Sorrells

1987

OAT NEWSLETTER

Vol. 38

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April 1988

Sponsored by the National Oat Conference

Transfer [illegible] using [illegible] p. [illegible]
Peduncle extension p 48
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Accession Prelims P 72
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1987

OAT NEWSLETTER

VOLUME 38

Edited in the Department of Agronomy, North Dakota State University, Fargo, ND 58105. Costs of preparation financed by the Quaker Oats Company, Chicago, Illinois 60654.

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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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Fargo, ND 58105, USA

Please Do Not Cite The Oat Newsletter in Published Bibliographies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".

REPORT OF NOIC LEGISLATIVE COMMITTEE

Deon D. Stuthman

The Legislative Subcommittee of the National Oat Improvement Council made its 11th successive annual visit to Washington, D.C. on February 8-11, 1988. The current members are K.J. Frey, Paul Murphy, H.W. Ohm, D.J. Schrickel, D.D. Stuthman, and S.H. Weaver. Drs. Murphy and Weaver made the trip for the first time and will replace Frey and Schrickel, respectively, for 1989. Mr. Pat Racey from the Quaker Oats Company arranged the Capitol Hill visits and accompanied the group for that part of the visit. Dr. C.F. Murphy arranged the group's itinerary for visits with USDA people both in Washington and in Beltsville.

The items we supported this year were: continued increased funding for plant germplasm efforts in ARS and construction money for the proposed addition to the National Seed Storage Laboratory at Fort Collins, Colorado. Although our visit preceeded the presentation of the President's budget proposal to Congress, we have subsequently learned that the construction money for the lab addition was included in the President's budget proposal for 1989 but not new funds for plant germplasm. It should be noted that ARS germplasm funding was increased this past year from $18+ million to $25.5 million so it is not surprising that no additional funds were recommended for the new budget.

One nonbudget concern of interest was raised by Congressman George Brown's staff--what kinds of plant materials should be patentable. In our discussions with Dr. Mary Carter, USDA-ARS Deputy Administrator, and with Dr. Orville Bentley, Assistant Secretary of Agriculture, we urged that ARS provide leadership in making input into the US Patent Office regarding the best approach to patenting plant varieties. Dr. Bentley asked us to provide him with names of individuals who might provide suitable advice on this topic.

This year we also had several discussions on the commodity programs as they affect oat acreage. We met with congressional staff who will be working on the next Farm Bill as well as with Dr. John Miranowski, Director of the Natural Resources Division of the Economic Research Service of the USDA. This latter group has responsibility for analyzing possible outcomes of alternative proposals for various commodity programs.

Our discussions with the National Program Staff at Beltsville included USDA efforts on barley yellow dwarf virus, beta glucans, and continued development of the GRIN data system for the National Oat Collection.

We welcome any suggestions for other issues which you feel we should pursue. The group appreciates the financial assistance provided by the Milling Oats Improvement Association.

AMERICAN OAT WORKERS' CONFERENCE COMMITTEE, 1986-89

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- D. D. Stuthman, Past Chairman
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- M. S. McMullen, Editor, Oat Newsletter

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AUSTRALIAN OAT RUST SURVEY - 1986-87

J. D. OATES

For the second successive season dry conditions through the cereal belts of Australia have restricted the occurrence of the oat rusts. Financial and time factors have restricted the ability of the Institute to conduct its own survey, further inhibiting the effectiveness of the survey.

Only 112 accessions were made, 62% were identified as being on wild oat species. Three accessions failed to germinate. One sample was on a genus (Lolium perenne) other than Avena.

OAT STEM RUST - Puccinia graminis f. sp. avenae

Of 59 viable accessions 85 isolates were identified. The International Races and Local Strains recovered during the 1986-87 Survey are listed in Table 1, which also lists their Virulence Patterns, Frequency and Area from which each was recovered.

Race 22 again is the predominant strain in Western Australia; observations on the strain makeup in other areas are negated by the very small numbers recovered.

The Lolium perenne sample yielded race 24 and was from the South Perth plots of the W. A. Department of Agriculture.

OAT LEAF (CROWN) RUST - Puccinia coronata f. sp. avenae

Seventeen races were identified on the international set of differential varieties (Table 2). No new races were recognized although a number of rare races were isolated in Queensland and northern N.S.W. e.g. race 384 first recovered in 1984-85 and race 289 identified once in the 1979-80 season.

From 59 viable accessions, 69 isolates were identified. The very low numbers preclude generalizations regarding the race population; although again races 216 and 240 were the most frequent isolates respectively from Queensland and Western Australia.

Table 3 lists the Frequency of each race and the area from which each was isolated in the Survey Period April 1986 to March 1987.

Supplemental differential lines Pc 38, 39, 45, 50, 55, 56, Ascencae, TAM 301, TAM 312, Swan and Mortlock were used to identify a further 16 strains of the above races. Line Pc 45 was susceptible to 48% of isolates, and Pc 38 to 3%, continuing the decline in the number of Pc 38 virulent isolates evident since the 1980-81 survey. Strain isolates were identified with virulence for the combinations Pc 38, 45, Pc 48(49) and Pc 45,48 [( ) = partial virulence].

Table 1. Frequency and distribution of oat stem rust races identified during the 1986-87 Australian Oat Rust Survey.

Race	Virul. Pg	Qld	N.NSW	S.NSW	Vic	SA	WA	Total
1	-		2	1	1		3	7
2	3	1		2	3	1	11	18
2+Sa	3,Sa						4	4
6	1,2,3			1				1
20	1,2,3,4	5		3	1			9
22	2,3,4	1	1	2	1	1	28	34
24	2,4	3	1	1		1	4	10
Saia	Sa	1			1			2
		11	4	10	7	3	50	85

Table 2. Oat leaf rust strains identified during 1986-87 Australian Oat Rust Survey on Standard International Set of differential varieties.

	Differential Variety*										
Race	1	2	3	4	5	6	7	8	9	10	No. Isolates
201	-	-	S	S	-	-	-	-	-	-	3
203	S	-	S	S	-	-	S	-	-	-	7
211	-	-	S	S	-	-	S	-	-	-	2
216	S	S	S	S	-	-	S	-	-	-	10
226	S	-	S	-	-	-	S	-	-	-	11
230	-	-	S	-	-	-	S	-	-	-	4
231	S	-	-	-	-	-	S	-	-	-	2
236	S	-	S	-	-	-	-	-	-	S	1
237	S	-	S	-	-	-	-	-	-	-	1
240	S	-	-	-	-	-	-	-	-	-	8
260	S	-	S	-	S	-	-	-	-	-	2
264	S	S	S	S	S	S	S	S	S	S	1
276	S	-	S	S	S	S	S	S	S	-	3
289	-	-	S	-	-	-	-	-	-	S	1
294	-	-	S	S	S	S	S	-	-	-	2
295	S	-	S	S	S	S	S	-	-	-	1
384	-	-	S	S	S	S	S	S	S	-	10

* 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 1986-87 Australian Oat Rust Survey

Race	Qld	N.NSW	S.NSW	Vic	SA	WA	NZ	CH	Total
201							3		3
203	5	1	1						7
211	1						1		2
216	8	2							10
226	1	2	3	2	1	1		1	11
230			1	2	1				4
231					1	1			2
236	1								1
237						1			1
240						8			8
260								2	2
264		1							1
276	3								3
289	1								1
294	1	1							2
295		1							1
384	6	4							10
	27	12	5	4	3	11	4	3	69

The Rust of Oats in 1985, 1986, and 1987 in the United States

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

1985 Oat stem rust--By mid-January stem rust was severe in south Texas; however, subsequent cold weather delayed rust development. By early April stem rust was scattered throughout south Texas fields and plots, and as the season progressed it became severe. Disease in this area provides much of the rust inoculum for the northern oat growing area. No oat stem rust was reported from the Gulf Coast states except Florida and Texas. By mid-May rust was found as far north as west central Kansas, which was a month earlier than normal. Throughout eastern South Dakota in mid-June rust was present in light amounts. The early planting of oats in the northern Great Plains and the extensive dry areas in the Dakotas and southeast Minnesota reduced the potential for losses except for late-planted fields. This was the most severe oat stem rust epidemic observed in the past 30 years in Illinois and Wisconsin where moisture was not limiting.

The most prevalent race in the U.S. in 1985 was race NA-27, making up 96% of the isolates (Table 1). All isolates from commercial fields were of this race in the U.S. This race has predominated in the U.S. population since 1965. However, NA-27 has only caused severe losses in the Dakotas and Minnesota in 1977 and again in 1985 in Wisconsin and Illinois. Race NA-16 was found in Texas and the Dakotas. Race NA-5, was found in nurseries scattered throughout the U.S. and NA-10 was found in California. Races NA-1, NA-23, NA-24 and NA-39 were found in trace amounts. NA-24 was found in the northern oat growing area of the U.S. and Ontario, Canada, and one isolate from Texas.

1986 Oat stem rust--In early April severe oat stem rust was found in south Texas fields and plots where it had overwintered. The rust moved into northern Texas but a dry period limited development. Stem rust was found in almost every field in the northern oat growing area (Minnesota and the eastern Dakota's) but since the inoculum arrived in light amounts, losses were light except for a few late-planted fields in central Minnesota, southeast South Dakota, and northern Wisconsin. Little rust developed north of Fargo. As in previous years oat stem rust was severe on wild oats (*Aveva fatua*) in eastern North Dakota and northwestern Minnesota but was unusually late in the western Dakota's. Note the difference in virulence of the California (western) and Great Plains rust populations (Table 2).

1987 Oat stem rust--Traces of oat stem rust were found in early April in southern Texas, Louisiana and Florida fields and plots. There was much less rust than usual in this area. The Northern Plains also had less stem rust than normal which probably was due to the dry summer and the low inoculum level in the Southern Plains. Traces of oat stem rust were found on wild oats (*Avena fatua*) in eastern North Dakota and northwestern Minnesota. The Great Plains oat stem rust race population consisted of NA-27 (Table 3).

Oat Crown Rust

1985--Severe crown rust was observed in south Texas fields and plots in early April. By mid-May rust was prevalent throughout oat fields in Kansas and Oklahoma. The first crown rust was found in the northern oat growing area in early June. Much of this crown rust developed in fields where inoculum arrived early and moisture was adequate. In a few areas buckthorns growing in close proximity to oat fields also provided some inoculum. Severe rust developed with resultant losses in many fields from central Wisconsin to eastern South Dakota. North of this area was drier and crown rust was light.

1986--Oat crown rust was more widespread and severe throughout Texas fields and plots than in the previous two years. In the outbreaks of crown rust in Iowa in the past 30 years most of the rust developed in fields where inoculum arrived early from the south and conditions were ideal for rust development. Buckthorn hedges growing in close proximity to oat fields also provided some of the initial inoculum in Iowa and Wisconsin. Severe rust developed with resultant losses in many fields from central Wisconsin to eastern South Dakota.

1987--Crown rust was severe in southern Texas, where it overwintered, and in central Iowa and southern Wisconsin. The heaviest crown rust infection on buckthorn (alternate host) in many years occurred in central Iowa. In 1987, like in 1986, one of the earliest and most severe outbreaks of crown rust occurred in central Iowa and southern Wisconsin in the past 30 years. Most of the rust developed in fields where infections occurred in June, and some of these fields were near buckthorn hedges. The severe rust resulted in losses in many fields in Iowa, Wisconsin, and southeastern South Dakota.

An annual estimate of loesses due to the rusts of oats is complied by the Cereal Rust Laboratory, and are available on an annual basis. The losses during the past years for the major production states is shown in Table 4. Important losses in both grain and forage production can also occur in Texas.

Table 1. Physiological races of *Puccinia graminis* f. sp. *avenae* identified from oats in 1985.

State	Source of coll.	Number of coll.	Number of isol.	NA-1[a]	NA-5[a]	NA-10[a]	NA-16[a]	NA-23[a]	NA-24[a]	NA-27[a]	NA-39[a]
				Percent of isolates of each race[a]							
AR	Nursery	1	3							100	
CA	Nursery	8	22		23	77					
	Wild oats	1	2								100
FL	Nursery	1	3							100	
IA	Field	7	19							100	
	Nursery	4	10							100	
IL	Field	1	3							100	
	Nursery	1	3							100	
KS	Field	6	15							100	
	Nursery	1	3							100	
MI	Nursery	1	3							100	
MN	Field	63	173							100	
	Nursery	20	60						5	95	
	Wild oats	8	23							100	
ND	Field	3	9							100	
	Nursery	10	30				10			90	
	Wild oats	13	33							100	
NE	Field	1	3							100	
	Nursery	1	2		50					50	
OK	Field	2	6							100	
	Wild oats	3	9							100	
SD	Field	1	3							100	
	Nursery	14	42						7	93	
	Wild oats	10	23				4			96	
TX	Field	12	36							100	
	Nursery	127	331	1	1		1	1	*	97	
	Wild oats	6	17				18			82	
WI	Field	112	333							100	
	Nursery	4	12							100	
WV	Field	4	12							100	
USA	Field	205	593							100	
	Nursery	200	543	*	2	3	1	*	1	92	
	Wild oats	41	107				4			94	2
	Total	446	1243	*	1	1	1	*	*	96	*
MEX	Nursery	2	4							100	
CAN[b]	Field	7	21						5	71	
	Nursery	18	52				2		6	44	

[a] See Martens et al. Phytopathology 69:293-294.
[b] All collections from Ontario.
[*] Less than 0.6%.

Table 2. Physiological races of *Puccinia graminis* f. sp. *avenae* identified from oats in 1986.

State	Source of coll.	Number of coll.	Number of isol.	Percent of isolates of each race[a] NA-5	NA-16	NA-25	NA-27	NA-29	NA-39	Other
CA	Nursery	11	33	88				9	3	
KS	Field	3	7				100			
MN	Field	49	135		1		98			
	Nursery	15	45				100			
	Wild oats	3	9		22		78			
MT	Nursery	1	3				100			
ND	Field	1	3				100			
	Nursery	6	16				100			
	Wild oats	3	9				100			
NE	Nursery	1	3				100			
SD	Field	1	3				100			
	Nursery	2	6				100			
	Wild oats	2	4				100			
TX	Field	4	12		25		75			
	Nursery	60	173	3	3	2	89	2		
WI	Field	69	84				100			
USA	Field	127	244		2		98			
	Nursery	96	279	12	2	1	81	1	1	*
	Wild oats	8	22		9		91			
	Total	231	545	6	2	1	89	*	*	*
MEX	Nursery	1	3				100			
CAN	Field	7	19**							100[c]
	Nursery	9	16***				62			38[d]

[a] See Martens *et al*. Phytopathology 69:293-294

[b] All collections from Ontario

[c] NA-12 26%, NA-25 63%, NA-26 10%

[d] NA-25 38%

* Less than 0.6%.

Table 3. Physiological races of <u>Puccinia graminis</u> f. sp. <u>avenae</u> identified from oats in 1987.

State	Source of coll.	Number of coll.	Number of isol.	Percent of isolates of each race[a] NA-3	NA-5	NA-10	NA-25	NA-27
AL	Field	1	3					100
AR	Nursery	1						
CA	Nursery	4	12		25	75		
FL	Nursery	3	9		11			89
GA	Nursery	1	3					100
KS	Field	3	9					100
	Nursery	1	2					100
LA	Field	1	3					100
	Nursery	2	4					100
MN	Field	7	19					100
	Nursery	5	12					100
	Wild oats	5	14					100
ND	Field	1	3					100
	Nursery	1	3					100
	Wild oats	2	4					100
NE	Nursery	1	3					100
SC	Nursery	1	3	100				
SD	Nursery	1	1					100
	Wild oats	1	1					100
TX	Field	4	12					100
	Nursery	67	173	7				93
	Wild oats	2	6					100
WI	Field	3	5					100
USA	Field	20	54					100
	Nursery	88	225	7	2	4		88
	Wild oats	10	25					100
	Total	118	304	5	1	3		91
MEX	Nursery	2	6					100
CAN	Field	11	30				100	

[a] See Martens <u>et</u> <u>al</u>. Phytopathology 69:293-294

[b] All collections from Ontario

Table 4. Estimated rust losses in 1985, 86, 87 in selected states.

Year and State[c]	1,000 of acres harvested[a]	Yield in bushels per acre	Production in 1,000 of bushels	Losses due to[b] Stem rust Per-cent	Stem rust 1,000 bushels	Crown rust Per-cent	Crown rust 1,000 bushels
1985							
Iowa	760	76.0	57,760	Trace	Trace	Trace	Trace
Minnesota	1,100	70.0	77,000	Trace	Trace	1.0	777.8
North Dakota	840	53.0	44,520	Trace	Trace	Trace	Trace
South Dakota	1,420	56.0	79,520	Trace	Trace	1.0	803.2
Wisconsin	780	66.0	51,480	2.0	1,061.4	1.0	530.7
1986							
Iowa	630	60.0	37,800	Trace	Trace	8.0	3,287.0
Minnesota	850	51.0	43,350	Trace	Trace	5.0	2,281.6
North Dakota	700	55.0	38,500	Trace	Trace	5.0	2,026.3
South Dakota	1,050	44.0	46,200	1.0	519.1	10.0	5,191.0
Wisconsin	850	62.0	52,700	0.3	159.4	0.5	265.6
1987							
Iowa	650	55.0	35,750	Trace	Trace	12.0	4,875.0
Minnesota	800	57.0	45,600	Trace	Trace	0.5	229.1
North Dakota	700	52.0	36,400	Trace	Trace	Trace	Trace
South Dakota	1,150	46.0	52,900	Trace	Trace	2.0	1,079.6
Wisconsin	800	54.0	43,200	Trace	Trace	10.0	4,800.0

[a] Acreage harvested and yield and production records based on Annual Crop Summary, Agricultural Statistics Board, USDA.

[b] 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, USDA, and the Cereal Rust Laboratory.

[c] These five states represent over 50% of the oat acreage in the United States annually.

CONTRIBUTION FOR 1987 OAT NEWSLETTER (Vol.38)

Andrew R. Barr

Oat Production and varieties in South Australia 1987

The Department of Agriculture estimates that 233,020 ha were sown in 1987 which returned 241,905t. This represents an increase from the previous year and reflected a large increase in the area sown to oats in Australia as a whole. Oat prices were the highest since 1982. Several buyers were offering $140 per tonne (less freight and handling charges). This compares to approximately $100 in 1986. These prices have stimulated increased interest in the crop for the 1988 season.

Seasonal conditions began favourably but spring conditions were severe in many ways. Strong hot north winds damaged crops during and after anthesis with many towns establishing new October maximum temperature records. Frost severely damaged crops in southern areas of the state during mid-October. Farmer reports indicate that oats were less severely affected than wheat, barley and peas. Nevertheless severe crop damage resulted. Hailstorms wreaked havoc through several areas include a major research station for field crop research.

The semi-dwarf variety Echidna increased from 15% in 1986 to nearly 40% of the area sown and is now the most widely grown variety. The other major varieties in 1987 were Swan(36%), West(10%), Avon(5%) and Mortlock(2%). Mortlock will probably increase further in 1988 due mainly to its excellent milling quality and high protein content.

Oat Breeding

"Wallaroo" and "Marloo" were registered and released in May 1987. Both are resistant and tolerant to the Australian biotype of the cereal cyst nematode (Heterodera avenae). Wallaroo is early maturing and well adapted to the lower rainfall areas of the cereal belt. Marloo flowers approximately 10 days after Wallaroo and will be of use for grain and oaten hay in areas with a longer growing season.

Naked grain types with semi-dwarf plant types were disappointing in the high temperatures and severe drought stress which characterised 1987. The best selections returned yields equal to the grain yield of the husked control,West, in the favourable season of 1986. However, in 1987 these same lines were 15% lower yielding than West. Our hypothesis is that the developing grain of naked grain types is more prone to dessication due to the "looseness" of the lemma and palea around the groat. Therefore they will be more drought affected than husked types. Our 1986 and 1987 data provides circumstantial evidence in support of this hypothesis.

