Neal F. Jensen

1968

OAT NEWSLETTER

Vol. 19

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

May 1, 1969

Sponsored by the National Oat Conference

1968

OAT NEWSLETTER

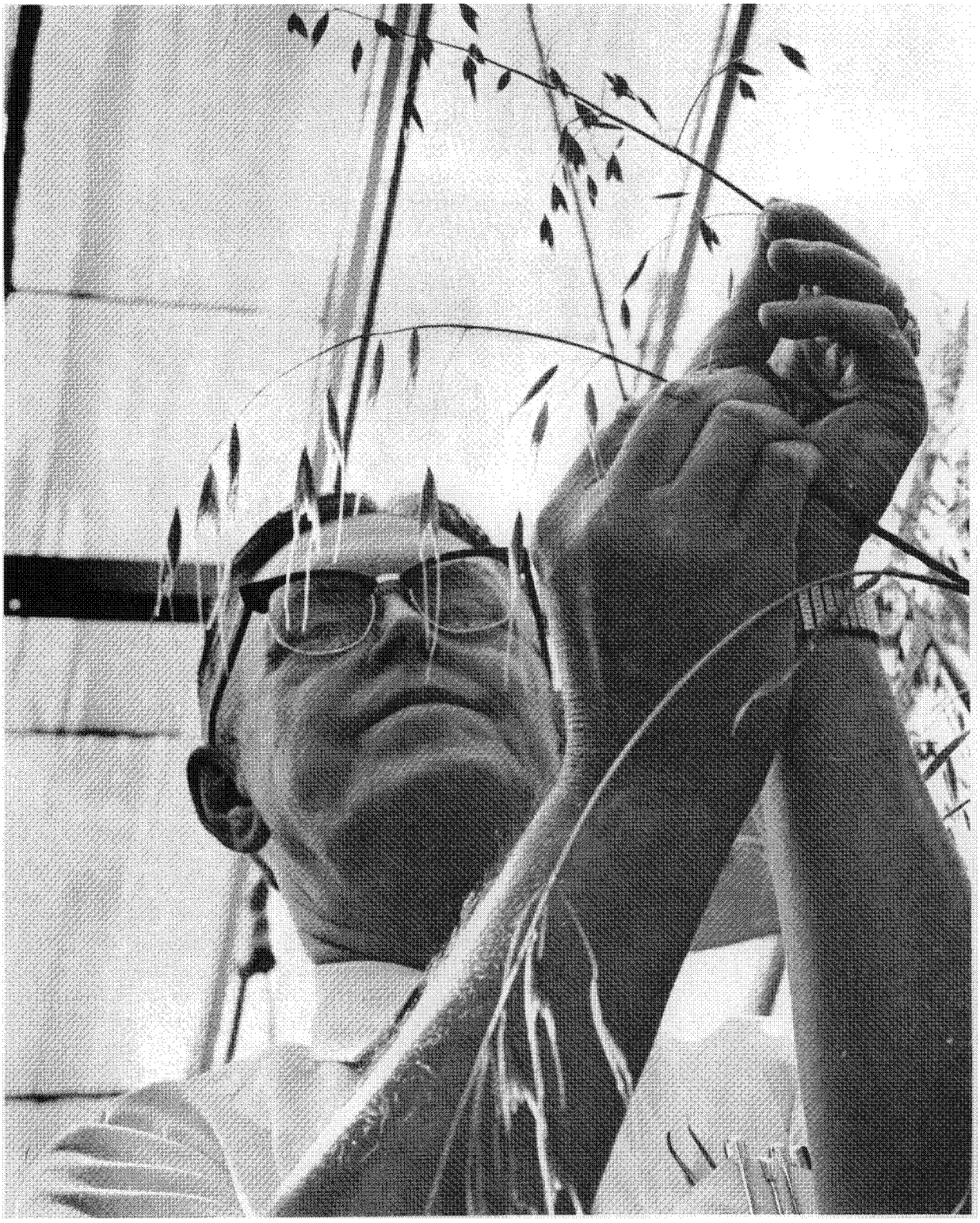
Volume 19

Edited and multilithed by the Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa 50010. Costs of preparation financed by the Quaker Oats Company, Chicago, Illinois.

May 1, 1969

Sponsored by the National Oat Conference

J. Artie Browning, Editor



Dr. H. C. (Pat) Murphy

"Oat Man of the Years"

IN MEMORIAM

DR. HICKMAN C. MURPHY, 1902 - 1968

Dr. Hickman C. (Pat) Murphy, internationally renowned oat authority, National Oat Conference chairman, and U.S.D.A. Oat Investigations Leader, died accidentally July 20, 1968, while on a field trip to the Idaho Branch Experiment Station, Aberdeen, Idaho. Volume 19 of the Oat Newsletter is dedicated to the memory of Dr. Pat Murphy, "Oat Man of the Years."

Dr. Murphy was born in Montrose, West Virginia, son of Stephen H. and Sarah Valentine Murphy, and completed his early schooling there. He earned his B.S. degree from the University of West Virginia, and continued his studies in the Graduate School of Iowa State College at Ames. He was awarded the M.S. degree in 1927, and began his outstanding career with the U. S. Department of Agriculture in 1928. Stationed at Ames, he began a long and fruitful period of close cooperation with personnel of the Iowa Agriculture Experiment Station. He also continued his graduate education and received the Ph.D. degree from Iowa State in 1930.

Dr. Murphy's initial interest was in oat diseases which he recognized to be limiting factors in oat production. His interest in diseases motivated a highly successful breeding program that encompassed disease resistance and necessary agronomic attributes. Early in his career, he ran experiments that made plant pathologists, agronomists, and farmers in general aware of the destructive potential of the oat crown rust disease. He was the first to screen the world oat collection for crown rust resistance and to establish a standard set of crown rust differentials for identifying pathogenic races of Puccinia coronata avenae.

He made operational a crossing program that, in cooperation with U.S.D.A. agronomists T. R. Stanton and Frank Coffman, made Ames a focus from which oat germ plasm was sent around the world. Within this program were developed the first important commercial varieties of hybrid origin, the "Victoria-Richlands." Released in the early 1940's, they replaced the previously-grown pure line selections in Iowa more rapidly than open-pollinated corn had been replaced by hybrid corn. These varieties combined resistance to crown rust, stem rust, and smut races prevalent at that time. This resistance was to prove ephemeral, but Dr. Murphy's program of early detection of new races and discovery of new resistance genes provided a continuing source of improved, disease resistant varieties. More than 30 such varieties were released from this program. For a period of years, they occupied the majority of the oat acreage of the United States. Some are grown widely in the United States, Brazil, and other countries, even today, and they appear in the ancestry of most oats grown in the United States.

While the majority of Dr. Murphy's time as a research scientist was devoted to crown rust, and led to elucidation of various aspects of the relationship of the crown rust fungus to its host, he also made important contributions to the understanding of other oat diseases. From the beginning of his career, he worked toward combining resistance to all diseases into improved oat varieties. He was among the first to recognize Septoria avenae

and the barley yellow dwarf virus as important pathogens on oats. He and students working under his direction investigated these and less well-known oat diseases, such as halo blight, Pythium root rot, anthracnose, and manganese deficiency. His leadership in the discovery and study of Victoria blight led to the description of the pathogen as Helminthosporium victoriae Meehan and Murphy, and the prompt suppression of this devasting oat disease. Victoria blight still stands as one of the all-too-rare examples of a major field crop disease being controlled successfully and, apparently, permanently by breeding resistant varieties, a real tribute to a scientist who successfully combined the disciplines of plant pathology and plant breeding in a programmatic project. H. victoriae, the toxin it produces, and the action of loci which condition resistance to it are the objects of major research projects in several universities today.

Dr. Murphy's program of oat hybridization opened the door for a general improvement of the oat crop in all aspects. Not only did his new varieties have disease resistance, they gave higher yields, improved quality, and stiffer straw. It may be unfair to name any one of his varieties as most outstanding, but Clinton, which set a new standard for straw strength, became best known. Clinton, a Bond derivative, occupied 5.6 million acres in Iowa in 1948 (95% of the total oat acreage) and by 1950 was grown on over 75% of the total oat acreage of the U.S.A. The Clinton type was perpetuated in a series of backcross varieties from Indiana (Clintland, Clintland 60, Clintland 64, and Clintford) and a Clinton type is the recurrent parent in Iowa's midseason multiline series from which Multiline M68 and Multiline M69 have been released.

While stationed at Ames, Dr. Murphy was active in the affairs of the University. He held a joint professorship in the Department of Botany and Plant Pathology and the Department of Agronomy, and he was a member of the Graduate Faculty. His broad knowledge, patience, and willingness and ability to give of himself made him a highly effective counselor of students. Several undergraduate students were motivated by him to become professional plant scientists, and a number of graduate students obtained advanced degrees under his direction.

In 1952, Dr. Murphy became Leader of Oat Investigations for the U.S.D.A., and in 1958 he was transferred to Beltsville, Maryland. During the period of his vigorous leadership, the Oat Investigations section underwent its greatest growth with the addition of personnel to study oat viruses, foliar pathogens other than rusts, cytogenetics, and winter hardiness. He gave valuable leadership to these young investigators, providing financial support, advice, suggestions and encouragement as needed, but always within a framework of freedom for each to proceed with an original and independent program. He also found time for a research program of his own and for domestic and foreign travel. Much of the travel followed from the tremendous interest in oat breeding around the world stimulated by his own research, publications, and contagious enthusiasm for oats.

