1978

OAT NEWSLETTER

Vol. 29

The data presented here are not to be used in publications without the consent of the authors.

May 1979

Sponsored by the National Oat Conference

1978

OAT NEWSLETTER

Volume 29

Edited by the Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa 50011. Costs of preparation financed by the Quaker Oats Company, Chicago, Illinois 60654.

May 1979

Sponsored by the National Oat Conference

Marr D. Simons, Editor

CONTENTS

I. NOTES

NEWSLETTER ANNOUNCEMENTS AND INSTRUCTIONS

Overseas contributions - Foreign contributors are urged to anticipate the annual call for material for the next newsletter and to submit articles or notes to the editor at any time of the year.

Available back issues - Back issues of certain volumes are available on request. Please write the editor.

Variety descriptions - When you name or release a new variety, in addition to your account in the State Report section, please submit a separate description to be included under "Oat Cultivars." We would like to make the "Oat Cultivars" section as complete and useful as possible.

Please do not Cite the Oat Newsletter in Published Bibliographies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.

Citing the Newsletter creates a demand for it outside the oat workers' group. For example, libraries request it, and we refuse them. (If the Newsletter were made available to libraries, it could not be produced as we now do it because the mailing list would triple.) So why cite it in a bibliography?

Certain agencies require approval of material before it is published. Their criteria for approval of material that goes into the Newsletter are different from criteria for publishing. 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, 1978-81

Executive Committee

R. A. Forsberg, Chairman
*C. F. Murphy, Past-chairman
*H. G. Marshall, Secretary
*M. D. Simons, Editor, Oat Newsletter

Representatives

M. Sorrels, Northeast Region, USA
H. W. Ohm, Central Region, USA
H. Harrison, Southern Region, USA
D. M. Wesenberg, Western Region, USA
H. G. Marshall, U. S. Department of Agriculture
H. T. Allen, Canada Department of Agriculture
V. D. Burrows, Eastern Canada
R. I. H. McKenzie, Western Canada
M. Navarro-Franco, Mexico
D. Schrickel, Representative at large
C. M. Brown, Representative at large
M. E. McDaniel, Representative at large

* Non-voting member unless also a representative

REPORT ON THE AMERICAN OAT WORKERS CONFERENCE

The American Oat Workers met in conference in March, 1978, at Texas A&M University, College Station, Texas, and summaries of paper sessions and business meetings were published in Volume 28 of the Oat Newsletter. Conferees recommended action in several areas and resulting activities are described below.

Legislative Subcommittee. The Executive Committee of the AOWC was urged to meet with appropriate officials of SEA, USDA, and with members of Congress to communicate our grave concerns over continued erosion of the USDA oat research budget. A visitation or Legislative Subcommittee was appointed and the first visitation occurred in May, 1978. (The activities and recommendations of this Subcommittee are summarized below in a report by D. J. Schrickel.)

In addition to opening lines of communication, the main result of the first visitation was the recommendation that a National Oat Improvement Council (NOIC) be formed. The proposed functions of this Council and a report of its first meeting are outlined in an adjacent report. A second visit to Washington by the Legislative Subcommittee took place Feb. 6-7, 1979.

Germplasm Subcommittee. A motion was passed at the Texas Conference that a plant pathologist be appointed to the Subcommittee for Improved Utilization of the Oat Germplasm Collection. Dr. Greg E. Shaner, Purdue University, has agreed to participate in this very important activity. The activities of this Subcommittee are also summarized below in a report by D. D. Stuthman.

International Oat Conference Subcommittee. A committee composed of Dr. K. J. Frey (Chairman), Iowa State University; Dr. R. I. H. McKenzie, C.D.A., Winnipeg; and Dr. Bengt Mattsson, Svalov, Sweden was appointed to investigate the possibility of organizing an International Oat Conference.

The nutritional and agronomic value of oats is not widely recognized and oat programs, both federal and state, continue to receive low priority rankings. As a group oat workers must work together to present documented evidence of the value of oats in human nutrition and in livestock and crop programs. The various committees described above welcome your suggestions so that oat programs both on a discipline and on a regional basis can be strengthened.

Respectfully submitted,

R. A. Forsberg
Chairman, AOWC

REPORT ON THE NATIONAL OAT IMPROVEMENT COUNCIL

The major recommendation by the Legislative Subcommittee of the AOWC following the May, 1978, Washington, D.C. visitation was the establishment of a National Oat Improvement Council (NOIC). The main functions of the NOIC are to help coordinate oat research on a national level and to communicate program needs to SEA/AR, USDA administrators and to appropriate congressional representatives and committees. Initially, the NOIC will operate as an Ad-Hoc Committee appointed by the AOWC chairman using the Legislative Subcommittee as a nucleus. Regional, discipline, and federal/state representation influenced committee composition. Members are:

L. W. Briggle	M. E. McDaniel	D. J. Schrickel
C. M. Brown	C. F. Murphy	M. D. Simons
K. J. Frey	D. M. Peterson	D. D. Stuthman
R. A. Forsberg	H. W. Rines	D. M. Wesenberg
H. G. Marshall	P. G. Rothman	V. L. Youngs

The NOIC met for the first time on November 6, 1978 in Minneapolis, MN. Three key points were made early in the discussion, and they set the stage for much of the remaining dialogue:

(1) Funding and staffing for agricultural research should be increased, not decreased.

(2) Oat workers must not take their traditional supportive USDA laboratories and field stations for granted.

(3) Support must be sought for productive, on-going, long-term research and breeding programs.

These important points, in addition to others, were transmitted by members of the Legislative Subcommittee during their February 6-7, 1979, visit to Washington.

Annual November meetings of the NOIC are anticipated. You are invited to share your concerns and suggestions with any member of the Council. Detailed minutes of the November 6, 1978, meeting are available upon request.

Respectfully submitted,

R. A. Forsberg
Moderator, NOIC

WASHINGTON D.C. MEETINGS OF THE LEGISLATIVE SUB-COMMITTEE AMERICAN OATWORKERS CONFERENCE

D. J. Schrickel

At the American Oatworkers conference held in College Station, Texas on March 20-22, 1978, a legislative sub-committee was appointed to present research needs of U.S. oats breeders to members of Congress. By properly presenting needs, the Committee hoped to increase funding of oats research within the Department of Agriculture.

The Committee is composed of the following members: Bob Forsberg, University of Wisconsin; Ken Frey, Iowa State; Chuck Murphy, North Carolina State; Deon Stuthman, University of Minnesota; Lee Briggle, USDA; Harold Marshall, USDA; and Don Schrickel, Quaker Oats.

The Committee met in Washington in May of 1978 and February of 1979. Members who are employed by USDA were not involved in presentations to members of Congress since this might involve conflict of interest.

On both occasions, presentations were made to staff members of both House and Senate Appropriations Committee legislators. As a result of these preparatory meetings, we currently plan to testify before the Appropriations Committees of the House and Senate in March of 1979. The testimony will describe particular research needs for the fiscal year beginning October 1, 1979.

The legislative sub-committee has taken on additional responsibility of communicating research needs to the top administrators of Agricultural Research - Science and Administration USDA. On both Washington visits, the Committee met with T. W. Edminster and other key administrators to define these needs.

Some members of the Committee were able to spend a half day visiting the USDA agricultural research facilities at Beltsville, Maryland. Staff members described various programs including the germ-plasm project, oats rust nurseries, and overall research objectives.

REPORT OF GERMPLASM SUBCOMMITTEE OF THE NOIC

The 1977 Oat Newsletter has two items regarding our subcommittee (see pages 13, 32 and 33). This report will describe our activities during the past year. Our committee membership was expanded as per the resolution passed at the American Oat Workers Conference. Greg Shaner from Purdue was appointed by Chairman Forsberg as the plant pathologist on our subcommittee.

In May several committee members met with several members of the National Wheat Improvement Committee and the GRIP team prior to a meeting of the National Plant Germ Plasm Committee. We have also maintained close contact with the germplasm people at USDA-SEA at Beltsville. In the fall a survey was conducted among oat researchers to determine priority of traits to be included in an evaluation. The results have been transmitted to the IS/GR people.

The committee appreciates the prompt responses to our questionnaire regarding priorities and would welcome any other suggestions.

J. C. Craddock, Chairman
D. J. Schrickel
G. E. Shaner
D. D. Stuthman
D. M. Wesenberg

1978 North Central (NCR-15) Oat Workers Field Day

North Central oat workers participated in their 1978 annual field day at Michigan State University, E. Lansing. The group gathered for a very enjoyable Sunday evening, June 25 at the home of Dr. John Grafius.

Monday morning the group enjoyed a stimulating 'classroom' discussion on plant breeding methods presented by Dr. Grafius. The main theme of the plant breeding section was "The population as a focal point in a plant breeding program". The purpose here was to demonstrate the use of recurrent selection as a means of moving the population. In this method less attention is paid to isolating the one superior individual but instead we attempt to move the entire population so that a number of good isolates can be found. Certain good lines are recrossed. The computer is used extensively in selection of parents for crosses. In this way, relatively few crosses need to be made, e.g. instead of 12-15 crosses, may need to make only about 4 crosses. It is important to have breeding programs at many locations. For example, in Michigan, high yielding oat types need to have many seeds per panicle, whereas in New York large seeds are very important. The relative importance of various traits at different locations related back to differences in population structure and in parental selection in the breeding program.

The group observed several equipment items used in the MSU oats breeding program. A seeder and a 'homemade' plot harvester were of particular interest.

Dr. Grafius pointed out hill plots and populations in the breeding program and the group discussed these in relation to points presented in the classroom discussion. The MSU oats breeding program has been very successful in accomplishing goals with relatively small numbers of plots and populations in the field.

Three graduate students showed portions of their research. Mr. James Nelson showed examples of intergeneric and interspecific crosses of barley with its wild relatives. Mr. James Whyte talked about the role of the meristem in control of the negative correlation between tiller number and seeds/ear. Mr. Al-Shamma described tests for differences in salt tolerance in a genetic study of this trait in barley.

At another location on the same farm, Drs. David H. Smith and James A. Webster and graduate students discussed several very interesting studies on the cereal leaf beetle pest. All cereal leaf beetle tests at East Lansing were performed in cages to insure adequate levels of infestation of the insect. Yield trials of resistant and susceptible winter wheat in insecticide treated vs untreated plots were used to provide information on the effectiveness of resistance. Economic thresholds for differing levels of attack were being determined on a susceptible variety of wheat. The influence on beetle damage to susceptible oats, planted adjacent to beetle infested susceptible and resistant wheats was tested. A group of 30 barley lines with improved cereal leaf beetle resistance was tested against 3 levels of insect population in 3 cages 100' x 10' to determine the effects of differing population levels on the expression of resistance.

Miss Carrie Young, a graduate research assistant sponsored by the Quaker Oats Company, was testing pubescent lines of oats under these same 3 levels of insect attack.

An enjoyable lunch sponsored by the Milling Oats Improvement Association concluded the Field Day.

Thanks to the oats breeding staff and graduate students at MSU for a very meaningful and stimulating tour and for the opportunity to share information and ideas.

Submitted,

H. W. Ohm
Secretary NCR-15

OAT WORKERS IN ATTENDANCE, NORTH CENTRAL FIELD DAY

V. L. Youngs	Howard Rines	John Grafius
M. A. Brinkman	Mike McMullen	Dave Smith
R. A. Forsberg	V. Jons	Don Schrickel
Ron Duerst	Dale Reeves	Sam Webster
George Luk	Herbert Ohm	Carrie Young
Yeong D. Rho	Roger Kuhn	Jim Whyte
Jay Miller	Dale Wickersham	Jim Nelson
Ken McNamara	Don Avey	Al Shamma
Russ Karow	K. J. Frey	D. D. Harpstead
Sherri Stern	Earnie Reinbergs	Bob Olien
Wesley Root	Les Shugar	Mervin Reines
D. D. Stuthman	Harold Marshall	Sam Weaver
Paul Rothman	Lee Briggle	

NCR-15 OAT WORKERS FIELD DAY FOR 1979

Dr. Michael McMullen has invited oat workers, particularly those in the North Central U.S. and adjacent parts of Canada, to visit his oat breeding program at Fargo, North Dakota in 1979. The date has been tentatively set as July 23, 1979. Information on lodging, travel, and activities will be mailed automatically to oat workers in the North Central States of the U.S. and adjacent parts of Canada. Others can write Dr. McMullen for such information.

NORTH CENTRAL OAT CONFERENCE IN 1980

The biennial North Central Oat Conference, and concurrent meeting of the NCR-15 Committee, is scheduled for some time during early February to mid-March, 1980 at the University of Wisconsin. Program chairman, H. W. Ohm of Purdue University encourages each potential participant to give thought to items or subjects of possible interest for the conference. He will appreciate your letting him know of any ideas you might have on any phase of the conference.

II. SPECIAL REPORTS

Discussion of Milling Quality Characteristics of Oats

S.H. Weaver, R.A. Forsberg, W.R. Root, R.D. Duerst and V.L. Youngs

PHYSIOLOGICAL MILLING CHARACTERISTICS OF OATS

1. Dark Kernel Count

This study is in progress. It involves North and South Dakota, Minnesota, the Oat Quality Laboratory and Quaker Oats Company. The hypothesis is that certain varieties may be more susceptible to dark kernels than others. The three states have submitted samples to the Oat Lab. and dark kernels are being counted. Data will be handled statistically to decide if the hypothesis is true.

The remaining topics are extensions of the term "milling quality" beyond the physical aspects.

2. Oat Protein

   a. The essential amino acid balance in oats is excellent and remains that way through variation in protein concentration. The reason for this is that the globulins represent the major protein storage fraction, and their amino acid composition is similar to that of the oat groat. Thus a change in protein concentration in the oat groat does not produce a notable change in the amino acid balance.

   b. Both environments and heredity play a role in oat protein concentration.

   c. It appears that when protein is increased in the oat groat, the increase is faster in the bran than in the endosperm part of the groat.

   d. The Oat Quality Laboratory will analysize its 200,000th sample for U.S. Oat Breeders some time during the winter of 1979. We began this service in November, 1971.

3. Oat Lipids

   a. A lipid range of 3.1%-11.6% has been reported in oat groats. However 95% of the oat groats contained 5%-9%.

   b. Oat lipids are highly heritable and are fairly independent of environmental effects.

   c. Variation in F.A. composition among oat groats.

Range	Correlation with Total Fat
Palmitic, 16.2-21.8%	-0.76**
Oleic, 28.4-40.3%	0.91**
Linoleic, 36.6-45.8%	-0.85**

These data indicate a trend towards less linoleic acid (also less palmitic acid) with an increase in total lipid.

d. Triglycerides represent the major lipid constituent. Our preliminary data show an abundance of unsaturated fatty acids connected to the second carbon of the triglyceride molecule. This is nutritionally desireable. The heritability of this is not known.

e. Lipase activity varies among different oat selection.

f. Studies have shown oats or groats store well if the kernels are not broken; i.e., lipase remains inactive unless the kernel is ground.

4. Relationship Between Oat Protein and Lipid

We analyzed data from the Uniform Midseason Oat Production and the Uniform Early Oat Production Nurseries grown during the years 1972-76. Many correlations were determined and the conclusion reached was that there is no significant relationship between protein and lipid.

5. Fiber

Only limited data are available on oat fiber. One study titled "Gastrointestinal response to oat and wheat milling fractions in older women" (Mey and Calloway) reported oat bran produced less discomfort to the women that wheat bran. There is a need for studies on fiber quality. It has been suggested that oat bran contains more lignin and less hemicullulose than wheat bran. This may have contributed to the results.

6. Phytic Acid

An acceptance of the whole grain concept toward better nutrition generally would be highly desireable. However, in certain cases where "bran freaks" may go overboard the danger of mineral binding by phytic acid in cereal brans exists. Our studies have shown that phytic acid concentration does vary among oat varieties, and phytic acid concentration also varies directly with the amoun of phosphorus in the soil.

MILLING QUALITY CHARACTERISTICS

I. Physical Traits

A. Size and shape

Ideally, the groat should be slightly shorter than the oat in order to accomplish separation in the cleaning house. The width of the groat should be 30-35% of the length (roughly 8-9mm. long x 2.5-3mm. wide). Oats that are too plump, over 3mm. wide, are difficult to separate from barely and are consequently undesirable.

B. Hull/groat ratio

Currently, the hull represents 26-28% of the oat. One percentage point reduction in hull is equal to 1-1½ lbs. improvement in milling yield. Our goal should be to have oats of 20% hull and 80% graot. Realizing this goal would result in an 8-9 lb. improvement in milling yield.

C. Test weight

Each pound of improvement in test weight is equal to 2½-3 lbs. improvement in milling yield.

D. Bosom or double oats

Since bosom oats are primarily two sets of hulls around one small or two very small groats, milling efficiency is greatly affected in their presence. However, this trait is caused primarily by environment and breeding may not be extremely useful in their elimination.

E. Depth of crease

The longitudinal crease, if too deep, represents a physical "weak spot" in the groat. During the hulling process, these groats can split along the crease. These splits are lost to by-products. Consequently, the depth of the crease should be minimized.

F. Groat hairs

The tiny hairs on the groats create considerable dust during milling. More importantly, they accumulate in the milling equipment resulting in an inefficient operation. It would be very desirable to eliminate or greatly reduce them.

II. Physiological milling qualities

A. Protein percent

The protein should be maintained at the highest possible level, but not at the expense of grain yield.

B. Oil percent

The oil level is currently between 6-8% and causes no problems relative to the self-life of products. The heat treatment of the groats prior to rolling inactivates to the lipase enzymes, thus reducing the likelihood of rancidity. However, if oil percentage increase because of demands by farmers for a higher energy product, the effect on shelf-life is in question.

C. Color

Quaker desires groats that are as near white as possible. The heat treatment causes the groats to darken slightly. Obviously, the whiter they are, the better. A bright groat is preferred over a dull groat. The brightness is affected by weathering and/or disease organisms. If possible, it would be desirable to have resistance to weathering and/or the disease organisms.

Oat Quality Studies at Wisconsin

I. Influence of kernel and groat shape on quality traits.

Traits studied:

1. Groat length

2. Groat width

3. Cylindrical volume (cyl. vol.) = Volume of a true cylinder with same length and width as those of an oat groat.

4. Groat displacement in acetone = True groat volume.

5. Ratio of displacement: cyl. vol. = volume of a true cylinder actually filled by the groat.

6. Groat weight

7. Groat density

8. Groat protein percentage

9. Groat protein content

10. Groat percentage and hull percentage

Relationships among these traits have been studies in diverse oat varieties and selections and in progenies from crosses between the varieties and selections. Inheritance patterns are being determined.

II. Relationships among kernel and groat shape, quality traits, and milling yield.

Traits studied:

1. Milling yield

2. Test weight (bushel weight)

3. Groat percentage

4. 1,000 kernel weight

5. No. of kernels per unit volume

6. Length of primary kernels

7. Width of primary kernels

8. Displacement volume of primary kernels

9. Cylindrical volume of primary kernels

10. Ratio of displacement: cyl. vol. for primary kernels

11. Length of secondary kernels

12. Width of secondary kernels

13. Displacement volume of secondary kernels

14. Cylindrical volume of secondary kernels

15. Ratio of displacement: cyl. vol. for secondary kernels

Relationships among these traits are being determined for a selected group of oat varieties and selections.

III. Conformation of Oat Groats

Each year in the Wisconsin oat program over 4,000 oat groat samples are classified for groat shape as an integral part of the quality evaluation process. Groat length and uniformity of "filling" from base to tip are emphasized. Kernel and groat mounts (2x2 colored slides) demonstrating the different groat conformation classes were presented. Extreme groat types such as plump, long and thin, wide crease, no crease, dark (dirty), and clean (bright) were also shown.

SUMMARY

It was determined that the most significant improvement in milling yield would result from increasing the groat percentage and increasing the heritable test weight of oats. A reasonable goal for groat percentage is 80%. Achieving this goal will reduce the amount of oats required to make 100 pounds of groats by about 5%. Each pound of increase in test weight will improve milling yields by about 2%. One of the components of test weight is grain fill. A well-filled kernel with little or no crease, such as the variety Wright, is generally higher in test weight.

Most of the oats varieties examined at the University of Wisconsin are 2½-3mm in width, but that a very small percentage are 8½-9mm in length. In general terms, suffice it to say that the ideal milling oats should be uniform, long and plump. This offers a great advantage in the milling process of separating the oats and oats groats from other small grains.

Bosom oats and groat hairs are relatively minor problems in the milling process, but any reduction in the amounts of either or both would offer a milling advantage.

Researchers at the University of Wisconsin have initiated studies to evaluate groat conformation. A numerical scale is being developed and should evolve into a useful classification system for breeding purposes.

Milling companies desire oats with the highest possible level of groat protein. However, there is no advantage to increasing protein percentage at the expense of grain yield.

The current importance to milling companies of oil level in oats centers around the shelf-life of oats products. Basically, the lipase enzymes are inactivated during processing resulting in stable products. The range in oil is 3.1-11.6% and 90% of the oats contain 5-9% oil. Consequently, there should be little concern about ill effects of high oil levels.

Protein Analysis by Near-Infrared Reflectance System at the USDA Oat Quality Laboratory

V. L. Youngs & K. D. Gilchrist

On December 21, 1978, the Oat Quality Laboratory changed its major system of protein analysis from dye-binding to a near-infrared reflectance system (Neotec Grain Quality Analyzer, Model 41,* equipped with teletype printout). The sample cell of the Grain Quality Analyzer (GQA), originally designed to hold 8-10 grams, was reduced in size to hold about three grams of ground sample, the amount normally submitted by U.S. oat breeders. Data from both the large and small sample cups compared very well (Table 1).

Between the above date and January 22, 1979, 4926 oat groat samples have been analyzed by this system. This number includes 82 internal check samples, but does not include 67 samples reanalyzed by the Kjeldahl technique.

Exclusive of grinding, two operators can be fully utilized by the GQA when three sample cells are used. The operators, in a coordinated routine, fill and assemble the cups, insert them into the GQA, remove the cups, disassemble, clean and reload. We estimate the maximum capacity of the GQA to be about 105 samples per hour. Two operators, working under pressure (self-imposed), analyzed 99 samples in a one-hour period. Normally, they analyze about 70 samples per hour. In the Oat Quality Laboratory this figure cannot be used to predict daily output because most of our labor is part-time, and other tasks such as unpacking and sorting samples, grinding, handling data, and other unrelated laboratory duties do not permit the system to be operated continuously. Average output for the time period cited was 224 analyses per day.

Accuracy and precision of the system are adequate. The correlation between protein values obtained on 67 samples analyzed by the Kjeldahl method and the system described was 0.98. Mean protein values for the Kjeldahl and current system were 18.55 and 18.45, respectively. About 75% of the samples selected for Kjeldahl analysis were random selections; the remainder were hand picked because of potentially unusual protein values. Variation among internal check samples is shown in Table 2.

Refinements in procedures, and expansion of analyses to other oat kernel components are being investigated.

*Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture and does not imply its approval to the exclusion of other products that may also be suitable.

Table 1. Comparison of different sized sample cells used with the GQA (using the same regression equation).

Sample cell (capacity)	No. samples analyzed[1]	Mean prot. %[2]	s.d.[2]
8 g	120	18.77	2.83
5 g	120	18.64	2.74
3 g	120	18.52	2.76
Kjeldahl	120	18.53	2.93

[1] Kjeldahl protein range of the 120 samples was 10.42-25.42%.
[2] Analysis of variance comparing the three sample cups yielded $F<1.0$ (NS), and all possible comparisons between means were also not significant ($t<1.0$).

Table 2. Deviation among internal check sample protein concentrations analyzed by the GQA.

Check sample	No. analyzed	Prot. range %	Prot. Mean %	s.d.
A	37	19.7-22.0	20.5	0.46
B	23	17.4-18.6	17.9	0.35
C	22	17.5-18.9	18.1	0.30

Carbohydrates of Oats

L.A. MacArthur and B.L. D'Appolonia

I Sugars

Sugars in three oat cultivars of different protein levels were investigated and compared to a Hard Red Spring (HRS) wheat cultivar. All samples were milled into flour and bran on a Brabender Quadrumat Jr. flour mill. Percentages of total sugars and individual free sugars were determined in each mill stream. Of the oat flours, the high protein oat cultivar (Dal) contained the greatest amount of total sugars. All three oat cultivars contained lesser amount of total sugar in the bran compared to the wheat bran. Seven individual free sugars, when present, were quantitatively measured. Sucrose was the predominant sugar for all samples examined followed by raffinose. Stachyose occurred in the oat flours and brans in relatively high amounts whereas only a trace was detected in the wheat bran. Small amounts of verbascose were tentatively identified in the oat brans. For all samples small differences were noted in the amounts of maltose, fructose and glucose.

II Starch

Starch from three oat cultivars of different protein concentrations was isolated and fractionated into amylose and amylopectin and compared to a hard red spring (HRS) wheat starch and its fractions. The oat cultivars showed increasing amounts of prime starch as the protein concentration of the cultivars decreased. Small differences were observed in the initial pasting temperature of the various starches; however, the oat starches exhibited higher peak height and 15 min. hold height, and greater height after cooling at 50^{o}C than the HRS wheat starch. The values for peak height, 15 min. hold height and height after colling at 50^{o}C of the oat starches increased as the protein concentration of the parent oat flour decreased. The oat starches, in contrast to wheat starch, required a longer heating period before reaching a peak viscosity. Small differences were noted in the chemical and physicochemical properties of the oat starches as compared to the HRS wheat starch. Total lipid in the oat flours and brans and corresponding starches was higher in all cases than the wheat flour, bran and starch. Starch content of the oats was similar to the wheat for Froker and Cayuse but lower for Dal, the high protein cultivar. In general, Dal showed the greatest difference among the three oat cultivars and also between the oat and wheat starch.

III Non-Starchy Polysaccharides in Oats Compared to Wheat

The flour and bran from one oat cultivar (Dal) were used for isolation of crude water-soluble non-starchy polysaccharides (WSNP). The oat flour WSNP were compared to the WSNP of wheat flour. The α-amylase purified WSNP were fractionated employing two different techniques: DEAE-cellulose column chromatography and a graded ammonium sulfate procedure.

Higher amounts of water extractable carbohydrate material was obtained from the oats than wheat. However, no essentially pure arabinoxylan fraction was obtained from the WSNP of oats by DEAE-cellulose fractionation whereas fractionation of the wheat flour WSNP resulted in two essentially pure arabinoxylan fractions. Ammonium sulfate fractionation of wheat flour amylase treated WSNP indicated that fraction 5 was predominantly an arabinoxylan; whereas, the oat flour and bran WSNP contained glucose as the component sugar in all ammonium sulfate fractions.

Selected ammonium sulfate fractions were combined and subjected to DEAE-cellulose fractionation. The results obtained were similar to the initial DEAE-cellulose-fractionation of the amylase treated WSNP.

The water insoluble non-starchy polysaccharides (WINP) present in oat flour and bran were also examined. The WINP were isolated from the layer of material on top of the prime starch after centrifugation of the four or bran-water slurry (high-protein layer). In this case, essentially pure arabinoxylan fractions were obtained after DEAE-cellulose fractionation of the oat bran WINP.

Greenbug Resistance in Oats

Norris E. Daniels

From 1970 through 1977, 4,343 oat selections from the U.S.D.A. World Collection were tested in the greenhouse for biotype C greenbug resistance. Of these selections 31 were found to be resistant (See Texas report).

In 1978, 464 selections were tested. Of these, nine had ratings of 3.2 to 3.8, table 1. Thirty to 40 seeds were planted per row in large flats. The plants, when about an inch tall, were infested with greenbugs. After the plants were heavily damaged, ratings of 1 through 6 were made. A rating of 1 = no damage; a rating of 6 = a dead plant.

Table 1. Resistant oat selections, Bushland, Texas, 1978.

P. I. Number	Designation	Source	Rating
258646	Sovetskii		3.3
264853		Yugoslavia	3.2
264856		Yugoslavia	3.5
264857		Yugoslavia	3.5
264860		Yugoslavia	3.2
280428	Sovetsky		3.3
280431	L' Govsky 1026		3.6
290021	Icar 878	Hungary	3.6
290026	Hatvani 187	Hungary	3.8

Resistance to the Cereal Leaf Beetle

Carrie Young, J. A. Webster, and D. H. Smith, Jr.
Department of Crop and Soil Sciences, and
USDA-SEA-Agricultural Research
Michigan State University
East Lansing, MI 48824

Two oat lines from crosses with P.I. 311677, a collection of *Avena sterilis*, have shown promise of increased resistance to the cereal leaf beetle in tests conducted during the past two years. Selection 12-8 came from a cross between P.I. 311677 x C.I. 521 and selection 13-16 from P.I. 311677 x C.I. 1625. Both C.I. 521 and C.I. 1625 are lines of *Avena sativa* that have been rated as moderately resistant in field screening tests. P.I. 311677 has a moderate amount of pubescence and has a moderate level of cereal leaf beetle resistance. Ten replications of these lines, and sibs and lines from other crosses, were grown in three large cages in the field. Adult cereal leaf beetles were placed in the cages at densities of $4/ft^2$, $2/ft^2$, and $1/ft^2$. Highly significant differences in larval feeding damage occurred both within entries in a cage and between cages. The use of field cages, which allows the control of the level of insect infestation, has proved useful in the identification of lines who resistance could easily be masked under heavier insect attack.

CHANGES IN THE OAT RUST NURSERY PROGRAMS AT BELTSVILLE, MD

R. A. Kilpatrick

The oat rust nursery programs, coordinated by U.S.D.A. at Beltsville will be changed in 1979.

A panel of oat investigators discussed the future of the oat rust nursery programs at a meeting in Minneapolis, Minnesota, November 7-8, 1978. The following recommendations were made to be effective September 1, 1979:

1. The UNIFORM OAT RUST NURSERY PROGRAM will be incorporated into the International Oat Rust Nursery (IORN). The Uniform Oat Rust Nursery will be discontinued after the 1979 nursery.
2. Objectives of the INTERNATIONAL OAT RUST NURSERY will be modified and revised:
   - A. To test new cultivars and promising selections for resistance to rusts
   - B. To include single gene lines for identifying new virulences and/or build-up of virulences of rusts in specific areas
   - C. To determine degree of effectiveness of resistant sources
   - D. To find new genes or gene combinations conditioning resistance
   - E. To provide information and material to research workers in other countries
   - F. To increase the number of locations
3. A letter with an enclosed questionnaire will be sent to all cooperators each year. The cooperator will be requested to return the questionnaire if they wish to continue in the program.
4. Submission of entries will not be restricted per location. However, the following information must be submitted with each entry: 1) reason for submitting (ex. resistance to stem or crown rust or both); and 2) priority.
5. Multiple entries per cross is discouraged
6. Mature, field resistance will receive greater attention
7. A preliminary report will be prepared in July each year. The comprehensive report, showing reaction of entries at all locations, will be prepared and distributed approximately 22-24 months after assembling seed into nurseries.

The panel recommended the above changes to increase the efficiency of the program by reducing the amount of work and to increase the effectiveness by providing greater participation and by obtaining more information. Comments on ways for improving the oat rust nursery program are encouraged and welcomed.

Cambios en los Programas de Experimentos de Royas en Lineas de Avena*

R. A. Kilpatrick
Traducido por Jane Scott

Los programas de experimentos de royas en avena, coordinados por el Departamento de Agricultura de Los Estados Unidos en Beltsville, van a ser cambiados en 1979.

Un comite de investigadores de avena discutió el futuro de los programas de experimentos de roya en avena en una reunión en Minneapolis, Minnesota, et, 7-8 de noviembre de 1978. Fueron hechas las siguientes recomendaciónes para que fueran efectivas a partir de 1º de septiembre de 1979:

1. El Programa Común de Experimentos de Royas en Avena (Uniform Oat Rust Nursery) desaparecerá como tal programa en 1979 ya que quedará incorporado en el Programa Internacional de Experimentos de Royas en Avena (International Oat Rust Nursery-IORN).

2. Los objetivos de los Experimentos Internacionales de Roya en Avena seran modificados y revisados con el fin de:

   A. Examinar nuevas líneas y selecciones que prometen resistencia a las royas.
   B. Incluir líneas con un único par génico para identificar neuvas virulencias y/o incremento de la virulencia de royas en áreas específicas.
   C. Determinar el grado de eficiencia de fuentes de resistencia.
   D. Encontrar nuevos genes o combinaciones de genes que condicionen resistencia.
   E. Proveer información y materiales a los investigadores de otros países.
   F. Aumentar el numero de localidades para evaluación de las líneas.

3. Cada ano, se enviarán a los cooperadores una carta incluyendo un cuestionario. Al cooperador se le solicitará devolver el cuestionario completo, si desea continuar en el programa.

4. No habrá limitaciones en el número de líneas de avena por localidad. Sin embargo, la siguiente información deberá ser suministrada para cada línea: 1) razones para incluirla (por ejemplo, resistencia a roya de tallo o roya de corona, o las dos); 2) prioridad de investigación.

5. No se recomienda la inclusión de varias líneas provenientes del mismo cruzamiento.

6. Se prestara mayor atención a aquellas líneas que tengan resistencia o tolerencia en el momento de la madurez.

7. Un informe preliminar será preparado en julio de cada año. El informe completo, mostrando la reacción de las líneas en cada localidad, será preparado y distribuído aproximadamente entre 22 y 24 meses despues de cósechar las semillas en los lugares de experimentación.

El comité recomendó los cambios mencionados para incrementar la eficiencia de el programa reduciendo la cantidad de trabajo, y para aumentar la efectividad proveyendo mayor participación y obteniendo más información. Toda sugerencia para mejorar los programas de Experimentos de Royas en Avena será bién recibida y atendida.

*--Oat Rust Nursery

Screening for Stem Rust and Crown Rust Resistance

P. G. Rothman

Oat crown rust -- The distribution of virulence within the aeciospore inoculum and subsequent urediospore inoculum in the buckthorn plots at St. Paul, Minnesota, was tested during 1978. Seedling reactions of key oat lines within 3 differential crown rust series to bulked collections of aeciospores and urediospores were compared to field readings recorded for these 3 series. Aeciospores were collected in mid-June, with a cyclone collector from about 300 feet of buckthorn hedge, artificially inoculated with teliospore bearing straw, overwintered from the previous year's nursery. Urediospores were collected in a similar manner, in early August, from a late planted section of the buckthorn nursery, which included most of the lines in these series.

The similar host reactions to the aeciospore and uredial spore inoculations, implies similar virulences for the 2 reproductive stages. No increase nor decrease in virulence was noted, but field reactions of the adult plants suggest that some differentials, especially in the Standard 10, exhibit field resistance.

No susceptible isolates have been found within the bulked aeciospores or urediospores with seedling virulence for the differentials Ascencao, Pc 39, Pc 55, Pc 57, or Coker 234.

BYDV Tolerant Lines -- The 13 recently released oat germplasm lines with excellent tolerance to BYDV were highly susceptible to both crown rust and stem rust. The lines planted among the buckthorn hedge and subjected to the inoculum load of spores generated by the inoculated hedge were killed by crown rust before heading. Likewise, the lines planted in the stem rust nursery did not head because of the spread of stem rust from the susceptible borders inoculated with races 31 and 87.

	Seedling reaction of Aeciospores	Seedling reaction of Uredispores	Field Reaction (7-12-79)
(10 Standard Crown Rust Differentials)			
1 Anthony	S	S	40MS-S
2 Victoria	S	S-MS	50MS-S
3 Appler	S	R-S	10MS
4 Bond	S	S	60S
5 Landhafer	S-R	S-R	40MR-MS
6 Santa Fe	R-S	R-S	60R-MR
7 Ukraine	R-S	R-MR,TS	40HR-R
8 Trispernia	R,TS	R	40R-MR
9 Bondvic	R	R,TS	70R-MR
10 Saia	R,TS	S-R	TR-HR
(Iowa B series of Supplement Crown Rust Differentials)			
1 Ascencao	R	R	20HR
2 Iowa 421	HR,TS	S-R	20HR-MS
3 H-382	R-S	R-S	60HR-MS
4 Iowa X475	S-R	R-S	50MS-S
5 AB 101	S-R	S-R	80S
6 Iowa X434	R-S	S-R	40R-MR
7 Pc 38	R,TS	R-S	30HR-MR
8 Pc 39	HR	HR	20HR
9 Coker 234	HR	HR	10HR
10 Pc 45	HR,TS	R-S	40HR-R
11 Pc 46	R	R	60HR-MR
12 Pc 50	S-R	S-R	40R-MR
13 Pc 57	HR	HR	30HR
(Canadian Pendek Backcross single gene lines)			
1 Pc 35	S-R	R	60S
2 Pc 38	HR	R	40HR-MS
3 Pc 39	HR	HR	10HR
4 Pc 40	S-R	R-S	80S
5 Pc 45	HR	HR-S	20HR-MS
6 Pc 46	R	R	60HR-MS
7 Pc 47	R,TS	R	50R-MS
8 Pc 48	R-S	S-R	20HR-R
9 Pc 50	S-R	S-R	40MR-S
10 Pc 54	R-S	R,TS	40R-MS
11 Pc 55	HR	HR	20HR
12 Pc 56	R-S	R,TS	50MR-S
13 Pc 38 and 39	HR	HR	30HR

THE ROLE OF BACTERIA IN THE RED LEAF DISEASE OF OATS

C. W. Roane, W. E. Kuriger, Jr., and T. M. Starling

We have previously alluded to the association of bacteria with the red leaf disease of oats (Roane & Starling 1975; Roane & Kuriger, 1976) but there is no proof that the bacteria play any role in the expression of red leaf symptoms. Red leaf of oats is generally attributed to the barley yellow dwarf virus (BYDV); therefore, an investigation was conducted by Kuriger (1978) to determine whether or not the associated bacteria contributed to symptom expression.

Bacteria in high numbers were present in field plants displaying red leaf symptoms. Species isolated from such leaves included *Pseudomonas coronafaciens* (*Pc*), the halo blight organism, *P. syringae*, *Erwinia herbicola* and several saprophytic pseudomonads. These organisms were used to inoculate oats before and after the plants were inoculated by aphids with BYDV. In addition, healthy oats were inoculated with isolates of bacteria alone and with combinations of Pc, *P. syringae* , *E. herbicola* and unidentified pseudomonads.

The BYDV alone caused red leaf of oats but none of the bacteria alone or in combination caused red leaf. Only *Pc* appeared to colonize oats and induce symptoms of any kind. Other bacteria and a prior infection of oats by *Pc*. Bacteria did not interfere with or enhance the development of BYDV-induced red leaf. The presence of BYDV in reddened leaves was demonstrated by enzyme-linked immunosorbent assay (ELISA) and by serologically specific electron microscopy (SSEM).