Since the release of Echidna and Dolphin a great deal of effort has been invested in producing large-grained, semi-dwarf types. The three main donors of the large-grain trait have been Swan, Irwin and Mortlock. Generally, Swan and Irwin have been disappointing parents as many of their progeny are low yielding, very rust susceptible and have poor plant type. The progeny from Mortlock crosses appear more promising except that a large proportion are very short, semi-dwarfs. The best selections tested thus far come from the crosses Mortlock/Echidna and Egdolon/Irwin//Echidna. The best lines have excellent milling quality and yield well in favourable environments but lack the wide adaptation of Echidna.

RECENT DEVELOPMENTS IN OAT CROWN RUST VIRULENCE IN CANADA

J. Chong

Crown rust of oats caused by Puccinia coronata Cda. occurs in varying amounts wherever oats are grown in Canada. It is particularly severe in Manitoba, and in parts of Ontario and Quebec where the alternate host buckthorn (Rhamnus cathartica L.) is common. At present most cultivars of oats grown in Manitoba are highly resistant to the prevalent races found in western Canada. However, in Ontario where many susceptible cultivars are still being grown, the combination of favourable weather and the widespread occurrence of the alternate host has often resulted in high infection levels and crop losses.

Based on the virulence characteristics of the rust, Canada may be divided into two regions with distinct populations: the eastern region, comprising mainly Ontario and Quebec; and the western region, comprising mainly Manitoba and Saskatchewan. The eastern rust population is generally more variable in virulence and thus quite distinct from that of the west. Recycling of the rust on buckthorn, which is widespread in many of the agricultural areas in Ontario, probably provides the basis for this greater variability.

Despite the variability of the eastern rust population, the overall virulence was stable for many years. Typically, isolates with virulence on plants with genes Pc35 and Pc56 predominated. However, following the introduction of cultivar Woodstock in 1982, which carries gene Pc39 for crown rust resistance, there has been selection for virulence on Pc39 in the rust population.

The first race, capable of attacking Woodstock, was isolated from a farm field near Blakeney in Ontario (Table 1). In 1986 eight more dangerous new races were isolated from various locations in Ontario. These eight races were all virulent on plants with gene Pc39, which include Woodstock, but differed in virulence with respect to the other Pc genes (Table 1). Some of these races also attacked Fidler, which contains gene Pc39 plus other unknown factor(s) for crown rust resistance. However, the most dangerous race was the one with the virulence formula 35,40,45,46,48,50,54,56,58,63,67,68/ 38,39,55,64 (effective/ineffective Pc genes). It attacked Fidler and also plants with the gene combination Pc38/Pc39, including Dumont and Riel, which are currently the most crown rust resistant cultivars of the eastern Prairies. This is significant because for many years this gene combination has been effective worldwide in providing a high level of resistance to all field isolates, and only recently virulence on this gene combination was discovered at low levels (0.2%) in Australia.

The 1987 race survey study is not yet complete. Preliminary 1987 results indicate that the dangerous new races in Ontario in 1987 are even more abundant and widespread than in 1986. Of the 26 virulence combinations that have been identified so far from field and nursery samples, 11 were potentially dangerous races, including 8 not previously detected (Table 1). Four additional new races were isolated from the trap nurseries (Table 1). All these races were virulent on plants with gene Pc39, many of these races also attacked Fidler, but none attacked Dumont.

Like the eastern rust population, the general composition of the western rust population in the Prairies was stable in recent years. Typically, isolates with virulence on plants with resistance genes Pc35, Pc40, and Pc46 predominated. However, in 1987 dangerous new races were found in field surveys. The 1987 race study is not yet complete. A total of five races with potentially dangerous new virulence combinations so far have been identified from field and trap nursery samples (Table 1). This represents the largest number of dangerous new races ever found in Manitoba in annual surveys. All these races were virulent on plants with gene Pc39, but only two were virulent on Fidler. These latter two races were also virulent on plants with gene Pc38 or both Pc38 and Pc39, but unlike the 1986 race from Ontario, were avirulent on Dumont and Riel. It appears that Dumont and Riel may carry unknown resistance factor(s) in addition to Pc38 and Pc39. Nevertheless, these new races are significant because they attack plants with both Pc38 and Pc39, which are the major genes still actively used in oat breeding programs at Winnipeg Research Station and elsewhere.

Considering the recent sharp increase in the number of isolates with virulence on gene Pc39 and the occurrence of other isolates with virulence on plants with both genes Pc38 and Pc39, breeding strategies may need to be modified, either by adding more resistance genes to the present combination of Pc38/Pc39 or by employing new blocks of resistance genes. At present, a good number of crown rust resistance genes are available, and they could be used in varying combinations to effectively control the pathogen.

Table 1. Virulence combinations of potentially dangerous new races of oat crown rust identified from field and nursery collections in Canada in 1985-1987.

Avirulence/virulence formula (Pc genes)	No. of isolates	
	Ont/Que	Man/Sask
1985		
38,40,45,46,48,50,54,56,62,63,64,67,68 / 35,39,55	1(1)	
1986		
35,38,40,45,46,48,50,54,56,62,63,64,67,68 / 39,55	4	
35,38,40,46,48,50,54,56,62,63,64,67,68 / 39,45,55	1	
35,38,40,45,48,50,54,56,62,63,64,67,68 / 39,46,55	1	
35,38,40,45,46,48,50,54,62,63,64,67,68 / 39,55,56	7(2)*	
38,40,45,46,48,50,54,62,63,64,67,68 / 35,39,55,56	3(1)	
35,40,45,46,48,50,54,56,62,63,67,68 / 38,39,55,64 a	1	
35,38,40,45,48,50,54,62,63,64,67,68 / 39,46,55,56	2	
38,40,45,48,50,54,62,63,64,67,68 / 35,39,46,55,56	1	
1987		
35,38,40,45,46,48,50,54,56,62,63,64,67,68 / 39,55	17(6)	
38,40,45,46,48,50,54,56,62,63,64,67,68 / 35,39,55	10(4)	1(1)
35,38,45,46,48,50,54,56,62,63,64,67,68 / 39,40,55	1	
35,38,40,45,46,48,50,54,62,63,64,67,68 / 39,55,56	19(5)	1(1)
35,38,40,45,46,48,50,54,56,62,63,64,68 / 39,55,67	1	
38,40,45,48,50,54,56,62,63,64,67,68 / 35,39,46,55	1	
38,40,45,46,48,50,54,62,63,64,67,68 / 35,39,55,56	12(5)	
35,38,40,45,48,50,54,62,63,64,67,68 / 39,46,55,56	2	
35,38,40,45,48,50,54,56,63,64,67,68 / 39,46,55,62	1	
35,38,40,45,46,48,54,62,63,64,67,68 / 39,50,55,56	1	
35,38,40,45,46,48,50,54,63,64,67,68 / 39,55,56,62	1	
35,38,40,45,46,48,50,54,56,63,67,68 / 39,55,62,64	1	
38,45,48,50,54,56,62,63,64,67,68 / 35,39,40,46,55		1(1)
38,40,45,48,50,54,62,63,64,67,68 / 35,39,46,55,56	1	
35,40,45,48,50,54,56,62,64,67,68 / 38,39,46,55,63 b		2
35,38,40,48,50,54,62,63,64,67,68 / 39,45,46,55,56	1	
40,45,48,50,54,56,62,64,67,68 / 35,38,39,46,55,63 b		2
35,38,48,50,56,62,63,64,67,68 / 39,40,45,46,54,55	1	

* number of isolates that were avirulent on Fidler.
a virulent on Fidler, Dumont and Riel.
b avirulent on Dumont and Riel, but virulent on Fidler.

AVENA PILOSA M. BIEB. - A SOURCE FOR MILDEW RESISTANCE USEFUL IN OAT BREEDING

M. KUMMER, H.-D. HOPPE, J.-CHR. SCHMIDT, J. SEBESTA

Avena pilosa is a diploid wild species with the genome C_p. Adult plants of *A. pilosa* (CAV 0128) were free of mildew infection (Sebesta, Zwatz, and Kummer, 1983) in Quedlinburg under different environmental conditions, and in Prague (Table 1). Embryo culture after crossing *A. pilosa* x *A. sativa* cv. Solidor (highly susceptible) made successful hybridization possible (26.7 F_1 plants per 100 pollinated florets). The F_1 plants were resistant to mildew but completely sterile. After colchicine application, 30% of the F_1 plants set seed. Progenies of these plants had almost normal meiosis and were amphidiploid (z = 56, AA CC C_pC_p DD). These alloocyoploids (*pilosa* x *sativa*)^2 were for a great part morphologically intermediate, mildew resistant, and fertile. Cytological examination of the A_2 generation confirmed the stability of the 8x ploidy level. Crosses between the allooctoploids used as the female parent and cv. Solidor produced 7.4% seed set (grains per pollinated floret). Embryo culture was no longer necessary. Crossability of the allooctoploids in the A_6 with another compatible oat variety confirmed these results with 20% seed set even in the reciprocal direction. The allooctoploid proved to be a stable donor of mildew resistance that may be crossed with *A. sativa* cultivars.

An average of 5% seed set was reached after three backcrosses with cv. Solidor used as the mate parent. Cytologically unstable (7x, 7x - 8x) and morphologically intermediate types seem to have been preferred by selection for mildew resistance. A remarkable change occurred in the second backcross which was performed for the first time in both directioins. Crosses using cv. Solidor as the female resulted in distinctly higher seed set (5.5 vs 13.5%). Abrupt restitution of the *A. sativa* phenotype with increased vigor occurred when returning from the C plasmone (*A. pilosa*) to the A plasmone (*A. sativa*). This even was accompanied by a considerable loss of mildew resistance. Only 6.4% resistant plants were identified in the reciprocal BC_2F_2 population. Although 10.2% of the progenies from these plants were classified as resistant in the BC_2F_4. Analysis of leaf enzyme systems was used to aid in the search for BC_2F_2 plants with a contribution of *pilosa* genetic information. The existence of *pilosa* information. The existence of *pilosa* information in 9.3% of these plants was verified by three enzyme systems (GOT, NAD - dependent aromatic ADH, and MDH). Progenies with 80-90% resistant or moderately resistant plants appeared after strict pedigree selection in the BC_2F_4 (reciprocal). The seed set of such single plant progenies was high (1.3-1.4 seeds per spikelet). Meiotic analysis of randomly chosen single plant progenies resulted in an average of 20.5-21.0 bivalents with a small portion of uni- and quadrivalents per pmc. This seems to be the first evidence encouraging the possibility of using *A. pilosa* gene(s) to improve cultivated oats. Such evidence was not yet possible in our first communications (Kummer, 1984; Sebesta, 1985)) on this new source of mildew resistance.

Table 1. Comparison of response to powdery mildew in *Avena pilosa* CAV 0128 and hexaploid oats with race specific and adult plant resistance evaluated in field trials at the Research Institute for Crop Production in Prague in 1981 and 1982.

Oat	1981 RT[1]	1981 %[2]	1982 RT	1982 %
Avena pilosa CAV 0128	0	1	0	5
	Race Specific Resistance Sources			
Manod	III	3	III	5
Mostyn	0-I	1	I-II	8
Cc 6490	0-II	5	I	10
Cc 4146	I	5	II-III	10
	Adult Plant Resistance Sources			
Maldwyn	IV	20	IV	15
Maelor	III	10	III	15
Roxton	III	5	III	15

[1] Reaction type evaluated according to Hiura (1960) scale.

[2] Percentage of leaf area affected estimated according to cereal mildew key (Pl. Path. Lab., Harpenden, 1969).

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SELECTIVITY OF DICLOFOP-METHYL BETWEEN CULTIVATED OAT AND WILD OAT, PRE-EMERGENCE

W.G. Richardson* and T.M. West**

Recently there has been interest in the control of wild oat (*Avena fatua*, L.) in certain oat cultivars with diclofop-methyl used post-emergence. This report indicates selectivity also from pre-emergence treatments. Although a high, probably uneconomical dose is needed, the fact that selectivity exists pre-emergence, suggests that the herbicide possesses a mechanism of action which can distinguish between crop and weed.

In the experiment, seeds of *A. fatua* and oats (cv Condor) were sown 1.3 cm deep in a sandy loam soil, contained in 10 cm diameter plastic pots. The herbicide was applied to the soil surface with a laboratory track-sprayer. Pots were kept in a glasshouse and watered gently, as necessary, from overhead. Assessments were made by counting surviving plants and recording their fresh weight per pot.

Table 1. Response of *A. fatua* and oat to diclofop-methyl, pre-emergence.

		Shoot fresh weight per pot (g)			
		Avena fatua		Oat 'Condor'	
	kg a.i./ha	mean	%	mean	%
Untreated	-	3.98	100	8.85	100
Diclofop-methyl	1.0	1.41	35	8.92	101
	2.0	0.95	24	8.32	94
	4.0	0.15	4	5.10	58

Oat was tolerant to 1.0 and 2.0 kg a.i./ha while *A. fatua* was reduced by 65% and 75% respectively, suggesting a good margin of selectivity. Although in the field higher doses may be necessary to control *A. fatua* adequately, the selectivity is still interesting and possibly of practical value in the lighter, sandy soils.

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COMPARATIVE YIELD PERFORMANCE OF DIFFERENT VARIETIES OF *AVENA SATIVA* AS INFLUENCED BY VARYING LEVELS OF NITROGEN AND PHOSPHORUS UNDER MID-HILL CONDITIONS IN KASHMIR VALLEY

M. H. SHAH and K. N. SINGH

Evaluation studies of different strains of oats has been a continuous effort at the Sher-e-Kashmir University of Agricultural Sciences and Technology since 1985. Cultivars have been tested for their suitability, adaptability, production potential besides other growth traits like persistence, regeneration, resistance to drought and insect-pest incidence. Studies of manipulation of agronomical techniques applied to the most promising strains are warranted for exploiting their true genetic potential. Forages are grown on less than 3 percent area of the state out of the total geographical area of 2.41 million hectares. The 0.28 million hectares presently occupied by a paddy crop, could profitably be utilized for forage production in addition to other important crops like oil seed and pulses. The fodder deficit in the State is around 4 million tons against a total requirement of about 7 million tons on dry matter basis for a cattle population of 5.8 million (1984-85).

The present study was undertaken at the Exotic Cattle Breeding Farm, Manasbal under rainfed conditions. The experiment was conducted in a randomized block design with four replications during 1985 and 1986. The varieties included in these studies were 'Black Nip' and 'Kent'. The basis for inclusion of these varieties in these studies was that Black Nip showed a great promise in the evaluation studies during 1985 while Kent is the variety commonly being cultivated in the state of Jammu and Kashmir in general and the Kashmir Valley in particular. The other treatments consisted of five nitrogen levels (0, 20, 40, 60 and 80 kg/ha) and two phosphorus levels (20 and 40 kg/ha). Half of the nitrogen and all of the P and K was applied as basal while other half of nitrogen was applied 21 days after germination. The strains were sown September 25 and harvested at the milk stage of growth during both years.

Black Nip produced more green fodder yield than Kent during 1985 and 1986 by 15.2 and 21.4 percent respectively (Table 1). Although the height of these varieties remained more or less the same, number of tillers per running meter was greater in Black Nip relative to Kent by 12.5 and 12.1 percent during 1985 and 1986 respectively. Fodder yield increased with successive increments of nitrogen during 1985 and 1986. Application of phosphorus increased forage yield significantly.

Results suggest use of improved cultivars and improved soil fertility management would be helpful in reducing the fodder deficit which is around 4 million tons on dry matter basis (1987).

Table 1. Green fodder yield and other growth attributes of two cultivars of oats as influenced by different levels of nitrogen and phosphorus.

Treatment	Mean plant height (cm)		No. of tillers/ running m		Green fodder yield (q/ha)	
	1985	1986	1985	1986	1985	1986
Varieties						
V1 (Kent)	103.6	104.2	304.0	298.0	314.0	318.0
V2 (Black Nip)	101.9	102.6	342.0	334.0	362.0	386.0
C.D. at 5%	NS	NS	7.8	6.3	40.4	33.0
Nitrogen levels						
N0-	100.3	103.4	162.0	159.0	200.0	219.0
N1-	101.5	105.6	236.0	233.0	276.0	273.0
N2-	102.8	102.4	323.0	319.0	325.0	340.0
N3-	103.9	101.6	414.8	400.0	410.0	418.0
N4-	105.9	103.4	480.0	471.0	475.0	494.0
C.D. at 5%	NS	NS	12.5	9.9	63.9	52.1
Phosphorus levels						
P1-	102.4	100.8	301.0	295.0	310.0	320.0
P2-	103.1	102.9	344.0	337.0	366.0	384.0
C. D. at 5%	NS	NS	7.8	6.3	40.4	33.0

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EVALUATION OF OAT STRAINS FOR SUITABILITY, ADAPTABILITY AND PRODUCTION POTENTIAL UNDER MID-HIMALAYAN CONDITIONS OF KASHMIR VALLEY

M. H. SHAH, K. N. SINGH AND A. S. BALI

Rice in the Jammu and Kashmir States is cultivated at varying altitudes in an area of 2.76 lakh hectares (Anon, 1985) and most of the area is monocropped. The remaining area is utilized for crops like oilseeds, pulses, forages, etc. The major problem with rice growing areas is lack of a compatible crop-rotation. Recently paddy based crop rotation with oats has been accepted by the majority of the farming community. Therefore, efforts to evaluate indigenous and exotic cultivars of oat for their suitability, adaptability, winter hardiness, regeneration capacity, cutting frequency etc. have been continued. The kerawas are plateaus of alluvial or lacastrine deposits having varied topography suggesting the lake origin of the valley. The oat crop performs well in these areas because a good amount of precipitation is received between autumn and late spring and thus crop establishment and oat forage production potential is excellent. Trials to identify strains with a fair degree of resistance to moisture stress conditions are useful to select genotypes adapted to these conditions.

During 1985, Sher-e-Kashmir University of Agricultural Sciences and Technology evaluated 11w strains and the present study is a continuation of this effort. Twenty additional strains obtained from the B.G. Pant University of Agricultural Sciences, Panth Nagar were evaluated. The present study was conducted at the Exotic Cattle Breeding Farm, Manasbal under rainfed conditions. The strains were sown September 30 and harvested at the milk stage of growth. The plots were divided in two equal halves and first half was harvested just once like other traditional varieties and the first defoliation of the other half was done at milk stage of growth with later defoliations at 30 days interval. The last defoliation was done 10 days before the final land preparation for paddy transplantation leaving sufficient time between harvesting and paddy transplantation. This is an important consideration for utilization of the double cropping system. Cultivars were grown in three replications without addition of chemical fertilizer. Availability of green forage at regular intervals which has been possible because of the multiple cut potential of these strains should help in the establishment of the paddy-oat rotation. The forage yield attributes like plant height, number of tillers and fresh fodder yield, etc. are summarized in tables 1 and 2. It is clear from the results that a few cultivars are potentially useful for single cut production while others are best suited to multicuts. This yield fluctuation may not be considered a negative point but varieties which yield well in multicut situations are useful for providing green fodder during the off season.

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Table 1. Performance of oat cultivars for different forage attributes under Multicut system.

