to the National Small Grains Germplasm Research Facility at Aberdeen and will be under the direction of D.M. Wesenberg.

A set of descriptors appropriate for each of the principal small grain crop species - wheat, barley, oats, and rice - was established in collaboration with the appropriate Crop Advisory Committees (CAC's) prior to 1983. Data on field descriptors have been obtained on approximately 35,500 wheat accessions, 11,000 oat accessions, and 9,000 barley accessions during the 1983-89 period. Special nurseries were grown for that purpose at Aberdeen, Idaho and Maricopa, Arizona. Grain was harvested from each field evaluation nursery to replenish NSGC seed stocks for distribution to research personnel, both domestic and foreign.

Field evaluation data were 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 were 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. Weight of grain harvested from each evaluation plot was recorded. That grain will be used for further evaluation for disease and insect resistance, quality factors, and other characters in addition to distribution as referred to above.

Evaluations for disease and insect resistance were similarly initiated in 1983. Accessions submitted for formal NSGC disease and insect evaluations include the following:

Barley Yellow Dwarf	1983-89	Davis, CA 27,300 wheats 9,100 barleys 8,400 oats Urbana, IL 24,500 wheats 10,000 oats
Soilborne Mosaic Virus	1985-89	Urbana, IL 10,000 wheats
Barley Stripe Mosaic Virus	1986-89	Aberdeen, ID & Fargo, ND 10,200 barleys
Crown Rust	1983-85	Ames, IA 9,250 oats
	1986	2,000 *Avena sterilis*
Leaf Rust	1983-89	Manhattan, KS 29,900 wheats
Stripe Rust	1984-89	Pullman, WA 23,400 wheats
Stem Rust	1987-89	St. Paul, MN 9,700 wheats 184 Aegilops Fargo, ND 290 Aegilops
Spot Blotch	1985-89	Fargo, ND 10,500 barleys Athens, GA 2,200 barleys
Net Blotch	1985-89	Fargo, ND 8,500 barleys Athens, GA 2,200 barleys
Common and Dwarf Bunt	1985-86	Pendleton, OR 5,000 wheats
Karnal Bunt	1988-89	Ludhiana, India 1,522 wheats
Smut	1989	St. Paul, MN 946 oats
Hessian Fly	1983-89	Lafayette, IN 26,100 wheats
Russian Wheat Aphid	1989	Stillwater, OK 2,987 barleys

Efforts at the National Small Grains Germplasm Research Facility in 1989 focused on various germplasm enhancement activities, including research under Dr. Bockelman's direction concerned with the relationship between vesicular-arbuscular mycorrhizal (VAM) fungi and wheat; RFLPs as a tool for genetic analysis and germplasm enhancement in oats under the direction of Dr. Hoffman; regional dwarf bunt testing coordinated and conducted by Mr. Goates; processing NSGC seed requests; entry of NSGC evaluation data into the Germplasm Resources Information Network (GRIN); assignment of PI numbers to rice accessions; cooperative Barley Stripe Mosaic Virus (BSMV) serological evaluations of NSGC barley germplasm (referred to above); grow out and taxonomic evaluation of 2259 low inventory NSGC wheat accessions and 975 low inventory NSGC oat accessions; and grow out and evaluation of a wheat germplasm collection derived from a series of interspecific crosses completed by Mr. William J. Sando in the 1930s and last grown in the 1960s. Cooperative ploidy analysis of Triticum species conducted by Dr. Gordon Kimber and staff, Columbia, Missouri, continued in 1989 in cooperation with Dr. Briggle and the staff at Aberdeen. Taxonomic classifications were completed for about 3,000 previously unclassified NSGC oat accessions from CI 213 to CI 6087 with the assistance of Dallas Western. A formal agreement was established in 1989 to initiate evaluation of NSGC barley germplasm for Russian Wheat Aphid reaction at Stillwater, Oklahoma. Finally, over 3,000 oat samples have been submitted to the USDA-ARS Cereal Crops Research Unit, Madison, WI for cooperative evaluations of beta-glucan content, including nearly 2,800 recent origin NSGC oat accessions. Seven hundred additional NSGC oat accessions stand ready for submission to the Madison laboratory.