Oats became a major crop in Mexico primarily because of the disease-resistant material supplied by Dr. Murphy for testing in areas where oats were

adapted, and advice he offered during three visits to that country. He figured prominently in the development of disease-resistant oats in South America, particularly Colombia and Brazil. When virulent races of stem rust prevented growing oats in Colombia, he provided the initiative to obtain a U.S.D.A. P.L.-480 grant to investigate the entire problem in cooperation with the Rockefeller Foundation, the Quaker Oats Co., and the Instituto Colombiano Agropecuario. His motive was dual: to help the people of Colombia grow oats needed for human consumption, and to minimize the threat of virulent Andean inoculum reaching oat growing areas of North America. In Brazil, Dr. Murphy supplied crown rust resistant material for testing, and supervised a hybridization program to develop grain and forage varieties suitable for the livestock producing area of Rio Grande do Sul. An important grain variety in Brazil is Amisade (C.I. 5871) which was a sister selection to Burnett, the last variety released from Dr. Murphy's program in Iowa.

His constant search for new rust resistance took Dr. Murphy to Israel and other Mediterranean countries to observe and collect, particularly, the wild species Avena sterilis. This developed into another P.L.-480 program and one of his most fruitful ventures. Always alert to any avenue that might lead to oat improvement, he had strains of A. sterilis tested for protein content and found some that were greatly superior to any cultivated oats. Realizing the significance of this finding in a protein-hungry world, he immediately began extensive testing and crossing, and generously shared the promising germ plasm with plant breeders everywhere. The discovery of the promising, new solid-strawed, tetraploid oat species, Avena magna Murphy and Terrell, also was a product of the Mediterranean venture by Dr. Murphy and his colleagues.

Dr. Murphy was a guiding force in the establishment and operation of the oat testing program in Puerto Rico. Under his leadership, uniform nurseries, breeding material, and promising sources of resistance have been tested for the past 13 years with crown and stem rust races too virulent to be released safely in continental North America. He personally evaluated material in these nurseries most years.

Since he observed the same material growing in the nurseries of state and federal experiment stations in the States, as well as in Puerto Rico, he served as liaison scientist among breeders, and between them and their material being tested at other stations. His tradition of visiting most oat research projects each year, studying their advanced material, reviewing experiments, discussing recent research data, and encouraging graduate students and project leaders alike with his constructive criticism and enthusiasm made his visit the highlight of the year.

It was on his annual visit to the Idaho Branch Experiment Station that Dr. Murphy met his tragic and untimely death. Because of the superior growth of small grains under irrigation and disease-free conditions at Aberdeen, Dr. Murphy and others had long grown F_1's and other valuable material at that location, and had gone there during July to make crosses and take notes. The group of small grain workers who usually assembled had come to enjoy an annual fishing outing in the trout streams of Idaho. Although he seldom fished elsewhere, Dr. Murphy especially enjoyed these outings and spoke of them often.

It was on such an expedition to the Lost River, near Aberdeen, Idaho, that Dr. Murphy was accidentally drowned in fast water on Saturday, July 20, 1968.

Dr. Murphy was a member of the American Society of Agronomy, the Crop Science Society of America, and the American Phytopathology Society. He was, of course, active in the National Oat Conference from its inception and was its chairman at the time of his death. He had looked forward to its meeting in 1970 at Raleigh, North Carolina, with himself as chairman and his son as host. He helped establish the Oat Newsletter in 1950 and was a frequent contributor to it. His research led to the publication of more than 90 scientific papers and 33 semi-technical articles. Due to his great success in developing disease resistant varieties, which were of untold value to the farmers of America and other countries, his training of graduate students as future plant pathologists and plant breeders, his willingness to share material and knowledge with co-workers in all countries, and his advancement of scientific knowledge to people everywhere, he was given many honors and awards. Most notable of these were: Chairman, Iowa State College's Osborn Research Club; President, Iowa State College Chapter of Sigma Xi; Fellow, American Society of Agronomy; and Iowa State College Alumni Merit Award. Also he was granted the U.S.D.A. Superior Service Award in 1967 in recognition of his truly significant contributions to American agriculture.

Dr. Murphy is survived by his wife, the former Greta Hanmer; one son, Charles F., Associate Professor of Crop Science and small grain breeder at the University of North Carolina, Raleigh; and one grandson.

He is survived also by a host of personal friends. A genius has been defined as one whose death is mourned by a discerning portion of the population. We do not know, nor can we imagine, anyone's death being more genuinely mourned by such a vast majority of those who knew him than was that of Dr. Murphy. Many of his professional associates, in the United States and around the world, also were his personal friends. A man of even temperament and charitable, considerate personality, he never made a derogatory remark about anyone but, to the contrary, could find a sincere word of praise and encouragement for every individual. He had disappointments, naturally--for he was human--but his only remark would be, "Well, I'll swear!" But he never did.

It probably can be said truthfully that his family and his work were both his hobbies and his raison d'être. He was an especially devoted family man. Many personal friends enjoyed the hospitality of the Murphy home, and there they experienced the depth of graciousness and devotion that permeated that home. Surely, more so than even his devotion to his friends and his work, this was the measure of this man, Pat Murphy. To the larger "oat family," the Oat Newsletter recipients, we can summarize his biography in the single sentence, "One man's life with Greta and Avena." We believe that, if he could read this one-sentence biography, it would please him very much. Certainly, his great devotion to his family, friends, and work shall never be forgotten.

ANNOUNCEMENTS

H. C. (PAT) MURPHY MEMORIAL LIBRARY

The family and friends of Dr. H. C. (Pat) Murphy, in seeking a suitable memorial, have decided to establish a memorial library of plant pathology journals and books for graduate students in the Department of Botany and Plant Pathology at Iowa State University. Dr. Murphy's personal set of Phytopathology and Review of Applied Mycology, both complete and bound, with other books on plant pathology, will form the nucleus of the library. It is hoped that contributions by friends will provide an endowment, the interest from which will continue Dr. Murphy's journals in perpetuity, subscribe to additional plant pathology journals, and purchase additional works on plant diseases as they are published.

Room 434 in Iowa State's new Bessey Hall has been designated to house the Murphy Memorial Library, and will include a portrait of Dr. Murphy, volumes donated or purchased in his memory, and a book of remembrance listing contributors to the memorial fund.

The establishment of the H. C. (Pat) Murphy Memorial Library will be announced May 10, 1969, by Dr. F. G. Smith, Head, Department of Botany and Plant Pathology, at a luncheon and open house commemorating the opening of Bessey Hall. Friends and alumni of the department, including many of Dr. Murphy's former classmates, associates and friends will be present.

Contributions credited to the H. C. (Pat) Murphy Memorial Library can be made payable to the Alumni Achievement Fund, and mailed to the Alumni Achievement Fund, 242 Memorial Union, Ames, Iowa 50010. All contributions are, of course, tax deductable.

H. C. (PAT) MURPHY ASSISTANTSHIP IN AGRICULTURE

The establishment of the H. C. (Pat) Murphy Assistantship in Agriculture in the Department of Botany and Plant Pathology at Iowa State University will be announced May 10, 1969. The graduate student assistantship, in recognition of Dr. Murphy's contribution to agriculture, will be financed by the Quaker Oats Company. It will support research for the purpose of improving the oats crop and its production through improved breeding, disease control, and related investigations and practices. The establishment of the assistantship will be announced at a luncheon commemorating the opening of Bessey Hall. The announcement will be made by Mr. Dallas E. Western, representing the Quaker Oats Company and Dr. Murphy's long-time friend, associate, and traveling companion. Many other friends, classmates, and associates of Dr. Murphy will be in attendance at the luncheon.

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 all volumes since and including 1960 are available on request.

Variety descriptions - It would be helpful if, when you name or release a new variety, in addition to your account in the State report section, you would submit a separate description to be included under "New Varieties." We would like to make the "New Varieties" section as complete and useful as possible.

PLEASE DO NOT CITE THE OAT NEWSLETTER IN PUBLISHED BIBLIOGRAPHIES

Citation of articles or reports of Newsletter items apparently is causing some concern. The policy of the Newsletter, as laid down by the oat workers themselves and later reiterated, 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. Just as definitely, no material is wanted which is of a nature that fits a normal journal pattern. Each year's call for material emphasizes this point. Unless there has been a change of thinking the oat workers do not aspire to 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 send several requests a year for 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 approximately triple in number). So why cite it in a bibliography?

Certain agencies require approval of material before it is published. Their approval of material which goes into the Newsletter is a different evaluation from approval for publishing. Abuse of this informal relationship by secondary citation could well choke off the submission of information.

One suggestion which may help: If there is material in the Newsletter which 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."

CONTENTS

I. CONFERENCE AND REGIONAL NOTES

ORGANIZATION OF THE NATIONAL OAT CONFERENCE

Executive Committee

Acting Chairman - J. E. Grafius
*Past Chairman - J. E. Grafius
*Secretary - F. L. Patterson
*Editor Newsletter - J. A. Browning

Representatives:

North Central Region - J. A. Browning, J. M. Poehlman, H. L. Shands
Northeastern Region - N. F. Jensen, H. G. Marshall
Southern Region - V. C. Finkner, C. F. Murphy
Western Region - C. F. Konzak, D. M. Wesenberg
Cereal Crops Research Branch - L. A. Tatum
Oat Investigations - L. W. Briggle

*Non-voting

National Oat Conference 1970

The Executive Committee has elected J. E. Grafius as Acting Chairman. The next National Oat Conference will be held at Raleigh, North Carolina, January 26-28, 1970. It was necessary to shift a few days from the earlier discussed dates to obtain more satisfactory facilities. Dr. C. F. Murphy will be in charge of local arrangements. Please advise other colleagues at your University of the time and place of the Conference.

Second Call for Papers

The program will consist of 15-minute volunteer papers as at the last meeting. Your secretary will give a final call for paper titles about November 1, 1969.