The evidence obtained in this investigation clearly demonstrates that bacteria have no role in red leaf symptom development, but their presence in high numbers strongly suggests why Manns (1909), Sechler et al. (1959), and Roane & Starling (1975) concluded that *Pc* and other bacteria played a role in red leaf symptom developement.

Literature cited:

Kuriger, W. E., Jr. 1978. The effect of *Pseudomonas* coronafaciens (Elliott) Stevens on winter survival of oats, and the role of bacteria and barley yellow dwarf virus in red leaf of oats. Ph. D. Dissertation VPI & SU. 161 pp.

Manns, T. F. 1909. The blade blight of oats. Ohio Expt. Sta. Bul. 210.

Roane, C. W., and W. E. Kuriger. 1976. The Pseudomonas coronafaciens syndrome of oats. Proc. Am. Phytopathol. Soc. 3: 291 (Abstr.).

Roane, C. W., and T. M. Starling. 1975. Are bacterial diseases a real problem? 1974 Oat Newsletter 25: 31.

Sechler, D. T., J. M. Poehlman, M. D. Whitehead, and O. H. Calvert. 1959. The barley yellow dwarf virus-bacterial blight complex on oats in Missouri in 1959. Plant Dis. Reptr. Suppl. 262: 351-353.

Rust of oats in 1978

A. P. Roelfs, D. L. Long, and D. H. Casper

Oat crown rust -- Crown rust was light for the second consecutive year in the southern states. A cool dry spring and resistant cultivars limited crown rust development. In early April, crown rust was heavy in the southern Texas nurseries, but rust spread slowly. No crown rust was found in north Texas in early May. By mid-June, traces of crown rust were found in commercial fields throughout the North Central States where warm temperatures and abundant moisture created conditions favorable for moderate to heavy crown rust development. In 1978, oat crown rust caused losses that were greater than in the past few years in the North Central States. Severities were as high as 80% in some late maturing western Minnesota and eastern North Dakota fields and caused losses of 5 to 10%.

Oat stem rust -- Oat stem rust was observed on March 23, in nurseries in San Patricio and Bee County, Texas. In early April, traces of stem rust were present in commercial fields in southern Texas. By early May, stem rust had spread northward into central Texas; however, it did not become as severe or as widespread as it was in 1977. Oat stem rust was also found in trace amounts in nurseries at Baton Rouge, Louisiana and Hartsville, South Carolina. By early June, traces of stem rust were present in central Kansas, and by late June, it had spread into Iowa, southern Minnesota, and eastern South Dakota. Some losses occurred in the late maturing fields of North Dakota and northwest Minnesota, but in 1978 crop maturity was more uniform than in 1977 when heavy losses occurred in late maturing oats. Most commercial cultivars remain susceptible to oat stem rust. Environmental conditions were adequate for epidemic development in 1978, but because the area initially infected in the northern states was smaller in size and infection occurred later in the season, rust damage was less than in 1977.

Among 1,167 isolates of oat stem rust identified from collections made in the U.S.A., race 31 comprised 85% of all isolates (Table 1) and was the most commonly identified race in all states except in Idaho.

Table 1. Physiological races of oat stem rust identified from collections made from oats in 1978.

State	Source	Number of Collec-tions	Number of Iso-lates	Percent of isolates of each race 1	2	7	20	31	61	86	87
Arkansas	Nursery	1	1					100			
Idaho	Nursery	2	5		100						
Illinois	Nursery	4	12					100			
Iowa	Field	44	122					95	5		
	Nursery	7	20					100			
Kansas	Field	4	12					50	50		
	Nursery	1	3					33	66		
Louisiana	Nursery	1	3					100			
Michigan	Field	2	5					100			
	Nursery	1	3					100			
Minnesota	Field	80	218					98	2		
	Nursery	18	46					80	20		
	Wild oats	6	14					78	21		
Missouri	Nursery	3	9					100			
Montana	Field	3	7					100			
	Nursery	1	1					100			
	Wild oats	2	6					100			
Nebraska	Field	1	3					100			
North Dakota	Field	36	100					99	1		
	Nursery	8	22					100			
	Wild oats	6	17					70	29		
Oklahoma	Field	2	6					17	83		
	Nursery	1	3					100			
Pennsylvania	Nursery	1	3					100			
S. Carolina	Nursery	2	6					100			
South Dakota	Field	14	38					97	3		
	Nursery	12	23					78	22		
	Wild oats	1	3					100			
Texas	Field	5	11			18		54	27		
	Nursery	124	364	2	4	1		69	24		
	Wild oats	2	6	17	33			17	33		
Wisconsin	Field	24	67					100			
	Nursery	4	8					100			
U.S.A.	Field	215	589			*		95	4		
	Nursery	191	532	2	4	1		74	20		
	Wild oats	17	46	2	4			72	22		
	Total	423	1167	1	2	*		85	12		
Ontario	Nursery	15	38				29		5	16	50

* Less than 0.6%

III. CONTRIBUTIONS FROM OTHER COUNTRIES

OAT BREEDING IN ARGENTINA

Hector Jose Martinuzzi and Hector Leopoldo Carbajo
Barrow, Argentina

In the 1976-77 season, oats were seeded on 1,400,000 ha. in Argentina. The average yield was 1384 kg/ha. for a total production of 530,000 tn. The province of Buenos Aires is the principal region of oat production in Argentina, accounting for 62% of the total area seeded and 31% of the total production. Other important oat growing regions are Entre Rios and Santa Fe, provinces. Only 30% of the total area sown is harvested for grain, because the principal use of oats in Argentina is for grazing.

Within *Avena sativa* (white oats) the most popular cultivars are Suregrain and Buck Epecuen. La Prevision 13 and Buck 152 are the most important of the *A. byzantina* (yellow oats) cultivars. Overall, Suregrain is the most important cultivar.

Since grazing is the principal use of oats in Argentina, the breeding program concentrates on improvement of traits important to grazing quality. Secondary attention is given to high grain yield and adequate quality for the milling industry.

Greenbugs and crown rust, which affect the yield of forage, are important in the region around the Chacra Experiment Station. For this reason one of the objectives of the local breeding program is to introduce material and make crosses that are potentially of value for their resistance to greenbugs and crown rust. For *P. coronata*, material introduced from Wisconsin, which has, in some cases, good resistance to the races present in the area is used. Some material, in the F_6 generation, has high resistance to both stem and crown rust and was derived from a cross of C.I. 8360 x Stormgull. This material, however, does not have good grazing characteristics, but will be useful as a source of resistance in future breeding efforts.

The greenbug problem is more difficult. It is complicated by the existance of differences biotypes of the aphid. Some lines in early stages of development appear to have good resistance to some of the biotypes under conditions of artificial infestation in the greenhouse. This material will be field tested. Material being used in the program to develop greenbug resistant varieties includes C.I. 1580, P.I. 186,270 and Acencao x Russian-77.

Frost and drought are important in some regions of Argentina but not in the region of the Chacra Experiment Station. Thus these traits are considered in a minor way, and limited material is being handled with the objective of improving frost and drought tolerance.

Oat Marketing in South Australia

H.J. Sims
Australian Barley Board
Adelaide, South Australia

Australian farmers for many years have shown an interest in organized marketing of primary products through marketing boards. As the Australian Constitution does not give the Australian Parliament specific power to legislate on marketing matters, any marketing board to cover all Australian production of a commodity can be set up only after the passing of complementary legislation in the Commonwealth Parliament and in all State Parliaments. The Australian Wheat Board operates under this type of legislation.

Barley and oat marketing boards have been set up in various States under State legislation. Under such legislation there are four barley marketing boards covering five States. Western Australia, Queensland, and New South Wales each have a State Barley Board, while the Australian Barley Board operates in South Australia and Victoria under joint legislation effective in these two States.

Although oat marketing boards have operated in several States in the past, New South Wales was the only State with such a board in 1977-78. However, at the request of farmers in South Australia, the Parliament of that State in late 1977 amended the South Australian Barley Marketing Act 1947-73 to authorize that Board to market oats in South Australia, commencing with the 1978-79 crop.

Under the amended Act, all oats harvested in South Australia after the appointed date, namely 1st October 1978 "... shall not be sold or delivered to any person other than the Board except where

- the oats are retained by the grower for use on the farm where it is grown,
- the oats have been purchased from the Board,
- the oats are sold or delivered to any person with the approval of the Board,
- the oats are sold at any auction market in accordance with a permit granted by the Board,
- the oats the subject of trade, commerce or intercourse between States are required by the owner thereof for the purpose of trade, commerce or intercourse between States; or
- oats sold to a person where these oats are not resold by that person otherwise than in a manufactured or processed form including ... the processed form of chopped, crushed or milled oats."

Thus delivery of oats to the Australian Barley Board is not compulsory in all circumstances. A grower may sell oats to any person who will use these oats (e.g. racehorse owner, dairy farmer) or who will manufacture or process these oats before resale. Oats cannot be sold to a person who will resell these oats as whole grain.

When designing the procedures for receiving and marketing oats, the Board consulted representatives from all sections of the oat industry, from the growers to the end users. For the 1978-79 season, standards for two grades of oats, as set out below, are being used. Standards for a third grade have also been drawn up, for future use if required.

The main factors which determine the grade are variety (cultivar), density (bushel weight), screenings and amount of foreign grain. Attention is also paid to weed seed contamination.

Oat Grade Standards, 1978-79. South Australia

	No 1 Grade	No 2 Grade
Varieties Eligible	Swan, Irwin, West, Kent.	Any variety except Saia.
Density	Min. 52.5 kg/hl , (Approx. 42 lb/bus)	Min. 50 kg/hl (Approx 40 lb/bus)
Screenings, 1.5 mm screen	Max. 5 percent	Max. 10 percent
Other Cereals, including wheat, barley and rye	Max. 1 percent	Max. 6 percent

During the receival season, a special grade, designated No 4 Grade, was set up for the receival of oats with a greater than acceptable amount of wheat. Such oats had been grown on wheaten stubble, often with the intention of being grazed, but were not required for this purpose because of the very favourable season. In other instances, on account of wet sowing conditions, self sown wheat plants had not been controlled adequately.

Receivals of oats up to 15th January, 1979, totaled 29,670 tonnes. Most crops had been harvested by this date. Of the receivals, 6,724 tonnes (22.7 percent) was in No 1 Grade, 20,843 tonnes (70.2 percent) was in No 2 Grade and 2,103 tonnes (7.1 percent) in No 4 Grade.

Oat Breeding in South Australia

A. R. Barr

Department of Agriculture and Fisheries
South Australia

Oat Industry in South Australia

Oats : Area and Production South Australia

Particulars	Unit	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
Total area	hectare	252 348	214 810	194 603	197 917	212 457	304 000*
Grain area	hectare	152 241	134 861	119 037	116 708	129 990	212 720*
Production	tonne	142 325	111 673	107 273	90 294	55 362	223 620
Yield/hectare	tonne	0.93	0.83	0.90	0.77	0.43	1.05
Onfarm feed	tonne	53 000	45 000	NA	NA	NA	NA
Hay	hectare	56 391	34 951	34 445	40 923	NA	NA
Hay yield/ hectare	tonne	3.4	3.36	2.86	2.79	NA	NA

NA - not available yet or no longer collected
* - estimates only

1978 was an extremely good year in South Australia. Above average yields were recorded and grain quality was very good. Both rusts were widely recorded but were generally not severe. The most damaging pathogen was undoubtedly the cereal cyst nematode Heterodera avenae. Stem nematode (Ditylenchus dipsaci) although rare in South Australia, is now spreading. Serious damage was reported in isolated crops.

Varieties

Oats: Varieties, South Australia

Variety	Origin	Proportion of Total Area		
		1975-76	1976-77	1977-78
		%	%	%
Avon	Western Australia(W.A.)	16.00	15.47	13.84
Coolabah	New South Wales (N.S.W.)	0.96	1.24	1.52
Irwin	W.A.	8.47	6.77	6.00
Kent	W.A.	4.55	4.62	3.70
Kherson (incl.Early)	Russia via U.S.A.	6.51	6.58	5.32
New Zealand Cape	Selection from Algerian	1.62	1.90	1.51
Orient	Victoria	2.12	1.85	1.92
Swan	W.A.	50.77	50.12	53.46
West	W.A.	n.a.	0.98	3.04
Other (incl.unspec.)		8.99	10.47	9.69

Varieties which are increasing in South Australia are Cassia (ex. N.S.W. 1974), West (ex. W.A. 1975) and Saia. Many enquiries regarding the new Western Australian variety Moore have been received.

Breeding Programme

The oat breeding programme, which was initiated in March 1977, has the following major objectives :

1. Higher grain yield.
2. Improved plant type i.e. lodging and shattering resistant.
3. Resistance to the cereal cyst nematode (Heterodera avenae)
4. Resistance to the stem rust (Puccinia graminis f.sp. avenae)
5. Improved grain quality - increased protein and/or oil%
   - better milling quality.

Features of the programme thus far follow :

I. General

Duplicate F2 nurseries were sown at 2 sites in 1978. Some very promising lines were selected from crosses of the following parents to Australian parents.

F2 characters / Introduced parent	Stem rust Resis.	Shattering Resis.	Height	Lodging Resis.	Grain type
Stout (USA)	good.	ex.	short	ex.	Many = Swan
Dwarf OT184 (Can)	ex.	av.	dwarf	ex.	V.short,plump
Elan (USA)	good	av.	short	good	av.
Hudson (Can)	ex.	av.	mid	good	av.
Trio (USA)	good*	av.	tall	fair	av.
Maris Oberon (UK)	none*	good	mid	good	av.

* except if rust resis. Aust. parent used.

Following the irrigated oversummer F3 generation, these crosses will enter F4 yield trials in winter 1979.

II. Cereal cyst nematode (Heterodera avenae) resistance breeding

Lines reported in European work to have resistance to this nematode and tested with a South Australian population of Heterodera avenae. The Avena sativa lines C.I. 2154, C.I. 2863 and C.I. 5188 were susceptible. Cyst numbers were very similar to those found on cv. West, a susceptible Western Australian variety. No cysts developed on A. sativa cv. New Zealand Cape or A. sterilis Cc 4658. Field tests in South Australia have shown that a small number of cysts often develop on New Zealand Cape. This, coupled with information that New Zealand Cape's resistance is governed by two recessive genes (Cotten and Hayes (1972) Euphytica 21: 538-542), has led to the choice of Cc 4658 as the donor parent in a backcross program to cv. West. This complements the Victorian work with Swan and Cc 4658.

Selected F3 lines of West x New Zealand Cape and West x Mortgage Lifter are under test as a "back-up" to the Cc 4658 programme.

III. Resistance to Stem (*Puccinia graminis* f.sp. *avenae*) and crown rust (*Puccinia coronata* f.sp. *avenae*)

Oat rust samples are collected from all oat growing areas in S.A. and "typed" by Sydney University. The results for the 1977/78 and 1978/79 surveys are shown in the following tables.

Stem Rust Race	Virulent on Host genes	No. Samples 1977/78	1978/79
1	-	14	55
2	Pg 3	28	48
4	Pg 1 Pg 2	3	1
5	semi Pg 3	8	2
7	Pg 1 Pg 3	2	-
8	Pg 2 Pg 3	-	2
11	Pg 2	-	2
42	Pg 1 Saia	1	-
59	Pg 1 Pg 3 Saia	-	1
	Total	56	111

Crown Rust Race	1977/78	1978/79	Virulent on Anthony	Appler	Ukraine	Saia	*A. sterilis* Pc lines
237	0	20	√	√	-	-	-
226	0	8	√	√	√	-	-
240	0	1	√	-	-	-	-
227	0	1	√	√	√	√	-
230 + Pc 38	0	1	-	√	√	-	-

The S.A. stem rust flora is relatively avirulent, when compared to the Eastern States and overseas countries. F2 selections from 1978/79 contained various combinations of Pg 1, 2, 3, 4 and 9 - it appears that provided Pg 4 and/or pg 9 are present, lines from this nursery will have useful resistance. Material in the 1979/80 F2 nursery will include Pg 8, 9, 11, 12, 13, 14 and *A. sterilis* genes which also will be highly effective.

West, (Pg 2, Pg 4) Cassia (Pg 1) Saia (A. *strigosa* undesignated) and Moose (resistance not established fully yet) showed good resistance at most sites to stem rust. These are the only varieties grown in South Australia with stem rust resistance.

Saia is the only oat variety frown in S. A. that has any crown rust resistance. Saia has been grown in S. A. for 2-3 years. It is perhaps surprising to find crown rust isolates virulent on a number of resistance genes. Even more surprising is the finding that crown rust races present in N.S.W. can attack the most recently identified *A. sterilis* resistant lines from the Middle East.

IV. Grain Quality Selections

F3's were selected from a number of crosses between Australian varieties and high protein/oil lines. Husk percentage is generally high in the high oil crosses but some good grain types exist in the protein crosses. Unfortunately the high oil parental lines have several other bad characters i.e. poor straw strength, a tendency to shatter, late maturity and susceptibility to both rusts. F2's of the high protein lines appear much more "civilized". Analysis of these lines is underway.

V. Crossing

The approach crossing technique was used in the spring of 1977. Success rate was highly variable - ranging from 0 to 90% seed set in emasculated flowers, with a mean over approximately 50 crosses of 45%. However, from mid-November onward till the end of crossing, i.e. 2nd January, the success rate dropped greatly to a stage where only one third of all crosses attempted set any seed. It was noticeable that as the daylength and temperature increased -

(1) the amount of pollen produced decreased rapidly

(2) the number of flowers per panicle declined, as did the proportion of those flowers mature at any one time;

(3) flowers and pollen heads dessicated more rapidly.

Open bottles of water were taped inside the crossing bag in an attempt to alleviate the latter problem. This was of some assistance.

Another period of crossing was undertaken in autumn 1978. Success rate was very low and pollen shed was poor. All but one cross of those which appeared to set seed (i.e. husk appeared above the level of the cut glumes) failed to produce viable seed - in fact a husk with no endosperm developed.

Our experience with approach crossing indicates that a bountiful supply of pollen is necessary for satisfactory success rates and that such a pollen supply is rarely achieved 'out of season'. Hand pollination is now being tried for the out-of-season crosses.

Experience with approach crossing in Spring 1978 has reinforced our conclusions of 1977. Definite differences in the performance of lines as ♀/♂ parents were noted. "Cut flower solution" was used in the bottles containing the ♂ parent - this did not markedly increase the duration or amount of pollen shed. Generally success rate was higher in 1978 - we must have learnt something!

A number of lines introduced from Iowa, Minnesota, Manitoba and the 1977 IORN were included in the crossing programme this year. West, Swan, Irwin, OXB 6, Moore, Coolabah and to a lesser extent Cassia, Avon, OXB 198, Golden Orient and Kent were the Australian parents used.

New South Wales Oat Crop 1978-79

R. W. Fitzsimmons
New South Wales, Australia

It is estimated that oats was sown on 540,000 hectares of which 334,000 were harvested for grain for a production of 500,000 tonnes. This is the second highest production on record (record production was 744,000 tonnes in 1966) but the estimated yield is a record 1.50 tonnes/hectare compared with 1.36 tonnes/hectare in 1966.

Better returns from livestock products stimulated a greater interest in oats this year. However higher rainfall than average during the winter either prevented grazing because of the wet soil or because it induced sufficient growth of other pastures so that grazing of oats was not necessary. Thus the grazing of oats was less than in most years.

An early break in the season enabled oats intended for grazing to be sown in February and March. The main oat variety sown early was Cooba, but the late maturing variety Blackbutt is becoming very popular on the Tablelands and the better rainfall areas of the Slopes. Its outstanding grain recovery after heavy grazing, combined with its strong straw and tolerance to stem rust commend it to farmers. Further oat sowings were delayed by very dry weather in April but good rains in early May enabled sowings (for grain only) to continue but for a short period only, as further rain in mid to late May held up sowing operations. By early May the early sown crops were providing excellent grazing for stock.

Disease incidence during the season was low. Some crops were affected by powdery mildew during the winter but the disease disappeared in the spring. Temperatures in the spring were cool and this prevented any major outbreaks of stem rust. Despite protracted rain in early summer, oat crops suffered little weather damage prior to harvest.

Breeding Oats at the University of Passo Fundo

E. L. Floss and A. C. Baier

Rio Grande Do Sul, Brazil

Oats were grown for grain on some 20,000 ha, with yield being around one metric ton per ha during the last 3 years in Rio Grande do Sul, Brazil. Additional acreage, especially of A. strigosa, is grown for pasture during winter and spring. Climatic conditions are similar to the Southern States of the U.S. During winter there are some light frosts. High humidity and rainfall prevail during most springs.

Presently the most potentially destructive diseases are barley yellow dwarf virus, stem rust, and leaf rust.

The importance of oats for this region is increasing since soil born diseases on wheat like Ophiolulus, Helminthosporium and soil born viruses are getting more important. This besides other factors is increasing the need for diversification from wheat.

The program at the university started 2 years ago with material sent by Prof. H. L. Shands of the University of Wisconsin and material obtained from the National Wheat Research Center. The assistance of Prof. Shands, Donald J. Schrickel and Milton McDaniel and financial support from Quaker is acknowledged. The main objectives are to select and increase high yielding, resistant and locally adapted varieties, both for grain and pasture.

During 1978 the program included selection from segregating populations in F_2, F_3 and F_4, and yield trails and seed multiplication of the outstanding lines. Soil acidity was neutralized by lime application. The seeding was done manually between June 24 and July 7, 1978. The nurseries and segregating populations were planted in 5 m (0.4 m apart) rows. Climatic conditions were good and favored the development of a vigorous crop and also a severe incidence of leaf rust, B.Y.D.V. and stem rust late in the season. Only tolerant or resistant plants and lines were selected.

Collection of F_3 bulks:

Selections were made in 220 F_3 bulk populations at the end of November. 686 single panicles were selected.

F_4 single panicle selection:

Single panicle selections were made in 515 lines from 84 different crosses.

403 panicles were selected and 19 lines were bulked for preliminary trials in 1979.

1978 screening nursery:

483 oat lines, introduced from the University of Wisconsin, former nurseries and from the National Wheat Research Center were observed in 1978. The evaluation was done considering crown rust, stem rust and B.Y.D.V. incidence, plant height, yield, flowering date and agronomic characteristics. Coker, FLA, TAM and X lines were the most outstanding for grain production, while X lines and strains of Avena strigosa most frequently looked better for forage.

Preliminary trial:

The 23 most outstanding lines from the 1977 nursery were included. The parcels had 4 rows of 5 m, spaced by 0.2 meter and were replicated 4 times.

The following lines were the most outstanding: X2-055-1, X2-505-4, Flórida 501, X63-16 (67AB 112), X61-7 (2912-15), X2060-5, Flórida 500, 08356 CI 8234.

Regional Yield Trials:

The most outstanding lines from the 1977 Preliminary Trial were evaluated in a Regional Trial planted in Passo Fundo, Vacaria, Ibirubá, Cruz Alta, Ijuí and Bagé, in the state of Rio Grande do Sul. Bagé represents the Southern range country. The other 5 locations are in the Northern part of the state where most soybeans are grown. The soil originally was acid, high in toxic aluminum and low in calcium and phosphorus; most areas were treated with limestone.

The trial was organized in Randomized Blocks with 4 replications, parcel of 5 lines of 5 m (0.2 m apart) with 40 apr seeds per m^2. The trial in Passo Fundo and Ibirubá was done by the University, in Vacaria by the National Wheat Center, in Ijuí by the Cotrijui, in Cruz Alta by the FECOTRIGO and in Bagé by the State Research Service.

Table 1 shows that X64-46 (AB 113) had the highest average without being the best at most places. This high average is especially due to its stable resistance to leaf rust, barley yellow dwarf virus and tolerance or resistance against, stem rust in bage where there was a heavy infection which was not scored. 200 kg of seed of this line are available.

Seed increases:

Since this is the only oats breeding program in this country we need to have a small amount of seed to hand over to the seed growers association and the cooperatives. Both organizations are highly interested in the new seeds.

Last year a total of 20 kg from 7 different lines were increased and 776 kg of foundation seed was harvested.

Table 1. Yield in kg/ha, and incidence of leaf rust and barley yellow dwarf virus in the Regional Oats trial in Rio Grande do Sul, Brazil in 1978

Yield kg/ha								Average
No.	Cultivar	P. Fundo	Vacaria	Ibirubá	C. Alta	Ijuí	Bagé	
1	Suregrain	2.370	3.508	2.853	1.636	3.047	1.032	2.408
2	Coronado	2.225	3.095	2.785	2.366	2.272	835	2.263
3	Coker 4239	4.526	2.800	3.969	2.373	2.925	780	2.895
4	Coker 227	2.943	3.458	3.910	2.520	2.857	1.020	2.785
5	Coker 234	2.532	3.545	2.812	1.663	2.465	910	2.321
6	X 63-46 (AB 113)	4.351	3.458	4.097	2.458	3.182	2.470	3.336
7	X 63-46 (AB 596)	2.969	3.029	3.038	1.900	1.003	2.515	2.409
8	X 63-46 (OIR 125-28)	1.760	3.054	4.537	2.725	2.212	2.247	2.756

Leaf Rust		Locations					
No.	Cultivar	P. Fundo	Vacaria	Ibirubá	C. Alta	Ijuí	Bagé
1	Suregrain	10MR	30MS	40MS	60MS	40MR	20MS
2	Coronado	20MR	15MS	40S	40MR	60MS	60MS
3	Coker 4239	20R	10MR	40MR	20MR	20MR	60MS
4	Coker 227	20MR	10R	10R	20R	40MR	60MS
5	Coker 234	40MR	10MR	20MR	40MR	20R	60MR
6	X63-46 (AB 113)	10MR	10MR	10R	10R	10R	10MR
7	X63-46 (AB 596)	5MR	5R	20R	10R	20MR	10MR
8	X63-46 (OIR 125-28)	10MR	10MR	20R	20R	40R	20MR

Barley Yellow Dwarf Virus		Locations					
No.	Cultivar	P. Fundo	Vacaria	Ibirubá	C. Alta	Ijuí	Bagé
1	Suregrain	S	S	S	S	MS	S
2	Coronado	S	S	S	S	S	S
3	Coker 4239	MS	S	S	MS	MS	MS
4	Coker 227	MS	MR	MS	MS	MS	MS
5	Coker 234	MS	S	MS	MR	MR	MS
6	X63-46 (AB 113)	MR	MR	MR	MR	MR	MR
7	X63-46 (AB 596)	MR	MR	MR	MS	MR	R
8	X63-45 (OIR 125-28)	MS	MR	MR	MR	MR	R

Long Peduncled Dwarf Oats

V.D. Burrows

A major advance was made by Dr. R.I.H. McKenzie at Winnipeg in the development of an oat suitable for growing under conditions of high fertility when he isolated a dwarf mutant from Harmon. This dwarf (OT 184D) which was produced by irridating Harmon with fast neutrons, possesses a short peduncle which does not allow the panicle to emerge completely from the leaf sheath. Many basal florets, especially in the panicles of tillers, fail to pollinate and high yields of OT 184 are not realized. I found that the peduncle could be elongated and yields increased by treatment of the plant with gibberellic acid (50-100 ppm) when it was in the flag leaf stage of growth. Because spraying of the crop at this stage of growth is not likely to be a practical solution to the problem, I attempted to find a gene which would accomplish the same result. The gene would have to modify the rather intractible dominant dwarfing gene and elongate the peduncle at the time of flowering. After searching the progeny of 126 different hybrids we found the gene(s) we were looking for in a very tall dormoat strain. It appears to be a recessive (genetic study in progress) and to be expressed in the later stages of stem elongation. The plants are obviously dwarfed but the peduncle is elongated and the panicle is free of the leaf sheath. The new dwarf possesses a normal sized panicle carried on short thick culms. Originally seed size was small in OT 184D x dormoat hybrid but this problem is being overcome by further breeding. The combination of the McKenzie dwarfing gene with the long peduncle gene we have found may make it possible to subject oats to intensive management without inducing lodging.

Powdery Mildew of Oats

R.V. Clark

Powdery mildew (Erysiphe graminis D.C. ex Merat) of oats rarely occurs in the field in Ontario, and it is of no economic importance. However, occassionally a severe epidemic develops in the greenhouse. This happened recently when a group of oat cultivars and strains from various tests and locations were grown for other disease assessments. Approximately 150 individuals replicated 4 times were evaluated for mildew severity from the early to late heading stage and the cultivars Roxton and Leanda showed trace and light amounts of mildew respectively. All other cultivars ranged from susceptible to extremely susceptible.

Oat in Western Canada 1978

R.I.H. McKenzie, C.C. Gill, J.W. Martens and D.E. Harder

According to Statistics Canada, 1,740,000 hectares of oats were sown in the three Prairie Provinces in 1978, which was a reduction of 600,000 hectares from the previous year. Yields average 2.01 tonnes per hectare on the 1,397.000 hectares harvested for grain which is about 4% below the yields obtained in 1977. Seeding was generally early except in southern Alberta where heavy rains delayed seeding until June. Wet harvesting weather delayed the harvest over most of the prairies but particularly in Alberta.

Barley yellow dwarf

A severe epidemic of BYD occurred on cereal crops in southern Manitoba extending from Brandon in the west to the limit of cultivation in the eastern part of the province. Farmers were reporting losses on oats and two-rowed barley up to 50% or more, and estimated losses on wheat average 24% per late-seeded field. Heavy rains in the second half of May delayed seeding and many flooded crops were reseeded because of rain damage. This large area of late cereals was highly attractive to the aphid vectors which migrated into the province at the end of June. Conditions were particulary favourable for secondary spread of the disease within fields. Aphid populations consisted chiefly of _Sitobion avenae_ (Fabricius) and _Rhopalosiphum padi_ (L.). The predominant virus strain was aphid non-specific.

West of Brandon in southern Manitoba, and in eastern Saskatchewan, cereal crops were seeded early and BYD damage was minimal. In parts of Alberta, the incidence of BYD infection was above normal and symptoms on cereal crops appeared earlier than usual. Virus isolates from Alberta were tentatively identified as _Schizaphis graminum_-specific, aphid non-specific, or _Rhopalosiphum padi_-specific.

Oat Stem Rust

Oat stem rust was first observed in southern Manitoba in mid-July. Light infections occurred thoughout Manitoba and eastern Saskatchewan by the third week in August but crop losses were confined to late-seeded fields in eastern and central Manitoba where infections of up to 80% of the stem area were observed at the end of August. Physiologic races NA27 = 9,13,15,16,a/1,2,3,4,8,9 (67%) and NA16 = 2,4,9,13,15,16,a/1,3,8, (14%) continued to predominate in Western Canada while race NA25 = 8,13,16,a/1,2,3,4,9,15 continued to be the most common in Eastern Canada. The cultivar Hudson, which comprised 25% of the oat hectarage in the rust area of Western Canada continues to be the only commercial cultivar moderately resistant to all the races of stem rust occurring in Western Canada. No resistant cultivars are available for Eastern Canada.

Oat Crown Rust

Oat crown rust did not cause serious damage in most oat fields in Manitoba in 1978. There was heavy infection in some late-sown fields but estimation of damage was complicated by the widespread occurrence of barley yellow dwarf virus. Increased production of Hudson, which is resistant to most races, helped to reduce crown rust damage.

No new races of crown rust have been found that are of serious concern in breeding for crown rust resistance. Combinations of resistance genes Pc38-39 and Pc55-56 have remained highly effective in providing resistance to crown rust.

ONTARIO SCREENING PROGRAM OF EUROPEAN OAT LINES

Leslie P. Shugar
W.G. Thompson and Sons Limited
Blenheim, Ontario
Canada NOP 1A0

W.G. Thompson and Sons Limited initiated its cereal breeding program in April, 1978. The breeding effort primarily involves winter wheat (70%) and six-row barley. However, we have an exclusive contract with Weibulls of Sweden to screen their advanced lines and varieties of two-row barley, spring wheat and oats and have the rights to their material for licensing and marketing in Canada.

After only one growing season, we have two Weibull oat lines, TO 7901 and TO 7902, entered in the Eastern Co-operative Oat Test for licensing purposes. We will be placing oat lines in the Western Co-operative Tests that are better adapted to that area. In the past, European oat material has tended to break down post-anthesis. However, from all reports throughout Canada, the Weibull lines tested have remained upright to maturity, with little leaf or stem blotch (septoria). Some lines also carry the Landhafer R resistance to crown rust.

We will be growing the Eastern Co-operative Oat Test at our home research farm (1,200 acres) 15 miles east of Blenheim, on the north shore of Lake Erie.

Oat Breeding in Ecuador

Jorge A. Paz

Institute Nacional de Investigaciones Agropecurrias
Estacion Santa Catalina
Quito, Ecuador

The experiment station of Santa Catalina has made important contributions to the agriculture and livestock industry of the mountainous areas of Ecuador through the development of new oat varieties that are suitable for production of seed and forage. At present, promising lines include C.I. 6969, ICA Bacata, Sac, CH-UxC. I. 6969, Rucklands, Delfin-9, Delfin-10, Delfin-11, Delfin-13, and Delfin-19.

In the year 1967 the station released the varieties INIAB-67 and Santa Catalina-67 which were characterized by their resistance to *Puccinia graminis*, P. coronata, and barley yellow dwarf as well as their high yields of grain and forage of 60 quintals per/hectar and 50 TM per/hectar, respectively. The recently released variety Santa Catalina-76 has very good grain and plant type with an average height of 140 centimeters, with strong straw, but has some degree of susceptibility to the rusts and to barley yellow dwarf.

Analysis of Character Association in Grain Oats

D.S. Katiyar, B.D. Patil and U.S. Mishra
Indian Grassland and Fodder Research Institute
Jhansi, India

Four grain yield components, viz. number of grains per panicle, grain weight per panicle or panicle field, thousand grain weight, and number of spikelets per panicle along with days to 50% bloom and number of tillers per plant were studied at the Indian Grassland and Fodder Research Institute, Jhansi, India, in oats (Avena sativa Linn.). Metroglyph and index scores procedures (Anderson, 1957; Mehra and Anderson, 1961) were used to determine the character association in 92 cultivars of oats.

A wide range of variability was observed in all the six characters. Range of each character value was divided in to four grades, i.e. very low, low, medium and high. Character association analysis revealed four groups. They were as follows:

Group - one: Twelve cultivars belonged to this group, possessing very low and low values for number of spikelets, 1000 grain weight, number of grains per panicle and panicle yield, and very low to medium grades for the remaining characters.

Group - two: This group possessed seventeen cultivars showing low grades for number of spikelets per panicle, and tiller number and very low to medium grades for the remaining characters.

Group - three: Comprised thirty nine cultivars ranged between low to high grades for panicle number, low to medium grades for number of grains per panicle and panicle yield, and very low to high grades for flowering and tiller number per plant.

Group - four: Constituted twenty four cultivars showing medium to high grades for number of spikelets per panicle very low to medium grades for 1000 grain weight and low to high grades for remaining characters.

Certain cultivars showed several combinations of very low, low, medium, and high grades of the characters. Association of 1000 grain weight with number of spikelets per panicle and days to 50% flowering with tiller number appeared independent. There was a tendency of association between number of grains per panicle and number of spikelets per panicle. Days to flowering appeared to be independent of all the panicle characters. Increased number of spikelets was associated with increased expression of characters like number of grains per panicle and panicle yield.

All the cultivars ranged between 1 and 15 for index scores. There were very few cultivars (13) with low score values; the majority of the cultivars (68) had intermediate index score values, and a few had high index score values. Very few cultivars showed either high or very low scores for all the panicle characters; while most of them showed combinations of low and high values of these characters. The majority of the cultivars appear to have originated as a result of introgression between two extreme types.

A Study of Regeneration Capacity in Oats

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

Oats is a well known nutritious rabi cereal and fodder crop, and occupies a prominent place among the green fodder crops. It fits well into our crop rotation. It grown rapidly and attains high vegetative growth in the short period from October to April. It is a highly nutritious crop with ME 693 K Cal/Kg. and protein 15.33% of D. M. (Crampton and Harris, 1969). It is generally grown for a single cut, but there are varieties which have good regeneration capacity and give more than one cutting. The multicut varieties give a regular supply of green fodder for longer periods. Keeping this in view selected oat varieties were studied for there regeneration capacity.

Twenty-four varieties were grown in a randomized block design with three replications at the farm of the Indian Agricultural Research Institute during rabi 1977-78. The plots consisted of 11 row, 30 cms apart and a row length of 5 meters. The central 9 rows were subdivided into 3 sub-plots of 3 rows each. The three sub-plots were randomized in each main plot. Two cuttings, one 80 days after sowing and a second at 50% flowering was taken in one sub-plot; in the other sub-plot only one cutting at 50% flowering was taken, and the third sub-plot was left for grain.

The green and dry fodder yields for one and two cuttings and grain yields are given in Table I. The results have shown that there is reduction in the green fodder yields for all the varieties when two cuttings are taken as compared with the yields for single cuttings, except in variety 43556. But it is just the opposite in the case of dry fodder yields, which are greater when two cuttings are taken than when a single cutting is taken. It is interesting to find that two cuttings not only give a regular supply of green fodder but also more dry fodder yield.

With a single cutting, varieties in order of merit for green fodder yields were 34587 (562.88 q/ha), IGFRI-3021 (488.88 q/ha) and IGFRI-2688 (481.55 q/ha); and in two cuttings, 43556 (414.88 q/ha), 35701 (381.55 q/ha) and 29933 (370.44 q/ha).

In dry matter production, the varieties in order of merit was 34587 (134.41 q/ha), IGFRI-3021 (108.09 q/ha) and H-163 (103.04 q/ha) in single cuttings and 29933 (146.08 q/ha), 34587 (136.38 q/ha) and 36818 (135.67 q/ha) in two cuttings.

For grain yield production, which is a limiting factor in forage crops, the highest three varieties were 29933 (40.39 q/ha), IGFRI-2688 (38.13 q/ha) and 36818 (37.33 q/ha).

To summarize, 34587, with highest green and dry fodder yields combined with sufficient grain production, is recommended as a single cut variety. On the other hand 29933, with the highest dry fodder yields, and grain yields, but slightly less green fodder yield, is recommended as a multicut dual purpose variety.

Table 1. Green fodder, dry fodder and grain yield in 24 oat varieties.