PLANT VARIETY PROTECTION OFFICE PROGRESS REPORT

Eldon E. Taylor, Examiner

The Plant Variety Protection Office (Office) received a record number of applications for protection in Fiscal Year 1989 - 330 - and issued 141 certificates. During the first 3 months of Fiscal Year 1990, 56 new applications were received and 19 certificates were issued. As of January 1, 1990, the Office was in the process of examining 468 applications for protection. To sustain these examinations, examiners continually update, expand, and revise computerized variety description files for more than 100 different crops.

On September 27-29, 1989, the Office hosted a "Workshop on the Examination of Soya Bean" sponsored by the International Union for the Protection of New Varieties of Plants (UPOV). The United States is one of the nineteen member countries of UPOV. The main purpose of the workshop was to discuss the "minimum distance" between varieties for them to be considered distinct or novel. Five member countries were represented at the workshop.

From enactment of the Plant Variety Protection Act (Act) in 1970 to January 1, 1990, a total of 3,102 applications were received and 2,240 certificates of protection were issued. As of January 1, 1990, the Plant Variety Protection Office (Office) had received 31 applications for protection of oat cultivars, only one of which was received in 1989. Eighteen of the oat applications are from experiment stations. A total of 23 certificates have been issued on oat cultivars. There were 3 oat applications pending on January 1, 1990.

Of the 23 certificates issued on oat varieties, 20 specified that the variety was to be sold by variety name only as a class of certified seed. Five oat applications have been abandoned, withdrawn, or found ineligible since the Office began processing applications.

The Office solicits descriptions of varieties which are being released without variety protection. Only adequate descriptions of existing varieties can preclude issuing certificates on varieties identical to previously released varieties. We would appreciate copies of any descriptions prepared for other organizations, such as the Certified Small Grain Variety Review Board of the Association of Official Seed Certifying Agencies (AOSCA). However, Review Board information is not used by the Office unless permission is granted by the applicant.

Application forms, Exhibit C forms (Objective Description of Variety) and information may be obtained from:

Plant Variety Protection Office
Commodities Scientific Support Division, AMS
U.S. Department of Agriculture
National Agricultural Library Building, Rm. 500
Beltsville, Maryland 20705-2351
(301) 344-2518

Application should be made to the above address on Form CSSD-470 along with the necessary exhibits and at least 2500 viable untreated seed of the variety. The filing and search fee of $2150 is payable by check or money order to the "Treasurer of the United States" at the time of application. The required exhibits and their contents are listed and described on the application form. Applications will not be filed until all required exhibits, fees and seed are received in the Office. A $250 allowance (issuance) fee will be requested by the Office when the search is completed and the application variety is deemed eligible for a certificate of protection.

The following table summarizes the status of all applications in the Plant Variety Protection Office as of January 1, 1990:

Total applications received	3,102
Total applications received from foreign countries	288
Total applications received from public institutions	338
Total applications abandoned, ineligible, withdrawn, or denied	388
Total certificates issued	2,240
Total certificates in force	2,229
Total certificates issued as certified seed only	728
Total applications pending final action	468

The breakdown of applications pending final action is as follows:

Certificate stage	6
Search stage	88
Extended time	30
Pending examination	350
Reconsideration	0

Class Breakdown of:

Applications Received:			Certificates Issued:		
2,103	agricultural	67.8%	1,529	agricultural	68.2%
147	ornamental	4.7%	93	ornamental	4.2%
852	vegetable	27.5%	618	vegetable	27.6%

Certificates have been issued in 83 crops. The greatest number of certificates have been issued in the following 20 crops:

soybean	498	corn	131	bluegrass	42	onion	25
wheat	229	lettuce	93	marigold	40	tobacco	23
pea	195	fescue	85	barley	38	oat	23
bean	180	ryegrass	73	tomato	36	cauliflower	20
cotton	160	alfalfa	60	watermelon	25	rice	19

