1985
OAT NEWSLETTER

Volume 36

April 1986

Sponsored by the National Oat Conference

1985

OAT NEWSLETTER

Volume 36

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.

April 1986

Sponsored by the National Oat Conference

Michael S. McMullen, Editor

CONTENTS

III. CONTRIBUTIONS FROM COUNTRIES OTHER THAN THE UNITED STATES

GERMPLASM AND RELATED REPORTS

I. NOTES

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:

Michael S. McMullen
Agronomy Dept., NDSU
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Please Do Not Cite The Oat Newsletter in Published Bibliographies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."

AMERICAN OAT WORKERS' CONFERENCE COMMITTEE

Executive Committee

D. D. Stuthman (Chair)
R. A. Forsberg (Past Chair)
H. G. Marshall (Secretary)
M. S. McMullen (Editor)

Federal Advisor:

H. G. Marshall

USA	CANADA	MEXICO
Regional Representatives:		
M. E. Sorrels (NE)	J. P. Dubuc	M.Navarro-Franco
D. L. Reeves (NC)	R. I. H. McKenzie	
D. M. Wesenberg (W)	V. D. Burrows	
M. E. McDaniel (So)		

At Large:

C. F. Murphy
G. E. Shaner
S. H. Weaver

American Oat Workers Conference-1986

The American Oat Workers conference will be held on July 14, 15, 16 and 17 in Ottawa, Canada, at the Talisman Motor Hotel, 1376 Carling Avenue, Ottawa, Ontario, K1Z 7L5, (Telephone: 1-800-267-4166; Telex: 053-4181). Registration and reception will begin on July 14 in the evening. Further information may be obtained by contacting:

Dr. V. Burrows, Chairman, Host Organizing Committee,
Cereal Building #75, Ottawa Research Station,
Agriculture Canada, Ottawa, Ontario, Canada, K1A 0C6.

Telephone: (613) 995-9428
Home: (613) 224-5769

Device for Dehulling Small Samples of Oats for Grain Inspection

R. I. H. McKenzie, E. F. Ikonen, and P. D. Brown

A prototype device for dehulling small samples of oats has been developed under a Research Station contract. Tests by the Canadian Grain Commission, Grain Inspection Division have indicated that the prototype dehuller can satisfactorily remove oat hulls and enable a grain inspector or elevator manager to distinguish between tan (red) oats and heated white oats. The prototype also meets the safety requirements of primary and terminal elevators.

The development of tan colored oat cultivars with excellent kernel quality has created problems for the Canadian grading system. These tan oats are very similar in appearance to heated white oats, and with existing grading methods would have to be graded No. 3 feed, the lowest possible grade. Some method had to be found to easily dehull an oat sample.

The dehulling apparatus that was developed consists of:

1. Centrifugal high speed fan (1500-1800 RPM) driven by a 120 Volt motor.
2. Centrifugal cyclone.
3. Drop down pouring spout for dehulled grain.
4. Dust and hull collector (vacuum cleaner bag) - removable for cleaning purposes.
5. Timer for time delayed electromagnetic door.
6. Variable timer controlling total running time.
7. Stainless steel enclosure.
8. Chute for grain intake.

The cycle is begun by pushing the start switch and immediately pouring a 50 gram grain sample into the fan intake chute. While the electromagnetic door is closed (10-30 seconds), the grain circulates through the fan intake to the fan wheel and is exhausted to the fan housing blades in the fan housing. These blades stop the grain from revolving in the housing.

After the preset time the electromagnetic door opens, the groats and hulls go into the cyclone where the groats fall to the bottom of the cyclone and the hulls and dust go to the dust collector. The fan runs a specified length of time controlled by timer No. 6 and then the unit shuts off. The unit sits on a lab bench and is 14" high by 17" wide by 8" deep and weighs 30 pounds.

The unit does not dehull 100 percent of the sample and some groats will be cracked. It has been found to be quite acceptable by the Canadian Grain Inspection Division for dehulling barley and sunflowers as well as oats. Samples of all these crops can then be examined more thoroughly when dehulled.

STABILITY OF ELECTROPHOREGRAMS OF HEAT-TREATED OAT GROATS

George L. Lookhart, L. Albers, and Y. Pomeranz
U.S. Grain Marketing Research Laboratory
United States Dept. of Agriculture, Agricultural Research Service
Manhattan, Kansas, U.S.A.

Oat groats with protein contents of 16.2%, 16.4%, and 20.0% (N x 6.25 dry basis) from the oat varieties Ogle, IL75-58670, and X4020-4-1, respectively, were sampled at various steps in commercial processing. The samples were: original cleaned groats, groats after drying at 121°C, and flakes produced by steaming at 100°C and rolling. Each sample was tested for gross composition, electrophoretic pattern, and cell structure damage. Larger differences in gross composition were found among varieties than within samples at various stages of processing. Electrophoretic patterns of the prolamin fractions, obtained by polyacrylamide gel electrophoresis (PAGE), were identical for each sample of a given variety but different for each variety. Endosperm changes were noted on processing, especially heating, by scanning electron microscopy. It was concluded that commercial processing does not affect the prolamin electrophoretic pattern even though small differences in gross composition (protein, ash, oil, and carbohydrates) and changes in microscopic appearance were found.

Source: Cereal Foods World 30:545. 1985. [Abstract]
Other Publications: Cereal Chem. 62:162-166. 1985.
Cereal Chem. 62:355-360. 1985.

Oat Newsletter
Québec, Canada
A. Comeau, J.-P. Dubuc

Barley yellow dwarf resistance in oats

Preparing nursery for international testing

Interest for an international oat BYDV nursery has been expressed by many scientists, but the funding of such an operation on an annual basis may be hard to obtain unless this nursery could be attached to currently existing nurseries that have international distribution. We are presently undertaking the multiplication of some of the best resistance sources we have identified. Only a minority of these possess multiple resistance to BYDV and rusts. The best sources of multiple resistance may be 1984 IORN no. 86 and 155, and 1985 IORN no. 24. The Winnipeg group is the one that has spent the largest effort in breeding oats with multiple resistance. However, the BYDV resistance genes may in practice last much longer than the rust-resistance genes, so the value of rust-susceptible lines with very high BYDV resistance should not be underestimated in a breeding project.

Trial on winter oats

A trial with Pennsylvania hardy winter oats was tested with and without BYDV. Both groups were winterkilled quite severely, and only the most winterhardy cultivars could be evaluated for BYDV resistance. It appears that all surviving winter oat lines possess intermediate BYDV resistance levels. Hybridation with the winterhardy BYDV-resistant *Avena macrostachya* as practiced by the Leggett group (Wales) would be one way of improving this character. However the use of Ogle or 76 S6-1454 in a (winter-spring) x winter backcross could also improve the BYDV resistance of winter oats. In other species improving BYDV resistance has improved winterhardiness.

Our interest in winter oats is academic, we do not grow this crop in Canada. However, in the future, hybridation with extremely winterhardy *Helictotrichon* and *Avenula* species might result in large increases in winterhardiness and adaptability of the oat crop. This could become a goal of a wide-cross or protoplast fusion project when the biotechnological methods become better adapted to cereals.

SOURCES OF RESISTANCE IN OATS TO POWDERY MILDEW (*ERYSIPHE GRAMINIS* f.sp. *AVENAE*)

I.T. Jones and H.W. Roderick
Welsh Plant Breeding Station, Aberystwyth, Wales, UK

Mildew is the most serious foliar disease of oats in Britain and an active research and breeding programme is pursued to understand the various mechanisms involved in resistance and to ensure adequate protection in new cultivars released from the Station.

During the International Oat Workshop held in July 1986 a nursery constituting a range of mildew resistances in hexaploid, tetraploid and diploid oats was exhibited. From the percentage green leaf area infected with mildew, estimated on four dates during the season on this material, the area under the disease progress curve (ADPC) was calculated and is presented in Table 1.

In the hexaploids, the only genotype showing complete resistance was the translocation line Cc 6490 carrying the Eg-4 gene for resistance derived from a genotype of *Avena barbata*. It remained immune throughout the season, although some mildew did develop on *A.barbata* (Cc 4897) itself by the last scoring date.

Very high levels of partial resistance were shown from the seedling stage onwards by Bage sel Klein, Rouge d'Algerie and 93-2-4 (IORN 1983, entry 118). Roxton, Cc 4761 (Creme), Maelor, Maldwyn, Cc 4146 (*A.sativa* x *A.ludoviciana*) and Saladin showed low to moderate levels of adult plant resistance.

It is interesting to note that all cultivars with Cc 4146 derived resistance such as 7718 Cn, Margam, Mandarin, Maris Tabard, Maris Oberon, Rollo, Trafalgar and Cabana were more susceptible than Cc 4146 itself indicating that the latter may still have some useful additive (minor) genes not transferred to these cultivars.

The two tetraploids were highly resistant although a small amount of mildew developed late in the season. The diploid oats Cc 3678, Cc 4093 and Cc 6557 were completely resistant, but slight mildew was recorded on S.171 (*A.brevis* x *A.strigosa*) whereas S.75, a selection from *A.strigosa* produced as a forage oat for hill lands in the 1920s, was moderately susceptible.

The incorporation of the resistances from Bage sel Klein and Rouge d'Algerie into agronomically more desirable types has begun but studies on their genetics and resistance mechanisms need to be done to assess their durability. New sources of adult plant resistance, should be exploited, since it has been shown that even higher levels of resistance can be achieved by identifying transgressive segregants in progenies of intercrosses (Jones, *Euphytica* 1983, 32, 499-503). However, agronomic selection must be carried out simultaneously so that breeders can exploit material as early as possible.

Table 1. Oat genotypes ranked according to their levels of resistance as described by their ADPC+ values

Hexaploids (2n=42)					
Cc 6490	0	Leanda	8.48	Mandarin	12.69
Bage sel Klein	0.81	Forward	8.54	Dula	12.90
Rouge d'Algerie	0.98	Milford	9.30	9065 Cn	13.08
93-2-4 (IORN 118)*	1.47	07718 Cn	9.75	Maris Tabard	13.16
Roxton	3.36	Manod	10.90	Maris Oberon	13.38
Cc 4761	4.19	Milo	11.02	Rollo	13.80
Maelor	4.36	Mostyn	11.19	Trafalgar	15.47
Maldwyn	5.60	Menai	11.52	Cabana	16.94
Cc 4146	6.30	Margam	11.82		
Saladin	6.58	Avalanche	12.60		
Tetraploids (2n=28)					
Avena barbata Cc 4897	0.28				
A.murphyi Cc 6558	0.76				
Diploids (2n=14)*					
A.strigosa ssp. hirtula Cc 3678	0				
A.strigosa var. glabrota Cc 4093	0				
A.prostrata Cc 6557	0				
Ceirch Llwyd Cwta, S.171	0.55				
Ceirch Llwyd, S.75	7.2				
A.prostrata addition line (2n=44)					
Av 1900/2/47 Cc 6989	0				

*Results from one unreplicated drill
+Area under the Disease Progress Curve expressed on a 'per unit' basis

The incorporation of resistance from diploids and tetraploids into cultivated hexaploid oats is more complex and difficult due to fertility barriers, and the resistances when incorporated are not necessarily any more durable. The mechanisms involved in each source need clarifying as they could be different within the diploids, for instance in the completely resistant types Cc 4093 and Cc 6557 compared with the partial resistance of S.171.

Because of the lack of readily transferrable resistances in the available collections of the hexaploid A.sterilis, these unexploited sources at lower ploidy levels need utilising, and with the new cytological techniques now becoming available this should become easier.

Methods for combining such complete (maybe hypersensitive) resistances with partial, adult plant resistances have been developed and are being operated fairly satisfactory but further refinement is required to speed up the flow of new complex germplasm with maximum resistance barriers to the pathogen.

MODIFICATION OF THE USDA, INTERNATIONAL OAT RUST NURSERY PROGRAM

J. G. Moseman
USDA, ARS

The USDA International Oat Rust Nursery program, which has been coordinated by USDA, ARS, scientists at Beltsville since its inception in 1950 will be modified. The objectives of the modified program will be the same as those of the nursery program. Those objectives are to evaluate advanced selections and new cultivars for reactions to rusts world-wide and to identify new resistance genes and gene combinations.

The following was accomplished in the nursery program in 1985. The report on the 1984 International Oat Rust Nursery was compiled and distributed to the cooperators in July. Seed of the 1985 nursery was sent to the cooperators and some data from that nursery has been compiled. Some of the seed of the 1986 nursery has been sent to the cooperators.

The 1986 nursery will be the last nursery sent to all cooperators in the nursery program. The data obtained on the 1986 nursery, sent to the cooperators in 1985 and 1986, will be compiled and distributed to the cooperators before July 1, 1987.

The modified program will be initiated to replace the 1987 International Oat Rust Nursery program. In 1986 the cooperators are being requested to send to the coordinator 40-50 grams of seed of each new entry they wish in the program instead of 20-40 grams. The coordinator will not increase the seed as was done for the nursery program. Arrangements will be made with scientists at 6-7 institutions, which have the interest, expertise and facilities, to evaluaate the new entries for reactions to the pathogenic strains of the rusts at their locations. Those scientists will evaluate the new entries for seedling and when possible mature plant reactions. The results from the tests of seedling reactions will be sent to the coordinator, who within one year, will compile and send those data to the cooperators who furnished the new entries. Within two years, the results from all tests, seedling and mature plant or field reactions, will be compiled and furnished the cooperators who furnish the new entries.

In the nursery program, only the new entries constituted the germplasm with new genes and gene combinations furnished the cooperators. In the modified program, additional germplasm with new genes and gene combinations may be furnished. Seedling and some mature plant data on reactions of the new entries will be available to assist in identifying those new entries with new genes and gene combinations. The USDA, ARS, scientists and the scientists conducting the evaluations, who are experts on resistant genes and gene combinations, will be requested to furnish from their programs germplasm with new genes and gene combinations.

In the present nursery program, the cooperators who furnish the new entries did not receive information on those entries for almost three years. In the modified program, they will receive some information within one year, and all of the information within two years. The information should also be reliable, since the evaluations will be conducted by individuals who specialize in conducting such evaluations.

THE UNIVERSITY OF SYDNEY

AUSTRALASIAN OAT RUST SURVEY 1984/85

J.D. OATES

Oat rusts were prevalent in Western Australia in contrast to the other states from where reduced numbers of samples were received, particularly so from South Australia.

405 samples were received, 50% were identified as being on wild oats, and 5 samples were on genera other than Avena. 28 samples failed to germinate.

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

The identification of the new strain, Race 2 + pg 13, recovered from Queensland, is the main change in a strain make-up remarkably similar to the 1983-84 survey, even though this year's survey is dominated by W.A. The four races 1,2,22 and 24 were present in the same proportions in both surveys.

Strain 2 + pg 13 is the only collection capable of full virulence on oat lines with pg 13. This strain has been built up and is being used in routine rust analyses of oat lines.

Of 133 viable accessions, 369 isolates were identified. Race 14, last recovered in the 1978-79 Season, has been found in New Zealand. Races 15 and 19, not previously recovered by this laboratory, were also found in New Zealand.

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

27 races were identified on the international set of differentials (Table 2). Although a number of rare races reappeared, only 3 races were identified for the first time (* in Table 2).

From 144 viable accessions, 194 isolates were identified. Race 226 continues to dominate the population. Race 230 and 237 are common, followed by 203 and 211. All other races were recovered only occasionally. Again, the 3 new races were from Queensland and Northern N.S.W.

Table 3 lists the frequency of each race and the area from which each was isolated during the Season April, 1984 to March 1985.

Of the supplemental differential and resistant lines inoculated with each accession, Pc 45 was susceptible to 64% and Pc 38 to 4% of the isolates. Strain isolates were identified with virulence for the combination of Pc 45, (48), i.e. partial virulence on Pc 48. The following lines were resistant to all leaf rust isolates: Pc 50, Pc 55, Pc 56, TAM 301, TAM 312 and Ascencao.

TABLE 1: FREQUENCY OF OAT STEM RUST RACES/STRAINS 1984-85

RACE/ STRAIN	VIRUL. Pg	QLD	N.NSW	S.NSW	VIC	SA	WA	N.Z. NI	N.Z. SI	CH	TOTAL
1		6	9	4	21	1	19			1	61
2	3	5	4	10	12	1	46				78
2+Saia	3+Sa				1		11				12
2+Pg	3+13	1									1
8	2,3		3		1						4
11	2		1		1		2				4
14	4							1			1
15	3,4							2			2
18	1,2,4	2	1				1		6	3	13
19	4,9								1		1
20	1,2,3,4	12	4	4	11		1			1	33
22	2,3,4	5	1	1	4		39		1	6	57
24	2,4	12	6	9	14	1	46	1	1	1	91
24+Sa?	2,4,Sa				1		1				2
24(22)	2,(3),4							3			3
Saia	Sa			1			5				6
		43	39	29	66	3	171	8	14	6	369

TABLE 2: OAT LEAF RUST RACES 1984-85

Race	ANTHONY	VICTORIA	APPLER	BOND	LANDHAFER	SANTA FE	UKRAINE	TRISPERNIA	BONDVIC	SAIA	No. of Isolates
	DIFFERENTIAL VARIETIES										
202	S	-	S	S	-	-	-	-	-	-	1
203	S	-	S	S	-	-	S	-	-	-	12
211	-	-	S	S	-	-	S	-	-	-	11
216	S	S	S	S	-	-	S	-	-	-	1
223*	S	-	S	S	-	-	S	S	-	S	1
226	S	-	S	-	-	-	S	-	-	-	70
227	S	-	S	-	-	-	S	-	-	S	6
228	-	-	-	-	-	-	S	-	-	-	2
230	-	-	S	-	-	-	S	-	-	-	23
231	S	-	-	-	-	-	S	-	-	-	1
236	S	-	S	-	-	-	-	-	-	S	1
237	S	-	S	-	-	-	-	-	-	-	23
238	-	-	S	-	-	-	-	-	-	-	4
240	S	-	-	-	-	-	-	-	-	-	2
259	S	S	S	-	-	-	S	-	-	-	2
260	S	-	S	-	S	-	-	-	-	-	1
264	S	S	S	S	S	S	S	S	S	-	4
268	S	-	S	-	-	-	S	-	S	-	1
276	S	-	S	S	S	S	S	S	S	S	6
287	-	-	S	-	S	S	-	S	S	-	3
294	-	-	S	S	S	S	S	-	-	-	2
295	S	-	S	S	S	S	S	-	-	-	9
384*	-	-	S	S	S	S	S	S	S	-	3
413	-	-	S	-	S	S	S	-	-	-	1
416	-	-	S	-	S	S	S	-	-	-	2
427*	S	-	S	-	S	S	S	-	-	-	1
SAIA	-	-	-	-	-	-	-	-	-	S	1
											194

TABLE 3: FREQUENCY AND DISTRIBUTION OF OAT LEAF RUST RACES 1984-85

RACE	AREA QLD	N.NSW	S.NSW	VIC	SA	WA	N.Z. NI	N.Z. SI	CH	TOTAL
202								1		1
203	6	1	2	1		2				12
211	6	1	3	1						11
216	1									1
223*		1								1
226	6	20	11	6	1	13	1	9	3	70
227			2					1	3	6
228		1		1						2
230	3	1	6	10		2			1	23
231						1				1
236									1	1
237				5	1	6	1	10		23
238	1	1				1	1			4
240						2				2
259		2								2
260		1								1
264	3	1								4
268			1							1
276	4	2								6
287	2		1							3
294	2									2
295	6	1	1			1				9
384*	3									3
413			1							1
416	1	1								2
427*	1									1
SAIA		1								1
	45	35	28	24	2	28	3	21	8	194

Rust Resistance from *Avena* abyssinica

P. G. Rothman

USDA/University of Minnesota

J. H. Craigie was most fluent when he wrote "As a rule - high resistance to stem rust occurs naturally in varieties that are of little or no commercial value." Genes of desirable characteristics are common in species unsuited for cultivation. These genes can be identified among the segregates of interspecific crosses too, but because of their fraility, progeny survivals are few in numbers.

Much interest was generated 25 years ago when F. J. Zillinsky identified a derived tetraploid (Ab 101) from the interspecific cross of *Avena abyssinica* (CD 4549) and *A. strigosa* (CD 3820). Ab 101 was used as a source of crown rust resistance in several oat breeding programs, but its source of stem rust resistance was never determined or utilized.

Ab 101 was crossed with CI 7233, another crown rust resistant *A. abyssinica* tetraploid but also with resistance to stem rust race 6AF (NA 27). Fertility was low among the F_1 plants of these two parents; however, an F_2 selection was successfully backcrossed to Ab 101. The progeny of the backcrossed line has been pursued through the F_{15}. Seed color through the generations has been a variation of black to tan but seed size exceeds the short plump nature of Ab 101. Plant straw is weak and maturity late. Lines have been identified which are resistant to all the prevailing NA stem rust races as well as the races of crown rust within the St. Paul buckthorn nursery composite, some of which parasitize Ab 101. Sterility is evident but select lines have been successfully crossed with hexaploid oats and resistance to the rusts recovered in fully fertile progenies.

Seed is available for distribution.