No.	Variety	GREEN (Qtls/ha) I Cut	GREEN (Qtls/ha) II Cut at 50%	GREEN (Qtls/ha) Total of I & II cut	GREEN (Qtls/ha) At 50% Fl. cut	DRY (Qtls/ha) I Cut	DRY (Qtls/ha) II cut at 50% Fl.	DRY (Qtls/ha) Total of I & II cut	DRY (Qtls/ha) At 50% Fl. cut	Grain Yield
1.	IGFRI-3021	173.99	155.55	329.55	488.88	19.71	34.22	109.83	108.09	18.66
2.	X-27	162.88	162.88	325.99	351.77	23.34	36.92	120.58	69.93	35.06
3.	4263	166.66	181.55	348.22	414.88	21.48	27.83	98.26	77.87	10.93
4.	35701	218.44	162.88	381.55	418.44	30.34	38.81	118.47	95.27	35.59
5.	55196	203.77	155.55	359.33	392.66	27.61	37.06	132.73	84.61	35.59
6.	25232	166.66	159.33	325.99	411.11	21.84	29.47	104.12	80.62	21.33
7.	H-114	151.77	170.44	322.22	351.77	17.87	38.34	110.42	70.70	35.06
8.	35750	129.55	96.22	225.99	311.11	20.72	22.77	89.62	67.04	27.46
9.	29933	173.99	159.33	370.44	248.22	25.12	39.83	146.10	39.69	40.39
10.	96571	199.99	114.88	314.88	422.22	27.99	26.80	116.17	90.01	34.66
11.	13185	181.55	148.22	329.55	411.11	27.23	29.88	115.86	84.48	34.13
12.	36818	203.77	151.77	355.55	366.66	28.52	35.66	135.67	72.08	37.33
13.	54807	199.99	166.66	366.66	373.99	28.65	36.66	133.20	87.25	34.13
14.	43556	155.55	259.33	414.88	340.66	24.18	43.56	134.33	71.12	13.33
15.	Kent	173.99	170.44	344.44	337.11	23.76	41.17	130.30	73.75	29.33
16.	13294	192.66	177.77	362.88	373.99	24.60	36.44	120.73	78.08	32.79
17.	34587	199.99	151.77	351.77	562.88	28.21	37.44	136.38	134.41	34.13
18.	N.P. Hyb-2	181.55	148.22	329.55	366.66	24.60	33.09	110.24	75.75	36.39
19.	54800	125.99	188.88	314.66	399.99	18.19	31.78	109.21	95.95	12.26
20.	39059	170.44	185.11	355.55	381.55	21.59	44.72	130.94	76.69	33.73
21.	96559	103.77	170.44	277.77	414.88	14.06	28.68	84.38	77.87	14.66
22.	IGFRI-2688	140.66	233.33	373.99	481.55	17.03	55.99	138.75	101.65	38.13
23.	H-54	177.77	122.22	299.99	322.22	25.27	25.86	104.15	70.14	26.13
24.	H-163	193.11	118.44	311.11	448.22	26.82	23.87	105.93	103.04	23.46
	C. D. at 5%	81.77	50.44	79.77	127.99	1.25	0.87	2.70	0.31	10.13

COMPARATIVE PERFORMANCE OF CERTAIN ELITE LINES OF OATS

P. L. MANCHANDA and RANJIT GHOSH
Division of Genetics
Indian Agricultural Research Institute
New Delhi

Oats are grown in India both for their nutritious grain and high quality fodder. It is a rabi cereal fodder and is generally grown in areas with limited irrigation facilities.

Nearly 600 lines available at this Institute were screened from the fodder point of view and 20 high yielding elite lines including a check (H-114) were grown in a randomized block design with three replications at eleven locations during 1975-76 and at nine locations during 1976-77 in rabi season. The performance of different varieties in different locations for two seasons is presented in Tables I and II. The results show that the varieties behave differently under different environments.

The average performance of different varieties for the two years is given in Table III. The lowest yield (130.2 qtls/ha) was recorded at Hanumangarh during the year 1975-76 and at Karnal (182.7 qtls/ha) in the year 1976-77 while highest yield (767.5 qtls/ha) was recorded at Hissar in the year 1975-76 and at Delhi (725.0 qtls/ha) in the year 1976-77. This is due to the seasonal fluctuations.

The material was evaluated at Lucknow under saline conditons. The three highest yielding varieties at Lucknow, namely E.C. 55196 (357.7 qtls/ha), H-114 (353.2 qtls/ha) and E.C. 35701 (351.0 qtls/ha), are suitable for saline soils.

At Hanumangarh (Rajasthan), with low rainfall, the three highest yielding varieties were H-114 (156.6 qtls/ha), E.C. 4263 (153.8 qtls/ha) and E.C. 96559 (151.0 qtls/ha). These varieties are suitable in a moisture stress condition.

On the basis of overall performance under normal conditions in 20 environments the first five varieties are: i) E.C. 4263 (426.2 qtls/ha), ii) E.C. 54807 (421.4 qtls/ha), iii) E.C. 34587 (418.4 qtls/ha), iv) E.C. 13294 (417.8 qtls/ha) and v) H-114 (407.3 qtls/ha) which are all similar in yield.

The average yield during the year 1975-76 was 411.5 qtls/ha and 371.2 qtls/ha during 1976-77. This shows that there were low yields during the year 1976-77 as compared to 1975-76.

Special mention is made of the variety H-114 from Haryana, which is suitable for both saline soil as well as in limited moisture conditions and is also a high yielder on the basis of over all performance under different environments.

These varieties will be further evaluated under the All India Coordinated Project Research on Forage Crops.

Table 1. Green yield of 20 oats varieties (qtls/ha) 1975 - 1976

S. No.	Varieties	Delhi	Mathura	Hissar	Ludhiana	Sriganga -nagar	Lucknow
1.	N.P. Hyb.-2	549.94	296.08	673.82	446.06	566.61	293.30
2.	E.C. 54807	666.00	272.19	816.59	501.61	799.92	264.47
3.	E.C. 36818	669.37	255.30	734.37	552.16	683.26	268.86
4.	E.C. 96571	627.71	179.42	849.92	560.49	716.59	267.75
5.	E.C. 43556	633.27	272.19	936.02	534.39	644.38	287.19
6.	E.C. 29933	433.29	257.19	601.62	439.40	533.28	299.97
7.	E.C. 35701	649.93	269.97	742.15	433.84	649.93	351.07
8.	Kent	616.60	306.63	896.02	407.73	661.04	326.63
9.	E.C. 34587	669.37	249.41	1016.57	489.39	683.26	313.30
10.	E.C. 54800	663.82	217.75	777.70	445.50	672.15	283.86
11.	X - 27	691.59	338.29	700.49	557.72	705.48	311.63
12.	E.C. 39059	624.93	341.07	803.81	458.28	733.26	300.52
13.	E.C. 13294	649.93	279.41	869.36	548.27	683.26	287.19
14.	E.C. 96559	633.27	251.08	627.72	383.85	583.27	255.53
15.	E.C. 4263	688.82	226.64	772.15	364.40	633.27	246.08
16.	H - 114	677.71	313.85	684.93	504.94	766.59	353.29
17.	E.C. 13185	641.60	268.30	897.13	356.07	666.60	327.74
18.	E.C. 25232	558.27	269.97	691.60	353.85	644.38	268.30
19.	E.C. 35750	583.27	261.08	716.60	383.85	627.71	281.63
20.	E.C. 55196	677.71	350.52	538.28	428.84	705.48	357.74
	Mean	630.32	273.82	767.34	457.53	667.99	297.30
	C.D. at 5%	106.74	86.82	186.42	197.21	67.73	81.01

Table 1 (Continued)

Kanpur	Hanuman -garh	Baraut (Meerut)	Durgapura (Rajasthan)	Jodhpur
274.97	112.21	488.84	171.64	309.19
336.07	137.20	527.72	197.20	438.28
342.18	137.20	427.73	200.53	380.51
283.86	139.98	494.39	209.42	358.29
329.96	116.65	361.07	163.87	397.18
232.19	59.43	377.74	101.65	251.08
293.30	149.98	494.39	202.75	279.41
299.41	102.76	499.95	193.86	367.18
348.29	163.87	433.29	236.64	389.96
305.52	130.54	327.74	156.09	283.86
311.63	133.32	527.72	166.09	345.52
299.41	133.32	522.17	242.19	328.85
348.29	127.76	433.29	206.09	339.96
299.41	151.09	458.16	154.98	389.96
317.74	153.87	427.73	198.86	401.07
354.40	156.65	505.50	199.42	354.96
329.96	122.21	444.40	216.08	437.73
305.52	130.54	461.06	177.76	368.29
256.64	120.54	455.51	193.31	290.52
262.75	123.32	538.83	271.63	293.30
306.58	130.12	460.36	193.00	350.26
53.29	42.66	53.95	91.47	57.60

Table 2. Green fodder yield of 20 oat varieties (qtls/ha) 1976-1977

S. No.	Varieties	Delhi	Kanpur	Lucknow	Karnal	Hissar	Jodhpur	Durgapura (Rajasthan)	Indore
1.	N.P. Hyb.-2	698.11	503.99	231.44	198.11	481.44	351.11	236.66	184.77
2.	E.C. 54807	757.33	709.22	216.66	207.44	455.55	339.99	251.88	199.22
3.	E.C. 36818	716.66	533.99	211.88	188.88	499.99	370.77	274.77	175.22
4.	E.C. 96571	714.77	569.22	210.77	170.33	507.33	326.99	328.55	159.66
5.	E.C. 43556	762.88	641.77	212.99	179.66	525.88	225.55	261.11	255.55
6.	E.C. 29933	566.66	555.11	246.99	150.33	429.55	274.11	144.44	195.88
7.	E.C. 35701	740.66	634.44	184.66	176.11	470.33	296.66	235.88	185.55
8.	Kent	764.77	539.55	185.22	181.44	566.66	324.44	249.99	188.88
9.	E.C. 34587	731.44	656.22	200.77	177.77	511.11	310.77	266.66	209.22
10.	E.C. 54800	788.88	571.11	174.11	168.55	425.88	195.60	175.55	233.33
11.	X - 27	681.44	499.99	194.77	157.77	533.33	306.22	208.11	203.66
12.	E.C. 39059	618.44	616.22	196.33	174.11	536.99	300.33	238.88	203.33
13.	E.C. 13294	673.99	611.77	212.22	174.11	507.33	289.22	247.44	183.33
14.	E.C. 96559	659.22	695.11	175.55	224.11	470.33	211.88	221.11	283.33
15.	E.C. 4263	814.77	690.33	227.44	216.66	636.99	392.99	277.77	181.44
16.	H - 114	725.88	623.99	177.77	190.77	499.99	313.33	261.11	181.44
17.	E.C. 13185	748.11	534.77	219.66	172.22	511.11	357.77	196.99	182.22
18.	E.C. 25232	851.77	576.66	223.33	207.44	492.55	339.99	270.33	201.11
19.	E.C. 35750	699.99	522.22	209.99	161.11	511.11	353.33	208.11	209.99
20.	E.C. 55196	844.44	671.11	229.66	177.77	436.99	322.22	249.99	205.22
	Mean	728.01	597.85	207.11	182.73	500.52	310.16	240.27	201.12
	C.D. at 5%	184.57	167.83	61.42	69.55	146.08	111.72	113.54	87.48

Table 3. Green fodder yield in fodder oats (qtls/ha)

S. No.	Varieties	1975-76	1976-77	Mean
1.	N.P. Hyb.-2	380.24	360.70	370.47
2.	E.C. 54807	450.66	392.16	421.14
3.	E.C. 36818	422.86	371.52	397.19
4.	E.C. 96571	426.17	373.45	399.81
5.	E.C. 43556	425.11	383.17	404.14
6.	E.C. 29933	271.94	320.38	296.16
7.	E.C. 35701	410.61	365.54	388.08
8.	Kent	425.26	375.12	400.19
9.	E.C. 34587	453.94	383.00	418.47
10.	E.C. 54800	387.68	341.63	364.66
11.	X-27	435.41	348.16	391.79
12.	E.C. 39059	435.26	366.45	400.86
13.	E.C. 13294	473.24	362.43	417.84
14.	E.C. 96559	380.76	367.58	374.17
15.	E.C. 4263	402.78	429.80	426.29
16.	H-114	442.93	371.79	407.36
17.	E.C. 13185	427.98	365.36	396.67
18.	E.C. 25232	384.50	395.40	389.95
19.	E.C. 35740	379.15	359.48	369.32
20.	E.C. 55196	413.49	392.18	402.84
	Mean	411.50	371.27	391.88
	C.D. at 5%	105.74	78.99	92.37

Breeding Oats For Increased Forage Yield

S.N. Mishra
G.B. Pant University of Agriculture & Technology,
Pantnagar, UP, India

Oats are becoming increasingly important as a forage crop in North India where there are sufficient irrigation facilities and lower temperatures. However, it has been noticed over the years that due to increasing temperatures on the season advances, especially after the post flowering period (April-May), that late maturing cultivars do not set good seed in sufficient amount and, therefore, suffer substantial losses of grain yield and hamper successful seed production. Although, the late maturing cultivars produce high tonnages of green matter, their nutritive quality is poor as compared to the early and medium duration varieties. With this objective in mind the oat breeding program has been oriented primarily to produce cultivars having early to medium maturity, along with high yields of green matter, dry matter, and seed.

Under our conditions the cultivars 'Portal' and 'Orbit' have been producing high yields of green forage but very low seed yields because of their very late maturity which causes them to flow during the months when hot winds blow. Therefore, an intensive crossing program was initiated to incorporate the earliness of 'Rapida', 'Montezuma', and 'Kent', which flower 20 to 50 days earlier. Kent, being a widely grown cultivar of high adaptability, was included in all the crosses to incorporate its panicle type, kernel plumpness and disease resistance. Section for earliness ranging from 70 to 110 days (days to 50% heading), was made, keeping in mind the plant type of 'Portal' and 'Orbit' and panicle type of 'Kent' in Portal/Kent and Orbit/Kent crosses, and plant type of Kent and earliness of 'Rapida' and 'Montezuma' in Kent/Rapida and Kent/Montezuma crosses.

During winter season 1977-78, 35 F_5 progenies of four crosses involving the above mentioned parents were compared for green matter and dry matter yields. The test was carried out in a randomized complete block design with three replications. Planting was done in rows spaced 25 cm in plot size of 4.5 m^2. Harvesting was done at 50% flowering stage. The results of the test are presented in Table 1.

Highest green forage yield was obtained from the progeny OX 8F_5-13-4 (858.25 g/ha) which was equal to one of the five parents used in the crosses. However, this progeny took 13 days less to 50% heading. In general, the performance of the F_5 progenies was greater than their respective parents with respect to green forage and dry matter yields. The performance of the cross OX 9 (Kent/Rapida) improved considerably with respect to green forage yield, dry matter yield and resistance to blight to which the parent 'Rapida' was highly susceptible.

On the basis of per day production (yield efficiency index), the highest yield was obtained by the progenies OX 12 F_5-13-2 (8.63 q/ha/day) and OX 8 F_5-44-13 (8.57 q/ha/day). It appeared that most of the progenies had more yield efficiency than their parents except the progenies of the cross OX 9 where also they produced more than the parent 'Rapida'.

The progenies generally produced more good quality seed because of their earliness than their respective late parents. On the basis of the superior performance of these crosses it is hoped that in two to three years a few very promising cultivars will be developed and released to the farmers for general cultivation.

Table 1. Comperative performance of parents and their F_5 progenies for days to 50% heading (DH), green forage (GF) and dry matter (DM) yields, and yield efficiency index (YEI) in 1977-78 Pantnagar oat tests.

	Pedigree	DH	Yield q/ha		YEI	
			GF	DM	GF (q/ha/d)	DM (q/ha/d)
PARENTS:						
Rapida		79	318.12	67.26	4.03	0.85
Montezuma		101	577.20	138.30	5.72	1.37
Orbit		128	858.25	206.46	6.71	1.61
Protal		128	651.12	122.10	5.09	0.95
Kent		107	806.52	109.92	7.54	1.03
Mean		108.6	6642.24	128.81	5.82	1.16
PROGENIES:						
OX $1F_5$-16-2	Kent/Montez.	103	813.85	187.14	7.90	1.82
OX $8F_5$-7-1	Portal/Kent	103	806.52	152.29	7.83	1.48
OX $8F_5$-13-4	Portal/Kent	115	858.25	162.72	7.46	1.41
OX $8F_5$-44-6	Portal/Kent	105	817.62	176.71	7.79	1.68
OX $8F_5$-44-13	Portal/Kent	95	813.85	196.02	8.57	2.06
OX $9F_5$-49-3	Kent/Rapida	72	477.30	105.67	6.63	1.47
OX $9F_5$-49-8	Kent/Rapida	80	477.55	101.23	5.97	1.26
OX $9F_5$-241-2	Kent/Rapida	105	702.85	154.54	6.69	1.47
OX $12F_5$-13-2	Orbit/Kent	96	828.72	189.36	8.63	1.97
OX $12F_5$-24-7	Orbit/Kent	106	828.72	176.71	7.82	1.67
OX $12F_5$-24-11	Orbit/Kent	106	817.62	176.71	7.71	1.63
Mean		98.7	749.35	145.6	7.54	1.63

Performance of Some Varietal Mixtures in Oats

K.R. Solanki and C. Kishor
Department of Forage Research,
Haryana Agricultural University,
Hissar - 125004 (India)

Research workers on Forage crops at Aberystwyth, Wales, U.K. have observed that when two genotypes are grown in a 50:50 mixture in the same plot, both the components of the mixture increase, relative to their pure stand values to give yields in excess of those expected on an additive basis. Keeping this in view an experiment was planned to study the effect of 50:50 mixture of the approved varieties of oats which are generally grown in monoculture in North India.

The experimental material for the present study consisted of six varieties i.e., Algerian, Kent, Weston-11, FOS 1/29 Fulghum and HFO 114 and their fifteen combinations. The mixtures of the pairs of varieties were made by mixing equal numbers of seeds on the basis of 1000-grain weight in a 1:1 ratio. All the 21 entries were grown in a randomised block design using three replications, with a plot size of 20 sq. meters. At the 50% panicle stage, plots were harvested and weighed to determine green fodder yield. An estimate of dry fodder yield was obtained by drying a 1.0 Kg. sample in an oven for 48 hours.

The data obtained on green and dry fodder yield and percentage increases over monoculture as well as over the superior check are presented in Table 1. It was revealed that among monocultures, variety Weston-11 gave the highest (667.4 q/ha) green fodder yield, whereas the highest (139.4 q/ha) dry fodder yield was recorded for FOS 1/29. Among mixtures, four combinations giving higher green fodder yield than their respective monocultures were recorded. Six mixtures showed increases in dry fodder yields. When increases was calculated over the superior check, it was observed that two combinations showed increases in green fodder, and three mixtures, increases in dry fodder yields. The mixture Kent + HFO 114 was highest for green fodder yield (6.51%) and for dry fodder yield (21.13%) over its monocultures. The same culture also showed the highest increase (14.18%) in dry fodder yield over the superior check. It is therefore, suggested that these types of mixtures should be grown to get additional forage yields without adding to the cost of production

Table 1. Inter-varietal competition trials in oats.

Sr. No.	Entries	Yield (q/ha) Green fodder	Yield (q/ha) Dry fodder	Monoculture Green fodder	Monoculture Dry fodder	Superior check Green fodder	Superior check Dry fodder
1.	Algerian	393.2	78.64				
2.	Kent	610.0	122.40				
3.	Weston-11	667.4	129.00				
4.	FOS 1/29	652.0	139.42				
5.	Fulghum	566.6	108.90				
6.	HFO 114	620.0	130.56				
7.	Algerian + Kent	526.6	120.98				
8.	Algerian + Weston-11	582.0	111.86				
9.	Algerian + FOS 1/29	599.8	121.94				
10.	Algerian + Fulghum	513.2	124.34		14.37		
11.	Algerian + HFO 114	543.4	106.82				
12.	Kent + Weston-11	673.4	139.08	0.89	7.24	0.89	
13.	Kent + FOS 1/29	593.4	122.58				
14.	Kent + Fulghum	623.0	119.74	2.24			
15.	Kent + HFO 114	663.2	158.16	6.51	21.13		14.18
16.	Weston-11 + FOS 1/29	450.0	100.70				
17.	Weston-11 + Fulghum	576.6	130.64		1.27		
18.	Weston-11 + HFO 114	703.2	143.32	5.36	7.16	5.36	2.87
19.	FOS 1/29 + Fulghum	566.6	113.32				
20.	FOS 1/29 + HFO 114	650.6	147.28		5.63		5.63
21.	Fulghum + HFO 114	503.4	106.82				
22.	S.E. (q/ha)	9.2	7.3				
23.	C.D (q/ha)	34.4	27.69				
24.	C.V. %	25.9	10.52				

CHAURI PATTI (Forage oat)

Kirpa Shanker, Ranjit Ghosh and Charan Singh

It is an established fact that for the ruminants, the forage crops are judged on the basis of percentage of crude protein rather than for protein quality. In this respect among the winter cereals, forage oats excels any of the cereals both for crude protein and dry matter yield. The green fodder is very nutritious and especially suitable for horses and milk cattle. It is for this reason that it is rapidly gaining popularity on military farms and with the progressive cultivators of the Punjab, Haryana, Uttar Pradesh and Maharashtra states of India.

Research relating to the development of improved varieties of forage oats in India hitherto was confined to introduction and adaptation of some of the older exotic varieties. These varieties possessed attributes of local adaptation with tolerance to the pests and disease complex. The yields were consistent but on the average quite low.

The research project for the development of improved varieties of forage oats at the National Dairy Research Institute was commenced in 1976. One of the major objectives of this program was to exploit diverse genetic variability for forage characters in the germplasm of oats available with the National Bureau of Plant Genetic Resources, with a view, if possible, to isolating varieties possessing superior yields and wider adaptability. For this purpose, the existing oat germplasm collection comprising 475 genetic stocks was intensively assessed under field conditions for several traits. Regional trials were conducted in collaboration of IARI, New Delhi at eight centers representing climatic conditions of sub-tropical Northern India. This resulted in the isolation of 20 elite strains. Further screening in the local trials resulted in the isolation of one accession, No. EC 54807.

The variety E.C. 54807 being leafy, juicy and having distinctly broader and lengthier leaves was further subjected to repeated cycles of intra-population selection. The resultant variety has been designated as "Chauri Patti" an identifying character for the variety understandable in the local language. This variety is also being included in the All India Co-ordinated trials for yield and quality tests from 1977 onwards.

The variety "Chauri Patti" showed superiority for green as well as dry matter yields as compared to the released varieties, Kent and H-114. Chauri Patti gave on an average 8.5% and 13.5% higher dry matter yield over H-114 and Kent respectively. The average green fodder yield is about 520 quintal/hectare as against 450 q/ha of H-114, the best check.

The main agronomic characteristics, identifying characters and cultural practices of Chauri Patti are as follows:

1. Chief attributes:

Green fodder yield	520 q/ha
Dry fodder yield	147 q/ha

Days to 50% flowering	125
Height of the plant in cm	140
Length of the inflorescence in cm	31
Total number of tillers in one metre	43
Total number of nodes per plant	5
Leaf length in cm	58
Leaf breadth in cm	2.5

2. Other attributes:

This variety can be easily recognized by its exceptionally broad and long leaves making plants richer for leafiness. Such varieties possess higher protein, minerals and vitamins, characteristics of highly nutritive green fodder.

3. Identifying characters:

Medium late, deep green color of the leaves. Leaves distinctly **broad**. Erect inflorescence and bolder spikelets.

4. Cultural practices: Normal practices of cultivation, preferably three to four discings followed by planting. The sowing should be done by the 2nd week of October to the 1st week of November in rows 25 to 30 cm apart with seed rates ranging from 90 to 110 kg/ha depending upon whether the fodder is to be cut once or twice in a season. If the soil has already been manured by 10 to 15 tonnes FYM/ha then 60 to 80 kg of nitrogen in two split doses along with 50 kg of phosphorus should be applied for optimum results. The crop needs a first irrigation 40 days after sowing. Subsequent irrigations are needed every 25 to 30 days. One irrigation at boot stage is very beneficial. The crop should be harvested at the dough stage for feeding and silage.

The crop can also be sown in mixtures with mustard field pea and turnip in the space between rows. It can also be interplanted in widely spaced crops like hybrid Napier, Guinea grass and Setaria sphecelata.

Comparing Oats and Triticale in the Production of Grain, High Protein Forage, and Hay

Herb Floyd and Frank Zillinsky

Throughout much of the developing world, livestock and grain production are associated on the same farms. Since many are small subsistence farms, forage for livestock and food for people must somehow be produced on the same land. Increasing numbers of livestock and people have created the need for a crop which could feed both during a single growing season.

Trials were established in Western Algeria in 1973-74 to determine both the grain and forage potential of a single strain of triticale. In these trials, triticale replaced oats in a vetch/oats crop used for hay production. Observations revealed that triticale had certain advantages over the oats commonly used for this purpose in North Africa. Triticale was less susceptible to lodging and therefore supported the vetch companion crop better. More important, the leaves on triticale remained green even through the soft dough stage of grain formation, whileas oat leaves tended to dry up earlier. This suggested that triticale might be better suited than oats for high-quality hay production under such conditions. Yields of about 12 t/ha of dry triticale-vetch hay were obtained under rainfed conditions (400 mm annual rainfall) on good soils at altitudes up to 600 mm. At about 1000 m, hay production declined to about 2.5 t/ha. Grain yields from the same triticale strain, Cinnamon, were generally disappointing.

Various other trials have been carried out to determine the ability of both triticale and oats to recover after clipping for forage and produce a subsequent grain crop. Dr. Matthew McMahon, of CIMMYT, carried out clipping trials under irrigation with triticale and oats in 1973-74, in Sonora, Mexico. Only one variety of oats, Kanota, was compared with one strain of triticale DRIRA, at 0, 1, and 2 clippings. Unclipped triticale produced considerably more grain but only slightly more hay than oats. After clipping the oats appeared to recover more rapidly and produced more forage but slightly less grain than the triticale. The grain yield of oats after the second clipping was almost as high as from the unclipped plot, while that from triticale was about 50% of the unclipped plot.

Extensive clipping experiments conducted at the CIANO station near Obregon, Mexico, in 1974-75, to test forage and grain producing potential of 150 strains of triticales and five strains of oats (included as checks) used three criteria:

a) the ability to recover and produce high protein forage (H.P.F.) and grain after repeated clippings;

b) the ability to produce grain without clipping; and

c) the ability to produce a single cut of hay (at the soft-dough stage).

Fertilizer equivalent to 200 kg/ha of N and 50 kg/ha of P_2O_5 was applied with 100 kg/ha of N being applied before planting and 50 kg/ha in split applications, one after each of the first two clippings. Irrigation was carried out as needed. Harvested material was dried, weighed, and analyses for protein were made in CIMMYT laboratories at El Bataan.

Observations on the Clipping Experiments

1. Triticales yielded considerably more grain than the oat strains included as checks. The top 10% of the triticale lines (15) produced an average of 6946 kg/ha compared to 3178 kg/ha for the top oat variety.

2. The high nitrogen applications induced severe lodging in the oats. However, clipping greatly reduced the incidence of lodging, and practically no lodging occured in oats after three clippings. The oats showed a greater tendency to lodge than the triticales. No lodging was observed in triticales after one clipping.

3. Growth and recovery rates among oat varieties were greater after clipping than among triticales; oats also produced more H.P.F. The tendency to lodge also affected grain yields; those of triticale generally declined with each successive clipping while the opposite was true with oats. For example, whereas the top five triticales averaged 3115 kg/ha after four clippings (vs. 7883 kg/ha unclipped), the top oat variety produced 4956 kg/ha (vs. 3178 kg/ha unclipped).

4. Lodging among the oats influenced hay production as well but to a lesser extent. Although the average production of hay from the triticales and oats was similar, the top 15 triticale strains produced almost 2 t/ha more than the top oat strain (20,581 kg/ha vs. 18,844 kg/ha).

5. The H.P.F. production of the average triticale was about half as much as the oats. Even the best forage producing triticales attained only 2.5 t/ha of H.P.F. compared to 3.2 t/ha for the best oats. Combined with better grain production in the oats after four clippings, this gave oats a very significant advantage over the best triticales for multiple grazing or clipping.

6. Maximum protein production was obtained with the hay cut. The top triticale yielded 23,567 kg/ha of dry hay containing 1,885 kg of protein while the top oat variety produced 18,844 kg/ha containing 1696 kg of protein.

7. Taking current prices of 44% soybean oil meal at $27.28/100 kgs, the value of protein is about US$0.62/kg and the hay yields above would provide protein worth $1,167 and $1,051/ha respectively.

8. However, multiple clipping followed by a grain harvest results in less production of total protein than with a single hay cut. Under multiple clip-

ping oats outproduced the triticales. The average protein production of oats was 1389 kg/ha while that for the top five triticales was 1087 kg/ha.

9. The strains of triticale used in these experiments had been selected for visually estimated forage potential from the CIMMYT summer nurseries at El Bataan and Toluca; individual selections had generally been made of plants with a tall, leafy appearance in the hope that these might prove to be interesting for forage production. No measurement criteria were used in the selection process. Yet management practices applied during the cutting experiment divided the material roughly into four categories:

a) grain types - strains with good grain production potential and some ability to recover after one or two clippings of H.P.F.;

b) hay types - strains with good hay potential but poor or only fair grain production potential;

c) H.P.F. types - strains with ability to recover fairly rapidly after clipping and hence good H.P.F. but poor grain potential; and

d) strains which had only mediocre potential for either grain, H.P.F., or hay production; these were discarded on the basis of the data collected.

10. Several observations illustrate this categorization:

a) none of the top grain producing triticales were among the top H.P.F. producing strains;

b) only 3 of the top 15 grain producers were good hay producers;

c) grain production among the top hay producing triticales was mediocre (4578 kg/ha) compared to the top grain producers (7880 kg/ha);

d) two of the triticale strains which averaged over 6 tons of grain/ha yielded 20 tons of hay/ha; however, neither of these strains recovered well after clipping; and

e) oats are highly productive in H.P.F. and grain after multiple clippings and would appear to be good hay producers if lodging and rusts could be eliminated.

In separate grazing experiments carried out near Hermosillo, in Sonora, the same year, one hectare plots of oats and triticale were grazed consecutively for 10 days by 28 young bulls. Estimated yields of green forage obtained from clipped samples indicated that the oats produced 13 t/ha (green weight) at the time of the first grazing. The estimate for triticale was 18 t/ha on a sample taken 10 days later. Irrigation water and ammonia fertilizer were applied at the end of the first grazing periods. An interval of about 3 weeks was provided to allow regrowth before the plots were grazed a second time. Although the plots appeared to be badly trampled, regrowth appeared to be at least as good after grazing as after clipping. The plots were allowed to mature after the second grazing and were harvested for grain, with the yield of oats considerably more than the yield of triticales.

Both fenced plots were surrounded by ryegrass which the farmer traditionally used under a rotation grazing system. Recovery after grazing appeared to be most rapid in ryegrass, slightly slower in oats, and even more slowly in triticale.

Conclusions

The results obtained through these various trials suggest interesting prospects for additional development for a multipurpose plant for both oats and triticale. Ideally, strains could be developed which would recover quickly from one or several clippings or grazings and still produce either a satisfactory grain yield or hay crop. Future research could take the form of a) selection for rapid recovery after clipping among the better grain producing strains and b) selection for better grain production among lines having good recovery after clipping. In view of the absence of any correlation between grain yield and hay yield, different varieties could be developed for these purposes.

No selection pressure had been applied previously on either the oats or triticales used in the experiments. It is possible that considerable improvement could be achieved in both crops if efficient selection techniques could be developed.

Only spring-type, daylength-insensitive strains of triticale were included in the trial. Perhaps semi-winter or daylength-sensitive spring types might make better forage producers. It would also be interesting to try triticale hybrids involving crosses between spring x winter on insensitive x sensitive or winter x insensitive parents.

Another interesting line of research might involve changes in cutting or grazing management in order to develop optimum production. It may be that fewer cuttings spaced over a greater time interval would result in increased production of both grain and forage.

Oats in Turkey

M. Kemslettin Haksel
Agricultural Research Institute
Eskisehir, Turkey

According to 1977 statistics, the total oat growing area in Turkey is 230,000 hectars and total production is 370,000 metric tons. Average yield per decar is 160.6 kilograms. As these values are compared to recent years, a gradual decrease in oat growing acreage is seen; however, average yield per unit area has increased due to improved agricultural techniques. The main reasons for the decrease in acreage are the lower price of oats as compared with wheat and barley, and the sensitivity of oats to adverse climatic conditions.

In our region, oats are seeded in fall and in spring; however most farmers don't want to seed oats in spring because of its susceptibility to spring drought. The main reason for farmers not to seed winter oats is that we don't yet have a sufficiently cold resistant variety. We have a certified variety in our institute with a moderate winter hardiness, but it can be damaged by hard winters. For the reasons mentioned above, the total acreage of oats has been gradually decreasing.

If we consider that oats have been widely used in recent years, especially for human food and in the livestock feed industry, total production should be increased, and this can be achieved only by developing varieties with high yielding ability, cold resistance, and good quality.

In our oat breeding program, with the major aim of higher yield per unit area, the greatest problem has been the difficulty in obtaining cold resistant varieties. Last year, we asked for material from many national and international organizations. Among nearly 400 varieties, most of which were spring type, there were some, though few, promising to be winter resistant. Twenty-four of these varieties were included in a preliminary yield trial. (But there wasn't a very cold winter last year). We hope to obtain out of these lines a variety which will be adapted to our regional conditions.

We had 10 lines in yield trials coming from recent years' studies. Cimarron, 66 A/76, 66 A/85, 66 A/84 and Mustang which had seemed to be promising last season, gave lower yields than standard this year. Opposedly, Grey Winter Lateria, Sporen, and Full Branch which had given lower yields than standard last season, were better than standard this year. Consequently, Apak (2-3) variety, which is our local standard, seems to be the most stable variety in terms of both yield and winter resistance.

In addition to these introduction studies we have a breeding program. Last year, crosses were made among parents selected for high yielding ability, winter resistance, and earliness. The program is continuing in the same direction.

This year, the yields obtained were lower as compared to last year's results. The probable explanation of this is quite a long duration of warm and dry weather during the growing season and excessive rainfall during maturation. No important disease symptoms were seen. Occasionally, some smut and stem rust were observed but they didn't reach serious levels. Also some signs of leaf burn were seen.

Current Progress in the Breeding of Naked Winter Oats at the Welsh Plant Breeding Station, Aberystwyth, Dyfed, UK

J. Valentine

The feeding value of naked or huskless oats is similar to that of maize, and appreciably better than that of wheat and barley (Moule, Bull. tech. Inf. Ingrs. Servs agric. 1966, No. 212, 591-597). The development of naked oats as a commercially important crop has however been prevented by deficiencies in yield and by certain other problems including vulnerability to threshing damage and poor storage of seed. Against this background, results obtained in 1978 indicate that encouraging progress is being made at Aberystwyth in the development of naked winter oat varieties.

Six F_5 lines from crosses of husked winter oat varieties with selected lines from the cross Pendrwm x Nuprime had groat yields generally similar to those of the husked varieties Pennal and Peniarth (Table 1), and well above that of one line of the single cross retained for comparison. No direct comparison with the spring naked oat Nuprime can be made because of this variety's extreme susceptibility to winter-kill.

The naked character was not fully expressed in the second cross lines, but even so groat content, and therefore feeding potential, was greatly enhanced. In addition there was extensive variation in the expression of nakedness between single ear progenies derived from these lines; thus further progress by selection for this attribute can be expected.

The second cross naked lines were generally taller than Peniarth and Pennal (Table 2). More favourably, some success has been achieved in recovering satisfactory levels of winter hardiness, with some second cross lines possessing similar resistance to Pennal. Notably, the naked lines had better resistance to mildew than Pennal, and to a lesser extent than Peniarth. A further favourable feature is that there appears to be scope for improving grain size, as indicated by the variation in thousand groat weight values.

The six second cross lines have been advanced to yield trials at four locations in 1978-79, along with previously untested lines showing high expression of the naked character. One of the latter group has, for the first time, broken the unfavourable association between grain nakedness and the multiflorous habit responsible for the production of a high proportion of small grains. Although panicles of the same line produced under artificially-lit glasshouse conditions had some multiflorous spikelets, the proportion was low. This indicates that number of florets in this line may be relatively stable over varying environments and it should be possible to fix in naked oats the normal two- or three-grained habit found in husked oats.

No information is currently available for these lines regarding characteristics such as resistance to threshing damage. While no problems have in fact yet been encountered in naked winter oats at the Station, the situation requires investigation in order that any such defects are identified and eliminated as expediently as possible. Research into the importance of these 'safety factors' and the development and use of tests in both the winter and spring oat breeding programmes is currently being carried out by M.S. Thornton through the award of a Home-Grown Cereals Authority grant.

Table 1. Yield and grain characteristics of naked winter oat lines

	Groat yield (g)	Naked grain (%)	Groat content by weight (%)	Thousand groat weight (g)
First cross [husked x naked]				
06683 Cn I/19/8	1601	97.3	99.3	33.4
Second cross [husked x (husked x naked)]				
Mean of six lines	3059	74.0	93.9	25.4
Range	2810 - 3204	61.3 - 86.7	91.7 - 96.4	21.9 - 29.8
Husked varieties				
Pennal	3088	23.7*	81.0	26.6
Peniarth	3059	22.0*	80.0	22.6
S.E.[+]	190.4[+]			

* Grain dehusked during threshing

[+] S.E. of yield uncorrected for differences in groat content

Table 2. Other characteristics of naked winter oat lines

	Height (cm)	Mildew infection (%) 31 May 78	Mildew infection (%) 5 July 78	Winter-hardiness rating (1 - 10)*
First cross /husked x naked/				
06683 Cn I/19/8	133	10.0	25.0	8.0
Second cross /husked x (husked x naked)/				
Mean of six lines	133	6.3	27.1	5.9
Range	126 - 139	4.0 - 8.0	25.0 - 30.0	5.3 - 6.5
Husked varieties				
Pennal	127	12.5	35.0	5.5
Peniarth	128	6.5	35.0	4.8
S.E. ±	2.96	2.21	2.81	0.34

*1 = hardy; 10 = susceptible

Yield Potential of Certain European Spring Oat Varieties

Aleksa Potovic and Dragoljub Maksimovic
Institute for Small Grains
Kragujevac, Yugoslavia

World wide, oats are produced over a wide geographical area for forage and/or grain, and are one of the main crops in the mountainous regions of Yugoslavia. It will be necessary to increase the yields of grain if the acreage under oats is to increase. I order to determine the yield potential of oats under our conditions we tested certain new European varieties and lines. Five high yielding varieties were tested at two locations for three years. The material was planted in randomized blocks with five replications in plots of five square meters. Sowing was at the rate of 500 germinable seeds per square meter.