RELEASE OF BARLEY YELLOW DWARF VIRUS TOLERANT SPRING OAT GERMPLASM LINES

F. L. Kolb, C. M. Brown, and A. D. Hewings
University of Illinois and ARS-USDA

Seven spring oat (Avena sativa L.) germplasm lines with a high level of tolerance to barley yellow dwarf virus (BYDV) have been cooperatively developed and will be released by the Illinois Agricultural Experiment Station and the USDA. The lines resulted from several cycles of selection for BYDV tolerance and other desirable traits, followed by intermating of selected genotypes. All seven of the germplasm lines were significantly more tolerant to BYDV than Ogle based on visual symptoms in PAV-IL inoculated hills. Thus, these lines represent an improvement in the level of BYDV tolerance compared to Ogle which is itself quite tolerant to BYDV.

The parentage of the seven lines and BYDV rating compared to Ogle are presented in Table 1.

Most of the lines tend to be slightly taller and later in maturity than Ogle. Based on our tests, several of the lines, IL 85-1538, IL 86-4407 and IL 86-5698 are resistant to crown rust races prevalent in Illinois. All of the lines except IL 86-4189 are resistant or moderately resistant to loose smut.

Table 1. BYDV rating and pedigrees of seven BYDV tolerant spring oat germplasm lines and BYDV rating of Ogle.

Illinois Seln. No.	Pedigree	BYDV rating[1]
IL 85-1538	Hazel/Coker 81B151	2.2
IL 86-1150	Ogle*2/IL 75-5743	1.9
IL 86-4189	Lang/IL 75-5662//IL 79-1776	2.2
IL 86-4407	Lang/IL 75-5662//IL 75-5743/Larry	2.3
IL 86-5262	MO 06425//Otee/Noble/3/IL 75-5743/Larry	2.0
IL 86-5698	IL 74-5234/IL 75-5662//IL 81-1454	1.8
IL 86-6404	IL 75-5743/IL 75-5662//IL 81-1454	2.0
Ogle		3.3
$LSD_{.05}$		0.7

[1] Visual symptoms rated on a scale. 1 = very tolerant, 9 = very sensitive. Three replications of PAV-IL infected hills were grown in 1988 and 1989 and rated twice each year.

DANE OATS

R. A. Forsberg, M. A. Brinkman, and R. D. Duerst

Dane is a new, early, high yielding oat variety developed by workers in the Department of Agronomy, College of Agricultural and Life Sciences, University of Wisconsin-Madison. Tested as Wisconsin selection X4872-1-3, seed of Dane was released by the Wisconsin Agricultural Experiment Station to Certified Seed growers in February 1990, and Certified Seed will be available for general farm production in 1991. The name is after Dane County, a large agricultural county in south central Wisconsin in which Madison and UW-Madison are located.

The pedigree of Dane is:

Holden/4-Irr./Garland/2/6x-amphiploid/2*C.I.6936/3Garland/5/Froker/6/Ogle

The final cross, X3530-47/Ogle, was made in 1978. Yield testing of X4872-1-3 began at Madison in 1986, and it was tested statewide and in the USDA Uniform Early Oat Performance Nursery (UEOPN) in 1988 and 1989.

Dane is early in maturity, heading 7 days earlier than Hazel and 5 days earlier than Ogle at Madison. Dane was second earliest in heading among 24 entries in the 1988 UEOPN and third among 32 entries in the 1989 UEOPN. In both the Arlington drill plot series and in statewide Wisconsin tests for the 3-year period 1987-89, the average yields of Dane (96.2 and 73.6 b/a, respectively) were exceeded only by Valley (99.0 and 74.2 b/a) and Horicon (96.5 and 73.8 b/a). Dane ranked first for grain yield among 24 entries in the 1988 UEOPN (15 locations) and it ranked 15th of 32 entries in the 1989 UEOPN (15 locations). Dane has yellow, nonflorescent kernels with higher groat percentage than other oat cultivars. Test weights have been average or above in Wisconsin tests. Straw strength is excellent, equal to that of Ogle. Dane has excellent resistance to crown (leaf) rust including seedling and adult-plant resistance to races 264B, Pc62, Pc58, and Pc59. Although susceptible to barley yellow dwarf virus in Illinois screening tests, Dane demonstrated field tolerance under severe natural infection in the 1986 Madison nursery. It has been resistant to smut in Wisconsin tests, and it showed high tolerance to stem rust under severe natural infection in the 1989 Madison nursery.