A Promising Oat Strain for Kashmir Valley

Bimal Misri, R. N. Choubey and S. K. Gupta
Indian Grassland and Fodder Research Institute, Jhansi-284003 (India)

The whole valley of Kashmir is a monocrop area and all the available land is used for rice cultivation during summer season. Most of these fields get waterlogged in the winter and hence are rendered useless. The dry areas available for cultivation are now, mostly, put under winter crop of fodder oats. The oat cultivation is becoming increasingly popular with the farmers and the cultivar 'Kent' is usually grown. The initial evaluation of five new oat strains developed at the Indian Grassland and Fodder Research Institute, Jhansi, was done during winter 1983-84 whereby 'JHO-810' performed much better than 'Kent' (1984 Oat Newsletter, p. 24). During winter 1984-85 the same strains were tested at three sites in the valley, representing different types of soil formations. A brief description of these three sites is as follows:

1. IGFRI Substation Farm, Manasbal:
   This farm is situated in the southwest of Srinagar, capital of the Jammu and Kashmir state, at a distance of about 30 kms and the land is Karewa type. The Karewas are dry table lands pierced by ravines and are of lacustrine nature. They may be as high as 500 m from the level of the valley. The soil possesses greater proportion of macro-pores and is poor in moisture retention. The lithology of soil reveals loam and loamy clay with coarse drab or brown sand. The soil is very poor in organic matter.

2. Rice field, village Asham:
   The village Asham is situated in the northwest of Manasbal at a distance of 10 km. A typical rice-field was selected for conducting the trial and sowing of oat was done after rice. This was a big flat terrace on a slope and well-drained. The soil is loam in texture, black and develops cracks when dry.

3. Botanical Garden, University of Kashmir:
   The site is situated at a distance of 12 km away from Srinagar and represents basin of the valley which is the deepest part of the valley. The soil is sandy loam and light in texture. Such soils are spread throughout the valley and are used for the cultivation of rice and vegetables.

The performance of all strains as compared to the check variety 'Kent' for green fodder and dry matter yield is presented in Table 1. It is apparent that 'JHO-810' produced significantly higher forage yield than 'Kent' at all the three sites and surpassed all other strains too. 'JHO-802' was also observed to be better over 'Kent' although last year its performance was not so appreciable. However, 'JHO-810' appeared to be the most suitable fodder oat genotype for the Kashmir valley and its performance has been observed to be stable over the three locations.

We plan to test the forage yield potential of the promising strain 'JHO-810' at many locations within the valley in the coming years.

Table 1. Average green and dry matter yield of various oat genotypes at three locations in Kashmir valley.

S.No.	Genotypes	Green fodder yield (q/ha)				Dry matter yield (q/ha)			
		L_1	L_2	L_3	Average	L_1	L_2	L_3	Average
1.	JHO 801	154.66	198.66	108.66	153.99	46.66	37.66	31.00	38.44
2.	JHO 802	226.00	212.00	195.33	211.11	50.00	49.66	51.66	50.44
3.	JHO 810	296.00	262.66	223.33	260.66	63.00	52.33	58.00	57.77
4.	JHO 815	169.33	253.33	179.66	200.77	37.33	44.00	51.66	44.33
5.	JHO 819	204.66	189.33	172.00	188.66	55.33	41.66	45.00	47.33
6.	Kent	158.00	149.33	122.66	143.33	34.66	43.33	39.66	39.21
C.D. (5%)		50.29	68.11	59.77	54.74	17.16	8.71	12.96	12.25

L_1 = IGFRI Substation Farm, Manasbal.
L_2 = Rice field, Village Asham.
L_3 = Botanical Garden, University of Kashmir.

Quality of Newly Bred Strains of Forage Oats

Bhagwan Das, K. R. Solanki and B. S. Jhorar

The objective of the oat improvement program at this University continues to develop high yielding cultivars with better nutritive quality as the oat acreage is gradually increasing for green forages and is most suited to our conditions in the Northern part of the country as an appreciable winter season prevails.

Lines of oats previously found to possess high green forage yield were selected for the analysis of traits important in quality. The best ten lines were selected and the results are reported in Table 1.

The crude protein percentage varied from 6.12 to 10.06 whereas *in vitro* dry matter digestibility ranged between 66.40 and 76.80. Crude protein yield varied from 8.61 to 15.73 q/ha and the digestible dry matter ranged from 79.34 to 115.81 q/ha.

From the data it is indicated that the strains OS-86, OS-100, OS-107 and OS-113 are the best and most suitable for cultivation as single cut varieties.

Table 1. Chemical composition of oat strains.

S. No.	Strain	CP %	IVDMD %	Yield (q/ha) CP	R	DDM	R
1.	OS-86	10.06	66.40	15.73	1	103.85	5
2.	OS-87	8.31	68.60	11.33	4	93.57	9
3.	OS-93	6.12	66.80	8.61	10	94.05	8
4.	OS-96	9.62	66.40	13.97	3	96.41	7
5.	OS-100	10.06	71.60	14.65	2	104.25	4
6.	OS-101	8.31	69.60	9.47	8	79.34	10
7.	OS-107	6.56	69.60	10.91	6	115.81	1
8.	OS-110	6.56	69.20	9.38	9	98.95	6
9.	OS-113	7.87	76.80	11.16	5	108.90	2
10.	OS-6	7.00	72.80	10.29	7	107.01	3

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

III. CONTRIBUTIONS FROM COUNTRIES OTHER THAN THE UNITED STATES

Oat Production and Breeding in South Australia

A.R. Barr

OAT PRODUCTION: The South Australian Department of Agriculture estimates that 158,000 ha was sown to oats for grain in 1985 with an expected production of 166,000 t. This is lower than 1984 when estimates were 166,900 ha and 202,700 t respectively. In addition to the grain area, approximately 30,000 ha is usually sown for grazing and another 40,000 for hay. Domestic price is currently $90-$100 per tonne delivered to Adelaide, in contrast to the estimated export price of $85 per tonne.

The varieties grown in South Australia are undergoing a period of rapid change. The semi-dwarf varieties, Echidna and Dolphin which were released in March 1984, were in 1985 sown on 15% and 3% of the area respectively. Areas sown to other varieties are Swan (52%), West (18%), Avon (4%) and Bulban (1%).

Echidna has confirmed in commerce the potential it demonstrated in trial plots. Dryland crops up to 7t/ha have been recorded. Both Echidna and Dolphin are very resistant to lodging and grain shedding and as a result many farmers have changed their harvest priorities from barley, oats, wheat to barley, wheat, oats. This allows the oats to be stored in field bins which, in the previous system, were required for the wheat harvest. Oats are then available for autumn feeding programmes without purchasing extra storage silos.

OAT BREEDING: The breeding programme is concentrating on developing varieties with resistance and tolerance to the cereal cyst nematode, *Heterodera avenae*. This nematode is a major disease of wheat, barley and oats in South Australia. New Zealand Cape and *A. sterilis* Cc4658 are the main sources of resistance/tolerance in use. Promising material from the cross West//West/New Zealand Cape is near release.

Other areas of current interest are:

(1) improving the grain quality of semi-dwarf germplasm derived from OT 207 (carrying DW6).

(2) testing naked grain genotypes carrying the DW6 gene.

(3) transferring the stem rust genes present in 'Amagalon' and 'Obee' into commercially useful genotypes.

(4) accumulating stem rust, crown rust, BYDV, *Septoria* and *Psuedomonas* spp resistance in varieties adapted to high rainfall areas.

OATS IN MANITOBA - 1985

P.D. Brown, D.E. Harder, J. Chong, S. Haber
Agriculture Canada, Research Station, Winnipeg, Manitoba

In 1985 soil moisture reserves in Manitoba were adequate and favourable weather permitted producers to plant early in the season. Temperature in June,,July and August were cool. Rainfall in June and July was adequate for good growth; August, especially in eastern Manitoba, was wet. The wet weather delayed harvest and resulted in a reduction in grain quality. Yields ranged from very high in eastern Manitoba to average in western Manitoba. Estimated grain yields averaged 2.49 tonnes per hectare (up 29% over 1984) on 223,000 hectares (down 4% over 1984) over the entire province. Fidler was the most common variety having been sown on 49% of the area. Dumont was sown on 32% of the area, up from 10% in 1984; 13% of the oats sown was Harmon and 6% was Hudson. Areas inspected of all generations of pedigreed seed of Dumont, Fidler, Harmon and Riel were 1084, 71, 18 and 29 hectars respectively. Riel (W80474) was licensed by the Food Production and Inspection Branch of Agriculture Canada in 1985.

Alison Baillie, a Masters student at the University of Manitoba is nearing completion of the project. She is screening selected diploid and tetraploid _Avena_ accessions for stem rust resistance. She also made intraspecific crosses and is studying the inheritance of resistance within selected diploid and tetraploid species. A further aspect of her project has been to transfer resistance from the diploid or tetraploid to hexaploid _A. sativa_ L.

Tom Warkentin, also a Masters student at the University of Manitoba, has been studying the inheritance of a moderate level of hoegrass (diclofop-methyl) tolerance in oats. Preliminary results indicate that this trait appears to be controlled by one or two genes, that selection for tolerance is fairly easy and that this trait could be readily incoporated into a breeding program.

The Oat Rusts in western Canada in 1985

The inocula of oat stem rust and oat crown rust arrived early in 1985. By mid-July both rusts were already quite common in southern Manitoba. Because of the very early appearance of the rusts, it was anticipated that heavy infections would follow. However, weather conditions were too cool and dry for good rust development. A second factor is its increased cultivation of resistant cultivars in the rust areas of the prairies. In 1985 about 81% of this area seeded to oats in Manitoba comprised the cultivars Fidler and Dumont. This trend should continue with the introduction of Riel oats.

There were no important changes in virulence combinations of both rusts from those in recent years. The predominant stem rust race found in western Canada is NA27 which attacks Pg1, Pg2, Pg3, Pg4, and Pg8. For the crown rust, the main virulence of this natural population in western Canada is on lines containing gene Pc35, Pc40, or Pc46. None of the field isolates of both rusts poses a threat to the resistant genes currently used in the oat breeding program in Winnipeg, and the cultivars Fidler, Dumont, and Riel remain highly resistant to all these isolates.

Survey of natural barley yellow dwarf infections in Manitoba, Saskatchewan and Alberta - 1985

The incidence of barley yellow dwarf virus (BYDV) was found to be higher than in 1984, but lower than levels reported in epidemic years such as 1978. Aphid vectors were more numerous and a few days earlier inarriving in barley, oat and wheat fields surveyed in eastern, central- and southern Manitoba in 1985 than in 1984. In parts of central Saskatchewan, late planting in some areas resulted in occasional high incidences of BYDV in oats, and particularly in barley. As in previous years the majority among detected vector species were English grain aphids; in southern Manitoba about one-fifth of the vector aphids were cherry oatbird aphids. The cherry oat aphid non-specific strain (PAV-type of BYDV) made up, as in previous years, the majority of isolates obtained in the field survey; one isolate of the corn leaf aphid specific strain (RMV-type of BYDV) was obtained from winter wheat in south central Manitoba and one strain of the English grain aphid-specific strain (MAV-type of BYDV) was obtained from barley in central Alberta.

Oat Production and Research in Saskatchewan

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

Oat production in Saskatchewan continues on approximately 1.0 million acres (400,000 hectares) annually with a significant portion of this production being used as forage in most years. Nevertheless, some 20-25 million bushels of oat grain are produced annually. Nearly all of this is fed to livestock in the locale of production with less than 5% being utilized by the food industry.

1985 was a relatively good year in most of the oat growing regions of Saskatchewan with grain yields averaging 10-12% above 1984. These higher yields were created by a longer and cooler than normal growing season. The weather significantly affected grain quality in the form of a very damp prolonged harvest season. In addition this weather has affected germination of seed crops negatively, such that good oat seed may be difficult to come by in the spring of 1986.

The old variety Harmon continues to be the most widely grown variety in the province, however it is being rapidly replaced by three newer superior varieties, Calibre, Cascade and Dumont. Of these varieties Calibre, produced by the U. of Sask. breeding program, continues to be the number one performer in the non-rust area (approximately 700,000 acres) while Dumont should be the variety of choice in the south-east rust area. Calibre combines high yield potential (12-15% Harmon) with superior kernel quality having very high test weight and low hull content. Dumont is a good yielder (10% Harmon) with good kernel quality but also has the necessary disease resistance for the rust area of south-east Saskatchewan. Pedigreed seed producers have responded rapidly and we anticipate these two varieties becoming the most popular very quickly.

The oat research program at the U. of Sask. continues to select heavily for improved yield potential and superior kernel quality. Current emphasis is on improving the plumpness and smut resistance of Calibre.

Utilization of Wild *Avena* Species for Gene Introgression

R. N. Choubey, S. K. Gupta and M. N. Premachandran
Indian Grassland and Fodder Research Institute, JHANSI-284003 (INDIA)

Wild *Avena* species such as *A. sterilis* and *A. magna* possess many desirable forage attributes viz., better tillering, quick regeneration and high protein content in comparison to the cultivated *A. sativa*. A program for introgression of genes from these two species to the cultivated oats was initiated at the Indian Grassland and Fodder Research Institute, Jhansi (India), starting from the winter season 1980-81 with an aim to develop genotypes possessing high forage yield potential in a multicut system of cropping and good forage quality.

A. sativa x *A. sterilis*:

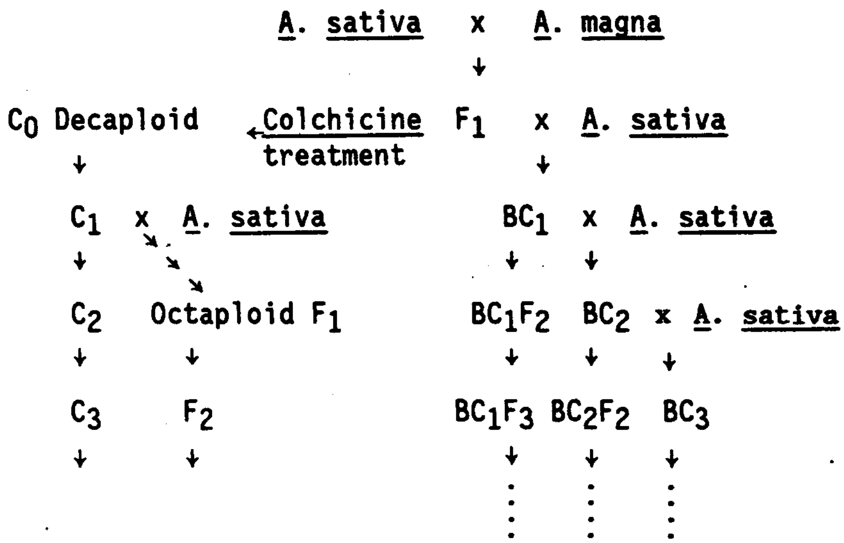
Three fodder oat genotypes viz., OS-6, UPO-94 and PO-3 were utilized for mating with *A. sterilis* in 1981 and subsequent generations were advanced as per the following scheme:

	A. sativa		x	*A. sterilis*
			↓	
	A. sativa	x	F_1	
		↓	↓	
A. sativa x		BC_1	F_2	
↓		↓	↓	
BC_2		BC_1 F_2	F_3	
↓		↓	↓	
BC_2F_2		BC_1 F_3	F_4	
↓		↓	↓	
⋮		⋮	⋮	

Introgression of such characters as high tillering and quick regneration has been observed. Although the analysis of protein content in the forage has to be postponed until sufficient status of homozygosity is achieved, selection for leaf:stem ratio in the segregating progenies is in progress.

A. sativa x *A. magna*:

Five *A. sativa* genotypes viz., OS-6, OS-7, JHO-801, UPO-94 and IGO-500 were included in this program. Although pentaploid F_1 hybrids were established in all the five hexaploid x tetraploid matings, further success was achieved in three crosses only. The following scheme was adopted to handle this material:



So far several decaploids and octaploids have been derived and have been found to possess high tillering potential. Most of these have desirable agronomic characters. The seeds are very bold and plump, about one and half times those of *A. sativa*. In most of the BC_1F_2's and BC_2 plants, hexaploid derivatives with stable chromosome number are expected. The majority of the decaploid derivatives have been found to possess very high seed fertility and chromosomal stability and do not show any sign of meiotic breakdown.

Adventitious Branching in Oats

S. N. Mishra, R. Prasad and J. S. Verma
Department of Plant Breeding
G. B. Pant University of Agriculture and Technology
Pantnagar, Nainital - 263145, India.

In oats, tillering is a common phenomenon but occurrence of adventitious branching of the stem is very rare and has not been reported. Such branchings of the stem if fixed in the cultivated genotypes may increase yield. In the present study, some observations on the branching of the stem of oats have been reported.

Branching of stem was noticed in biparental (BIP) progenies developed from F_2 and F_3 populations of the crosses Coachman x Swan, Goodland x UPO 92, and Lyon x Montezuma. Such plant types were noticed both in BIPs and in BIPs selfs. Neither the parents (F_2) nor the grandparents (parents of the original cross) had this pattern of branching.

Regarding their frequency, adventitious type of branching differed from cross to cross and also among the populations within the cross (Table 1). In the cross Coachman x Swan, the F_2 bips had 0.70% which the F_2 bips selfs and F_3 bips had 2.19% and 3.80%, respectively. In the other two crosses, only the F_2 bips selfs and the F_3 bips showed this branching. However, in these two crosses the frequency of such plants were only of the tune of 0.35% to 0.71%. These observations combined with continued occurrence of such form in selfs and F_3 bips indicate that this habit may be under genetic control. Also, such forms appeared after biparental matings in these crosses suggesting the possibility of gene reshuffling due to breakage of linkages. It may be possible that such genes responsible for stem branching might have been linked with other genes which did not allow them to express in associative situations. Therefore, occurrence of such types indicate gene reshuffling and also allowing them to express in the derived progenies. Finally, to assess their value on breeding potential, number of spikelets per panicle was observed and compared with the normal (Table 1). It is clearly indicated that the branched stem types had greater number of spikelets per panicle than the normal ones. Averaged over all the crosses and populations, branched stem types produced about 18.76% more spikelets than the normal ones. Further work on this aspect is continuing to find out its inheritance pattern and practical utility.

Table 1. Frequency of branched stem plants and number of spikelets per panicle in branched and normal oats.

Cross/ population	Frequency %	Number of spikelets/panicle	
		Branched	Normal
1. Coachman x Swan			
F_2 bips	0.70	83.81	76.79
F_2 bips selfs	2.19	93.44	83.79
F_3 bips	3.80	120.09	103.00
2. Goodland x UPO-92			
F_2 bips selfs	0.35	116.00	71.53
F_3 bips	0.71	127.00	110.07
3. Lyon x Montezuma			
F_2 bips selfs	0.39	97.00	75.73
F_3 bips	0.47	94.00	94.88
Average	1.22	104.47	87.97

Relative Performance of Oat and Barley Fodder

P. L. Manchanda and Ranjit Ghosh
Cummings Laboratory, Division of Genetics
Indian Agricultural Research Institute
New Delhi 110012 (India)

Barley is a highly nutritive rabi cereal, generally used either as flour (pure or mixed with that of wheat or gram) for chapati making or as parched grain to make sattu. Similarly oats, a good nutritive rabi crop, is mainly used as fodder for horses and milk animals. A limited portion of this crop is being used as a breakfast food in the form of porridge.

A few selected cultivars of barley were tested along with some promising strains of oats to determine the relative performance among them in respect to different fodder attributes.

A trial was laid out with ten varieties of barley and four varieties of oats in R.B.D. with three replications. The following data was recorded at the time of 50% bloom, on days to flower, height of the plant, green and dry fodder yield and digestibility percentage and is presented in the table.

It has been found that barley takes 80-90 days to flower while the oat has taken 107 days. Plant height in barley ranges between 70-90 cms while in oats it is 91-122 cms. The green fodder yield in barley is between 290.00 q/ha to 483.30 q/ha and 480 q/ha to 560 q/ha in oats. In oats the dry fodder yield ranged between 85.40 q/ha and 91.70 q/ha and between 49.00 q/ha and 71.50 q/ha in barley. The digestibility percentage range is between 72.60 and 82.50 in barley and between 72.60 and 80.52 in oats.

It is clear from the results that the barley varieties flower 17 days earlier than oats. The green and dry fodder yield is more in oats than barley whereas the digestibility percentage between the two fodder crops is not significantly different. The advantage of oats crop is that less land is required to produce the same amount of fodder required by the animal whereas in barley being early, field could be utilized for sowing of some other rabi crop.

Comparison of characters in oats and barley

S. No.*	Varieties	Days to 50% flower	Height at 50% flowering (cm)	Green wt at 50% fl. (q/ha)	Dry wt (q/ha)	Digestibility	
1.	DL-386	80	73.70	290.00	54.90	44	72.60
2.	DL-5082	88	97.30	390.00	60.30	44	72.60
3.	11-57	89	84.70	483.30	68.50	49	80.85
4.	D-120	88	76.50	376.60	49.00	50	82.50
5.	D-226	88	89.90	410.00	61.20	48	79.20
6.	DL-268	88	86.90	356.60	55.50	44	72.60
7.	DL-157	88	83.20	423.30	63.20	46	75.90
8.	Ratna	88	81.30	453.00	71.50	48	79.20
9.	DL-36	88	83.10	446.60	65.20	46	75.90
10.	DL-348	88	90.10	473.30	66.20	48	74.25
11.	13185	107	109.90	516.60	85.40	45	74.25
12.	4263	107	99.80	486.60	88.80	49	80.85
13.	34587	107	119.50	560.00	98.50	48	79.20
14.	Kent	107	122.70	480.00	91.70	44	72.60
	CDa 45%	0.5328	6.7103	84.09	19.46		2.1190

*S. No 1-10 barley
S. No 11-14 oats

Oat Research In South Africa

Maryke Aartsma, Small Grain Centre, Bethlehem

An oat improvement program at Bethlehem was started in 1981 with three objectives in mind, that is to develop:

1. A forage type suitable for dryland farming
2. A selection that is tolerant of frost
3. A selection resistant to stem rust

Both local and imported lines are evaluated yearly, and encouraging selections are used as parents in greenhouse crossings.