The new European varieties (Table 1) are semi-dwarf and characterized by short, stiff straw, high resistance to lodging, high resistance to disease, high productivity, and high seed quality. The semi-dwarf varieties are well adapted to production on highly fertile soils, and high rates of fertilization can be used. Under optimum conditions the yield of grain can be over 70 q/ha.

Table 1. The yield of grain of five oat varieties tested in Yugoslavia

	Varieties						
Year	UPBS 3016-74	UPBS 3067-75	Leanda	Flamings-treue	Condor	Average yield q/ha	LSD .5%
			Kragujevac				
1975	44,08	46,58	51,73	37,34	42,36	44,50	4,52
1976	71,28	73,76	72,24	51,12	64,64	66,61	5,11
1977	54,12	45,88	49,80	49,36	43,76	48,58	2,92
Mean	56,49	55,41	57,92	46,07	50,25	53,23	
			Krusevac				
1975	41,92	42,64	43,40	34,76	40,92	40,73	4,34
1976	53,60	50,92	48,28	46,76	43,64	48,64	5,01
1977	37,96	34,48	37,44	36,00	32,52	35,68	2,98
Mean	44,49	42,68	43,04	39,17	39,03	41,68	
Mean	50,49	49,04	50,48	42,62	44,62	47,45	

The highest yields were obtained in Kragujevac in 1976. In that year UPBS 3067-75 was highest for yield, followed by the variety Leanda from Holland (Table 2). Over 3 years and both locations, the English and Dutch varieties were highest yielding. Condor is presently the most widely grown variety in our area. It is tall and lodging may be the cause of its relatively low yields.

Table 2. Maximum yields at Kragujevac in 1976.

Variety and Lines	Yield of grain q/ha	± to the variety Condor
UPBS 3016-74	71,28	+ 6,64
UPBS 3067-75	73,76	+ 9,12
Leanda	72,24	+ 7,60
Flamingstreue	51,12	-13,52
Condor	64,64	St.

The variety Flamingstreue was the tallest of the five varieties (Table 3). It ranged from 120 to 159 cm, and for that reason is susceptible to lodging. This would explain its relatively low yields. UPBS 3067-75 has short straw (103 cm) and is more resistant to lodging. Since straw is very important to the producer, however, we do not favor extremely short varieties.

Table 3. Plant height in cm of 5 oat varieties in 3 years.

Variety	1975	1976	1977	Average weight
UPBS 3016-74	122	131	100	118
UPBS 3067-75	105	110	95	103
Leanda	137	130	95	121
Flamingstreue	147	159	120	142
Condor	132	125	110	122

Grain quality was measured in terms of 1,000 kernel weight and hectoliter weight. Quality, by both these criteria was lower in 1975 than in the other years (Table 4 and 5).

Table 4. 1,000 kernel weight of 5 varieties in 3 years.

Variety	1975	1976	1977	Average weight
UPBS 3016-74	23,40	29,40	29,80	27,53
UPBS 3067-75	25,40	30,40	27,60	27,80
Leanda	23,90	26,80	30,40	27,03
Flamingstreue	21,70	30,20	28,80	26,90
Condor	21,40	30,60	29,30	27,10
Mean for year	23,16	29,50	29.20	27,27

In average for three years the line UPBS 3016-74 has the highest 1,000 kernel weight, and the variety Flamingstreue has the lowest (26,90 grams).

Table 5. Hectoliter weight of 5 varieties in 3 years.

Variety	1975	1976	1977	Average weight
UPBS 3016-74	40,71	39,50	45,97	42,06
UPBS 3067-74	50,70	43,64	52,07	48,80
Leanda	43,20	41,04	46,30	43,51
Flamingstreue	47,64	43,40	44,47	45,17
Condor	40,34	40,38	49,43	43,48
Mean	44,60	41,59	47,65	

ARKANSAS

F.C. Collins, J.P. Jones, and M.L. Fouts

Production: Oat acreage has been relatively stable during the past decade in Arkansas with farmers planting a little less than 100,000 acres (80,000 in 1979) and harvesting grain from about 70% of the acreage (55,000 in 1979). In spite of the relatively severe winter in 1977-78 in which many fields of late planted oats were completely lost, the state yield average was 73 bu/A. Our oat acreage is concentrated in the Grand Prairie region of the state where oats are included in a rice-soybean-oats-doublecropped soybean rotation. Oats are grown in this region for seed which is marketed in neighboring states for forage planting. Our better farmers normally expect oat yields of 100-140 bu/A.

Breeding efforts: Emphasis continues to be placed on incorporating resistance to crown rust and barley yellow dwarf virus into early maturing, high yielding lines with acceptable forage yields. Additionally, emphasis has also been placed on improving the protein level of the grain because grain not marketed for seed is sold for livestock feed. Bob represents improvements in these areas and it is apparently being well accepted within the state. We anticipate that it will eventually replace Nora.

Diseases: No substantial outbreaks of disease were observed during the 1977-78 season, as has been the case in the last two seasons. Results from our seed treatment tests indicated that several experimental compounds were effective in disease control. Significant increases in seedling emergence occurred from seed treated with the compounds Bayleton, Furavax, Orthocide-Vitavax, Mertect 340F, Vitavax 200, and three coded formulations BASF-389-01, BTS-40-542 and KGW-0519. Replacing water with acetone as a diluent substantially increased the effectiveness of Bayleton, Furavax and KGW-0519. Good to excellent control of covered smut was also obtained with Bayleton, Benlate, Furavax, Orthocide-Vitavax (both as a slurry and dry powder) and the coded products BASF-389-01, KGW-0519 and RH-2161. The effective rates of application in these tests varied from one to eight ounces of products per hundredweight of seed.

Personnel changes: Mr. W.T. McGraw completed his M.S. program and he is presently employed by Hartz Seed Company at Stuttgart, Arkansas where he is working on soybean and oat breeding. Michael L. Fouts, a graduate of Arkansas State University, has filled the research assistant position and will work toward a M.S. degree.

GEORGIA

A. R. Brown (Athens), B. M. Cunfer, J. H. Massey,
J. W. Johnson (Experiment) and D. D. Morey (Tifton)

The Georgia Crop Reporting Service has estimated the 1978-79 oat acreage to be 135,000, or approximately the same as last season. Total production will depend upon seasonal conditions, winterkilling, diseases and possible abandonment. Diseases and insects have not been serious, but January 1979 was damp and cold and grazing has been poor this season.

The cultivars most widely planted in Georgia are Florida 501, Coker 227 and Elan. Coker 716 (C-70-16) has been approved for growing in North Georgia and is expected to take over acreage formerly planted to Coker 66-22 and other hardy but disease susceptible varieties.

Indiana

H. W. Ohm, F. L. Patterson, G. E. Shaner, J. J. Roberts (Breeding, Genetics and Pathology), J. E. Foster (Entomology), Kelly Day, O. W. Luetkemeier (Variety Testing), and K. L. Polizotto (Extension).

Production: Indiana oats production for 1978 was estimated by the Indiana Crop and Livestock Reporting Service at 8.91 million bushels, up 12 percent from 1977. Average yield was 54 bu/A.

Oats seeding was much delayed by wet and cold weather during April. Growth and development were behind the previous year and average due to cool temperatures through mid-May. Much of the oats headed mid- to late June -- 10 - 12 days later than normal. Significant soil moisture stress developed from the last week in May through heading (third week in June). Aphid, primarily *Rhopalosiphum padi*, populations were large and widespread on oats throughout Indiana. One to two aphids/culm were observed in several commercial oats fields at mid-to late May. Yellow dwarf symptoms were widespread throughout Indiana. Symptoms were severe in many fields with a low fertility level and/or with moisture stress.

Research: Breeding for resistance to yellow dwarf and crown rust continue to be important objectives of our program.

Populations of plants were grown in the field and spaced uniformly 10 cm apart in rows 30 cm apart. At the one to two leaf stage viruliferous aphids, *R. padi*, were either introduced and retained on plants for two weeks or were restricted from plants by fine nylon mesh. All plants were then sprayed with Cygon. Seed yield of infested plant populations of Stout, Otee, and CI9312 were 11, 40, and 65%, respectively, of control. Plant height and tillers/plant were reduced accordingly. Data were similar from 1 m subplots within two center rows of four-row yield plots, but we had some problems with uniformity of infestation.

Screening of seedlings for yellow dwarf resistance in the greenhouse is effective, at least in the identification of susceptible lines in the breeding program. We note that with ample fertility and especially with ample soil moisture, we cannot identify visual symptom expression even in seedlings of Clintland 64 -- a very susceptible cultivar. Therefore, a certain level of stress must be maintained. The influence of levels or degrees of stress (especially moisture and fertility) for yellow dwarf symptom expression may explain certain year-to-year differences within and among cultivars. The degree of environmental stress at various growth stages may have a large influence on symptom expression.

At least two cases involving commercial oats fields seem appropriate to report: In both cases (different areas in the state) moderate to severe yellow dwarf symptoms were observed the first week in May. Both farmers had applied only 20-30 pounds of N/Acre and general fertility was minimal. The cultivar was Noble. The farmers were advised to apply an additional 40-60 pounds of N/A. Also, Cygon was applied to reduce the aphid population.

Subsequently, field 'A' received ample rainfall, and field 'B' received some rainfall but not as much as did field 'A'. Field 'A' recovered very well and yielded 65 to 70 bu/A. Field 'B' recovered somewhat and according to the farmer yielded 'moderately well'.

In cooperation with Dr. R. M. Lister, Virologist, Department of Botany and Plant Pathology, we are attempting to develop ELISA as a useful quantitative test for yellow dwarf resistance in our oats breeding program.

Oats breeders have developed various schemes by which to increase the number of generations in a given time period. We were successful in the processing and screening of a set of material this past season, which may be useful to mention: Approximately 1,700 space-planted F_1 plants from many different 3-way and 4-way crosses made in March, 1978 in the greenhouse, were grown in the field in 1978. Nearly all parents in these crosses are advanced breeding lines or well adapted cultivars. Severe levels of infection of yellow dwarf and crown rust (mixture of 3 races) were effected. Plants which developed moderate or severe yellow dwarf symptoms and/or moderate crown rust symptoms were discarded. Progeny from harvested plants will be processed in a pedigree or bulk system. However, five plants (each from different crosses) with little yellow dwarf symptom expression and no crown rust pustules and exceptionally good for agronomic characters were noted. Fifty F_2 plants from each of these five F_1 plants were grown in the greenhouse, October - December. Plants susceptible to crown rust were discarded. Resistant plants were crossed as males to adapted breeding lines or cultivars. Fifteen F_3 plants (5 plants/5 inch pot) from all harvested F_2 plants are being grown in the greenhouse, January - March. These plants are infested with viruliferous aphids. Plants with severe symptoms will be discarded. F_4 plants will be grown in the field in 1979.

Iowa

K. J. Frey, J. A. Browning, M. D. Simons, R. Skrdla

The year 1978 was fair to middling for oat production in Iowa. The state yield was 58 bushels per acre on 1.2 million harvested acres for a total production of 67 million bushels. Moisture during the growing season was adequate, but high temperatures during mid July ripened oats prematurely resulting in low test weights and reduced yields. Many diseases occurred in trace amounts, but none caused significant yield loss.

Much oat research at Iowa State involves the species *Avena sterilis* L. In one such study, two cultivated varieties and four *A. sterilis* collections were tested for root volume production. Five of the oat lines produced maximum root volumes of 1.5-4.0 cc per plant, but one *A. sterilis* line, P.I. 324748, produced a volume of 15 cc. The first five showed no or only small increases in root volume after anthesis, but P.I. 324748 had a fairly constant growth throughout the season. Whether root volume of oats is related to water and (or) mineral absorption is not known, of course.

Over the several decades of research on mutation breeding with cereals (where the desired trait is increased seed production), it has become fairly evident that induced mutations have been most useful when utilized in a hybridization program. We put this hypothesis to test with oats, i.e., that useful induced mutations for increased grain yield may be masked by companion deleterious mutations that have occurred simultaneously. Outcrossing should release the "high-yield" mutations via segregation. Four hundred M_1 plants were backcrossed to the control, and 400 were used to produce M_2 plants. Ultimately, we tested 800 F_2-derived lines (outcrossing population = O), 800 M_2-derived lines (mutagen population = M), and 800 check lines (C population). Generally, ethyl methanesulfonate (EMS) treatment induced mutations for significantly later maturity, short plant height, and lower grain yield, straw yield, and plant weight. Outcrossing produced some recovery toward the C population mean, but the O population average was consistently less than midway between the M and C population means for grain yield. No F_2 or M_2-derived line was significantly improved for grain yield. Thus, no evidence was found for the occurrence and subsequent "free segregation" of induced "high-yield" mutations in oats.

Personnel: J. A. Browning spent 1978 on sabbatical leave studying and doing research in Israel and England. Robert (Bob) L. Segebart received his Ph.D. degree, and he is now employed as a corn breeder and station manager for Pioneer Hi-Bred International. J. Paul Murphy finished his M.S. degree, and he is continuing study for a Ph.D. at Iowa State. Diana Bloethe-Helsel has taken a position as corn breeder with DeKalb Ag Research, Inc. Currently, she is writing her Ph.D. dissertation. New graduate students who joined our project in 1978 are Jim Fawcett, Rodger Reinhart, and Bruce McBratney.

KANSAS

E. G. Heyne

Only 4,680,000 bushels of oats were produced in Kansas in 1978. This was the second lowest production since records have been taken in over 110 years. The average yield per acre was 39 bushels. Oats in Kansas is essentially all spring sown. A few acres are fall seeded for pasture but rarely overwinter for grain production.

Lang and Bates have been tested in Kansas since 1975 and clearly are superior to any other cultivars available, especially when BYDV is present.

Although Lang and Bates are superior, a number of certified seed growers produced certified seed in 1978 of the following cultivars: Bates, Lang, Lodi, Otee, Pettis, Spear, Stout, and Trio.

The uniform winter oat nursery was grown at Hutchinson, KS. Lee had less than 5% survival while the remaining 10 entries varied from 55 to 84% survival. Yields were below average ranging from 39 to 68 bushels per acre. There are no cultivars hardy enough for certain production in southern Kansas.

Minnesota

D. D. Stuthman, H. W. Rines and R. D. Wilcoxson

Production

Oat production for Minnesota in 1978 totaled nearly 100 million bushels on 1.8 million acres, both figures significantly below comparable figures for 1977. In addition, the average yield of 54 bushels per acre represents a sharp drop from the record 68 bushels per acre recorded in 1977. Rainfall was above the seasonal average and included several severe storms producing flash floods. As a result of the high moisture conditions, crown rust infection was greatly increased over recent years and increased lodging also occurred. These two problems were primary causes for reduced yields and bushel weights.

As usually happens after a disappointing oat production year, intentions for 1979 plantings are down sharply (83% of 1978 plantings). A sharp increase in sunflower acreage (to almost 1 million acres) is also a factor.

Avena fatua collections

During September 1978 a trip for collecting *A. fatua* in Mexico was undertaken by Deon Stuthman. The effort was jointly sponsored by the United States Department of Agriculture and the Instituto Nacional de Investigaciones Agricolas (INIA) of Mexico. Seed was collected from growing plants in high valleys primarily from the half dozen states surrounding Mexico City. Bulk samples from grain mill cleanings, etc. were also obtained from six different areas wehre spring wheat is grown under irrigation during the winter months. Because oat stem rust is frequently abundant in many areas of oat production in Mexico, it is our hope that this germplasm will contain useful stem rust resistance genes.

Personnel

Dr. Roy Thompson, formerly Extension Specialist for small grains, has become Assistant Director of the Minnesota Agricultural Experiment Station. We are actively seeking his replacement. Rob Bertram and Ted Schiele completed M.S. degrees during the year and Jim Radke, Jim Luby and Arturo Hernandez began Ph.D. programs.

MISSOURI

Dale Sechler, J. M. Poehlman, Paul Rowoth (Columbia),
Boyd Strong (Mt. Vernon), and Lewis Meinke (Spickard)

Production: The 1978 harvested oat acreage in Missouri dropped to 35,000 acres, according to the Crop Reporting Service. This was a record low acreage for the State. Continuing weather adversity throughout the spring either prevented seeding or resulted in seeding too late for a favorable plant response. Only two of the four outstate variety trials could be seeded and these were seeded almost two months later than is considered optimum. A late, cool spring did permit more favorable plant response than would have been anticipated, however. An average yield of 38 bu/acre was reported for the State as compared to 50 bu/acre for 1977.

Diseases: Growth and development of late seeded oats was often abnormal but varied, as did disease development. BYDV damage was rather severe in some fields in Southwest Mo., where more oats were seeded, but the damage was minimal further north. Leaf damage from halo blight was more prevalent than normal in North Mo., especially during early vegetative development. Differences in varietal response were evident. Crown rust was observed also in several fields. At Columbia, in some very late seeded oats, the stem maggot and the corn borer caused an unprecedented amount of damage.

Varieties: In spite of delayed seeding, the Bates and Lang varieties led the variety trials in grain yield. This is consistant with their relative performance in recent years when they were seeded at a normal planting date.

NEBRASKA

John W. Schmidt and Stephen M. Dofing

Oat acreage in Nebraska had been steadily increasing since 1972 but took a sharp drop to 450,000 harvested acres in 1978. Average statewide yield was a respectable 47 bu/a. Growing conditions were generally favorable except for a three-day hot and windy period in mid-June. Diseases were not major factors in production although some leaf reddening was observed.

Bates was distributed to Nebraska growers in 1978. Although grower reaction to the variety was mixed, we feel that it performed well in 1978 and has a place in Nebraska. Lang had the best statewide performance as it has the past few years. Of the later-maturing varieties, Wright and Kelsey were best.

NEW YORK

Mark E. Sorrells

Dr. Neal Jensen officially retired on September 30, 1978 and moved to Sun City, Arizona the following week. He is working part-time as an agricultural consultant. My appointment in May, 1978 provided for a 7-month overlap with Neal, during which time he familiarized me with general field, laboratory, and record keeping procedures. The transferral of information on breeding lines, and the exchange of ideas and breeding philosophies were the most valuable accomplishments.

Because of the difficulty in dehulling small oat samples in the Quaker Oats machine, we have explored other techniques. The best alternative found was the head thresher manufactured by the Precision Machine Company of Lincoln, NE. The machine does a good job of removing hulls, blowing out debris and is much faster than the other methods tried.

Several lines having high groat oil content are being crossed to adapted parents with the goal of increasing the field value of oats and at the same time maintaining current yields.

Kevitt Brown recently completed his Master's Degree. His thesis involved a study of inter- and intra-row arrangements of two-genotype barley and oat populations. The results of his study indicate that there is no difference in grain yield for either intra-or inter-row mixtures; however, both mixtures yield significantly more than the theoretical midcomponent value.

NORTH CAROLINA

C. F. Murphy, T. T. Herbert and R. E. Jarrett

Production: The winter of 1977-78 was not as dramatically cold as the previous winter but it was characterized by a large number of days with below normal temperatures. This resulted in some losses due to winterkilling in the Piedmont area. These losses were compensated, however, by an increase in planted acreage and by growing conditions which were otherwise quite good. An average yield of 53.0 bushels per acre was produced on 90 thousand acres.

Oat Varieties: The variety Brooks was released and is described elsewhere in this volume. It is expected that it will be well received by producers. Salem is widely grown and Carolee persists as a popular variety along with Coker 66-22 and Coker 227. Firecracker does not have sufficient winter hardiness for wide adaptation but it works very well for double cropping in the relatively mild coastal plain areas.

Diseases: Barley yellow dwarf virus is the only serious disease of oats in North Carolina. The levels of tolerance to this disease are being constantly increased as new varieties are released but the disease still results in significant yield losses. Crown rust becomes a problem south of here and soil-borne mosaic virus is an occassional problem.

North Dakota

Michael S. McMullen

Production:

The 1978 oat acreage harvested for grain in North Dakota was 1,220,000 acres, 18% lower than 1978 while oat production was increased approximately 10% to 65,880,000 bushels during the same period with an average yield of 54 Bu/A. Favorable growing conditions with abundant moisture, particularly in the western portion of the state account for the increased production from fewer acres.

Diseases:

Stem rust and crown rust infections were not severe over most of North Dakota. Heavy crown rust infections developed in late planted fields primarily in the southeastern portion of the state. Stem rust infection was light throughout the state. Improving stem rust and crown rust resistance remain major objectives of the oat improvement program.

Severe leaf diseases apparently of bacterial origin developed early in the season but disappeared as warmer temperatures occurred later in the season.

Barley yellow dwarf virus infection was prevalent in late planted nursery material at Fargo, but apparently caused little damage to commercial fields.

Personel:

Jim Oard completed his M.S. requirements with a thesis entitled "The effects of water stress and leaf characteristics on water use efficiency in oats." Mr. Oard is now employed as an agronomist with INTSOY in Puerto Rico. Frank Moser is a new graduate student from Ohio. Russell Mathison left the technician position and was replaced by Hal Fisher.

OHIO

Dale A. Ray

Production. Cold, wet conditions that prevailed in the early spring months delayed oat seeding and probably contributed to the reduced acreage of the crop in Ohio. Most seedings were made in April but some oats were not drilled before mid-May. Stand establishment was slow, but midseason growing conditions were favorable. After a dry, hot period immediately following heading, the crop was ready for harvest only 7 to 10 days later than the normal schedule. Ohio farmers harvested about 400,000 acres of oats that produced an average yield of 61.0 bushels per acre. The harvested acreage was a 20,000 decline and the yield 2 bushels per acre higher than for the 1977 crop. Oat rusts occurred only in trace amounts, however the barley yellow dwarf virus was widespread and damaging in fields of susceptible varieties.

Oat Varieties. The recommended oat varieties for production in Ohio are Clintford, Dal, Noble, Otee, and Stout, with Noble, Otee, and Clintford ranking highest in order of preference by Ohio farmers. Noble was the highest yielding variety in five of the six statewide performance tests conducted in 1978.

Oat Breeding. Extensive plantings were made in 1978 with panicle collections representing panicle-rows of several advanced-generation selections grown the previous year. These selections were obtained from bulked populations of an *Avena sterilis* selection crossed with Florida 500 and Garland and of Clintland 60 x Rodney 2x Putnam 61. Each panicle-row was rated for uniformity, relative maturity, straw strength, and tolerance to BYDV. These data along with protein analysis, will be used to determine bulkings into new lines for preliminary performance tests.

OKLAHOMA

H. Pass, L. H. Edwards, E. L. Smith and R. L. Wilson

Production: The Oklahoma state average oat yields and acreage fluctuate from year to year. The 1978 oat crop amounted to 4.3 million bushels and was harvested from 120,000 acres with a yield of 36.0 bushels per acre. This was a smaller crop than 1977, by 10,000 acres and 10 bushels per acre average yield. Also, it was considerable less than the five-year average production of 5,045,000 bushels from 145,000 acres. It is estimated that over one-half of the fall seeded oats are used for pasture and hay.

Oat Varieties: Most of the oat acreage is seeded to winter oats. The popular varieties are Cimarron, Chilocco and Nora. The increased presents of Barley Yellow Dwarf Virus the past two or three years, has taken a toll on Nora. Also, winterkilling was heavy in 1978. We have seen some increase of spring oat planting in the state the past two years.

Selection OK7222336 (Chilocco/Ora) C.I.9258 was named "Okay" and released in 1978. In a five-year state average yield, Okay has a 17 percent yield advantage over the best parent. It ranks high in all forage tests. Foundation Seeds Stock, Inc. has about 500 bushels seeded for increase.

We are continuing to try transferring greenbug resistance to our adapted winter oat varieties. We are using P.I.186270 and C.I.1580 as principle source of resistance. Dr. R. L. "Dick" Wilson, Research Entomology, U.S.D.A. is doing the screening tests, using biotype "C" greenbug, in the greenhouse.

PENNSYLVANIA

H. G. Marshall

Production. The estimated oat acreage harvested for grain in Pennsylvania during 1978 was 340,000 acres. Production was estimated at 18,020,000 bushels with an average yield of 53 bushels per acre. Planting in the state was delayed by a wet spring, but relatively cool, moist conditions throughout the growing season prevented yield losses that usually would result from late planting. Oat diseases apparently were not serious in commercial fields.

Cultivars. The recommended cultivars for Pennsylvania for 1979 are Otee, Clintford, Noble, Lang, Astro, Dal, Garry, and Mariner. Average yields of these varieties at University Park over the past 4 years have been 89, 84, 95, 99, 93, 90, 94, and 96 bu/A, respectively. Clintford may be dropped from the recommended list for 1980.

Of the several new cultivars released for 1979 by various states, Marathon (from Wisconsin) seems to have the most potential for production in Pennsylvania.

Spring oat research. A Spring Oat Performance Test was grown at four locations in Pennsylvania during 1978. Yields were excellent at University Park ($\bar{x}$ = 123 bu/A) and Landisville (112 bu/A) where planting dates were April 17 and April 10, respectively. Two tests on cooperating farms could not be planted until the first week of May and average yields dropped to about 60 bu/A. Lang was the highest yielding cultivar over all locations, but the experimental variety Ill 73-2664 was superior by 5.5 bu/A. Ill 73-2186 also was slightly higher yielding than Lang.

A major part of the spring oat breeding effort still is devoted to the development of semidwarf germplasm. Most of the selection effort has been in populations involving the dwarf oat C.I. 8447 (from the North Carolina program). To date most semidwarf lines have resembled C.I. 8447 and have not performed well. A major problem is loss of green leaf area before grain filling is complete. The semidwarfs are very susceptible to leaf and stem blighting caused by *Helminthosporium avena* and *Septoria avena*, but the premature senesence of leaves occurs even when these pathogens are controlled with fungicides. Applications of additional water or nutrients have not significantly delayed leaf senesence. However, we have extracted lines from only a few combinations and are optimistic about finding much better semidwarf types. Our present lines are yield responsive to high nitrogen fertilization and a 5 inch row spacing (compared to 7 inches).

Several crosses also have been made with O.T. 207 dwarf and a few dwarf lines have been grown in preliminary tests. These lines also have been too late under Pennsylvania conditions and grain filling tends to be incomplete. The dwarf characteristic is dominant and most panicles do not emerge completely from the boot. However, the panicles were completely emerged on a few panicle rows that were saved during the past summer. These lines are being used in backcrosses and new crosses.

Populations with Maupa 70, Egdolon 23, and Egdolon 26 also are yielding lines with short plant height and excellent lodging resistance. Late maturity also is a problem with these lines.

Winter oat research. Winter oats and the breeding program have been hard pressed to survive in Pennsylvania during the last few years. Our best lines and advanced generation bulk composites have been completely winter-killed during the past two winters. Even our safety plantings at Warsaw, Virginia, have been severely damaged during those severe winters. Over 300 lines were increased at Aberdeen, Idaho, during 1978 in order to have sufficient seed for fall planting of local tests.

We are using controlled freezing to apply recurrent cycles of selection pressure to segregating populations. By using nutriculture and carefully controlled environmental conditions during germination, pre-hardening growth, hardening, freezing, thawing, and recovery, we can separate genotypes with a degree of precision that should effect a selection differential for freezing resistance. We are using freezing tests to search for transgressive types in populations from hardy domestic x wild oat populations. Selection is based on individual plant survival followed by progeny tests for freezing resistance.

Personnel. Dr. Raymond E. Hite, Research Plant Pathologist, left the project during 1977. He was replaced in June, 1978, by Dr. James A. Frank. Dr. Frank is located in the Department of Plant Pathology and will spend most of his time working on oat disease problems. Mr. Frederick J. Kolb is assigned to the project as a support scientist in genetics and breeding.

South Dakota

D. L. Reeves and L. Hall

Production: Oat production dropped 22 percent from 1977 to 102.7 million bushels in 1978. This was accounted for by reducing the acreage and yield. Oat acres decreased from 2.9 to 2.57 million acres with an average yield of 46.5 bushels per acre. Even though acreage and production dropped sharply, 1978 was an average year for oat acreage and yields. Some test weights in the eastern portion of the state were very low. Many reports were received of oats having test weights in the 20's. A few elevators reported 19-pound test weights.

A combination of factors is believed to have contributed to the lower yields per acre. Seeding was delayed due to wet fields but moisture was generally quite good till heading. The last of June produced several hot days. We believe our lower yields and poor test weights were due to a combination of factors. The delayed seeding and excellent surface moisture probably resulted in a shallow root system. In addition before the hot winds at the end of June, we had considerable leaf rust present. In test plots the leaf rust susceptible lines showed drastic decreases in yields. Therefore, it appears that leaf rust on stressed plants was the real zapper.

Disease: Leaf rust was the only significant disease this year. Several varieties had readings of 40 to 50% at Brookings.

Varieties: Final seed increase prior to release was made for SD 9095 (Lancer) with release in 1979. Lancer, C.I. 9256, is a selection from a Neal/Clintland 64 cross. It has excellent straw strength, good yields and a high groat protein content. Kernels are plump, white and have a good test weight. Under field conditions it has better leaf rust resistance than Spear or Chief. Seedling tests indicate Lancer is resistant to race 264B and moderately susceptible to Pc-45 and 47. Lancer is resistant to race 61 of stem rust; moderately susceptible to newer smut races; and susceptible to yellow dwarf.

Equipment: We modified our planting equipment so two people and one tractor can plant head rows, single rows, or four-row plots. It requires about 10 minutes to change the seed distributor from one system to another.

TEXAS

M.E. McDaniel, J.H. Gardenhire, L.H. Nelson, K.B. Porter, Norris Daniels, Earl Burnett, Lucas Reyes, Dennis Johnson, E.C. Gilmore and Charles Erickson

Production: The seeded acreage of oats in Texas in 1978 increased to 1,800,000 acres. This represents an increase of 24% over the 1977 acreage, and approaches the average of 1,883,000 acres seeded in Texas for the 10-year period 1968-1977. The harvested acreage in 1978 was 430,000 acres or 23.9% of the acreage seeded. The proportion of the crop harvested was slightly lower than the 10 year average of 27.7% for 1968-1977. The 1978 statewide yield of 32.0 bushels per acre also was slightly lower than that for the previous 10-year period (34.7 bushels per acre average).

The low percentage of oats harvested for grain in 1978 undoubtedly was related to the very unusual financial situation which developed in the livestock industry. Lightweight stocker steers were purchased in the fall at a substantially lower price per pound than that which was eventually paid for much heavier animals at the end of the small grain grazing season. Thus the stockman made a profit not only on the gain, but on the original animal weight as well. Livestock operators were quick to sense that this was a "winning" situation, and utilized all available small grain pasture.

Research: Stem rust continued to increase in severity in South Texas in 1978. The Beeville nursery developed a heavy epidemic as the crop approached maturity; some commercial fields of Coker 234 near Giddings were completely destroyed. Resistance from the Minnesota germplasm sources C.I. 9221, C.I. 9222, and C.I. 9139 appears very promising; we are transferring resistance from these sources into Texas-adapted material as quickly as possible.

Barley yellow dwarf virus (BYVD) was much more widespread in distribution and more severe in intensity in 1978 than is usually the case in Texas. Varieties and selections which appeared tolerant to BYDV in Texas nurseries were tested in Illinois (Brown and Jedlinski) and in Quebec, Canada (Comeau); none appeared outstanding for BYDV resistance in these tests. It is possible that the BYDV strain prevalent in Texas is different from that used in the Illinois or Canadian programs.

Breeding for resistance to the greenbug aphid continued. A line derived from the cross P.I. 186270 x P.I. 183990 has appeared to have good resistance to biotype C. Resistance appeared to be recessive in crosses with Coronado, TAM O-312, Coker 234, and Coker 75-12. We assumed, therefore, that the resistant F_2 plants were homozygous for the gene conditioning greenbug reaction. However, when F_3 progenies from resistant F_2 plants were tested, most F_3 plants were classified as susceptible. A few F_3 plants appeared to be resistant; these will be grown to maturity and their progenies will be tested for greenbug reaction.

Norris E. Daniels, entomologist at Bushland, tested 4,343 oat selections from the World Collection for reaction to the biotype C greenbug[1/]. Thirty-one

---

1/ Daniels, Norris E. 1978. Greenbug resistance in oats. The Southwestern Entomologist. 3:210-214.

selections were found to be resistant; all had better ratings than P.I. 186270. The 31 resistant selections were tested a total of three times; 13 of the selections were grown to maturity in the greenhouse without controlling greenbugs. Susceptible plants were killed by the time they reached a height of 6 to 12 inches, usually within a month after greenbug infestation. The data for the 31 resistant selections is given in Table 1; all these selections had ratings of 3.5 or below and all are considered capable of withstanding a severe greenbug attack in the field. Portions of these data previously were reported in the 1972, 1975, and 1977 Oat Newsletters.

Rusts: Crown rust cultures with complete virulence on TAM 0-312 oats were found at Tynan and Beeville, Texas in 1978. No other major shifts in virulence of crown rust or stem rust were noted in Texas this past oat season.

Latin American Oat Research: The Texas Agricultural Experiment Station has agreed to assume leadership of the Latin American Oat research project initiated by Dr. H.L. Shands, University of Wisconsin. This research currently is sponsored by the Quaker Oats Company. Results of Latin American investigations since inception of this project have shown that "winter" oats such as those grown in the southern United States are reasonably well adapted in South America. As in the southern U.S., grazing is an important consideration in Latin America. In addition, climatic conditions and production hazards (crown rust, stem rust, BYDV, greenbugs) of major oat production areas in South America are similar to those of Texas and other southern states. We feel that most of the goals of the Texas and Latin American oat research programs will be quite compatible; additional emphasis will be placed on grain quality in the Latin American effort.

TABLE 1. Biotype C Greenbug Resistant Oat Selections Evaluated During Years Indicated, Bushland, Texas

P.I. or C.I. Number[a/]	Designation	Source	Rating[c/]
	1970		
2711	Unknown	Manchuria	3.5
2712	Unknown	Manchuria	3.0[d/]
2713	Unknown	Manchuria	3.2
2910	Big Boy	U.S.A. (S. Carolina)	3.5
2931	Red Algerian (Hafar 30)	Germany	3.5
	1971		
1579[b/]	F.H.B. 28821	S. Africa	2.3[d/]
1580[b/]	Black Tartarian	U.S.A. (New York)	2.5[d/]
3223	Shlykov 7237	Russia	3.0[d/]

TABLE 1. Continued.

P.I. or C.I. Number[a]	Designation	Source	Rating[c]
		1972	
4485	Leteriax Fulwin	U.S.A. (N. Carolina)	3.5
4767	Mutica	Russia	3.1[d]
4770	Mutica	Russia	2.8[d]
4888	Lasio	Italy	3.3
5061	Unknown	Russia	3.3
5068	Rousse	Bulgaria	3.0[d]
5069	Rousse	Bulgaria	3.2
		1973	
7251	Bonda	U.S.A. (Idaho)	3.5
7252	Bonda	U.S.A. (Idaho)	3.5
		1975	
8250	KYTO-64SP68	Unknown	3.5
8290	6984	Turkey	3.5
8291	7449	Turkey	3.5
		1977	
197840	Yliternio	Sweden	3.5
221289	Novi Sad 4116	Yugoslavia	3.5
221290	Novi Sad 4120	Yugoslavia	3.5
251580	Von Lochow	Yugoslavia	3.0[d]
251581	Von Lochow 286	Yugoslavia	3.4
251582	Von Lochow 555	Yugoslavia	3.2
251896	49.K4649	Russia	2.5[d]
251898	52.K8257	Russia	2.7[d]
258612	Khasan	Russia	2.8[d]
258637	Muticax Aurea	Russia	3.0[d]
258644	Aristata 7763	Russia	2.8[d]

a/ Four-digit numbers are C.I. (Cereal Investigation) numbers; Six-digit numbers are P.I. (Plant Introduction) numbers.
b/ Tested in 1967 and again in 1971 (resistant to both biotypes, B & C).
c/ A rating of 1 = no damage; a rating of 6 = a dead plant.
d/ Grown to maturity without controlling greenbugs.

UTAH

R. S. Albrechtsen

Utah's oat acreage has shown a gradual but quite consistent long-term decline. This decline has leveled off and harvested acreage has stabilized over the last several years. Yield per acre has been variable, but the long trend has been upward. However, per-acre yields are rather low compared to those of other small grains because the oat crop is often relegated to marginal conditions in terms of soil, moisture, fertility, etc. Because of such practices, oats often do not appear to be competitive with barley or wheat. Losses from diseases are generally minimal although occasional fields are badly damaged by smut.

We depend upon improved varieties from other sources since we are not carrying on an active oat breeding program. New material that looks promising for us is identified by growing the Northwestern States Oat Nursery and by personal contact with individual breeders. Some of the advanced lines from Idaho and Washington look impressive at the present time.

Oat Research at Washington State

C. F. Konzak

Appaloosa Oat, CI9272, was released in Washington in 1978. Appaloosa has a higher BYDV tolerance from cooperative tests at Davis, California, and has shown a consistent yield advantage over Cayuse in Washington. Terra hulless oat continued to perform well and may be of interest to swine feeders. The 1978 oat acreage in Washington was again small, but yields were average or above. Significant advances in yield, test weight and quality may be needed to reverse the acreage trend. To this end, new crosses were made in 1978 to combine the BYDV tolerance of better WA selections with larger kerneled semidwarf and hulless types. BYDV was the only disease present which may have reduced yields of some cultivars.

WISCONSIN

R. A. Forsberg, M. A. Brinkman, Z. M. Arawinko, R. D. Duerst,
E. S. Oplinger, H. L. Shands, V. L. Youngs, D. M. Peterson (Agronomy),
and D. C. Arny and C. R. Grau (Plant Pathology)

Late planting of oats in Wisconsin in 1978 resulted in reduced grain yields and contributed to lower test weights. A cold, wet spring delayed seeding until early to mid-May in many central and southern areas. Harvesting was timely in southern Wisconsin but heavy rains in the north in the last half of August resulted in severe lodging, excessive weed growth, and delays in harvest. The average yield of oats was 57 bushels per acre, down 9 bushels from the 1977 record yield. Total oat production was 62.7 million bushels, a decline of 18% from 1977. The 1.25 million acres planted was 20,000 acres less than the previous year.

The 1978 growing season (April 1 to September 30) was the wettest in 40 years and the second wettest on record since 1891 in Wisconsin. Total rainfall for this period averaged 28.7 inches compared to 22.8 inches in 1977 and a normal of 21.4 inches.