S. No.	Cultivar	Plant height at each defoliation (cm)			No. of tillers at each defoliation			Forage yield (q/ha) at each defoliation			Cumulative yield (q/ha)	Regeneration capacity	Winter hardiness
		I	II	III	I	II	III	I	II	III			
1	OGP 7605	8.0	31.0	85.0	10	20	34	50.0	135.9	306.0	491.9	Q	E
2	OGP 262407	8.5	13.5	75.0	15	16	19	62.4	130.0	270.1	462.5	Q	E
3	OGP 8531	9.5	13.5	90.0	5	10	18	40.9	169.8	306.0	516.7	Q	E
4	OGP 900	9.5	17.0	85.0	15	23	25	68.1	140.9	408.0	617.0	Q	E
5	OGP 7278	12.0	14.0	45.0	6	12	15	63.1	68.4	102.0	233.5	M	G
6	OGP 7468	13.0	21.0	55.0	9	21	25	67.0	137.4	142.6	347.0	Q	E
7	OGP 210	14.0	24.0	95.0	18	32	40	130.0	139.9	204.0	473.9	Q	E
8	OGP 7887	23.0	25.0	70.0	17	21	25	130.4	135.9	170.0	436.3	Q	E
9	OGP 875	13.0	16.0	75.0	15	20	27	70.0	141.4	172.0	383.4	Q	E
10	OGP 101	27.0	35.0	90.0	19	20	28	131.9	175.0	476.1	783.0	Q	E
11	OGP 211	21.0	32.0	75.0	16	18	21	137.0	147.3	178.1	462.4	Q	E
12	OX291-16-1-5-1	10.0	16.0	110.0	15	17	23	69.2	102.0	272.1	443.3	Q	E
13	OX263-25-2-1-3	12.5	17.0	75.0	6	7	9	33.9	40.2	70.0	144.1	L	P
14	OX261-27-1-2-2	8.0	14.0	40.0	4	5	10	35.0	60.4	71.2	166.6	L	P
15	OX293-11-1-2-2	42.0	46.0	115.0	10	30	26	68.1	170.1	237.0	475.2	Q	E
16	OX263-25-2-1-2	25.0	30.0	80.0	9	18	22	64.0	135.9	172.0	371.9	Q	E
17	OX293-11-1-2-3	25.0	33.0	115.0	14	17	17	69.0	101.9	204.0	374.9	Q	E
18	OX239-27-1-2-3	36.6	41.0	105.0	21	23	30	131.0	171.7	270.1	572.8	Q	E
19	OX391-16-1-4-1	53.5	61.0	85.0	17	17	32	170.1	204.0	270.7	644.8	Q	E
20	OX291-16-1-4-3	36.0	41.0	85.0	14	15	23	136.0	170.0	205.0	511.0	Q	E

Rating Index:

A. Regeneration capacity:
- i. Q (Quick)
- ii. M (Medium)
- iii. L (Low)

B. Winter hardiness:
- i. E (Excellent)
- ii. G (Good)
- iii. P (Poor)

Table 2. Performance of oat cultivars for different forage attributes under single cut system

S. No.	Cultivar	Plant height (cm)	Tillers	Forage yield (q/ha)
1	OGP 7605	60	13	280.1
2	OGP 262407	70	15	140.0
3	OGP 8531	70	19	504.2
4	OGP 900	100	18	408.0
5	OGP 7278	65	16	170.1
6	OGP 7468	65	6	238.2
7	OGP 210	130	28	350.0
8	OGP 7887	90	15	102.0
9	OGP 875	130	26	612.3
10	OGP 101	125	25	340.2
11	OGP 211	115	13	260.0
12	OX291-16-1-5-1	100	14	272.1
13	OX263-25-2-1-3	80	16	275.4
14	OX261-27-1-2-2	85	10	269.9
15	OX293-11-1-2-2	160	27	680.4
16	OX263-25-2-1-2	130	13	235.9
17	OX293-11-1-2-3	160	16	372.1
18	OX239-27-1-2-3	140	21	544.2
19	OX391-16-1-4-1	130	17	544.2
20	OX291-16-1-4-3	110	14	374.1

PERFORMANCE OF SOME OAT ACCESSIONS FOR FODDER YIELD AND RELATED TRAITS

R. N. CHOUBEY AND S. K. GUPTA

In India, oats are grown as a forage crop in the winter season supplying highly palatable and nutritious green fodder and a good quality hay. The Indian Grassland and Fodder Research Institute, Jhansi is actively engaged in developing superior forage oat varieties suitable for different farming situations.

For a long term improvement program in forage oats, regular inflow of new genetic variability and its proper utilization in crossing a program are essential. The oat breeding project at this institute is continuously enriching its genetic resources through germplasm collections from both the indigenous and the exotic sources. Simultaneously, the lines from these collections are being evaluated and examined for suitability as parental stocks in hybridization programs. Keeping these objectives in view, the present study was undertaken to assess the performance of some exotic oat accessions for forage yield and its related traits.

Fifteen oat varieties from Mexico and U.S.A. along with the local check, 'OS-6', were grown during winter (1986-87) in a randomized block design with 3 replications at C.R. Farm of the Institute situated at an altitude of 275 m above mean sea level. The seeds of each entry were sown in 3 meter long 5 row plots with a 30 cm row spacing. The characters studied were green fodder yield, dry matter yield, plant height, days to 50% flowering, and tiller number per meter row length. The data were recorded at 50% flowering stage of each line.

'Chihuahua' produced the maximum green fodder yield (722.1 q/ha) followed by 'Pennline-6571' (707.4 q/ha). However, Pennline-6571 and Chihuahua produced 127.0 and 111.6 q/ha dry matter yield, respectively. 'Tulancingo' maintained its 3rd rank for both green fodder and dry matter yields. These three entries were significantly superior to the control, OS-6, for green fodder yield. One genotype, Pennline-6571, was the only genotype with significantly higher dry matter yield than the control. 'Nodaway', 'Gena', 'PA-8224' and 'AB-177' were late flowering while 'Diamante', 'Tarahumara', 'Huamantla', 'Tulancingo', 'Paramo', and 'Guelatao' appeared to be early flowering types. The variety 'Gena' registered the longest duration for 50% flowering. None of the accessions were taller than the check. Almost all the entries exhibited medium plant height. A good amount of variation was observed for tiller number per meter row length in the present material. The varieties superior for tillering ability in comparison to the control were Tulancingo, Tarahumara, Huamantla, Diamante and Guelatao. Higher tillering potential was observed in the genotype Tulancingo followed by Tarahumara and Huamantla.

Based on the performance of these accessions with respect to different forage traits, Chihuahua, Pennline-6571 and Tulancingo were suitable for utilization in breeding programs for high forage yield. For programs on development of multicut varieties, the late flowering lines, viz., Gena, Nodaway, PA-8224, and AB-177 were desirable. Besides these, Tarahumara, Diamante, Huamantla and Tulancingo were promising for use as donors of high tillering potential.

Table 1. Mean performance of various oat accessions for forage attributes.

S.N.	Accessions	Green fodder yield (q/ha)	Dry matter yield (q/ha)	Days to 50% flowering	Plant height (cm)	Tiller no./ meter row length
1.	Nodaway	496.2	76.7	108.7	144.7	58.7
2.	Gena	440.7	71.7	131.3	175.1	95.7
3.	Diamante	440.7	75.5	75.0	128.3	170.3
4.	Tarahumara	511.1	80.5	75.3	117.4	202.7
5.	Cuauhtemoc	500.0	84.5	101.7	156.9	107.3
6.	PA-8224	462.9	97.6	108.7	152.9	91.7
7.	Huamantla	525.9	80.5	81.3	117.7	183.0
8.	Pennline-6571	707.4	127.0	101.3	144.5	101.7
9.	Chihuahua	722.1	111.6	101.7	148.0	115.7
10.	Tulancingo	688.2	102.8	81.3	119.1	205.3
11.	Guelatao	418.5	67.2	74.7	118.3	156.7
12.	Perla	570.3	88.9	101.3	150.1	117.0
13.	AB-177	562.9	99.5	109.3	152.7	65.7
14.	Paramo	459.2	79.3	75.0	132.4	123.3
15.	OS-6 (Check)	544.4	106.7	101.3	187.8	102.0
	C.D. (5%)	114.9	12.9	2.1	13.5	21.6

TRACE MINERALS IN OAT SPECIES

BHAGWAN DAS, C. KISHOR, G. P. LODHI AND R. D. KAUSHIK

Interspecific hybridization of Avena species provides new germplasm for the improvement of forage oats. Forage yield and quality are the main factors determining animal production. Before taking up a hybridization program, it was considered worthwhile to investigate the level of trace elements present in different species of oats.

Forage samples were taken from 12 species of Avena at 50% flowering which were grown in a randomized block design with three replications. In some cases different genotypes from the same species were sampled. These samples were analyzed for copper, iron, zinc and manganese contents by using an Atomic Absorption spectrophotometer.

The iron content varied from 87.5 to 225 ppm. All the species met the ARC (1965) requirement of 30 ppm for cattle whereas NRC (1971) requirement of 100 ppm was not met by all species/genotypes.

Variation for zinc content was from 20 to 35 ppm and the requirement of dairy animals (30-40 ppm) as indicated by Miller (1970) could be met in certain cases only. Manganese content was much higher in all the species/genotypes than the recommended levels of 20 and 40 ppm for dairy animals by NRC (1971) and ARC (1965), respectively.

Thus it appears that considerable variation is present with regard to the trace elements.

Table 1. Dry matter concentration (ppm) of copper, iron, zinc and manganese in oat species.

Species/Genotype	Cu	Fe	Zn	MN
Avena abyssinica				
HFO-512	9	87.5	25	160
Avena barbata				
HFO-500	11	125	30	130
Avena brevis				
HFO-303	13.5	100	35	140
Avena byzantina				
HFO-59	11	87.5	30	150
513	11	100	25	150
514	11	137.5	30	140
516	11	225	25	150
Avena fatua				
HFO-55	11	112.5	35	160
503	11	162.5	25	140
504	13.5	100	25	120
Avena longiglumis				
HFO-498	9	87.5	30	146
Avena nuda				
HFO-104	9	87.5	25	120
Avena orientalis				
HFO-103	9	87.5	25	100
Avena pratensis				
HFO-502	11	137.5	25	120
Avena sativa				
HFO-107	11	125	30	140
109	9	100	30	180
124	11	87.5	30	140
125	9	112.5	25	170
127	9	87.5	30	150
291	9	112.5	30	160
Avena sterilis				
HFO-307	13.5	87.5	25	110
508	11	125	25	160
511	9	87.5	35	140
Avena strigosa				
HFO-56	11	75	25	130
505	11	200	27	120
506	11	100	20	100

INTRA-POPULATION SELECTION IN VARIETY-KENT

D. S. KATIYAR and U. S. MISHRA

'Kent' is a dual purpose, stiff strawed, bold seeded variety used for both fodder and grain introduced into India in the early 1950s from Australia.. It attains 50% flowering in 78 to 90 days, is capable of producing green fodder yields of about 450-475 q/hectare, and is widely adapted in northern India for fodder production purposes.

The original Kent material has genetically drifted and formed a bulk of different plant types including types with less and more tillering, less and more leafiness, bold seeded and thin seeded types, and awned and awnless types. On the basis of these variations about 100 plants were isolated from a bulk population. The isolated plants were grown in progeny rows and selection was repeated resulting in identification of 31 lines.

Thirty-one single plant progenies were grown in replicated rows and evaluated for fodder yield and seed yield component characters. Significant variability among the lines was observed for days to 100% bloom, height, leaf no., leaf length, leaf breadth, stem thickness, tiller no., leaf stem ratio (dry matter basis), green fodder yield and seed yield etc.

The study revealed that bold seeded types with no awns produced more green and dry fodder yield than the original Kent variety. Seed yield was also higher in this type.

PERFORMANCE OF CERTAIN PLANT CHARACTERISTICS IN *AVENA SATIVA* L. X *A. STERILIS* L. POPULATIONS

S. N. MISHRA and J. S. VERMA

The most important cultivated species of oats is *Avena sativa* (L.) which has been estimated to cover about eighty percent of the total world oat acreage. *A. sterilis*, a progenitor of cultivated oats, is considered an important source of crown rust resistance genes, yield genes, and protein genes. It has also been observed that *A. sterilis* tends to be a good source of genes for high biomass and high vegetative growth index. The objective of the present study was to study the effects of *A. sterilis* germplasm in increasing forage production and certain other related traits when introgressed into *A. sativa*.

PI 295932 (*A. sterilis* L.) was crossed to three *A. sativa* lines (Kent, Nodaway, and WA 1470). The populations developed were parental (P_1 = *A. sativa* parent, and P_2 = *A. sterilis* parent), F_2, F_3, B_{1S} ($B_1 = (P_1 x\ P_2)\ x\ P_1$ selfed), B_{2S} ($B_2 = (P_1 x P_2)\ x\ P_2$ selfed), B_{11} ($B_1 x P_1$) and B_{22} ($B_2 x P_2$). The original crosses made were: Cross 1 = Kent/PI 295932, Cross 2 = Nodaway/PI 295932, and Cross 3 = WA 1470/PI295932. Two rows of parental, 7 rows of F_2, 6 rows of F_3, B_{1S} and B_{2S} and 4 rows of B_{11} and B_{22} were grown in a randomized complete block design with 3 replications. Observations on days to 50% heading and number of tillers/plant were recorded on 10 plants in the parents, 30 plants in the F_2, 18 plants in the F_3, 10 plants in the B_{1S} and B_{2S}, and 15 plants in the B_{11} and B_{22} populations in each replication. Green forage yield and dry matter yield were recorded per meter row length in the above populations.

The F_2 populations were earlier than parents by 5 to 8 days in all the three crosses (Table 1). The other populations also closely approximated the F_2/F_3 populations and were earlier than the parents. *A. sterilis* line 295932 produced more tillers than the *A. sativa* parents. The number of tillers in all other populations were higher than the parental populations. Backcross populations, however, produced more tillers than other populations. Cross 1 showed maximum grain forage yield in the F_2 and F_3 generations. Among the backcross populations Cross 1 produced the maximum green forage yield. Comparing all 4 backcross populations, B_{11} and B_{22} produced higher green forage yield in Cross 1 than other populations and crosses. The same trend occurred for dry matter yield. The study indicated that useful genes exist in the *A. sterilis* line which improved yielding ability along with associated characters such as number of tillers/plant and days to 50% heading. It will be useful to study more *A. sterilis* lines relative to their combining ability with *A. sativa* lines for yield and related characters. It is evident that among the three crosses, all have differential response to *A. sterilis* genes/cytoplasm. *A. sterilis* may therefore become one of the important sources of genetic variability for improving *A. sativa* for forage/grazing.

Table 1. Mean performance of parental, F_2, F_3 and backcross generations for certain characters in three *Avena sativa* x *A. sterilis* crosses.

Generation	Days to 50% heading			Tiller number/plant			Green forage yield/meter row length (kg)			Dry matter yield per meter row length (kg)		
	Cross 1	Cross 2	Cross 3	Cross 1	Cross 2	Cross 3	Cross 1	Cross 2	Cross 3	Cross 1	Cross 2	Cross 3
P_1	105.6	110.6	99.8	9.2	11.5	9.8	2.645	1.870	1.153	0.526	0.259	0.230
P_2	104.4	104.4	104.6	10.7	10.9	10.4	2.490	2.388	2.230	0.357	0.347	0.357
F_2	97.9	98.2	93.0	10.6	11.4	11.2	2.769	2.340	1.455	0.454	0.336	0.269
F_3	105.6	102.9	95.8	13.4	13.1	12.5	2.956	2.230	1.346	0.414	0.324	0.242
B_{1S}	97.1	101.2	92.1	10.0	14.3	13.3	2.422	2.453	1.200	0.420	0.361	0.241
B_{2S}	99.0	100.3	99.4	12.4	14.2	12.2	2.505	2.215	1.460	0.443	0.308	0.259
B_{11}	102.8	100.8	95.8	10.8	12.4	11.8	3.420	1.670	1.335	0.597	0.218	0.268
B_{22}	93.0	102.6	103.1	13.4	10.8	13.6	3.070	1.850	1.550	0.500	0.251	0.295

B_{1S} = B_1 selfed, B_{2S} = B_2 selfed, B_{11} = B_1 = B_1 x Parent-1, B_{22} = B_2 x Parent-2

Cross 1 = Kent x PI 295932 (AS), Cross 2 = Nodaway x PI 295932, Cross 3 = WA 1470 x PI 295932

GENERATION OF GENETIC VARIABILITY THROUGH BIPARENTAL MATINGS IN OATS

C. HISHOR, R. S. PARODA, D. S. JATASRA and K. R. SOLANKI

Presence of wide genetic variability in genetic material is essential for any selection program. Variability generated by biparental matings was compared with that of F_2 and F_3 generations of oats (Avena sativa L.) which occupies a prominent place among the winter cereal fodders in India.

The experimental material for this study consisted of F_2 and F_3 generations and intermated populations in the F_2 generation in the fashion of North Carolina design I (NC 1), North Carolina design II (NC II) and triple testcross (TTC). The material was sown during winter of 1981-82 in four different randomized block designs with three replications. Five competitive plants from each of the 45 progenies in all the three mating designs, and 45 plants each from F_2 and F_3 populations were selected at random and the data was recorded on forage yield and its components.

The range for days to flower and dry leaf weight was more in all the three matings designs than F_2 and F_3 populations. In addition to these two characters, NC I showed greater range than F_2 in characters like the number of tillers, green leaf weight and dry matter yield, while in NC II, more variability was observed for the number of tillers, the number of leaves, green leaf weight, dry stem weight, green fodder yield and dry matter yield.

The range in NC I and NC II was greater for almost all the characters than in F_3 population except plant height in NC II. In the triple testcross, the range was more than in the F_3 population for only four characters, days to flower, dry leaf weight, dry stem weight and dry matter yield. Among all the three mating designs, NC II exhibited a greater range of variability for most of the characters than NC I and TTC.

Lower and upper values for almost all the characters in NC I and NC II indicated improvement in the desired direction over the F_2 and F_3 populations. The lower limit of the range was fore-shortened for almost all the characters in the three mating designs, and thus, the extent of undesirable variability was reduced considerably. The upper limit of most of the characters increased in the desired direction in the case of NC I and NC II over the F_2 and F_3 populations, while in TTC, the upper limit was increased for five characters. Therefore, there appeared to be substantial variation among segregants which can be exploited through intermating in the F_2 generation in order to increase genetic variability relative to the F_3 which had narrower range than NC I and NC II.

A comparison of genotypic coefficients of variation between various characters among different mating designs revealed that almost all the characters showed a higher coefficient of variation than F_2 and F_3 populations except plant height in NC II. This indicated that a considerable amount of genetic variability was generated through intermating in F_2 population as compared to that in F_3 population and thus may provide better chances of selecting desired types.

The phenotypic coefficient of variation for almost all the characters were higher in the F_2 than all the three mating designs. The phenotypic coefficient of variation in the F_3 was also higher than all the three mating designs for most of the characters. It indicated greater influence of environment on F_2 and F_3 populations.

The magnitude of genotypic coefficient of variability in all the three mating designs differed for various characters. For the characters days to flower, plant height, dry leaf weight, dry stem weight and dry matter yield, the magnitude of variability was maximum in the TTC relative to the other two mating designs. For the number of tillers and green stem weight, the magnitude was highest in NC I followed by that in NC II and TTC. The magnitude of genotypic coefficient of variability for the number of leaves, green leaf weight and green fodder yield was maximum in NC II. In general, the magnitude of genotypic coefficient of variability for three dry matter traits was higher in TTC, while for three green fodder characters it was higher in NC II.

The increase in the genotypic variances in all three mating designs as compared to the F_2 and F_3 populations in the present study may be due to the breakage of undesirable linkages, thus releasing new genetic variability. The usefulness of intermating in biparental progenies is largely dependent on aspects like genetic makeup and the nature of linkages among genes controlling specific traits. Utility of biparental matings would be more pronounced if the additive or additive x additive type of genetic variances are predominantly coupled with repulsion phase linkage between the genes.