For forage potential trials, the oats are physically grazed by sheep, which gives an estimate of tastiness, and later, of regrowth. Two or three successive grazings are given within a reasonable lapse of time, after which seed yield is also evaluated. Samples are tested for protein content.

Two planting dates are used, one in March for forage potential, and one in June for seed yield. Frost tolerance is evaluated together with forage potential.

In the past three years two lines, CI 8163 and Coker 76-20 performed exceptionally well for both forage potential, frost resistance, regrowth and seed yield.

Greenhouse work consists of collecting rust samples from different locations throughout the country.

Differential plants and cultivars with known genes will be inoculated. Results will indicate sources of resistance, susceptible genes, and the make-up of the rust population. This information can be used to recommend control measures.

IV. STATE REPORTS

ARKANSAS

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

Production. Oat acreage in Arkansas continued to decline in the 1984-85 growing season. Acreage planted was at an all time low of 22,000 acres. Of the 17,000 acres harvested, the average yield was 65 bu/A. Oat acreage has declined in recent years in favor of wheat. However oat acreage planted was down 56% from 1983-84 which was similar to the decline in wheat acreage of 57%. These large declines were due to excessive rainfall during October and November which prevented planting.

Breeding. The line designated AR 102-5 has yielded well in state trials and in the Uniform Central Winter Oat Nursery. It appears to have superior winterhardiness over the current University cultivar 'Bob'. Panicle selections will be made this year for possible increase and release. We have also begun collecting naked oat germplasm for evaluation.

Personnel. Dr. J.P. Jones returned to the small grains program in May after 4 years in Egypt working on the USAID Rice Project.

INDIANA

Purdue University. H. W. Ohm, F. L. Patterson, J. M. Hertel (Breeding, Genetics), J. E. Foster (Entomology), G. E. Shaner, G. C. Buechley (Pathology), R. M. Lister (Virology), K. M. Day and O. W. Luetkemeier (Variety Testing), and C. L. Harms (Extension).

Production. Oat production in Indiana for 1985 is estimated by the Indiana Crop and Livestock Reporting Service at 7.59 million bushels, up 53 percent from 1984. Yield was a record 69 bu/acre, 4 bushels above the previous high in 1980 and 1981. Acres harvested totaled 110,000, up 38 percent from 1984.

Season. By late March, field conditions became dry enough to plant oats. Wet weather returned briefly in early April. Favorable weather by mid-April permitted oat planting to proceed a week earlier than normal. By the first week in May oat height at 6 inches tall tied the record for oat development. Beginning the second week in May and for the remainder of the growing season, dry and generally cool weather persisted in northern and central Indiana while wet weather prevailed in the southern part of the state. Oat harvest was completed in early August, nearly a week earlier than normal.

Varieties. The most popular variety in the state continues to be Noble with 37.4 percent of the total harvested acreage. However Ogle is close behind with 35.3 percent of the acreage.

Research. The main emphasis of our program is the selection of high yielding types with tolerance to barley yellow dwarf virus (BYDV) and resistance to crown rust.

Our selection process for tolerance to BYDV is to infect each entry from the yield nurseries separately with the PAV or RPV strains of the virus in hill plots. The infected plants and noninfected (control) plants are then transplanted into the field. These hill plots can then be compared and given a symptom score for BYD. This process has been very effective; however, it is important to carry out the infection process (infestation of just-emerged seedlings by viruliferous aphids) in a controlled chamber to minimize plant-to-plant variation. Also, if possible, the test plants should be protected from infestation by natural aphid populations after seedlings are transplanted into the field.

We are also evaluating F_2-derived advanced-generation lines of three oat populations for their reaction to BYDV. Each of the three populations resulted from a single cross between two oat lines with different sources of tolerance to BYDV. F_2 plants were advanced to F_7 by single seed descent. Each F_7 family of plants (the progeny of a single F_6 plant) and the parents were planted in the field in 1985 in a split-plot design. Lines and parents were assigned at random to whole plots. The three treatments -- infection by the BYDV isolates RPV and PAV and a control -- were assigned to subplots. Subplots were hillplots consisting of 10 oat seedlings. Grain yield and a BYD symptom score were recorded for each subplot. Preliminary analysis indicates that the parents in these crosses differ by few genes for tolerance to BYDV.

A recurrent selection program based on a broad genetic based oat population has gone through two cycles of selection for tolerance to BYD. Progress from selection will be evaluated in 1986 and selection for resistance to crown rust will be initiated. We will also begin development of inbred lines from the improved populations. To date we have demonstrated that the logistics of carrying out recurrent selection in oats is feasible.

IOWA

K. J. Frey, M. D. Simons, R. K. Skrdla,
L. J. Mitchel, and G. A. Patrick

About 750,000 acres of oats were harvested for grain in Iowa in 1985. Mean yield was 73 bushels per acre so the state production was about 50 million bushels. The grain yield in 1985 was 8 bushels greater than in any previous year. Oats were sown at the normal time in 1985, and there was adequate moisture and moderate temperatures during plant development and grain filling. Thus, production was excellent and the test weight for oats in 1985 was the best on record. Neither crown rust nor barley yellow dwarf was of any importance to oat production in Iowa in 1985, but there was more stem rust development than at any time during the past quarter century.

Foundation seed of 'Webster' variety of oats was released to Iowa farmers in 1985 and a large quantity of registered seed of this variety is available for planting in 1986. Webster has a performance and test weight about the same as Lang, but its crown rust resistance is the best among the oat varieties available in Iowa.

Recently, (Robertson, L. D. and K. J. Frey, Crop Sci. 24:200-204. 1984) we reported that on average, segregates from interspecific crosses of *Avena sativa* x *A. sterilis* yielded about 6% more when they had *A. sterilis* cytoplasm than in the reciprocal crosses. The cytoplasmic effect was not uniform, but was evident in certain matings. Six of the highest yielding lines in *A. sterilis* cytoplasm from this study were backcrossed two additional generations to give BC_4F_2 derived lines. Backcrossing beyond BC_2 caused these lines to regress in yield to a level of the recurrent parent. This indicates that cytoplasmic effects *per se* do not exist for grain yield, but that cytoplasmic effects on trait expression are manifest as nuclear-cytoplasmic interactions. This hypothesis is in agreement with findings in molecular biology in that most polypeptides encoded by cytoplasmic DNA do not form functional enzymes unless they are adjoined to polypeptides encoded within the nuclear genome. One experimental line from the Robertson study, D623-15, was grown in the early uniform nursery in 1985 and has been tested in Iowa variety trials for four years. It shows sufficient promise that a small increase of this entry is being made in 1986.

Jaime Sahagun recently completed a study in which he compared augmented, randomized block, and lattice designs for efficiency for selection of oat breeding lines. When these designs were replicated, the lattice design was the most efficient for controlling intrasite error variance, and the augmented design was the least efficient. However, there was little difference among the replicated designs when efficiency of selection for grain yield was the judgment criterion. Experimental designs, either unreplicated or replicated, that used plot yield adjustments in general were not better for selection than those where no adjustments of plot yields were made. All replicated and unreplicated designs were successful for selection according to every criterion used, but making a choice among either unreplicated or among replicated designs for efficiency of selection was relatively small.

Several changes have occurred in the ISU oat project personnel during

1985. Six students have finished Ph.D. degrees during 1985 and they have taken jobs elsewhere. Dr. Neil Cowen is now a small grain breeder at the University of Missouri, Columbia, Missouri; Dr. Paula Bramel-Cox is a sorghum breeder at Kansas State University, Manhattan, Kansas; Dr. Jaime Sahagun is a statistics teacher and consultant at the Graduate College, Chapingo, Mexico; Dr. Gary Weber is a corn breeder with Pioneer Hi-Bred International at Wahpeton, North Dakota; Dr. Luis Barrales is a statistics consultant in the Ministry of Agriculture, Santiago, Chile; Dr. Bill Beavis is a sorghum breeder with Pioneer Hi-Bred International, Plainview, Texas. New faces on the small grains project are Mark Smith from Nebraska, Dan Currier from Nebraska, and Kevin Pixley from Flordia, all of whom are working toward Ph.D. degrees.

MARYLAND

D. J. Sammons
University of Maryland
College Park

Production

Maryland producers harvested a total of 15,000 acres (6075 hectares) of oats in 1985, about the same as in 1984. Statewide, oat yields averaged 60 bu/acre (2150 kg/ha), a new state record, for a total state production of 900,000 bushels (13,091 metric tons), about 5% above 1984 production. The involvement of the small grain breeding program with oats is limited to variety testing spring oat cultivars. Yield data for entries in the 1985 spring oat variety trial is presented in Table 1 below.

The geographical location of Maryland makes it a transitional state in terms of oat production, although an important horse industry provides a strong market for the grain. There are environmental risks in the production of both winter and spring oats in the state. Winter oats are risky in most areas of the state except on the Eastern Shore because of the danger of winter kill. Spring oats are generally most successful in the western region of the state, but only if they are planted early enough (March) to mature before the excessive heat of early summer.

Table 1. Spring oat yield performance in Maryland, 1985.

Entry	Yield (bu/a)	Rank	Management Data
Ogle	142.8	3	
Otee	115.8	10	Date of Planting = March 11, 1985
Lang	125.8	4	Date of Harvest = July 19, 1985
Larry	117.5	9	Fertility = 40 lb. N/A plow down
Noble	123.4	6	at Planting
Pennlo	100.0	13	Soil Type = Manor silt loam
Porter	151.2	1	Location = Agronomy-Forage-Dairy
Centennial	98.8	14	Research Farm, Clarks-
Bates	146.8	2	ville, Maryland.
Pa 7967-6689	119.2	7	Plot Size = 48 sq.ft. (5 rows-7"x16')
Pa 8098-13900	124.8	5	Four Replications
SS 76-30	118.0	8	
Pa 8196-1556	103.9	12	
Pa 8196-1338	108.1	11	

MINNESOTA

D.D. Stuthman, H.W. Rines, P.G. Rothman, L.L. Hardman, and R.D. Wilcoxson

Production: Nearly 80 million bushels of oats, about the same as in 1984, were harvested from about 1.1 million acres in Minnesota in 1985. The average yield was estimated at 70 bu/A, an all-time record. Once again the weather conditions were nearly ideal for oat production. Planting into soils with good moisture was timely. Temperature and moisture were very favorable through heading, resulting in a productive crop of high quality. In general disease (both crown and stem rust) development was also favored by optimal conditions although the onset was delayed and except for isolated locations only minimal damage occurred. For the first time in the past several years stem rust was quite prevalent at one of our sites for the state-wide variety trial, Grand Rapids.

Varieties: Minnesota selection Mn 80116 was released to seed growers with the name Starter. It is described elsewhere in this Newsletter. In last year's Newsletter we mentioned an initial increase of Mn 81227, which has now been put on hold.

Moore was the most popular (17%) variety in Minnesota in 1985according to a survey conducted by the Minnesota Agriculture Statistics Service. It was followed by Noble (12%), Preston (12%), Fidler (11%), Lyon (10%), Ogle (9%), and others (30%).

Research: The four cycles of our recurrent selection program have produced 28% higher yields. In a two location experiment in 1985, the C_4 parents, on average, produced 28% more grain than did the original (C_0) parents. The C_0 parents yielded slightly more than the group of check cultivars which included Moore, Marathon, Lyon, Starter, Ogle, Pierce and Stout. We have made a bulk of all C_3 progeny and also have considerable seed of each of the 21 C_3 parents which were intercrossed to produce the third cycle progeny. Both are available for distribution.

Personnel: Mr. Mark Farnham joined the oat breeding project as a Ph.D. student after obtaining his M.S. from North Carolina State. He will be working with dwarf OT 207 derivatives and with a very promising source of peduncle extension from *Avena sterilis*.

Mr. Jim Vogt will join the project in June 1986 as an M.S. student. He has a B.S. from the University of Wisconsin-River Falls.

Mr. Gary Pomeranke will join the project during the summer as a Ph.D. student. He will have an M.S. from the University of Illinois.

Ms. Teresa Gruber recently completed her M.S. degree. Her thesis research dealt with combining generalized resistance to crown rust with dwarfs which have extended peduncles. She obtained several progeny which contain a combination of the desired levels of each of the three traits.

Complementing the oat breeding project is a new interdisciplinary program in Cellular and Molecular Genetics of Oats. Four graduate student assistantships are being sponsored by The Quaker Oats Company in support of this endeavor. Two students are on board and two will be starting this summer or fall. Mr. Phil Bregitzer, who completed his M.S. on the oat breeding project last June, is working on oat cell and protoplast culture with Drs. David Somers and Howard Rines. Ms. Nandini Mendu, a Ph.D. student in the Department of Genetics and Cell Biology, is cloning and characterizing tubulin genes and studying tubulin gene expression in oats in the lab of Dr. Carolyn Silflow. Mr. Eric Jellum will join the lab group of Dr. Ronald Phillips to work on oat molecular cytogenetics after completing his B.S. degree in June at Brighman Young University. Ms. Lynn Dahleen will be analyzing variation in tissue culture derived oat lines with Drs. Howard Rines and Deon Stuthman starting this fall after completing an M.S. at the University of Kentucky.

All of us were saddened by the death of Professor Emeritus Mathew B. Moore in July 1985. Matt made many valuable contributions to our program at Minnesota and to oat and cereal disease efforts generally. A memorial fund in his name has been established in the Plant Pathology Department. Details may be obtained by writing Dr. Philip O. Larsen, Department of Plant Pathology, University of Minnesota, 495 Borlaug Hall, St. Paul, MN 55108.

NEBRASKA

T. S. Payne and J. W. Schmidt
University of Nebraska

Oat acreage in Nebraska continued at the one-half million acre level but the trend of recent years to harvest less than 80% of planted acres (ca. 380,000 acres) continued in 1985. An average grain yield of 60 bu/A was reported, accounting for a new statewide record and resulting in 22.9 million harvested bushels. This average grain yield was 11 bu/A above that achieved in 1984 and 2 bu/A above the previous record years of 1982 and 1977. Early date of planting and favorable vegetative and grain fill periods contributed to this record. By April 21, 1985 98% of the crop was seeded compared with a normal 50% on this date.

In 1985, the Department of Agronomy, the Northeast Research and Extension Center and the Nebraska Crop Improvement Association cooperated in a survey of oat varieties being planted in the Northeast Crop Reporting District. The purpose of this survey was to determine the varieties in current use. A total of 1,347 postcards were sent to farmers in 13 counties--540 replies were recieved. Interestingly, thirtyfour cultivars were reported in current cultivation. 'Burnett' was planted on one-third of the acreage. This cultivar was released in 1956. 'Ogle' ranked second with nearly 13% of the acreage followed by 'Nodaway' with 11% of the acreage.

On December 31, 1985 the retirement of J. W. Schmidt became officially recognized. John has held the small grains position at the University of Nebraska for over 30 years. John will be concentrating on winter durum and triticale improvement in his retirement. Search for a new project leader is in progress.

NORTH CAROLINA

Ronald E. Jarrett and J. Paul Murphy

Growing Season

The 1984-85 growing season was overall poor for growing oats. There were prolonged droughts as rainfall was well below normal. Also, record-breaking low temperatures throughout the season helped to reduce yields. Diseases were more prevalent than the year before, but still remained moderate. Harvesting was often interrupted by showers and was completed by early July.

Production

There were 125,000 acres of oats planted in North Carolina. Over one-half of the acreage (63,000) was grown for cover crops, hay, silage, etc., while the remaining 62,000 acres (9% decrease from 1984) were harvested for grain. Most of the acreage was planted with the varieties Brooks and Coker 716, along with some Madison. Production was 2.6 million bushels. The average yield per acre was 42 bushels as compared to 58 bushels per acre in 1984. The value of grain production was 4.5 million while the total value of the entire crop was approximately 9.1 million.

Performance of Breeding Lines

Severe winter killing due to low temperatures in January 1985 eliminated our preliminary and advanced yield nurseries in the Piedmont Region for the second consecutive season. Nevertheless three sister-line selections from the cross Salem/Coker 74-24 (NC81-333, NC81-335, and NC81-355) exhibited excellent winter-hardiness under these circumstances. Survival of the three sister-lines was much superior to Coker 716 or Simpson. These lines were entered into the 1986 Uniform Winter-hardiness Oat Nursery to obtain more information on their adaptability. Straw strength in these lines is poor at maturity, thus their value will be as parents in cultivar development programs.

Problem Areas

The main problems continue to be winterhardiness, diseases, insects, and competition. Many oats suffer winterkill, particularly in western North Carolina (Piedmont and Mountains). The main disease problems are barley yellow dwarf virus (BYDV) and crown rust. The cereal leaf beetle continues to spread over the entire state. In addition, interest in doublecropping with wheat, pursuing maximum yields or conducting intensive management practices with wheat, compete heavily and prevent any major increases in oat acreages.

NORTH DAKOTA

Michael S. McMullen and H. A. Fisher

PRODUCTION:

According to the North Dakota Crop and Livestock Reporting Service, 1,175,000 acres of oats were planted and 840,000 acres were harvested for grain in North Dakota during the 1985 crop year. This represents a 25,000 acre increase and 140,000 acre decrease in area planted and area harvested for grain respectively relative to the 1984 crop year. The average yield per acre harvested for grain was 53.0 bu. which is 6.9 bu/a higher than the five year average. Total oat production in North Dakota in 1985 was 44,520,000 bushels which is 4,460,000 less than in 1984.

The 1985 North Dakota environment varied from extreme stress in the northwestern part of the state to ideal for oat production in the north-central and eastern regions. Rains during harvest caused some problems in the eastern and northern regions. Some of the crop was in the swath for over a month in these areas resulting in reduced grain quality. Nursery mean yields of 148.6, 165.6, and 179.5 bu/a were obtained at Fargo, Minot, and Langdon respectively for an Advanced Yield Trial. One entry mean yield was 220 bu./a at Langdon. The nursery mean yield for the Williston location was 43.5 bu/a representing an extremely stressed location.

DISEASES:

Heavy rains early in May resulted in water-logged soils in eastern North Dakota. Severe downy mildew infections were observed in oats that emerged under these conditions. One nursery location was extensively infected with this disease resulting in poor data from that location. Root rot was prevalent at the Fargo location. Fusarium was associated with the infected plants.

BREEDING PROGRAM:

Preliminary increases of ND810104 (RL3038/Goodland//Ogle) and ND820603 (Froker/RL3038//Hudson/3/Porter) are planned for 1986 with the intent of producing approximately 100 bu. of seed. A decision to produce a major increase of these lines in 1987 will be made in the fall of 1986 with the possible intent to release as varieties for 1988. The mean yield of ND810104, ND820603, Otana, Riel, and Dumont was 113.9, 108.1, 108.1, 109.4, 108.3 bu./a. respectively from eight locations in the North Dakota Oat Variety Trials. ND820603 has exceptionally good straw strength and good test weight under North Dakota conditions. Although the test weight of ND810104 is not as high as ND820603, ND810104 produces a higher groat percentage. ND810104 has exhibited a good level of BYDV tolerance in our tests. Both lines have crown rust resistance provided by Pc-38 and Pc-39 and stem rust resistance gene pg-13.

THESIS RESEARCH:

John Erpelding is studying the inheritance of stem rust resistance in North Dakota breeding lines derived from C.I.9221. Some of these lines were found to possess pg-13 in addition to the Alpha resistance from C.I.9221. One line, ND811386 (C.I.9221/Otee//RL3038/Dal) which has been of particular interest because of its high level of stem rust resistance was found to possess pg-13 in addition to Alpha stem rust resistance. Seedling rust tests with critical races indicate ND811386 also has crown rust resistance genes Pc-38 and Pc-39. Some of the progeny lines of a cross of ND811386 and a line with pg-13 were susceptible to race NA27. The susceptible lines studied were aneuploid suggesting the loss of the chromosome with pg-13. Albino plants are often observed during seedling rust testing of progeny lines derived from parents with the Alpha resistance suggesting that some degree of chromosome instabilitty is encountered at least during early generations in these populations. Several lines with the Alpha resitance are performing very well in advanced yield trials.

OHIO

R.W. Gooding and H.N. Lafever

Production:

Oat production in Ohio was much improved this year over last. According to estimates from the Ohio Crop Reporting Service, per acre yields were up 42 per cent in 1985 over the previous year; from 60 to 85 bushels per acre. Overall production in the state was up from 13.9 million bushels in 1984 to a production level of 26.4 million bushels, an increase of over 89 per cent. This resulted from the aforementioned increase in per acre yields coupled with a 41 per cent increase in harvested acres. Oat acreages were up in 1985 primarily due to a wet fall in 1984 which prohibited many farmers from planting wheat.

Oat Varieties:

In statewide variety trials, yields averaged 103.8 bu/a. Porter led all entries with an average of 117.7 bu/a followed closely by Heritage (117.1 bu/a). Ogle (105.7 bu/a) and Dal (102.4 bu/a) ranked 3rd and 4th, respectively, out of the 8 entries in the test. In the highly productive environments at Wooster and Northwestern Ohio, Heritage outyielded Porter. At Wooster, Heritage yielded 12 bu/a higher than Porter and outyielded Ogle by nearly 20 bu/a. Heritage did not yield significantly greater than Porter at our Northwestern Ohio branch station (Custar, Ohio), but Ogle was ranked 6th by yield, averaging over 28 bu/a less than Heritage. Results were less dramatic at other locations, but either Heritage or Porter continued to rank first in yield at the remaining 3 locations in 1985.