Application for Plant Variety Protection has been submitted for Dane oats.

DERBY OAT

B.G. Rossnagel and R.S. Bhatty
Crop Development Centre
University of Saskatchewan

Derby, a new oat variety developed at the Crop Development Centre, University of Saskatchewan, has been registered for sale in Canada.

Derby, selected and developed from a cross between the Centre's previous variety Calibre, and another popular variety, Cascade, is well adapted to the majority of Saskatchewan's oat growing region, with the exception of south-east Saskatchewan where oat rusts are a limiting factor. It is well suited to all of Alberta's oat producing region.

Derby is similar to Calibre, demonstrating high yield potential combined with large kernels, very high test weight and good protein content. However, it is a significant improvement over Calibre in terms of grain plumpness and has even lower hull content than Calibre, which is already one of the best available cultivars for this trait. Derby is also slightly earlier maturing than Calibre, but not as early as Cascade.

Derby's combination of yield potential and kernel quality should make it a very competitive variety in the oat marketplace. It is anticipated that it's heavy, plump, white grain should be attractive to the domestic and export milling and race horse markets. These characteristics are also desirable for the remainder of the oat market, i.e. the feed industry. Seed for commercial planting should be in good supply for the spring of 1991.

The Crop Development Centre is funded by the Saskatchewan Agriculture Development Fund and the oat research program receives additional support from the Quaker Oats Co. of Canada and Robin Hood Multifoods.

ENSILER OATS

M. A. Brinkman, R.A. Forsberg, J. B. Stevens, and R. D. Duerst

Ensiler is a new forage oat developed by workers in the Department of Agronomy, College of Agricultural and Life Sciences, University of Wisconsin-Madison. Tested as Wisconsin selection SN404, seed of Ensiler was released to Certified Seed growers in February 1990, and Certified Seed will be available for general farm production in 1991. Ensiler is to be grown and used as a forage oat, hence its name. It is not intended to be a grain oat.

Ensiler was selected from an Otee/X2286-2 cross. The pedigree of Ensiler is: Otee/4/X666-2/Lodi/2/PI295909/3/CI7463/Lodi/2/PI295909

Ensiler is a tall, late maturing oat that heads 2 to 3 days later than Porter. Forage yield and quality of Ensiler were evaluated in seven tests conducted at Arlington, Wisconsin in 1986-89. Ensiler has produced high forage yields, high protein yields, and good forage quality in these tests (Table 1). Ensiler should be harvested for forage in the late boot to early heading stage. Harvesting after heading will result in higher forage yields but lower forage quality, and will increase the probability of lodging. Harvesting Ensiler in the late boot to early heading stage will allow first-year harvesting of underseeded alfalfa in mid to late August in much of the Upper Midwest.

Ensiler has been tested in grain yield trials throughout Wisconsin for three years, and has been below average in grain yield in most of these tests. It produced above-average grain yields when crown rust was present in several trials in 1987, but yielded poorly under the drouthy conditions of 1988. A Foundation Seed increase field near Kewaunee, Wisconsin yielded 80 bu/a of clean seed in 1989.

Ensiler has excellent resistance to crown rust and smut, but is susceptible to race NA-27 of stem rust. It also has demonstrated good tolerance to BYDV. At ripening Ensiler is 4-6 inches taller than Porter and Dal, 1-2 inches taller than Steele, and 1-2 inches shorter than Lodi. It is similar to Lodi and Steele in straw strength, but is not as stiff as Dal.

Table 1. Forage characteristics of eight oat cultivars harvested at early heading in seven tests at Arlington, Wisconsin, 1986-89.