Table 1. Comparison of variability for various characters between F_2, F_3, North Carolina design I, II and triple testcross

Character	Range				
	F_2	F_3	NC I	NC II	TTC
Days to 50% flowering	119.0-132.0	119.0-132.0	112.0-135.4	115.4-129.6	116.6-133.4
Plant height (cm)	105.0-170.0	101.0-158.0	103.0-160.0	126.6-167.2	122.0-174.4
Number of tillers/ plant	5.0- 13.0	5.0- 12.0	5.2- 13.4	5.6- 14.8	5.7- 12.4
Number of leaves/ plant	34.0- 92.0	29.0- 82.0	27.0- 80.8	36.0- 99.6	37.2- 76.0
Green leaf weight/ plant (g)	60.0-135.0	50.0-125.0	50.0-142.0	58.0-166.0	55.0-125.0
Dry leaf weight/ plant (g)	10.2- 21.9	9.6- 20.7	9.4- 24.1	11.0- 23.6	9.7- 22.0
Green stem weight/ plant (g)	170.0-550.0	200.0-490.0	231.0-572.0	216.0-549.0	219.0-470.0
Dry stem weight/ plant (g)	32.1- 92.8	38.0- 90.6	45.2-102.4	37.2-107.4	37.2- 94.3
Green fodder yield/ plant (g)	230.0-665.0	250.0-600.0	281.0-714.0	274.0-715.0	278.0-589.0
Dry matter yield/ plant (g)	43.0-113.7	48.2-111.3	52.2-126.5	48.2-127.8	47.0-116.5

Table 1 (continued)

Character	Coefficient of variation									
	F_2		F_3		NC I		NC II		TTC	
	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic
Days to 50% flowering	1.08	2.31	0.88	2.22	1.88	2.53	1.49	2.14	2.37	2.90
Plant height (cm)	5.00	10.06	4.59	9.50	6.19	7.22	3.83	4.78	7.87	8.59
Number of tillers/ plant	11.36	21.24	9.76	19.60	17.01	18.51	16.03	17.74	14.06	15.92
Number of leaves/ plant	10.87	21.01	9.82	20.77	14.84	16.48	16.41	17.68	13.65	15.00
Green leaf weight/ plant (g)	10.32	18.63	9.41	18.53	19.85	21.06	22.59	23.58	21.61	22.45
Dry leaf weight/ plant (g)	9.09	16.67	8.70	16.05	14.03	15.27	15.32	16.36	16.71	17.63
Green stem weight/ plant (g)	11.14	25.50	9.85	18.26	17.69	18.46	17.53	18.26	16.12	16.81
Dry stem weight/ plant (g)	11.22	23.73	8.19	18.31	17.83	18.73	17.86	18.64	18.97	19.55
Green fodder yield/ plant (g)	10.92	22.90	10.74	18.32	17.41	18.24	17.99	18.73	16.39	17.12
Dry matter yield/ plant (g)	10.75	21.12	8.74	17.46	16.05	17.01	16.71	17.52	17.33	17.98

INVESTIGATION OF NEW YUGOSLAV SPRING OAT F_7 GENERATION LINES IN KRAGUJEVAC IN 1985

DRAGOLJUB MAKSIMOVIC, MIODRAG KRSTIC, and BRANKA PONOS

In Yugoslavia oats was grown on 152,000 ha in 1984 and on 151,000 ha in 1985. More than 90% of land under oat cultivation is sown to spring oat and only 10% is planted to winter oat. Development of new Yugoslav spring oat varieties takes place at the Institut for Small Grains in Kragujevac. A new spring oat variety 'Rajac' was recognized by the Yugoslav Oat Commission in 1986 and 'Mediteran' was recognized in 1987. Both varieties are high yielding with good quality kernel. They originate from single crosses of two parents.

This paper presents results of trials of 62 new spring oat lines originating from the single crossing scheme. New lines were obtained from crosses among Holland spring oat varieties 'Astor', 'Bento', 'Gambo', 'Marino', 'Leanda', and 'Condor', Swedish varieties 'Sang', 'Solidor', and 'Risto' and an English line 'UPBS-3016-74. Approximate grain yield and kernel protein content on these 62 lines in the F_7 generation were determined.

Grain yield was estimated in 5 m^2 plots and compared with the yield of the standard varieties Astor and Condor (Table 1). Of the nine cross combinations tested, F_7 generation lines from Bento x Solidor crosses had the highest average yield of grain (4732 kg/ha). Lines from Solidor x Astor crosses yielded 4277 kg/ha, Astor x Sang lines yielded 4148 kg/ha and Marino x Solidor lines yielded 4047 kg/ha. Individual lines from combinations Bento x Solidor, Solidor x Astor and Gambo x Risto were the highest yielders with 5480, 5380, and 5100 kg/ha, respectively. Astor yielded 4480 kg/ha and Condor yielded 4520 kg/ha.

Table 1. Grain yield of new Yugoslav spring oat lines tested in Kragupjevac in 1985.

No.	Combination	Number of lines	Average grain yield kg/ha	Range of grain yield in lines kg/ha
1.	Astor x Sang	5	4.148	3.340-4.640
2.	Bento x Solidor	5	4.732	4.360-5.480
3.	Sang x Bento	2	2.860	2.600-3.120
4.	Gambo x Risto	5	3.964	3.040-5.100
5.	Marino x Solidor	6	4.047	3.780-4.580
6.	Leanda x UPBS-3016-74	6	3.860	2.600-4.680
7.	Condor x Solidor	6	3.623	2.580-4.220
8.	UPBS-3016-74 x Risto	14	3.294	2.460-3.800
9.	Solidor x Astor	13	4.277	3.000-5.380
	Astor (standard)	-	4.480	
	Condor (standard)	-	4.520	

Grain protein content of F_7 generation progeny and the standard varieties Astor and Condor was determined by Kjeldahl analysis (Nx5,7). F_7 generation lines of combination Astor x Sang had the highest protein content (13.33%) (Table 2). Average protein content of lines from the cross Sang x Bento was 12.81%, in lines derived from Bento x Solidor, 12.67%, and in Marino x Solidor lines, 12.65%. The highest protein content of an individual line was from Astor x Sang cross (13.93%) and from combinations Bento x Solidor and Condor x Solidor (13.63%). Protein content of standard varieties was: Astor 11.99% and Condor 11.51%.

Table 2. Kernel protein content in new Yugoslav spring oat lines investigated in Kragujevac in 1985.

No.	Combination	Number of lines	Average kernel protein content, %	Range of protein content
1.	Astor x Sang	5	13.33	12.73-13.93
2.	Bento x Solidor	5	12.67	11.50-13.63
3.	Sang x Bento	2	12.81	12.73-12.88
4.	Gambo x Risto	5	11.98	11.17-12.67
5.	Marino x Solidor	6	12.65	12.06-13.00
6.	Leanda x UPBS-3016-74	6	12.03	11.09-13.43
7.	Condor x Solidor	6	12.35	11.09-13.63
8.	UPBS-3016-74 x Risto	14	11.51	10.35-12.67
9.	Solidor x Astor	13	11.93	11.31-13.09
	Astor (standard)	-	11.99	
	Condor (standard)	-	11.51	

Selected new lines with increased yielding and higher kernel protein content will be tested further in 1988 by Yugoslav Commission for New Agricultural Plants Varieties Acknowledgement.

OAT PROGRAM AT THE UNIVERSITY OF GUELPH

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The oat program at the University of Guelph is continuing to try to develop cultivars with improved agronomic characteristics, better disease resistance and higher milling yield. Our most recent cultivar, OAC Woodstock has become susceptible to crown rust in Eastern Ontario where it was the only adapted oat with sufficient resistance. The breakdown has progressed rapidly from a few isolated reports of rust on OAC Woodstock in 1986 to most of the fields showing fairly heavy infection in 1987. Eastern Ontario is known to have a high population of buckthorn which is acting as the over-wintering host for the crown rust in most fence rows and scrub areas. OAC Woodstock no longer can provide adequate resistance to crown rust in Eastern Ontario although it is still effective in Western Ontario where the buckthorn is more scarce.

Increased resistance (tolerance) has been found to BYDV in a cross of Ogle (good resistance) by Donald (some resistance/tolerance) by Dr. Andre Comeau in screening some of our early generation material. The tolerance from Donald seems to be increasing the level of resitance found in Ogle. This material was screened in the F_3 generation in Ontario under a heavy natural aphid infestation and in the F_4 in California during a winter increase. Several lines from this cross showed good tolerance under heavy artificial inoculation. All of the lines being developed are day-length insensitive with the Ogle plant type and improved BYDV resistance. The purpose of the cross was to produce a high-quality milling oat with virus resistance.

The Guelph program has initiated a project to investigate the possibility of a modified barley anther culture system to give haploids and doubled haploids from oat anther culture. As the project is in its initiation stages, it is too early to report any results. It is hoped that eventually it may be possible to use a microspore culture system in oats as in tobacco and rapeseed.

OATS IN MANITOBA - 1987

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In 1987, spring seeding occurred from mid April until the end of May. Soil moisture reserves were adequate for germination. Hot, dry weather until mid June resulted in poor tillering, especially in the early sown crops. Near normal rainfall and temperatures in the latter portion of the growing season encouraged good grain filling. Harvest conditions were excellent.

Estimated grain yields were 2.3 tonnes per hectare (60 bu/acre) on 180,000 hectares (450,000 acres) harvested for grain. Both yields and seeded area are down from 1986 by 8% and 18%, respectively. The five main oat varieties (with the percentage of the area sown to each) were Dumont (51%), Fidler (31%), Harmon (8%), Riel (5%), and Hudson (4%). The area planted to Fidler, Harmon and Hudson continues to decrease. Within Manitoba, the inspected areas of all generations of pedigreed seed of Dumont, Fidler and Riel were 1287, 12 and 1490 hectares, respectively. Robert, (W82056) was registered by the Food Production and Inspection Branch of Agriculture Canada in 1987.

Stephen Fox, a Masters student, is screening selected hexaploid, tetraploid and diploid *Avena* accessions for crown rust resistance. He is making intraspecific crosses to study the inheritance of resistance and interspecific crosses with *Avena sativa* L. as one of the parents in attempts to transfer oat crown rust to the hexaploid.

Crown rust was first found in trace amounts in Manitoba on June 26, 1987. The inoculum arrived about two weeks earlier than usual, but the development of the rust following the initial infections was slow and uneven because of dry conditions. By early August, crown rust was widespread on wild oats in Manitoba, with the heaviest infections occurring in the southern part of the Red River Valley. The recommended cultivars Fidler, Dumont and Riel are highly resistant to the prevalent races of the rust, and remained rust free. Only three of the 28 commercial oat fields examined were found to have infections and these were light.

The race study is not yet complete. A total of five races with potentially dangerous virulence combinations so far have been identified from field and trap nursery samples. This represents the largest number of dangerous new races ever found in annual surveys in Manitoba. All these new races were virulent on plants with gene Pc39, but only two were virulent on Fidler. The latter two races were also virulent on plants with gene Pc38 or both Pc38 and Pc39, but not Dumont and Riel. It appears that Dumont and Riel may carry other resistance factor(s) in addition to Pc38 and Pc39.

Oat stem rust was quite widespread across the prairies in 1987, but developed too late to cause significant damage. As with crown rust, the currently recommended oat cultivars in Manitoba are stem rust resistant, thus were unaffected. Race NA27 continued to predominate in western Canada, and race NA25 predominated in eastern Canada. There were no significant new races in Canada in 1987.

The most serious economic virus disease problem on cereals in western Canada is aphid-borne barley yellow dwarf (BYD). The virus (BYDV), transmitted to cereal crops by several species of cereal aphids that are carried north each year on southerly, low-level, jet winds, induces greater losses the earlier it is transmitted to its cereal host. The condition of infected plants is often not recognized as being due to a disease agent, but variously attributed to water stress or poor nutrient status of the soil. By recognizing the role of BYD in unthrifty growth of cereal crops - both by direct effects of BYDV, and by pre-disposition to greater damage from environmental stresses and secondary, opportunistic pathogens - ineffective "remedies" can be avoided.

A cereal virus survey conducted across the Prairies in early July, 1987 showed BYD was widespread, and causing yield losses of up to 90%. The high levels of the disease in 1987 can be linked to the early arrival of aphid inoculum on hot southerly winds in mid-to-late May when plants were at the vulnerable 2-3 leaf stage. Analysis of survey samples by transmission and serological tests shows that, as in previous years, the preponderance of isolates are similar to the "PAV" strain described by Rochow.

The only feasible control of BYD in western Canada is the use of tolerant cereal varieties; because virus transmission by cereal aphids is of a persistent nature, control by aphicides is ineffective as well as uneconomic.

The recently registered cultivar Robert has good tolerance to BYDV and is the first oat cultivar to combine crown rust and stem rust resistance with BYDV tolerance.

OAT IN SASKATCHEWAN

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Interest in the oat crop in Saskatchewan has reached a recent high. This interest is primarily due to very depressed wheat and barley markets, but has been spurned by some active marketing of high-quality Saskatchewan oat into U.S. milling and "Pony" oat markets. In fact, since late December good quality oat has been priced at a premium to barley. Acreage in 1987 was 1,000,000 acres and with the interest generated during the off-season we expect it to increase in 1988.

The Crop Development Centre variety Calibre, released in 1983, continues to increase in popularity in Saskatchewan and Alberta. The high grain quality of Calibre is in specific demand in the expanding U.S. oat market, such that it is being specified by variety name in contracts.

Commercial acreage of Calibre in Saskatchewan tripled from 7.2% of the total acreage in 1986 to 22% in 1987. In Alberta it moved from 8.5% in 1986 to 14.3% in 1986. Total 1987 commercial Calibre acreage was estimated at nearly one-half million acres, or 15% of the Prairie total.

In excess of 15,300 acres of pedigreed seed of Calibre were inspected in 1987. This amount was three times that of any other currently available variety in Western Canada and represented 41% of the western Canadian pedigreed oat seed acreage. Calibre represented 75% of the registered and certified oat acreage in Saskatchewan in 1987.

Our research and breeding program goals to improve upon Calibre are continuing with demonstrated success in the receipt of support for registration of a new line, OT322, in 1988. This line, as yet un-named, is essentially equal to Calibre, but consistently demonstrates improved kernel plumpness, weight and has even lower hull percentage than Calibre. It is anticipated that this type of material will continue to be in strong demand in the future. The improved plumpness is especially important to processors and cleaners, whether they are in the seed or industrial market. Seed of OT322 should be available at commercial levels by planting time 1990.

In addition to the long-term, significant research support the Crop Development Centre program continues to received from the Quaker Oats Co. of Canada we are pleased that Robin Hood Multifoods, Ltd., the second major player in the Canadian milling oat market, has also been convinced of the value of our research program, and has seen fit to come forward with support for our program as well. We really appreciate this support from industry and look forward to a long lasting relationship with both Quaker and Robin Hood.

ARKANSAS

R.K. Bacon and J.P. Jones
University of Arkansas

Production. According to the Arkansas Agricultural Statistics Service, the decline in oat production in the state continued with only 22,000 acres planted for the 1986-87 season equalling the all-time low of 1985. Approximately 18,000 acres were harvested for grain with an average yield of 70 bu/A resulting in a total production of 1,260,000 bushels. Production continues to be centered in the east central area of the state.

Breeding. A small block of breeder's seed of the experimental line AR 102-5 was planted this fall for increase and possible release. It has been a consistently high yielding line with good winterhardiness.

Personnel. Dr. John P. Jones took early retirement from the University in July after 27 years of dedicated service as small grains pathologist. His cooperative efforts in the breeding program were instrumental in the development of the cultivars 'Ora', 'Nora', and 'Bob'. He is now working as the small grains pathologist in Morocco with the Maroc/MIAC Project.

ILLINOIS

C. M. Brown and F. L. Kolb (Agronomy) and
A. Hewings and W. L. Pederson (Plant Pathology)

Illinois farmers planted 2,100,00 acres of oats in 1987 but harvested only 190,000 acres for grain. The oats not harvested were grown on land set-aside from production to comply with the government farm program. The yield of oats harvested for grain was estimated to be 69 bu/acre. Most of the oats crop for grain production was planted very early and the crop germinated well and got off to an excellent start. The early part of the growing season was excellent for growth and development but it became very hot and dry during later development and grain filling causing a reduction in yield and test weight. Diseases, except for some localized attacks of barley yellow dwarf, appeared to be of very little consequence. Some crown rust and stem rust appeared late in the season but no yield damage was noted.

The popularity of oats for set-aside acres has created a brisk demand for seed oats. The price of seed oats has been high and some poor quality, weed infested seed oats have been planted on some set-aside acres causing increased weed populations and the introduction of some new weed species. Some farmers have obtained good results by allowing the oats to mature on set-aside acres and then disking to help control weed populations and to move some of the seeds into the soil to enhance germination. When moisture is adequate a very dense stand of oats is established to help control weeds and provide ground cover for erosion control.

Oat Varieties

Although the Illinois Crop Reporting Service has not conducted a variety survey in recent years, information from seedsmen suggest that 'Ogle' continues to be the most widely grown variety in Illinois. 'Larry', 'Noble', and 'Otee' continue to be grown on significant acreage and the newer varieties 'Don' and 'Hazel' are increasing.

Personnel

Dr. Fred Kolb joined the Illinois Agronomy faculty in May 1987 and will devote a considerable part of his efforts to oat improvement. He will also work in the winter wheat improvement program and teach a beginning genetics course. Fred received his degrees from Pennsylvania State University where he gained valuable experience in the small grains program with Dr. Harold Marshall.

Dr. Adrianna D. Hewings has been appointed Research Plant Pathologist and Lead Scientist of the Cereal Virology Group in the USDA-ARS Crop Protection Research Unit at Urbana. She received her Ph.D. in plant virology in 1983 from the Department of Plant Pathology, University of Illinois. Her thesis work concentrated on purification, characterization, and diagnosis of beet western yellows and barley yellow dwarf viruses. From 1983 to 1987, Dr. Hewings was a Research Plant Pathologist at the USDA-ARS Foreign Disease-Weed Science Unit, Frederick, MD, a facility where pathogens potentially damaging to U.S. Agriculture are studied in containment greenhouses and laboratories.

At Frederick work focused on the basic biology and vector relationships of soybean dwarf virus, an exotic pest related to BYDV that causes serious diseases on legumes in Japan, Australia and New Zealand. At Urbana, Dr. Hewings' major responsibilities will be to continue the BYDV and soil borne wheat mosaic uniform nursery program established by Dr. Jedlinski, to continue collaboration with Drs. C. M. Brown and F. L. Kolb on oat and wheat germplasm enhancement and to begin a new program on mechanisms of resistance to barley yellow dwarf virus. A second virologist and a post doctoral research associate will be joining the group in the near future to work on molecular aspects of cereal viruses.

Dr. Wayne L. Pederson of the University of Illinois Plant Pathology Department has shifted approximately 50% of his effort from corn to small grains research. Wayne has worked on breeding for disease resistance and crop loss on corn for the past seven years. Prior to that he worked on wheat and barley diseases at North Dakota, Nebraska and Pennsylvania for nine years. His major emphasis will be on fungus diseases although he will be an active participant in all phases of the Illinois oat improvement program.

INDIANA

H. W. Ohm, Hari Sharma (Breeding, Genetics), J. E. Foster (Entomology), G. E. Shaner, G. C. Buechley (Pathology), R. M. Lister (Virology), K. M. Day (Variety Testing), and C. L. Harms (Extension).

Production. Oat production in 1987 is estimated by the Indiana Crop and Livestock Reporting Service at 6.4 million bushels, the same as in 1986. The state average yield was 67 bu/acre. Of the 600 thousand acres seeded to oat, the crop on 95 thousand acres was grown and harvested for grain and the crop on the remaining acreage was grown for soil conservation and was not harvested. The two most widely grown varieties in Indiana, Ogle and Noble, were grown on 39 percent and 26 percent respectively of the state oat acreage.

Season. Oat seeding began in March, and by the first week in April, 56 percent of the crop was seeded. Oat seeding was virtually completed by the end of April, and the average plant height of 5 inches was 2 inches higher than normal. Barley yellow dwarf virus (BYDV) was widespread and symptoms appeared early in the season, and together with dry weather throughout most of the oat growing season reduced the amount of tillering and yield in many fields. The oat crop was 93 percent headed by the third week in June, which was a day earlier than the previous record set in 1977. Harvest was underway in a few scattered fields by the end of June. By the third week in July oat harvest was 70 percent completed. In nursery trials at the Purdue University Agronomy Farm oat yields averaged 75 bu/acre in 1987 compared to 135 bu/acre in 1986, 124 in 1985, 103 in 1984, and 139 in 1983.