Based on acres of certified seed produced, Ogle remains the most popular oat variety in Ohio, followed by Noble and Porter. Other varieties currently being grown in Ohio include Dal, Heritage and Otee.

Breeding Program:

Our small program, initiated in 1984, continues to grow with the leading edge in the "pipeline" consisting of 942 breeding lines in the F_6 generation and 4,248 F_5 lines. We continue to select for increased yield potential, BYDV resistance, improved quality and standability.

SOUTH DAKOTA

D. L. Reeves and Lon Hall

Production: Harvested oat acreage and production were both down 8% from the previous year. The harvested acreage was 1.4 million acres, the lowest harvested acreage since 1976. The average yield of 56 bushel was the same as 1984 and was exceeded only in 1982. Total production was 79,520,000 bushels. South Dakota has now ranked number one in oat production for the past four years.

Good moisture statewide in midsummer has boosted our state average yields in recent years. This late moisture has also caused late varieties to perform quite well. Therefore, in many areas, farmers have shifted to later varieties. Diseases weren't much of a problem this year. There was sufficient crown rust for good disease readings, but only the late planted fields suffered much.

Varieties: Burnett is still our leading variety in the state, but most of its acreage is now in the central and western parts of the state. In the east central and northeastern regions, Moore is very popular. Moore has moved further south than most late varieties. This is because it seems to tolerate the warmer and/or drier conditions better than other varieties of similar maturity.

The other major varieties in the state are Nodaway 70, Lancer, Benson and Lyon. Each of these varieties tends to be popular in a specific region. Kelly is being well accepted and appears to be replacing Nodaway 70 in many areas.

Marketing: The best estimates we've been able to put together indicate South Dakota is annually exporting 20-25 million bushels of milling oats and 5-10 million bushels of 'race horse' or trucker oats. If these are worth an average of 20 cents a bushel above 'bin run', this means an additional 6 million dollars annually to the state. Precise figures on this market cannot be found since many of these premium oats are transported by truck. In addition, some elevators won't disclose their market outlets and some farmers make direct sales to truckers.

New varieties: Two new varieties have been released. They are Sandy, a late oat and Hytest, a midseason variety. Both are described in more detail elsewhere in the newsletter.

U T A H

R.S. Albrechtsen
Utah State University

Production. Following three consecutive years of cold, wet spring weather, 1985 provided a more normal weather pattern, and crop planting proceeded on a more favorable schedule. Oat acreage in Utah has remained small but quite stable over the last 15 years. Average yields have generally shown increases for many years, as a result of improvements in both varieties and cultural practices. Unfortunately, prices received for the 1985 crop were the lowest recorded in more than a decade. Essentially all of our oat acreage is irrigated and most is harvested for grain, with some grown for forage.

Losses from diseases were minimal, as is the general rule. Heavy infestations of the Cereal Leaf Beetle (which was first observed in Utah in 1984) were present in certain areas and considerable injury occurred in some fields. Control efforts are under way through the use of pesticides and the establishment of parasitic populations for biological control.

Oat Program. Our small oat acreage does not justify an oat breeding program. Improved cultivars are identified from entries in the Uniform Northwestern States Oat Nursery and from other sources.

OATS IN WASHINGTON

C. F. Konzak and K. J. Morrison
Department of Agronomy and Soils
Washington State University

Drought stress was the main factor limiting oat yields and test weights in Washington trials during 1985. N fertilizer (60 lbs N/A) increased yields with little effect on test weights. Regional entries with highest yields and test weights included Dumont, RL3057/Otana = W0800474, ND810917, and Porter. The highest yielder (with N added) was ID815792 = 74AB2608/Cayuse. Its test weight was above that of Cayuse and its yield significantly better--124 vs. 109 bu/ac. These lines and cultivars may have better drought tolerance than others. In State Extension Service trials and in the regional test at Pullman, Monida did not fare so well, suggesting it is better adapted to higher rainfall conditions. However, its comparatively tall, weaker straw will be drawbacks.

WISCONSIN

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

Production, Diseases, and Varieties

Wisconsin farmers planted approximately 950,000 acres of oats in 1985 and harvested approximately 780,000 acres for grain and straw. The average grain yield was estimated at 66 bu/a, an increase of 2 bu/a over the 1984 average. Wisconsin ranked fourth in production of oats in 1985. Straw yields were average or lower in many areas of the state because heading was early and plant height was relatively short. Some farmers were left without adequate bedding for the winter. Most of the acreage that was not harvested for grain and straw was harvested as oatlage between mid-boot and heading. It was estimated that 50% of the oats in two dairy-intensive counties were harvested in this manner in 1985. Many dairy farmers who are harvesting their oats as oatlage are mixing Canadian field peas with oats at planting time. Oats are seeded at 1.8 to 2.0 bu/a, peas are seeded at about 1.0 bu/a, and alfalfa is seeded at 15 to 20 lbs/a. Research at Wisconsin has shown that adding peas will result in a moderate increase in forage yield (1 to 12%) and significant increases in protein percentage and protein yield. In 1984, pure stands of Stout and Porter averaged 11.8% protein when harvested at early heading, while Stout and Porter mixed with Trapper field peas averaged 16.5% protein at early heading. Farmers who harvested oatlage or pea/oatlage mixtures also harvested a good crop of alfalfa later in the season.

The 1985 growing season was fairly well-suited for oat growth in most areas of the state. Temperatures were relatively warm during April and May, which hastened early growth and resulted in early heading and relatively short straw. Accumulated growing degree days were 45% above normal by the end of May. Thereafter temperatures were moderate, with many cool nights and very few days above 90°F. Temperatures were below normal in June. The lower two-thirds of the state was relatively dry in June and July, but oat yields were not reduced significantly unless subsoil moisture retention capacity was below average. There was very little leaf rust in Wisconsin oat fields in 1985, apparently due to the relatively dry conditions in June and July. Stem rust was prevalent in some areas, but it did not develop early enough to cause much damage. There was more stem rust in the Madison oat nursery in 1985 than in any of the 10 previous years. The USDA Cereal Rust Laboratory at St. Paul, Minnesota identified the stem rust at Madison as race NA-27(3). The lack of diseases and favorable temperatures in June and July resulted in very good oat grain and straw quality. Bushel weights of most varieties were relatively high.

The new Wisconsin oat variety Centennial, although somewhat erratic in adaptation, continues to outyield currently grown varieties except Ogle and Porter. Dal and Stout have retained some popularity in the state. The Wisconsin Crop Improvement Association has voted to include the new varieties Hazel (Illinois) and Webster (Iowa) in its Certified Seed program.

South American Oat Nursery

There were 320 pure lines and 110 segregating populations (F_3 generation) in the Quaker nurseries grown throughout South and North America in 1985. M. A. Brinkman, C. M. Brown (University of Illinois) and D. J. Schrickel (Quaker Oats Company) visited nurseries in Brazil, Argentina and Chile in November, 1985. Oats production in Brazil was very good in the state of Parana, but was very poor in several areas of Rio Grande do Sul. Oats in the Ijui area of Rio Grande do Sul were destroyed by unfavorable weather and severe crown rust. Despite widespread flooding, oat production in the Tres Arroyos and Bordenave regions of Argentina was very good in 1985. Regrowth after grazing was especially good in most oat growing areas. Several oat fields in the Temuco area of Chile looked especially productive. Plant height in one oat field between Temuco and Villarica was approximately six feet.

Cereal Crops Research Unit

Dr. Cynthia Henson, a plant physiologist, was hired in August 1985, to replace Dr. Pat Unkefer. Dr. Henson received her Ph.D. in Agronomy from the University of Wisconsin in 1982. She has had several years of postdoctoral experience. Dr. Henson is initiating research on environmental effects on α-amylase in germinating cereal grains. She also plans to investigate the synthesis of β-glucans in oats. Dr. Henson is very willing to discuss physiological aspects of oat production and quality, and is open to suggestions for relevant problems in need of research.

Dr. David Peterson, research leader, will be on a sabbatical leave from June 1986 - June 1987, at the Rothamsted Experimental Station in Harpenden, England. During his sabbatical he will be studying gene regulation of specific proteins during maturation of barley. It is his expectation that he will be able to apply the techniques and knowledge gained to problems of oats upon his return to Madison.

Thesis Research Projects

Oat Plant Morphology Study (R. A. Bunch)

Groat percentage is an important quality factor in oats (*Avena sativa* L.), and selection for high groat percentage is practiced in nearly all oat improvement programs. In the Wisconsin oat breeding program, it has been noted that vigorous and productive breeding lines often have hully kernels. Mr. Bunch is conducting research to measure precise relationships among vegetative weight, seed production, and groat percentage of various genotypes representing a wide range in kernel conformation and quality. Vegetative and seed weights and groat percentages were determined for individual plants spaced 2.5 cm apart, and correlation analysis was performed on means of the various genotypes.

Results of data collected in 1983 and 1984 revealed that groat percentage was negatively correlated with vegetative and grain productivity. In the 1983 initial survey, correlation coefficients for primary groat percentage with grain and vegetative weight of the primary culm were -.37* and -.45**, respectively, among 35 cross means. In 1984, correlation coefficients from Expt. No. 1, a replicated study with 32 crosses, were -.51** and -.46** for primary groat percentage with grain and vegetative weight from the primary culm, respectively. In Expt. No. 2 involving 15 cultivars and advanced selections, correlation coefficients were -.57** and -.41 for primary groat percentage with grain and vegetative weight from the primary culm, respectively. Although this negative relationship suggests that unilateral selection for high groat percentage may be accompanied by decreased vegetative and seed productivity, some lines in this study had moderately high productivity and relatively high groat percentage. Moderate grain yields coupled with acceptable grain quality represents a type of balance or compromise frequently encountered when multiple traits are considered.

Genetic Studies--Oat Crown (Leaf) Rust (M. A. Moustafa):

Crosses between crown rust resistant Wisconsin translocation lines and A. sativa result in conventional 3R:1S and/or unconventional 1R:1S F_2 segregation ratios. Mr. Moustafa is conducting studies to elucidate causes of the abnormal gene-transfer frequencies, including examination of chromosome pairing, pollen development, and gene transmission through both the egg and pollen.

Performance of Backcross Lines Derived from Avena fatua (J. B. Stevens):

Jim Stevens completed his M.S. research on backcross lines derived from A. fatua. Avena sativa/A. fatua F_1 hybrids were backcrossed twice to A. sativa, and lines from three backcross populations were selected on the basis of agronomic performance in segregating generations. The A. sativa recurrent parents were Stout (short and early) and Dal (tall and late). Backcross lines and recurrent parents were evaluated in five performance trials from 1983 through 1985. There was significant variation among backcross lines for most traits, but most backcross lines did not produce higher grain and straw yields than their A. sativa parent. Several backcross lines were higher than their recurrent parent in test weight and groat percentage. A line derived from Stout, 175BC2-6, was considered to be the most promising backcross line in the study. This line produced more grain, had heavier kernels, and headed 2.7 days earlier than Stout.

Pre- and Post-Heading Growth Rate in Oats (A. A. Salman):

Abduljabbar Salman is studying pre- and post-heading growth rate in oats for his Ph.D. research. Fifteen oat genotypes were evaluated at Madison and Arlington in 1985. Heading date was positively associated with pre-heading growth rate (r=0.84**) and negatively associated with post-heading growth rate (r=-0.66**). Dry matter yield at maturity was strongly associated with pre-heading growth rate (0.72**) and growth rate during the entire season (r=0.74**), but was not associated with post-heading growth rate (r=0.11). Grain yield was positively associated with post-heading growth rate (r=0.68**) and growth rate during the entire season (r=0.85**), but was not associated with pre-heading growth rate (r=0.05). These results indicate that high grain yielding oat cultivars should have a high growth rate throughout the growing season, especially after heading, and that they should also have a reasonably high harvest index.

ARNE

Bengt Mattsson, Svalof, Sweden

Arne is a new oat cultivar resistant to nematodes released in Sweden in 1986. The line was selected from the cross Nem.res. Sol II x Condor x Sv 68289.

Yields have been equal to the standard cultivar Selma and about 2% and 1%, resp., better than Sang and Svea. The lodging resistance is better than Selma and as good as Svea. Arne is as early as Sang and characterized by an even maturity. The quality of Arne is high with a fairly high level of protein and fat content and in addition the hectolitre weight is higher than the two nematode resistant cultivars Fix and Nema.

Arne will be of great value in the crop rotation to diminish the level of cereal cyst nematodes.

HYTEST

D. L. Reeves and Lon Hall

Hytest, P.I. 501525, is a spring oat cultivar developed by the South Dakota Agricultural Experiment Station. It was derived from the cross 'Moore'//'Dal'/'Nodaway 70'. The final cross was made in 1977. Hytest was obtained from a single F_3 panicle with selection on a F_4 head row. It was tested as SD 810095 in the Uniform Midseason Oat Performance Nursery in 1984 and 1985.

Under our conditions, Hytest is a tall, midseason cultivar. Straw strength is probably fair-good. Under our conditions, leaning is common, but we've not observed complete lodging. Yields have been good, but not above released cultivars. Late seeding appears to be more detrimental than for many cultivars.

Test weights have always been very high (hence the name). Hytest has usually had the highest test weight in every test. In our trials we use Wright as a standard against which to compare test weights. In our eastern South Dakota trials, Hytest was 2.2 and 2.7 lbs/bu above Wright during the past two years respectively. In the regional nursery it was ranked No. 1 in test weight for 1984 and 1985. Groat percent is high and kernel size is large. Milling evaluations rank Hytest as very good. Groat protein percent is high while the oil percent is medium.

Most panicles have a few primary kernels with awns. These awns are usually short, thin and light-colored, although midsized awns with a dark base are occasionally present.

Hytest is moderately susceptible to crown rust. Seedling tests for crown rust show Hytest to be susceptible to races 264A, 264B and PL62. Field observations indicate the adult plant resistance is better than on juvenile plants. For stem rust, Pg2 and Pg4 genes are present.

Hytest was resistant to loose smut in two states when inoculated, but developed 2,5 and 20% smut respectively in the other three tests. It is susceptible to barley yellow dwarf.

KAPP

Magne Gullord
Apelsvoll Agricultural Research Station, 2858 KAPP, Norway

Kapp is a new oat cultivar released by the Norwegian Cereal Breeding Program at Apelsvoll. The cultivar was selected from the cross Grakall/Tador made in 1976, and was field tested initially as A0022.

Kapp matures at the same time as Titus and 3 days before Svea. It has straw strength similar to Svea, but significantly better than Titus. Kapp is very stable over large arrays of environments. Over four years in official trials Kapp outyielded Titus and Svea by 11 and 1 percent, respectively.

Kapp is a good feed quality oat with low husk percentage and high protein content. The oil content in the whole grain is high, 6.6 percent compared to 5.7 percent in Svea. Kapp has a low test weight and a slightly higher grain weight than Titus and Svea. Totally it has 4 and 5 percent better feeding value than Svea and Titus, respectively.

Kapp is added to the official Norwegian List of Cultivars in 1986.

LENA

Magne Gullord
Apelsvoll Agricultural Research Station, 2858 KAPP, Norway

Lena is a new oat cultivar released by the Norwegian Cereal Breeding Program at Apelsvoll. The cultivar was selected from the cross Sang/Unisignum made in 1976. and was field tested initially as A0072.

Lena flowers and matures 3 and 1 day respectively before Svea. It has an excellent straw quality and is shorter than Svea (on average by 10 cm). Lena is very stable over a large array of environments. Over five years in official trials Lena outyielded Svea by 2%.

Lena is a good quality oat with high test weight and low hull percent. The grain weight and protein content is slightly higher than for Svea. The oil content is, however, lower. Lena has a high post harvest sprouting resistance.

Lena is added to the official Norwegian List of Cultivars in 1986.

RIEL Oats

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

Riel, a spring oat, was developed by the Oat Rust-Area Project Group coordinated from the Agriculture Canada Research Station, Winnipeg, Manitoba. The most important feature of this new cultivar is that it combines exceptional kernel quality with excellent disease resistance and good yield.

Riel originated from the cross RL3057 x Otana made in 1977. RL3057 is the result of a complex series of crosses involving Kent, Pendek, Rodney, Kelsey, Harmon, Rosen's Mutant, CI6792 and a sister line of Hudson as well as three wild _Avena sterilis_ L. accessions CAV2647, CAV2648, and CAV5165, originating from the Mediterranean area. Kent, an Australian oat, is the source of the red (tan) hull color in Riel, which is the first red oat to be licensed in Canada. An F_5 line was bulked in 1979 to form this cultivar. The F_2 and F_4 generations were grown at Gore, New Zealand, and the F_3 and F_5 were grown in nurseries at Glenlea, Manitoba, which were artificially inoculated with stem rust, crown rust, and smut. Riel was tested in the Western Oat Co-op Test from 1982 to 1984, and was licensed (NO. 2535) by the Food Production and Inspection Branch of Agriculture Canada in 1985.

It possesses genes _Pc_-38 and _Pc_-39 that confer very good resistance to all known isolates of oat crown rust. It possesses stem rust resistance genes Pg-2 and Pg-13, and possibly Pg-1 and Pg-9, but like Dumont and Fidler is susceptible to the rarely occurring race NA26. Like Dumont and Fidler it is resistant to all races and collections of loose and covered smut to which it has been tested. Riel appears to be very susceptible to BYDV.

Based on four years of testing, Riel has exceeded the yield of Dumont and Fidler in Manitoba by 4 and 10%, respectively, but yields poorly in Saskatchewan and Alberta. It has also yielded very well in the USDA Cooperative Uniform Midseason Oat Performance nursery where it ranked 1st and 3rd in 1984 and 1985. Riel is the same height as Dumont but has slightly better straw strength. It has a panicle that is tending to equilateral although branches often hang mostly to one side.

Kernels are normally light tan, but vary from distinctly red to almost white under different growing conditions. The lemma has a pointed tip, sometimes a weak awn is present, and usually a few basal hairs occur. Riel has exceptional kernel quality with about 2% higher protein than other Canadian oats, and compared to Dumont has 2% lower hull and 1 kg/hl higher test weight. Oil content is similar to Harmon and Dumont. Riel appears to have better resistance to after harvest sprouting than other Canadian oats.

Riel is well adapted to Manitoba because of its good yield and superior stem and crown rust resistance. It is named after Louis Riel, a metis leader in Manitoba and Saskatchewan.

A total 1500 kg of pedigreed seed was sown in 1985. The Canadian distribution will be Secan Association. Breeder seed will be maintained by the Seed Section, Agriculture Canada Experimental Farm, Indian Head, Saskatchewan.

SANDY

D. L. Reeves and Lon Hall

Sandy, P.I. 501524, is a spring oat cultivar developed by South Dakota Agricultural Experiment Station. It was derived from the cross 'Dal'/'Nodaway 70'//'Moore'. The final cross was made in 1976. Sandy was obtained from a single F_2 panicle with selection made on a F_3 head row. It was tested as SD 790188 in Uniform Midseason Oat Performance Nursery in 1984 and 1985.

Under our conditions, Sandy is tall and late. Heading is equal to Moore or a day later while height averages 2-5 cm taller than Moore. In South Dakota trials, Sandy lodges less than Moore. Yields have been good unless grown in areas best suited to earlier maturing cultivars.

Test weights have been quite good averaging 0.4 to 1.1 lbs/bu. higher than Moore in eastern South Dakota. The grain is of good quality and has a light cream color. Milling yields have been very good. Both groat protein and oil percents are in the medium range.

Panicles having some kernels with awns are very common. Most of the awns are small, but some are midsized. The base of the awn is sometimes dark.

Crown rust resistance in the field has been good. Field readings in South Dakota have always been less than Moore. Seeding tests for crown rust show Sandy to be susceptible to races 264A, 264B, Pc62 and MS for Pc59. For stem rust, Pg2 and Pg4 genes are present. In inoculated loose smut tests in the region, readings have varied from 0 to 25 depending upon location or year. In South Dakota we have never observed smut in Sandy. The probable rating for smut would be resistant to moderately resistant. Sandy is susceptible to barley yellow dwarf.

SANTO ALEIXO OATS

Francisco Bagulho, Jose Coutinho and Benvindo Macas
Cereal Department-National Plant Breeding Station, Elvas, Portugal

Santo Aleixo is a new oat variety released in the National Plant Breeding Station at Elvas, and the first one to be approved for the National Varieties Catalog. The new cultivar was selected from the cross 'Avon' x 'Avena Cartuja' made in 1970.

A single F_2 plant was increased in a F_3 row in 1972. Replicated yield testing was initiated in 1975. Results from the adaptation trials at 6 different locations during three years (1981-1984), and at one location (Elvas), in the period between (1979-1981) are presented in Table 1.

The results indicate a slight advance in relation to Avon. It has been difficult to surpass the national check Avon, an Australian variety, very well adapted to our conditions.

However, in three years of field testing, Santo Aleixo shows:

- better one thousand kernel weight
- better hectoliter weight
- and also better yield potential

Height and straw strength are similar to Avon. Also the cycle is similar to our national check.

Santo Aleixo, will provide growers with good insurance against severe losses due to foliar diseases. However, it shows some susceptibility to *Erysiphe graminis* and *Puccinia coronata*.