Entry	Harvest date	Forage yield	Crude protein	Protein yield	ADF[2/]	NDF[2/]	Milk yield[1/]	Milk value[1/]
	June	lb/a	%	lb/a	%	%	lb/a	$/a
Webster	8	2570	15.0	386	28.8	49.6	1117	139
Ogle	11	3350	13.0	436	31.3	53.6	880	109
Hazel	11	3480	12.9	449	30.8	54.1	899	111
Centennial	13	3346	12.8	428	30.6	54.1	877	109
Porter	16	3914	12.8	501	30.9	54.8	922	114
Lodi	16	4048	12.7	514	31.6	55.7	779	97
Dal	17	3924	13.1	514	31.4	54.5	913	113
Ensiler	18	4314	13.2	569	31.2	52.2	1320	164
Mean	14	3618	13.2	475	30.8	53.6	963	120
Prime alfalfa (bud stage)			19-22		28-32	37-42		

1/ Milk yield and value assumptions: 1350 lb cow, 3.8% milk fat, 18,000 lb milk/year, TMR (total mixed ration), and a milk price of $12.40 cwt.

2/ Lower value = best.

NEWDAK

Michael S. McMullen

'NEWDAK' spring oat was developed at the North Dakota Agricultural Experiment Station in cooperation with the USDA-ARS and co-released by the North Dakota and New York Agricultural Experiment Stations in 1990. It was tested under the experimental designation, ND810104. Newdak was selected from the progeny of a series of crosses with the pedigree RL3038/'Goodland'//'Ogle'. The last cross was made in 1979. Newdak was selected as an F_4-derived line in the F_5 generation in 1980.

Newdak has been tested in replicated yield trials in North Dakota since 1982, and in the North Dakota Oat Variety Trials since 1985. The grain yield of Newdak has been equal to or higher than other cultivars tested in North Dakota during this period. It heads about 4 days earlier than 'Dumont' and produces exceptionally high grain yield relative to its early maturity. Newdak has lodging resistance similar to 'Steele'. The test weight of Newdak is slightly lower than that of Dumont, but its groat content has been slightly higher than Dumont. The whole oat protein content of Newdak is slightly higher than Dumont, but lower than Steele. The plant height of Newdak is about midway between 'Valley' and 'Dumont'. Newdak was entered in the Uniform Midseason Oat Performance Nursery from 1985 to 1987 and produced high grain yields over many environments. The kernels of Newdak are white.

Newdak exhibited excellent resistance to crown rust under conditions of heavy infection in 1986 and 1987. Seedling tests with critical crown rust isolates indicate Newdak possesses the crown rust resistance genes *Pc-38* and *Pc-39*. This gene combination provided excellent crown rust resistance until 1989. However, the identification of isolates virulent on this gene combination suggests they may not provide effective protection in the future. Seedling tests with critical stem rust isolates indicate Newdak possesses at least the stem rust resistance gene *Pg-13* which provides good protection from the prevalent stem rust races. Newdak exhibited greater tolerance to barley yellow dwarf virus than any cultivar adapted to North Dakota.

OZARK

R.K. Bacon

AR 102-5 was released in the summer of 1989 for its improved winterhardiness and its adaptation throughout the state which will be increasingly important if oat production continues to spread to areas outside the Grand Prairie region of Arkansas. The line was named 'Ozark' because some of the breeding work took place at Fayetteville and because this line has sufficient winterhardiness to survive the winters even in the northern region of Arkansas. Ozark originated from the cross Florida 501/PI 296254 made in 1972. PI 296254 is a plant introduction from Israel classified as *Avena sterilis*.

More emphasis has been given to winterhardiness recently in the oat breeding program at the University of Arkansas. In 1989, the severe winterkill which occurred in small grains allowed good ratings for damage in nursery plots. Ozark showed excellent winterhardiness as indicated by an average winterkill rating (0-10) in 32 plots of 2.1 compared to 3.8 for 'Coker 227', 5.0 for 'Bob', and 5.2 for 'Brooks'. This line had been identified as winterhardy in nursery plots in 1984, and since then had been tested in the USDA Uniform Winterhardiness Oat Nursery. AR 102-5 performed well, having a mean winter survival of 67.0% compared to the test mean of 56.6% and 71.2% for the 'Wintock' check from 1985-1989.