In spite of the relatively high moisture, losses due to crown (leaf) rust, stem rust, and red leaf were negligible. Incidence of oat smut was much reduced over 1976 and 1977 levels due in part to the use of resistant varieties, the use of disease-free seed, seed treatment, and environmental conditions. The Wisconsin Crop Improvement Association requires seed treatment with Vitavax if the smut infection level in a "certified" seed production field exceeds 1%.

The high moisture conditions undoubtedly contributed to a higher-than-average proportion of discolored groats of oat varieties and test selections in seven state-wide performance trials. While it is known that rains at or near maturity contribute to groat discoloration, Madison groats were unusually dark even though rainfall at harvest was not noticeably excessive. However, high soil moisture results in frequent and heavy morning dews in Wisconsin, and this provides another source of moisture for fungal growth on oat groats.

Release of Marathon oats. The Wisconsin Agricultural Experiment Station released Marathon oats (X2456-2, C.I. 9360) in January, 1979. This selection was derived from a cross by H. L. Shands between Holden and X1289-1, the latter parent a sister line of Dal. In Wisconsin and USDA performance tests Marathon has yielded well and has ranked high for pounds of groat protein per acre. It is widely adapted in Wisconsin and has produced well under stress conditions. Straw strength is good and test weight is average. A more complete release statement appears elsewhere in this Newsletter.

Response of Oat Genotypes to Atrazine. A 2-year study on the response of 20 oat genotypes to atrazine by M. A. Brinkman revealed that Froker, Lang, Mackinaw, X1839-1, and X2078-1 were the most tolerant while Allen, Dal, Lyon, and Otee were least tolerant.

Performance of oat plants from primary and secondary kernels. The performance of oat plants grown from primary and secondary kernels was evaluated by M. A. Brinkman in a 2-year, four-location test. Four genotypes differing in primary:secondary kernel weight ratio were used. Overall, plants in plots grown from 100% primary kernels yielded 14.5% more grain and 13.1% more straw than plants in plots grown from 100% secondary kernels. The higher grain yields of plants grown from primary kernels were due to comparable increases in tillering and spikelets per panicle. Results also indicated that grain and straw yields can be increased significantly by separating out at least one-half of the secondary kernels in seed oats. The influence of different planting ratios of primary and secondary kernels was the same in all four genotypes indicating that the effects of primary:secondary kernel weight ratio were nonsignificant.

Dr. H. L. Shands has continued his program concerned with the development and utilization of oat germplasm in developing countries. The project is supported by the Quaker Oats Company. Dr. M. E. McDaniel, Texas A&M University, will be assuming leadership for this project, and College Station, Texas will be the primary site for germplasm development and selection. Wisconsin will continue to be an active partner. (We have received no response as yet to the oat Title XII preproposal document.)

Thesis Research Projects.

Oat groat conformation. Mr. Wesley R. Root is continuing his Ph.D. study of oat groat conformation and its effect on certain grain quality characteristics. Mr. Root discussed some of his results in a paper presented at the annual meeting of the American Society of Agronomy (ASA) in Chicago in December, 1978.

Avena translocation lines. Mr. James A. Radtke, now at the University of Minnesota, discussed the results of his MS thesis research in a paper presented at the Chicago ASA meetings in December, 1978.

Ms. R. Sherri Stern is continuing some inheritance phases of this project in her MS program. The segregation ratios in *A. sativa* x translocation-line F_2 populations and in translocation line x translocation line F_2 populations will be determined.

Interspecific transfer of genes for stem rust resistance. Mr. P. Douglas Brown is continuing his Ph.D. program at Wisconsin while maintaining employment with Agriculture Canada at Winnipeg. Mr. Brown is working with stem rust resistance derived from tetraploid *A. barbata* selection D203 in the program of Dr. R. I. H. McKenzie. The resistance exists at the hexaploid level in monosomic and disomic alien addition lines (2n=43 and 44, respectively) and in a monosomic alien substitution (MAS) line (2n=42). The Driscoll and Jensen genetic method is being used in attempts to utilize the 44-chromosome lines as donor parents, and Sharma and Knott's translocation method will be used in attempts to transfer the gene for resistance from the MAS line to *A. sativa*.

Transfer of genes for crown rust resistance from tetraploid *A. barbata* var. Excoimbra (#20) to *A. sativa*. Mr. Kenneth R. McNamara completed his MS program in December, 1978, and is now a member of the LaCrosse County Extension staff, LaCrosse, WI. Mr. McNamara verified that derived tetraploid C.I. 7232 and tetraploid #20 carry independent genes for crown rust resistance. Meiosis in F_1's was normal with 14 bivalents. Resistant plants in F_7-F_{12} #20 x Clintland 60 lines were identified and performance of progeny lines in future generations will be monitored closely.

Mr. Yeong Rho, a Ph.D. candidate under the direction of Dr. Brinkman, is continuing to evaluate multiple cropping of Lang oats and Hodgson soybeans under southern Wisconsin growing conditions. Multiple cropping is practiced extensively in Korea, Mr. Rho's native country.

Mr. Jonathan Reich recently joined the small grains project. Jonathan will be working on an MS degree under the direction of Dr. Brinkman, and his research will be concerned with *A. sativa* x *A. sterilis* and *A. sativa* x *A. fatua* crosses. Jonathan received his BS degree from the University of Missouri at Columbia.

The U.S.D.A. Oat Quality Laboratory. Madeline Chinnici completed her MS degree under the direction of David M. Peterson. She reported on her study of temperature and drought effects on blast and other characteristics of oats at the A.S.A. meetings in December 1978. Lucia Lesar (MS -D. M. Peterson) is investigating the effect of assimilate supply on grain composition in oats, using a technique of culturing post-anthesis excised panicles in defined media. Gordon Miller (MS -V. L. Youngs) has completed his research on the relationship between phytic acid in oat groats and soil phosphorus, and Tom Frantz is beginning an MS study on physiological aspects of halo blight.

V. NEW CULTIVARS AND RELATED MATERIAL

Benson

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

'Benson', C.I. 9358, is a recently released spring oat cultivar developed cooperatively by the Minnesota Agricultural Experiment Station and USDA-SEA-AR. Benson is a selection from the cross 'Portage' X 'Burnett' and was advanced in early generations by single seed descent. Benson has been in Minnesota statewide trials for six years, 1973-78, in the Uniform Midseason Performance Nursery during 1974-77 and in the International Oat Rust Nursery (IORN). It was identified in the latter two nurseries as Mn 71211.

Benson has yielded well in Minnesota trials ranking second only to Moore during 1974-78. It had the highest protein yield (kg/ha) among entries in these trials. Its maturity, test weight, groat percentage and protein percentage are similar to Lyon. It is 6-7 cm shorter than Lyon, but more lodging susceptible. Because of the weaker straw, Benson is best suited to lower rainfall areas where lodging is less of a problem.

The variety Benson is resistant to smut and has some broad based resistance to crown rust. During 1974-77, the average coefficient of crown rust infection in the IORN was almost equal to that of the Iowa multiline variety series E&M. The leaves of Benson are light green and relatively short and narrow. The panicle is small and spreading. Hull color is white-light ivory.

Breeder seed will be maintained by the Minnesota Crop Improvement Association, St. Paul, MN 55108. Variety protection via seed certification will be sought.

BROOKS

C. F. Murphy

'Brooks' oats (Avena sativa L.), C.I. 9260, is a high yielding, stiff strawed winter oat with excellent winterhardiness (43% greater than 'Carolee'), early maturity and exceptional potential for protein production. It has shown at least a 25% advantage in pounds of protein per acre over other commonly grown varieties.

Brooks is a pure line selection from the cross Co x Fgn 4x Fgn 3x Cmr x Hj-Jt 2x Atlt x Ctn-SF. The last cross was made in 1967, with the final selection (F_7) having been made in 1973. It was tested as NC 73-15, by the North Carolina Agricultural Experiment Station from 1975-78. It was also tested from 1977-78 in the North Carolina Official Variety Test and the Uniform Central Area Winter Oat Nursery.

Brooks has some tolerance to barley yellow dwarf virus and moderate resistance to soil-borne mosaic virus. It has semiprostrate juvenile plant growth and midsized yellow stems with pubescent internodes. Leaf blades are midwide and the leaf margin is mostly glabrous. The leaf sheaths are hairy and ligules are present. Panicles are equilateral, midsized, midlong, midbroad, and ovate. The branch attitude is erect to spreading with ascending branches. The rachis is straight, spikelet separation is by semiabscission, and floret separation is by disarticulation. The lemma is very short, yellow, and glabrous. The grain is midplump and the second floret rachilla segment is long and glabrous. Basal hairs are few or absent and awns are absent.

Gema

C.A. Jiménez-González and M. Navarro-Franco

Gema, a spring oat variety for forage bred at the Instituto Nacional de Investigaciones Agrícolas, was authorized on December 1978 for commercial use by the National Qualifier Committee of Varieties and Plants.

Gema was derived by the pedigree method from the cross:

[(Arkansas x No. 58-AB 177/Curt x Nodaway^3) (Indio-Nodaway)] Faunl, I-1169-1M-3R-0C. It yields 13% to 53% more green forage than the standard varieties in Mexicali, Baja California, and it has shown 4 to 11% higher green forage yield than the check varieties in Zaragoza, Coahuila. Gema is moderately resistant to lodging, moderately susceptible to *Puccinia graminis avenae*, susceptible to *Puccinia coronata* and moderately resistant to *Erysiphe graminis*. Gema has semiprostate to erect juvenile growth habit. Adult plant height averages 120 to 130 cm. Culms are midsized with 4 to 6 glabrous internodes. Leaves are midwide light green and glabrous. Panicle is equilateral midlong to long (19 to 23 cm). Rachis is straight with 4 to 6 nodes and false node. Branches are midlong to long (10 to 16 and almost 8 cm long) straight to drooping, spikelets numerous (46 to 66). Glumes pale green at flowering, long (25 to 27 mm) fine in texture; florets 2 rarely 3, lemma yellow, midlong (10 to 15 mm); nerves 7 to 8; palea narrow yellow; spikelet separation by abscission, basal scar present, basal pubescence few short; floret separation by fracture; awns few and usually straight; kernel slender; rachilla segment short, slender, sparsely hairy.

MARATHON

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

'Marathon', C.I. 9360, is a new oat variety developed by workers at the University of Wisconsin. Tested as Wisconsin selection X2456-2, seed has been released by the Wisconsin Agricultural Experiment Station to Certified Seed growers, and Certified Seed will be available for general farm production in 1980. This oat has been named after Marathon County in north central Wisconsin which continuously has the highest oat acreage in the State.

The pedigree of Marathon is Holden/3/Trispernia/Belar/2/Beedee. The final cross, made in 1967 by H. L. Shands, was between Holden and a sister line of Dal (X1289-1). Marathon is in the late-maturing group, intermediate in heading between Froker and Dal. Grain color is light tan.

Yield testing of Marathon began at Madison, WI in 1972. It has been tested statewide since 1973 and in the USDA Uniform Midseason Oat Performance Nursery since 1974. In 39 Wisconsin tests and in 92 USDA tests, Marathon outyielded both Dal and Lodi by over 5.6 bushels per acre. Test weight of Marathon is intermediate between Dal and Lodi, and Marathon is similar to Dal in hull percentage. Marathon averages only 0.8% below Dal in groat protein which, in combination with high grain yields, has resulted in production levels of protein pounds per acre which exceed those of all other named varieties in Wisconsin tests including Dal.

Plant height of Marathon is about 1/2 inch taller than Holden and about 1 inch shorter than Dal. It has good straw strength and lodges less than Dal, Froker, Lodi, or Wright. Marathon has good resistance to the newer, prevalent smut races and to prevalent races of oat leaf and stem rust. It is moderately susceptible to the oat red leaf virus. Marathon appears to have wide adaptability, and it has responded well to stress environments. Application for Plant Variety Protection is planned.

Financial support by the Quaker Oats Company and by the Wisconsin Seed Growers Small Grain Research Fund, and assistance of D. C. Arny (Dept. of Plant Pathology), University of Wisconsin Experimental Farms and Extension personnel, graduate students, and the USDA Oat Quality Laboratory are gratefully acknowledged.

Moore

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

The Minnesota Agricultural Experiment Station has approved the release of 'Moore', a spring oat variety developed in cooperation with USDA-SEA-AR. Moore is a selection from the cross 'Lodi' ^{2}X Mn 65B1286. The selection Mn 65B1286 is a crown rust resistant progeny from the cross 'Landhafer' 3X 'Mindo' 2X 'Hajira' X 'Joanette' 4X^2 'Andrew' 5X 'Rodney' 6X Black Mesdag X Ab. 101 7X 'Rodney'. Occasionally that pedigree has been abbreviated as MN 11-54-2 X Ab. 5088 2X Rodney. Ab. 5088 was obtained from F. A. Coffman about 1957.

Moore has been in Minnesota statewide trials for five years, 1974-78, in the Uniform Midseason Performance Nursery during 1975-77 and in the IORN from 1974 to 1977. It was identified in the latter two nurseries as Mn 73231 and has been assigned C.I. 9359.

Moore was the highest yielding entry in Minnesota trials during 1974-78. Its maturity, height, lodging resistance and overall appearance are similar to Lodi, but test weight and groat percentage are significantly higher. Moore is moderately resistant to smut and probably has some generalized resistance to crown rust as evidenced by its low average coefficient of infection in the IORN. The leaves of Moore are blue-green and droopy. The panicle is medium sized and spreading. Hull color is white.

Breeder seed will be maintained by the Minnesota Crop Improvement Association, St. Paul, MN 55108. Variety protection via seed certification will be sought.

OHAU

G. M. Wright

Ohau is a new spring milling oat admitted to the New Zealand Schedule of Acceptable Crop Cultivars in 1978. It was bred by the Crop Research Division at Lincoln from the cross Milford/Rodney/Avon made in 1961, is a sister selection of Omihi (Oat Newsletter 27, 70), and had its final trials under the designation Omihi/2.

Ohau is a white oat with very short thick straw and a moderately dense equilateral panicle. It has very broad green leaves and the panicle color at maturity is rather pale. The grain is plump, medium long, palea brown flecked, nerves prominent, no awns or basal hairs. It is resistant to crown rust and smuts, immune to stem rust, and has useful tolerance to BYDV.

Tests in Canada have shown that the most BYDV tolerant of our selections from the above cross is the line reported on as M-921. Seed of this is available from Agriculture Canada, Winnipeg.

OKAY

Bill Pass

"Okay" oats (Avena Sativa L.), C.I.9258, OK7222336, is a winter oat cultivar released by the Oklahoma Agricultural Experiment Station in 1978. It was derived from a cross of 'Chilocco' x 'Ora' made in 1970. Okay traces to a head row selection from a F_3 bulk population. This selection exhibited good plant type and yield potential.

Okay has been tested in Oklahoma state yield tests for five years. The state-average yield for this time shows Okay yielding 79.8 bushels per acre, to 64.9 for Chilocco and 60.5 for Nora. The winterhardiness and test weight are intermediate between parents. Tolerance to BYDV is simular to Chilocco.

The Okay variety tillers extremely well. Juvenile growth habit is semiprostrate to slightly erect and adult plant height is equal to Chilocco and 14 cm taller than Ora. Panicles are medium sized, equilateral and spreading. Culms are mid-sized and lightly pubsecent above the nodes. Leaf blades are midwide with glabrous margins and sheaths are glabrous. Kernels are small and plump. Awns are common and subgeniculate.

SVEA

Bengt Mattsson

Svea, a spring oat bred at the Swedish Seed Association, Svalöf was granted Plant Breeders Rights in 1976 and added to the Official Swedish List of Cultivars in 1977. It was selected from the cross (Voll x Blixt) x Titus.

Svea matures 4 days earlier than Selma and 2 days earlier than Sang. In spite of that it is outyielding both of them in a great part of the middle of Sweden and looking at the whole country Svea gives somewhat higher yield than Sang and almost the same as Selma. It has a stiffer straw than Selma but not as stiff as Sang.

Svea has a higher protein content than both the standard varieties. The hectolitre-weight is at the level of Sang and somewhat lower than Selma while the thousand grain weight is lower than either.

The variety has no particular disease resistance.

Svea will be marketed in 1980.

USDA OAT COLLECTION

J. C. Craddock

There were 89 entries accessioned to the USDA Oat Collection during 1978. The 53 foreign entries from nine countries were assigned Plant Introduction (PI) numbers. Oat workers from two states of the U.S. contributed 36 samples that were assigned Cereal Identification (CI) numbers.

Oat Researchers are encouraged to contribute lines that possess outstanding combinations of germplasm to the collection. Many worthwhile selections that have been developed should be saved even though they will not be released as a cultivar. Germplasm donated to the collection will be maintained for future use and will be available to oat workers world-wide. Should you decide to donate selections, all that is required is a seed sample (10 to 500 grams) and a statement acknowledging that the selection becomes public domain when added to the collection. Any information and comments pertaining to the oat are welcome as such information may be helpful in documenting the entry.

Contributions to the Oat Gene Bank are needed. Although you may only have a few seeds from F_1 and F_2 plants that are surplus to your needs, every contribution helps to maintain this bank.

A computerized system to store and retrieve information is being implemented for the USDA Oat Collection. Should your files contain data on oats from the collection, it would be appreciated if this information was forwarded to the Small Grains Collection. All data contributed whether or not it is incorporated into the data bank becomes public domain and is available to anyone upon request.

There were 7,914 samples distributed to oat workers world-wide in 71 shipments during the past year. 680 samples were distributed in 42 shipments to oat workers in 18 foreign countries. The U.S. workers in 19 states received 7,234 samples in 29 shipments.

The duplication of cultivar names or possible infringement on existing trademarks can be minimized by requesting a name clearance. The proposed name will be checked against the cultivar name files of the Oat Collection and the Trademark and Patent Office. It is helpful if you indicate the Station and/or Breeder's number and the CI number if one has been assigned.

The CI numbers assigned in 1978 are listed.

OAT CI NUMBERS ASSIGNED IN 1978

CI No.	Name/Designation	Parentage	Source
9317	RL 805: RdyPgOExt (resistance dominant)	Rodney *5/Exeter	Minnesota
9318	RL 899: RdyPglWR (resistance dominant)	Rodney *5/Exeter//Rodney *4/White Russian	Minnesota
9319	RL 815: RdyPg2 (resistance dominant)	Rodney *5/Exeter/7/Rodney *6/6/Santa Fe/3/ Victoria//Hajira/Banner/4/Ajax/5/Garry	Minnesota
9320	RL 902: RdyPg3Jst (resistance dominant)	Rodney *5/Exeter/2/Rodney *6/Jostrain	Minnesota
9321	RL 903: Rdypg8 (resistance recessive)	Rodney *5/Exeter/3/Rodney *6//Hajira/Jostrain	Minnesota
9322	RL 879: Rdypg9 (resistance recessive)	Rodney *5/Exeter *3/7/Rodney *6/5/Lanhafer/3/ Mindo//Hajira/Jostrain/4/Andrew *2/6/ Forvic/CI 5254	Minnesota
9323	PA 316-9148	Wintok Sel /Clintland 60	Pennsylvania
9324	PA 418-732	Dubois/Newton	Pennsylvania
9325	PA 522-7	Wintok//Wintok Sel /Hairy Culberson/3/Craig/ Alamo	Pennsylvania
9326	PA 522-23	Ballard//Wintok Sel /Hairy Culberson/3/Dubois/ Fulwin	Pennsylvania
9327	PA 621-87	Ballard//Wintok Sel /Hairy Culberson/3/Dubois/ Fulwin	Pennsylvania
9328	PA 621-1819	Dubois/6904//Nysel/3/Dubois/Milford	Pennsylvania
9329	PA 621-2898	Cornell Sel 5221aB-2B/PA 59UWH33-2/3/LeConte// Ballard/CI 7317	Pennsylvania
9330	PA 621-2901	Cornell Sel 5221 Ab-2B/Pa. 59UWH33-2/3/ LeConte//Ballard/CI 7317	Pennsylvania
9331	PA 621-3274	PA 5991/LeConte//CI 7128	Pennsylvania
9332	PA 724-1124	Nysel/Ballard//Dubois/CI 7317	Pennsylvania
9333	PA 724-1437	Wintok Sel /Hairy Culberson//Dubois	Pennsylvania
9334	PA 724-1738	Milford//Wintok Sel /Hairy Culberson/3/Ballard// Wintok Sel /Hairy Culberson	Pennsylvania

CI No.	Name/Designation	Parentage	Source
9335	PA 724-2589	A117-5/Putnam	Pennsylvania
9336	PA 725-2151	Dubois//Dubois/Milford	Pennsylvania
9337	PA 725-4277	Fulghum//Wintok Sel /Hairy Culberson /3/Wintok Sel /Aa. 676	Pennsylvania
9338	PA 725-4743	Ballard/PA 3823//Ballard/PA 3823	Pennsylvania
9339	PA 725-4787	Dubois/Newton	Pennsylvania
9340	PA 725-4984	PA 5346/LeConte//Ballard/3/CI 7317/CI 8126	Pennsylvania
9341	PA 725-6113	CI 7317/Ballard	Pennsylvania
9342	PA 822-641	Nysel/Hairy Culberson/3/Waubay//Wintok Sel / Hairy Culberson	Pennsylvania
9343	PA 822-818	Milford//Wintok Sel /Hairy Culberson/3/LeConte/ Dubois//Nysel	Pennsylvania
9344	PA 822-855	PA 3827/CI 7326//PA 3827/CI 7326	Pennsylvania
9345	PA 822-5462	Milford//Wintok Sel /Hairy Culberson	Pennsylvania
9346	PA 822-5650	Wintok/Bicknell/3/Milford//Wintok Sel /Hairy Culberson/4/Nysel/Ballard//Dubois/CI 7317	Pennsylvania
9347	PA 822-5687	Milford/Wintok//Nysel/Hairy Culberson	Pennsylvania
9348	PA 822-7323	Dubois/Nysel//Milford/Wintok/3/Dubois/Milford// Wintok Sel /Hairy Culberson	Pennsylvania
9349	PA 822-7325	Dubois/Nysel//Milford/Wintok/3/Dubois/Milford// Wintok Sel /Hairy Culberson	Pennsylvania
9350	PA 822-7329	Dubois/Nysel//Milford/Wintok/3/Dubois/Milford// Wintok Sel /Hairy Culberson	Pennsylvania
9351	RL 997: RdyPg 15	Rodney *5/Exeter *2//CAV 1830 (A. sterilis)	Minnesota
9352	RL 882: RdyPg 16	Rodney *5/Exeter *5//D 203 (A. barbata)	Minnesota
9353	NC 75-2	NC 2469-2/Ark 40-79	North Carolina
9354	NC 75-6	NC 2469-2/Ark 40-79	North Carolina
9355	Ark 0136-1	CI 8362//Florida 500/Mid-South	Arkansas
9356	Ark 0151-6	Coker 227//Florida 501/Nora	Arkansas
9357	Ark 0151-11	Coker 227//Florida 501/Nora	Arkansas
9358	BENSON		Minnesota
9359	MOORE		Minnesota
9360	MARATHON	Holden/3/Trispernia/Belar//Beedee	Wisconsin

Germplasm Preservation

Louis N. Bass
Director, National Seed Storage Laboratory

This is a reminder that the Crop Science Society has a requirement that all new registrations of varieties and germplasm must have a sample deposited in the National Seed Storage Laboratory at the time registration is requested.

The National Seed Storage Laboratory would like to have at least 10,000 seeds of each accession as an initial deposit. This will permit the Laboratory to monitor the germination at periodic intervals over a long period of time.

Application forms for submitting seed samples to the National Seed Storage Laboratory are available directly from the Laboratory or from the Crop Subcommittee Chairman of C-852. As much information about each seed accession as is available is requested, particularly a copy of the descriptive material used in registering the variety and any other information which the originator feels desirable to have available for other plant breeders.

VI. PUBLICATIONS

BREEDING, GENETICS and TAXONOMY

ALLEN, F. L., R. E. COMSTOCK AND D. C. RASMUSSON. 1978. Optimal Environments for Yield Testing. Crop Sci 18:747-751.

ASHES, J. R. AND N. J. PECK. 1978. A simple device for de hulling seeds and grain. Anim Feed Sci Technol. 3:109-116.

BAKER, E. P. 1977. Oat variety. J. Aust Inst Agric Sci. 43:177.

BAUM, B. R. 1977. Assessment of cladograms obtained for fourteen species of Avena by two methods of numerical analysis. Syst Bot 2:141-150.

BECKER, V. 1978. Lyon outperforms other oat varieties. Minn Sci 33:14.

BERATTO, M. E. 1977. Oat varieties for grain (SPA). Invest Prog Agric 9:31-36.

BERATTO, M. E. 1977. Effectiveness of pure line selection in improving the rubia oat variety for resistance to lodging in Chile (SPA). Agric Tec 37:150-155.

BOHM, W. AND U. KOPKE. 1977. Comparative root investigations with two profile wall methods. Z Acker Pflanzenbau 144:297-303.

BRINKMAN, M. A. AND K. J. FREY. 1978. Flag leaf physiological analysis of oat isolines that differ in grain yield from their recurrent parents. Crop Sci 18:69-73.

BRINKMAN, M. A., K. J. FREY AND J. A. BROWNING. 1978. Influence of an extra pair of fragment chromosomes on grain yield in a hexaploid oat. Crop Sci 18:147-148.

BROWN, C. M., H. JEDLINSKI. 1978. Registration of lang oat cultivars. Crop Sci 18:525.

CAHANA, H. AND G. LADIZINSKY. 1978. The cytogenetic position of Avena Damascena among the diploid oats. Can J. Genet Cytol 20:399-404.

COCUCCI, A. E. AND M. E. ASTEGIANO. 1978. Interpretation of the embryo of of the poaceae. Kurtziana 11:41-54. Biol Abstr 67, 010026.

COLLINS, F. C. AND J. P. JONES. 1978. Registration of bob oat cultivar. Crop Sci 18:913.

COLLINS, F. C., J. P. JONES AND W. T. MC GRAW. 1977. Arkansas oat and wheat variety tests. Arkansas Farm Res 26:4.

COMEAU, A. AND N. F. JENSEN. 1978. Registration of oat composite N Y I-V R Germplasm. Crop Sci 18:530-531.

CRUZ, A. M. AND P. A. R. TORRES. 1977. Grain and forage yield test with 12 varieties of Avena sativa L. Informe Invest Inst Technol 15:69-70.

CUMMINGS, D. P., D. D. STUTHMAN AND C. E. GREEN. 1978. Morphological mutations induced with ethyl methanesulfonate in oats. J Hered 69:3-7.

DEUMLING B. 1978. Localization of repetitive DNA in cereals by in-situ hybridization, cross hybridization among wheat, rye, barley, and oat. Plant Syst Evol 129:261-268. Biol Abstr 67, 028301.

DHUMALE, D. B. AND S. N. MISHRA. 1977. Genetic variability for quantitative traits in oat (Avena species). Pantnagar J Res 1977:15-18.

DOVGAL, T. K. 1977. Improvement of the technique of oat hybridization. Sel Semenovod 2:73-74.

FIDDIAN, W. E. H. 1976. Wheat, barley and oat varieties completing primary trials in 1975. J Natl Inst Agric Bot 14:105-156.

FREY, K. J. 1977. Protein of oats. Z pflanzenzucht 78:185-215.

GAMZIKOVA, O.I., V. I. BOGACHKOV AND V. F. ZENCHENKO. 1977. Results of studying the oat collection for the content of protein and lysine in the grain in the forest-steppe of Western Siberia. Sib Vestn S-KH Nauk 4:31-34.

GERVAIS CAMILLE. 1973. Contribution to the cytotaxonomic study of oats. Schweizerische naturforschende gesellschaft 88:156.

GORNALL, R. J. 1977. Notes on the size and exine ornamentation of Avena Oats. Can J Bot 55:2622-2629.

HAFIZ, H. M. I. AND H. THOMAS. 1978. Genetic background and the breeding behavior of monosomic lines of avena sativa L. Z Pflanzenzucht 81:32-39.

HAFIZ, H. M. I. 1977. Meiotic instability in monosomic lines of Avena sativa linnaeus. Biologia 27:31-40.

HAVEY, M. J. AND K. J. FREY. 1978. Optimal sample size and number per plot and replicate number for seed weight of oats. Cereal Res Commun 6:113-122.

HELSEL, D. B. AND K. J. FREY. 1978. Grain yield variations in oats associated with differences in leaf area duration among oat lines. Crop Sci 18:765-769.

ILYAS HAFIZ H. M. 1977. Production of aneu ploid gametes by monosomics of Avena sativa. Pak J Bot 9:89-98. Biol Abstr 67, 028282.

JENSEN, N. F. 1978. Composite breeding methods and the DSM system in cereals. Crop Sci 18:622-626.

KOLP, B. J., L. R. RICHARDSON AND G. P. ROEHRKASSE. 1977. Wyoming oat variety trials. Bull Wyo Univ Agric Ext Serv 8 p.

LADIZINSKY, G. AND R. FAINSTEIN. 1978. A case of genome partition in polyploid oats. Theor Appl Genet 51:159-160.

LARIK, A. S. 1978. Morphology and cytology of different aneuploids in in Avena sativa L. Cytologia 43:695-704.

LAWES, D. A. 1977. Yield improvements in spring oats. J Agric Sci 89:751-757.

LEGGETT, J. M. 1977. The meiotic behavior of aneupolyhaphoids of the cultivated oat Avena sativa. Can J Genet Cytol 19:651-656.

LE GRAND, F. E. AND L. EDWARDS. 1969. Barley and oat varieties for Oklahoma. Okla State Univ Coop Ext Serv 2 p.

LUK'IANOVA M. V. AND N. A. RODIONOVA. 1977. The problem of breeding oats and barley for quality. Tr Prikl Bot Genet Sel 59:60-65.

LYZLOV E. V., E. D. NETTEVICH AND N. V. SEREBRIAKOVA. 1977. Once more about fatuoids. Deviating forms of oats, admixture in the crops of a major variety. Sel Semenovod 1:55-58.

MATTSSON, B. 1977. Oats with high protein content - an important goal for improvement research. Tidskr Sver Utsadesforen 87:317-323.

MC DANIEL, M. E. AND D. J. DUNPHY. 1978. Differential iron chlorosis of oat cultivars. Crop Sci 18:136-138.

MORIKAWA T. 1977. Cytogenetical characteristics of double monosomics obtained from intercrosses between monosomic lines in kanota oats. Jap J Genet 52:31-39.

MORIKAWA, T. 1978. Identification of monosomic and nullisomic oats using leaf propxidase isozymes. Jap J. Genet 53:191-198.

MOROZ, N.A. AND V. L. POLIAKOVA. 1976. Results of studying selection methods for barley and oats. Sel Semenovod 4:53-56.

MURPHY, J. P. 1978. Environmental effects on grain yield of some high-yielding lines of oats (Avena sativa L.). M.S. thesis, Iowa State Univ. Library.

NAIR, P.S. AND Y. K. GUPTA. 1977. Analysis of genetic parameters on dry matter yield and its components in fodder oats (Avena sativa L.). Agric Res J Kerala 15:128-132.

NARSIMHA, Reddy B. AND S. D. RAI. 1977. Components of seed yield in oats (Avena sativa L.) varieties. Forage Res 3:153-156.

NISHIYAMA, I. AND T. YABUNO. 1978. Basic genetic behavior of eu ploid and aneu ploid fatuoid oats. Jpn J Genet 53:353-360. Biol Abstr 67, 047738.

NISHIYAMA, I. AND T. YABUNO. 1978. Interspecific cross-incompatibility due to disturbed activation of the polar nuclei bu the mocale nucleus. Jap J Breed 28:71-80.

NISHIYAMA, I. AND T. YABUNO. 1978. Causal relationships between the polar nuclei in double fertilization and interspecific crosses-incompatibility in Avena hybridization. Cytologia 43:453-466.

NUZHDIN, N. I. AND N. S. SAMOKHVALOVA. Influence of the physiological state of dry seeds on the radiobiological effect of the gamma rays of CS137 Biol Bull Acad Sci USSR 1:225-229.

OPLINGER, E. S. 1975. Oat varieties for 1975. Wisconsin University Cooperative Extension Programs. Pub No A1929.

OPLINGER, E. S., R. A. FORSBERG AND M. A. BRINKMAN. 1978. Oat varieties for 1978. Publ Coop Ext Programs Univ Wis Ext 4 p.

PATTERSON, F. L. AND J. F. SCHAFER. 1978. Registration of tippecanoe oats. Crop Sci 18:355-356.

PATTERSON, F. L. AND J. F. SCHAFER. 1978. Registration of norline oats. Crop Sci 18:356.

PATTERSON, F. L. AND J. F. SCHAFER. 1978. Registration of clintland 60 and Clintland 64 oats. Crop Sci 18:354-355.

PATTERSON, F. L. AND J. F. SCHAFER. 1978. Registration of Putnam 61 oats. Crop Sci 18:355.

PHILLIPS, M.S. 1978. The frequency of natural crossing in composite cross populations of oats grown in Scotland. Cereal Res Commun 6:67-69.

REEVES, D. L. 1978. Registration of spear oats. Crop Sci 18:524.

RIMPAU, J., D. SMITH AND R. FLAVELL. 1978. Sequence organization analysis of the wheat and rye genomes by interspecies DNA-DNA hybridization. J Mol Biol 123:327-360. Biol Abstr 67, 015444.

SCHLER D. AND J. M. POEHLMAN. 1978. Registration of Bates Oats. Crop Sci 18:525.

SEGERBART, R. L. 1978. Magnitude and distribution of genetic variation from mutagenesis and hybridization. Ph.D. dissertation. Iowa State Univ. Library.

SEMIKHOV, V. F., O. A. KALISTRATOVA AND L. P. AREF'EVA. Biochemical evolution of the tribe stipeae poaceae. Bot ZH 63:812-826. Biol Abstr 67,026573.

SHARMA, D. C. 1978. Disomic alien chromosome substition and addition in hexaploid oat. Euphytica 27:581-586.

SHISHLOV, M. P. and A. M. SHISHLOVA. Test of oat grain for protein content, evaluation of breeding material. Sel Semenovod 3:29-30.

SHORTER, R., P. GIBSON AND K. J. FREY. 1978. Outcrossing rates in oat species crosses (Avena sativa L. x Avena sterilis L.). Crop Sci 18:877-878.

SIMONS, M. D., J. W. MARTENS, R. I. H. MC KENZIE, I. NISHIYAMA, K. SADANAGA, J. SEBESTA AND H. THOMAS. 1978. Oats: A standardized system of nomenclature for genes and chromosomes and catalog of genes governing characters. U. S. Dept. of Agriculture. Agriculture Handbook: No. 509. 40 p.

SMITH, L. J., G. W. WALLINGFORD AND R. K. SEVERSON. 1978. Varietal screening of wheat, barley and oats with and without copper at two locations in 1977. Soil Ser Minn Univ Agric Ext Serv 103:51.

STEWART, V. R., D. M. WESENBERG, R. M. HAYES AND F. C. PETR. 1978. Registration of Otana oats. Crop Sci 18:693.

STUTHMAN, D. D., M. B. MOORE, P. G. ROTHMAN AND R. D. WILCOXSON. 1978. Registration of Lyon oats. Crop Sci 18:356.
SWINK, J. F. AND T. E. HAUS. 1978. Barley and oat tests. Prog Rep Colo Exp Stn 2 p.
TAYLOR, R. L. 1978. Registration of ceal oats. Crop Sci 18:525.
THOMAS, H. AND T. AUNG. 1977. Transfer of alien genes by means of induced translocation in oats and other crop species rysiphe graminis, mildew, resistance, Avena Barbata. Induced Mutations against plant diseases: Proc. of a Symposium p. 515-525.
TROFIMOVSKAIA, A. I. A. 1977. Ways of raising the efficiency of barley and oat breeding. Tr Prikl Bot Genet Sel 59:51-59.
TROFIMOVSKAIA, A. I. A., N. A. RODIONOVA AND B. N. SOLDATOV. 1977. Genetic resources of oats and their use in breeding. Tr Prikl Bot Genet Sel 60:58-62.
TYAGI, I. D., R. K. DIXIT, MURTZA AND H. G. SINGH. 1977. Note on the genetic variability in fodder oat. Indian J Agric Sci 47:629-631.
VELIKOVSKY V. 1978. Genetic evaluation of yield components of oat grain. Genet slechteni 14:33-41.
VELIKOVSKY, V. 1978. Evluation and use of mutant forms of oats. Genet Slechteni 14:117-125.
WHITLOCK R. 1978. A pre-harvest look at cereal wheat, barley, oats. Arable farming 8:22,26.
YAZDI-SAMADI, B. K. K. WU AND S. K. JAIN. 1978. Population biology of Avena Oats. V.I. The role of genetic polymorphisms in the outcome of interspecific competition. Genetica 42:151-159.
YEN, S. T. AND K. SADANAGA. 1977. Nullisomic and monosomic analyses of genes controlling leaf peroxidases in oats. Can J Genet Cytol 19:395-403.
Yen S. T. AND W. G. FILION. 1977. Differential giemsa staining in plants. V. Two types of constitutive heterochromatin in species of Avena. Can J Genet Cytol 19:739-743.
ZDRAHALOVA, B. 1977. Correlation between Huskiness and crude fiber content in oats in relation to breeding. Genet Slechteni 13:137-141.

CULTURE and PHYSIOLOGY

ALBERT, E. 1978. Pot experiments for determining suitable NPK. Arch Ackerpflanzenbau bodenkd 22:193-202.
ABURTO, S. AND J. S. CAVAZOS. 1977. Determination of the yield of green forage and hay and the recovery of fodder oats (Avena sativa L.). Informe Invest Inst Technol 15:67-69.
ABURTO, S. AND G. J. LEAL. 1977. Comparison of 8 introduced varieties of oats (Avena sativa L.) and the complex variety 2 as to forage production at different stages of maturation. Informe Invest Inst Technol 15:66-67.
ALEKSANDROVA, I. V. 1977. Soil organic matter and nitrogen nutrition of plants. Pochvovedenie 5:31-38.
ALLEN M. 1977. Yield comparisons of cool-season annual grasses. 1976-77. Annu Prog Rep Southeast LA Dairy Pasture Exp Stn 51-60.
ANDEL, O. M. VAN AND D. R. VERKERKE. 1978. Stimulation and inhibition by Ethephon of stem and leaf growth of some gramineae at different stages of development. J Exp Bot 29:639-651.
BABKOV, G. A., N. M. GABITOV, M. Z. GOLOVATIUK AND B. V. KHUSAINOV. 1977. Ways of increasing the output and improving the quality of grain in Siberia. Sib Vestin S-KH Nauk 3:82-87.
BAMBERG, K. K. 1978. The significance and necessity of using trace elements in the agriculture of the latvian-SSR. Latv Psr Zinat Akad Vestis 128-133.