In summary, Santo Aleixo is an interesting genotype for farmers, and in terms of breeding it was a good advance, because up to now it has been difficult to surpass the Australian variety Avon.

Commercial supplies of seed will be available by 1987.

Table 1. Average yields of the varieties Santo Aleixo and Avon at one location (Elvas) during three years (1979-81), and at six locations during three years (1981-84).

Varieties	ELVAS Yield kg/ha	%	ELVAS Days to Heading	ELVAS Days to Maturity	Plant height (cm)	Hectoliter weight (kg/hl)	6 other locations yield kg/ha	%
Avon (check)	3333	100	138	191	109	43.84	2555	100
Santo Aleixo	3356	101	138	190	112	45.22	2667	104

STARTER

D.D. Stuthman, H.W. Rines, P.G. Rothman, and R.D. Wilcoxson

'Starter' is a yellow-seeded, early spring oat developed cooperatively by the Minnesota Agricultural Experiment Station and USDA-ARS and released in 1986. It was selected from the cross Dal/3/Garland/Burnett//Diana/CI8344/4/Noble (CI8344 is an *Avena sterilis* accession which has high protein content and excellent crown rust resistance). Progeny were advanced from F_2 to F_5 using single seed descent. Yield evaluations in replicated hill plots were begun in F_6 (1978) and replicated row testing in the next generation and year.

Starter has been tested in Minnesota statewide trials for five years, 1981-85, under the number Mn 80116. It was also included in the Uniform Early Oat Performance Nursery (UEOPN) for four years (1982-85). Starter has yielded more than any other cultivar of similar maturity tested in Minnesota during 1981-85. It has the best lodging score and is at least equal in kernel quality to the best cultivar in those tests. It has also been the earliest and shortest. In regional tests (UEOPN) it has consistently averaged in the top half for grain yield and been near the top in test weight, lodging percentage, and protein percentage. Its test weight is almost equal to that of Clintford, long acknowledged as the test weight standard in that nursery.

Starter has good resistance to smut in Minnesota tests and has some field resistance to crown rust. It is moderately tolerant to barley yellow dwarf virus being similar to Lang. The seed of Starter is non-florescent. A small number of taller and later plants (<0.1%) have been observed in and rogued out of Foundation seed fields.

Application for Plant Variety Protection is anticipated. We expect Starter to compete favorably with Preston and Noble, two currently popular varieties in Minnesota which are of similar maturity. We believe it will be useful as a companion crop variety and that its grain will be attractive to oat millers and processors.

PLANT VARIETY PROTECTION OFFICE PROGRESS REPORT

Eldon E. Taylor
Examiner

From enactment of the Plant Variety Protection Act in 1970 to January 1, 1986, a total of 2,143 applications were received and 1,490 certificates of protection were issued. As of January 1, 1986, the Plant Variety Protection Office had received 26 applications for protection of oat cultivars, only one of which was received last year. Fourteen of the oat applications are from experiment stations and none are from foreign sources. A total of 16 certificates have been issued on oat cultivars.

Of the 16 certificates issued on oat varieties, 15 specified that the variety was to be sold by variety name only as a class of certified seed. Four oat applications have been abandoned, withdrawn, or found ineligible since the Office began processing applications.

There were 6 oat applications pending as of January 1, 1986.

In October 1982, the staff of the Plant Variety Protection Office was significantly reduced. In addition to the Commissioner, Dr. Kenneth H. Evans, the Office now consists of 4 full-time examiners, a secretary and a part-time clerk. In July 1984, a new microcomputer system was installed in the Office to handle all of the data and word processing functions of the Office, including preparation of the Official Journal. The data processing conversion from mainframe computer to microcomputer required training the entire staff in the use of the new system as well as downloading and restructuring all databases from the mainframe computer in Washington, D.C. to the in-house microcomputer at Beltsville, Md.

In Fiscal Year 1985, the Office received a total of 219 applications, the greatest number ever received in any one year.

We solicit descriptions of varieties which are being released without variety protection. Only adequate descriptions of existing varieties can preclude issuing certificates on varieties identical to previously released varieties. We would appreciate copies of any descriptions prepared for other organizations, such as the Certified Small Grain Variety Review Board of AOSCA. Review Board information cannot be used unless released by the applicant.

Applications or information requests should be sent to:

Plant Variety Protection Office
Livestock and Seed Division, AMS
U.S. Department of Agriculture
National Agricultural Library Building, Rm. 500
Beltsville, Maryland 20705

REPORT FROM THE AUSTRALIAN WINTER CEREALS COLLECTION

M C MACKAY
CURATOR

OAT COLLECTION

Progress towards the establishment of the national oat collection is well underway. We have received 5,336 seed samples from five breeders collections, and relevant passport information is being entered into a database. This information will be collated and all material regenerated in the field during the 1986 and 1987 seasons for detection of duplicates and further preliminary evaluation (height, maturity, morphological, characters, etc.).

In future years segments of material accessioned into the collection will be evaluated for diseases, photoperiod response and other characteristics of value to breeders.

REGISTRATIONS

No new cultivars have been registered since those reported in Volume 35. Restricted registration has been issued for SAVENA 1, a line with tolerance to the herbicide Hoegrass (R) (375g/L diclofop-methyl). This tolerance was derived from New Zealand Cape. The pedigree of SAVENA 1 is West//West/New Zealand Cape. Savena 1 will tolerate Hoegrass (R), applications of up to 1.5L/HA under some seasonal conditions. Savena 1 was bred by Andrew Barr of the South Australian Department of Agriculture.

GERMPLASM EXCHANGE

Listings and seed of material accessioned into the collection will be available by 1988. All oat introductions to Australia will be directed to this collection for quarantine and forwarding. Oat workers sending material to Australia should address it to the Curator, Australian Winter Cereals Collection, P.M.B., R.M.B. 944, Tamworth NSW 2340, Australia. Please include full descriptions of material and any forwarding instructions.

Collection staff will be happy to assist oat workers select material from the collection for specific projects. A full list of the descriptors being used by the collection will be included in our 1986 report.

EVALUATION OF SMALL GRAIN GERMPLASM

L. W. Briggle
Plant Genetics and Germplasm Institute
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 15,200 wheat accessions, 7,500 oat accessions, and 4,500 barley accessions during the 1983-85 period. All barley and oat data were collected at the Aberdeen, Idaho grow-out location. Most wheat accessions (11,200) were evaluated at Aberdeen also; field descriptor data were obtained at Mesa or Maricopa, Arizona on 4,000 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 the 1983 wheat accessions grown at Aberdeen were obtained during the winter of 1984-85 and will be finished during the winter of 1985-86. Similar data will be collected on as many of the 1983 oat accessions (panicles) as possible during the current 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 1986 season approximately 3,000 wheat accessions will be grown at Maricopa, Arizona to meet quarantine and propagation requirements. Field descriptor data will be obtained at the same time. Approximately 2,500 wheats, 2,500 barleys, and a lesser number of oat accessions (most spring oats are evaluated) will be field evaluated at Aberdeen, Idaho in 1986.

Evaluation for disease and insect resistance was initiated in 1983 and expanded in 1984 and 1985. Further expansion is planned for 1986. Accessions evaluated so far and planned for 1986 are as follows:

Barley Yellow Dwarf:	1983-85	Davis, CA 10,000 wheats 2,000 barleys 2,000 oats	Urbana, IL 5,000 wheats 10,000 oats
	1986	5,000 barleys 2,500 oats	5,000 wheats
Hessian Fly:	1983-86	Lafayette, IN 20,000 wheats	
Crown Rust:	1983-85	Ames, IA 9,250 oats	
	1986	2,000 *Avena sterilis*	

Leaf Rust:	1983-85	Manhattan, KS 20,000 wheats
	1986	5,000 wheats
Spot Blotch:	1985	Fargo, ND 2,500 barleys
	1986	2,500 barleys
Net Blotch:	1985	Fargo, ND 2,500 barleys
	1986	2,500 barleys
Common and Dwarf Bunt:	1985-86	Pendleton, OR 5,000 wheats
Stripe Rust:	1984-85	Pullman, WA 10,000 wheats
	1986	5,000 wheats

Growth habit (winter, facultative, or spring type) determinations are done primarily at Bozeman, Montana from a late spring planting made in June. Data are also recorded on plots at Aberdeen, Idaho when growth habit is apparent. In 1985 5,000 wheat accessions, 2,000 oats, 400 non-shattering *Avena* species, and 2,000 barleys were tested at Bozeman.

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 will be rogued and every effort made to clean them up, including establishment of a special "Purity Nursery" at Aberdeen in which mixed accessions will be thinly planted and plots 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 will be grown in 1985-86. When proper classification is difficult, chromosome counts are made at Columbia, Missouri. This procedure has proved to be very helpful.

A new metal storage and work space building (30' x 80') to be used 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 will be used for evaluation and propagation of the NSGC. Plans call for a technician position, funded by ARS, to be established at Maricopa in 1986.

THE NATIONAL SMALL GRAIN COLLECTION

D.H. Smith, Jr.,
Curator

The Agricultural Research Service of the U.S. Department of Agriculture maintains a collection of cereals known as the National Small Grain Collection. The collection consists of wheat, barley, rice, oats, rye, triticale, Aegilops and their related species. This effort is an invaluable resource for current and future use to improve yield, quality, and other characteristics in cereals. Numerous examples of benefits from using accessions in the collection in breeding programs can be cited, such as insect and disease resistance, high protein, and improved amino acid ratios, and tolerance to aluminum toxicity.

The collection, maintenance, evaluation, and distribution of cereal germplasm are ongoing activities of the USDA. Since the organization of the Seed and Plant Introduction Office in 1897 there has been a continuing program to: (a) collect and maintain plant material that may contribute either directly or indirectly to crop improvement; (b) establish reliable procedures to preclude the inadvertent introduction of new diseases, insects and weeds; and (c) distribute useful introductions for use in plant breeding and other research programs. Increased support for the National Small Grain Collection was provided by a special appropriation of the Research and Marketing Act of 1946. This additional funding was used to grow introductions in quarantine, insure the maintenance of viable seed, accumulate data on adaptation and reaction to pests, catalog other information of use in improving the crop, and fill requests for seed from researchers.

Our current holdings make the collection one of the largest working collections in the world.

1985 TOTALS NSGC

WHEAT	40,068
BARLEY	25,382
RICE	20,021
OATS	19,726
RYE	2,307
TRITICALE	928
AEGILOPS	574
TOTAL	109,006

Included in these totals are accessions of related species, both domesticated and wild. These accessions have been received from plant exploration, exchanges with other collections, and from individual research workers throughout the world. The major sources have been Asia, Europe, the United States, Australia, and

New Zealand, with fewer introductions received from Africa, South and Central America, Mexico, and Canada. Distribution of small samples, usually five grams, are made upon request at no charge. Requests come from both foreign and domestic sources. In a given year seed may be distributed to as many as 70 countries.

The maintenance of seed stocks is expensive, but much less expensive than the concerted effort needed to locate specific seed sources that have been lost or discarded from breeding programs. Furthermore, the original genetic sources may have disappeared in the country or region where it was collected. Changing agricultural practices, including the adoption and widespread use of improved varieties, have reduced the genetic variability that was once found in or near certain major centers of origin or diversity. In addition to agricultural development, intensive grazing, population pressure, and industrial growth have contributed to the loss of natural plant populations, including primitive forms and wild relatives that serve as a potential reservoir of diversity.

Collections of germplasm fall into two major categories, working and base collections. The National Small Grain Collection located at the Beltsville Agricultural Research Center is a working collection. We insure that all seed stocks are documented, held in appropriate storage conditions, evaluated, and made available for use. In contrast, accessions in base collections are stored under conditions enhancing long-term conservation. Seed in base collections may duplicate working collections, but accessions are released only when they are not available from other sources. Seed moves from working collections to long-term storage in base collections.

One goal of the National Small Grain collection is to increase genetic diversity in small grain cultivars. This is accomplished through collection, maintenance, evaluation and distribution of germplasm suited to the needs of research workers. Documentation and dissemination of evaluation data is also an important means of achieving this goal. Assembling and maintaining germplasm received from plant exploration and seed exchanges with research workers in the United States and other countries are major undertakings. Procedures followed in handling our small grain collection illustrate both the complexity of the task and the need for cooperation and good coordination among private, state, regional, national and international agencies and organizations. Accessions include mutations, synthesized species and lines that represent new or unusual gene recombinations.

Seed of accessions received from foreign sources is inspected and fumigated to kill insects. They are then assigned a Plant Inventory (PI) number by the Plant Introduction Officer, and available information such as name, origin, and any other special characteristics is documented. Seed is increased either in the greenhouse or field nurseries under strict quarantine procedures where each accession is observed for evidence of such seed borne diseases as the smuts and certain viruses. The nurseries are isolated from major grain growing areas so that latent plant diseases brought in with imported seed samples can be intercepted without endangering U.S. crops. Contaminated accessions are treated and replanted. Those accession are discarded if there is evidence that treatment did not eliminate the disease. About 400 grams of seed of each entry are returned to the collection for inclusion in the collection.

Seed is stored at 10° C and 40% relative humidity. Five-gram samples are distributed without charge to public and private research workers for experimental purposes. Requests may range from a single item to complete set of one of the crop collections. We normally process over 500 requests involving over 100,000 samples in a year.

An automated information system is used to store and retrieve data stored in the computer files. The system can be queried to select for certain characters and then to print work lists, seed envelopes and field notebooks.

OAT PI NUMBERS ASSIGNED IN 1985

PI No.	Name/Designation	Pedigree	Class	Source
494755	Simpson	Ballard/CI 4897	W	SC
495812	Bundalong	Cayuse/Avon	W	AUS
495813	Murray	Fulmark/Newton//Swan(66Q 01-44) /3/(X BVT 183) Kent/Ballidu (M127)//Curt		"
495814	Winjardie	Fulmark/Newton//Swan(66Q 01-44) /3/(X BVT 183) Kent/Ballidu (M127)//Curt		" "
495868	Jasper	Cavell/Gemini	S	CAN
496251	PGR 4655 Athabasca	OA123-3/Pendek	S	"
496252	PGR 8687 Cascade	Random/Forward	S	"
496253	PGR 16145 Dumont	Harmon Ham/Double Cross	S	"
496254	PGR 9871 Fidler	Random/RL 3013	S	"
497686	MN 846001	Amagalon/Black Mesdag		MN
497687	MN 845450	Amagalon/Marvellous		MN
497688	MN 842503	Amagalon/Gopher		MN
497689	MN 848450	Amagalon/Amagalon		MN
497690	MN 788788	Amagalon/Amagalon		MN
497691	MN 847048	Alpha/Amagalon		MN
497692	MN 844723	Alpha/Amagalon		MN
497694	MN 843117	Amagalon/Black Mesdag/ Delredsa		MN
497695	MN 843231	Amagalon/Black Mesdag/ Fidler		MN
497696	MN 843113	Amagalon/Black Mesdag/ A. sterilis/Kyto		MN
497697	MN 840644	Amagalon/Black Mesdag/ Obee/3/Gopher/MN 2629/Fulghum/ Fla. 500		MN
497698	MN 846259	Amagalon/Black Mesdag/Aojss/		MN
497699	MN 846041	Amagalon/Black Mesdag/A. sterilis /Kyto		MN
497700	MN 848038	Amagalon/Black Mesdag/Froker/ Omega/3/Aojss		MN
497701	MN 843893	Amagalon/Black Mesdag/ A. abyssinica/*2AB101		MN
497702	MN 811019	Amagalon/Black Mesdag/Froker/ Omega		MN
497703	MN 811050-1	Amagalon/Black Mesdag//Froker/ Omega/3/Amagalon/Black Mesdag		MN
497704	MN 847021	Alpha/Amagalon/3/Amagalon/ Marvellous//Amagalon/Black Mesdag		MN
497705	MN 845349	Alpha/Amagalon/3/Amagalon/ Marvellous/Amagalon/Black Mesdag		MN
497706	MN 848419	Amagalon/Amagalon//MN2629/Alpha		MN
497707	MN 9973-3	Amagalon/Amagalon//Aojss		MN
497708	MN 7053	Amagalon/Amagalon//Omega/MN 2629		MN
497709	MN 842492	Amagalon/Marvellous//Amagalon/ Black Mesdag		MN
497710	MN 846027	Amagalon/Marvellous*2/Ajoss		MN
497711	MN 848187	Amagalon/Marvellous//		MN

497712	MN 846712	Amagalon//A. nuda/Marvellous	MN
497713	MN 843032	Amagalon*2/Black Mesdag	MN
497715	MN 846960	Amagalon/A. nude*2//Delredsa	MN
497716	MN 9320	Amagalon/A. nuda*2//Delredsa	MN
497717	MN 849895	Amagalon//A nuda/Marvellous /4/Obee/3/Gopher/MN 2629// Fulghum/Fla 500	MN
497718	MN 846710	Amagalon/A. nuda//Amagalon	MN
497719	MN 849804	Amagalon/A nuda//Amagalon/4/ Dal/Alpha//Amagalon/Minhi #8 /3/Marvellous/5/a//Amagalon/ Marvellous/5/	MN
497720	MN 842710	Amagalon/Minhi #8//Delredsa	MN
497721	MN 848402	Amagalon/Minhi #8//Aojss	MN
497722	MN 847444	Amagalon//Obee/A.sterilis/3/ Amagalon/Black Mesdag//Froker/ Omega	MN
497723	MN 843895	Amagalon//Obee/A. sterilis/3/ Amagalon/Black Mesdag//Froker/ Omega	MN
497724	MN 9554	Amagalon//Obee/A. sterilis/3/ A. abyssinica/2*AB101	MN
497725	MN 844643	Amagalon//Omega/MN2629	MN
497726	MN 848090	Amagalon//A. sterilis/Kyto/3/ Mariner/Omega	MN
497727	MN 7443	Amagalon//A. sterilis/Kyto	MN
497728	MN 849889	Amagalon/4/Alpha/MN2629/3/ Ag 27/Lodi//Lodi/Egdolon-26	MN
497729	MN 831605	Amagalon/4/Alpha/MN2629/3/Ag 27 /Lodi//Lodi//Egdolon-26	MN
497730	MN 9383	Amagalon//Omega/MN 2629/3/ A.fatua/Marvellous	MN
497731	MN 843851	Amagalon selection	MN
497732	MN 843852	" "	MN
497733	MN 843862	" "	MN
497734	MN 843867	" "	MN
497735	MN 6085	" "	MN
497736	MN 842101	" "	MN
497737	MN 842106	" "	MN
497738	MN 842138	" "	MN
497739	MN 842144	" "	MN
497740	MN 842146	" "	MN
497741	MN 6090	" "	MN
497742	MN 842101	" "	MN
497743	MN 843203	Aojss/Ogle	MN
497744	MN 846078	Aojss	MN
497745	MN 842701	Aojss/Delrecsa	MN
497746	MN 845428	Allen/3/Minha//Gopher/MN 2629	MN
497747	MN 7435-3	Alpha/Kyto/CI3034	MN
497748	MN 5382	Alpha/Kyto	MN
497749	MN 845458	A. abyssinica/2*AB101	MN
497750	MN 848039	A. abyssinica/2*AB101 /Dal/Alpha	MN
497751	MN 844644	A. abyssinica/2*AB101/Dal/Alpha	MN

497752	MN 849092	A. abyssinica/2*AB101/Dal/Alpha /3/Amagalon/A. nuda//Delredsa
497753	MN 9345	A. abyssinica/2*AB101//Dal/Alpha /3/Amagalon/A. nuda//Delredsa
497754	MN 10350	A. abyssinica/2*AB101//Amagalon/ A. nuda//Amagalon
497755	MN 9339	A. abyssinica/2*AB101//Mariner/ Omega/3/Delredsa//Amagalon/Black Mesdag
497756	MN 809146	A. abyssinica/2*AB101//Mariner/ Omega
497757	MN 817679	A. abyssinica/2*AB101/Mariner/ Omega
497758	MN 8290098	A. abyssinica/2*AB101//Obee
497759	MN 843827	A. abyssinica/ASG-660//Minhi #8
497760	MN 843828	A. abyssinica/ASG-660//Minhi #8
497761	MN 843831	"
497762	MN 5881-1	A. abyssinica/ASG-660 Tetraploid
497763	MN 11810	AAAS*2/KRC
497764	MN 806179	A. barbata//A. sterilis/Kyto
497765	MN 8185	"
497766	MN 808729	A. barbata/Minhafer
497767	MN 11788	A. barbata/Minhafer//A. barbata
497768	MN 117608	"
497769	MN 800230	Black Mesdag/Marvellous//Dal/Alpha
496770	MN 6810	Black Mesdag/Midsouth
497771	MN 1833-6	Black Mesdag/AB101//Delair
497772	MN 1661-65	Black Mesdag/AB101//Delair/3/ Japanese Strigosa/ASG-660
497773	MN3280	Black Mesdag/AB101//Delair/3/ Japanese strigosa/ASG-660/4/ #8
497774	MN 841898	Markton/1052 (CD 3820 *2/Victory)/ /CI7909/Ascencao
497775	MN 811045	Markton/1052 (CD 3820 *2/Victory //Ora/3/Amagalon
497776	MN 5653B	Chief/Omega
497777	MN 841913	Dal/Alpha/Moore
497778	MN 846342	"
497779	MN 5498	Dal/Alpha/Amagalon
497780	MN 846049	Delredsa//Amagalon/Black Mesdag
497781	MN 846953	"
497782	MN 842490	Delredsa #1//Amagalon/Marvellous
497783	MN 846032	Delredsa//Amagalon/Marvellous
497784	MN 848525	Delredsa/Ajojss
497785	MN 846036	Delredsa//Rodney O*4/CI9139
497786	MN 846139	Delredsa/ #1/Porter
497787	MN 846197	Delredsa #1/MN 78142
497788	MN 846970	Delredsa/Aojss/3/A abyssinica/2*AB101/Dal/Alpha
497789	MN 844651	"
497790	MN 3405	Elamo/Ora//Jostrain/Portal
497791	MN 3218	Elamo/Ora//Minhi #8
497792	MN 3214	Elamo/Delair