Ozark has shown excellent yield potential in nursery trials at various Arkansas locations. Table 1 gives yield averages and agronomic characteristics of Ozark and three current oat cultivars. Averaged across the 13 location-years, AR 102-5 yielded 14% more than Bob. Ozark has a test weight similar to Bob. Preliminary tests have shown Ozark to have slightly lower protein content than Bob which was selected for high protein.

Ozark is approximately 3 inches taller than Bob. The additional height does not appear to increase lodging (Table 1). It matures approximately 3 days later than Bob but is similar in maturity to '833' and 'Nora'. Although very limited disease data are available, Ozark appears to be similar to Bob in reaction to stem rust, smut, halo blight, and crown rust. Much of the oat produced in Arkansas is sold as seed to other states where it will be used for forage production. Across 12 forage tests in 4 surrounding states, Ozark produced 5598 lbs/A compared to Bob which produced 4900 lbs/A. Breeder seed is available to other public institutions upon request.

Table 1. Yield and agronomic data* for Ozark and 3 other cultivars.

	Yield[1]	Test weight	Plant Height	Maturity Date	Lodging
	bu/A	lb/bu	in		%
OZARK	108.9	36.3	37	05/21	24.4
BOB	95.3	36.5	34	05/18	26.5
833	98.8	33.8	36	05/20	27.9
NORA	97.8	34.4	39	05/21	25.0

*Data taken from State Variety Tests from 1987-89 at three locations.
[1]A mean of 13 location-years in nursery trials in Arkansas.

PREMIER

D.D. Stuthman, R.D. Wilcoxson, and H.W. Rines
University of Minnesota

'Premier' spring oats was developed at the Minnesota Agricultural Experiment Station in cooperation with the USDA-ARS and released in 1990. The pedigree of Premier is Wisc 1986-1/Noble. (In earlier communications the pedigree was given as Wisc 1961-1/Noble.) The pedigree of Wisc 1986-1 is Ark. 674/CI 4629 (Clinton type)//RL524-1/3/Ark. 674/CI 4629/4/Clintford/Garland.

'Premier' oats has been tested in Minnesota statewide trials since 1982 under the designation Mn 81229. It has also been included in similar trials of several surrounding states for the last several years. It is midseason in maturity, heading two days later than Preston and one day earlier than Hazel. In Minnesota Variety Trials for the seven year period, 1983-89, Premier and Steele were equal in grain yield and better than all other cultivars tested. For the five year period, 1985-89, only Don was significantly higher yielding than Premier in these same tests. Premier was also included in the Uniform Midseason Oat Performance Nursery for four years, 1983-86.

Premier has excellent test weight and a high groat percentage. Its lodging resistance is at least average. The smut resistance of Premier is very good and it has a small amount of resistance to crown rust and tolerance to BYDV.

The seed of Premier is yellow, nonfluorescent and very plump. Plant Variety Protection will be applied for with the option that Premier may be sold for seed by name only under the certified class.

SELNUDCAST OAT

Jose A. Sierra F.

'SELNUDCAST' is a new spring naked oat devloped at Tundama Experiment Station in Cundinamarca State Colombia, South America, by Jose A. Sierra F., research coworkers, and research people from Quaker Oats Company. It is an early cultivar derived from the heterogenous variety 79 Castellar SELN (Hull-less) received with the 1982 Experimental Oat Nursery International Oat Breeding Project from the Quaker Oats Company. Single panicles exhibiting naked seed, good disease reaction, desired plant height, etc. were selected to produce the naked cultivar Selnudcast.

Selnudcast under our enviromental conditions grows well from 2,600 m. up to 3,100 above sea level. Plant height of Selnudcast ranges between 120-170 cm and it has good straw strength and lodging resistance.

Selnudcast is early requiring 60-70 days from seeding to flowering and 155-170 days from seeding to maturity, depending on the altitude. It yields over 2 tons/ha when grown in areas best suited.