BARNETT, R. D. 1978. Forage production and quality of hexaploid and diploid oats in mixtures with ryegrass. Proc Soil Crop Sci Soc Fla 37:68-71.

BENGTSON, C., S. LARSSON AND C. LILJENBERG. 1978. Effects of water stress on cuticular transpiration rate and amount of composition of EPI cuticular wax in seedlings of 6 oat varieties. Physiol Plant 44:319-324.

BLAIR, A. M. Interactions between barban herbicide and protectants on maize. Weed Res 18:77-81.

BOHLE, H. AND F. WAGNER. 1977. Yield and Quality of different grass clover mixtures sown in autumn or spring. Wirtschaftseigene futter 23:102-121.

BROMFIELD, S. M. 1978. The effect of manganese oxidizing bacteria and pH on the availability on manganous ions and manganese oxides in nutrient solutions. Plant Soil 49:23-40.

BROWN, J. C. AND M. E. MC DANIEL. 1978. Factors associated with differential response of two oat cultivars to zinc and copper stress plant nutritional deficiencies. Crop Sci 18:817-820.

CHENG, B. T. AND PESANT A. 1977. Manganese and copper nutrients in oats as affected by natural color and texture of soil associated with temperature and aeration. Agrochimica 21:170-179.

CHIBA, S. AND K. TAKAHASHI. 1977. Studies on heavy metal popPution in agricultural land. Part 2. Absorption of cadmium and growth retardation in forage crops. Bull Shikoku Agric Exp Stn 49-73.

CHRISTENSON, D. R. AND E. C. DOLL. 1978. Magnesium uptake from exchangable and nonexchangable sources in soils as measured by intensive oat cropping. Soil Sci 126:166-168.

CISAR G. AND H. L. SHANDS. 1978. Floral initiation and development in cultivars of oats. Crop Sci 18:461-464.

CURE, W. W. AND R. L. MOTT. 1978. A comparative anatomical study of organogenesis in cultured tissues of maize, wheat and oats shoot regeneration. Physiol Plant 42:91-96.

DEBRECZENI, B. 1978. Some effects of different cultural practices on the nutrient content of oats. Novenytermeles 25:335-342.

DEXTER, A. R. AND J. S. HEWITT. 1978. The deflection of plant roots. J Agric Eng Res 23:17-22.

DOSPEKHOV, B. A., A. Y. RASSADIN, AND A. E. ALEKSEEVA. 1977. Water demand and yield of grain crops in cultivation systems of different intensity. Izv Timiryazev S-KH Akad 39-46.

EAGLES, H. A., R. M. HASLEMORE AND C. A. STEWART. 1978. Nitrogen Utilisation in Libyan strains of Avena sterilis L. A hexaploid oat with high groat protein and high straw nitrogen content. N Z J Agric Res 21:65-72.

FARNWORTH, J. AND R. J. WILLIAMS. 1977. The effect of cutting height on oats, barley and wheat cut for forage, grain or forage followed by grain. Publ Jt Agric Res Dev Proj 9 p.

FARNWORTH, J. AND R. J. WILLIAMS. 1977. The effect of harvesting regime on the forage yield of wheat, oats and barley grown in Saudi Arabia. Publ Jt Agric Res Dev Proj 12 p.

FARNWORTH, J. AND R. J. WILLIAMS. 1977. Preliminary field scale observations on winter potoseeding of oats, barley or wheat into phodesgrass. Publ Jt Agric Res Dev Proj 17 p.

FARNWORTH, J. AND R. J. WILLIAMS. 1977. The effect of sowing date on forage yield and composition of oats, barley and wheat grown under irrigation in Saudi Arabia. 1. The effect of winter-spring sowing date. Publ Jt. Agric Res Dev Proj 9 p.

FILIPPOV, A.S. AND O. I. PAVLIV. 1977. Sowing dates of Nadezhnyi oats for seed in the Irkutsk region. Sel semenovod 2:52-53.

FITZSIMMONS, R. W. 1977. Oat growing. Bull P N S W Dep Agric 22 p.

FITZSIMMONS, R. W. 1978. Developments in the oat growing industry. Agric gaz N S W. 89:35-37.

FIXEN, P. E. AND P. L. CARSON. 1978. Relationship between soil test and small grain; wheat, barley, oats. Response to P. phosphorus fertilization in field experiments. Agron J 70:838-844.

FOKANOV, A. M. 1976. Watch the effect of barley and oat seed moisture content during threshing and storage on their sowing qualities. Sel Semenovod 6:46-49.

FOTYMA, M. AND S. GOSEK. 1977. Utilization of soil phosphorus reserves accumulated due to fertilization during a period of many years. Pol J Soil Sci 10:139-148.

FUENTES, SANCHEZ C., TOLEDANO T. ARANGUEZ AND J. MUNOZ. 1978. Avena sativa L. contribution to the ecological study of stony ground regions. I. Effect of phizobium on dry matter, organic matter, and digestible organic matter, and protein content of the genus VI. Rev Ecol Biol Sol 15:205-217.

FUHREMANN, T. W. AND E. P. LICHTENSTEIN. 1978. Release of soil bound methyl carbon-14 parathion residues and their uptake by earthworms and oat plants. J Agric Food Chem 26:605-610.

FURRER, J. D. AND T. LAVY. 1978. A quick test for atrazine carryover pesticide injuries, residues, beans, oats. Ext Bull Mich State Univ Coop Ext Serv 3 p.

GALKINA, A. A. 1977. Effect of residual peat thickness on the yields of agricultural crops. Pochvovedenie 10:82-88.

GOMONOVA, N. F. 1977. Effect of liming and prolonged application of mineral fertilizers on urease activity and yield of some crops. Vestn Mosk Univ Ser XVII Pochvoved 80-85.

GOMONOVA, N. F. 1977. Influence of lime and long-term application of mineral fertilizers on the urease activity and yield of certain crops. Mosc Univ Soil Sci Bull 32:64-68.

GROMBEIN, S., W. RUEDIGER AND R. HAMPP. 1978. Destruction and possible de-novo synthesis of phytochrome in sub cellular fractions of laminae from avena sativa. Planta (Berl) 141:273-278.

GRZESIUK, W, J. CHODAN, L. ZAWARTKA AND J. KICHARSKI. 1977. Preliminary evaluation of agramid and agroform as fertilizers. Pol J Soil Sci 10:79-86.

GUKOVA, M. M. AND V. S. AGEEVA. 1978. Nitrogen balance with respect to nutritional condition of a vetch oat mixture. IZV Timiryazev S-KH Akad. 91-100.

GUKOVA, M. M. AND V. S. AGEEVA. 1977. The development of different components in a vetch oats mixture and general productivity under different conditions of nutrition. Izv Timiryazev S-KH Akad. 78-87.

GUKOVA, M. M., AND V. S. AGEEVA. 1977. Development of industrial components in a vetch-oat mixture and total productivity of the crop under different nutritional conditions pot experiments with fertilizers. Izv timiriazevsk S-KH Akad 5:78-87.

GULIAKIN, I.V. N. B. BEKMUKHAMEDOVA AND V. A. DEMIN. 1977. Effect of annual and periodic application of phosphorus and potassium fertilizers on the yield and quality of oat grain. Izv Timiriazfvsk S-Kh Akad 1:219-223.

GUTSER, R., K. BURKART AND A. AMBERGER. 1978. The effect of potassium nutrition on potassium dynamics of potassium fixing soils, on yields and mineral uptake of green oats. 146:249-265.

HANCHARYK, M. M., B. I. LIAHENCHANKA, S. A. MIKUL'SKAIA, K. S. TALANAVA AND V. P. MATSIUSHEUSKAIA. 1976. Effect of impulse sprinkling on the physiology and productivity of oats with different moisture contents of peat soil. 6:5-11.

HECK, W. W. AND J. A. DUNNING. 1978. Response of oats to sulfur dioxide air pollutant: interactions of growth temperature with exposure temperature or humidity. 28:241-246.

HILL, L. 1977. Wheat and oat production. Coop Ext Pub La State Univ Agric Mech Coll Coop Ext Serv 1799, 4 p.

ISAEVA, L. G. 1977. Aftereffect of phosphorus fertilizers on oats on soils with different content of mobile phosphorus. Biull Nauchno-Tekh Inf Vses Nauchno - Issled Inst Zernobobovykh Krupianykn Kul't 15:64-66.

IVANEK, V. 1977. Quality of natural lowland meadows and effect of fertilizing. Poljopr Znan Smotra 41:5-14.

JASKOWSKI Z. 1977. The effect of magnesium nitro-chalk on oat yields. Pamiet Pulawski Inst Uprawy Nawozenia Glebozn 67:97-113.

JOHNSTON, H. W., J. B. SANDERSON AND J. A. MACLEOD. 1978. Cropping mixtures of field peas and cereals; barley, oats, wheat in Prince Edward Island. Can J Plant Sci 58:421-426.

JOKINEN, R. 1977. Effect of added magnesium, potassium, lime and nitrogen on oats. I. Yields. J Sci Agric Soc Finl 49:283-295.

JOKINEN, R. 1977. Effect of added magnesium, potassium, lime and nitrogen on oats. I I. Nutrient contents. Cation ratios and magnesium uptake. J Sci Agric Soc Finl 49:296-314.

JOSHI B. S. AND R. PRASAD. 1977. The effects of rates of application and sources of nitrogen on nitrate concentration in oat forage. J Br Grassl Soc 32:213-216.

JURKOWSKA, H. AND A. ROGOZ. 1977. The influencing of liming on copper concentration in plants in relation to the dose and kind of copper fertilizer. Pol J Soil Sci 10:149-156.

KHAN, S. U. AND P. B. MARRIAGE. 1977. Residues of atrazine herbicide and its metabolites in an orchard soil and their uptake by oat plants. J Agric Food Chem 25:1408-1413.

KIRCHOFF, B. K., L. F. ALLARD AND W. C. BIGELOW. Scanning electron microscopy cold stage techniques for the observation of vegetative and floral apices of oat (Avena sativa L.) plants. Proc Electron Micros Soc Am 35:590-591.

KITTLITZ, E VON. 1978. Influence of agrotechnical treatments on the germination ability of naked oats (Avena N) Landwirtsch forsch sonderh 34:185-192.

KLOCKARE, R., A. JOHNSSON, T. BROGARDH AND M. HELLGREN. 1978. Oscillatory transpiration and water uptake Avena-sativa plants, part 6, Influence of the irradiance level. Physiol Plant 42:379-386.

KOBAYASHI H. AND Y. OTAKE. 1977. Studies on physical interaction of forage roots on grassland soil. IV. Growth of root-system in the fixed pore model. J Jpn Soc Grassl Sci 23:241-246.

KOEHLER D. 1978. The course of ortho geo tropic reactions of shoots. Z phlanzenphysiol 87:463-468. Biol Abstr 66, 067081.

KUDEYAROVA, A. Y. U. AND A. I. TRUBIN. 1977. Comparative conditions of formation. Solubility and availability of variscite and metavariscite. In proceedings of the International Seminar on Soil Environment and Fertility Management In Intensive Agriculture p. 816-818.

KUKURENDA, HEIRONIM. 1976. Influence of variable environmental conditions on the transformation of soil manganese and its availability for oats. Akademia Rolnicza W. Poznaniu Prace Habilitacyjne 66:42-44.
LEBEDEVA L. A. 1977. Effect of prolonged use of mineral fertilizers on the fertility of soddy podzolic soils. Biol Nauki 20:7-17. Biol Abstr 66, 067782.
LUGAUSKAS, A. YU., D. YU SHYAUZHENE AND R. I. MIL'KIS. 1977. Myco flora of the rhizosphere of barley sown after fodder grasses. Liet Tsr Mokslu Akad Darb Ser C Biol Mokslai 3-12. Biol Abstr 67, 017880.
LISTE, H. J. AND V. EHRENPFORDT. 1977. The action of intensive cultivation measures in cereal crop rotations. Wiss Z Martin Luther Univ Halle-Wittenberg Math-Naturwiss Reihe 26:29-38. Biol Abstr 65, 055936.
MACKENZIE, J. M., Jr., W. R. BRIGGS AND L. H. PRATT. 1978. Intra cellular phtochrome distribution as a function of its molecular form and of its destruction. Am J Bot 65:671-676.
MACUHA. P. 1978. Effect of Nitrogen manuring on the amino acid composition and on the yield of dry matter and protein of the biomass of oats. Pol'nohospodarstvo 24:219-230.
MACUHA, P. 1977. Nitrogen fertilization of oats as a bulk feed. Agrochemia 17:48-52.
MEREDITH H., M. WIENS, R. SCHOPER AND J. LENSING. 1978. N Nitrogen rate studies of dryland and irrigated wheat and oats with and without legumes underseeding staples. Soil Ser Minn Univ Agric Ext Serv 103:95-106.
MICHALK, D. L. AND P. A. WITSCHI. 1977. Dry matter production from irrigated winter forage crops in the murrumbidgee irrigation area. Aust J. Exp Agric Anim Husb 17:1004-1010. Biol Abstr 66, 024891.
MUIR, R. M., K. CHEN CHANG AND B. R. STOKES. 1977. Control of growth by IAA. In Plant Growth Regulators: Proceedings of the international symposium on plant growth regulators 117-123.
MURDOCK, L. W. AND K. L. WELLS. 1978. Yields nutrient removal and nutrient concentrations of double cropped corn and small grain silage. Agron J 70:573-576.
MURPHY, C. F., J. C. BURNS AND L. A. NELSON. 1978. Effects of a commercial nutrient and evaluation of a seedling growth technique. Agron J 70:247-251.
NEPOCHATOV, A. P. AND A. T. ZIMOVSKAIA. 1977. Effect of mineral fertilizers on the effectiveness of herbicide 2,4-Dichlorophenozyacetic acid in the crops of barley, oats and maize for green forage. Agrokhimiia 7:104-110.
PETERS, T. W. 1977. Relationships of yield data of wheat, oats, and barley to agroclimates, soil capability classification and soils of Alberta. Can J Soil Sci 57:341-347.
PETRIKOVA, V. 1977. The effectivity of the application of fresh swine slurry to light-textured and heavy-textured soil. Rostl Vyroba Cesk Akad Zemed Ustav Vedeckotech Inf 23:353-359.
PINKERTON, A. AND J. R. SIMPSON. 1977. Root growth and heavy metal uptake by three graminaceous plants; barley, oats and rye in differentially limed layers of an acid, minespoil-contaminated soil. Environ Pollut 14:159-168.
PRASAD, R. D., K. N. SINGH AND K. V. BONDALE. 1977. Influence of sowing season. Levels of nitrogen and phosphorus on oats fodder and grain yield in Kodai Hills. Mysore J Agric Sci 11:154-160.
PRESSLAND, A. J. 1977. Water spreading in southwestern Queensland Australia native pasture production and forage cropping. Queensl J Agric Anim Sci 34:213-223. Biol Abstr 67, 051680.
PRZESZLAKOWSKA, M. AND R. WOJTYSIAK. 1977. Changes in the chemical composition of culms at their ear forming stage depending on mineral. Acta Agrobot 30:85-94. Biol Abstr 66, 031147.

QUALSET, C. O. AND M. L. PETERSON. 1978. Polymorphism for vernalization requirement in a winter oat cultivar. Crop Sci 18:311-315.

RASMUSSEN, K. J. 1977. Tromling af lerjorde Cambridge rolling after sowing barley and oats on loamy soils. Tidsskr Plant 81:248-256.

REEVES, D. L. AND H. S. SRAON. How an oat plant develops germination. Bull S D State Univ Agric Exp Stn 15 p.

REIMETS, E. 1977. Yield dynamics of oats and mixed crops. Sb Nauchn Tr Eest Pollumajanduse Akad 109:81-89.

ROMAOVA, L. M. 1977. Changes in the zoning of buckwheat. Zernovoe Khoz 7:40.

SANDHU, B. S. AND M. L. HORTON. 1978. Temperature response of oats to water stress in the field. Agric Meteorol 19:329-336.

SAWICKI, J. 1977. Productivity of spring barley in mixtures with spring wheat and oats. Acta Agrar Silv Ser Agrar 17:39-57.

SELMER-OLSEN, A. R., A. SORTEBERG AND M. ODELIEN. 1978. Pot experiments with various sulphur-containing compounds for rye grass. Acta Agric Scand 28:293-297.

SEMB, G. 1978. Effect of liming on crop soil and mineral content of the plants. Res Norw Agric 29:19-32.

SHKOL'NIK, M. YA AND A. N. MAEVSKAYA. 1977. Differences in sensitivity to boron deficiency in various taxa and their causes. Bot Zh 62:1528-1540.

SINGH, M. AND S. S. GREWAL. 1977. Effect of companion fodder crops and nitrogen on the forage yield of oats (Avena sativa L.). Indian J Ecol 4:194-198.

SKAAR, J. AND A. JOHNSSON. 1978. Rapid blue-light induced transpiration in Avena. Physiol Plant 43:321-325.

SORTEBERG, A. 1977. Molybdenum on oats: An instance of its use on peat soil. Jord Myr 1:19-27.

STEER, M. W. 1977. Differentiation of the tapetum in Avena. I I. The endoplasmic reticulum and golgi apparatus. J Cell Sci 28:71-86.

STEPHEN, R. C., R. C. MC DONALD AND A. KELSON. 1977. Influence of cutting date and frequency on dry matter production and nitrogen content of autumn-sown greenfeeds. N Z J Exp Agric 5:227-231.

SKACHKOVA, V. N. 1977. Dynamics of oat panicle development. IZV Akad Nauk Tadzh S S R 1:73-78.

STASKAWICZ B., R. KAUR-SAWHNEY, R. SLAYBAUGH, W. ADAMS, JR. AND A. W. GALSTON. 1978. The cytokinin-like action of the systemic fungicide Benomyl Methyl-2-Benzimidazolecarbamate on oat leaves and protoplasts. Pestic Biochem Physiol 8:106-110.

SUESS, A., G. FUCHSBICHLER AND H. SIEGMUND. 1978. Uptake of absorbed monolinuron by oat plants. Z Pflanzenernauhr Bodenkd 141:275-284.

SUSKEVIC, M. 1977. Minimization of soil cultivation for oats as a function of preceding crops and fertilization. Rostl Vyroba Cesk Akad Zemed Ustav Vedeckotech Inf 23:1043-1050.

SCIRYDAU, M. F. AND P. S. MIADZELETS. 1976. Response of barley and oat crops to mineral fertilizers on loamy sand soils of the polesye in the belorussian S S R. Vestsi IZV Ser S-Kh Nauk Minsk Belarus Akad Navuk 2:43-46.

TAHTINEN H. 1976. The effects of lime and phosphorus on copper uptake by oats and on the response to copper fertilization. Ann Agric Fenn 15:245-253. Biol Abstr 66, 036234.

TAJI, K., H. KAKIHARA, S. KUMAI AND S. KURIHARA. 1977. Studies on effect of manure application upon chemical composition and feeding value in forage crops 2. soiling oats. J Jpn Soc Grassl Sci 23:159-165.

TARAFDAR, J. C. AND P. K. CHHONKAR. 1978. Status of phosphatases in the root soil interface of leguminous and nonleguminous crops. Z Pflanzenernaehr Bodenkd 141:347-352.

TAYLOR, B. R. 1978. Studies on a barley oat mixture. J Agric Sci 91:587-592.

ULMANN, L. 1977. Influence of different nitrogen fertilizers on oat yield. Agrochemia 17:131-133.

ULMANN, L. 1977. The response of the "tiger" oat cultivar to nitrogen differentiated rates and to time of application. Rostl Vyroba Cesk Akad Zemed Ustav Vedeckotech Inf 23:343-352.

VAN ANDEL, O. M. AND D. R. VERKERKE. 1978. Stimulation and inhibitation by Ethephon of stem and leaf growth of some gramineae at different stages of development. J Exp Bot 29:639-652.

VERKHOVTSEVA, N. V. 1975. Influence of urea applied by the foliar and soil methods on the quality of oats. Mosc Univ Soil Sci Bull. 30:21-24.

VORA, A. B. AND M. K. PATEL. 1977. Effects of various osmotica on seedling growth of oat. Indian J Plant Physiol 20:44-49.

WICHMANN, W. AND A. FINCK. 1978. Determination of plant analysis criteria characterizing the magnesium nutrition of oats, spring wheat and maize. Z Pflanzenernaehr Bodenkd 141:95-106.

WICHMANN, W. AND A. FINCK. 1977. Holstein plant analysis data for the evaluation of the magnesium supply of oats and maize in Schleswig-Holstein. Landwirtsch-Forsch 30:296-302.

WINKLER, F. J., E. WIRTH, E. LATZKO, H. L. SCHMIDT, W. HOPPE AND P. WIMMER. 1978. Influence of growth conditions and development on delta carbon-13 values in different organs and constituents of wheat, oat and maize. Z Pflanzenphysiol 87:255-264.

WUNSCHE, U. 1977. Influence of growth retarding substances on cereals. I I I. Field experiments with C C C, D M C and C E P A Chlormequat, diethylmorpholinium chloride, 2-chloroethylphosphonicacid on wheat, rye, barley and oats. Z Acker Phlanzenbau 145:238-253.

WUNSCHE, U. 1977. Effects of growth retardants on tillering of cereals; wheat, barley, oats, rye. In plant growth regulator: Proceedings of the International Symposium on plant growth regulators. 2D:674-680.

YOUNIE, D. AND I. B. RUXTON. 1977. The effect of shelter date palm frond windbreaks on yield and composition of oats and barley grown for forage in Saudi Arabia. Publ Jr Agric Res Dev Proj 7 p.

YOUNIE, D. 1978. Effect of seed rate and nitrogen application rate on yield and composition of forage oats grown after alfalfa. Jount Agricultural Research & Development Project. Publ. No. 69.

YUKIMURA, T. AND M. KANDA. 1978. Studies on population establishment in artificial grasslands. 2. Significance of seed weight as factor influencing the neighboring interaction during the period of grass establisment oats. Rep Inst Agric Res Tohoku Univ 29:1-8.

ZAKHARCHENKO, I. H. AND O. A. LEONCHIK. 1976. Use by winter wheat and oats. Plants of nitrogen applied in the form of biological mass of legumes and cereals. Zemlerobstvo 43:83-91.

ZEMSKAYA, V. A., Y. U. V. RAKITIN, L. M. CHERNIKOVA AND Z. V. KALIBERNAYA. 1977. Distribution and transformation of 2,4-D Dichlorophenoxyacetic acid in tissues of graminious plants. Sov Plant Physiol 24:994-999.

ZIMOVA, DANA. 1978. Obzor = The growing of oats. Studijni informace 56 p.

DISEASES, INSECTS and NEMATODES

AGAFONOVA, Z. I. A., N. A. RODIONOVA AND N. S. IVANOVA. 1977. Rate of oat damage by oscinella frit in the non-chernozem zone. Bull Vses Inst Rastenievod 71:77-82.

AHMAD, S. T., S. P. RAYCHAUDHURI AND A. M. KHAN. 1977. Studies in the crown rust of oats, Puccinia coronata var Avenae. I. I. Factors influencing the formation and germination of teliospores. Forage Res 3:83-86.

ALCOCK, K. T. 1978. Field Evaluation of 2, 4, 5 Tri Methyl-N-Phenyl-3 Furan-carboxamide UBI-H-719 against cereal smut diseases in Australia. Plant Dis Rep 62:854-858. Biol Abstr 67, 030539.

ANDERSSON, K. 1977. Why doesn't aphis control work in cereals?. Vaxtskyddsnotiser 41:67-76.

AYANRU, D. K. G. AND J. A. BROWNING. 1977. Effect of heterogeneous oat populations on the epiphytotic development of victoria blight. New Phytol 79: 613-623.

AUNG, T., H., THOMAS AND I. T. JONES. The transfer of the gene for mildew, erysiphe graminis avenae resistance from avena barbata (4X) into the cultivated oat Avena sativa by an induced translocation. Euphytica 26:623-632.

BERKENKAMP, W. B., H. T. ALLEN AND M. L. KAUFMANN. 1978. Tolerance of oat cultivars to gray speck. Phytoprotection 59:137-138. Biol Abstr 67, 056840.

BREWER, F. D. AND A. L. TIDWELL, JR. 1978. Evaluating of wheast, proflo, oats and seven soybean materials as a source of protein in A W heat germ-based diet for rearing heliothis zea. J Ga Entomol Soc 13:7-12.

BURNETT, P. A. AND J. W. ASHBY. 1978. Barley stripe mosaic in New Zealand. N Z J Agric Res 21:143-146.

CARVER, T. L. W. AND A. J. H. CARR. 1978. The early stages of mildew colony. Ann Appl Biol 89:201-209.

CARVER, T. L. W. AND J. A. CHAMBERLAIN. 1978. Scanning electron microscopy of barley and oat mildew. Trans Br Mycol Soc 70:166-169.

CHAEVA, T. F. 1977. Results of the evaluation of spring cereal resistance to oscinella frit. Sel Semenovod 4:28.

CHUMAEVSKAYA, M. A. AND L. K. PAVLOVA-IVANOVA. 1976. Halo blight pseudomonas coronafaciens of oats and its developmental characteristics in minsk region. Translated from Vestnik Moskovskogo Universitita Biologia Pochvovedenie 31:74-79.

CHUPTSOVA, O. E. 1976. Identification of crown rust. Tr Vses Nauchno Issled Inst Zashch Rust 49:43-44.

CLARK, D. C. 1978. When oat plants become purplish-red. Barley yellow virus disease spread by the vector rhopalosiphum padi. Agrochem Cour 22:5.

COELHO, E. T. 1976. Distribution and prevalence of races of puccinia-coronata-var-avenae in Rio-grande-do-sul Brazil. Pesqui Agropecu Bras Ser Agron. 11:23-26.

COMEAU, A. AND G. J. PELLETIER. 1977. A new problem: damages to oats caused by oscinella nitidissima. Ann Soc Entomol Que 22:59-61.

CROW, R. V. AND D. H. MACDONALD. 1978. Phyto parasitic nematodes adjacent to established strawberry plantations. J Nematol 10:204-207.

CRUMP, D. H. AND B. R. KERRY. 1977. Maturation of females of the cereal cyst-nematode on oat roots and infection by an entomophthora-like fungus in observation chambers. Nematologica 23:398-402.

DANIELS, M. E. 1978. Greenbug schizaphis graminum resistance in oats. Southwest Entomol 3:210-214.

DANIELS, M. E. 1978. Greenbug resistance in oats. SW Entomologist 3:210-214.

DENISOVA, E. S. AND I. U. N. SUSLOVA. 1977. Breeding oats for loose smut Tr Prikl Bot Benet Sel 58:130-134.

DICKINSON, S. 1977. Studies in the physiology of obligate parasitism. X. Induction of responses to a thigmotropic stimulus, Puccinia Coronota in leaves of oats. Phytopathol Z 89:97-115.

DUFFUS, J. E. AND W. F. ROCHOW. 1978. Neutralization of beet western yellows virus by anti sera against barley yellow dwarf virus. Phytopathology 68:45-50.
FEDOTINA, V. L. 1977. Virus particles and mycoplasma-like organisms in cells of oat infested with pseudorosette disease. Arch Phytopathol Phlanzenschutz 13:177-191.
FURUSAWA, I. AND T. OKUNO. 1978. Infection with brome mosaic virus of mesophyll protoplasts isolated from 5 plant species. J Gen Virol 40:489-492.
GAGE, S. H. AND M. K. MUKERJI. 1978. Crop losses associated with grasshoppers in relation to economics of crop production. J Econ Entomol 71:487-498.
GILL, C. C. AND R. I. H. MC KENZIE. 1977. Susceptibility of oat cultivars to barley yellow dwarf virus in Manitoba. Can J Plant Sci 57:1021-1027.
GOLEBIOWSKA, Z. 1977. Kukurydzy on the necessity for registering the occurence of the frit fly, oscinella on oats and maize. Ochr Rosl 21:3-4.
GRAU, C. R. AND D. C. ARNY. 1978. Rust Diseases. Publ Coop Ext Programs Univ Wis Ext 2 p.
GUSEVA, K. A. 1977. Initial material for breeding oat and barley varieties resistant to major fungus diseases in the northwestern zone. Tr Prikl Bot Genet Sel 58:155-156.
HARDER, D. E. 1978. Crown Rust, Puccinia coronata of oats in Canada in 1977. Can Plant Dis Surv Can Dep Agric Res Branch 58:39-43.
HARDER, D. E., R. I. H. MC KENZIE, J. W. MARTENS AND P. D. BROWN. 1977. Strategies in Canada for improving rust resistance in oats. In Induced Mutations against Plant Diseases: Proceedings of a Symposium 1977, p. 495-498.
HARKONEN, M. 1978. Physarum-Apiculosporum new-species of myxomycetes described and cultivated. Karstenia 18:24-26. Biol Abstr 66, 068990.
HARMUTH, P. 1977. Factors involved in oat plant resistance to the cereal cyst nematode heterodera avenae wollenweber, 1924, abstract only. Mitt Biol Bundesanst Land Forstwirtsch 178:132.
HOSFORD, R. M., JR. 1978. Effects of wetting period on resistance to leaf spotting of wheat by leptosphaeria-microscopica with conidial stage phaeo-septoria-urvilleana. Phytopathology 68:908-912.
JOHNSTON, H. W. AND J. D. E. STERLING. 1977. Effect of seed treatment on emergence and vigor of cereal seedlings grown at several soil temperatures. Plant Dis Rep 61:981-983.
JONASSON, T. 1978. Resistance in Oats. Vaxtskyddsrapporter Jordbruk Upps Lantbrukshogsk Inst Vaxt-Och Skogsskydd Konsulentavdelningen/vaxtskydd 4:35-40.
JONES, I. T. 1978. Components of adult plant resistance to powdery mildew (Erysiphe graminis F. Sp. Avenae) in oats. Ann Appl Biol 90:233-239.
KASK, K. R. AND I. I. A. LAURSON. 1977. Preliminary results of breeding oats for crown and black stem rust. Tr Prikl Bot Genet Sel 58:139-142.
KATO, H., T. YAMAGUCHI AND N. NISHIHARA. 1977. Seed transmission pathogenicity and control of ragi blast fungus and susceptibility of ragi to pyricularia-spp from grasses, cereals, and mioga. Ann Phytopathol Soc Jpn 43:392-401.
KONOVALOVA, N. E., M. V. SUZDAI'SKAIA, L. P. SEMENOVA, G. K. SOROKINA, I. U. V. GORBUNOVA, A. I. HEMCHUZHINA, E. A. ARUTINIAN AND R. A. AKHMEROV. 1977. Distribution of races of cereal rust pathogens on the territory of the USSR in 1975. Mikol Fitopatol 11:499-503.
KOZAR, F. AND H. J. NETOLITZKY. 1978. Studies on hyphal development and appress-orium formation of colletotrichum-graminicola. Can J Bot 56:2234-2242.
KRIVCHENKO, V. I., L. G. SHCHELKO AND Z. V. TIMOSHENKO. 1977. Methods of studying resistance of barley and oats to smut diseases. In Metody Fitopatologicheskikh I Entomologicheskikh Issledovanii V Sel Rast I U. N. Fadeev & others p. 51-57.

LAPP, M. S. AND W. P. SKOROPAD. 1978. Nature of adhesive material of collet-otrichum-graminicola appressoria. Trans Br Mycol Soc 70:221-224.

LAUVA, R. E. AND I. R. SHUTELE. 1976. Frit Flies in Latvia oscinella frit and oscinella pusilla, pests of oats and barley respectively. Zashch Rast 6:11.

LEWIS, L. C. AND E. S. RAUN. 1978. Laboratory and field evaluation of the DD-136 strain of neoaplectana-carpocapsae for control of the European corn borer ostrinia-nubilis. Iowa State J Res 52:391-396. Biol Abstr 66, 051281.

LUENING, H. U. B. G. WAIYAKI AND E. SCHLOESSER. 1978. Role of saponins in anti fungal resistance, Part 8 Avena-sativa, fusarium-avenaceum interactions. Phytopathol Z 92:338-345.

LUKE, H. H. AND V. E. GRACEN. 1978. Some molecular properties of victorin. Plant Dis Rep 62:789-792.

MAC KEY, J. 1977. Strategies of race-specific phytoparasitism and its control by plant breeding. Acta Biol Iugosl Ser F. Genet 9:237-255.

MAC KEY, J. 1976. Genes of virulence and their general adaptability in oat stem rust. In European and Mediterranean Cereal Rusts Conference: Proceedings 1976. 4:35.

MAKELA, K. 1977. Septoria and selenophoma species on gramineae in Finland. Ann Agric Fenn 16:256-276.

MALLOTT, P. G. AND A. J. DAVY. 1978. Analysis of effects of the bird cherry-oat aphid on the growth of barley unrestricted infestation. New Phytol 80: 209-218.

MARTENS, J. W. 1978. Stem rust, puccinia graminis avenae of oats in Canada in 1977. Can Plant Dis Surv Can Dep Agric Res Branch 58:51-52.

MARTENS, J. W. AND R. I. H. MCKENZIE. 1976. Stem rust of oats in Canada in 1976. Can Plant Dis Surv 56:126-128.

MARTENS, J. W., P. A. BURNETT AND G. M. WRIGHT. 1977. Virulence in Puccinia Coronata, F. Sp. Avenae and Puccinia Graminis F. Sp. Avenae on oats in New Zealand. Phytopathology 67:1519-1521.

MARTINEZ, M. J. M. GARCIA BAUDIN AND M. BRANAS. 1976. Search for resistance to crown rust. In European and Mediterranean Cereal Rusts Conference: Proceedings 4:141-143.

MC CAMMON, S. AND H. WHEELER. 1978. Prevention of effects of victorin produced by helminthosporium victoriae on oat seed germnation. Physiol Plant Pathol 2:191-198.

MC DANIEL, M. C. AND C. L. MASON. 1978. Control of diseases of small grain E. L. Arkansas Univ Coop Ext Serv 519:8.

MILLS, J. T., J. NIELSON, G. PELLETIER, J. G. N. DAVIDSON AND L. J. PIENING. 1976. Cooperative seed treatment trials, 1976. Can Plant Dis Surv 56:110-113. Biol Abstr 66, 005135.

MILNE, R. G. AND D. E. LESEMANN. 1978. An immunoelectron microscopic investigation of oat sterile dwarf and related viruses. Virology 90:299-304.

MIROCHA, C. J., S. V. PATHRE, J. BEHRENS AND B. SCHAUERHAMER. 1978. Uterotropic activity of cis and trans isomers of zearalenone and zearalenol, fusarium colonizing maize, oats, barley, wheat and sorghum. Applied Environ Microbiol 35:986-987.

MITCHELL, D. T., A. K. FUNG AND D. H. LEWIS. 1978. Changes in the ethanol' soluble carbohydrate composition and acid invertase in infected 1st leaf tissues susceptible to crown rust of oat and wheat stem rust. New Phytol 80:381-392. Biol Abstr 66, 029666.

MOHAMED, N. A. 1978. Physical and chemical properties of cynosurus mottle virus. J Gen Virol 40:379-390.

NABETA, K. G. KADOTA, T. TANI AND H. SHIGA. 1977. Growth inhibitors of rust fungi, Puccinia coronata avenae detected in healthy oat leaves. Ann Phytopathol Soc Jap 43:575-582.

NAMAJUNAS, B. AND M. STRUKCINSKAS. 1977. Biology of the pathogen of crown rust (Puccinia coronata corda var Avenae Fraser et led) of oats in Lithuania. 2. The period of spread of rust aeciospores. Darb Tr Ser C Ser V Liet T S R Mokslu Akad 4:49-54.

NIELSEN, J. 1976. A method for artificial inoculation of oats and barley for seed treatment trials on seedling infecting smuts. Can Plant Dis Surv 56:114-116.

NIKITINA, K. V. AND L. V. PREOBRAZHENSKAIA. 1977. Bacterial diseases of oats and evaluation of the collection for resistance to them. Biull Vses Inst Rastenievod 72:62-66.

NORDLANDER, G. 1978. Population ecology of the frit fly. Vaxtskyddsrapporter Jordbruk Upps Lantbrukshogsk Inst Vaxt-Och Skogsskydd Konsulentavdelningen/ Vaxtskydd 4:41-51.

NYVALL, R. F. AND A. H. EPSTEIN. 1978. Loose Smut Ustilago Avenae of Oats. P M Iowa State Univ Sci Technol Ames Coop Ext Serv 830, 2 p.

OATES, J. D. 1977. Breeding leaf-rust Puccinia coronata avenae-resistant oats for coastal New South Wales. In Plant Breeding papers: Int Congr of the Society for the Advancement of Breeding Researches in Asia & Oceania 4:9-13.

ONYSHCHENKO, A. M., I. H. SKRYPAL, N. V. TORYANYK AND L. P. MALYNOVS'KA. 1977 Pathogenic properties of mycoplasma an agent of cereal light-green dwarf disease Mikrobiol ZH (KIEV) 39:621-626.

PANAYOTOU, P. C. 1978. Effect of barley yellow dwarf virus infection on the germinability of seeds and establishment of seedlings. Plant Dis Rep 62: 243-246.

PARADIES, M., D. SISTO AND J. VALLEGA. 1976. Behavior of some oats to races of "Stem Rust" found in Italy in 1974 and 1975. In European and Mediterranean Cereal Rusts Conference: Proceeding 1976. 4:85-86.

PAVLOVA-IVANOVA, L. K. AND M. A. CHUMAEVSKAIA. 1977. Evaluation of oat specimens for resistance to halo blight. In Bakterial'Nye Bolezni Rastenii. M. V. Gorlenko p. 40-45.

PERUTIK, R. 1976. Varietal resistance to frit fly. SB U V T I. Ochr Fostl Cesk Akad Zemed 12:283-291.

RIBEIRO, R. D. L. D., R. D. DURBIN, D. C. ARNY AND T. F. UCHYTIL. 1977. Characterization of the bacterium inciting chocolate spot on corn. Phytopathology 67:1427-1432, Biol Abstr 65, 060974.

ROCHOW, W. F. AND C. C. GILL. 1978. Dependent virus transmission by rhopalosiphum-padi from mixed infections of various isolates of barley yellow dwarf virus. Phytopathology 68:451-456.