497793	MN 2706	Elamo/Fla. 500	MN
497794	MN 1841-1	Elamo*2/Fla. 500	MN
497795	MN 1843-1	Elamo/Albion	MN
497796	MN 11812	A. fatua/Marvellous	MN
497797	MN 842630	A. fatua/A. sterilis	MN
497798	MN 841973	A. fatua/A. sterilis//Aojss	MN
497799	MN 846264	"	MN
497800	MN 841919	Froker/Dal	MN
497801	MN 6644	Froker/Omega	MN
497802	MN 8883-5	Froker/Omega/Otee/Omega	MN
497803	MN 1832-1	Fulghum/Fla. 500	MN
497804	MN 3771-1	Fla. 500/Kyto	MN
497805	MN 1218-2	Fla. 500/Sturdy	MN
497806	MN 3308	Golden 1/Omega	MN
497807	MN 3313	"	MN
497808	MN 3274	Golden 1/Minhi #1/3/Fulghum /Fla. 500//Johnson	MN MN
497809	Mn 848482	Goodland/3/Minhafer// Gopher/MN 2629	MN
497810	MN 811048	Gopher/MN 2629//Fulghum/Fla. 500	MN
497811	MN 722375	Gopher/3/Gopher/MN 2629//Fulghum /Fla. 500	MN
497812	MN 829556	Gopher/Obee	MN
497813	MN 2713	Gopher/CI3034	MN
497814	MN 2669	Gopher*2/Illinois Hull-less	MN
497815	MN 2662	Gopher/Jostrain	MN
497816	MN 2517	Gopher*2/Jostrain	MN
497817	MN 848041	Garland/3/Minhafer//Gopher/MN 2629	MN
497818	MN 833794	Johnson selection/Sturdy	MN
497819	MN 3393B	Jostrain/Portal	MN
497820	MN 3391B	Jostrain/Portal//Elamo/Ora	MN
497821	MN 2853	Jostrain/Gopher	MN
497822	MN 2661	Jostrain//Gopher*2/Jostrain	MN
497823	MN 2837-B	Japanese strigosa/ASG-660 Tetraploid	MN
497824	MN 2478	Jaycee//Tippecanoe*3/CI3034	MN
497825	MN 10221B	Kyto/Obee	MN
497826	MN 5369	Kyto/CI3034	MN
497827	MN 5436B	Kyto*2/CI3034	MN
497828	MN 4498B	Kyto/Minhafer	MN
497829	MN 4968	Kyto//A. sterilis/Kyto	MN
497830	MN 4455B	Kherson 27/Kyto	MN
497831	MN 846327	Moore (Aus) Moore(USA)//Amagalon	MN
497832	MN 846331	"	MN
497833	MN 843122	Moore (Aus)/Moore(USA)//Dal/Alpha	MN
497834	MN 842633	Moore/Aojss	MN
497835	MN 843042	"	MN
497836	MN 9363	Moore/Aojss//Moore/A barbata(?)/3/ Amagalon/Marvellous	MN
497837	MN 845341	Moore//Amagalon/Marvellous	MN
497838	MN 832175	Moore/A.barbata (?)//Amagalon/Black Mesdag	MN
497839	MN 8979	"	MN
497840	MN 829045	Moore/PG-11 II	MN

497841	MN9347	Mariner/Omega//A. abyssinica/2*AB101 /3/Delredsa//Aojss	MN MN
497842	MN 834047	Marvellous/CI3034	MN
497843	MN 8582-4	Marvellous/Black Mesdag//Omega	MN
497844	MN 9348	Mariner/Omega//A. abyssinica/ /2*AB101/3/Delredsa//Ajoss	MN MN
497845	MN 2756B	Minhi #1/Tippecanoe	MN
497846	MN 2758B	Minhi #1/Obee/Midsouth	MN
497847	MN 2760	Minhi (St.)//Gopher/Jostrain	MN
497848	MN 2754	Minhi #1//Fulghum/Fla. 500	MN
497849	MN 2683	Minhi #1//Fulghum/Fla. 500 /3/Johnson Selection/Sturdy #2	MN
497850	MN 2721	Minhi #1//Fulghum/Fla. 500/3/ Johnson Selection/Marvellous	MN
497851	MN 10550-B	A. nuda/Marvellous	MN
497852	MN 837801	Obee. 8x	MN
497853	MN 11828B	"	MN
497854	MN 844526	"	MN
497855	MN 11808	Obee/Sajapago	MN
497856	MN 844670	Obee/Satapago//Amagalon/Black Mesdag	MN
497857	MN 832331	Obee/Saia Bfc	MN
497858	MN 839956	Obee/Obee	MN
497859	MN 816896	Obee/Obee//A. fatua	MN
497860	MN 846291	"	MN
497861	MN 847241	Obee/Obee//A.fatua/3/Amagalon	MN
497862	MN 789790	Obee/Obee//A. sterilis	MN
497863	MN 1539	Obee/Saia	MN
497864	MN 843896	Obee/Saia/4/Obee/3/MN2629// Fulghum/Fla. 500	MN
497865	MN 1700-1710	Obee/ASG-060	MN
497866	MN 670-1	Obee/ASG-660//Obee	MN
497867	MN 3954	Obee/Ora	MN
497868	MN 849188	Obee/Ora/Minhafer	MN
497869	MN 841911	Obee/3/Gopher/MN 2629//Fulghum /Fla. 500	MN
497870	MN 801989	Obee/Ora//A. sterilis	MN
497871	MN 686-1	Obee/Ora//Obee/Obee	MN
497872	MN 1474B	Obee/Midsouth//Obee/Ora	MN
497873	MN 844977	Obee/Midsouth	MN
497874	MN 813331	"	MN
497875	MN 844942	Obee/Moore	MN
497876	MN 754013	Obee/Fla. 500//A. sterilis	MN
497877	MN 846105	Ogle//A. abyssinica/2*AB101	MN
497878	MN 5676B	Otee/Omega	MN
497879	MN 4875	Otee/Omega//Amagalon/Minhafer	MN
497880	MN 646917	Omega/Alpha	MN
497881	MN 6327	Omega/MN 2629	MN
497882	MN 7117B	Omega*2/MN 2629	MN
497883	MN 846923	"	MN
497884	MN 722378	Omega/A. Chinese	MN
497885	MN 2680	Omega/A. Chinese//MN 2629/ Omega	MN
497886	MN 843128	Porter/Aojss	MN

497887	MN 811012-2	PG 11-111a//Froker/Omega	
497888	MN 848446	MN 2629/Alpha	
497889	MN 734526-1	MN 2629/Alpha (Albino line)	
497890	MN 811013-3	MN 2629/4/Markton/1052(CD 3820 /Victoria)//CI7909/3/Ora	
497891	MN 2677	MN 2629/Omega/3/Tippecanoe*3/ CI3034//X-1588-2	
497892	MN 2672	MN 2629//Gopher*2/Jostrain	
497893	MN 3535-1	Richland/Kyto	
497894	MN 711477	Saia Bcf. Tetraploid	
497895	MN 849280	"	
497896	MN 331	Saia Bcf/Japanese strigosa //ASG-660 Tetraploid	
497897	MN 2834B	"	
497898	MN 769013	Sajapago Tetraploid	
497899	MN 2837	Japanese strigosa/ASG-660 Tetraploid	
497900	MN 602	Sarecol S. Tetraploid	
497901	MN 1219-1-1	Sturdy/Fla. 500	
497902	MN 9328	Santa catalina/3/Mariner/Omega //A. abyssinica/2*AB101	
497903	MN 9337	Santa catalina/3/Moore/ A. barbata (?)//Amagalon/Marvellous	
497904	MN 9301	Santa Catalina/3/Moore/ A. barbata (?)//Amagalon/Marvellous	
497905	MN 2266-B	Tippecanoe*3/CI3034//X-1588-2	
497906	MN 837800	Obee 8x	
497907	MN 837802	"	
497908	MN 819659	"	
497909	MN 759099	Obee/Ora	
497910	MN 759100	Obee/Fla. 500	
497911	MN 759101	"	
497912	MN 4504	Ascencao/Kyto	
497913	MN 4484	Appler/Kyto	
497914	MN 415	Albion/A. sterilis (Whal #2)	
497915	MN 411	Albion/Golden//Black Mesdag/ AB101	
497916	MN 817682	Mariner/Omega//A. AB101/2*AB101	
497917	MN 9308	Moore*2/A. barbata (?)	
497918	MN 3298	Minhi #3/3/Obee/Ora//Minhafer/ 4/Minhi #1//Fulghum/Fla.500/3/ Johnson Sel.	
497919	MN 819573	A. sterilis/Kyto	
497920	MN 5503-1	A. sterilis/2*Kyto	
497921	MN 842109	Amagalon selection	
498423	IL 75-5860	Coker 234//Orbit/CI 8168	S
498424	IL 75-1056	Coker 227//Clintford/Portal	S
499349	WA6391/WA6392	Sib cross of Cayuse/CI12874	S
499350	WA6394/WA6392	"	S
501521	H590-293	F4 Sel from Clinton/PI 309432 (A. sterilis)	S
501522	H632-518	BC2 F4 Sel. from Clinton 2/PI 298129 (A. sterilis)	S
501523	H639-662	BC2 F4 Sel. from Clinton 2/PI	S

VI. MAILING LIST

M. Aartsma
Small Grain Centre
Private Bag 2C29
Bethlehem 9700
SOUTH AFRICA

Bari Abdallah
Station Centrale des Plantes Fourrager
INRA BP 415 Guich
Rabat
MOROCCO

Abdelkader Benbelkacem
Institut Des Grandes Cultures
Station Experimentale
Khroub - W Constantine
ALGERIA

Bryce C. Abel
Agronomy Department
Plant Introduction Station
Ames, Iowa 50010-1010

Dr. Aristeo Acosta-Carreon
Universidad Autonoma Agraria
"Antonio Narro"
Buenavista Saltillo
Coahuila, MEXICO

Rulon S. Albrechtsen
Plant Science Dept.
UMC 48
Utah State University
Logan, UT 84321

Dr. Illimar Altosaar
Professor, Biochemistry Dept.
University of Ottawa
40 Somerset St
Ottawa, Ontario, Canada K1N 6N5

M. J. Ambrose
John Innes Institute
Colney Lane
Norwich Norfolk
ENGLAND

H. M. Anderson
Long Ashton Research Station
Univ. of Bristol
Long Ashton
Bristol, B518 9AF UK

Deane C. Arny
Dept. of Plant Pathology
University of Wisconsin
1630 Linden Dr.
Madison, WI 53706

Sr Jose Ascoli
Quaker de Guatemala
6 Av 060 Zona 4
Torre Professional II Oficina 411
Guatemala City, GUATEMALA

Mr. I. M. Atkins
521 A West 15th St
Hereford, TX 79045

Dr. R. E. Atkins
Agronomy Department
Iowa State University
Ames, IA 50011-1010

Dr. Robert Bacon
Agronomy Department
115 Plant Science Bldg.
University of Arkansas
Fayetteville, AR 72701

Francisco Bagulho
Natl Plant Breeding Station
P - 7351
Elvas Codex
PORTUGAL

J. H. Baldwin
15 Langley Way
Hemingford Grey
Huntingdon Cambs. PE18 9DB
ENGLAND

David Baltenberger
Agronomy Dept.
Purdue University
Lafayette, IN 47907

R. D. Barnett
University of Florida
Route 3 Box 4370
Quincy, FL 32351

Andrew R. Barr
South Australian Dept. of Agric.
G P O Box 1671
Adelaide
SOUTH AUSTRALIA 5001

Manuel T. Barradas
Nat'l Plant Breeding Station
7350 Elvas
PORTUGAL

Luis Barrales
120 Agronomy
Iowa State University
Ames, Iowa 50011-1010

Director
Nat'l Seed Storage Lab
Colorado State University
Ft. Collins, CO 80523

D. B. Bechtel
U.S. Grain Marketing Res. Cen.
1515 College Ave.
Manhattan, KS 66502

Dan Belgum
310 Bessey Hall
Iowa State University
Ames, Iowa 50011-1020

Edmundo D. Beratto
Carillanca Experimental Sta.
Casilla 58-D
Temuco, CHILE

Gary C. Bergstrom
Dept. of Plant Pathology
Cornell University
334 Plant Science Bldg.
Ithaca, NY 14853

Ron Bhatty
Dept. Crop Science
Univ. of Saskatchewan
Saskatoon, Sask.
Canada S7N OWO

Biblioteca Estacion Exp Carillanca
Casilla 58 D
Temuco, CHILE

Bibliotheek de Haaff
Stichtng Voor Plantenveredeling
Postbus 117 - 6700 AC
Wageningen, NETHERLANDS

Ulrike Bickelmann
Bleichenhofstr. 5
D-7500 Karlsruhe 41
WEST GERMANY

Robert A. Black
Border Oats Limited
Edington Mill
CHIRNSIDE, Duns
Berwickshire U.K.

Dr. Jane Brace
Dept. Biol. Sci.
Manchester Polytechnic
Oxford Road, Manchester Lancs.
ENGLAND

G. R. Boughton
Experimental Farm
P.O. Box 760
Indian Head, Saskatchewan
Canada SOG 2KO

Chris Branson
6 Agron Rm 1
Iowa State University
Ames, Iowa 50011-1010

Phil Bregitzer
Dept of Agron/Pl Genetics
University of Minnesota
1509 Gortner Ave.
St. Paul, MN 55108

L. W. Briggle
USDA S&E ARS PGGI
Germplasm Resources Lab
Room 334 B-001 BARC-WEST
BELTSVILLE, MD 20705

Marshall A. Brinkman
Agronomy Dept.
University of Wisconsin
Madison, WI 53706

Jan B. Broower
Victorian Crops Res. Inst.
Horsham, Victoria 3400
AUSTRALIA

A. R. Brown
Rm 3111 Plant Sci. Bldg.
University of Georgia
Athens, GA 30602

Dr. C. M. Brown
Dept. of Agronomy
University of Illinois
Urbana, IL 61801

J. F. Brown
Botany Dept.
Univ. of New England
Armidale, N.S.W. 2351
AUSTRALIA

P. D. Brown
Agriculture Canada
Res Station De Recherche
195 Dafoe Rd
Winnipeg, Manitoba R3T 2M9

J. A. Browning
Dept. of Plant Science
Texas A & M Univ.
College Station, TX 77843

P. L. Bruckner
Dept. of Agronomy
Coastal Plain Experiment Station
Tifton, GA 31793-0748

William P. Bullock
Agronomy & Plant Genetics
University of Minnesota
St. Paul, MN 55108

Ron Bunch
Dept. of Agronomy
1575 Linden Drive
Madison, WI 53706

Trond Buraas
Bjorke Forsokgard
2344 Ilseng
NORWAY

David Burnett
The Quaker Oats Company
Merchandise Mart Bldg.
Chicago, IL 60654

E. Burnett
Soil & Crop Sciences
Texas A & M Univ.
College Station, TX 77843

Dr. Peter A. Burnett
CIMMYT
Apdo Postal 6-641
06600 Mexico 6 DF
MEXICO

Vernon D. Burrows
Res. Branch Central Region
Ottawa Res. Station Bldg. 75
Ottawa, Ontario
Canada K1A 0C6

Hector L. Carbajo
Istilart 189
7500 Tres Arroyos
Buenos Aires
ARGENTINA

Gilberto Carvalho
Porductos Ad Quaker
Cx Postal 2501
Porto Alegre
BRAZIL

David H. Casper
Cereal Rust Lab
University of Minnesota
St. Paul, MN 55108

Central Scientific Agricultural Library
Dept. of Intern. Book Exchange
Orlikov bystreet, 3.
Moscow, B-139, USSR

B. D. Chaudhary
121 Mohalla Chaudharian
Hisar-125 001
INDIA

James Chong
Research Station
195 Dafoe Road
Winnipeg, Manitoba
Canada R3T 2M9

R. N. Choubey
Indian Grassl.& Fod. Res. Inst.
Pahuj Dam
Jhansi-Gwalior Road
284003 U P, INDIA

O. K. Chung
1515 College Ave.
USDA/ARA Grain Mkt Res. Ctr.
Manhattan, KS 66052

G. Clamot
Stat. D'Amelioration des Plante
Rue du Bordia, 4
B-5800 Gembloux
BELGIUM

R. V. Clark
Research Station Res. Br.
Agriculture Canada Bldg. 75
Ottawa, Ontario
Canada K1A 0C6

B. C. Clifford
Welsh Plant Breeding Station
Plas Gogerddan Negr Aberystwyth
SY23-3EB
Wales, UNITED KINGDOM

R. B. Clothier
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

T. M. Codd
Long Ashton Research Station
Weed Research Division
Begbroke Hill
Yarnton, Oxford OX5 1PF ENGLAND

Dr. Fred Collins
Dept. of Agronomy
University of Arkansas
Fayetteville, AR 72701

Andre Comeau
Agriculture Canada
2560 Boul Hochelaga
Sainte-Foy, Quebec
Canada G1V 2J3

Roger Cook
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
SY23-3EB
Wales, UNITED KINGDOM

Cornell University
Aquisitions Division
Albert R. Mann Library
Ithaca, NY 14853-4301

Jose Coutinho
Estacao Nacional de Melhoramento
De Plantas
7350
Elvas, PORTUGAL

Neil Cowen
106 Curtis Hall
University of Missouri
Columbia, MO 65211

Bhagwan Das
Dept. of Plant Breeding
Haryana Agri University
Hissar - 125004
INDIA

M. A. Davis
Agronomy Dept.
Washington State Univ.
Pullman, WA 99164

K. M. Day
Agronomy Dept.
Purdue University
Lafayette, IN 47907

Lealand Dean
P O Drawer B
Denton, TX 76201

Amos Dinoor
Dept. of Plant Path & Microbio.
Faculty of Agriculture
Rehovot, ISRAEL

Editor
Diversity Magazine
727 8th St. S.E.
Washington, D.C. 20003

Direccion Del CIAMEC-INIA
Apdo. Postal #10
Chapingo, MEXICO

Merrill Donoho
General Mills
Box 15003 Commerce
Minneapolis, MN 55415

J. P. Dubuc
Agriculture Canada
2560 Boul Hochelaya
Sainte-Foy, Quebec
Canada

Ronald D. Duerst
Agronomy Dept.
University of Wisconsin
Madison, WI 53706

Philip Dyck
Camp Agricu Exptal Sierra de Chih
Apdo Postal 554
CD Cuauhtemoc Chih
Mexico

Janet Erb
310 Bessey Hall
Iowa State University
Ames, Iowa 50011

C. Erickson
Soil & Crop Sciences
Texas A & M University
College Station, TX 77843

Lars Eskilsson
Weibullsholm PBI Box 520
S-261 24 Landskrona
SWEDEN

Estacao Nacional
De Melhoramento de Plantas
ATTN: J. Contusky
Elvas
PORTGUAL

Kenneth H. Evans
Plant Variety Protection Office AMS
National Agricultural Library Bldg.
Rm 500
Beltsville, MD 20705

Mary Evans
3 Agronomy
Iowa State University
Ames, Iowa 50011-1010

Rhiannon Evans
Twyford Seeds Ltd.
Scotts Farm, Kings Sutton
Banbury Oxon
ENGLAND

Dr. Diane Exley
MAFF, Great Westminster House
Horseferry Road
London SW1P ZAE
UNITED KINGDOM

Dr. Zahir Eyal
Dept. of Botany
Tel-Aviv University
Ramat-Aviv, Tel-Aviv 69978
ISRAEL

H. A. Fisher
Agronomy Dept.
North Dakota State University
Fargo, ND 58105-5051

R. W. Fitzsimmons, Dept. of Agric.
McKell Bldg. Rawson Place,
Sydney 2000
P O Box K220 Haymarket 2000
N.S.W., AUSTRALIA

John Flahavan
E. Flahavan & Sons Limited
Kilmacthomas
County Waterford
IRELAND

Eng Agr Elmar Luiz Floss
Caixa Postal 5690 NOMIA
Embrapa
Passo Fundo, RS
BRAZIL

Dr. R. A. Forsberg
Dept. of Agronomy
University of Wisconsin
Madison, WI 53706

J. E. Foster
Agronomy Dept.
Purdue University
W. Lafayette, IN 47907

Dr. Russell Freed
Crop & Soil Science Dept.
Michigan State University
East Lansing, MI 48824

Dr. Brad Fraleigh
Head Plant Gene Resource, Canada
Ottawa Research Station
Ottawa, Ontario
Canada K1A 0C6

Dr. Judith Fregeau
Plant Physiologist
Cereal Crops Section
Ottawa Research Station
Ottawa, Ontario, Canada K1A 0C6