Please plan to bring with you about 75 copies of an abstract and tables of your paper for distribution. The abstract should be suitable for publication in the Oat Newsletter. Agronomy Abstracts and Phytopathology Abstracts may be used as guides for preparing concise and informational abstracts.

F. L. Patterson
Secretary

II. SPECIAL REPORTS

Correlations Indicate Protein Heritability from *Avena sterilis* x *Avena sativa* Crosses

R. T. Smith and J. R. Scott,
Crops Research Division, ARS, USDA

Five oat varieties were crossed with a high protein *Avena sterilis* selection in 1966. Several F_1 plants of each of the five crosses were grown at Aberdeen, Idaho, in 1966 and F_2 populations of 100 to 200 plants each in 1967. Replicated F_3 5 foot rows of each cross were grown in Idaho during 1968.

Protein content was determined on parents and seed of F_1 plants. Generally, the protein content of seed from F_1 plants was intermediate between the parents. Where more than one F_1 was grown of each cross, the seed from the highest protein F_1 was selected for the F_2 population. Distribution of classes based on protein content of the five F_2 populations conformed to a normal curve with little evidence of transgressive segregation. Parents showed little variability. It was observed from the F_2 populations that the higher protein segregates seemed to retain more of the undesirable characteristics of *A. sterilis*.

Correlations between F_2 and F_3 populations, number in each population, average population protein level, and parents are shown below:

Population	"r"	"n"	Average % Protein	
			F_2	F_3
Garland x *A. sterilis*	.433**	195	21.7	21.1
Portal x *A. sterilis*	.434**	108	21.8	21.8
C.I. 7920 x *A. sterilis*	.494**	104	21.3	20.3
A. sterilis x Diana	.804**	112	23.2	22.3
A. sterilis x Florida 500	.633**	151	24.0	23.2

**Correlation is significant at .01 level

It is interesting to note from the above that the highest F_2-F_3 correlation coefficients and highest mean protein contents were found for those two crosses in which *A. sterilis* was used as the female parent. Average protein content of parents is not shown in the above table, but was approximately 3 to 4 percentage points above the progeny mean in the case of *A. sterilis* parents, while the *A. sativa* parents were about that much lower than the F_2 and F_3 means.

The *A. sterilis* selection, used in all five crosses, possesses a decumbent type growth habit, is weak strawed, and has few spikelets per panicle. It is one of the lines selected by J. D. Miller in Puerto Rico, 1967, for horizontal resistance to stem rust, and also selected by D. D. Morey at Tifton, Georgia, 1968, for resistance to BYDV.

Have "Better Bets" Been By Passed?

Franklin A. Coffman, Collaborator, U.S.D.A.

Grain quality probably ranks next to yield in importance in oats, yet compared to some other sectors of improvement it has had a "poor press" in the past quarter century. Faced with a decline of over 40% in acreage and well over one third in total yield in the U.S., in a span of some 10 years, it would seem no important improvement in oats should remain poorly recorded. Much, little publicized, data are available indicating improvement in grain quality. One revision upward in commercial grades, based in part on test weights of oats, has already been made and who can predict the future in this respect.

Data on test weights are available in compilations prepared annually over 3½ decades as a result of a nation-wide program, started in a general way in the early 1920's, and reorganized in 1940-42 and which at its high point, 1950 to about 1953, included some 45-46 states and over 120 stations.1/

The history of this program for the first 30 years appeared in Oat Newsletter, Vol. III, 1953. The program has been continued in a general way to date, or now for nearly half a century, and a mass of data awaits those who man the computer. Lacking use of office machines, this writer has assembled a few early data by that now antiquated pencil and paper method.

At the start of this program three, then well-known early oat varieties, Kanota, Richland and Gopher were included as checks.

It should be stated that prior to the middle 1930's all were widely "touted" as "superior" in both yield and in test weight. Mean average annual, 5-year and 10-year data on Gopher and Richland follow. (See page 4)

Data for 15 years are available on 5 "check" varieties grown on stations in that wide area extending from the central Corn Belt southward. This has long been considered the "spring sown red oat area." A summary of these data follows. (See page 4).

The slight overall difference between Clinton and Andrew is obvious.

When released by Kansas, some 50 years ago, Kanota was described as having a "superior test weight" in areas where adapted. The superiority in test weight of Mo. 0-205 was evident almost at once. This has continued. In the numerous nurseries in which it was compared with Kanota it has tested 2.1 lb or 7% heavier. Its yield has possibly exceeded that of Kanota by 2 to 3 times that 7% difference in test weight.

1/ In a recent oat report data were assembled from 84 points in 38 states.

Average Annual Bushel Weights of Gopher and Richland.
"Historical" Checks Grown for 10 Years in Spring Sown Oat Nurseries.

Year	Average lb./bu. Gopher	Richland
1943	26.8	28.3
1944	26.1	27.8
1945	28.7	28.6
1946	31.2	31.6
1947	30.2	30.0
5 years mean (lbs.)	28.6	29.3
1948[1/]	26.6	27.4
1949	29.0	29.1
1950	29.9	30.1
1951	31.1	30.9
5 years mean (lbs.)	29.4	29.6
10 year total; 137 nurseries		
10 year mean av. (lbs.)	29.0	29.4
Mean difference	--	+0.4

1/ Richland and Gopher were grown in different uniform nurseries in 1948 but data are available from 7 stations that grew both. To save space and labor Richland was discontinued as a check in more recent years.

Mean Average 5-year and 15-year test weights of 5 "Check" Varieties grown in the same nurseries each year for 15 years in the "Spring Sown Red Oat Area"

5-year Periods	Mean Average lb./bu. for-- Kanota	Columbia	Andrew	Clinton	Mo. 0-205
1948-1952	29.5	31.0	31.0	30.7[1/]	31.9
1953-1957	29.6	31.1	30.8	30.2[1/]	31.6
1958-1962	30.3	31.4	30.6	31.7	32.3
15-year total 200 nurseries					
15-year mean ave.	29.8	31.2	30.8	30.9	31.9
Mean ave. dev. from Kanota	-	+1.4	+1.0	+1.1	+2.1

1/ Clinton (C.I. 3971) was grown previous to 1953; Clinton 59 thereafter until 1963. In upwards of 100 nurseries over 6 years Clinton 3971 and Clinton 59 "tested" exactly the same.

Time available precluded summarizing and tabulating all data on hand from all geographic areas of the United States, but in the area primarily to the north of that from which data presented above were obtained among early old-time checks were Gopher, Andrew, Clinton and Mo. 0-205. Over

some 20 years Clinton and Andrew differed by only 0.1 lb. in mean average test weights in favor of Clinton. Agronomists are aware that more often Andrew outyielded Clinton by at least a slight margin, hence Clinton as such was discontinued.

In these nurseries average mean test weights for well over two decades for Gopher and Andrew were approximately 29.7 and 32.4 lb., respectively; or differed by 2.7 lb. in favor of Andrew. In a shorter span in which Gopher, Andrew and Mo. 0-205 were included the average mean test weights for these were approximately 30.0, 32.4 and 33.3 lb., respectively. The latter's test weight exceeded the older variety (Gopher) by 10% or 3.3 lb.

When other grain characters are equal, that difference in test weight is sufficient to result in an advance in grain grade and hence usually sales price.

Numerous new oats have been included in more recent years, but in any several-year comparisons with Mo. 0-205 the yield and test weight of that oat has still ranked it high. It is well known that Mo. 0-205 has certain unfavorable morphologic characters, from the commercial standpoint, but its record shows it is slightly superior to even Andrew in standing ability. As a result it seems probable that Mo. 0-205's superior qualities have warranted its wider use by oat breeders than is indicated by the few hybrid entries that have appeared to date of which it was listed as a parent.

A further argument for wider use of Mo. 0-205 in crossing might be made by reference to reports from Northwest Irrigated Stations. In such Bingham, a white kerneled oat, derived from a cross of which Mo. 0-205 was a parent, produced a mean average acre yield of about 130 bushels over several years. This average exceeded that of Victory, the long time "check" by some 18 bu. or over 16%. In those areas where winds may be disastrous to freshly-irrigated crops, Bingham and Clinton both, noted for stiff straw, were reported to have lodged on the average, over several years about the same, or 3.28 and 3.36%, respectively. In these same nurseries lodging in certain "old time checks" of that area often averaged over 40% or some 12 times as much as that in either Clinton or Bingham.

Yield records for Bingham exceeding 200 bu./A in that area are hardly news. (Top average about 300 bu.). Admittedly its test weight is not equal to several weaker strawed varieties but in that area its mean average test weight was calculated at about 35.4 lb. which is less than 4% below that calculated for Clinton, a variety which in comparable years tests in that area, yielded on the average about 30 bu. less than Bingham.

In spite of these unusual records, no Bingham, and only a few, new Mo. 0-205 hybrid derivatives have apparently been entered in any U.S. regional spring-sown oat nursery in the last 10 years, and this despite the crop's recent decline.

Physiologic Races of Oat Stem Rust in the USA in 1968

D. M. Stewart and P. G. Rothman

Among 178 field isolates of oat stem rust identified in the Cooperative Rust Laboratory at St. Paul, Minnesota, race 6AF comprised 74% of the isolates; race 6F, 16%; 7F, 3%; 6AH, 2%; and the remaining 5% included 2 isolates of 7FH, and 1 isolate each of 2H, 7AF, 7AFH, 13AF, and 13AH.

This is the sixth consecutive year that races 6AF and 6F have been the most prevalent races in the survey and the fourth consecutive year 6AF has predominated. The virulent 6AFH first found near barberry in Pennsylvania in 1965 was identified once or twice the following year in Iowa, Minnesota, Pennsylvania, and Texas, but was not found in 1967. In 1968, this race was found only in the Uniform Oat Rust Nursery near barberry at University Park, Pennsylvania, where it was one of the most prevalent races.