ROCHOW, W. F. AND J. E. DUFFUS. 1978. Relationships between barley yellow dwarf virus and beet western yellow virus. Phytopathology 68:51-58. Biol Abstr 65, 067152.

RODIONOVA, N. A. AND V. N. SOLDATOV. 1977. Initial material for breeding oats for resistance to fungal and bacterial diseases. Tr Prikl Bot Genet Sel 58: 134-138.

ROELFS, A. P., D. L. LONG, D. H. CASPER AND P. G. ROTHMAN. 1977. Races of Puccinia graminis F. Sp. Avenae in the USA during 1976. Plant Dis Rep 61: 1071-1073.

SHCHELKO, L. G. AND Z. V. TIMOSHENKO. 1977. Methods of Phytopathologic Evaluation of barley and oat resistance to different rust species root rots and leaf spot diseases. In Metody Fitopatologicheskikh I Entomologicheskikh Issledovanii V Sel Rast I U. N. Fadeev & Others p. 40-50.

SCHWEISSING, F. C. AND G. WILDE. 1978. Temperature influence on greenbug resistance of crops in the seedling stage. Environ Entomol 7:831-834.

SEBESTA, J. 1977. The inheritance of vertical resistance to the oat cultivars dodge and garland to central European crown rust races. Genet Slechteni 13: 71-79.

SEBESTA J. 1976. The inheritance of resistance in oats to Central European crown rust races. In European and Mediterranean Cereal Rusts Conference; Proceedings 4:156-158.

SEBESTA, J. AND J. CERVENKA. 1977. Heredity of the vertical resistance of oats to black. Genet Slechteni 13:123-130.

SHARMA, D. C. AND R. A. FORSBERG. 1977. Spontaneous and induced interspecific gene transfer for crown rust resistance in Avena. Crop Sci 17:855-860. Biol Abstr 65, 067216.

SHIABOVA, T. I. AND N. N. POSKOL'NYI. 1976. Oat nematode Heterodera Avenae in the altai territory. Zashch Rast 9:46.

SHKIPSNA, I. A. E. 1977. Results of studies of initial and bred material of oats for resistance to crown Puccinia coronata and black stem. Tr Prikl Bot Genet Sel 58:160.

SIMONS, M. D. 1977. Influence of cron rust, Puccinia coronata resistance genes from a wild oat, Avena sterilis on yield of cultivated-type oats. Abstract only. Proc Am Phytopathol Soc 4:103.

SIMONS, M. D. AND K. J. FREY. 1977. Induced mutations for tolerance of oats to crown rust. In Induced Mutations against Plant Diseases; Proceedings of a symposium 1977, p. 499-512.

SINYA, R. N. AND P. W. VOISEY. 1978. Seed coat puncture resistance in cereal and oilseed cultivars a possible source of susceptibility to insect damage in stored grains. Can J Plant Sci 58:679-684. Biol Abstr 67, 034376.

STENMARK, A. 1977. Repellents against birds? Vaxtskyddsnotiser 41:121-122.

STEUDEL, W. AND H. J. RUMPENHORST. 1978. Experiments on the population dynamics of the cereal cyst nematode (Heterodera avenae woll.) and the yield of susceptible and resistant oats growing in continuous cultivation. Z Acker Pflanzenbau 146:90-108.

TANI, T., H. TAMAMOTO, Y. OHASA AND Y. YAMASHITA. 1978. Nonhost response of oat leaves against rust infection. A-n Phytopathol Soc Jpn 44:325-333. Biol Abstr 67, 056866.

TANI, T. AND H. YAMAMOTO. 1978. Nucleic acid and protein synthesis in association with the resistance of oat leaves to cron rust. Physiol Plant Pathol 12:113-121.

TIMOSHENKO, Z . V. AND N. A. RODIONOVA. 1977. Characteristics of oat specimens for resistance to loose Ustilago Avenae and covered tilago levis smuts. Tr Prikl Bot Genet Sel 58:127-130.

TRUSZKOWSKA, W. 1976. Crop rotation as a means for controlling wilt disease of lupinus-luteus on the base of mycological investigations. Acta Mycol 12:225-240. Biol Abstr 65, 067109.

VIENNOT-BOURGIN, V. 1977. Studies on the fungal spermoflora including plant pathogens on seeds of oats, wheat and flax. Rev Mycol 41:33-48.

VOITOVA, L. R. 1977. Determination of oat seed infection by the pathogen of red-brown leaf spot. Mikol Fitopatol 11:162-163.

WAIYAKI, B. G. AND E. SCHLOESSER. 1978. Role of saponins in anti fungi resistance Part 9 species specific inactivation of avenacin by fusarium-avenaceum. Phytopathol Z 92:346-350.

WILSON, R. L., K. J. STARKS, H. PASS AND E. A. WOOD. 1978. Resistance in 4 oat lines to 2 biotypes of the greenbug. J Econ Entomol 71:886-887.

WU, W. H. 1977. Botrytis cinerea blight of oats in Taiwan. Chung Hua Chih Wu Pao Hu Husueh Hui Plant Prot Bull. 19:119-123.

Wu, W. H. 1977. Antibiotic and mycoparasitic effects of several fungi, Aspergillus clavatus, trichoderma, epicoccum nigrum against seed and soil-borne pathogens. Bot Bull Acad Sin. New Ser 18:25-31.

YAMAMOTO, H., H. HOKIN, T. TANI and G. KADOTA. 1977. Phenylalanine ammonia-lyase in relation to the crown rust, puccinia coronata avenae resistance of oat leaves. Phytopathol 90:203-211.

YAMAMOTO, H., H. HOKIN AND T. TANI. 1978. Peroxidase and Polyphenoloxidase in relation to the crown rust. Phytopathol 91:193-202.

ZUTRA, D. AND R. KENNETH. 1978. Two bacterial diseases, pseudomonas striafaciens xanthomonas holcicola of oats and sorghum, new to Israel. Hassadeh 58:830-832.

QUALITY, COMPOSITION and UTILIZATION

ANDERSON, D. M., J. M. BELL AND G. I. CHRISTISON. 1978. Evaluation of a high-protein cultivar of oats (hinoats) as a feed for swine. Can J Anim Sci 58:87-96.

ARNOLD, G. W. AND D. W. BARRETT. 1978. Comparative nutritive value of hay made normally and by desiccation with paraquat. Aust J Exp Agric Anim Husb 18: 539:545. Biol Abstr 67, 051824.

AVRAMENKO, P. S., V. B. IOFFE AND L. M. POSTOVALOVA. 1978. Some methods of increasing the quality of lupine-oat silage. In Tekhnologiia Proizvodstva Khraneniia I Ispol'Zovaniia Kormov p. 42-44.

BISHNOI, U. R., P. CHITAPONG, J. HUGHES AND J. NISHIMUTA. 1978. Quantity and Quality of triticale and other small grain silages. Agron J 70:439-441. Biol Abstr 66, 043481.

BLANCO, A., J. A. FONSO, and A. DE MARCHI. 1977. Avena antioxidant properties of oat flour. Inf Sobre Grasas Aceites 16:27-33.

CANNON, D. J., M. J. SHARKEY AND P. T. STEWART. 1978. An evaluation of grazing oats for grain and wool production in northeastern victoria. Aust J Exp Agric Anim Husb 18:202-209. Biol Abstr 66, 068403.

CHANDER, R. AND S. NEELAKANTAN. 1974. Bacterial inoculation of silage Part 2 Effect of some additives on bacterial culture of ensiled oat Avena-sativa. Indian J Anim Sci 49:967-969. Biol Abstr 65, 070144.

CHAUHAN, T. R., R. S. GILL AND J. S. ICHHPONANI. 1978. Nutritive value of oat fodder (Avena sativa Linn) as green, hay or silage when fed to buffaloes. Indian J Anim Sci 48:355-357.

CHESTNUTT, D. M. B. 1977. Effect of ratio of oats to barley in the diet on the growth and carcass quality of earlt weakned lambs. Rec Agric Res 25:39-44. Biol Abstr 66, 062252.

CHRISTENSEN, D. A., G. STEACY AND W. L. CROWLE. 1977. Nutritive value of whole crop cereal silages. Can J Anim Sci 57:803-806. Biol Abstr 65, 056087.

CHUROVA, K. 1977. Analysis of production process of oats to green mass at different humidity of soil substrate. Ved Pr Vysk Ustavu Rastlinnej Vyroby Piestanoch 14:49-60. Biol Abstr 66, 024952.

CLUSKEY, J. E., Y. V. WU AND J. S. WALL. 1978. Density separation of protein from oat floar in nonaqueous solvents. J Food Sci 43:783-786.

COCHRANE, M. J. AND J. C. RADCLIFFE. 1977. Changes in digestibility, crude protein and yield of maturing wheat, oat and barley cultivars. A R Agric Rec 4:50-51.

COLCOMBET, G. 1977. A new forage: winter oats used in green forage. Agriculture 414:449-450.

D'APPOLONIA, B. L. AND V. L. YOUNGS. 1978. Effect of bran and high-protein concentrate from oats on dough properties and bread quality. Cereal Chem 55:736-743.

DAVIDSON, J., C. G. BANFIELD, J. G. W. DUGUID AND E. G. LEITCH. 1978. The measurement of metabolisable energy in samples of oats, barley and wheat using chicks. J Sci Food Agric 29:339-344.

DEVLIN, T. J., J. R. INGALLIS AND H. R. SHARMA. 1977. Evaluation of high fat oats in rations of growing and finishing ruminants. Can J Anim Sci 57:735-743.

DIEZ, T. AND A. ROSOPULO. 1977. Heavy metal contents in soils and plants; wheat, barley, oats, corn ,potatoes after application of extremely high amounts of sewage sludge. Landwirtsch Forsch Sonderh 33:236-248.

EMBRY, L. B. AND L. F. BUSH. 1977. Oat hay or oat haylage for growing cattle. Annu Cattle Feed Day S D Agric Ext Stn 21:11-14.

ERICKSON, D. O., N. R. RIVELAND. AND E. W. FRENCH. 1977. The nutritional value of oat hay harvested at several stages of maturity. N D Farm Res N D Agric Exp Stn 35:13-16.

FISHWICK, G., J. J. PARKINS, R. G. HEMINGWAY AND N. S. RITCHIE. 1978. A comparison of the voluntary intake and digestibility of beef cows of diets based on oat, straw and supplemented with different forms of nonprotein nitrogen. Anim Prod 26:135-142. Biol Abstr 66, 062235.

FUNKE, C. 1977. An aspiring market product. D L G Mitt Dtsch Landwirtsch Ges 92:610-611.

GRAHAM, W. R., JR. 1977. Oats milling. In Elements of Food Technology p. 170-173.

HENNESSY, D. W. AND G. G. ROBINSON. 1978. Oat Forage and grain supplements for the production of yearling beef from pasture on the northern tablelands of New South Wales. Aust J Exp Agric Anim Husb 18:183-189. Biol Abstr 66, 068402.

HUMMEL-GUMAELIUS, T. 1978. Report concerning the quality inventory of the swedish barley and oat crop, 1977 analysis. Tidskr Sver Utsadesforen 88:127-139.

KAUFMANN, W., M. SINNER AND H. H. DIETRICHS. 1978. Digestibility of straw and wood treated at high temperatures with saturated steam and washed with water and dilute alkali. Z Tierphysiol Tierernaehr Futtermittelkd 40:91-96.

KIM, S. I., L. CHARBONNIER AND J. MOSSE. 1978. Heterogeneity of Avenin. The oat prolamin. Fractionation. Molecular weight and amino acid composition. Biochim Biophys Acta 537:22-30.

KISHAN, J. AND U. B. SINGH. 1978. Volatile fatty-acids as indicator of fodder quality for buffalo. J Nucl Agric Biol 7:43-45. Biol Abstr 67, 013202.

KOJIMA, Y. AND K. OKANO. 1977. Comparison of the ordinary method and the van soest method of analysis of roughages. I I I. Comparison of the methods with silages of different growth stages of soiling oat and italian ryegrass. Sci Rep Kyoto Prefect Univ Agric 29:47-52.

KOSSILA, V. AND G. LJUNG. 1976. Value of whole oat plant pellets in horse feeding. Ann Agric Fenn 15:316-321. Biol Abstr 66, 055830.

KRISHCHENKO, V. P. 1978. Methods for determining amino-acid composition in plant samples and protein fractionation by buffer solutions. Izv Akad Nauk SSSR Ser Biol 405-417. Biol Abstr 67, 018023.

MAGA, J. A. 1978. Cereal volatiles a review. J Agric Food Chem 26:175-178. Biol Abstr 65, 058348.
MATTHEWS, R. H. AND J. S. DOUGLASS. 1978. Nutrient content of barley, oats and rye. Cereal Foods World 23:606-610.
MORTENSEN, J. Use of the dye binding method for determination of protein content in cereals; barley, oats, wheat and rye. Tidsskr Plant 81:215-227.
MUDGAL, V. D. AND N. SINGH. 1978. Evaluation of green oats by in vitro acid and in vivo techniques. Dairy cattle, nutritive value. Indian J Dairy Sci 31:93-98.
NIKOLAEVA, V. G. 1977. Plants used by ethnic groups of the USSR for treating diseases of the liver and bile secretory system. Rastit Resur 13:396-403. Biol Abstr 66, 023332.
OCKER, H. D. 1977. The content and distribution of heavy metals in cereals and cereal products. Ber Landwirtsch 55:796-808. Biol Abstr 66, 055705.
OLTJEN, J. W. AND K. K. BOLSEN. 1978. Wheat, barley and oat silages for beef cattle. Bull Kans Agric Exp Stn 613, 15 p.
OWEN, B. D., F. SOSULSKI, K. K. WU AND M. J. FARMER. Variation in mineral content of Saskatchewan feed grains. Can J Anim Sci 57:679-687.
PESTALOZZI, M. AND O. SAUE. 1978. Effect of harvesting and fertilizing time on quality and nutritional loss with the ensilaging of grass and green oats. Res Norw Agric 29:261-276.
PETERSON, D. M. 1978. Subunit structure and composition of oat seed globulin. Plant Physiol 62:506-509.
PYANOVSKAYA, T. P., A. S. KHALIKOV AND A. G. BUDAGOV. 1976. Hulless oats, a valuable feed for piglets. Sov Agric Sci 3:39-40.
SALO, M. L. 1978. Molasse and a preservative for high-moisture ground barley, oats and brewers grain. J Sci Agric Soc Finl 50:206-211.
SALO, M. L. 1978. Relationship between physical and chemical characteristics and calculated metabolizable energy values in barley and oats with highly variable volume weights. J Sci Agric Soc Finl 50:276-284.
SALOMONSSON, A. C., O. THEANDER AND P. AMAN. 1978. Quantitative determination by gas liquid chromatography of phenolic acids as ethyl detrivatives in cereal straws. J Agric Food Chem 26:830-835. Biol Abstr 67, 005201.
SALUN, I. P., S. A. KALUGINA, L. P. KROTOVA AND N. V. RATNIKOVA. 1977. Chemical Composition of oat products of different intensity of hydrothermal processing Vopr Pitan 1:81-83.
SEMB, G. 1978. Yield and mineral content of the plants in field experiments Res Norw Agric 29:1-18.
SHAFER, M. A. M AND M. E. ZABIK. 1978. Dietary fiber sources for baked products comparison of wheat brans and other cereal brans in layer cakes. J Food Sci 43:375-379.
SINGH, K. AND S. NEELAKANTAN. 1976. A note on laboratory ensilage of berseem trifolium-alexandrinum with green oat Avena-sativa paddy straw oryza-sativa and wheat straw triticum-aestivum with inoculation and additives. Indian J Anim Sci 46:624-626. Biol Abstr 65, 052195.
SINGH, R. B., G. C. BANERJEE AND B. N. GUPTA. 1977. A comparative study of direct and indirect methods in determing the nutritive value index of oat. Indian J Dairy Sci 30:259-263.
TEREKHOV, A. I. 1977. Use of an equation of comparative marketing evaluation of crops for the basis of the ratios of purchase prices. Biull Nauchno-Tekh Inf Vses Nauchno 15:10-14.
TODOROVA, M. 1978. Change of oat flour lipids during the production of pastes. Khranit Prom-St 4:23-25.

VERKHOVTSEVA, N. V. 1976. The protein of oats and its quality amino-acid composition in soddy-podzolic soil subjected to different degrees of cultivation. Mosc Univ Soil Sci Bull 31:23-27.

VILELA, H., S. S. CAVALCANTI , J. A. F. VELOSO AND H. A. MOREIRA. 1977. Oats Avena-sativa rye secale-cereale and wheat triticum-aestivum as winter forage. Arq Esc Vet Univ Fed Minas Gerais 29:137-142. Biol Abstr 66, 018657.

WAHLSTROM, R. C., L. J. REINER AND G. W. LIBAL. 1977. Oats, dehulled oats and hulless barley as ingredients in pig starter diets. J Anim Sci 45:948-952.

YOUNGS, V. L. 1978. Oat Lipids. Cereal Chem 55:591-597.

ZAB'IALOVA, V. L. 1977. Selection of components for feed grain crop mixtures containing oats. Sib Vestn S'Kh Nauk 5:113-116.

ZIMMERMANN, H. 1978. Investigations on the extraction of IAA proteins from oat. Z Pflanzenphysiol 89:115-118.

VII. MAILING LIST

Evert Aberg
Dept. of Plant Husbandry
Agri. College of Sweden
750 07 Uppsala 7, SWEDEN

Juan Acevedo
Casilla 58-D
Estacion Exper. Carillanca
Temuco, CHILE

Don Adams
Box 391
Little Rock, AR 72203

Jimi Adegoke
3 Agronomy - ISU
Ames, Iowa 50011

S. T. Ahmed
Indian Grassland & Fodder Res.
Jhansi (U.P.)
INDIA

A. Shoaib Ahsan
Indian Agriculture Research
Library Institute
New Delhi-12, INDIA

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

H. T. Allen
Research Station
Lacombe TOC 1SO
Alberta, CANADA

Saúl Flores Alvarez
Ciane-Cida, Km. 17 Carretera
Apdo Postal No. 247
Torreón, Coah, SPAIN

Guy L. Ames, Vice President
National Oats Company, Inc.
Cedar Rapids, IA 52402

Dr. Enrique F. Antonelli
Instituto de Fitotencnia
Castelar FCNS
Buenos Aires, ARGENTINA

Jay E. April
Sciences/Genetic Resources
University of Colorado
Boulder, CO 80309

Bert D'Appolonia
Cereal Chemistry and Tech.
North Dakota State University
Fargo, ND 58102

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

I. M. Atkins
1225 Clover Lane
Denton, TX 76201

R. E. Atkins
Department of Agronomy
Iowa State University
Ames, IA 50011

W. Baines
Plant Breeding Dept.
Cornell University
Ithaca, NY 14850

Agosto Baier
Caixa Postal 569
EMBRAPA
Passo Fundo, R.S., Brazil

E. P. Baker
Dept. of Agri. Botany, Univ. of Sydney
Sydney 2000
New South Wales, AUSTRALIA

R. J. Baker
Branch Res. Sta., 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

William S. Ball
CSU Extension Agronomist
251- 16th Street
Burlington, CO 80807

F. Baranao
Sociedad Anonima Com. E Indust
Dos Alamos, Roberto Espinoza 830
Santiago, CHILE

Roland Barker
Botany Greenhouse - ISU
Ames, Iowa 50011

R. D. Barnett
Agri. Res. and Ed. Center
P. O. Box 470
Quincy, FL 32351

Andrew R. Barr
Department of Agriculture and Fisheries
Box 1671, G.P.
Adelaide, SOUTH AUSTRILIA

Manuel T. Barradas
Estacao Melhoramento de Pl.
Elvas, PORTUGAL

Chacra Exp. de Barrow
Att: Hector L. Carbajo
Casilla Correo 216 Tres Arroyos (Pcia)
Buenos Aires, ARGENTINA

Louis N. Bass
National Seed Storage Lab.
Colorado State University
Ft. Collins, CO 80532

Richard P. Bates
Noble Foundation
Route 1
Ardmore, OK 73401

B. R. Baum
Plant Research Institute
Canada Dept. of Agriculture
Ottawa K1G 3T1, CANADA

Susan Behizadeh
310 Bessey - ISU
Ames, Iowa 50011

V. M. Bendelow
Branch Research Station, 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

Anders Bengtsson
Dept. of Plant Husbandry
Agri. College of Sweden
750 07 Uppsala 7, SWEDEN

M. Edmundo Beratto
Casilla 58-D
Estacion Exper. Carillanca
Temuco, CHILE

Mal Bhag
Indian Grassland & Fodder Research
Jhansi (U.P.)
INDIA

M. Biali
Dept. of Plant Path. & Microbio.
Faculty of Agriculture
Rehovot, ISRAEL

Biblioteca
Casilla 58-D
Estacion Exper. Carillanca
Temuco, CHILE

Biblioteca
Apartado Aereo 79-84
Inst. Colombiano Agropecuario
Bogota, COLOMBIA

Biblioteca
Apartado postal 6-641, Londres 40
Centro Internac. de Maiz y Tr
Mexico 6, D.F., MEXICO

Biblioteca
Inst. Nac. de Invest. Agri.
Apartado postal No. 6-882
Mexico 6, D.F., MEXICO

Biblioteca
Campo Agricola Experimental
Apartado postal 81
Cd. Delicias, MEXICO

Biblioteca CIANE
Apartado postal No. 1
Matamoros
Coahulla, MEXICO

Bibliotheek de Haaff
(Foundation for Agri. Pl. Breed.)
P.O. Box 117
Wageningen, NETHERLANDS

La Biblioteca
Facultad de Agronomia
Calle 60 y 119, Casilla de Correo 31
LaPlata, ARGENTINA

Biblioteca of San Catalina
INIAP (Santa Catalina Exp Sta)
Apartado No. 340
Quito, ECUADOR

Morris J. Bitzer
Agronomy Department
University of Kentucky
Lexington, KY 40506

Ake Boklin
Caixa Postal 673
13100 Campinas, S.P.
BRAZIL

Head, Dept. of Agricultural Botany
University of Sydney
Sydney 2000
New South Wales, AUSTRALIA

W. J. R. Boyd
Agron. Dept., Univ. Western Australia
Nedlands
Western Australia, AUSTRALIA

Dan E. Brann
Dept. of Agronomy
Virginia Polytech. Inst. & Univ.
Blacksburg, VA 24061

L.W. Briggle
National Program Staff
Northeastern Region - BARC West
Beltsville, MD 20705

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

John Britt
Firstline Seeds
Royal Star Route
Othello, Washington 99344

J. B. Brouwer
State Research Farm
Werribee 3030
Victoria, AUSTRALIA

L. Browder
Pl. Path. Dept., Dickens H.
Kansas State University
Manhattan, KS 66502

Acton R. Brown
Agronomy Dept., Univ. of Georgia
Athens, GA 30601

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

J. F. Brown
Dept. Botany, Univ. of New England
Armidale, New South Wales 2351
AUSTRALIA

P. D. Brown
Branch Res. Station, 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

J. A. Browning
315 Bessey - ISU
Ames, Iowa 50011

G. W. Bruehl
Plant Pathology Dept.
Washington State University
Pullman, WA 99163

P. A. Burnett
Crop. Res. Div., DSIR
Private Bag
Christchurch, NEW ZEALAND

Vernon D. Burrows
Central Experimental Farm
Research Station
Ottawa K1G 3T1, CANADA

W. Bushuk
Dept. of Plant Science
Univ. of Manitoba
Winnipeg R3T 2N2, Manitoba, CANADA

Elkin Bustamante
Apartado Aereo 79-84
Inst. Colombiano Agropecuario
Bogota, COLOMBIA

W. P. Byrd
Exp. Statistics Division
Clemson University
Clemson, SC 29631

Donald Cameron
Scottish Pl. Breeding Sta
Penlandfield, Roslin
Midlothian, Scotland, UNITED KINGDOM

H. M. Camper
Agricultural Exp. Station
Warsaw, VA 22572

Canada Experimental Farm
P.O. Box 400
La Pocatiere GOR 120
Quebec, CANADA

Hector L. Carbajo
Alvarado 166
7500 TRES ARROYOS
Argentina, SOUTH AMERICA

Gregg R. Carlson
Cooperative Extension Service, USDA
Montana State University
Gavre, Montana 59501

J. F. Carter
Dept. of Agronomy
N. Dakota State University
Fargo. ND 58102

Fernando Carvalho
FAV - Universidade Federal do
Caxia Postal 776
Porto Alegre, RS, Brazil

David H. Casper, USDA, SEA, FR
Cereal Rust Laboratory
University of Minnesota
St. Paul, MN 55108

Gorgeh Cazenave
A.A.C.R.E.A., Corrientes 127
3 er piso-Edificio "Bol Cereal
Buenos Aires, ARGENTINA

Te-Tzu Chang
P.O. Box 933
International Rice Res. Inst.
Manila, PHILIPPINES

W. H. Chapman
P.O. Box 377A
Cullowhee, N.C. 28723

B. E. Clark
Dept. of Seed Investigations
New York State Agri. Exp. Sta.
Geneva, NY 14456

G. H. Clark
Research Station
Harrow
Ontario, CANADA

R. V. Clark
Central Experimental Farm
Research Station
Ottawa K1G 3T1, CANADA

O. M. Clayton
Box 8455
The Canadian Seed Growers' Assn.
Ottawa, K1G 3T1, CANADA

James E. Cluskey
USDA NRRC
1815 N. University St.
Peoria, IL 61604

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

Dr. Andre Comeau
Sta. de Recherches, 2560, Chemin Gomin
Ste-Foy, P.Q. CANADA
G1V 2J3

Thomas J. Conlon
Dickinson Exp. Station
Dickinson, ND 58601

The Counsellor (Agricultural-Scientific)
Embassy of South Africa,
2555 M Street, N.W., Suite 300,
Washington, D.C. 20037

Stan Cox
1 Agronomy - ISU
Ames, Iowa 50011

J. C. Craddock
Small Grains Col. Bldg. 046
Northeastern Region - BARC West
Beltsville, MD 20705

J. P. Craigmiles
Texas Agri. Exp. Station
Box 366, R#5
Beaumont, TX 77706

Robert L. Croissant
Extension Agronomist
251 16th Street
Burlington, CO 80807

I. R. Cubitt
Rothwell Pl. Breed., Ltd., Rothwell
Lincoln LN7 6BR
England, UNITED KINGDOM

B. M. Cunfer
Georgia Experiment Station
Experiment, GA 30212

Current Serials Record
USDA National Agri. Library
Northeastern Region - BARC West
Beltsville, MD 20705

J. D. Curtis
Kemptville College of Agr. Tech.
Kemptville
Ontario, CANADA

Norris Daniels
US Great Plains Field Station
Bushland, TX 79012

Kelly Day
Agronomy Department
Purdue University
Lafayette, IN 47907

Lealand Dean
Agronomist
Drawer B
Denton, TX 76201

Wade G. Dewey
Plant Science Dept.
Utah State University
Logan, UT 84321

A. J. Dimino
Fabrica la Azteca
Apartado Postal 31 Bis
Mexico 1, D.F., MEXICO

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

Giles E. Dixon, RL
North American Plant Breeders
P. O. Box 2955
Mission, KS 66205

Larry W. Dosier
Plant Variety Protection Office
USDA, AMS, GSD Nat. Agr. Library, Rm 205
Beltsville, MD 20705

R. Drishnan
Indian Grassland & Fodder Res.
Jhansi (U.P.)
INDIA

Jean-Pierre Dubuc
Station de Recherches
2560, Chemin Gomin
Sainte-Foy GIV 2J3, Quebec, CANADA

D. J. Dunphy
Soil and Crop Science Department
Texas A&M University
College Station, TX 77843

R. D. Durbin
Dept. of Plant Pathology
University of Wisconsin
Madison, WI 53706

Philip Dyck
Campo Exp. de Comite Menonita
Aparto postal 224
Cuauhtemoc, Chihuahua, MEXICO

Howard Eagles
Dept. Sci. & Indus. Res. Pl. Phys. Div.
Private Bag
Palmerston North, NEW ZEALAND

James Echols
Department of Agronomy
Colorado State University
Ft. Collins, CO 80521

L. V. Edgington
Botany Dept., Univ. of Guelph
Guelph
Ontario, CANADA

L. H. Edwards
Agronomy Dept.
Oklahoma State University
Stillwater, OK 74074

B. E. Eisenberg
Dept. Agr. Tech. Services
Stellenbosch (Private Bag 5023)
REPUBLIC OF SOUTH AFRICA

Albert H. Ellingboe
Dept. of Botany & Pl. Path.
Michigan State University
East Lansing, MI 48823

F. C. Elliott
Dept. of Crop & Soil Sci.
Michigan State University
East Lansing, MI 48823

Charles Erickson
Texas A&M Ext. Cen. - Uvalde
PO Drawer 1051
Uvalde, TX 78801

Raul Escobar-P
INIAP (Santa Catalina Exp. Sta.)
Apartado No. 340
Quito, ECUADOR

N. Eshed
Dept. of Pl. Path. & Microbio
Faculty of Agriculture
Rehoot, ISRAEL

E. B. Eskew
Dept. of Agronomy & Soils
Clemson University
Clemson, SC 29631

Lars Eskilsson
Weibullsholm Pl. Br. Inst.
Witham, Essex CM8 2DT
England, UNITED KINGDOM

Kenneth H. Evans
Plant Variety Protection, USDA, AMS,GSD
National Agricultural Library, Rm 205
Beltsville, MD 20705

Zahir Eyal
Dept. of Botany
Tel Aviv University
Tel Aviv (Ramat-Aviv), ISRAEL

Luis Fabini, Jr.
Molino Puritas S.A.
Vidal y Fuentes 3092
Montevideo, Uruguay

Donald G. Faris
Research Station, Box 29
Beverlodge TOH OCO
Alberta, CANADA

Gail Fenderson
122 Capitol Building
State Seed Lab.
Oklahoma City, OK 73105

V. C. Finkner
Agronomy Department
University of Kentucky
Lexington, KY 40506

Adrian Fisher
San Juan Branch Experiment Station
Hesperus, CO 81326

D. C. Fisher
The Quaker Oats Company
1019 Grain Exchange, Main Bldg.
Minneapolis, MN 55415

Hal Fisher
Agronomy Department
NDSU
Fargo, ND 58105

R. W. Fitzsimmons
State Office Block, Dept. of Agri.
Sydney 2000
New South Wales, AUSTRALIA

Elmer Luiz Floss
Faculdade de Agronomia
Universidade de Passo Fundo
99.100 - Passo Fundo - RS BRAZIL

W. H. Foote
Agricultural Exp. Station
Oregon State University
Corvallis, OR 97331

R.E. Ford
Department of Plant Pathology
University of Illinois
Urbana, IL 61801

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

K. J. Frey
1 Agronomy - ISU
Ames, Iowa 50011

Dr. Frimmel
"NORDSAAT" Saatzucht. m.b.H.
Post Lutjenburgl ostholstein
2322 Waterneverstorf, WEST GERMANY

Fruita Research Center
Colorado State University
PO Box 786
Grand Junction, CO 81501

Jesus Moncada de la Fuente
Director CIANE
Apartado Postal No. 247
Torreon, Coahuila, MEXICO

Gustavo Fuentes
INIAP (Santa Catalina Exp. Sta.)
Apartado No. 340
Quito, ECUADOR

Rodolfo Moreno Galvez
Inst. Nac. de Invest. Agri.
Apartado postal No. 6-882
Mexico 6, D.F., MEXICO

J. H. Gardenhire
Research & Extension Center
Texas A&M University
Renner, TX 75079

Ranjit Ghosh
National Dairy Research Institute
Indian Council of Agric. Research
Karnal (Haryana) INDIA

Stanislaw Gielo
Institute of Plant Breeding
Radzikow 05-870
Blonie, POLAND

C. C. Gill
Branch Research Station, 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

E. C. Gilmore
Texas Agr. Res. & Ext. Chillicothe-Vernon
PO Box 1658
Vernon, Texas 76384

Harvey J. Gold
Statistics Department
North Carolina State Univ.
Raleigh, NC 27607

Carlos Gonzalez Gonzalez
Campo Agricola Experimental
Apartado postal No. 81
Cd. Delicias, Chihuahua, MEXICO

Francis J. Gough
Plant Pathology Dept.
Oklahoma State University
Stillwater, OK 74074

Lynn Gourley
Dept. of Agronomy
Mississippi State College
State College, MS 39762

D. W. Graffis
Dept. of Agronomy
University of Illinois
Urbana, IL 61801

J. E. Grafius
Dept. of Crop and Soil Sci.
Michigan State University
East Lansing, MI 48823

Ken Grafton
Agronomy Department
University of Missouri
Columbia, MO 65201

Doyce Graham, Jr.
Dept. of Agronomy & Soils
Clemson University
Clemson, SC 29631

Craig R. Grau
Department of Plant Pathology
University of Wisconsin
Madison, WI 53706

C. R. Graves
Agronomy Dept.
University of Tennessee
Knoxville, TN 37901

Jimmie L. Green
Agriculture Dept.
West Texas State University
Canyon, TX 79015

D. J. Griffiths
Welsh Pl. Breed. Sta., Plas Gogerddan
Near Aberystwyth SY23-3EB
Wales, UNITED KINGDOM

Clarence D. Grogan
Science & Education Administration
U.S. Dept. of Agriculture
Washington, D.C. 20250

Magne Gullord
Agr. Exp. Stn. Apelsvoll
2858 Kapp
NORWAY

Scott Hackett
General Mills, Inc.
Box 15003, Commerce Station
Minneapolis, MN 55145

N. O. Hagberth
Oat Breeding Dept.
Weibullsholm Pl. Breed. Inst.
261 20 Landskrona, SWEDEN

M. Kemalettin Haksel
Zirai Arasturma Enstitusu Mudurlugu
Agricultural Research Institute
P. K. 17
Eskisehir, TURKEY

Philip M. Halisky
Plant Biology Dept.
Rutgers University
New Brunswick, NJ 08903

Dorothy Hall
Plant Research Institute
Canada Dept. of Agriculture
Ottawa K1G 3T1, CANADA

A. G. Halle
Elaboradora Argentia de Cereales S.A.
Casilla de Correo 1108
Correo Central, Buenos Aires, ARGENTINA

Richard Halstead
Dept. of Agronomy & Plant Genetics
Univ. of Minnesota
St. Paul, MN 55108

Cebeco-Handelsraad
Plant Breeding Station
Lisdoddeweg 36
Lelystad, NETHERLANDS

B. J. Hankins
Agronomy Department
Purdue University
Lafayette, IN 47907

Sv. E. Hansen
Statens Forsogsstation
Tylstrup
DENMARK

E. D. Hansing
Plant Pathology Department
Kansas State University
Manhattan, KS 66506

Richard T. Harada
N. Agricultural Res. Center
Star Route 36-Box 43
Havre, MT 59501

D. E. Harder
Branch Res. Station, 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

Howard F. Harrison
Coker's Pedigreed Seed Co.
Hartsville, SC 29550

Robert Harrold
Animal Science Department
North Dakota State University
Fargo, ND 58102

Bob R. Hathcock
School of Agriculture
University of Tennessee
Martin, TN 38237

T. E. Haus
Department of Agronomy
Colorado State University
Fort Collins, CO 80521

E. G. Hayden, Jr.
Cereal Institute, Inc.
135 So. LaSalle St.
Chicago, IL 60603

J. D. Hayes
University College of Wales,
Department of Agriculture
Penglais, Aberystwyth,
Dyfed, U.K.

Ralph M. Hayes
Research & Extension Center
Aberdeen, ID 83210

T. T. Hebert
Department of Crop Science
North Carolina State University
Raleigh, NC 27607

K. L. Henhra
Indian Grassland & Fodder Res.
Jhansi (U.P.)
INDIA

E. G. Heyne
Agronomy Dept., Waters Hall
Kansas State University
Manhattan, KS 66502

Charles Higgins
Area Ext. Agronomist, Co. Court House
Box 580
Grand Junction, CO 81501

Greg Hinze
Central Great Plains Field Station
USDA
Akron, CO 80720

Ben Hoag, Superintendent
North Central Experiment Station
Route #3
Minot, MD 58701

S. J. Hodges
Dept. of Crop Science
N. Carolina State University
Raleigh, NC 27607

G. J. Hollanby
Agricultural College
Roseworthy 5371
South Australia, AUSTRALIA

A. L. Hooker
Dept. of Plant Pathology
University of Illinois
Urbana, IL 61801

D. N. Huntley
Parliament Buildings
Ontario Dept. of Agri. & Food
Ontario, CANADA

Oiba Inkila
Dept. of Plant Breeding
Agri. Research Center
SF-31600 Jokioinen, FINLAND

Dr. Jahn, Akad. der Landwirt. der DDR
Inst. fur Zuchtungsforschung
DDR-43 Quedlinburg
E.u.J.-Rosenberg-Str. 22/23, E. GERMANY

R. E. Jarrett
Department of Crop Science
North Carolina State University
Raleigh, NC 27607

H. Jedlinski
N431 Turner Hall
University of Illinois
Urbana, IL 61801

G. Jenkins
Plant Breeding Institute
Maris Lane, Trumpington
Cambridge CB2 2LQ, England, U. K.

Neal F. Jensen
17606 Foothills Drive
Sun City, Arizona 85373

Stanley G. Jensen
N. Grain Insect Res. Lab.
Brookings, SD 57006

Carlos Jiminez
Inst. Nac. de Invest. Agricolas
Apdo. postal No. 6-882 y 6-883
Mexico 6, D.F., MEXICO

Dennis Johnson
Texas A&M Agric. Res. & Ext.
Chillicothe-Vernon PO Box 1658
Vernon, TX 76384

J. W. Johnson
Agronomy Department
University of Maryland
College Park, MD 20742

R. P. Johnston
P.O. Box 231
Warwick
Queensland, AUSTRALIA

John Jones
Plant Pathology Department
University of Arkansas
Fayetteville, AR 72701

Louis Jupe
Douglass King Seed Co.
Box 20320
San Antonio, TX 78286

C. A. Kallfelz
Productos Ad. Quaker
Cx. Postal 2501
Porto Alegre, BRAZIL

D. S. Katiyar
Indian Grassland & Fodder Research
Jhansi (U.P.)
INDIA

J. A. Keaton
Coker's Pedigreed Seed Co.
Hartsville, SC 29550

Richard L. Kiesling
Box 5012, Plant Path. Department
North Dakota State University
Fargo, ND 58102