Research. Advanced-generation family analysis for tolerance to BYDV. A single seed descent procedure was used to obtain homozygous F_7-derived families from three single crosses. The families and parents were infected with pure isolates of BYDV in isolated chambers. A controlled infestation decreases the chances of a plant escaping infection, and pure isolates guard against any confounding effects of isolate mixtures. The plots in the field were protected from natural infestation of aphids by a nylon net cage, and application of an insecticide as needed.

Despite these efforts to control variation, no distinct, non-overlapping phenotypic classes were identified among the F_7-derived progenies for either the BYD symptom score or grain yield. The lack of phenotypic classes among progeny means indicates the BYD tolerance in the four parents used in this study is quantitatively inherited.

Recurrent selection for tolerance to BYDV. Two cycles of recurrent selection were conducted to determine the feasibility and effectiveness of this breeding strategy for improving tolerance to BYDV in an oat (*Avena sativa* L.) population. The base population (C_0) originated from 57 crosses between eight winter and nine spring oat lines, selected for their good agronomic traits and BYDV tolerance and/or crown rust resistance. A cycle of recurrent selection involved random intermating of the population twice followed by selection of BYDV tolerant plants to provide parents for the next cycle of random intermating. Selection for BYDV tolerance was among single S_0 plants that were infected with BYDV isolate PAV, and transplanted to the field for observation of BYDV symptoms. To evaluate progress for BYDV tolerance, three hundred randomly selected plants from the unselected C_0, C_1 and C_2 populations were grown to the one-leaf stage in transplanting flats and infested with viruliferous Rhopalosiphum padi L. aphids carrying the PAV isolate of BYDV. Plants were transplanted into the field in a completely randomized design with subsampling. A wooden frame cage covered with nylon net was erected over the experimental area to exclude natural populations of aphids. Heading date and BYD symptom score were recorded for each plant. Based on the mean BYD symptom scores (0-9 scale) for the C_0, C_1, and C_2 populations, significant progress for BYDV tolerance was made after two cycles of recurrent selection. The mean symptom score for C_0 was 5.2; that for C_1 was 5.0; and the mean symptom score for C_2 was 4.3, significantly reduced from that of C_0. Progress was made for BYDV tolerance. Thus recurrent selection for BYDV tolerance is effective and feasible in oat.

BYD symptom severity in oat affected by plant growth stages and type of field plots. The severity of BYD symptom development was determined in oat subsequent to infection at three plant growth stages and with two types of field plots. A combination of split-plot and split-block designs with four blocks was used to determine effects of plant growth stages at infection of BYDV in oat. Four treatments, non-inoculated, and inoculated at the three-leaf, four- to five-leaf, and stem elongation stages, were randomly assigned to whole plots. Oat cultivars 7869D1-5-3-4, Ogle, Noble, Putnam 61, and Clintland 64, listed in order of tolerance level, were randomly assigned to subplots. Two types of plot, hill and space-planted, were whole units in strips across the five cultivars. Effect of plot type was not significant and there was, in general, a high correlation between the two types of plot for the characters measured. Although differences among cultivars were greatest when infected at the three-leaf stage of growth, the rank was similar at all growth stages, indicating that susceptible cultivars may be severely damaged by BYDV infection at any stage of development through stem elongation. Infection at stem elongation, the treatment with least-severe BYD symptoms, did reveal differences between oat cultivar Putnam 61 that had a small level of tolerance, and Clintland 64 that was susceptible.

Personnel changes. David Baltenberger completed requirements for the Ph.D. degree and accepted a position with the Holly Sugar Company, P.O. Box 764, Sheridan, WY 82801. Judy Hertel has returned to a career in teaching. Dr. Hari Sharma who had initially joined the small grains research group as a Postdoctoral Fellow is now on our staff as a Research Agronomist.

IOWA

K. J. Frey, A. H. Epstein, R. K. Skrdla,
G. A. Patrick, and G. A. Schuler

About 650,000 acres of oats were harvested for grain in Iowa in 1987. Mean yield was 55 bushels per acre so the state production was about 35 million bushels. Oats were sown in Iowa in late March and early April, and there was adequate moisture for plant development. Temperatures were higher than normal which resulted in short a grain filling period and reduced test weight. Crown rust, stem rust, and barley yellow dwarf diseases were present in most areas of Iowa and losses to both crown rust and barley yellow dwarf were quite severe in 1987. Inspite of the weather and disease problems, grain yields were satisfactory.

Three experimental lines of oats, B605-1085, D226-30, and D227-32, have been mated to donor parents to provide isolines with different crown rust resistance genes for use in constructing multiline cultivars for these strains. All three experimental lines have high test weights and high yields. D226-30 and D227-32 are tolerant to barley yellow dwarf and B605-1085 is the most lodging resistant oat that has been developed recently. Four isolines of B605-1085, three of D226-30, and three of D227-32 have been composited to form three multilines that are being tested state-wide in Iowa in 1988. It is intended that each new multiline ultimately will contain six or seven isolines. Seed of these multilines will be available for sharing with other states in the Midwestern region for 1989 testing.

A study has been completed to (a) determine the range of nitrogen harvest indices (NHI) of oat lines in the gene pool used for breeding oats at Iowa State and (b) the relationship between NHI and adaptability parameters of oat lines to varying levels of soil N. The 480 oat lines used in this study had a range from 40-74% for NHI and tested in a high nitrogen environment. These lines were divided into 10 strata on the basis of their NHI values and five lines were selected at random from each stratum to represent 10 NHI groups. These 50 lines plus nine check cultivars were tested in 15 environments with productivity indexes from 0.90 to 3.18 Mg ha^{-1} grain yield. Three yield parameters, mean across environments, regression response to improving environments, and stability of response were used to measure adaptability. The groups were significantly variable in grain and straw yields. They were responsive to the improving environments, but were not significantly variable in their responsiveness. Among the yield characteristics, only mean grain yield was significantly correlated with nitrogen harvest index.

Recently, efforts have been made to enhance the groat-oil percentage of oats. Oat oil is a high quality vegetable oil suitable for human consumption. In this study, three cycles of phenotypic recurrent selection for high groat-oil content were conducted in an introgressed oat gene pool constructed to contain high oil alleles for both *Avena sativa* and the wild hexaploid oat *A. sterilis* in an adapted agronomic background. Selection for groat-oil content was applied to individual F_1 plants with recombination among the highest 10% to form the improved populations. One year was required to complete one cycle of selection. Samples of lines from the original gene pool and populations from three cycles of recurrent selection were evaluated for groat-oil content *per se*, oil yield per unit land area, and several other unselected agronomic traits. Gain in groat-oil content was realized both in cycle means and individual lines performance. The groat-oil content increased linearly 0.92% per cycle of selection, thus, increasing oil yield 21 kg per hectare per cycle. Broad-sense heritability and genetic variance remained high and significant suggesting that continued progress could be made for increasing oil percentage. Phenotype recurrent selection for high groat-oil content resulted in no significant correlated change in mean expression of any unselected agronomic trait.

Several changes have occurred in the ISU oat breeding personnel during 1987. Narimah Kairudin finished her Ph.D. degree, and she is now an assistant professor of genetics at Universiti Kebangsaan Malaysia in Sabah, Malaysia; Chris Branson completed his Ph.D. in late 1987, and he is a flax breeder with CSIRO in Canberra, Australia; Mary Evans completed all requirements for an M.S. degree in plant breeding, and she has chosen to pursue aquaculture for her Ph.D. degree at the University of Washington, Seattle. A new face on the small grains project is Steve Klein from Utah State University where he did a B.S. degree in biology.

MINNESOTA

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

Production

Oat production in Minnesota in 1987 was 45.6 million bushels, just slightly more than in 1986. The acreage harvested for grain, 800,000 acres, was the lowest since 1881. The proportion of planted acreage harvested for grain, 38%, is the lowest ever recorded and is even lower than during the PIK program in 1983. The 1987 season started out with reduced surface soil moisture in much of the state because of little snowfall in the winter. Seeding was quite early in some areas and emergence spotty in others. Temperatures and rainfall were not always favorable for the oat crop early in the growing period, but became more favorable. As a result, although yields were only average, quality was quite good in many areas and certainly better than in 1986.

Research in recurrent selection

Progeny from the fourth cycle of recurrent selection will be evaluated for a second year and also at a second location. In 1986, C_4 progeny yielded 52.9% more than the original C_0 parents as well as 6.2% more than their C_4 parents. In past comparisons, progeny from any given cycle have not exceeded their parents in yield. Progeny from C_4 parents crossed with Ogle exceeded C_4 progeny in grain yield by 5.8% while progeny from Starter crosses with C_4 parents averaged 94.7% of C_4 progeny. These latter results (Gary Pomeranke's Ph.D. research) are encouraging because it appears that we can open our recurrent selection system and cross with other genetic backgrounds to correct some deficiencies created by our single trait selection and yet not lose the very high yielding gene combinations accumulated by recurrent selection. If these results are confirmed with further testing, we may be able to take advantage of the high yielding germplasm generated by recurrent selection to produce new cultivars with only one cycle of crossing with outside germplasm. Previously we were concerned that our closed system might result in gene combinations which would be superior within the system but which might combine quite poorly with genetic backgrounds outside the original gene pool. The C_4 parents have been formally released as germplasm and seed of each is available upon request.

Other germplasm releases

We have also released Mn 88301 germplasm, a line with the pedigree St 39/4/Noble/Clintland 64/3/Ot 207/Froker/Noble (St 39 = Garland/Portage//Otter/CI 8339/3/Otter/CI 8335/4/Garland//Stormont/CI 8320/3/Garland/Portage//Jaycee/CI 8340) which contains the peduncle extender gene(s) probably derived from *Avena sterilis* L. This material is the subject of Mark Farnham's Ph.D. thesis research which he is about to complete.

A second germplasm line Mn 88302 with the pedigree Astro/3/Stormont/CI 8340//Lodi/Egdolon #26 has also been approved for release and seed is available upon request. This selection is usually not competitive for grain yield but has excellent lodging and crown rust resistance, the latter most likely contributed by CI 8340, an *Avena sterilis* accession.

Personnel

Mr. David Miller joined the breeding program last June to pursue a M.S. degree. He will be assessing the effectiveness of early generation selection for lodging resistance and for barley yellow dwarf virus tolerance. He is also studying the inheritance of the smut resistance being used in our breeding program.

Ms. Hakima Bahri recently joined the breeding project in pursuit of a Ph.D. Hakima has the equivalent of a M.S. degree from The Institute of Agriculture and Veterinary Medicine Hassan II in Rabat, Morocco. She will be assessing the effectiveness of using early generation bulks to predict the superior crosses in our recurrent selection program.

Mr. James Reysack will join the project in June 1988 after earning his B.S. at Iowa State. His thesis research area has not yet been decided.

Dr. Kurt Leonard has agreed to assume the Directorship of the Cereal Rust Lab this summer. We look forward to his coming and to his research on oat rusts. He will assume management of the buckthorn nursery beginning with the 1989 season.

MISSOURI

Anne McKendry, Paul Rowoth, Calvin Hoenshell

Production: Oat acreage in Missouri has been on the rise in recent years averaging 180,000 acres for the past three years. The 1987 growing season was one of regional areas of high temperature and drought. Barley yellow dwarf virus was of major concern in the oat growing regions of Missouri, moving into fields early in the season. The lack of rainfall and high temperatures enhanced the impact of the disease and resulted in severe regional yield losses.

Varieties: Ogle continues to be the major variety grown in Missouri.

Personnel Changes: Dr. Anne L. McKendry, a graduate of the University of Manitoba, Canada, has taken over the small grains breeding program from Dr. Dale Sechler who will be retiring. Her main research objectives in the oat breeding program will be to increase the biological efficiency of the crop when grown under Missouri conditions, through investigations of a basic and applied nature, of characters important to the success of the crop including BYDV and stress tolerance.

NEBRASKA

P. Stephen Baenziger, Thomas S. Payne
University of Nebraska

The Nebraska 1987 harvested oat acreage was estimated at 400,000 acres. The state-wide grain yield average was estimated at 48.0 bu/A. Spring seeding generally occurred at a rate ahead of normal due to favorable planting conditions. In southeastern Nebraska, however, early springtime rains delayed planting. Hot, dry weather conditions occurred throughout the state in April and May resulting in reduced opportunity for tiller development, and subsequent reductions in grain yield. Barley yellow dwarf virus was the only disease of consequence.

Oats variety testing was performed at five environments (one irrigated) across Nebraska in cooperation with Professor A. F. Dreier, Nebraska Outstate Testing. Sixteen cultivars, and three experimental lines (MN81229, SD810109, and WI X4872-2) were included in these trials. A summarization of the data from these trials is presented in "Nebraska spring small grain variety tests-1987" (E. C. 87-102). The four highest yielding (bu/A) cultivars or lines in these statewide trials were Ogle (98), WI X4872-2 (87), Don (85), and Hazel (84). The Uniform Early Oats Performance Nursery, and Uniform Mid-Season Oats Performance Nursery were cooperatively evaluated at Mead, NE.

August F. Drier, longtime coordinator of the Nebraska Outstate Testing Variety Trials, will retire from this position in April, 1988. Dr. Lenis A. Nelson has been selected to fill this position. Thomas S. Payne, spring grains nurseries cooperator, will received a Ph. D. in Agronomy-Plant Breeding in May, 1988. He has accepted a post-doctoral position with the CIMMYT wheat program. Mr. Terry Burke, Graduate Research Assistant for P. S. Baenziger, will replace Mr. Payne.

NEW YORK

Mark E. Sorrells and G. C. Bergstrom

1987 Spring Oat Production: The 1987 oat crop for New York State averaged 65 b/a on 190 thousand acres harvested 8 b/a lower yield and 10 thousand more acres than for 1986. The yield reduction was probably due to a warmer and dryer than average early spring followed by very wet cloudy weather during grain fill. Ogle and Porter continue to dominate the acreage planted.

Cultivar Development: There is a strong demand for white oats by the race horse trade. Ed Souza has completed a backcrossing program to transfer white hull color into Ogle. Approximately 50 backcross 4, F3 families will be field grown and evaluated in 1988. If performance data are similar to Ogle we anticipate a release in 1989.

NY80002-1 will enter the Uniform Midseason Oat Performance Nursery in 1988. This line has performed well over the past two years in New York trials. Yield is equal to Ogle and test weight is 7 kg/hl higher. Lodging resistance is superior to Porter but lower than Ogle under New York growing conditions. The origin of this line is unusual in that it was a selection from a composite of crosses between cultivars and *Avena sterilis* developed by the Iowa State University breeding program. The composite was described by Dr. Frey in the 1977 Oat Newsletter.

Genetic Relationships Among North American Oats In 1987 a 3 year project was completed examining the relationships among recent oat cultivars. Two objectives of this research were: 1) review genetic relationships among oat cultivars using three genetic measures and 2) evaluate the usefulness of genetic relationship measures for parental selection.

Three genetic relationship measures were used to form clusters of similar genotypes: 1) coefficients-of-parentage, 2) similarity of quantitative morphological characters, and 3) covariance-of-allele measures based on simply inherited morphological and biochemical traits. Coefficients-of-parentage and covariance-of-allele genotype clusters were the most similar to each other. Clustering by quantitative morphological characters was a poor measure of genetic similarity due to biases of simply inherited factors controlling photoperiod and vernalization; however, it was an efficient method of identifying cultivars with similar adaptation. Conclusions of cultivar clustering by coefficients-of-parentage and covariance-of-alleles were:

1) regional oat germplasm pools have declined significantly in importance since the 1950's due to inter-hybridization. During 1951-60, 56% of the cultivars released belonged to regional parentage groups such as the fall planted, Northeast, or Canadian praire regions. From 1976-85, 85% of released cultivars were grouped into a single central parentage cluster, including most Canadian and fall planted cultivars.

2) the germplasm pool parentage is becoming more diverse, with the 10 most important ancestral parents accounting for 34% less of the oat parentage from 1976-85 than for the cultivars released from 1951-1960. It was also found that an average of 13% of the parentage of all cultivars released could be traced to the cultivar Victoria. This was more than any other land race or plant introduction.

3) The midseason and Canadian spring cultivars sampled had high similarity based on the covariance-of-allele measurements; jointly had a 33% lower genetic diversity level than the smaller sample of fall cultivars. The covariance of alleles between the cultivar clusters indicates that the fall germplasm, particularly the *A. byzantina* types are still highly divergent from the spring germplasm and probably have considerable potential for providing useful quantitative variation for crop improvement in the larger midseason and Canadian growing regions

Prediction of progeny variation by genetic relationship measures was tested in two field experiments: 1) a Design II experiment using 76 F_1 hybrids and 2) an F_4 family experiment to estimate genetic variances within crosses using 20 crosses and 600 families. The best predictors of F_1 specific combining ability (SCA) were genetic relationship measures that combined similarities of quantitative morphological characters with either coefficients-of-parentage or covariance-of-allele measures. The highest positive SCA effects for most agronomic traits were among the most genetically similar parents. Genetic distance between parents based on coefficients-of-parentage (J_r) was the best predictor of genetic variance among random F_4 families within a cross. A positive association was found between J_r and genetic variances for plant biomass (R^2=0.48) and negative association were found to grain yield, test weight, heading date, physiological maturity date, and grain filling period. Genetic variances for characters such as test weight may have been high for divergent crosses; however, the variance may not have been expressed due to the poor progeny adaptation. An example of this would be the cross Marathon/Calibre which had a high J_r value but a low genetic variance for test weight [2.4 (kg $hl^{-1})^2$] because many of the progeny headed too late (average 29 June) in the season to produce well-filled seed. Ogle and Porter, well adapted cultivars, headed on 19 and 24 June respectively. The Marathon/Calibre families had the lowest average test weights of any of the crosses (33.1 kg hl^{-1}).

Distances between parents based on coefficients-of-parentage is both the simplest and most reliable predictor, examined in this research, of genetic variances of inbred progenies. For selection of improved inbred cultivars the best crosses for a breeding program are crosses between divergent parents that are generally adapted to the targeted growing area. This does not preclude the use of unadapted, genetically divergent, germplasm, but these experiments indicate that the full range of genetic variation will not be expressed in the adapted-by-unadapted cross due to poor progeny adaptation. Therefore, identification of superior adapted lines will require large populations for selection. These results confirm intuitive plant breeding methodology, however, they also provide an additional objective criteria for efficient selection of parental combination. This is of particular importance for new breeders unfamiliar with the available germplasm or experienced breeders who need a criteria for culling through potential parents that have been found to be locally adapted but have not been used previously in a crossing program.

The inheritances were studied of four avenin loci (*Av-1*, *Av-2*, *Av-3*, and *Av-4*), four esterase loci (*E-11*, *E-12*, *E-13*, and *Be-1*), and one diaphorase locus (*Dia-1*) as well as four morphological characters: seedling pigmentation, nodal pubescence, sheath pubescence and leaf margin pubescence.

The results of this research are presented in Ed Souza's dissertation. Mark Sorrells and Ed Souza are planning to publish in a department bulletin the coefficients of parentage for 205 oat cultivars released since 1951.

Publications:

Souza, E. J., and M. E. Sorrells. 1988. Mass selection for improved groat percentage in oats. Crop Sci. 28: Accept for pub.

NORTH CAROLINA

Ronald E. Jarrett, Steve Leath and Paul Murphy
North Carolina State University

Growing Season

The 1986-87 growing season was good for oat production. Temperatures were near or above normal, and rainfall was more than adequate to produce a good crop. Diseases, as always, were present but were not a major problem. Harvesting was completed in early July.