In a cooperative oat stem rust study with W. O. Keim (Plant Pest Control) and Dr. R. Pfeiffer, Associate Professor of Agronomy at Pennsylvania State University, University Park, Pennsylvania, 166 isolates were identified from 86 collections in the Uniform Oat Rust Nursery. Among the identifications race 6AH and 13AH comprised 52% of the isolates; 6AFH and 13AFH, 27%; 6AF and 13AF, 9.6%; and the remaining included 4H, 4AH, 6A, 6F, 7A, 7F, 7AF, and 13A. Further details of this study will be published.

Problems of Storing Plant Disease Data For Retrieval by Automatic Data Processing Machines

William Q. Loegering

Washington Agricultural Experiment Station, College of Agriculture, Washington State University Bulletin 705, December, 1968. (Single copies are free. Write to Bulletin Department, Publications Building, Washington State University, Pullman, Washington 99163. Please include your zip code in your return address).

SUMMARY

Plant disease data for automatic machine processing must be stored in a way that permits useful retrieval. As a consequence of the peculiarities of plant disease and plant disease data, there is need for a storage method that may appear to be needlessly complex. The peculiarities and the means by which such data can be stored and retrieved are:

1. A plant disease datum only has value if accompanied by information on the variety, the disease and the circumstance.

2. Plant disease data are range data which usually represent a scale from good to bad from the plant breeding point of view.

3. A series of disease observations on a single variety under varying circumstances is apt to be an extremely variable set of data. Thus, disease data itself cannot be averaged and varieties cannot be classified as resistant or susceptible to a disease.

4. A plant disease datum is an indirect measurement of variety response and therefore must be interpreted if it is to be used in characterizing a variety. It is, therefore, necessary for the plant breeder to have a guide to the potential of a variety with respect to resistance to a pathogen. Average guide codes are suggested for this purpose.

5. The average guide code is used to guide the plant breeder to the original data which are indispensable in reaching final judgments on whether or not a given variety may be useful in a breeding program.

A simpler approach to the problems of plant disease data storage may be possible; however, unless such an approach is flexible and versatile, it probably will not survive.

A Proposed Standard Method for Illustrating Pedigrees of Small Grain Varieties

Laurence H. Purdy, W. Q. Loegering, C. F. Konzak, C. J. Peterson, and R. E. Allan

Scientific Paper No. 3025. College of Agriculture, Washington State University, Pullman. Crop Science 8:405-406, 1968. Single copies are free. Write to C. F. Konzak, Department of Agronomy, Washington State University, Pullman, Washington 99163. Please include your zip code in your return address.

CONCLUSION

The proposed method of writing pedigrees of small grain varieties should be applicable for manual and automatic machine operations. This simple and versatile method may be useful under a wide variety of situations and should be directly adaptable for other crops. International groups concerned with problems of storing crop plant data may wish to use it.

Progress Report on Studies Toward Increased International Standardization in Crop Research Data Recording and toward a World Plant Germ Plasm Records System

C. F. Konzak

The research at Washington State University was supported in part by funds from Project 1568, Washington State Department of Agriculture, and Project 4068, Atomic Energy Commission.

Despite delays experienced due to personnel changes in the cooperating international agencies, FAO and IAEA, and the funds squeeze, a number of forward steps toward our goals have been achieved and the program continued.

Several papers dealing with aspects of the program have been published or are now in various stages of the publication process. Some of these are listed in the Newsletter. Manuscripts by Broekhuizen and T. T. Chang describing standard plant growth stage codes for cereals, wheat, oats, barley and rice are near completion.

A symposium on "Centers of Plant Diversity and Conservation of Crop Germ Plasm" was held at the AIBS meeting in Columbus, Ohio, September 4-6, 1968. A paper on "Documentation for the Conservation and Use of Plant Germ Plasm Resources" was presented by C. F. Konzak and S. M. Dietz. A paper on the concept of a world plant germ plasm record system was read at the XII International Genetics Congress by Dr. B. Sigurbjörnsson, now Deputy Director, FAO/IAEA, Division of Atomic Energy in Agriculture, Vienna, Austria.

Experiment Station Project 1980 has been initiated at Washington State University to study methods of storage and retrieving information on plant genetic resources. This project involves the collaboration among three units of the University, including Agronomy and Genetics--C.F. Konzak; USDA Plant Introduction-- S.M. Dietz; and the Washington State University Computing Center and Statistical Services--T.P. Bogyo and W. E. Walden. Also associated with this project are Dr. Basri Devecioglu, a postdoctoral trainee from the Plant Collection Center, Izmir, Turkey; L. W. Hudson, a horticulturist; and R. D. Dutton, a graduate assistant in Information Science; as well as a part-time computer programmer and part-time secretarial assistance. Dr. T. P. Bogyo is currently on Sabbatical Leave from Washington State University serving as a consultant to the Plant Breeding and Genetics Section of FAO/IAEA in Vienna. He is collaborating also with Dr. Erna Bennett in the FAO Plant Production and Protection Division, Rome, on aspects of the World Plant Germ Plasm Records project.

In the Washington State University project, information storage and retrieval studies are being undertaken using data on the USDA's CI and PI collections of Triticum and Phaseolus. For this purpose, the TAXIR information retrieval system developed by the Taximetrics Laboratory of Dr. David Rogers at Colorado State University is being converted for operation on the Washington State University IBM 360 equipment. It is expected that the programming conversion will be completed in time for practical testing of the system to begin about mid-year.

A further revision in the proposed general world plant germ plasm record system formats for registering genetic stocks is now in process. Consequently, revision has again delayed plans for wider scale tests of the system, but it is still hoped that adoption of the formats will be completed in time for cooperative international studies to be initiated in 1969 as an International Biological Program project. In connection with this IBP effort, plans of Washington State University projects include a survey of primitive cultivars among the USDA collection of plant introductions.

III. CONTRIBUTIONS FROM OTHER COUNTRIES

Oats in Western Australia

By J. Reeves

Oats are second only to wheat in area sown. During 1967, 1,621,000 acres were planted compared with 6,692,000 acres for wheat. The crop is mostly used for grain with hay and green fodder of lesser importance. Considerable quantities of grain are exported overseas, mainly for human consumption. Varieties planted are early to mid-season maturing and have a spring habit of growth.

The 1967 Season

Conditions in the early part of the season were excellent for growth. Waterlogging was present in some areas but pests and diseases were of little importance. The main feature affecting yields was a hot, dry spell in September which resulted in premature ripening of crops in some localities. The average yield of 17.1 bu./A was 1.3 bu./A less than for the previous season and 1.7 bu./A less than in 1965.

Oat Varieties

It is anticipated that the new variety, Swan, will rapidly increase in popularity because of its higher yields and good agronomic characteristics. Date of release and popularity of varieties produced by the W. A. Department of Agriculture are shown in the following table:

Variety	Date Released	Percent of State Acreage (1967)
Wongan	1937	0.2
Ballidu	1942	29.1
Dale	1942	0.8
Avon	1954	33.5
Kent	1955	9.6
Irwin	1964	18.8
Swan	1967	-

Research

The varieties mentioned above were bred at the Wongan Hills Research Station, 120 miles northeast of Perth. With the newer varieties considerable advances have been made in yield improvement by increasing straw strength and improving resistance to shedding. Breeding for disease resistance is not being carried out; however, newer releases have shown useful tolerance to Barley Yellow Dwarf Virus. Although the disease was recognized only since the release of Avon, it is surmised that it was present during the early years of selection which produced this variety. Selection of vigorous healthy plants resulted in a measure of resistance.

All new releases must be suitable for milling, consequently grain size, color and husk percentage are important objectives in the breeding program.

Oat Research in Brazil - Rio Grande Do Sul

By Rubem Dischinger and Rubens E. Bertholdi

Data presented here refer to Rio Grande do Sul, the Southern State of Brazil, where an oat breeding program was started in 1965 with the selection of the first F_2's received with the cooperation of the University of Wisconsin, the Quaker Oats Company, the USDA, and other American universities. Local field work has been carried out cooperatively by the Ministry of Agriculture, the Quaker Oats Company, the Federal University of Pôrto Alegre, and the Federal University of Santa Maria.

Breeding work is progressing well; approximately one thousand promising oat lines will start preliminary yield tests this year.

A good approach was made toward evaluating Barley Yellow Dwarf Virus (BYDV) tolerance of oat lines which consists in growing the head rows in the summer as soon after harvest as possible. Thus with two generations per year instead of one it was possible to evaluate BYDV tolerance of most breeding lines without rust interference.

Puccinia coronata avenae survives in pastures in the summer on Dactylis glomerata but did not increase under our conditions in the last three summers. It was, therefore, possible to grow yield tests close to Dactylis using rust susceptible oats.

In 1968, as in the three previous years, crown rust was very intense and caused death to susceptible oats from seedings made at the normal time (May-July). Native oats usually showed less rust than exotic oats.

We continue our search for sources of resistance within the local native oats of which different types are rather abundant in this region. Also, some lines were found to have excellent resistance to the local rusts.

Warm weather came unusually early this year and caused an uncommonly intense stem rust epiphytotic. All oats of the International Oat Rust Nursery were attacked. This is new for us because this disease is not a problem in our region, and usually genes AB suffice. Of the differentials, ABDA and C.I. 8091 showed the fewest and smallest pustules. In the breeding lines, strains derived from the cross of native Quaker 604 x Florida 500 showed resistance to the local stem rust races.

Commercial plantings, primarily of native oats, have yielded fairly well. Commercial plantings of a new variety, IAS-5 (derived from C.I. 5871 x Magnif 29) were started in one section of the state. The proposed rust resistance genes for IAS-5 are BD for stem rust, SF and gene II of adult plant resistance for crown rust. According to information from growers, yields averaged 66 bu./acre.