R. A. Kilpatrick
Plant Genetics & Germplasm Inst.
Northeastern Region, BARC West
Beltsville, MD 20705

G. C. Kingsland
Botany & Backteriology Dept.
Clemson University
Clemson, SC 29631

C. Kishor
Dept. of Forage Research
Haryana Agricultural University
Hissar - 125004 (INDIA)

E. Kivi
Hankkija Pl. Breeding Inst.
SF-04300 Hyryla
FINLAND

H. R. Klinck
Agronomy Department
MacDonald College H0A 1C0
Quebec, CANADA

W. R. Knapp
Dept. of Agronomy
Cornell University
Ithaca, NY 14850

Mathias F. Kolding
Columbia Basin Agr. Res. Center
P.O. Box 370
Pendleton, OR 97801

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

M. R. Krause
Box 1671, G.P.O.
Adelaide, 5001 South Australia
AUSTRALIA

Bo Kristiansson
Oat & Wheat Breeding Dept.
Swedish Seed Association
268 00 Svalof, SWEDEN

Warren E. Kronstad
Farm Crops Dept.
Oregon State University
Corvallis, OR 97331

Karen Kuenzel
3 Agronomy - ISU
Ames, Iowa 50011

Tekeshi Kumagai
Hokkaido Nat. Agr. Exp. Sta. Oat Breeding
Hitsujigaoka 061-01
Sapporo, Toyohira, JAPAN

W. E. Kuriger, Jr.
396 Highland Avenue
Fitchburg, MA 01420

Greg Kushnak
Agr. Research Center
PO Box 1474
Conrad, MT 59425

Gideon Ladizinsky
Dept. of Pl. Path. & Microbio.
Faculty of Agriculture
Rehovot, ISRAEL

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

K. A. Lahr
Res. & Ext. at Chillicothe, PO Box 1658
Texas A&M University
Vernon, TX 76384

Arthur Lamey
Plant Path. Dept., Box 5012
North Dakota State University
Fargo, ND 58102

Helen Lane
Douglass W. King Co.
4627 Emil Road PO Box 20320
San Antonio, TX 78286

Phil Larson
654 Grain Exchange
Checkerboard Grain Co.
Minneapolis, MN 55415

Rune Larsson
Dept. of Plant Husbandry
Agr. College of Sweden
750 07 Uppsala 7, SWEDEN

D. A. Lawes
Welsh Pl. Breed. Sta., Plas Gogerddan
Near Aberystwyth SY23-3EB
Wales, UNITED KINGDOM

C. Lehmann
Zen. Inst. Genet. & Kulturpflan.
Deut. Akad. der Wissen, zu Ber. WEST
4325 Gatersleben,Corrensstrabe 3,GERMANY

Library of Congress
Exchange and Gift Division
Washington, D.C. 20000

Library & Doc. Center
International Rice Res. Inst.
PO Box 933
Manila, PHILIPPINES

Library, Plant Breeding Institute
Maris Lane, Trumpington
Cambridge CB2 2 LQ
England, UNITED KINGDOM

Library, Welsh Pl. Breeding Station
Plas Gogerddan
Near Aberystwyth SY23-3EB
Wales, UNITED KINGDOM

Ray Lind, Div. of Can Agra
Fruen Milling Company
Box 3172
Minneapolis, MN 55403

Ronald W. Livers
Fort Hays Branch Station
Hays, KS 67601

S. L. Lockington
The Quaker Oats Company
Peterborough
Ontario, CANADA

W. Q. Loegering
Plant Pathology Department
University of Missouri
Columbia, MO 65201

Roland Loiselle, P. Ag.
Head, Plant Gene Resources, Canada
Ottawa Branch Research Station
Ottawa, Ontario KLA OC6, CANADA

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

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

George Luk
Dept. of Agronomy
Univ. of Wisconsin
Madison, WI 53706

H. H. Luke
Plant Pathology Department
University of Florida, IFAS
Gainesville, FL 32611

Ted Lund
3 Agronomy - ISU
Ames, Iowa 50011

James Mackey
Dept. of Genet. & Pl. Breeding
Agri. College of Sweden
750 07 Uppsala 7, SWEDEN

MacMillan Library
Agri. & Forestry Library
Univ. of British Columbia
Vancouver 8, British Columbia, CANADA

Uriel Maldonado A., Dir. CIAMEC
Agricultural Research Center
INIA, APDO. Postal 10
Chapingo, MEXICO

Robert Malin
Agronomy Department
University of Missouri
Columbia, MO 65201

P. L. Manchanda
Cummings Laboratory
Indian Agricultural Research Institute
New Delhi - 110012 INDIA

Jacob Manistersky
Dept. of Botany, Tel-Aviv University
Tel-Aviv (Ramat-Aviv)
ISRAEL

H. O. Mann
SE Colorado Branch Exp. Station
Kim Route
Springfield, CO 81073

Albert R. Mann Library
Acquisitions Division
Ithaca, NY 14850

Rolf Manner
Dept. of Plant Breeding
Agr. Research Center
Jokionen FINLAND

B. D. Matil, Director of Institute
Indian Grassland & Fodder Research
Jhansi (U.P.)
INDIA

Maple Leaf Mills, Ltd., Res. Division
43 Junction Road
Toronto, Ontario M6N 1B5
CANADA

W. H. Marchant
Agronomy Department
Coastal Plain Exp. Sta.
Tifton, GA 31794

Harold G. Marshall
Agron. Dept., Tyson Building
Pennsylvania State University
University Park, PA 16802

J. W. Martens
Branch Research Station, 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

J. J. Martin
LaCrosse Milling Co., Inc.
Cochrane, WI 54622

Hector Jose Martinuzzi
Chacra Experimental De Barrow
7500 Tres Arroyos
Pcia Bs. As. Argentina

Snr. Matilde Martinez
Instituto Nacional de Investigaciones Ag.
Departamento de Cereales y Leguminosas
Finca "El Encin". Madrid SPAIN

J. H. Massey
Georgia Experiment Station
Experiment, GA 30212

S. L. MATHIES
GENERAL MILLS
Box 15003 - Commerce Station
Minneapolis, MN 55415

David L. Matthews
Agway, Inc.
P.O. Box 1333
Syracuse, NY 13201

Bengt Mattsson
Oat & Wheat Breeding Dept.
Swedish Seed Association
S-268 00 Svalöv, SWEDEN

Maria Mazaraki
Inst. Hodowli i Akli. Roslin
Zaklad Roslin Zbozosych ul. Zawila 4a
30-423 Krakow 12, POLAND

Thomas McCoy
Agronomy and Plant Genetics Dept.
303 Agronomy Bldg., Univ. of Minn.
St. Paul, MN 55108

LeRoy McCurdy
W. O. McCurdy & Sons
Fremont, IA 52561

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

W. C. McDonald
Branch Research Station, 195 Dafoe Rd.
Winnipeg, Manitoba
CANADA R3T 2M9

W. T. McGraw,
Jacob Hartz Seed Company, Inc.
POBox 946
Stuttgart. Arkansas 72160

Guy W. McKee
Agronomy Dept.
Pennsylvania State University
University Park, PA 16802

R.I.H. McKenzie
Branch Res. Station, 195 Dafoe Road
Winnipeg, Manitoba
CANADA R3T 2M9

F. W. McLaughlin
North Carolina Crop Improvement Assn.
State College Station
Raleigh, NC 27607

Mike McMullen
Dept. of Agronomy
North Dakota State University
Fargo, ND 58102

Renato Borges de Medeiros
Dept. Tecnico
Cotrijui
Ijui, R.S., Brazil

Leonard Michel
310 Bessey - ISU
Ames, Iowa 50011

K. Mikkelsen
Norwegian Grain Corporation
Stortingsgt 28
Oslo 1, NORWAY

R. L. Millar
Plant Pathology Dept.
Cornell University
Ithaca, NY 14850

Mark Millard
1 Agronomy - ISU
Ames, Iowa 50011

Oscar Millard
Procurement Rec., USDA Nat. Agr. Library
Northeastern Region - BARC West
Beltsville, MD 20705

S. N. Mishra
G.B. Pant Univ. Agr. & Tech.
Pantnagar --263145 Dist.
Nainital (U.P.), INDIA

U. S. Misra
Indian Grassland & Fodder Research
Jhansi (U.P.)
INDIA

E. Sanchez-Monge
Avda. Puerta de Hierro
Dept. Nac. de Mejora Maiz, Min. de Agri.
Madrid 3, SPAIN

M. B. Moore
Dept. of Plant Path.
University of Minnesota
St. Paul, MN 55108

D. D. Morey
Agronomy Department
Coastal Plain Exp. Sta.
Tifton, GA 31794

K. J. Morrison
Agronomy Dept.
Washington State University
Pullman, WA 99163

J. W. Morrison
Central Experimental Farm
Research Station
Ottawa K1G 3T1, CANADA

R. F. Morrison
ConAgra
Kiewit Plaza
Omaha, NE 68131

B. C. Morton
Dept. of Agronomy & Soils
Clemson University
Clemson, SC 29631

J. G. Moseman
Plant Genetics & Germplasm Inst.
Northeastern Region - BARC West
Beltsville, MD 20705

Frank Moser
Agronomy Department
NDSU
Fargo, ND 58105

Miguel Mota
Departmento de Genetica
Estacao Agronomica Nacional
Oeiras, PORTUGAL

J. V. Mullaly
G.P.O. Box 4041, Dept. of Agriculture
Melbourne 3001
Victoria, AUSTRALIA

Aage Munk
Sejet KD 8700
Landbrugets Kornforaedling
Horsens, DENMARK

C. F. Murphy
Department of Crop Science
North Carolina State University
Raleigh, NC 27607

Paul Murphy
10 Agronomy - ISU
Ames, Iowa 50011

Bronius Namajunas
Inst. of Bot., Acad. Sci. Lithuanian
N. Verkiu pl. 25
Vilnius 27, USSR

Manuel Navarro-Franco
Inst. Nac. de Invest. Agricolas
Apdo. postal No. 6-882 y 6-883
Mexico 6, D.F., MEXICO

J. W. Neely
Coker's Pedigreed Seed Company
Hartsville, SC 29550

L. R. Nelson
Research & Extension Center
Texas A&M University
Overton, TX 75684

R. O. Nesheim
The Quaker Oats Co. Res. Laboratory
617 West Main St.
Barrington, IL 60010

M. F. Newton
Department of Crop Science
North Carolina State University
Raleigh, NC 27607

J. L. Nielsen
Branch Research Station, 195 Dafoe Rd.
Winnipeg, Manitoba
CANADA R3T 2M9

Robert Nielsen
Agron. and Plant Genetics Dept.
303 Agron. Bldg., Univ. of Minn.
St. Paul, MN 55108

W. C. Niemans-Verdriee
Inst. of Plant Breeding
Lawickse Alle 166
Wageningen, NETHERLANDS

Ichizo Nishiyama
18 Hazamacho Shugaku-in
Sakyuku
Kyoto, JAPAN

Oliva Nissinen
Hankkija Pl. Breeding Inst.
SF-04300 Hyryla
FINLAND

L. W. Nittler
Dept. of Seed Investigations
NY State Agri. Exp. Station
Geneva, NY 14456

A J. Oakes
Plant Genetics & Germplasm Inst.
Northeastern Region - BARC West
Beltsville, MD 20705

J. D. Oates, Officer in charge
Pl. Breeding Inst. PO Box 180
Castle Hill (Univ. of Sydney)
New South Wales 2154, AUSTRALIA

Officer in Charge
Plant Breeding Station
PO Njoro
KENYA

H. W. Ohm
Agronomy Department
Purdue University
Lafayette, IN 47907

Gosta Olsson
Oat & Wheat Breeding Dept.
Swedish Seed Association
S-268 00 Svalöv, SWEDEN

Y. C. Paliway
Chem. & Biol. Res. Inst.,
Canada Dept. of Agri.
Ottawa, Ontario, CANADA K1A 0C6

James H. Palmer
Dept. of Agronomy & Soils
Clemson University
Clemson, SC 29631

W. D. Pardee
Plant Breeding Dept.
Cornell University
Ithaca, NY 14850

H. Pass
Agronomy Dept.
Okla. State University
Stillwater, OK 74074

George Patrick
10 Agronomy - ISU
Ames, Iowa 50011

F. L. Patterson
Agronomy Department
Purdue University
Lafayette, IN 47907

P. E. PAWLISCH
2040 West Wisconsin Avenue
Milwaukee, WI 53202

Jorge A. Paz
Instituto Nacional De Invest. Agro.
Estacion Santa Catalina
Apartado 340
Quito, Ecuador

J. W. Pendleton
Agronomy Department
University of Wisconsin
Madison, WI 53706

Per Johan Persson
Swedish Seed Association
Box 101
532 00 Skara, SWEDEN

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

R. Pfeifer
Agronomy Dept.
Pennsylvania State University
University Park, PA 16802

M. S. Phillips
Scottish Pl. Breed. Station
Penlandfield, Roslin
Midlothian, Scotland, UNITED KINGDOM

Pl. Breeding & Genetics Section
Div. of Atomic Energy in Food
Joint FAO-IAEA - PO Box 590
A-1011 Vienna, AUSTRIA

J. M. Poehlman
Dept. of Agronomy
University of Missouri
Columbia, MO 65201

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

Vidrel Popescu
Institutul Agornomic
Str. Manastur Nr. 3
Cluj, ROMANIA

Aleksa Popovic
Institute for Small Grains
Kragujevac
YUGOSLAVIA

K. B. Porter
US Great Plains Field Station
Bushland, TX 79012

Peter A. Portman
Jarrah Rd., Dept. of Agriculture
South Perth 6151
Western Australia, AUSTRALIA

J. Purcell
Cereal Breed. Sta., Dept. of Agri.
County Kildare
Backweston, Leixlip, IRELAND

Ignacio Ramirez A.
Instituto de Investigaciones Agropecuari
Casilla 5427 (La Platina)
Santiago, Chile

T. Rajhathy
Central Experimental Farm
Research Station
Ottawa K1G 3T1, CANADA

M. V. Rao
Division of Botany
Indian Agri. Res. Institute
New Delhi-12, INDIA

Dale A. Ray
Agron. Dept., Ohio State University
1885 Neil Ave.
Columbus, OH 43210

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

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

E. Reinbergs
Crop Science Dept.,
University of Guelph
Guelph, Ontario, CANADA

W. D. Reiss
Agronomy Department
Purdue University
Lafayette, IN 47907

Dr. Lars Reitan
Statens Forskingsstasjon Voll
postboks 1918 Moholtan
N-7001 Trondheim, NORWAY

Matti Rekunen
SF-36340 TOHKALA
Hankkija Plant Breeding Institute
Kangasala, FINLAND

Matt Renkoski
Department of Agronomy
University of Missouri
Columbia, MO 65201

Lucas Reyes
Center at Corpus Christi
Res & Ext, Texas A&M University
Corpus Christi, TX 78406

Reinaldo Reyes
Apartado Aereo 79-84
Instituto Colombiano Agropecuario
Bogota, COLOMBIA

Howard W. Rines
Agron. and Plant Genetics Dept.
303 Agronomy Bldg., Univ. of Minn.
St. Paul, MN 55108

Jimmy Ritchey
George Warner Seed Co.
PO Box 1448
Hereford, TX 79045

C. W. Roane
Dept. of Pl. Pathology & Phys.
Virginia Polytech. Inst. & Univ.
Blacksburg, VA 24061

C. L. Roberts
Agric. Research Station
Temora
New South Wales, AUSTRALIA

J. J. Roberts
Agronomy Department
Purdue University
Lafayette, IN 47907

Larry Robertson
3 Agronomy - ISU
Ames, Iowa 50011

W. F. Rochow
Plant Pathology Dept.
Cornell University
Ithaca, NY 14850

Dan Rodgers
3 Agronomy - ISU
Ames, Iowa 50011

Alan P. Roelfs
USDA, SEA, AR Cereal Rust Lab.
University of Minnesota
St. Paul, MN 55108

Charles R. Rohde
Columbia Basin Agr Res Center
PO Box 370
Pendleton, OR 97801

Magnus Roland
Weibullsholm Pl. Breed. Inst.
Bjertorp
530 20 Kvanum, SWEDEN

Brian Rossnagel
Crop Science Department
Univ. of Saskatchewan
Saskatoon S7N OWO, CANADA

Paul G. Rothman
Cereal Rust Lab., 1551 Lindig
University of Minnesota
St. Paul, MN 55108

John B. Rowell
USDA, SEA, FR Cereal Rust Laboratory
University of Minnesota
St. Paul, MN 55108

Paul Rowoth
Department of Agronomy
University of Missouri
Columbia, MO 65211

Sami Saad El-Din
1 Agronomy - ISU
Ames, Iowa 50011

D. R. Sampson
Central Experimental Farm
Research Station
Ottawa K1G 3T1, CANADA

John F. Schafer
Plant Pathology Dept.
Washington State University
Pullman, WA 99163

Roberto E. Schefer
Elaboradora Argentina de
Casilla de Correo 1108
Buenos Aires, Argentina

P. Schelling
Plant Breeding Station
Lisdoddeweg 36
Lelystad, NETHERLANDS

John W. Schmidt
Agronomy Department
University of Nebraska
Lincoln, NE 68503

Don Schrickel
Merchandise Mart Bldg.
The Quaker Oats Company
Chicago, IL 60654

O. E. Schultz
Plant Pathology Dept.
Cornell University
Ithaca, NY 14850

Jane Scott
3 Agronomy - ISU
Ames, Iowa 50011

W. O. Scott
Department of Agronomy
University of Illinois
Urbana, IL 61801

Josef Sebesta
Ripp-Inst. of Plant Protect.
Prague 6, Ruzyne 507
CZECHOSLOVAKIA

Dale Sechler
Agronomy Department
University of Missouri
Columbia, MO 65201

Adrian Segal
Department of Botany
Tel-Aviv University
Tel-Aviv (Ramat-Aviv), ISRAEL

Scott Seibert
National Oats Co., Inc.
Cedar Rapids, IA 52402

Hazel L. Shands
Agronomy Dept.
University of Wisconsin
Madison, WI 53706

Henry L. Shands
1211 Cumberland Ave., PO Box D
DeKalb Soft Wheat Res. Center
West Lafayette, IN 47906

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

Kripa Shanker
National Dairy Research Institute
Indian Council of Agricultural Research
Karnal (Haryana) 132001 INDIA

Eugene L. Sharp
Dept. of Botany & Microbiology
Montana State University
Bozeman, MT 59715

L. H. Shebeski
Dept. of Plant Science
Univ. of Manitoba
Winnipeg R3T 2N2, Manitoba, CANADA

Ch. Shoshan
Dept. of Plant Path. & Microbio.
Faculty of Agriculture
Rehovot, ISRAEL

Leslie Shugar
W.G.THOMPSON & SONS LIMITED
POBox 250
BLENHEIM, ONTARIO NOP 1 AO, CANADA

M. C. Shurtleff
Dept. of Plant Pathology
University of Illinois
Urbana, IL 61801

Jose A. Sierra F.
Calle 22 Bis
44A-64
Bogota, COLOMBIA

M. D. Simons
313 Bessey - ISU
Ames, Iowa 50011

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

Herbhajan Sing
Division of Pl. Introduction
Indian Agri. Res. Institute
New Delhi-12, INDIA

Charan Singh
National Dairy Research Institute
Indian Council of Agric. Research
Karnal (Haryana) INDIA

S. K. Sinha
Bhubaneswar/3
Orissa Univ. of Agri. & Tech.
Orissa, INDIA

A. V. Skepasts
Kemptville Col. of Agr. Tech.
Kemptville
Ontario, CANADA

Ron Skrdla
10 Agronomy - ISU
Ames, Iowa 50011

D. T. Slater, Agronomist
Soils and Crops Branch
Dept. of Agriculture & Marketing
Truro,Nova Scotia, Canada

A. E. Slinkard
Crop Science Dept., Univ. of Saskachewan
Saskatoon S7N OWO
Saskatchewan, CANADA

L. Slootmaker
ELST (Utr.)
Pl. Breeding Sta "Plantage Wil.
Cebeco-Handelsraad, NETHERLANDS

H. Smiljakovic
Institute for Small Grains
Kragujevac
YUGOSLAVIA

D. H. Smith
USDA, SEA, AR Crop & Soil Sciences
Michigan State University
East Lansing, MI 48824

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

Glenn S. Smith
Agronomy Department
North Dakota State University
Fargo, ND 58102

H. C. Smith
Crop Res. Div., DSIR
Private Bag
Christchurch, NEW ZEALAND

R. T. Smith
Plant Genetics & Germplasm Inst.
Northeastern Region - BARC West
Beltsville, MD 20705

K. R. Solanki
Forage Research Dept.
Haryana Agricultural University
Hissar 125004, INDIA

Dr. Mark E. Sorrells
Dept. of Plant Breeding & Biometry
252 Emerson Hall, Cornel Univ.
Ithaca, NY 14853

J. J. Stanton, Jr.
Coker's Pedigreed Seed Co.
Hartsville, SC 29550

T. M. Starling
Agronomy Department
V.P.I. and S.U.
Blacksburg, VA 24061

J. D. E. Sterling
Res. Station PO Box 1210
Charlottetown
Prince Edward Island,. CANADA

W. R. Stern
Agron. Dept., Univ. Western Australia
Nedlands
Western Australia, AUSTRALIA

E. G. Strand
CED, ERS, USDA, Room 240
500- 12th St. S.W.
Washington, D.C. 20250

Erling Strand
Dept. of Plant Husbandry
Agricultural College of Norway
Vollebekk, NORWAY

Oliver E. Strand
Dept. of Agronomy & Pl. Genetics
University of Minnesota
St. Paul, MN 55108

Boyd Strong
Southwest Center
University of Missouri
Mt. Vernon, MO 65712

Deon D. Stuthman
Dept. of Agronomy & Pl. Genet.
University of Minnesota
St. Paul, MN 55108

Thomas O'Sullivan
Cereal Station, Dept. of Agriculture
County Cork
Ballinacurra, IRELAND

M. S. Swaminathan
Dir., Indian Agr. Res. Institute
New Delhi-12
INDIA

James W. Swartz
Area Extension Agronomist
County Court House
Grand Junction, CO 81501

M. Swiderski
Polish Acad. Sci., Inst. Pl. Genetics
ul. Strzeszynska 30/36
60-479 Poznan, POLAND

Jerre F. Swink
Arkansas Valley Research Center
R 2, Box 186
Rocky Ford, CO 81067

Janos Szlertes
Gabonator, Kutato Intezet
Szeged, Alsokikotosor 5
HUNGARY

S. Tabata
Oat Breed., Hokkaido Nat.Agr.Exp. Sta.
Hitsujigaoka 061-01
Sapporo, Toyohira, JAPAN

Jack Tanner
Crop Science Dept.
University of Guelph
Guelph, Ontario, CANADA

Dir. Cayo Mario Tavella
La Estanzuela, Colonia, Uruguay

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

Roscoe L. Taylor, Agronomist
Agr. Exp. Sta. USDA ARS
PO Box AE
Palmer, AK 99645

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

Ronald C. Thomason, Head
Plant Science Department
West Texas State University
Canyon, TX 79015

D. J. Thompson
J. Nickerson Research Centre
Rothwell, Lincoln LN7 6DT
ENGLAND

Roy L. Thompson
Dept. of Agronomy & Plant Genetics
University of Minnesota
St. Paul, MN 55108

Ann Marie Thro
10 Agronomy - ISU
Ames, Iowa 50011

Robert W. Toler
Plant Sciences Dept.
Texas A&M University
College Station, TX 77843

Juan Carlos Tomaso
INTA, Estacion Expt'l Agropecuaria
8187 Bordenave, B.A.
ARGENTINA

W. E. Tossell, Assoc. Dean
University of Guelph
Guelph
Ontario, CANADA

Osman Tosum
T. C. Ankara Universitesi
Ziraat Fakultesi
Ankara, TURKEY

Neal A. Tuleen
Soil & Crop Sciences Dept.
Texas A&M University
College Station, TX 77843

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

K. S. Vashisth, Officer in Charge
Plant Virus Research Station
Agri. College Estate
Poona 5, INDIA

Kurt Vive
Abed Plant Breeding Station
KD 4920 Sollested
DENMARK

I. Wahl
Dept. of Botany, Tel-Aviv University
Tel-Aviv (Ramat-Aviv)
ISRAEL

Ted Walter
Agron. Dept., Waters Hall
Kansas State University
Manhattan, KS 66502

D. J. Warnock
PO Box 1240, Agr. Canada Res. Station
Melfort
Saskatchewan, CANADA

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

Darrell M. Wesenberg
Research & Extension Center
Aberdeen
IDAHO 83210

Dallas E. Western
3365 Spring Mill Circle
Sarasota, FL 33580

Arne Wiberg
Swedish Seed Association
Box 720
S-901 10 Umea, SWEDEN

R. D. Wilcoxson
Dept. of Plant Path.
University of Minnesota
St. Paul, MN 55108

Howard Wilkins
Agronomy Department
Kansas State University
Manhattan, KS 66506

R. L. Wilson
Entomology Department
Oklahoma State University
Stillwater, Oklahoma 74074

Earl K. Wold
1500 Jackson St., N.E.
Northrup, King and Co.
Minneapolis, MN 55401

E. A. Wood
Entomology Dept.
Oklahoma State University
Stillwater, OK 74074

D. S. C. Wright
Crop Res. Div. Substation
Private Bag
Gore, NEW ZEALAND

G. M. Wright
Crop Res. Div., DSIR
Private Bag
Christchurch, NEW ZEALAND

Victor Wu
USDA NRRC
1815 N. University St.
Peoria, IL 61604

W. S. Young
Crop Science Dept.
University of Guelph
Guelph, Ontario, CANADA

Ms. Carrie Young
Crop and Soil Sciences Dept.
Michigan State University
East Lansing, MI 48824

Vernon L. Youngs
Agronomy Dept.
University of Wisconsin
Madison, WI 53706

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

Kenneth E. Ziegler
263 N. Hyland
Ames
Iowa 50010

F. J. Zillinsky
Apartado postal 6-641, Londres 40
Centro Internac. de Maiz y Tr.
Mexico 6, D.F., MEXICO

D. Zohary
Laboratory of Genetics
Hebrew Univ. of Jerusalem
Jerusalem, ISRAEL

VIII. GEOGRAPHICAL DIRECTORY OF OAT WORKERS

UNITED STATES

ALASKA
- Roscoe L. Taylor

ARKANSAS
- Don Adams
- Fred C. Collins
- John Jones
- Tracy McGraw

ARIZONA
- Neal F. Jensen

COLORADO
- Jay E. April
- William S. Ball
- Louis N. Bass
- Robert L. Croissant
- James Echols
- Adrian Fisher
- T. E. Haus
- Charles Higgins
- Greg Hinze
- H. O. Mann
- James W. Swartz
- Jerre F. Swink

DISTRICT OF COLUMBIA
- Clarence D. Grogan
- E. G. Strand

FLORIDA
- R. D. Barnett
- H. H. Luke
- Dallas E. Western

GEORGIA
- Acton R. Brown
- B. M. Cunfer
- W. H. Marchant
- J. H. Massey
- D. D. Morey

IDAHO
- Ralph M. Hayes
- Darrell M. Wesenberg

ILLINOIS
- C. M. Brown
- James E. Cluskey
- R. E. Ford
- D. W. Graffis
- E. G. Hayden, Jr.
- A. L. Hooker
- H. Jedlinski
- R. O. Nesheim
- Don Schrickel
- W. O. Scott
- M. C. Shurtleff
- S. W. Weaver
- Victor Wu

INDIANA
- Kelly Day
- B. J. Hankins
- O. W. Luetkemeier
- H. W. Ohm
- F. L. Patterson
- W. D. Reiss
- J. J. Roberts
- Henry L. Shands
- G. E. Shaner

IOWA
- Jimi Adegoke
- Guy L. Ames
- R. E. Atkins
- Roland Barker
- Susan Behizadeh
- J. A. Browning
- Stan Cox
- K. J. Frey
- Karen Kuenzel
- Ted Lund
- LeRoy McCurdy
- Leonard Michel
- Mark Millard
- Paul Murphy
- George Patrick
- Larry Robertson
- Dan Rodgers
- Sami Saad El-Din
- Jane Scott
- Scott Seibert
- M. D. Simons
- Ron Skrdla
- Ann Marie Thro
- Kenneth E. Ziegler

KANSAS
- L. Browder
- Giles E. Dixon
- E. D. Hansing
- E. G. Heyne
- Ronald W. Livers
- Y. Pomeranz
- Ted Walter
- Howard Wilkins

KENTUCKY
- Morris J. Bitzer
- V. C. Finkner

MARYLAND
- L. W. Briggle
- J. C. Craddock
- Larry Dosier
- Kenneth H. Evans
- Ben Hoag
- J. W. Johnson
- R. A. Kilpatrick
- Oscar Millard
- J. G. Moseman
- A. J. Oakes
- R. T. Smith

MASSACHUSETTS
- W. E. Kuriger, Jr.

MICHIGAN
- Albert H. Ellingboe
- F. C. Elliott
- J. E. Grafius
- D. H. Smith
- Carrie Young

MISSISSIPPI
- Lynn Gourley

MINNESOTA
- David H. Casper
- D. C. Fisher
- Scott Hackett
- Richard Halstead
- Phil Larson
- Ray Lind
- David L. Long
- S. L. Mathies
- Thomas McCoy
- M. B. Moore
- Robert Nielsen
- Howard W. Rines
- Alan P. Roelfs
- A. B. Roskens
- Paul G. Rothman
- John B. Rowell
- Hervert S. Schiele
- Oliver E. Strand
- Deon D. Stuthman
- Roy L. Thompson
- R. D. Wilcoxson
- Earl K. Wold

MISSOURI
- Ken Grafton
- W. Q. Loegering
- Robert Malin
- J. M. Poehlman
- Matt Renkoski
- Paul Rowoth
- Dale Sechler
- Boyd Strong

MONTANA
- Gregg R. Carlson
- Richard T. Harada
- Greg Kushnak
- Eugene L. Sharp
- G. Allan Taylor

NEBRASKA
- R. F. Morrison
- John W. Schmidt

NEW JERSEY
- Philip M. Halisky

NEW YORK
- W. Baines
- B. E. Clark
- W. R. Knapp
- David L. Matthews
- R. L. Millar
- L. W. Nittler
- W. D. Pardee
- W. F. Rochow
- O. E. Schultz
- Mark Sorrells

NORTH CAROLINA
- W. H. Chapman
- Harvey J. Gold
- T. T. Hebert
- S. J. Hodges
- R. E. Jarrett
- F. W. McLaughlin
- C. F. Murphy
- M. F. Newton

NORTH DAKOTA
- Bert D'Appolonia
- J. F. Carter
- Thomas J. Conlon
- Hal Fisher
- Robert Harrold
- Richard L. Kiesling
- Arthur Lamey
- Mike McMullen
- Frank Moser
- Glenn S. Smith

OHIO
- H. N. Lafever
- Dale E. Ray

OKLAHOMA
- Richard P. Bates
- L. H. Edwards
- Gail Fenderson
- Francis J. Gough
- H. Pass
- E. L. Smith
- R. L. Wilson
- E. A. Wood

OREGON
- W. H. Foote
- Mathias F. Kolding
- Warren E. Kronstad
- Charles R. Rohde

PENNSYLVANIA
- Harold G. Marshall
- Guy W. McKee
- R. Pfeifer

SOUTH CAROLINA
- W. P. Byrd
- E. B. Eskew
- Doyce Graham, Jr.
- Howard F. Harrison
- J. A. Keaton
- G. C. Kingsland
- B. C. Morton
- J. W. Neely
- James H. Palmer
- J. J. Stanton, Jr.

SOUTH DAKOTA
- Stanley G. Jensen
- Dale L. Reeves

TENNESSEE
- C. R. Graves
- Bob R. Hathcock
- Vernon H. Reich

TEXAS
- I. M. Atkins
- J. P. Craigmiles
- Morris Daniels
- Lealand Dean
- D. J. Dunphy
- Charles Erickson
- J. H. Gardenhire
- E. C. Gilmore
- Jimmie L. Green
- Dennis Johnson
- Louis Jupe
- K. A. Lahr
- Helen Lane
- M. E. McDaniel
- L. R. Nelson
- K. B. Porter
- Lucas Reyes
- Jimmy Ritchey
- Ronald C. Thomason
- Robert W. Toler
- Neal A. Tuleen

UTAH
- Rulon S. Alberchtsen
- Wade G. Dewey

VIRGINIA
- Dan E. Brann
- H. M. Camper
- C. W. Roane
- T. M. Starling

WASHINGTON
- John Britt
- G. W. Bruehl
- C. F. Konzak
- K. J. Morrison
- John F. Schafer

WISCONSIN
- Deane C. Arny
- Marshall A. Brinkman
- R. D. Durbin
- R. A. Forsberg
- Craig R. Grau
- George Luk
- J. J. Martin
- P. E. Pawlisch
- J. W. Pendleton
- D. M. Peterson
- Hazel L. Shands
- Vernon L. Youngs

* * * * *

CANADA
- H. T. Allen
- R. J. Baker
- B. R. Baum
- V. M. Bendelow
- P. D. Brown
- Vernon D. Burrows
- W. Busbuk
- G. H. Clark
- R. V. Clark
- O. M. Clayton
- Andre Comeau
- J. D. Curtis
- Jean-Pierre Dubuc
- L. V. Edgington
- Donald G. Faris
- C. C. Gill
- Dorthy Hall
- D. E. Harder
- D. N. Huntley
- H. R. Klinck
- S. L. Lockington

Canada continued

Roland Loiselle
J. W. Martens
W. C. McDonald
R. I. H. McKenzie
J. W. Marrison
J. L. Nielsen
Y. C. Paliway
Brian Rossnagel
E. Reinbergs
T. Rajhathy
D. R. Sampson
L. H. Shebeski
Leslie P. Shugar
A. V. Skepasts
D. T. Slater
A. E. Slinkard
J. D. E. Sterling
Jack Tanner
W. E. Tossell
D. J. Warnock
W. S. Young

* * * * *

MEXICO

A. J. Dimino
Philip Dyck
Jesus Moncada de la Fuente
Rodolfo Moreno Galvez
Carlos Gonzalez Gonzalez
Carlos Jiminez
Uriel Maldonado A.
Manuel Navarro-Franco
F. J. Zillinsky

* * * * *

ARGENTINA

Enrique F. Antonelli
Hector L. Carbajo
Gorgeh Cazenave
A. G. Halle
Hector Jose Martinuzzi
Roberto E. Schefer
Juan Carlos Tomaso

* * * * *

AUSTRALIA

E. P. Baker
Andrew R. Barr
W. J. R. Boyd
J. B. Brouwer
J. F. Brown
R. W. Fitzsimmons
G. J. Hollanby
R. P. Johnston
M. R. Krause
J. V. Mullaly
J. D. Oates
Peter A. Portman

Australia continued

G. L. Roberts
H. J. Sims
W. R. Stern

* * * * *

BRAZIL

Agosto Baier
Ake Boklin
Fernando Carvalho
Elmer Luiz Floss
C. A. Kallfelz
Renato Borges de Medeiros

* * * * *

CHILE

Jaun Acevedo
F. Baranao
M. Edmundo Beratto
Ignacio Ramirez A.

* * * * *

COLUMBIA

Elkin Bustamante
Reinaldo Reyes
Jose A. Sierra F.

* * * * *

CZECHOSLOVAKIA

Josef Sebesta

* * * * *

DENMARK

Sv. E. Hansen
Aage Munk
Kurt Vive

* * * * *

ENGLAND

I. R. Cubitt
Lars Eskilsson
J. D. Hayes
G. Jenkins
D. J. Thompson

* * * * *

ECUADOR

Raul Escobar-P
Gustavo Fuentes
Jorge A. Paz

* * * * *

FINLAND

Oiba Inkila
E. Kivi
Rolf Manner
Oliva Nissinen
Matti Rekunen

* * * * *

EAST GERMANY
Jahn Akad, der Landwirt, der DDR
Dr. Jahn
K. Schulz

* * * * *

HUNGARY
Janos Sziertes

* * * * *

INDIA
St. T. Ahmed
A. Shoaib Ahsan
Mal Bhag
R. Drishnan
Ranjit Ghosh
K. L. Henhra
D. S. Katiyar
C. Kishor
P. L. Manchanda
B. D. Matil
S. N. Mishra
U. S. Misra
M. V. Rao
Kripa Shanker
Herbhajan Sing
Charan Singh
S. K. Sinha
K. R. Solanki
M. S. Swaminathan
K. S. Vashisth

* * * * *

IRELAND
J. Purcell
Thomas O'Sullivan

* * * * *

ISRAEL
M. Biali
Amos Dinoor
N. Eshed
Zahir Eyal
Gideon Ladizinsky
Jacob Manistersky
Adrian Segal
Ch. Shoshan
I. Wahl
D. Zohary

* * * * *

JAPAN
Tekeshi Kumagai
Ichizo Nishiyama
S. Tabata

* * * * *

NETHERLANDS
Cebeco-Handelsraad
W. C. Niemans-Verdriee
P. Schelling
L. Slootmaker

* * * * *

NEW ZEALAND
P. A. Burnett
Howard Eagles
H. C. Smith
D. S. C. Wright
G. M. Wright

* * * * *

NORWAY
Magne Gullord
K. Middelsen
Lars Reitan
Erling Strand

* * * * *

PHILLIPPINES
Te-Tzu Chang

* * * * *

POLAND
Stanislaw Gielo
Maria Mazaraki
M. Swiderski

* * * * *

PORTUGAL
Manual T. Barradas
Miguel Mota

* * * * *

ROMANIA
Vidrel Popescu

* * * * *

RUSSIA
Bronius Namajunas

* * * * *

SCOTLAND
Donald Cameron
M. S. Phillips

* * * * *

SOUTH AFRICA
B. E. Eisenberg

* * * * *

SPAIN

Saul Flores Alvarez
Matilde Martinez
E. Sanchez-Monge

* * * * *

SWEDEN

Evert Aberg
Anders Bengtsson
N. O. Hagberth
Bo Kristiansson
Rune Larsson
James Mackey
Bengt Mattsson
Gosta Olsson
Johan Persson
Magnus Roland
Arne Wiberg

* * * * *

TURKEY

M. Remalettih Haksel
Osman Tosum

* * * * *

WALES

D. J. Griffiths
D. A. Lawes
Hugh Thomas
J. Valentine

* * * * *

YUGOSLAVIA

Aleksa Popovic
H. Smiljakovic

* * * * *

URUGUAY

Luis Fabini, Jr.

* * * * *

WEST GERMANY

Dr. Frimmel
C. Lehmann
F. J. Zeller

* * * * *