Selnudcast is a naked variety and possesses a lemma and palea which are of light texture similar to that of the outer glumes neither which adheres closely to the caryopsis so that in threshing they are readily separated leaving the naked grain. The panicles are equilateral, spreading or open with several branches and develop several florets extending well beyond the limits of the outer glumes.

Selnudcast is moderately resistant (MR) to stem rust, moderately susceptible (MS) to crown rust and the reaction to barley yellow dwarf (BYDV) is 2, on a scale of 1 to 9.

Quality tests indicate that Selnudcast will be a contribution to the development of a better "human food" class of oats for the Colombian people.

SETTLER

D. L. Reeves

Settler is a midseason oat released by the South Dakota Agricultural Experiment Station in 1989. The name Settler is in recognition of the state centennial this year and acknowledges the pioneers who came to this region.

The pedigree is Benson//WI2221-2/Noble. The last cross was made in 1978. In statewide and regional tests, it was tested as SD 820045.

Settler is midseason to medium late in maturity generally being between Lancer and Wright. Plants are moderately tall being equal to Dal. In South Dakota it usually leans but does not lodge badly. Settler was regionally tested in the Uniform Midseason Oat Performance Nursery in 1986-88. In South Dakota tests, Settler usually ranks first or second for yield.

The grain of Settler is white with midsized kernels. Under some environmental conditions some dark pigmentation is present in the hulls. There is a very small percentage of non-fluorescent kernels. Test weight is very good. The groat oil percentage is fairly low while the groat protein is high. Settler has good resistance to crown (leaf) rust and is moderately resistant to Barley Yellow Dwarf. For smut, Settler is rated moderately resistant.

SOME CHARACTERISTICS OF NEW YUGOSLAV SPRING OAT CULTIVAR SLAVUJ

D. Maksimovic, M. Krstic, B. Ponos and D. Knezevic

A new Yugoslav spring oat cultivar, Slavuj, was approved by Yugoslav Variety Approvement Commission in 1989. The new cultivar was created by Dragoljub Maksimovic and Miodrag Krstic. Slavuj originated from crossing of English spring oat genotypes UPBS-- 3024 x UPBS - 3074/24.

Some characteristics of productivity and grain quality of Slavuj and the standard cultivar Condor are presented in Table 1.

Table 1. Some characteristics of new spring oat cultivar Slavuj and standard cultivar Condor investigated in trials in Yugoslavia.

Characteristic	Year of investigation	Mean		LSD (kg/ha)	
		Slavuj	Condor	0.05	0.01
Mean grain yield in Kragujevac (kg/ha)	1986-1989	6810	6019		
Mean grain yield in six locations of investigation (kg/ha)	1986-1988	4246	3838	152	200
Highest grain yield (kg/ha)	1986-1989	7852	7000		
Mean 1000 kernel weight (g)	1986-1989	28.82	27.42		
Mean test weight (kg)	1986-1989	46.51	44.82		
Mean plant height (cm)	1986-1989	112	108		
Kernel crude proteins (%)	1988	14.20	12.90		
Kernel crude lipids (%)	1988	6.30	4.90		

Besides being statistically significantly higher yielding than the standard variety Condor, Slavuj has higher kernel crude protein and kernel crude lipid content of 1.3% and 1.40% higher, respectively, than Condor. Seed production of Slavuj has begun in Yugoslavia.

FINNISH YTY OAT VARIETY

Marketta Saastamoinen

'Yty' oat was released in 1989 by the Institute of Plant Breeding, Agricultural Research Centre of Finland. It originates from the cross 'Rhyti'/'Titus' (Fig. 1). A head selected from the F_5 population led to the line Jo 1057 which was named Yty.