Production

There were 105,000 acres of oats planted in North Carolina. Forty-three percent of the acreage (45,000) was grown for cover crops, hay, silage, etc. while 57% (60,000 acres) was harvested for grain. Production was 3.54 million bushels (a 60.9% increase over 1986). The average yield per acre was 59 bushels (a 47.5% increase over 1986). The value of the grain production was $4.96 million (a 73% increase over 1986), while the total value of the entire crop was $8.67 million in 1987. The large increases in 1987 reflected a rebound from the poor yields in 1986 due to a prolonged drought and an overall poor growing season.

Breeding and Pathology

A study on the possible predisposition of oats to winter injury resulting from fall infections by soil-borne plant pathogens was initiated. Seeds of 10 cultures and 35 experimental lines were planted as plots and headrows, respectively, in both the Piedmont and Mountain regions of North Carolina in mid-October 1987. Soil treatments of methyl bromide, benomyl or metalaxyl were used to influence populations of pathogens in field plots. Lines will be evaluated for stand, plant vigor, yield, yield components and presence and identity of soil-borne pathogens, especially *Fusarium* sp., *Rhizoctonia solani* and *Pythium* sp. Powdery mildew of oats was visible in the breeding nursery this year after a long absence.

We routinely screen experimental lines for tolerance to the oat soil-borne mosaic virus (OMV) in short rows (1 x 0.3 m). We experience difficulties with studies involving segregating populations, or large-scale germplasm evaluations, due to space limitations in the designated areas of our nursery exhibiting intense, and even distribution of, virus in the soil. An experiment was initiated in the fall of 1986 to study the feasibility of using hill plots (7 seeds/hill) in field screening for OMV tolerance and to measure the correlation between tolerance estimated on plants grown in infested soil in the greenhouse and the field.

Two estimates of tolerance were obtained on 21 genotypes exhibiting a range of OMV tolerance: a) leaf mottling (0-9 scale) during the first flush of growth in spring (field) or after cold treatment (greenhouse) and b) plant vigor (0-9 scale) estimated in the boot stage. Spearman rank correlations between hill plots and short rows in the field were 0.83 and 0.80 for leaf mottling and plant vigor, respectively. Correlations between greenhouse and field estimates for leaf mottling were 0.50 to 0.58 for hill plots and short rows, respectively, and for plant vigor were 0.46 to 0.56 for hill plots and short rows, respectively. We concluded that hill plots can be substituted for short rows in field trials, but greenhouse screening cannot be substituted for field screening. David Uhr, an M.S. candidate, is continuing his soil-borne mosaic virus studies.

Personnel Changes

Dr. Carol Wilkinson completed the requirements for her doctoral degree in the fall of 1987 and is now an Assistant Professor of Agronomy at VPI&SU working on burley tobacco breeding. Tim Phillips, a Ph.D. candidate, joined our program in late 1987 and is studying isozyme variation among accessions in the USDA *Avena sterilis* germplasm collection.

NORTH DAKOTA

Michael S. McMullen

Production

The growing season was characterized by exceptionally warm temperatures allowing early planting. Above normal temperatures and below normal soil moisture resulted in heat and moisture stress in most areas of the state. Severe disease problems did not develop. According to the North Dakota Agricultural Statistics Service, the 1987 North Dakota oat crop averaged 52 b/a on 700,000 harvested acres producing 36.4 million bushels of grain. The grain yield was very close to the five year average of 52.5 b/a. The 1.05 million acres planted and .7 million acres harvested are identical to the 1986 statistics.

Varieties

The North Dakota Agricultural Statistics Service conducted an oat variety survey for the 1987 season and the following distribution of varieties was indicated:

VARIETY	PERCENTAGE OF ACREAGE	ACRES PLANTED
Otana	31.0	325,400
Steele	11.4	120,300
Dumont	11.2	117,200
Kelsey	8.6	90,200
Moore	8.0	83,500
Harmon	6.5	68,300
Rodney	4.6	48,900
Fidler	3.3	34,200
Burnett	1.7	17,300
Russell	1.2	12,400
Porter	1.1	11,100
Pierce	0.8	8,300
Lyon	0.5	5,500
Proat	0.5	5,600
Other & Unknown	9.6	101,800

Otana still remains the most popular variety in North Dakota, particularly in the western half of the state where stem and crown rust problems occur infrequently. Dumont and Steele have rapidly gained popularity. Steele seems best adapted to the eastern half of the state while Dumont has performed well over most of the state.

Breeding Program

ND820603 was named 'Valley' and released for the 1988 growing season. A description of Valley appears in the new variety section. A major increase of ND810104 (RL3038/Goodland//Ogle) is being made in 1988 with intent to release for 1989.

A severe hail storm destroyed an F_6 nursery, one location of preliminary yield trials, and purification increases of promising new lines. Seed was salvaged in cases where remnant seed was not available.

Research

A thesis study by John Erpelding determined that the 'Alpha' source of stem rust resistance of the breeding line ND811386 is conditioned by a complex of 3 recessive genes. Lines with the complex conditioning the resistant reaction tend to have increased groat percentage, decreased straw strength, increased plant height, and later maturity than lines without the complex which were derived from the same F_2 plant. It appears that special attention to selection for straw strength, reduced height, and relatively early maturity may be useful in working with breeding materials with the 'Alpha' resistance.

Personnel

John Erpelding completed his M.S degree in June. Eugene Leach will join our project as a M.S. student beginning June 1, 1988.

OHIO

O.A.R.D.C./O.S.U.
Robert W. Gooding and H. N. Lafever

Oat Production in Ohio in 1987

Oat production in Ohio was 17.5 million bushels in 1987, up 44 percent from 1986 levels. Acreage harvested at 250,000 acres (71 percent of acres planted) was an increase of 56 percent from the record low of 160,000 acres harvested in 1986. The statewide average yield of 70 bushels per acre was down 6 bushels per acre from the 76 bu/a yield of last year.

Oat production increases were due primarily to increased oat plantings brought about by a decrease in acres planted to wheat because of poor planting weather during the fall of 1986. In addition, prices received for oats also rebounded dramatically from 1986 to 1987 which contributed to an increase in harvested acres. Oat production in Ohio continues to be primarily in the northern half of the state with the bulk of the production being associated with the dairy industry and Amish communities of Wayne, Holmes and Stark counties located in Northeastern Ohio. The most popular varieties in Ohio continue to be 'Ogle', 'Noble' and 'Porter'.

In 1987, oat seedings in Ohio were timely with 50 percent of the crop seeded by the second week of April. Cold temperatures and heavy snows hampered field work during the first week of April, but afterwards, normal to above normal temperatures and below average precipitation allowed oat seeding to continue unabated. Across Ohio, oats were essentially 100 percent seeded and emerged by the middle of May.

By the third week of June, oat heading had reached 88 percent compared to 74 percent on the same date in 1986 and the 60 percent average. Although the crop was rated by the Ohio Agricultural Statistics Service as "in good condition", higher than normal temperatures across the state and generally lower than normal precipitation caused yields per acre to be down compared to 1986 levels. Oat harvests began in 1987 several days earlier than in previous years, diseases were minimal and while lodging was reported in some locations, the crop condition generally continued to be rated as good.

Oat Breeding & Research

In 1987, excellent progress was made towards the goal of developing new oat cultivars for Ohio and the Midwest with increased yield, crop and grain quality and disease resistance. The specific objectives of this program continue to include this goal, as well as the evaluation of out-of-state cultivars and experimental lines for Ohio production potential and their potential for inclusion in the crossing program. We are also studying optimum production practices for oats in Ohio.

At the inception of the program in 1984, plots evaluated totaled 831. By 1988, that number will have increased by over 950 percent to 7,966. In 1984, 31 percent of the plots evaluated in the program were devoted to early generation breeding material. By 1988, 78 percent of the plots will involve early generation breeding lines, 10 percent will be devoted to preliminary and advanced experimental line replicated yield trials and the remaining 12 percent will be devoted to statewide yield trials, uniform nurseries and miscellaneous nurseries. By the end of 1988, over 26,000 plots will have been evaluated in the oat breeding program.

In 1987, experimental lines selected in our own program were evaluated for the first time in replicated yield trials. Four 'preliminary rod-row nursery' experiments were conducted in which 22 lines and three check cultivars were evaluated in 4 replicates in each experiment. This resulted in a total of 88 experimental lines evaluated. Of these 88 lines, 64 were retained for further testing with 22 of them being promoted to a statewide advanced rod-row yield test to be conducted at 3 locations in Ohio in 1988.

In 1987, individual plant selections were made for the first time out of populations arising from crosses made in our own oat breeding program. In the 1987 season, over 4,500 selections were made in bulk populations grown in the field. These selections will be evaluated in the 1988 'Headrow' nursery comprised of 5,000 to 6,000 hill plots made up of check cultivars and F_4 plant selections.

OREGON

R.S. Karow and P.M. Hayes
Crop Science Department, Oregon State University

Oats were planted on 90,000 Oregon acres in 1987 and harvested from 65,000 acres according to the USDA Ag Statistics Office in Portland. Yield is estimated at 80 bu/A statewide. Harvested acreage is down by more than 15,000 acres from 1986. Oats rank 39th among Oregon agricultural commodities in terms of gross dollar sales with an estimated value of $9 million. Acreage is concentrated in the Willamette Valley (western Oregon) and in the Klamath Basin.

White, tan, yellow, grey, and red oats are grown. Common winter varieties include Walken, Grey Winter, Kenoat and Amity. Grain type spring oats include Cayuse, Otana, Border, and Monida. Kanota, Swan, Sierra, and Montezuma are grown for hay. More than 75% of the oats produced in Oregon enter market channels.

Quality of this past year's crop was average or below. Rains at harvest time led to some sprout damage and to discoloration of grain. Test weights tended to be lighter than normal.

Interest in oats is high, as is the case in much of the United States due to reports of shortages and imports from Canada and Europe. Prices have been very good in comparison to other feed grains and to wheat. Fall oats were planted in Oregon's Columbia Basin for the first time in many years and spring acreage, both dryland and irrigated, is being considered in this same area.

Research efforts continue to be limited due to the small acreage of this crop. No breeding work is being done at this time, though varieties and breeding lines from other programs in the west, midwest and east are being evaluated. Production research is underway to determine optimal management practices for newer varieties. Grain quality and yield will be evaluated in these trials.

An oat milling facility in Eugene, Oregon, has been renovated and the operators of this mill are seeking to use as many Oregon grown oats as possible; however, poor quality and low protein levels have limited usefulness of locally grown oats this year.

SOUTH DAKOTA

D. L. Reeves and Lon Hall

<u>Production</u>: Despite a record low planting of 1.4 million acres, oat production rose nearly 15% over the previous year. Grain production was 52.9 million bushels. Harvested acreage at 1.15 million acres, increased 10% from last year's record low. The government farm program continues to be a major factor in our reduced oat acreage. Grain quality was lower than usual. This was due to two factors. Barley yellow dwarf came into the state early and affected many fields. We had much more barley yellow dwarf than anytime in the preceding 15 years. If it continues at this level, it could become the major disease of oats in the state. In addition, some of the major oat growing areas also had below average rainfall during the oat growing season.

<u>Varieties</u>: Burnett continues to be very popular in the central and western parts of the state where it is drier and little crown rust is present. New varieties becoming quite popular are Don and Hytest. This is due to their large white kernels which are in demand in the race horse and trucker trade. The remaining acreage is split among several varieties.

<u>Research</u>: White grain with good test weight continues to be the major emphasis in our variety development program. Crown rust has been the disease receiving the most emphasis. Some BYDV resistance has been in the program, but much more emphasis is being placed on it now. Smut and stem rust are the other diseases of concern.

Herbicide research has shown an environment interaction with affects varying considerably in different environmental conditions. Variety x herbicide interactions are also sometimes found. Predicting herbicide injury can be very difficult if you've got to consider herbicide, variety, stage of spraying and environment.

The selection SD 810109 (PI 508100) was released in 1988 as the variety 'Trucker'. See the new varieties for a description. The selection SD 820045 is being increased with intent to release.

TEXAS

M. E. McDaniel, David S. Marshall, L. R. Nelson
K. B. Porter, W. D. Worrall, E. C. Gilmore,
James Mulkey, Lucas Reyes, and C. A. Erickson

The 1985, 1986, and 1987 crop seasons were relatively favorable for oat production in Texas. Following the disastrous freeze damage to much of the Texas crop in the 1983-84 season, the planted acreage of oats fell to 1.2 million acres in 1985. The planted acreage fell to 1.0 million acres in 1986, despite a record high average state yield of 50 bushels per acre in 1985. The planted acreage in 1987 was 1.1 million acres. Statewide oat yields in 1986 averaged 42 bushels per acre, while the average yield was 45 in 1987. The harvested acreage in Texas continues to be approximately 20 to 25 percent of the planted acreage each year; the primary utilization of the oat crop continues to be as livestock forage in the winter and spring months. Much of the harvested acreage is grazed excessively before cattle are removed, and this contributes to the rather low statewide average yields, as does less than optimal management of the oat crop.

We released a new oat variety, TAMO 386, in 1987. The variety has good resistance to crown rust and stem rust, and has an outstanding yield record in South Texas trials. Grain yield and test weight data for 1983-1987 oat yield trials at Beeville are given in Table 1. Crown rust and stem rust were very light in both 1983 and 1984, and yields of all entries were high. Both crown rust and stem rust caused severe damage to susceptible entries in 1985 (note extremely low yields and test weights of all entries except TAMO 386), and moderate to severe damage to susceptible entries in both 1986 and 1987. Yield and test weight were not obtained for Florida 501 in 1985 because of severe shattering of this early-maturing variety; harvest was seriously delayed by spring rains.

Table 1. Grain yields and test weights for TAMO 386 and check varieties in oat trials at Beeville, Texas, 1983-1987.

Variety	1983	1984	1985	1986	1987	Average
	Grain yield, bushels per acre					
TAMO 386	106.0	82.6	89.6	105.0	100.4	96.7
Nora	114.0	80.9	16.9	34.2	26.9	54.6
Coker 234	99.5	72.9	38.4	72.9	76.0	71.9
Big Mac	89.5	69.1	21.5	77.9	57.7	63.1
Mesquite	93.2	76.1	31.7	78.9	62.2	68.4
Coronado	92.8	82.3	44.5	52.0	60.8	66.5
Bob	101.9	72.5	30.1	52.4	41.6	59.7
H422	78.6	60.8	38.6	76.6	78.8	66.7
H833	95.4	77.6	17.4	88.1	69.5	69.6
Fla. 501	102.2	67.6	--	59.8	70.2	--

Table 1 (continued).

Variety	1983	1984	1985	1986	1987	Average
	Test weight, pounds per bushel					
TAMO 386	35.5	31.0	31.0	32.5	35.5	33.1
Nora	31.5	31.0	15.0	23.0	30.5	26.2
Coker 234	31.0	31.0	18.0	28.5	33.5	28.4
Big Mac	30.5	35.0	16.5	31.0	33.5	29.3
Mesquite	30.5	32.5	15.5	24.0	33.5	27.2
Coronado	33.5	32.5	17.5	28.0	34.5	29.2
Bob	36.5	37.5	20.5	30.0	35.0	31.9
H422	33.5	30.5	17.0	29.5	33.5	28.8
H833	29.5	32.5	14.5	26.5	32.0	27.0
Fla. 501	37.0	31.5	--	32.0	35.0	--

The relatively minor reduction in test weight of susceptible varieties in the 1987 trial (as compared to the degree of reduction in grain yield) is quite striking. We attribute this lack of serious test weight reduction to excellent soil moisture, and less damage from hot, drying winds than usually occurs at Beeville.

We also have compared the effect of fungicide protection on yield and test weight of TAMO 386 (resistant to both crown rust and stem rust) and Nora (very susceptible to crown rust and moderately susceptible to stem rust) at Beeville in the 1986 and 1987 seasons. Data are presented in Table 2. Yields and test weights of TAMO 386 were not significantly improved by one to three applications of 'Tilt' fungicide (Ciba-Geigy), while yields and test weights of Nora were improved dramatically each year.

Table 2. Yields and test weights of TAMO 386 and Nora Oats in fungicide-treated and untreated plots at Beeville, TX, in the 1985-86 and 1986-87 crop seasons 1/ .

Treatment 2/	Yield, bushels per acre					
	TAMO 386			Nora		
	1986	1987	Avg.	1986	1987	Avg.
Check	102.6	111.4	107.0	42.6	42.1	42.4
Early 3/	115.5	112.4	113.9	67.4	65.6	66.5
Late 4/	104.7	113.4	109.1	53.4	46.6	50.0
E. + L. 5/	105.8	119.1	112.5	79.7	71.0	75.4
"Full" 6/	102.3	114.2	108.3	86.0	76.6	81.3
L.S.D. (.05)	NS	NS	--	18.0	12.2	--

Table 2 (continued).

Treatment [2]	Test weight, pounds per bushel					
	------ TAMO 386 ------			------ Nora --------		
	1986	1987	Avg.	1986	1987	Avg.
Check	29.7	35.5	32.6	22.5	31.5	27.0
Early [3]	29.3	35.0	32.2	25.0	35.0	30.0
Late [4]	29.1	36.0	32.6	25.2	34.5	29.9
E. + L. [5]	29.5	35.5	32.5	27.2	36.5	31.9
"Full" [6]	29.1	36.0	32.6	27.6	36.5	32.1

1/ Both crown rust and stem rust caused moderate to severe damage in both these crop seasons at Beeville. Most of damage to Nora was from crown rust.
2/ Each application of Tilt was 4 oz. active ingredient per acre.
3/ Early treatment in late joint stage.
4/ Late treatment in milk stage.
5/ E. + L. treatments in both late joint and milk stages.
6/ "Full' treatments applied in late joint, milk, and dough.

We believe that the lack of response of TAMO 386 indicates that the crown rust and stem rust resistances of the new variety are providing very good protection against these diseases. It should be pointed out that Nora had appreciable levels of crown rust infection before fungicide was first applied in either year at Beeville. Repeated fungicide applications did give good protection to the upper three leaves. Commercial oats in Brazil are being protected against crown rust with two applications of Tilt at the 4 oz. rate. This treatment appears to give excellent control of the extremely virulent crown rust races in Brazil.

Male Sterile Oat: Inheritance of male sterility derived from spontaneous male-sterile plants discovered in the greenhouse at College Station is being studied. F_2 populations from crosses with the original male sterile plants had a low frequency of sterile plants. We sib-mated male sterile F_2 plants with fertile sibs; several F_1 families from such crosses appeared to segregate 1 fertile : 1 sterile. Therefore, it appears that we have eleminated one of the restorer genes, and that sterility in these families is being conditioned by one gene. Seed from fertile F_1 plants from these families will be distributed to interested oat workers; we expect a 3 fertile : 1 sterile segregation in the F_2 populations from these F_1 plants.

Three-lobed Stigma Trait: H833 oats (a commercial variety grown in Texas, developed by the Coker Pedigreed Seed Co.) was found to have an unusually high frequency of three-lobed stigmas. This trait might be suitable for a study of gene penetrance, as there appears to be considerable environmental influence on the frequency of expression of this characteristic.

Personnel: Dr. Bruce McDonald has recently joined the staff of the Department of Plant Pathology and Microbiology as an Assistant Professor in Small Grain Pathology. Dr. McDonald brings additional strength in population biology and genetics to the department and to the small grains research team; he will focus on dynamics of the host-pathogen interaction in small grain diseases. Dr. McDonald has a B. S. Degree in Plant Sciences from the University of California at Riverside, and completed his Ph. D. at the University of California at Davis in 1987. His Ph. D. work was directed by Dr. Bob Allard (population genetics) and Dr. Bob Webster (plant pathology). His dissertation research was a study of the host-pathogen interaction between *Rhynchosporium* (barley scald disease) and Suneson's Composite Cross II population in the F_{45} generation.