Dr. K. J. Frey
Agronomy Dept.
Iowa State University
Ames, Iowa 50011-1010

Sue E. Fritz
205 Curtis Hall
University of Missouri
Columbia, MO 65211

M. Frost, Librarian
Division of Animal Production
CSIRO, P O Box 239
Blacktown N.S.W.
AUSTRALIA 2148

David W. Gaffney
Quaker Products Australia Ltd
Sunshine Road West Footscray
Melbourne Victoria
AUSTRALIA 3012

Lynn W. Gallagher
Rabat-ID
% USAID
Washington, DC 20523

Salvador Galvan-Lamas
INIA-CIAN-CAESICH
Calle 4a. No. 262, APDO. Postal No 554
CD. Cuauhtemoc, Chic.
MEXICO

Dr. S. K. Gupta
Indian Grassland & Fodder
Research Institute
Jhansi 284003
INDIA

Steve Haber
Agriculture Canada
Research Station de Recherche
195 Dafoe Rd
Winnipeg, Manitoba R3T 2M9

Per Hagberg
Svalof Ab
S-26800 Svalov
SWEDEN

Lon Hall
Plant Science Dept.
South Dakota State University
Brookings, SD 57007

Richard P. Halstead
Agronomy & Plant Genetics
University of Minnesota
St. Paul, MN 55108

Cebeco-Handelsraad
Plant Breeding Station
P O Box 139
8200 AC Lelystad
NETHERLANDS

James J. Hanzel
Agronomy Dept.
North Dakota State University
Fargo, ND 58105

D. E. Harder
Research Station
195 Dafoe Rd
Winnipeg, Manitoba
Canada R3T 2M9

Leland L. Hardman
Agronomy & Pl Genetics
University of Minnesota
1509 Gortner Ave.
St. Paul, MN 55108

C. L. Harms
Agronomy Dept.
Purdue University
Lafayette, IN 47907

H. F. Harrison
CR Seeds
P O Box 1867
Hartsville, S.C. 29550

Stephen A. Harrison
155 Agronomy Horticulture Bldg.
Louisiana State Univ. Agric. Center
Baton Rouge, LA 70803-2110

Robert Harrold
Animal Science Dept.
North Dakota State University
Fargo, ND 58105

Nick Haugerud
Agronomy & Plant Genetics
University of Minnesota
1509 Gortner Ave.
St. Paul, MN 55108

Prof. J. D. Hayes
Univ. College of Wales
Agriculture
Penglais Aberystwyth Dyfed
UNITED KINGDOM

Robert G. Ganly
12 Cannes Court
Highton, 3216
Victoria, AUSTRALIA

Wendel Ganssman
Muhlenwerke am Hafen
D-220 Elmshorn
WEST GERMANY

James H. Gardenhire
607 Mimosa
Denton, TX 76201

K. D. Gilchrist
Agronomy Dept.
University of Wisconsin
Madison, WI 53706

E. C. Gilmore
Soil & Cop Sciences
Texas A & M University
College Station, TX 77843

C. I. Goellner
Caixa Postal 569
Embrapa
Passo Fundo R S
BRAZIL

C. A. Jimenez Gonzalez
Invest Prog. Avena
Apdo Postal 10
Chapingo, MEXICO

Robert W. Gooding
Dept. of Agronomy
Ohio Ag Res & Dev Center
Ohio State University
Wooster, Ohio 44691

David G. Goslin
The Quaker Oats Co. of Canada Ltd
Quaker Park
Peterborough, Ontario,
Canada K9J 7B2

Bruce Grant
North Eastern Farmers Ltd.
Bannermill
Aberdeen AB9 2QT
SCOTLAND

Dr. Craig Grau
Dept. of Plant Pathology
University of Wisconsin
Madison, WI 53706

Mrs. J. Green, Librarian
Plant Breeding Institute
Trumpington Cambridge
ENGLAND CB2 2LQ

T. E. R. Griffiths
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

Teresa Gruber
Dept. of Agronomy/Pl Genetics
University of Minnesota
1509 Gortner Ave.
St. Paul, MN 55108

Magne Gullord
Agr Exp Stn Apelsvill
2858 Kapp
NORWAY

M. D. Hayward
Crop Improvement Division
Walsh Plant Breeding
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

Dr. James Helm
Agronomy Dept.
North Dakota State University
Fargo, ND 58105-5051

Dr. Cynthia A. Henson
Dept. of Agronomy
University of Wisconsin
Madison, WI 53706

J. M. Hertel
Agronomy Dept.
Purdue University
Lafayette, IN 47907

C. Hoenschell
106 Curtis Hall
University of Missouri
Columbia, MO 65211

John Holden
The Steading
Yarrow
Selkirk
SCOTLAND

Geraldine R. Horton
Quaker Oats Research Library
617 W. Main Street
Barrington, IL 60010

H. David Hurt
The Quaker Oats Company
617 West Main St.
Barrington, IL 60010

Head Library Services
Indian Agric. Research Inst.
(Pusa) Library
New Delhi, 110012, INDIA

International Rice Research Inst.
Library & Documentation Ctr.
P O Box 933
Manilla, PHILLIPINES

Norio Iriki
Agronomy Dept.
Hokkaido Nat. Agr. Exp. Sta.
Hitsujigaoka, Toyohira
Sapporo 004, JAPAN

R. E. Jarrett
Crop Science Dept.
North Carolina State Univ.
Raleigh, NC 27695-7620

Dr. H. K. Jedlinski
Plant Pathology Dept.
N 431 Turner Hall
University of Illinois
Urbana, IL 61801

Neal F. Jensen
5416 Thomas Court N.E.
Albuquerque, NM 87111

Ing Gerardo Valdes Jimenez
U A A A N Programa De Cereales
Buenavista
Saltillo COAH
MEXICO

David R. Johnson
Cereal Rust Lab
University of Minnesota
St. Paul, MN 55108

E. W. C. Jones
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

I. T. Jones
Pathogen & Pest Resistance Group
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
SY23-3EB, Wales, UNITED KINGDOM

J. E. Jones
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
SY23-3EB Wales, UNITED KINGDOM

Omar Kafawin
Plant Science Dept.
South Dakota State University
Brookings, SD 57007

Russ Karow
Crop Science Dept.
Oregon State University
Corvallis, OR 97331

D. S. Katiyar
Scientist-S2
Indian Grass. & Fod. Res. Inst.
Jhansi, INDIA

Keizo Katsuya
Inst. Agr. & Forest
University of Tsukuba
Ibaraki 305
JAPAN

P. J. Keane
Latrobe University
Botany Dept.
Bundoora Victoria
AUSTRALIA 3083

R. L. Kirkby
The Oats Marketing Board
Box R196, P O Royal Exchange
Sydney N.S.W.
AUSTRALIA

A. E. Kirton
Canadian Wheat Board
423 Main St. Box 816
Winnipeg, Canada R3C 2P5

Dr. H. R. Klinck
Fac. of Agric., Plant Science Dept.
MacDonald Campus of McGill Univ.
21111 Lakeshore Road
Ste Anne De Bellevue, P Quebec H9X 1C0

F. L. Kolb
Agronomy Dept., Tyson Bldg.
Pennsylvania State Univ.
University Park, PA 16802

Peter Kölln
Mühlenwerke
D2200 Elmshorn
WEST GERMANY

C. F. Konzak
Agronomy Department
Washington State University
Pullman, WA 99164

Kiro Dimov Kostov
Plant Introduction Inst.
Sadavo
Plovdiv, BULGARIA

Bo Kristiansson
Svalof AB S-268 00
Svalov, SWEDEN

Takeshi Kumagai
Hokkaido Nat Agr Exp Sta
Higashi 1 jō 10 chōme 2-15
Tsukisamu, Toyohira
Sapparo 062, JAPAN

J. Kumar, Officer in Charge
Library Hill Campus
G.B.Pant University of Ag & Tech.
Ranichuri (Teri Garhwal)-249 199
Uttar Pradesh, INDIA

Greg Kushnak
Agr Research Center
P O Box 1474
Conrad, MT 59425

Hans Kuuts
The Jogeva Plant Breeding Station
202 350 Jogeva
Estonian SSR
USSR

Gideon Ladizinsky
Faculty of Agriculture
The Hebrew University
P. O. Box 12
Rehovot, ISRAEL

Dr. H. N. Lafever
Agronomy Dept.
Ohio Agr. Res. & Dev. Ctr.
Wooster, OH 44691

T. Lambert
Twyford Seeds Ltd.
Scotts Farms, Kings Sutton
Banbury
Oxon, ENGLAND

Arthur Lamey
Plant Pathology Dept.
North Dakota State University
Fargo, ND 58105-5012

Risto Lampien
Lansi-Hchkiala
SF-14700 Hauho
FINLAND

Michael Lane
Pillsbury Company
480 Grain Exchange
Minneapolis, Mn 55415

G. A. Lawes
Welsh Pl Breed Station
Plas Gogerddan Near Aberystwyth
SY23-3EB Wales
UNITED KINGDOM

J. E. Lea
Morning Foods Limited
Northwestern Mills
Crewe, CW2 6HP
Cheshire, UNITED KINGDOM

P. Lea
Morning Foods Limited
Northwestern Mills
Crewe, CW2 6HP
Cheshire, UNITED KINGDOM

J. M. Leggett
Welsh Plant Breeding Sta.
Plas Gogerddan Near Aberystwyth
SY23-3EB Wales
UNITED KINGDOM

Norbert Leist
Lufa-Augustenbberg
Nesslerstrasse 3
D-7500-Karlsruhe 41
WEST GERMANY

Marvin Lenz
Quaker Oats Co.
617 W Main St.
Barrington, IL 60010

D. Lewis
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

R. M. Lister
Agronomy Dept.
Purdue University
W. Lafayette, IN 47907

Dr. G. Lockhart
USDA
1515 College Ave.
Manhattan, KS 66502

H. B. Lockhart
Quaker Oats Company
Merchandise Mart Building
Chicago, IL 60654

S. M. Lockington
The Quaker Oats Co. of Canada Ltd
Quaker Park
Peterborough, Ontario
Canada K9J 7B2

Roland Loiselle, P Ag
Head Plant Gene Resources Canada
Ottawa Research Station
Ottawa, Ontario
Canada K1A 0C6

David L. Long
Cereal Rust Laboratory
University of Minnesota
St. Paul, MN 55108

O. W. Luetkemeier
Agronomy Dept.
Purdue University
Lafayette, IN 47907

H. H. Luke
Plant Pathology Dept.
Fifield Hall, Univ. of Florida
Gainesville, FL 32611

R. D. Lyons
Odlum Group Ltd.
Sallins
Co. Kildare, IRELAND

E. V. Lyzlov
Agricultural Research
Institute Nonchernozeme Zone
143013 Nemchinowka-1
Moscow Region, USSR

James Mac Key
Swedish Univ. of Agr. Science
Plant Breeding
S-750 07 Uppsala
SWEDEN

Benvindo Martins Macas
National Plant Breeding Station
7351 Elvas
Codex, PORTUGAL

M. C. Mackay, Curator
Australian Winter Cereals Collection
Private Mail Bag, R M B 944
Tamworth, N.S.W.
AUSTRALIA 2340

W. F. Mai
Plant Pathology Dept.
Plant Science 310
Cornell University
Ithaca, NY 14853

Dragoljob Maksimovic
Institute for Small Grains
Kragujevac
YUGOSLAVIA

Uriel Maldonado A.
Victoria #310-110
Centro CP 31000
Chihuahua, Chih.
MEXICO

P. L. Manchanda
Cummings Laboratory,Div.of Genetics
IARI
New Delhi 110012 INDIA

Jacob Manisterski
Dept. of Botany
Ramat Aviv, 6997-8 ISRAEL

Dr. H. G. Marshall
Agronomy Dept.
Pennsylvania State Univ.
University Park, PA 16802

Dr. J. W. Martens
Agriculture Canada
Research Station
195 Dafoe Road
Winnipeg, Manitoba R3T 2M9

Jim Martin
LaCrosse Milling Co.
Cochrane, WI 54622

Matilde Martinez
INIA Dept Cereales Leguminoses
Finca "El Encin" Apartado 127
Alcala de Henares
Madrid, SPAIN

Bengt Mattsson
Svalof AB 268 00
Svalof, SWEDEN

Maria Mazaraki
Plant Breed Institute
30-423 Cracow
4 Zawila Str
POLAND

Leonard Michel
310 Bessey
Iowa State University
Ames, Iowa 50011-1020

A. Micke
FAO-IAEA Div
P O Box 100
A-1400 Vienna
AUSTRIA

B. Middleton
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

K. Mikkelsen
Norwegian Grain Corp.
Prinsensgt. 7, N-1500 Moss
NORWAY

James Mills
Nor Oats, Inc.
P.O. Box 399
St. Ansgar, Iowa 50472

Dr. M. E. McDaniel
Soil & Crop Sciences Dept.
Texas A & M University
College Station, TX 77843

J. M. McEwan
Crop Research Division
D SIR, Private Bag
Palmerstown North
NEW ZEALAND

John McFerson
Agronomy Dept.
Iowa State University
Ames, Iowa 50011

R. L. McGraw
Agronomy & Plant Genetics
University of Minnesota
St. Paul, MN 55108

W. T. McGraw
Jacob Hartz Seed Co. Inc.
P O Box 946
Stuttgart, AR 72160

Dr. R.I.H. McKenzie
Agriculture Canada
Research Station
195 Dafoe Road
Winnipeg, Manitoba R3T 2M9

R. J. McLean
W. Aust. Dept. of Agriculture
Baron-Hay CRT
South Perth
WESTERN AUSTRALIA 6151

Mike McMullen
Agronomy Dept.
North Dakota State University
Fargo, ND 58105-5051

Marcia V. McMullen
Plant Pathology Dept.
North Dakota State University
Fargo, ND 58105

Renato Borges De Medeiros
Caixa Postal 111 Cotrijui
IJUI (RS) - BRAZIL
CEP 98700

J. D. Miller
Plant Pathology Dept.
North Dakota State Univ.
Fargo, ND 58105

S. N. Mishra
Dept. of Plant Breeding
G. B. Pant Univ Agr & Tech
Pantnagar 263 145 Dist
Nainital (U.P.) INDIA

Dr. Bimal Misri
Indian Grass & Fod Res Inst.
Manasbal 196 504
J & K State
INDIA

Dr. Darrell Morey
Agronomy Dept.
Coastal Plains Exp. Sta.
Tifton, GA 31794

David R. Morgan
B.O.B.M.A.
6 Catherine Street
London WC2 B5JJ
ENGLAND

George H. Morgan
Small Grains Bldg.
Agronomy Dept.
Oklahoma State University
Stillwater, OK 74078

Toshinobu Morikawa
College of Agricultureure
University of Osaka
Mozuumemachi, Sakai City
Osaka 591 JAPAN

John G. Moseman, USDA, ARS
Germplasm Quality & Enhancement Lab
PGGI Bldg. 001, RM 327
Beltsville, MD 20705

J. Mulkey
1619 Garner Field Rd
Uvalde, TX 78801

Chris Mundt
Dept. of Botany & Plant Pathology
Oregon State University
Corvallis, OR 97331-2902

Aage Munk
Landbrugents Kornforaedling
Noerremarksveg 67 Sejet
Dk 8700 Horsens
DENMARK

Kouj Murai
Faculty of Agriculture
Kyoto University
Kitashirakawa, Sakyo-ku
Kyoto 606 JAPAN

Dr. Charles F. Murphy
USDA, ARS, NPS
Bldg. 005, BARC-W
Beltsville, MD 20705

Paul Murphy
Crop Science Dept.
North Carolina State Univ.
Raleigh, NC 27695-7620

Manuel Navarro-Franco
INIFAP-CIAMEC
Apdo Postal No 10
56230 Chapingo, Mex
MEXICO

L. R. Nelson
Soil & Crop Sciences Dept
Texas A & M Univ, Drawer E
Overton, TX 75684

J. J. Nielsen
Agriculture Canada
Res Sta, 195 Dafoe Road
Winnipeg, Manitoba
Canada R3T 2M9

W. C. Niemans-Verdriee
Instituut Voor Plantenveredeling
Post Bus 386
6700 AJ Wageningen
NETHERLANDS

Ichizo Nishiyama
18-Hazamach Shugakuin
Sakyoku Kyoto 606
JAPAN

J. D. Oates, Off. in Charge
Pl. Brd. Inst. P O Box 180
Castle Hill - Univ of Sydney
N.S.W. 2154 AUSTRALIA

Dr. H. W. Ohm
Agronomy Dept.
Purdue University
W. Lafayette, IN 47907

W. H. Oliver
P. O. Box 148
Lindfield 2070
NSW, AUSTRALIA

Edward S. Oplinger
Agronomy Dept.
363 Moore Hall
University of Wisconsin
Madison, WI 53706

Yukio Ozeki
Hokkaido Nat. Agr. Exp. Sta.
Hitsujigaoka, Toyohira
Sapporo 004, JAPAN

K. W. Pakendorf
Small Grain Centre
Private Bag X29
Bethlehem 9700
Republic of South Africa

Andras Palagyi
Cereal Research Institute
Szeged
P O Box 391
HUNGARY 6701

Y. C. Paliwal
Chem & Biology Res Inst.
Research Branch, Canada Agric.
Ottawa, Ontario
Canada K1A 0C6

Brian Palmer
Ralston Purina Co
P. O. Box 3588
Davenport, IA 52808

R. S. Paroda
Dept. of Plant Breeding
Haryana Agricultural University
Hissar
INDIA 12500-4

Anna L. Parry
Plant Pathology Dept.
Walsh Plant Breeding Station
Plas Goggerddan Near Aberystwyth
S&23-3EB Wales, U.K.

M. Pass
Agronomy Dept.
Oklahoma State University
Stillwater, OK 74074

F. L. Patterson
Agronomy Dept.
Purdue University
W. Lafayette, IN 47907

B. D. Patil
Indian Grassland & Fodder Res.Inst.
Pahuj Dam, Jhansi-Gwalior Rd
Jhansi-284003 (U P)
INDIA

George Patrick
Agronomy Dept.
Iowa State University
Ames, Iowa 50011-1010

Thomas S. Payne
Dept. of Agronomy
279 Plant Sciences
University of Nebraska
Lincoln, NE 68583

Bill Pederson
Atwood-Larson Co.
876 Grain Exchange
Minneapolis, MN 55415

Robert E. Perdue
ARS, USDA
Room 366, Bldg. 001
BARC-West
Beltsville, MD 20705

Dr. Federico Cuevas Perez
Instituto Superior de Agricultura
Apartado de Correos 166
La Herradura Santiago
Dominican Republic

D. M. Peterson
Agronômy Dept.
University of Wisconsin
Madison, WI 53706

P. L. Pfahler
Agronomy Dept.
304 Newell Hall
University of Florida
Gainesville, FL 32611

Ariane Plourde
Universite Laval
Dept. Phytologie
FSAA, Quebec
Canada G1K 7P4

J. M. Poehlman
Dept. of Agronomy
109 Curtiss Hall
University of Missouri
Columbia, MO 65211

Y. Pomeranz
1515 College Ave.
USDA/ARS Grain Mkt Res Cen.
Manhattan, KS 66502

K. B. Porter
Soil & Crop Sciences
Texas A & M University
College Station, TX 77843

Peter Portmann
Dept. of Agriculture
Jarrah Road
South Perth
AUSTRALIA WA 61S 1

J. Postoyko
Dept. of Biological Sciences
John Dalton Building
Manchester Polytechnic
Oxford Road, Manchester, U.K.

R. Prasad
G. B. Pant Univ Agr & Tech.
Pantnagar 263 145 Dist
Nainital (U P)
INDIA

M N Premachandran
Indian Grassland & Fodder Res Inst.
Pahuj Dam
Jhansi-Gwalior Road
UP INDIA 284 003

Dr. C. O. Qualset
Assoc. Dean Plant Science
Univ. of California-Davis
Agricultural Experiment Station
Davis, CA 95616

Dr. Alfredo Carballo Quiroz
Centro de Genetica
Colegio de Postgraduados
Apdo Postal 1
Chapingo, MEXICO CP 56230

Ignacio Ramirez A.
Instituto de Investigaciones
Agropecuarieas
Casilla 5427 / La Platina
Santiago, CHILE

Mark Ramsland
Burdick Grain Co.
730 2nd Ave. S.
Minneapolis, MN 55402

M. V. Rao
Wheat Project Director
IARI
New Delhi, INDIA 11001-2

Dale L. Reeves
Plant Science Dept.
South Dakota State University
Brookings, SD 57006

Dr. V. H. Reich
Agronomy Dept.
University of Tennessee
Knoxville, TN 37901

E. Reinbergs
Crop Science Dept.
University of Guelph
Guelph, Ontario
Canada N1G 2W1

Lars Reitan
Statens Forskingsstasjon Kvithamar
7500 Stjordal
NORWAY

Matti Rekunen
Hankkija Plant Breeding Inst.
SF-04300 Hyryla
FINLAND

Lucas Reyes
R R 2 Box 589
Corpus Christi, TX 78410

W. G. Richardson
20 Hill Rise
Woodstock, Oxford
OX7 1AB
ENGLAND

Howard W. Rines
Agron & Plant Genetics Dept.
303 Agronomy Bldg.
University of Minnesota
St. Paul, MN 55108

G. Roberts
Temora Agric. Research Sta.
P O Box 304
Temora, N S W 2666
AUSTRALIA

H. W. Roderick
Welsh Plant Breeding Station
Plas Gogerddan
Aberystwyth SY23 3EB
Dyfed, WALES

Alan P Roelfs, USDA
Cereal Rust Laboratory
University of Minnesota
St. Paul, MN 55108