Yty is a rather early high-yielding variety with quite large white seeds. It has larger seeds that the other oat varieties cultivated in Finland. Its yields are as high as those of 'Puhti', the standard variety, but it is two days earlier than Puhti (Table 1). Only 'Nasta' and 'Veli' are earlier maturing than Yty in Finland. Yty has a rather long straw but like Puhti and Veli it has good loging resistance. Yty's hectolitre weight is higher than Puhti's. Yty has the same protein content as Puhti. The husk content of Yty is slightly higher than that of Puhti, but lower than that of 'Hankkija's Vouti', Nasta, 'Svea' and Veli.

Yty was put on the market especially because of its earliness and ability to produce high yields within a short growing time.

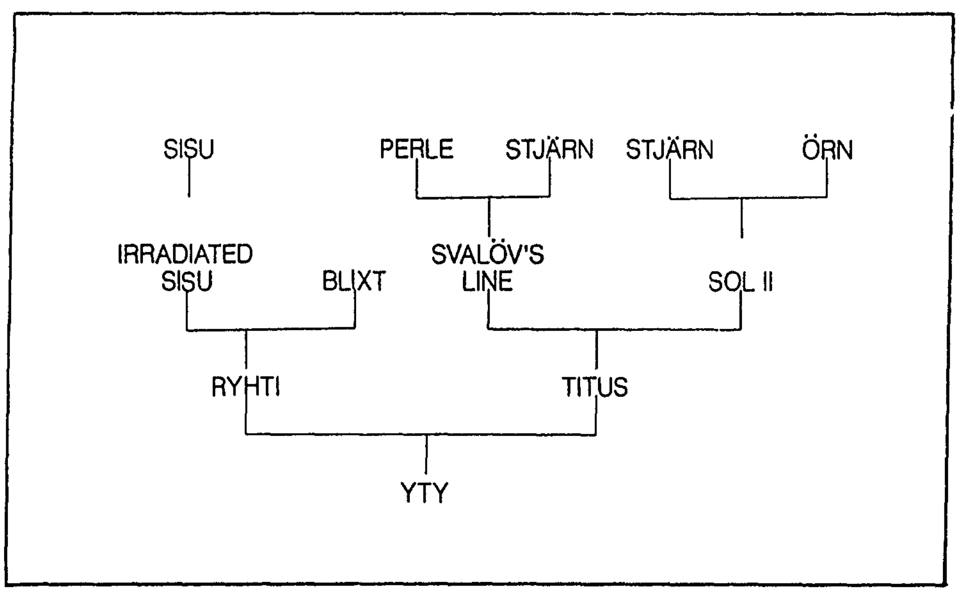

FIG. 1. PEDIGREE OF YTY OAT VARIETY

Table 1. Performance of Yty oat variety compared to other oat varieties cultivated in Finland in official variety trials in 1982-89

Variety	Breeder[1]	Number of trials n	Grain yield kg/ha	Growing time to yellow ripening days	Lodging %	Height cm	1000 grain weight g	Hl-weight kg	Protein %	Protein kg/ha	Husk %
Yty	Jo	90	5210	97	18	93	36.2	51.9	13.2	583	23.4
			=100			deviation from Yty					
Hja's Vouti	Hja	64	101	+3***	+6*	-3***	-2.4***	+0.2	-0.6***	-19**	+0.8***
Nasta	Jo	27	92***	-1	-2	-6***	-2.8***	+1.7***	+1.0***	-11	+0.2
Puhti	Jo	90	100	+2***	+2	+5***	-0.9***	-0.6***	0.0	+1	-1.4***
Ryhti	Jo	24	97*	+4***	+5	+8***	-0.3	+0.9**	-0.4**	-36***	0.0
Svea	Sv	29	99	+3***	+6	-3**	-2.2***	+0.9*	-0.6***	-32*	+0.9***
Veli	Jo	90	96***	-3***	0	-2***	-1.4***	+1.3***	+0.7***	+1	+0.2
Virma	Hja	74	101	+2***	-5*	-5***	-3.4***	+0.5***	-0.1	-3	-1.1***

Significance: *p < 0,05; **p < 0,01; ***p < 0,001

Breeder[1]: Jo = Institute of Plant Breeding, Agr. Res. Centre; Hja = Hankkija Plant Breeding Institute; Sv = Svalöv AB

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