UTAH

R.S. ALBRECHTSEN
UTAH STATE UNIVERSITY

Production. Weather conditions were favorable for planting the 1987 Utah oat crop. State-average yield was down slightly from that of the previous few years, but a small increase in acreage resulted in a near-average total production. Our oat acreage is small but stable.

Losses from diseases are generally minimal, although loose smut can sometimes be severe. Infestations of the Cereal Leaf Beetle can be heavy in given areas. Grasshoppers are also a problem in some years.

Oat Program. Utah's small oat acreage does not justify an oat breeding program. Improved cultivars are identified by growing the Uniform Northwestern States Oat Nursery. The relatively new cultivar, 'Monida', appears to be well 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, H. L. Shands, and
K. D. Gilchrist (Agronomy) and A. H. Ellingboe (Plant Pathology)

Production, Diseases, and Varieties

Wisconsin farmers planted 1,300,000 acres of oats in 1987 and harvested 800,000 acres for grain and straw. The statewide grain yield was estimated at 54 bu/a, down 8 bu from the 1986 average. The yield reduction was due to the prevalence of warm, dry conditions for a 4 to 6 week period during virtually all of June and in early July. In addition, severe, early crown rust infection developed in many oat growing areas in Wisconsin. Many fields of Ogle were damaged severely by the rust, resulting in low yields and light test weights. Ogle has been the leading variety in Wisconsin for several years. Porter oats also suffered crown rust induced reductions in yield and bushel weight. Centennial, Webster, and Steele, which have good to excellent crown rust resistance, performed well in much of the state, although there were several reports of BYDV in fields of Steele. There was very little stem rust in Wisconsin in 1987.

The new variety Hazel was produced by Certified seed growers for the first time in 1987 and will be grown on farms for the first time in 1988. Most of the Certified seed growers had highly favorable reports on Hazel. They were impressed with its disease resistance and its ability to produce a good crop in spite of heat and moisture stress. We are expecting that a sizable proportion of the Ogle acreage will be replaced by Hazel.

Wisconsin selection X4872-2 performed very well in 1987, so we are proceeding with a major increase of it in 1988. We anticipate releasing it to Certified seed growers in 1989. X4872-2 has produced yields similar to Ogle and Hazel in recent tests. Its level of crown rust resistance is similar to Centennial's, having good field resistance but not immunity.

We are also proceeding with an increase of the forage oat selection SN404. When harvested at early heading, its forage yield has exceeded Porter's and Lodi's by 600-700 lbs/a (dry basis) in two years of testing at Arlington. The 1988 seed production will determine how rapidly we proceed with it.

The interest in forage oats is continuing to increase in Wisconsin. Most of the state's 500,000 acres of oats that were not harvested for grain in 1987 were harvested in the late boot to early heading stage as forage. Canadian field peas were mixed with oats at planting in a number of fields. Dairymen have been pleased with the yields and quality of oat-pea mixtures as a source of feed for their high-producing milking cows. Our research has shown that planting oats at a rate of 1 to 1.5 bu/a and Trapper peas at a rate of 80 to 100 lbs/a should produce forage that has 17-18% protein and 46-50% NDF.

Quaker-South American Nursery

There were 160 pure lines and 140 segregating populations in the Quaker nurseries grown in South America in 1987. M. E. McDaniel (Texas A and M University), D. C. Burnette (Quaker Oats Company) and M. A. Brinkman visited nurseries in Brazil, Argentina, and Chile in November of 1987. The group visited four Quaker nurseries in Brazil, three in Argentina, and one in Chile. In general, all of the nurseries were in excellent condition for taking notes. The ME1563 source of crown rust resistance, derived from *Avena sterilis* L., continues to provide excellent resistance to crown rust, especially in the Coronado^2/Cortez^3/Pendek/ME1563 pedigrees. These pedigrees looked particularly good at Tres Arroyos in 1987. They tend to be later than desired in Brazil.

Commercial oat fields in Brazil, especially in Rio Grande do Sul, looked marvelous. Barring inclement weather, Elmar Floss felt that the 1987 season could be one of the best on record. UPF-5 is now widely grown in Rio Grande do Sul, and is easily the most popular variety. The Quaker group visited several fields of UPF-5 between Passo Fundo and Vacaria that looked excellent. The oats in several fields were close to 5 feet in height, as UPF-5 is a tall variety. The Quaker group also visited fields of UPF-7 and UPF-8 in the Passo Fundo area that looked excellent. Favorable oat growing weather was certainly one of the reasons for the excellent appearance of the oats crop in Brazil. Another reason is that Brazilian farmers are now using fungicides extensively on oats. One or two applications of Tilt or Bayleton are very common.

Most of the commercial oat fields in Argentina looked very good to excellent, although the Quaker group visited several fields east of Tres Arroyos that were heavily infested with rust. Most of the oats in Chile were not quite far enough along in their development to assess their yield potential, but they appeared to be developing well.

Thesis Research Projects

Mr. Ronald A. Bunch is in the final stage of his Ph.D. study of relationships among oat plant vegetative growth (vegetative yield), hull and groat percentage, and grain yield. Hull and groat growth rates for six genotypes have been determined at 2 to 3 day intervals from anthesis to maturity in 2 years. An interesting result is that lower groat percentages are more closely associated with higher hull growth rate and higher final hull weight than with lower groat growth rate and lower final groat weight.

Mr. M. A. Moustafa's ongoing Ph.D. research deals with elucidation of causes of aberrant F_2 and F_3 segregation ratios for resistance to crown rust present in crosses involving certain breeding stocks derived from interploidy gene-transfer projects.

Dr. Abduljabbar Salman completed his Ph.D. studies on pre- and post-heading dry matter accumulation in oats and barley. Most of his research dealt with 12 current oat cultivars. The objective was to evaluate the association of pre- and postheading growth rate and dry matter accumulation with grain yield and other traits. The study was grown at Arlington and

Madison in 1985 and 1986. There were significant differences among cultivars for all traits measured at heading and maturity. Phenotypic correlation coefficients for preheading growth rate with grain yield and harvest index were -0.35 and -0.85**, respectively, while phenotypic correlation coefficients for postheading growth rate with grain yield and harvest index were 0.86** and 0.83**, respectively. The cultivar "Ogle" was significantly higher than any other cultivar in grain yield, postheading growth rate, and postheading dry matter accumulation. The results of Dr. Salman's study indicate that differences in rate and amount of dry matter accumulation after heading are highly associated with grain yield differences among oat cultivars currently grown in the North Central region of the United States.

Mr. Louis Chapko is involved with two main areas of oats research for his Ph.D. studies. One of the studies deals with selection for panicle weight and its affect on grain yield and other agronomic traits. Lou is also involved in our oat-pea research. He is evaluating forage characteristics of 16 oat selections grown as pure stands and in mixtures with Trapper field peas. Lou has also surveyed a set of 64 oat selections for forage yield and quality and may do some indepth investigative work on a subset of these lines.

EVALUATION OF SMALL GRAIN GERMPLASM 1987 PROGRESS REPORT

L. W. Briggle
A.R.S., U.S. Dept. of Agriculture, Beltsville Agricultural Research Center

Systematic evaluation of accessions in the USDA-ARS National Small Grain Collection (NSGC) was initiated in 1983. Funding was obtained specifically for this purpose.

A set of descriptors appropriate for each of the principal small grain crop species - wheat, barley, oats, and rice - has been determined in collaboration with the appropriate Crop Advisory Committees (CAC's).

Data on field descriptors have been obtained on approximately 28,000 wheat accessions, 9,000 oat accessions, and 8,000 barley accessions during the 1983-87 period. All barley and oat data were collected at the Aberdeen, Idaho grow-out location. A total of 13,600 wheat accessions were evaluated at Aberdeen; field descriptor data were obtained at Mesa or Maricopa, Arizona on 14,500 wheat accessions. Field data were recorded on such descriptors as number of days from planting to anthesis, plant height, spike (or panicle) type, spike (or panicle) density, straw lodging, straw breakage, awn and glume characteristics. Spikes or panicles were collected from each accession at maturity. Seed and more precise spike data on all 1984 wheat accessions grown at Aberdeen were obtained during the winter of 1986-87. Similar data were collected on 3/4 of the 1984 oat accessions (panicles) during the same winter. The remaining oat panicle and barley and wheat spike data will be recorded as it can be scheduled. Grain from each plot each year was harvested and the weight recorded. Grain was (or will be) returned to Beltsville for storage and for use in further evaluation (for disease and insect resistance, quality factors, etc.)

During the 1988 season 3,000-5,000 NSGC accessions will be grown at Maricopa, Arizona to meet quarantine and propagation requirements. Field descriptor data will be obtained at the same time. Duplicate oats and wheat accessions (named varieties that appear two or more times in the NSGC) will be grown and studied for identification at Aberdeen, Idaho. True duplicates will be bulked. Purification nurseries for wheat, barley, and oats may also be grown in 1988. Numbers have not yet been determined.

Evaluation for disease and insect resistance was initiated in 1983 and expanded in 1984, 1985, 1986, and 1987. Accessions evaluated so far are as follows:

Barley Yellow Dwarf:	1983-87	Davis, CA 10,000 wheats 7,000 barleys 4,500 oats	Urbana, IL. 10,000 wheats 10,000 oats
Soilborne Mosaic Virus:	1985-87	Urbana, IL 10,000 wheats	
Hessian Fly:	1983-87	Lafayette, IN 20,000 wheats	

Crown Rust:	1983-85	Ames, IA 9,250 oats	
	1986	2,000 Avena sterilis	
Leaf Rust:	1983-87	Manhattan, KS 25,000 wheats	
Spot Blotch:	1985-87	Fargo, ND 7,000 barleys	Athens, GA 2,000 barleys
Net Blotch:	1987	Fargo, ND 5,000 barleys	
Barley Stripe Mosaic Virus:	1986-87	Aberdeen, ID 5,000 barleys	
Common and Dwarf Bunt:	1985-86	Pendleton, OR 5,000 wheats	
Stripe Rust:	1984-87	Pullman, WA 20,000 wheats	

Growth habit (winter, facultative, or spring type) determinations have been done primarily at Bozeman, Montana from a late spring planting made in June. Data were also recorded on plots at Aberdeen, Idaho and Maricopa, Arizona when growth habit was apparent. During 1985-86 15,000 wheat accessions, 2,000 oats, 400 non-shattering Avena species, and 4,000 barleys were tested at Bozeman. In 1987 this part of the evaluation program was shifted to Aberdeen, Idaho; 1,000 wheats, 1,000 barleys, and 1,000 oats were tested at Aberdeen or Tetonia, Idaho from a June planting.

Many wheat accessions and some Triticum species in the NSGC are misclassified. Some misclassification occurs in the oats and Avena species, but to a lesser extent. The problem is minor in the barleys and Hordeum species, but all accessions need to be carefully checked.

Mixtures occur in some accessions in all three crop species. Some accessions were actually heterogeneous populations when obtained, and will be retained as populations. Where appropriate, accessions are rogued and every effort made to clean them up, including establishment of special "Purity Nurseries" at Aberdeen, Idaho and Maricopa, Arizona in which mixed accessions are thinly planted and plots are separated by rows of strong straw borders of a different crop species.

An extremely valuable part of the National Small Grain Collection is that of the related species. About 250 accessions of Aegilops species were grown and classified in the greenhouse at Columbia, Missouri in 1983-84 and more in 1984-85. About 600 accessions of the Triticum species were grown and classified in the greenhouse at Beltsville in 1983-84 and another 1,200 in 1984-85. More were grown in 1985-86. When proper classification is difficult, chromosome counts are made at Columbia, Missouri. This procedure has proved to be very helpful. Approximately 700 ploidy analyses have been conducted. In 1986 Sandy Saufferer took charge of the Aegilops material in the NSGC. She has completed an inventory and has checked species classification, or is in the process of doing so, for each Aegilops accession. She grew approximately 70 Aegilops accessions in the Beltsville greenhouse to obtain seed and reference samples and 100 additional accessions were planted at Aberdeen, Idaho in 1987. Another 400 Aegilops, including new collections from Turkey in 1985 and 1986, were increased in the Beltsville greenhouse.

A new metal storage and work space building (30' x 80') for germplasm was erected at Aberdeen, Idaho in 1985. A full-time technician position for germplasm evaluation is funded at Aberdeen by ARS. A similar metal building (40' x 75') was built at Maricopa, Arizona also in 1985, and it too is used for evaluation and propagation of the NSGC. An ARS technician position was established at Maricopa in January 1987.

About 400 Triticum, Aegilops, Secale, and Hordeum (mostly Triticum) samples collected in 1985 and 1986 in southeastern Turkey were checked for species classification in 1986. About 300 of those (wheat collections) were grown either in the Beltsville greenhouse (those with small amounts of seed) or in the field at Maricopa, Arizona in 1987. Those grown in the greenhouse will be increased at Maricopa in 1988, prior to field evaluation. About 50 of the wheat collections grown at Maricopa in 1986-87 will be tested for reaction to dwarf smut at Logan, Utah in 1988.

THE AUSTRALIAN WINTER CEREALS COLLECTION

M C MACKAY, Curator

Australian Winter Cereals Collection
RMB 944, Tamworth NSW 2340, Australia

The Australian Winter Cereals Collection (AWCC) has been in operation since 1968. Since 1984 a national oat collection has been under development and so far around 2,000 cultivars, breeding lines, genetic stocks, disease differentials, landraces and wild types have been accessioned. These have almost entirely been provided by Australian breeders from their own collections. During 1989 a further 3,500 lines will be field grown for descriptive data collection and elimination of duplicates before accessioning. All accessions are stored under long-term conditions (-1C).

All passport and descriptive data is computerized and an evaluation program is being planned for the near future. A software application is being developed to automate most genebank management processes associated with seed movement into and out of the Collection (requests, orders abroard, quarantine, field regeneration etc.). The package will also allow Australian scientists on-line access for searching databases and lodging requests for seed samples.

The Collection is available for use by any *bone fide* scientist. Microfiche listings of the oat collection will be available by mid 1990.

AUSTRALIAN OAT CULTIVARS REGISTERED SINCE 1983

AUS #	**NAME**	**PEDIGREE**	**STATE**
700017	BARMAH	ALGERIBEE/GARRY//AVON	VIC DEPT
700018	MORTLOCK	ELAN 6161/3/(66Q01-63)FULMARK/ NEWTON//SWAN	WA DEPT
700019	DOLPHIN	WEST/OT207/3/12,3/12	SA DEPT
700020	ECHIDNA	WEST/OT207/2/4,2/4	SA DEPT
700021	MURRAY	FULMARK/NEWTON//SWAN(66Q01-44)/3/ (XBVT 183)KENT/BALLIDU(M127)//CURT	WA DEPT
700022	WINJARDIE	FULMARK/NEWTON//SWAN(66Q01-44)/3/ (XBVT 183)KENT/BALLIDU(M127)//CURT	WA DEPT
700023	BUNDALONG	CAYUSE/AVON	VIC DEPT
700024	SAVENA 1(R)	WEST*(WEST*N.Z.CAPE/23))/28	SA DEPT
700025	CYPRESS	KENT/ORIENT//COLLABAH/3/KENT/ FULMARK//2*COOBA	NSW DEPT
700029	WALLAROO	WEST/OX77;74-5	SA DEPT
700028	MARLOO	WEST/OX77;74-1	SA DEPT
700032	HAKEA	KENT/FULMARK//2*COOBA/3/COOLABAH	NSW DEPT

THE AUSTRALIAN WINTER CEREALS COLLECTION

Michael C Mackay
Curator

OAT COLLECTION

Establishment of the National Oat Collection from the contributed breeder's collections is now underway with the sorting and collation of material for field planting in May 1987. The primary goal this season is to determine which lines are duplicates and select the 'unique' lines for inclusion into the collection. Only named cultivars will be included as there is still considerable work to be done on deciphering abbreviations and sorting the material which appears to include breeding lines, landraces, disease differentials, nursery entries etc.

The Small Grain Collection micro-fiche have been invaluable in obtaining accurate passport data for much of the material but there are still large gaps of information. The exercise so far has really shown the need for comprehensive listings of pedigrees, abbreviations and prefixes for cross numbers or collection numbers. For example, we have numbers prefixed by Cc, Pg, AV, Aa and G which probably refer to institutions but we are not aware of their meaning. If such listings occur we will be grateful to receive copies, otherwise we are willing to collaborate in developing them.

REGISTRATIONS

Only one oat cultivar has been registered in the last year. CYPRESS was bred by Glenn Roberts, Temora, NSW as a dual purpose type suitable for early sowing and grazing prior to recovering for grain production. The grain is feed quality. Cypress has similar maturity, is taller and has weaker straw than Cooba. It has good crown rust resistance, moderate resistance to bacterial leaf stripe and septoria leaf blotch, moderately susceptible to BYDV and very susceptible to cereal cyst nematode. Yield attributes of Cypress are comparable or better than other dual purpose cultivars. It's quality is acceptable for milling with a high test weight, medium to low husk percentage and a light brown colour. The pedigree of Cypress is Kent/Orient//Coolabah/3/Kent/Fulmark//2*Cooba.

MARYLAND

NATIONAL SMALL GRAIN COLLECTION

D.H. SMITH, JR., CURATOR

ARS USDA PLANT SCIENCE INSTITUTE

GERMPLASM SERVICES LABORATORY

Starting last March all of the computerized activities involving the National Small Grain Collection (NSGC) were moved from the Washington Computer Center to the Germplasm Resources Information Network (GRIN) on the Prime computer in the National Agricultural Library building at BARC. It is now possible for our user clientele to view NSGC listings and place orders for desired accessions directly through the computer network.

In October the Germplasm Services Laboratory was organized. It includes the activities of the old Germplasm Introduction and Evaluation Laboratory and also the Data Base Management Unit of Grin.

The NSGC is to be moved to Aberdeen, Idaho, and will occupy space in the new Small Grain Research Facility that is currently under construction. Samples of all materials in the NSGC are being put up for shipment to NSSL in case of loss in transit. These samples will also insure that NSSL has a sample of everything that is listed for NSSL.

The following PI Numbers were assigned in 1987. It should be pointed out that assignment of a PI Number does not necessarily indicate that an accession is available.

1/21/88

OAT PI UPDATE

NO. TAXONOMY			CULTIVAR
PI 508536 Avena	nuda		
ORIGIN: United States	ACQUISITION:	United States	
PI 506242 Avena	sativa		Proat
ORIGIN: United States	ACQUISITION:	United States	
PI 508099 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508100 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508301 Avena	sativa		Coker 820
ORIGIN: United States	ACQUISITION:	United States	
PI 508537 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508538 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508539 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508540 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508541 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508542 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508543 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508544 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508545 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508546 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508547 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508548 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508549 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 508550 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 509115 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 509116 Avena	sativa		
ORIGIN: United States	ACQUISITION:	United States	
PI 510521 Avena	sativa		
ORIGIN: Peru	ACQUISITION:	Peru	
PI 510522 Avena	sativa		
ORIGIN: Peru	ACQUISITION:	Peru	
PI 510523 Avena	sativa		
ORIGIN: Peru	ACQUISITION:	Peru	
PI 510524 Avena	sativa		
ORIGIN: Peru	ACQUISITION:	Peru	
PI 511871 Avena	sativa		CYPRESS
ORIGIN: Australia	ACQUISITION:	Australia	
PI 511872 Avena	sativa		MARLOO
ORIGIN: Australia	ACQUISITION:	Australia	
PI 511873 Avena	sativa		WALLAROO
ORIGIN: Australia	ACQUISITION:	Australia	
PI 512038 Avena	sativa		WEBSTER
ORIGIN: United States	ACQUISITION:	United States	

TOTAL = 29

BABICORA

José J. Salmerón and Philip Dyck
INIFAP.- Apdo. Postal #554
Cd. Cuauhtémoc, Chih., Méx.