W. J. Rogers
Cytology Dept. W.P.B.S.
Plas Gogerddan Near Aberystwyth
SY23-3EB Wales
UNITED KINGDOM

Magnus Roland
Weibullsholm Pl Breed Inst.
Bjertorp
535 00 Kvanum,
SWEDEN

A. Bruce Roskens
The Quaker Oats Company
418 2nd St. N.E.
Box 1848
Cedar Rapids, IA 52406

Dr. Brian Rossnagel
Crop Development Centre
Univ. of Saskatchewan
Saskatoon, Sask. Canada S7N 0W0

Dr. P. G. Rothman
Cereal Rust Lab.
Univ. of Minnesota
St. Paul, MN 55108

Paul Rowoth
106 Curtis Hall
University of Missouri
Columbia, MO 65211

Marketta Saastamoinen
Dept. of Plant Breeding
Agricultural Research Center
31600 Jokionen
FINLAND

Jaime Sahagun
Agronomy Dept.
Iowa State University
Ames, IA 50011

Dr. Warren Sahs
Rm 107 Agric. Hall
East Campus, UNL
Lincoln, NE 68583

Dr. Jose Juan Salmeron-Zamora
APDO. Postal No. 554
CD. Cuauhtemoc, Chic.
MEXICO

David J. Sammons
Dept. of Agronomy
University of Maryland
College Park, MD 20742

Larry M. Seitz
1515 College Ave.
USDA Grain Mkt Res Center
Manhattan, KS 66052

Jayne T. Semple
Nickerson RPB Limited
Joseph Nickerson Research Centre
Rothwell, Lincoln, LN7, 6DT
ENGLAND

Dr. H. L. Shands
Agronomy Dept.
Univ. of Wisconsin
Madison, WI 53706

Henry L. Shands
Rm 140, Bldg. 005
BARC-West
Beltsville, MD 20705

G. E. Shaner
Botany & Pl. Pathology Dept.
Purdue University
W. Lafayette, IN 47907

Laurent Saur
I.N.R.A.
Station d Amelioration des plantes
B.P. 29
35650 LE RHEU, FRANCE

Jack Scanlan
National Oats Company
1515 H. Avenue N.E.
Cedar Rapids, IA 52402

John F. Schafer
Cereal Rust Laboratory
University of Minnesota
St. Paul, MN 55108

Dr. C. W. Schaller
Agron/Range Sci. Dept.
University of California
Davis, CA 95616

John W. Schmidt
322 Keim Hall - East Campus
University of Nebraska
Lincoln, NE 68583

Donald J. Schrickel
2502 E. Shaw Butte Dr.
Phoenix, AZ 85028

Grace Schuler
312 Bessey Hall
Iowa State University
Ames, Iowa 50011-1020

Josef Sebesta
Ripp-Plant Protection Div.
161 06 Prague 6 Ruzyne 507
CZECHOSLOVAKIA

Dr. Dale Sechler
Dept. of Agronomy
University of Missouri
Columbia, MO 65201

Adrian Segal
Tel Aviv University
Faculty of Life Sciences
Institute for Cereal Crops Impr.
Ramat Aviv, ISRAEL

Leslie Shugar
Cereal Research
W. G. Thompson & Sons Ltd.
Box 250
Blenheim, Ontario, Canada

Jose A. Sierra
Malteries, De Columbia
S. A. Calle 31 No. 13B-79
Bogata, Columbia
SOUTH AMERICA

Marr D. Simons
313 Bessey Hall
Iowa State University
Ames, IA 50011-1020

H. J. Sims
21 Morwell Avenue
Watsonia
Victoria 3087
AUSTRALIA

H. Singh
Dept. of Plant Breeding
Haryana Agri Univ.
Hissar-125004
INDIA

Ron Skrdla
10 Agronomy
Iowa State University
Ames, IA 50011-1010

A. E. Slinkard
Crop Science Dept.
University of Saskatchewan
Saskatoon, Sask.
Canada S7N 0W0

Dr. D. H. Smith
USDA-ARS
Bldg. 046 BARC-W
Beltsville, MD 20705

E. L. Smith
Agronomy Dept.
Oklahoma State University
Stillwater, OK 74074

Dr. G. S. Smith
Agronomy Dept.
North Dakota State University
Fargo, ND 58105

Gordon Smith
Quaker Oats Limited
P O Box 24, Bridge Road
Southall, Middlesex UB24AG
ENGLAND

Harry J. Smith
Quaker Oats Co. of Canada
Quaker Park
Peterborough, Ontario
Canada K3J 7B2

W. Smyth
Speedicook Ltd., Scarva Road
Tandragee
Co. Armagh BT62 2BY
IRELAND

Manuel Somoza
Juan Mata Ortiz No 303
C P 31700
Nuevo Casas Grandes Chih
MEXICO

Dr. M. E. Sorrells
Plant Breeding Dept.
Cornell University
Ithaca, NY 14853

Edward Souza
515 S. Albany St.
Ithaca, NY 14850

James Stage
Dept. of Agronomy & Plant Genetics
University of Minnesota
St. Paul, MN 55108

Dr. T. M. Starling
Dept. of Agronomy
Virginia Polytechnic Inst.
Blacksburg, VA 24061

J. B. Stevens
Agronomy Dept.
University of Wisconsin
Madison, WI 53706

C. A. St. Pierre
Agriculture Canada
2560 Boul Hochelaya
Sainte-Foy
Quebec, Canada

Margaret H. Streutker
Small Grain Center
Private Bag X29
Bethlehem 9700
REPUBLIC OF SOUTH AFRICA

Dr. D. D. Stuthman
Dept. of Agron. & Pl. Genetics
University of Minnesota
St. Paul, MN 55108

Seiji Tabata
Agronomy Dept.
Hokkaido Nat Agr Exp Sta
Hitsujigaoka Toyohira
Sapporo 004 JAPAN

Akitoshi Tajimi
Hokkaido National Agric.Exp. Sta.
Hitsujigaoka Toyohira-Ku
Sapporo 061-01
JAPAN

Hiroyuki Takada
Agronomy Dept.
Hokkaido Nat. Agr. Exp. STa.
Hitsujigaoka, Toyohira
Sapporo 004, JAPAN

K. D. Taneja
Dept. of Forage Research
Haryana Agric. University
Hissar-125004
INDIA

Eldon E. Taylor
Plant Variety Protection Office
L & S Division, AMS, USDA
Natl. Agric. Library, Rm 500
Beltsville, MD 20705

Dr. G. Allan Taylor
Dept. of Agronomy
Montana State University
Bozeman, MT 59715

H. F. Taylor
Long Ashton Research Division
Weed Research Division
Yarnton, Oxford OX5 1PF
UNITED KINGDOM

M. Taylor
Speedicook Ltd
Scarva Road, Tandragee
Co. Armagh, BT62 2BY
IRELAND

Roscoe Taylor, Agronomimst
Agr. Exp. Station
533 East Fireweed
Palmer, AK 99645

Hugh Thomas
Welsh Plant Breeding Station
Plas Gogerddan
Aberystwyth, DYFED
Wales, UNITED KINGDOM

Ronald C. Thomason
Plant Science Dept.
West Texas State Univ.
Canyon, TX 79016

Christine Tibelius
3 Grantham Bank
Barcome Near Lewes
E. Sussex BN85DJ
ENGLAND

Juan Carlos Tomaso
I.N.T.A. Estacion Experimental
Agro Pecuaria
8187 Bordenaze
Prov. De Buenes Aires, ARGENTINA

Walter Tonelli
Corso Statuto 26
12084 Mondovi (Cuneo)
ITALY

J. Truter
Winter Rainfall Region
Private Bag
Elsenburg 7607
REPUBLIC OF SOUTH AFRICA

Koichpiro Tsunewaki
Faculty of Agtriculture
Kyoto University
Kitashira Kawa, Sakyo-ku
Kyoto 606 JAPAN

Dr. J. Valentine
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

J. Van Der Mey
Small Grain Centre
Private Bag X29
Bethlehem 9700
REPUBLIC OF SOUTH AFRICA

Willem H. Van Der Vliet
c/o F T Pesquisa E Sementes
Caixa Postal 409 Pontagrossa
84100 Papana
BRASIL

H. A. Van Niekert
Private Bag X29
Bethlehem 9700
REPUBLIC OF SOUTH AFRICA

M. Vanselow
Institut fur Angewandte Genet.
Universitat Hannover
Hannover
WEST GERMANY

J. S. Verma
Dept. of Plant Breeding
G. B. Pant University of Agric. & Tech.
Pantnagar, Nainital-263145
INDIA 26314-5

Mary Jo Vivian
1 Agronomy Dept.
Iowa State University
Ames, Iowa 50011-1010

Ric Vogel
Fruen Milling Co.
301 Thomas Ave.
Minneapolis, MN 55406

I Wahl
Dept. of Botany
Tel Aviv University
Tel Aviv Ramat-Aviv
69978 ISRAEL

Harold Walter
Muhlenwerke am Hafen
d-2200 Elmshorn
WEST GERMANY

Ted Walter
Agronomy Dept.
Throckmorton Hall
Kansas State University
Manhattan, KS 66506

Dr. S. H. Weaver
The Quaker Oats Company
Merchandise Mart Bldg.
Chicago, IL 60654

Dr. J. A. Webster
Dept. of Entomology
Oklahoma State University
Stillwater, OK 74074

R. W. Welch
University College of Wales
Welsh Plant Breeding Station
Plas Gogerddan Near Aberystwyth
Wales, UNITED KINGDOM

Dr. D. M. Wesenberg
Research & Extension Center
P O Box AA
Aberdeen, ID 83210

D. E. Western
P O Box 703
Highlands, NC 28741

Donna L. Whiting
Acquisitions Divisions
Albert R Mann Library
Cornell University
Ithaca, NY 14853

Gerhard Wilbert
Cabec Intl Corp.
1607 - 116th Ave. N.E., Suite 105
Bellevue, WA 98004

Dr. Roy Wilcoxson
Dept. of Plant Pathology
University of Minnesota
St. Paul, MN 55108

H. T. Williams
A & R Scott
Cupar
Fife SCOTLAND

David Wilson
Crop Improvement Division
Welsh Plant Breeding Stn
Plas Gogerddan NEar Aberystwyth
SY23-3EB Wales, UNITED KINGDOM

Richard L. Wilson
Plant Introduction Station
Ames, Iowa 50011-1170

Ralph Woodhull
617 W. Main St.
Barrington, IL 60010

David Worrall
P. O. Box 1658
Texas Ag. Experiment Station
Vernon, TX 76384

Ing. K. P. Wouda
Semundo B.V. P.O. Box 2
9970 AA Ulrum (Gr.)
HOLLAND

D. S. C. Wright
Crop Research Div.
D S I R Private Bag
Christchurch, NEW ZEALAND

D. J. Wright
Colney Lane
Food Research Institute
Norwich, Norfolk NR47 7UA
UNITED KINGDOM

G. M. Wright
33 Harakeke St.
Christchurch, NEW ZEALAND

Victor Wu
USDA
Northern Regional Research Center
1815 N. University
Peoria, IL 61604

Hirofumi Yamaguchi
University of Osaka
Agriculture
Prefecture Sakai Osaka 591
JAPAN

Lee R. Young
617 West Main St.
Barrington, IL 60010

Dr. V. L. Youngs
Dept. of Cereal Technology
North Dakota State University
Fargo, ND 58105

F. J. Zeller
Technische Universitat Munchen
8050 Freising-Weihenstephan
WEST GERMANY

Kenneth E. Ziegler
108 Agronomy
Iowa State University
Ames, IA 50011

Ms Pam Zwer
Agronomy/Range Sci. Dept.
University of California
Davis, CA 95616

VII. GEOGRAPHICAL DIRECTORY OF OAT WORKERS

UNITED STATES

ALASKA
Roscoe Taylor

ARKANSAS
Robert Bacon
Fred Collins
W. T. McGraw

ARIZONA
Donald S. Schrickel

CALIFORNIA
C. O. Qualset
C. W. Schaller
Pam Zwer

FLORIDA
R. D. Barnett
P. L. Pfahler
H. H. Luke

GEORGIA
A. R. Brown
P. L. Bruckner
Darrell Morey

IDAHO
D. M. Wesenberg

ILLINOIS
C. M. Brown
David Burnett
Geraldine R. Horton
H. David Hurt
H. K. Jedlinski
Marvin Lenz
H. B. Lockhart
S. H. Weaver
Ralph Woodhull
Victor Wu
Lee R. Young

INDIANA
David Baltenberger
K. M. Day
J. E. Foster
C. L. Harmes
J. M. Hertel
R. M. Lister
W. Luetkemeier
Herbert W. Ohm
F. L. Patterson
G. E. Shaner

IOWA
Bryce C. Abel
R. E. Atkins
Luis Barrales
Dan Belgum
Chris Branson
Janet Erb
Mary Evans
K. J. Frey
John McFerson
Leonard Michel
James Mills
Brian Palmer
George Patrick
A. Bruce Roskens
Jaime Sahagun
Jack Scanlan
Grace Schuler
Marr D. Simons
Ron Skrdla
Mary Jo Vivian
Richard L. Wilson
Kenneth E. Ziegler

KANSAS
D. B. Bechtel
O. K. Chung
G. Lockhart
Y. Pomeranz
Larry M. Seitz
Ted Walter

LOUISIANA
Stephen A. Harrison

MARYLAND
L. W. Briggle
Kenneth H. Evans
John G. Moseman
C. F. Murphy
Robert Perdue
David J. Sammons
D. H. Smith
Eldon E. Taylor

MICHIGAN
Russell Freed

MINNESOTA
Phil Bregitzer
William P. Bullock
David H. Casper
Merrill Donoho
Teresa Gruber
Richard P. Halstead
Leland L. Hardman
Nick Haugerud
David R. Johnson
Michael Lane
David L. Long
R. L. McGraw
Bill Peterson
Mark Ramsland
Howard W. Rines
Alan P. Roelfs
P. G. Rothman
James Stage
D. D. Stuthman
Roy Wilcoxson
Ric Vogel

MISSOURI
Neil Cowen
Sue E. Fritz
C. Hoenschell
J. M. Poehlman
Paul Rowoth
Dale Sechler

NEBRASKA
Thomas S. Payne
John W. Schmidt
Warren Sahs

NEW MEXICO
Neal F. Jensen

NEW YORK
Gary C. Bergstrom
W. F. Mai
M. E. Sorrells
Edward Souza

MONTANA
Greg Kuchnak
G. Allan Taylor

NORTH CAROLINA
R. E. Jarrett
Paul Murphy
D. E. Western

NORTH DAKOTA
Tom Conlon
James J. Hanzel
Robert Harrold
James Helm
Arthur Lamey
Mike McMullen
Marcia McMullen
J. D. Miller
G. S. Smith
V. L. Youngs

OHIO
Robert W. Gooding
H. N. Lafever

OKLAHOMA
George H. Morgan
H. Pass
E. L. Smith
J. A. Webster

OREGON
Russ Karow
Chris Mundt

PENNSYLVANIA
F. L. Kolb
H. G. Marshall

SOUTH CAROLINA
H. F. Harrison

SOUTH DAKOTA
Lon Hall
Omar Katawin
Dale L. Reeves

TENNESSEE
V. H. Reich

TEXAS
J. A. Browning
I. M. Atkins
E. Burnett
Lealand Dean
C. Erickson
J. Gardenshire
E. C. Gilmore
M. E. McDaniel
J. Mulkey
L. R. Nelson
K. B. Porter
Lucas Reyes
Ronald Thomason
David Worrall

UTAH
Rulon S. Albrechtsen

VIRGINIA
T. M. Starling

WASHINGTON
M. A. Davis
C. F. Konzak
Gerhard Wilbert

WASHINGTON, D. C.
Lynn W. Gallagher

WISCONSIN
Deane C. Arny
Marshall A. Brinkman
Ron Bunch
Ronald D. Duerst
R. A. Forsberg
K. D. Gilchrist
Craig Grau
Cynthia A. Henson
Jim Martin
Edward S. Oplinger
D. M. Petersen
H. L. Shands
Henry L. Shands
J. B. Stevens

CANADA
MANITOBA
P. D. Brown
James Chong
Steve Haber
D. E. Harder
A. E. Kirton
J. W. Martens
R. I. H. McKenzie
J. J. Nielson

ONTARIO
Illimar Altosaar
Vernon D. Burrows
R. V. Clark
Brad Fraleigh
Judith Fregeau
David G. Goslin
S. M. Lockington
Roland Loiselle
Y. C. Paliwal
E. Reinbergs
Leslie Shugar
Harry J. Smith

QUEBEC
Andre Comeau
J. P. Dubuc
H. R. Klinck
C. A. St. Pierre
Ariane Plourde

SASKATCHEWAN
Ron Bhatty
G. R. Boughton
Brian Rossnagel
A. E. Slinkard

MEXICO
Aristeo Acosta-Carreonn
Peter A. Burnett
Philip Dyck
C. A. Jimenez Gonzalez
Gerardo De Jesus V. Jimenez
Salvador Galvan-Lamas
Uriel Maldonado
Manuel Navarro-Franco
Alfredo Carballo Quiroz
Manuel Somoza
Jose Juan Salmeron-Zamora

ALGERIA
Benbelkacem Abdelkader

ARGENTINA
Hector L. Carbajo
Juan Carlos Tomaso

AUSTRALIA
Andrew R. Barr
Jan B. Broower
J. F. Brown
R. W. Fitzsimmons
M. Frost
David W. Gaffney
Robert G. Ganly
P. J. Keane
R. L. Kirkby
M. C. Mackay
R. J. McLean
J. D. Oates
W. H. Oliver
Peter Portmann
G. Roberts
H. J. Sims

AUSTRIA
A. Micke

BELGIUM
G. Clamot

BULGARIA
Kiro Dimov Kostov

BRAZIL
Gilberto Carvalho
Elmar Luiz Floss
C. I. Goellner
Renato Borges De Medeiros
Willem H. Van Der Vliet

CHILE
Edmund D. Beratto
Ignacio Ramirez

CZECHOSLOVAKIA
Josef Sebesta

DENMARK
Aage Munk

DOMINICAN REPUBLIC
Federico Cuevas Perez

FINLAND
Risto Lampien
Matti Rekunen
Markette Saastamoinen

FRANCE
Laurent Saur

GUATEMALA
Jose Ascoli

HUNGARY
Andras Palagyi

INDIA
R. N. Choubey
B. D. Chaudhary
Bhagwan Das
S. K. Gupta
D. S. Katijar
J. Kumar
P. L. Manchanda
S. N. Mishra
Bimal Misri
R. S. Paroda
B. D. Patil
R. Prasad
M. N. Premacphandran
M. V. Rao
H. Singh
K. D. Taneja
J. S. Verma

IRELAND
John Flahavan
R. D. Lyons
W. Smyth
M. Taylor

ISRAEL
Amos Dinoor
Sahir Eyal
Gideon Ladizinsky
Jacob Manisterski
Adrian Segal
I. Wahl

ITALY
Walter Tonelli

JAPAN
Norio Iriki
Keizo Katsuya
Takeshi Kumagai
Toshinobu Morikawa
Kouj Murai
Ichizo Nishiyama
Yukio Ozeki
Seiji Tabata
Akitoshi Tajimi
Hiroyuki Takada
Koichpiro Tsunewaki
Hirofumi Yamaguchi

MOROCCO
Bari Abdallah

NETHERLANDS
Cebeco-Handelsraad
W. C. Niemans-Verdriee
K. P. Wouda

NEW ZEALAND
J. M. McEwan
D. S. C. Wright
G. M. Wright

NORWAY
Trond Buraas
Magne Gullord
K. Mikkelsen
Lars Reitan

POLAND
Maria Mazaraki

PORTUGAL
Francisco Bagulho
Manuel T. Barradas
Jose Coutinho
J. Contusky
B. M. Macas

REPUBLIC OF SOUTH AFRICA
M. Aartsma
K. W. Pakenndorf
Margaret H. Streutker
J. Truter
J. Van Der Mey
H. A. Van Niekert

SCOTLAND
Bruce Grant
John Holden
H. T. Williams

SOUTH AMERICA
Jose A. Sierra

SPAIN
Matilde Martinez

SWEDEN
Lars Eskilsson
Per Hagberg
Bo Kristiansson
James MacKey
Bengst Mattsson
Magnus Roland

UNITED KINGDOM
M. J. Ambrose
H. M. Anderson
J. H. Baldwin
Robert A. Black
Jane Brace
B. C. Clifford
R. B. Clothier
T. M. Codd
Roger Cook
Rhiannon Evans
Diane Exley
J. Green
T. E. R. Griffiths
J. D. Hayes
M. D. Hayward
E. W. C. Jones
I. T. Jones
J. E. Jones
T. Lambert
D. A. Lawes
J. E. Lea
P. Lea
J. M. Leggett
D. Lewis
B. Middleton
David R. Morgan
B. Middleton
Anna L. Parry
W. G. Richardson
H. W. Roderick
W. J. Rogers
Gordon Smith
H. F. Taylor
Hugh Thomas
Christine Tibelius
R. W. Welch
David Wilson
D. J. Wright
J. Valentine

USSR
Hans Kuuts
E. V. Lyzlov

WEST GERMANY
Ulrike Bickelmann
Wendel Ganssman
Peter Kolln
Norbert Leist
M. Vanselow
Harold Walter
F. J. Zeller

YUGOSLAVIA
Dragoljob Maksimovic