Small increase fields of foundation seed of Coronado, C.I. 8260, appeared promising.

Oats and Oat Diseases in Canada

R. I. H. McKenzie, G. Fleischmann, J. W. Martens and G. J. Green

A total of 5,340,000 acres of oats were harvested in the three Prairie Provinces in 1968, about 250,000 acres more than in 1967. Yields were generally good, averaging a record 51.3 bu./A in Manitoba, 41.1 in Saskatchewan and 48.0 in Alberta. Drought was a major factor only in southern Saskatchewan. Extremely wet, cool weather through the harvest period made harvesting difficult and some of the crop was still not in by November 1.

Yield reductions due to oat crown rust were appreciable in the Red River Valley of Manitoba in 1968 although disease development did not occur until well after heading. This late attack caused losses because of the unusual cool wet weather which delayed maturity of the crop while encouraging rust development. In experimental plots the tolerant variety Kelsey was reduced in yield by 25 bushels while the completely susceptible variety Eagle was reduced by 30 bushels.

Two races of crown rust, 295 and 326, were predominant among isolates identified from Western Canada. These races as well as most of the others from the west attacked the differential oat varieties Landhafer and Santa Fe. While 82% of western isolates were virulent on these differentials, only 8% of the physiologic races identified from Eastern Canada attacked Landhafer and Santa Fe.

A line of Pendek oats containing crown rust resistance gene Pc-39 from Avena sterilis was resistant to all 116 isolates of crown rust in the 1968 survey. Another line containing gene Pc-38 was resistant to all but 2 isolates. Lines containing genes Pc-40, Pc-41 and Pc-42, were not particularly effective against these crown rust isolates.

Stem rust of oats did not appear in western Canada until most of the oat crop was approaching maturity. Small amounts were first reported on August 27 and light infections developed in late fields in southeastern Manitoba. Over-all losses were slight. Race C10 (6AF) continued to predominate and small amounts of races C3 (7A) and C5 (6F) were found. In eastern Canada race C9 (6A) and C8 (4A) predominated along with C10.

Oat Research in Japan

T. Kumagai and S. Tabata

The weather this year was very favorable for oat growing in Hokkaido. The weather situation was very similar to the case of last year. The grain yield per acre in our nursery showed 38.6 Kg. in Zenshin, check variety in Hokkaido, 9% above the average during the past ten years.

The hybridization of 36 combinations was carried out in the greenhouse in order to improve the lower adaptability of Ōtsuku, a variety released in 1966, and to introduce foreign lodging resistance genes of Milford, an English variety; Pendek, a German variety; and so on, into our varieties. The performance test of F7 selected lines showed that 8 strains had higher yielding ability than Zenshin, a check variety. The experimental strain Honkei No. 286, selected from the cross of (S.84 x Milford) x Zenshin, had high yielding ability, 6% above the yield of Zenshin and looked the most promising among the selected strains examined. The varietal test of lodging resistance was conducted under dense planting and heavy application of fertilizers to investigate genotypic difference in lodging resistance under heavy application of fertilizers. We used the following seven varieties with excellent straw: Ōtsuku, Hokuyō, Kuromi No. 1, Clinton, S. 172, Milford, and Flamande Desprez. According to the results, Flamande Desprez, a French variety, kept higher resistance consistently even under heavy application of fertilizers. The varieties, whose lodging resistance tended to fluctuate and decrease strongly in accordance with increasing fertilizers, were Ōtsuku, Hokuyō, Kuromi No. 1 and Clinton.

Some winter-surviving oat plants were discovered in Ozawa province, western part of Hokkaido, that were buried deep in snow all winter. The plants were growing spontaneously and wildly in the field of a farmhouse. The plants collected were offered for identification and studies of the causes contributing to winter hardiness. The results revealed that the plants were of A. fatua, and the principal cause of winter-surviving was to be sought in their very long dormancy.

Resistance to the Cereal Cyst Nematode

J. Cotten and J. D. Hayes
Welsh Plant Breeding Station, Aberystwyth, U. K.

One of the main objectives of the oat breeding program at the Welsh Plant Breeding Station is the development of high yielding spring and winter oat varieties resistant to the cereal cyst nematode, Heterodera avenae Woll. The resistance found in Cc4658 Avena sterilis (I 376), which is manifest in the absence of adult females (cysts) on the host roots, appears to be controlled by several major genes with resistance dominant.

Cc 4658 has been tested against 22 populations of the cereal cyst nematode and although these can be differentiated into three races on the basis of their reaction to certain genotypes of barley, Cc 4658 has shown good resistance to all the populations.

Resistance from Cc 4658 has now been backcrossed into adapted spring and winter oat cultivars having a gene for resistance to races 1, 2 and 3 of powdery mildew, Erysiphe graminis avenae.

By pooling together homozygous resistant lines and, similarly, homozygous susceptible lines from within a segregating advanced generation population near isogenic resistant and susceptible oat populations have been developed. The cereal cyst nematode is known to be widely distributed throughout the cereal acreage in Britain, and these populations will be used to assess the effect of the nematode on the yield of oats.

IV. CONTRIBUTIONS FROM THE UNITED STATES

Arkansas

E. L. Clement and J. P. Jones

Production

Oat production in Arkansas for 1968 increased 7% over 1967. The per acre yields increased to 64 bu./A, an 8% increase. The two Arkansas varieties, Ora and Nora, continue to be the top varieties grown.

Breeding

Crosses continue to be made with Avena sterilis lines to obtain possible resistance to rust. Two lines were selected in the Oat Nursery for rust resistance. These lines are all being increased for future selections.

Personnel

Dr. Fred Collins will replace Dr. R. L. Smith and will be actively engaged in the Improvement and Testing of Small Grains in Arkansas. Dr. Collins received his degree from Purdue University working under Dr. R. C. Pickett.

COLORADO

T. E. Haus

The 1968 harvested oat acreage, 71,000 acres, was the second smallest of record dating back to 1909. The state average yield was estimated at 39.5 bu./A.

The most popular varieties in the state are Park, Russell and Colorado 37 on irrigated acreage and Fulton on dryland acreage.

A breeding program has been initiated to attempt to develop a productive, stiff-strawed, white oats for irrigated land. There is a good market for white oats for horse feed grown in the San Luis Valley in south central Colorado. The only variety that consistently produces acceptable color and high test weight is Colorado 37, but this variety has relatively weak straw.

Florida

W. H. Chapman

Oat acreage is remaining constant with indicated average yield of 40 bushels per acre for 1968 as compared to 37 bushels in 1967. Most of the acreage is grazed completely. Only about 5% of the crop is harvested for grain without some prior grazing.

There is considerable interest in sealed storage units for haylage and silage to be used in the cattle feeding program in North Florida. Crops involved are the small grains, corn, grain or forage sorghums, and millets or sorghum-sudan crosses. Harvesting these crops as haylage or silage shortens the growing season and points to the need of a multiple cropping system. The oats crop is being harvested as haylage in these studies and followed by grain or forage sorghum, millet or a sorghum-sudan cross, or late planted corn.

Fall and early winter growth of the 1967-68 nursery was excellent; however, temperatures in March and April were colder than average and moisture was deficient at maturity. For the first time in more than 27 years there was not sufficient crown rust for readings in any of the breeding nurseries. The rust nurseries were planted late and there was a light to moderate infection.

Florida 500 has produced excellent yields in commercial production. Florida 501 looked quite good in foundation seed fields and will likely replace Florida 500 because of its uniformity, high yields, and superior test weight and quality.

Georgia

Acton R. Brown and M. J. Bitzer
(Athens and Experiment)

Dr. Morris J. Bitzer joined the small grain research team in April, 1968. He will replace Dr. U. R. Gore who retired on June 30, 1968 after 26 years as a small grain breeder. Dr. Bitzer's primary responsibility will be in the area of wheat improvement, but he will work closely with Dr. A. R. Brown in other areas of small grain research.

Research and Extension Agronomists have reported soil-borne mosaic damage to oat fields in Northeast Georgia this season. A number of winter oat varieties and selections are now being tested at Experiment, Georgia in the mosaic nursery. Oat varieties and selections are also being tested at the Georgia Mountain Experiment Station, Blairsville for winter hardiness.

Georgia

Darrell D. Morey and R. H. Littrell
(Tifton)

The weather in South Georgia has been cold up to early February and diseases and aphids have not been serious to date. Crown rust did not develop in our nursery last year so we could not continue the studies with Plantvax and other promising chemicals for the control of crown rust. However, we have continued to select for crown rust resistance in Avena sterilis crosses with some success. Tests now underway in Puerto Rico will help evaluate oat selections from Tifton.

Preliminary testing of groats for protein indicate that protein can be increased from 13% in our regular varieties up to 20% or more in the A. sterilis crosses. More effort is needed but the work with protein is very encouraging.

Results from date-of-planting tests show that early planted oats (Aug., Sept.) survive diseases and insects better than early planted wheat and rye in South Georgia.

Idaho

Darrell M. Wesenberg and Ralph M. Hayes (Aberdeen)

Idaho's oat production was estimated at 3.85 million bu. for 1968--a marked increase compared to the previous year, but below the 1962-66 average. The 1968 harvested acreage was estimated at 74,000 acres. Record rainfall during August delayed harvest and caused light to heavy damage to cereal crops throughout the state. The total recorded August precipitation for Aberdeen was a record 3.63 inches compared to a 56-year average of 0.47 inches. The major portion of the Aberdeen nursery was harvested prior to the August rains, however, severe grain damage occurred in a few of the later plots.