Babícora is a new oat cultivar released by the Cereal Breeding program at Cd. Cuauhtémoc. The cultivar was selected by the mass (gravimetric) selection method of several F_2 crosses. After five cycles of bulk (gravimetric) selections, F_8 lines were extracted from the bulk populations and the yield from each line was recorded to choose the highest yielding lines.

Babícora matures six days after Páramo. It has straw strenght similar to Páramo. Babícora is very stable over large array of environments. Over five years in official trials Babícora outyielded páramo by 30 percent.

Babícora is a good quality oat with high test weight and low hull percent. The grain weight and protein content is slightly higher than for Páramo.

CUSI

J. Juan Salmerón and Philip Dyck
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Cd. Cuauhtémoc, Chih., Méx.

Cusi is a new oat cultivar released by the Cereal Breeding Program at Cd. Cuauhtémoc, Chih. The cultivar was selected from the cross Cate/Hua"S"//Jim-Inca/Colli//Tpc/mhf/7114/ENA/In.N)Jim/Inca made in 1978 and was field tested initially in 1983.

Cusi matures at the same time as Páramo. It has straw strenght and is shorter than Páramo (on average by 5 cm). Cusi is very stable over large arrays of environments. Over four years Cusi outyielded Páramo by 39 percent. Cusi has good resistance to stem rust. It has best groat percent. Its test weight is little less than Páramo.

DON

C. M. Brown and F. L. Kolb

Don, P.I.498423, is a high yielding early maturing spring oat cultivar developed cooperatively by the Illinois Agricultural Experiment Station and USDA-ARS and released in 1986. It was selected from the cross of Coker 234/2/Orbit/C.I.8168. It was first selected as a single panicle from a F_5 bulk in the field at Urbana in 1973 and in a single panicle row in 1974. The F_2 through F_4 generations were grown in the greenhouse using a modified single seed descent method similar to the one described in Crop Science 22:576-579, 1982. The initial breeder seed of Don resulted from bulking 200 single hill plots, each having originated from a single panicle and selected for uniform appearance. It was tested as IL.75-5860 in the Uniform Midseason Nursery from 1981-1983 and in the Early Oat Nursery since 1983, first as IL.75-5860 and recently by cultivar name as a check.

Don has generally produced higher yields that other early maturing cultivars and has been near the top when compared to midseason or later cultivars. Don has short straw but is only moderately resistant to lodging.

Don has excellent resistance to prevalent races of crown rust and smut, is only moderately tolerant to barley yellow dwarf, and is susceptible to stem rust.

The kernels of Don are dull white in color, awnless, medium to large and plump, and it produces grain of high test weight. The kernels are predominately fluorescent but the initial breeders seed contained approximately 0.2% of variants that were non-fluorescent and up to 0.1% of the plants in the breeder seed field of Don were 8 to 10 inches taller and slightly later in maturity. These few variants are considered normal components of the cultivar as described here.

Compared to the early maturing cultivars 'Lang' and 'Larry' both of which have been widely grown in Illinois and several other states, Don has very similar height and maturity, better yielding ability, better crown rust and smut resistance, equal barley yellow dwarf resistance, higher test weight, and more attractive kernels. Both Lang and Larry have better lodging resistance.

Don in not protected under the Plant Variety Protection Act. Breeder seed is maintained by the Illinois Agricultural Experiment Station.

HAZEL

C. M. Brown and F. L. Kolb

Hazel, P.I.498424, is a high yielding midseason spring oat cultivar developed cooperatively by the Illinois Agricultural Experiment Station and USDA-ARS and released in 1986. Hazel was selected from the cross Coker 227/2/Clintford/Portal. It was first selected as a single panicle from a F_4 bulk grown in the field at Urbana, Illinois in 1973 and in a single panicle row in 1974. The F_2 and F_3 were grown in the greenhouse using a modified single seed descent method similar to the one described in Crop Science 22:576-579, 1982. The initial breeder seed of Hazel resulted from bulking approximately 250 single panicle hills, each having originated from a single panicle and selected for uniformity. Hazel was tested as IL.75-1056 in the Uniform Midseason Nursery from 1979-1982.

Performance data in Illinois and other states suggest that Hazel is high yielding, midseason in maturity, has short, stiff straw and excellent lodging resistance.

Hazel has excellent resistance to prevalent races of crown rust and to barley yellow dwarf. It is susceptible to prevalent races of stem rust and smut.

The kernels of Hazel are greyish in color, medium to large in size, medium plump, and finely tapered at the tips. Some of the primary kernels have prominent, 1- to 3-cm. long awns that usually separate from the kernel during threshing. The kernels are predominantly fluorescent but the initial breeder seed contained approximately 0.2% of non-fluorescent variants. About 0.2% of plants in the original breeder seed field of Hazel were 8 to 10 inches taller and slightly later maturing. These variants are considered normal components of the cultivar as described here.

Compared to the widely adapted and high yielding cultivar 'Ogle', Hazel has about the same maturity and barley yellow dwarf resistance, has much better crown rust resistance, higher test weight, a more attractive kernel, higher grain protein percentage and equal or better straw strength. The yield of Hazel has been equal or better than most other midseason cultivars but in some tests has been slightly below Ogle. Like Ogle it is susceptible to smut and stem rust.

Hazel is not protected under the Plant Variety Protection Act and breeder seed is maintained by the Illinois Agricultural Experiment Station.

IMAGE, LUSTRE AND SOLVA

J Valentine, B T Middleton, T E R Griffiths,
R B Clothier and G Ll Thomas

Welsh Plant Breeding Station, Aberystwyth

Three new varieties of winter oats from the Welsh Plant Breeding Station, recently added to the National Institute of Agricultural Botany Recommended List of varieties most suitable for cultivation in England and Wales, offer significant advantages in grain yield and other characteristics compared to Pennal and Peniarth, the currently most widely-grown varieties.

Image, first recommended for general use for 1987, results from the cross Pendrwm x (Maris Quest x Peniarth). It has yielded 110% relative to the mean of control varieties, Pennal (103%), Peniarth (95%) and Bulwark (101%). The variety is resistant to stem eelworm and has good resistance to soil-borne oat mosaic virus. It is classed as susceptible to mildew but is more resistant than Pennal and Peniarth. Image has relatively good winter-hardiness and high kernel content.

Lustre ((02863 Cn x Cimarron) x Maris Osprey), also first recommended for use for 1987, has yielded 107% relative to controls. It has several very good characteristics including large, yellow grains with high kernel content of interest to oat millers, and high resistance to barley yellow dwarf virus (Catherall, Parry and Valentine, 1987, Tests of Agrochemicals and Cultivars 8, 148-149, Ann.appl.Biol. 110 (supplement)) and soil-borne oat mosaic virus (Catherall and Valentine, 1987, Ann.appl.Biol. 111, 483-487). Its large grain size (1000-grain weight = 42-45 g) is apparently confered by a single effective factor. Lustre is susceptible to mildew and stem eelworm and has an intermediate level of winter-hardiness.

Solva, resulting from a cross between Pennal x (Padarn x Nelson) and Oyster, was added to the Recommended List for 1988. It combines high yield (112% relative to controls) with good all-round characteristics. These include relatively good standing power and winter-hardiness, moderate resistance to mildew, resistance to stem eelworm and tolerance to soil-borne oat mosaic virus.

PAMPAS

J. Juan Salmerón and Philip Dyck
INIFAP.- Apdo. Postal # 554
Cd. Cuauhtémoc, Chih., Méx.

Pampas, a spring oat, was developed by the National Institute for Agriculture Research at Cd. Cuauhtémoc. The most important feature of this new cultivar is that it combines Kernel quality with moderately disease resistance and good yield.

Pampas originated from the mass (gravimetric) selection method. Several F_2 populations were combine harvested at Chapingo México where a heavy and uniform stem rust occurs anually. Because plants less affected by stem rust would be expected to produce plumper grain. The bulk seed was then subjected to fanning, screening and water floating, to eliminate the lighter seed, after five cycles of bulk (gravimetric) selection method F_8 lines were extracted to yield evaluation in 1982. Over five years in official trials in Chihuahua, México, Pampas outyielded Páramo by 18 percent.

Pampas flowers and matures 2 and 6 days respectively after Páramo. It has an excellent straw quality and is taller than Páramo (on average by 6 cm).

Pampas is a good quality oat with high test weight and low hull percent. The protein content is slightly higher than for Páramo. Pampas is moderately susceptible to stem rust.

PAPIGOCHI

José J. Salmerón and Philip Dyck

Papigochi is a spring oat cultivar developed by the National Institute for Agriculture Research at Cd. Cuauhtémoc. It was derived by the mass (gravimetric) selection procedure of several F_2 crosses. After five cycles of bulk (gravimetric) selections, F_8 lines were derived from the bulk populations, the yield from each line was recorded to choose the highest yielding lines.

Under our conditions Papigochi is a tall, late cultivar. Straw strenght is probably fair-good. Yields have been good, over five years Papigochi have outyielded Páramo by 34 percent.

Papigochi is a good feed quality oat with low husk percentage and high protein content. The test weight is higher than for Páramo. Groat protein percent is high

Most panicles have few primary kernels with awns. These awns are usually long with a dark base.

Papigochi is moderately susceptible to stem rust.

RARAMURI

J. Juan Salmerón and Philip Dyck

Raramuri is a spring oat cultivar developed by the National Institute for Agriculture Research at Cd. Cuauhtémoc. It was derived from the cross Tpc//Mhf/7114/ENA/In-N/Jim/Inca//Jim/ENA/Elliots. The final cross was made in 1976. Raramuri was obtained from a single Plant selected in F_2 and individual selections in F_3, F_4 and F_5 under three diferent environments of México.

Under our conditions Raramuri is tall, midseason cultivar. Heading is equal to Páramo or a day later while height averages 2-4 cm taller than Páramo. Over five years in official trials Raramuri outyielded Páramo by 11 percent. Raramuri is moderately susceptible to stem rust. It has best groat percent and higher groat protein than Páramo.

ROBERT OATS

P.D. Brown, R.I.H. McKenzie, D.E. Harder, J. Chong,
S. Haber, J. Nielsen, J.S. Noll and G.R. Boughton

Robert, a spring oat, was developed by the Oat Rust Area Project Group co-ordinated from the Agriculture Canada Research Station, Winnipeg, Manitoba. Robert was registered by the Food Production and Inspection Branch (registration no. 2879) in December, 1987. The prime strengths of this new cultivar are its good lodging resistance, early maturity, excellent kernel quality and its very good disease resistance, including BYDV tolerance.

Robert was developed from the cross OT212/RL3064. OT212 was derived from the cross OT187*2/Kent. OT187 was derived from 4-way cross no. 1 involving CI6792, Rodney, OT174, RL2877, Pendek and Lodi. RL3064 is the result of a complex series of crosses involving Kent, Pendek, Rodney, Kelsey, Harmon, Rosens Mutant, CI6792, and a sister line of Hudson, as well as the *A. sterilis* accessions CAV2647, CAV2648 and CAV5165.

The last cross in the development of this line was made in 1977. The F1 generation was grown in the greenhouse in 1978 and the F2 was grown in the field at Glenlea, Manitoba, in 1978. The F2 plants were screened with oat stem rust (*Puccinia graminis* f. sp. *avenae*) and oat crown rust (*P. coronata* f. sp. *avenae*) and harvested as a bulk. A subsample of the resulting seed was planted in the 1978-79 New Zealand nursery where individual heads were selected based on kernel appearance, agronomic merit and Barley Yellow Dwarf Virus (BYDV) and crown rust resistance. The F4 head rows were grown at Glenlea in 1979. Head selections were made based on stem rust, crown rust and smut (*Ustilago avenae* and *U. kolleri*) reactions, agronomic performance and kernel appearance. The F5 generation was grown in the 1979-80 New Zealand nursery where individual heads were again selected based on the selection criteria of the F3 generation. The F6 generation head rows were grown in 1980 at Glenlea; individual head rows were selected and bulked based on the same criteria used in the F4 generation as well as plot yield, test weight and a BYDV rating. This line was yield tested in 1981 (no. W81274) and in 1982 (no. W82056) in single 5 square meter plot preliminary yield trials, in 1983 in a replicated trial grown at eight stations in the rust area of Manitoba and Saskatchewan, and in 1984 - 1986 in the Western Canada Co-operative Oat Test. Approximately 200 F11 head rows were grown, rogued and harvested as a bulk in 1985 to be used as breeder seed.

Robert is best adapted to Manitoba. Based on three years of testing in the Western Co-operative Oat Test, its grain yield is 99% that of the widely grown variety Dumont. However, because Robert has a lower percent hull compared with Dumont, its groat yield is 101% that of Dumont.

Robert is 2.5 days earlier in maturity, 3 cm shorter, and has much better lodging resistance than Dumont. Robert's hull colour is generally tan but, depending upon growing conditions, the colour may vary from red to almost white. Robert has excellent kernel characteristics; compared with Dumont, its kernel is larger with 16% more plump kernels and heavier with a 1000 kernel weight that is 4.6 g greater. It has one percentage point lower hull. In grain quality characteristics, Robert has one percentage point higher protein and similar oil content to that of Dumont. The test weight of Robert, 49.1 kg/hl, is 1 kg/hl less than Dumont's.

TAMO 386

M. E. McDaniel, D. S. Marshall, L. R. Nelson, and W. D. Worrall

TAMO 386 was released as a new oat cultivar for Texas by the Texas Agricultural Experiment Station in March, 1987. Foundation Seed was first produced in 1987, and seedsmen are increasing the variety in the 1988 season. TAMO 386 is the bulk increase of a single F_6 plant selection from the cross 'Coker 75-12/4/'Coker 227'/'Coker 234'/3/'TAM 0-301'/'TAM 0-312'/2/CI 9221/5/TAM 0-312/ Coker 227. Coker 227, Coker 234, TAM 0-301, and TAM 0-312 are cultivars adapted in Central and South Texas. However, all are now susceptible to current crown rust races in Texas. CI 9221 is a stem rust resistant oat germplasm line (Alpha) developed by Paul Rothman at the USDA Cereal Rust Lab, St. Paul, MN. It is a tall, weak-strawed, late-maturing oat under Texas conditions, and has poor winterhardiness. Coker 75-12 is a semidwarf oat with a compact panicle and excellent straw strength. F_2 plants from each of the successive crosses were selected for seedling and adult-plant resistance to a culture of race NA27 of oat stem rust. These resistant plants were used as one of the parents for each cross in the series. Stem rust resistance was successfully transferred through each cross. Crown rust resistance in TAMO 386 appears to be conditioned by a combination of genes from the "TAM" and Coker parents; some resistance also may be derived from the CI 9221 parent, which exhibited moderate resistance to crown rust races 264 B and 325 in field and greenhouse tests.

TAMO 386 was tested in Texas (and in the Uniform Southern Winter Oat Tests of 1985-87) as TX 82C6023. It has excellent grain yield potential (see Texas contribution in this Newsletter Volume, Table 1, for data on yields and test weights of TAMO 386 and commercial varieties at Beeville for the 1983 through 1987 seasons). The variety has good resistance to both crown rust and stem rust, as evidenced by the lack of improvement in yield and test weight of TAMO 386 by fungicide treatment in seasons having heavy crown and stem rust epidemics at Beeville (Table 2 in Texas contribution). TAMO 386 is a rather tall variety (similar to 'Coronado' in height); however it has good straw strength, and good standability. Its primary weakness is a lack of winterhardiness. Although somewhat more winterhardy than Coronado, it is less winterhardy than the Coker varieties. We are recommending that it be produced south of Waco, Texas, to avoid winter injury problems.

Because of its good rust resistance, TAMO 386 is probably the best choice among currently-available oat varieties for production in the warm and humid South Texas area, which is subject to very severe crown rust and stem rust epidemics. The new variety has relatively large, attractive white seed with good plumpness; its average test weight has been superior to all other varieties in Texas tests.

Foundation seed is available from Foundation Seed Services, Texas A&M University, College Station, TX 77843.

Robert possesses crown rust resistance genes Pc38 and Pc39 and perhaps another gene that confer very good resistance to all prevalent isolates of oat crown rust. It possesses genes Pg2 and Pg13 giving Robert resistance to all known stem rust races except NA26. Like Dumont and Riel, it is resistant to all races of loose and covered smut to which it has been tested. Robert has good tolerance to barley yellow dwarf virus (BYDV) and is the first oat cultivar to combine crown rust and stem rust resistance with BYDV tolerance.

This oat cultivar was named after Mr. Robert Bristow, the oat breeding technician, who worked at the Winnipeg Research Station for 30 years.

In 1987, approximately 40 kg of breeder seed were increased at Indian Head and 2000 kg of uncleaned seed are available. Breeder seed will be maintained by Mr. Glen Boughton at the Agriculture Canada Experimental Farm Indian Head. Seed of this cultivar will be increased and distributed by Secan Association, 885 Meadowlands Dr., Ottawa, K2C 3N2.

TRUCKER

D. L. Reeves and Lon Hall

Trucker, P.I. 508100, is a spring oat cultivar developed by the South Dakota Agricultural Experiment Station. It was derived from the cross Moore//Dal/Nodaway 70. It is a sister selection to Hytest. Trucker was derived from a single F_3 panicle grown as a panicle row in the F_4. It was tested as SD 810109.

Trucker has been tested statewide for the past three years. In 1986 and 1987 it was in the Uniform Midseason Oat Performance Nursery (UMOPN). Trucker is moderately late being equal to Wright or slightly earlier. Yields in South Dakota have been comparable to other cultivars of similar maturity. Straw strength is good with plants being two to five centimeters shorter than Moore.

The grain of Trucker is white and of excellent quality with exceptional test weight. In the South Dakota Statewide trials it has been exceeded in test weight only by Hytest. In the UMOPN tests, Trucker ranked fourth and first respectively for test weight in 1986 and 1987. Trucker has a low hull percentage and very good milling yields. Protein and oil percentages are in the upper medium range. During the past three years in South Dakota, Trucker has averaged 18.4% groat protein and 7.4% oil.

Crown rust resistance is intermediate with field readings indicating a moderately resistant rating. Trucker is moderately resistant to smut. Stem rust resistance is the same as most cultivars in this region. Trucker is susceptible to barley yellow dwarf virus.

VALLEY

Michael S. McMullen and J. D. Miller

'Valley' spring oat was developed at the North Dakota Agricultural Experiment Station in cooperation with USDA-ARS and released in 1988. It was tested under the experimental designation ND820603 during its development. Valley was selected from the progeny of a series of crosses with the pedigree Froker/RL3038//Hudson/3/Porter. The final cross was made in the greenhouse in the fall of 1979. Valley was selected as an F_4-derived line in the F_5 generation in 1981.

It has been tested in replicated yield trials in North Dakota since 1983 and in the North Dakota Oat Variety Trials since 1985. In North Dakota variety trials averaged over 24 location years, Valley has yielded 109, 96, and 105% of Otana, Dumont, and Steele respectively. Valley exceeds Dumont in test weight and is similar to Dumont in groat percentage. It is 11 cm. shorter than Dumont and Steele under North Dakota conditions and has exceptional straw strength for a cultivar adapted to North Dakota. It exhibited the lowest lodging score of entries in the 1985-87 variety trials in North Dakota.

Crown rust and stem rust resistance of Valley are similar to Dumont and Steele providing good protection from the prevalent races of these diseases. Tests with critical races indicate Valley possesses crown rust resistance genes Pc-38 and Pc-39 and stem rust resistance gene Pg-13. Valley has a level of BYDV tolerance similar to Steele, which provides some protection from this disease, but Valley has less BYDV tolerance than 'Porter'.

The kernels of Valley are an off-white color and range from nearly white in some environments to tan in others. Valley was entered in the Uniform Midseason Oat Performance Nursery in 1985-86 and performed well over a wide range of environments. The yield performance of Valley in North Dakota trials was better in 1985 and 1986 than in 1987 and it seems to perform relatively better in environments with high yield potential. Valley should be useful under conditions of intensive management where straw strength is important, but may be shorter than desirable for stress environments of western North Dakota.

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