The Uniform Northwestern States Oat Nursery under irrigation averaged 140.0 bu/A at Aberdeen and 168.1 bu/A at Twin Falls. The dryland nursery at Tetonia averaged 65.1 bu/A. Cayuse was first in yield at Aberdeen and second at Twin Falls. Sierra had the highest average yield at Twin Falls with 201.1 bu/A. 63Ab7868 (Rodney x Shelby) was first in yield at Tetonia with 83.9 bu/A followed by Lodi and Cayuse.

Protein percentages (groat protein) were relatively low at Aberdeen, averaging only 13.6% for the Uniform nursery entries compared to 16.4% and 16.9% for Twin Falls and Tetonia, respectively. Clinton 59 was highest in protein content among the Uniform nursery entries at the three stations, averaging 18.3%. The highest protein yields in the Uniform nursery at

Aberdeen and Twin Falls were obtained for AuSable, Orbit, Sierra, Stormont, and CI 2874 (Minn. II-22-220) with, respectively, 593, 632, 620, 603, and 596 lb/A of protein. An Aberdeen selection of Park x Russell (65Ab4602) yielded 604 lb/A of protein per acre. Rapida was highest in protein content among the entries grown in yield nurseries at Aberdeen, Twin Falls, and Tetonia, averaging 21.0% for the three stations; however, protein yields/A were the lowest in each nursery.

The more promising selections from Aberdeen include 65Ab4547 (Park x Russell) which ranked 2nd for yield in the 10 irrigated stations of the Uniform Northwestern States Oat Nursery, averaging 116.1 bu/A compared to 117.3 bu/A for Cayuse.

Breeding for yield, straw strength, and grain quality is being continued at the Aberdeen Branch Experiment Station. Programs to study the inheritance of protein content in Avena sativa and the effect of nitrogen level on groat protein content and yield have been initiated. Approximately 300 early generation Wisconsin lines from several crosses were evaluated at Aberdeen in 1968. Certain of the Wisconsin lines may be of value as parents in breeding for yield and protein content at Aberdeen.

Personnel Items

Dr. Frank C. Petr resigned as Research Agronomist in charge of oat and barley research at Aberdeen effective December 31, 1967. Dr. Petr accepted a position with the Texas Extension Service at Amarillo, Texas. Dr. Darrell M. Wesenberg was appointed to fill the vacancy effective March 25, 1968. Ralph M. Hayes, Agricultural Research Technician, assists with the oat and barley research and also has major responsibility for increasing breeding material for research personnel at other institutions.

Illinois

C. M. Brown, H. Jedlinski, W. O. Scott, D. W. Graffis and M. P. Britton

The 1968 season was a good one for oats in Illinois. Record yields of over 100 bu./A were reported by some farmers. The state average yield of 64 bu./A was 4 bushels above the previous record set in 1966. The cool, moist spring with only a few very hot days during grain-filling contributed to the high yield and quality of the crop.

The oat acreage showed a slight increase with 802,000 acres harvested in 1968. This compares to 770,000 acres harvested in 1967. Garland replaced Newton as the most common variety grown in Illinois and accounted for 29% of the acreage. Newton was in second place with 23%. The Clinton types including Clinton, Clintland, Clintland 60, and Clintland 64 accounted for 12% of the acreage. The Certified class of the new variety Jaycee was grown by certified seed producers for the first time in 1968.

Oat fields were relatively free of diseases during the 1968 season. BYDV was severe in a few fields in Monroe County but was light in other areas.

Additional selections of Avena sterilis from Israel and other Mediterranean Regions obtained from Dr. J. C. Craddock, U. S. Department of Agriculture, were tested in 1968 for their reaction to the Champaign-6 and Southern Illinois-1 strains of barley yellow dwarf virus and to some races of crown rust. Some selections had combined resistance to both diseases. The results of the tests may be obtained by writing either to Dr. H. Jedlinski or Dr. L. W. Briggle. (See Mailing List for addresses).

Indiana

F. L. Patterson, R. M. Caldwell, G. E. Shaner, J. J. Roberts, R. E. Finney, R. D. Barnett (Breeding, Pathology, and Genetics), Kelly Day and O. W. Luetkemeier (Variety Testing), and W. D. Reiss and B. J. Hankins (Extension)

The 1968 Season

The 1968 season was an excellent one for evaluating the upper yield potential for lines and varieties. A favorable emergence and establishment period in April was followed by an extended cool wet period in May and early June. Conditions were generally favorable for heading and ripening with mostly fair weather and no moisture stress.

A record mean yield of 150 bu./A for 209 lines in the advanced rod-row nursery was set for Lafayette. Yields ranged from 124 to 175 bu/A. Yields were not closely related to maturity. Performances of some varieties were:

Variety	Headed June	Yield bu/A	Test weight
Jaycee	8	149	37.5
Clinford	9	160	38.4
Diana	10	143	34.9
Minn. C.E. 8304	10	167	32.8
Tippecanoe	10	138	35.0
Kota	11	163	31.8
Newton	11	143	35.4
Orbit	11	173	32.8
Stormont	11	153	34.6
Tyler	11	161	33.4
Clintland 64	12	146	34.0
Garland	12	138	31.6
Holden	12	150	31.8
Coachman	13	156	36.2
Portal	13	153	34.2
Kelsey	14	157	31.0
AuSable	17	154	33.0
Lodi	18	146	32.8

Acreage Changes

The oat crop of 377,000 acres in 1968 was an increase of 26 percent over 1967 but was 13 percent below the 1962-63 average. The average state yield was 62 bu/A compared with 48 bu/A in 1967.

Research

Both field and laboratory studies were conducted on the nature of slow-rusting and tolerance mechanisms of oats to Puccinia coronata. A settling tower was designed to provide uniform inoculation of mature leaves (Phytopathology 58:530-531. 1968).

Iowa

K. J. Frey

During the past 12 years we have created several bulk oat populations for use in basic and applied plant breeding studies. Several of these that may have value for variety selection (as follows) are being offered to any oat breeder who wishes to request seed (maximum allotment is 5#):

1. B422 - A composite of 4# of F_2 seed from 12 three-way crosses among lodging resistant exotic and Corn Belt varieties, that was irradiated with TN (dose = 2.21×10^{13}) before 1966 planting. In 1967, 4# of seed was again irradiated with TN (dose = 2.94×10^{13}) and used in alternate rows with a mixture of Multiline E68 and Multiline M68. From these conditions, outcrossing between rows is usually 5%. Female rows (i.e., B422) was threshed in bulk.

   Parents used in the 3-way crosses were: C.I. 7970, Goodfield, Tippecanoe, C.I. 7555 (Corn Belt adapted lines), T.F. 1012, Tex. 57C 1430, C.I. 5545, Tex. 56C 2233, Napped Argent, 13-11, A465, 50-250 (relatively unadapted lines with lodging resistance).

2. B421 - A composite of 4# of F_2 oat seed (10 gms from each of 160 crosses) from 2-way crosses put together in 1959. Each cross was made with at least one lodging resistant parent selected by Frey, et al (Agron. Jour. 50: 609-611. 1958). From 1959 through 1967 the successive generations of this composite were planted (5 bushels per acre) in the Iowa Crown Rust Nursery where artificial epiphytotics were created. After each harvest the seed was winnowed to rid the composite of light seed which would be produced on susceptible plants. Races of crown rust used to create the epiphytotics were current and the degree of damage varied from season to season.

3. B420 - A composite with identical treatment to B421 except that it originated in 1957 by mixing F_2 seed of 250 oat crosses. It was carried through F_{12} in 1967.

4. B375 - A composite of F_2 oat seeds (10 gms from each of 160 crosses) from 2-way crosses put together in 1959. (A lodging resistant composite). In 1959, 1960 and 1961 the composite (4#) was irradiated with x-rays (15,000 r in 1959) or TN (1960 and 1961) and in the latter 2 years significant quantities of new F_2 seeds from additional crosses (usually these added crosses brought in new disease resistant genes) were added. In 1962 and 1963 the composite was irradiated with TN and planted in alternate rows with the original 1959 composite which had been advanced without irradiation or seed addition. Outcrossing into the TN treated rows is expected to be 5%. The treated rows were harvested and bulk threshed. From 1964-1967 the composite was grown (½ acre each year) to permit segregation.

5. B399- A composite of F_3 seed from 36 two-way crosses between Corn Belt and exotic lodging resistant varieties. Composite has been grown in successive generations (½ acre per year) from 1964 through 1967.

Kansas

E. G. Heyne, E. D. Hansing, and J. F. Schafer

Oat production in Kansas may be at a stable level. 1968 was the first year for a number of years when there was no acreage reduction. There were 180,000 acres harvested for a total yield of 6,840,000 bu. This was an estimated 38 bu/A or the second highest yield per acre since records have been kept.

Oat breeding and research in Kansas has been reduced to a testing program, primarily of the early oat types and the winter oat uniform nurseries. Bulk crosses involving Avena sterilis x spring types are being grown as well as several winter oat bulks.

Pettis (C.I. 7805) oats has been recommended for Kansas. It is superior to Mo. 0-205 in several characters and has the best yield record in Kansas tests in comparison with named varieties.

Two experimental lines, C.I. 7674, Bond/Rainbow//Hijara/Joanette/3/Landhafer/4/3*Andrew and C.I. 7698, Improved Garry/5/Landhafer/3/Mindo//Hijara/Joanette/4/Andrew have given the highest yields in experimental plots. Several bushels of seed of each were produced in 1968. No action as to what may be done with these varieties has been made.

No damaging disease problems were present in 1968. Some crown rust and stem rust were observed late in the season. Methyl mercurial fungicides effectively controlled oat smut in 1968 experiments. Equally effective (or better) control was obtained with the systemic fungicides, Benlate and Vitavax.

Michigan

J. E. Grafius, A. H. Ellingboe and David H. Smith

The Michigan oat crop was good in 1968 except for isolated areas where storms caused severe damage. Foliar diseases caused very little damage.

We have been doing some thinking along the lines of optimum shape for varieties. In geometric terms this means the shape of the yield parallelpiped. Apparently there is such an optimum shape for a given environment. Oat varieties with many seed/heads (Y) are best adapted to East Lansing and, if X = heads per unit area and Z = average kernel weight, varieties of a high ratio of XY/Z are best suited to East Lansing. These observations make sense when one considers the timing of the impact of stresses in the development of the crop. A Corn Belt environment would be expected to have a different optimum shape. We have observed that while we may find low yielding varieties with optimum shapes we do not find high yielding varieties with suboptimum shapes.

As yet no real resistance to the Cereal Leaf Beetle has been found in oats. The beetle continues to spread but a vigorous three-pronged research attack in the areas of chemical control, biological control and host resistance will pay off. The entomologists have found systemic seed treatments which show promise of at least partial control.

Minnesota

D. D. Stuthman, O. D. Smith, M. B. Moore, P. C. Rothman and D. M. Stewart

The recommended varieties for 1969 are Garland, Portal and Lodi. About 3 million acres were harvested in Minnesota in 1968, producing a record yield of 60 bushels per acre.

Distribution of C.I. 8304

Small amounts of C.I. 8304 (Landhafer 3X Mindo 2X Hijara X Joanette $4X^2$ Andrew 5X Rodney) have been distributed to North Central Region states for increase purposes. C.I. 8304 is a high yielding white seeded line similar to Garland in maturity. It ranked first overall in the 1967 Midseason and 1968 Early Regional nurseries and fifth in 1968 Midseason nursery. It has above average straw strength and about the same height as Garland. Test weight has been down but the groat percentage has been above average. C.I. 8304 is resistant to smut, has genes A, B, and D for stem rust resistance and has a small amount of resistance to crown rust in the Minnesota Buckthorn plot.

The Adult Type Resistance of C.I. 3034

The usefulness of C.I. 3034 as an adult plant form of stem rust resistance to the new virulent races has been questioned. An apparent association of resistance in C.I. 3034 with its undesirable light green color and weak straw has been mentioned as a limiting factor in the exploitation of this moderate level of adult plant resistance. Data from the screening of

the F_2 generation of the second backcross progeny of Tippecanoe by C. I. 3034 (3 Tippecanoe / C.I. 3034) with the St. Paul isolate of race 6AFH show that such relationships can be broken (see following table). Both light green and normal green plants of both resistant and susceptible types were found. Panicle type and straw strength of resistant types approached that of the Tippecanoe parent.

Classification of adult F_2 plants from the cross 3 Tippecanoe/C.I. 3034 and the parents, inoculated with race 6AFH in the greenhouse at St. Paul.

Adult progeny	Rust reaction class					
	0[a]		Susceptible		Resistant	
	Plant color		Plant color		Plant color	
	Lt. Gr.	Nor. Gr.	Lt. Gr.	Nor. Gr.	Lt. Gr.	Nor. Gr.
3 Tp/C.I. 3034	7	23	24	118	4	7
Tippecanoe	0	3	0	26	0	0
C.I. 3034	0	0	0	0	15	0

[a]This class includes all plants without visible symptoms of stem rust.

Missouri

J. M. Poehlman, George Berger, Shu-Ten Tseng, Wayne Crook, Ronald C. Thomason (Columbia) and Leo Duclos (Portageville)

The spring oat variety Pettis was added to the 1969 recommended variety list for Missouri. Pettis originated from crosses involving the varieties Victoria, Hajira, Banner, Victory, Ajax, and Mo. 0-205. Pettis is an early maturing variety selected for its high yield, test weight, and good resistance to barley yellow dwarf virus disease. It is highly resistant to smut and races 2, 5, 7, 7A, and 8 of stem rust, but susceptible to the newer races of stem rust and to crown rust.

Another promising spring oat line which is being increased in 1969 is 04978. Spring oat 04978 is a selection from the variety Nodaway. 04978 yields well, has very good standing ability, and moderately good test weight. It has fair resistance to barley yellow dwarf virus, but is susceptible to crown rust.

The approach method of crossing was utilized in many oat hybridizations during 1968 in Missouri. A survey to determine the effectiveness of the method was conducted in the greenhouse at Mt. Vernon. In spring oats, 11 varieties were chosen to make 10 different crosses. A total of 3,257 florets were emasculated and an average seed set of 28.7% was obtained. The range for the 10 crosses was 14.6 to 54.7%. In the winter oat crosses, 11 varieties were chosen to make 14 different crosses. A total of 5,215 florets were emasculated and an average of 23.0% seed set was obtained. The range for the 14 crosses was 9.6 to 34.8%.

New York

N. F. Jensen, Ithaca

Varieties, production and acreage

Indications are that Orbit acreage now exceeds that of Garry. An estimated 420,000 acres were grown in 1968. It was a good crop year with state average yields at a new high of 59 bushels per acre.

Plans are to enter 4 new selections in the 1969 USDA Midseason Nurseries. These are too new to make any projections for the future; the 1969 results should help greatly in evaluating these selections.

Breeding for crown rust resistance

A program to breed for general and specific resistance to crown rust was begun in 1967. The primary emphasis is to strengthen the general type of resistance. The program, conducted at the Aurora, N.Y. farm, utilizes composites formed from various world germplasm sources and takes advantage of the extensive alternate host hedges bordering certain fields. Crown rust is prevalent and severe every year. The harvested seed is subjected to processing designed to eliminate all but the heaviest, plumpest, etc. seeds on the assumption that such seeds would come from plants having either general or specific types of resistance. No individual selection is intended for several years.

Emphasis

Currently on short, stiff types; capacity for maximum yields; improved nutritional quality.

North Dakota

David C. Ebeltoft, Fargo

The oat acreage in 1968 again went past the 2,000,000 mark, though one-half of this acreage is grown in seven southeastern counties. The state average this year was 49 bu/A.

Farmers in the Red River Valley are giving more attention to oat production with the result that 100-120 bu/A is commonplace. One 30-acre field of Sioux near Fargo averaged 147 bu/A.

Ohio

Dale A. Ray, Columbus

1968 Production

The remarkable recovery in Ohio oat production with an increase of 85% in 1968 over the figure for the previous year was accomplished with a 40% increase in acreage and a record high 66.0 bu/A state average yield. The

weather conditions were excellent for early seeding and favorable temperature and good distribution of rainfall prevailed through the growing season.

At the end of the harvest season, rain with wind did cause some lodging and reduced yield and quality. The oat crop in Ohio generally was good. Some cereal leaf beetle damage occurred at about oat heading and may have affected yield. Oat diseases were light and not a serious factor.

Oat Varieties

Brave, Clintford, Clintland 60, Garland, Goodfield and Jaycee varieties currently are recommended in Ohio. Clintford and Clintland 60 were the most widely grown varieties and occupied over 72% of the seed production acreage. In addition to the currently recommended varieties, Orbit and Holden produced outstanding yields in the state-wide oat yield trial.

Oat Breeding Studies

Several advanced-generation lines from Clintland 60 x Rodney 2x Putnam 61 were promising for yield and straw strength in rod-row yield nurseries at two locations. These materials will be entered in a more extensive testing program next year. Bulked early-generation material of Avena sterilis x common variety crosses supplied by Dr. H. C. Murphy was utilized by Jack Hoffman, a M.S. graduate student, in a study on protein composition. Individual segregating plants were collected for further study. Following very low survival in winter oat nurseries, plants and segregating lines with good survival were collected for increase and further study in nursery yield tests. Growers have interest in winter oats; however, available varieties are not acceptable with any certainty of survival.

Oklahoma

L. H. Edwards, H. C. Young, Jr., E. L. Smith, E. A. Wood, Jr., and H. Pass

Production

Oklahoma oat production increased to 4.5 million bushels in 1968 compared to the low of 3.4 million bushels harvested in 1967. Acreage harvested also increased from 112,000 acres in 1967 to 132,000 acres in 1968. However, both acreage and production for 1968 were well below the 1962-66 averages.

C. I. 8311

We propose to submit data on this Arlington/Wintok selection to our naming and release committee in the near future. C. I. 8311 yielded 70.5 bu/A compared with 63.6 for Bronco, 62.4 for Cimarron, and 59.2 for Forkedeer on an average of 23 tests. The early growth of C.I. 8311 is semi-prostrate to slightly upright and maturity is midseason. C. I. 8311 has good lodging resistance and averaged 31 inches in height in 20 tests. Plants tiller heavily and have large culms with stiff straw. Kernels are awnless, mid-plump, and yellow in color. Winterhardiness of C. I. 8311 appears to be slightly less than Cimarron but better than Nora, a recent Arkansas release.

Greenbug Resistance

We are continuing the work started last year of incorporating greenbug resistance from P.I. 186270 into adapted oat types. P. I. 186270 has shown a high degree of tolerance to strain B ("Tigerbug") of the greenbug. This line has also shown resistance to the sugarcane aphid, Sipha flava (Forbes).

Ora and Nora

These two varieties, which were released by Arkansas in 1964 and 1966, are becoming very popular especially in Eastern Oklahoma. Their performance has been outstanding in almost all of our variety tests.

Disease

Attempts to initiate a crown rust epidemic in the greenhouse were only partially successful. It is extremely difficult to maintain high levels of pustule development under these conditions which permit very rapid growth of the host.

While one year of yield data may not have much real meaning, a crown rust tolerance yield test made in cooperation with Dr. M. E. McDaniels and Dr. I. M. Atkins at College Station, Texas, indicated that certain varieties with as much as 30 to 40 percent severity at late flowering stage were equal in yield to a few varieties having 5 percent severity or less. Certain varieties in the test appeared to have a "late rusting" characteristic. Those varieties had 5 percent severity, or less, at late flowering but developed over 75 percent severity by early ripening stage.

Pennsylvania

H. G. Marshall and F. J. Muehlbauer

Spring Oats

Conditions were generally excellent for oat production during 1968 and record yields were obtained. The acreage was estimated at 477,000 acres which is a 6% increase over 1967. The average yield was estimated to be a record 56 bushels per acre. No serious disease problems occurred, but lodging was a major problem. This latter weakness of oats is one of the major discouraging factors for the farmer. The need for short, lodging-resistant varieties is apparent and deserves major emphasis in oat improvement programs.

Winter Oats

There are no data available for winter oat production in Pennsylvania, but the acreage probably does not exceed 5% of the state total. Most of this acreage is found in the southeastern and southcentral regions of the state where satisfactory winter survival is relatively certain.

Severe winterkilling occurred in the winter oat breeding nurseries at two locations in Pennsylvania, and this should have favored effective natural selection for winter hardiness in the numerous bulk populations in our program. Many of our advanced generation bulk populations have winter hardiness equal to or better than that of the recommended variety Norline, and the prospects for obtaining selections with outstanding winter hardiness are good. However, observations of these populations suggests, in general, that

natural selection for greater winter hardiness has been accompanied by a shift to weak-strawed, undesirable plant types.

Several Pennsylvania lines performed well in local and national tests during 1968. A preliminary seed increase of C.I. 8312: (Craigs Afterlea x C.I. 8126 2x Ballard x Dubois) has been planted since that variety appears to represent significant improvement for both winter hardiness and yield. Its winter survival in national tests has exceeded that of Norline by about 7% over the past 2 years. It also topped the 1968 Uniform Northern Nursery for yield, and exceeded Norline by 14 bushels per acre. C. I. 8312 is similar to Norline for plant height and lodging resistance.

Freezing resistance data from F_2 and F_3 populations from top-crosses which involved varieties of Avena sterilis, A. fatua, and A. byzantina and the two tester parents Wintok and Ballard indicated that freezing resistance per se may be a poor indication of parental value.

Mr. Fred J. Muehlbauer has completed his Ph.D. thesis research concerned with differences between populations from reciprocal oat crosses. He is now on temporary appointment as small grains breeder for the Pennsylvania Station. Dr. Robert Pfeifer is now Associate Professor of International Agronomy. He is currently working with crop production problems in India, and has just returned from an initial trip to that country.

South Carolina

Doyce Graham, Jr., E. B. Eskew, G. C. Kingsland, and J. H. Palmer

Release of SC60-C16 as a forage oat primarily for grazing, hay, and silage purposes has been tentatively approved. This oat has been tested in Uniform Central Area Oat Nursery and has given good grain yields though never being among the top entries. Its main advantages are soil-borne mosaic virus tolerance and tall leafy plants. The oat remains vegetative approximately ten days longer than varieties normally grown. This oat would be intended primarily for Piedmont areas.

Soil-borne mosaic virus is being observed on ultra susceptible varieties such as Ora and Nora in fields previously considered to be free of the virus in the Piedmont area of South Carolina. A study by Kingsland (see publications) with susceptible varieties planted over 4 consecutive seasons and in rotations confirmed decisively that tolerant varieties are necessary for successful oat culture when the virus is present.

Crown rust presence during past growing season was negligible in South Carolina.

South Dakota

R. S. Albrechtsen, Brookings

1968 Season and Production

The 1968 oat crop in South Dakota varied from poor to excellent. Seeding was accomplished on schedule in most areas of the state, with a few exceptions. Temperatures and precipitation were variable but temperatures averaged below normal over the state. Precipitation was generally below normal during May and was extremely limited in the south-central area of the state throughout the entire small grain season, resulting in near crop failure in this area. Some varieties suffered stand reductions from late spring frosts.

The harvested oat acreage increased in South Dakota for the second consecutive year. An estimated 2,451,000 acres were harvested in 1968 compared to 2,357,000 acres in 1967. An average yield of 43.0 bu/A in 1968 was 3.5 bu below that obtained in 1967 but 7.0 bu above the 1962-66 average. Total production in 1968 was estimated at 105,393,000 bu, 4% below the 1967 production but 15% above the previous 5-year average (1962-66).

Stem rust and crown rust became quite heavily established in some areas and did considerable damage to susceptible varieties in these areas.

New Varieties and Seed Increased and Distributed

C.I. 8178 was named "Kota" and was released as a new variety by the South Dakota Agricultural Experiment Station in January, 1969. (See New Varieties Section for a complete description).

In addition to Kota, the South Dakota Foundation Seed Stock Division participated in the increase of Pettis, Multiline M68 and Multiline E68 in 1968. Seed of all of these varieties in being released to County Crop Improvement Associations for registered and certified production in 1969.

Personnel Item

Mr. LeRoy A. Spilde joined the Oat Project in June, 1968 on a graduate research assistantship supported by the Quaker Oats Company. His thesis research will be concerned with the high protein *Avena sterilis* materials. He will be working toward the M. S. degree.

Texas

I. M. Atkins, M. E. McDaniel, Neal A. Tuleen, Bobby R. Hathcock, Francis Gough (USDA), and Robert W. Toler, College Station; K. B. Porter, Bushland; J. H. Gardenhire, Denton; K. A. Lahr, Chillicothe; M. J. Norris, McGregor; Lucas Reyes, Beeville; and J. P. Craigmile, Beaumont.

The seeded acreage of oats for the 1968 crop was estimated at 2,074,500 acres. Of this, only 614,000 acres were harvested for grain. This acreage averaged 34.0 bushels per acre, one of the highest on record, for total production of 20,876,000 bushels. Continued increase in use of the oat crop exclusively for forage emphasizes the need for major emphasis in the breeding program on adaptation for winter grazing purposes.

An unofficial survey of oat varieties grown in Texas was made by means of County Agent estimates. This survey indicates that Ora, Moregrain, New Nortex, Alamo-X and Suregrain occupy 28.1, 20.2, 18.8, 8.6 and 6.9 percent, respectively, of the Texas acreage. Sixteen other varieties were reported on less extensive acreages, with Bronco, Mustang, and Cimarron occupying important acreages in the areas where winterhardiness is essential.

Yields in performance trials at 8 locations were good. Fall-sown, irrigated oats at Bushland yielded from 85 to 178 bushels per acre, the highest experimental yields ever recorded in Texas to our knowledge. Coronado oats performed well the first season of commercial production and it is planned to release also the sister strain 64C4194-2 (Atkins).

Denton (Gardenhire)

Races of crown rust identified from Denton in 1968 were 325, 327, and 264B.

A number of large-seeded strains have been developed that have good tolerance to the greenbug.

Below are given the yield of forage from three clipping frequencies.

Variety	Clippin Frequency		
	Dec. 1-Jan. 1-Feb. 27	Jan. 1-Feb. 27	Feb. 27
	Pounds air dry forage		
New Nortex	3149	3401	3013
Ora	2246	2382	2234
Bronco	2407	2565	2697
Norwin	2631	3095	2738
Alamo-X	2691	2978	3191
Moregrain	3045	3223	2854
Nora	2165	2506	2411
Average	2619	2878	2734

College Station (McDaniel and Hathcock)

Texas Selection 64C4194-2 from the cross (Santa Fe X^2 Clinton 3x Sac 2x Hajira x Joanette, C.I. 6671) 4x New Nortex x Landhafer 5x Black Mesdag x Ab101 (?), C.I. 7650) is being increased for release as the variety Cortez. The variety is similar to the sister strain Coronado, but is about 4 days earlier in maturity. Straw strength is equal or superior to that of any known variety adapted to the Southern Winter Oat area. The grain is large and plump, with good test weight.

A new crown rust race complex was very damaging in portions of South Texas last year. Previously resistant varieties such as Coronado were seriously damaged in some areas. Ora and Nora were killed at a few locations. Florida 500 exhibited a moderately resistant reaction. However, it was appreciably damaged as much leaf area was affected, though pustules were small. It appears that a more aggressive form of race 264 (identified as 264-B) and race 327 were most damaging.

A study of the inheritance of crown rust resistance in 6 strains of Avena sterilis has been completed. At least 3 independently inherited genes conditioning leaf rust reaction and genes conditioning the morphological traits of awning, lemma pubescence, grain color, and type of spikelet separation. It appears that transfer of any of these genes to cultivated types should be relatively easy. Several methods of breaking dormancy of A. sterilis were studied. The most satisfactory method appeared to be germination of seed in a refrigerator at 3°F. for 7-10 days.

A study of the effect of stigma mutilation on oat seed set revealed that minor stigma damage as might occur accidently during evasculation has little effect on seed set under good greenhouse conditions.

Heterosis for straw weight, plant height, grain yield and yield components was determined for seven Avena spp. crosses. Five replications of the parents, F_1's and F_2's of each cross were grown at two locations. Plots consisted of 30 plants of an entry in a single row 1.42m long with a between-row spacing of 30.5cm. Grain yield of F_1's was significantly greater than that of the respective better parent in 5 of 7 crosses at Temple and 4 crosses at McGregor. High parent heterosis ranged from 0 to 130%. Three F_1's at Temple yielded significantly more grain than the best pure line in this test. At McGregor 2 of the same 3 F_1's showed significant yield increases over the best pure line in that test. Comparison of the mean of all F_1's and high parents revealed the mean of F_1's to be significantly higher at both locations.

In the two crosses at Temple exhibiting the most pronounced F_1 heterosis, grain yields of the F_2's were also significantly greater than those of the better parent. Loss of heterosis in F_2's due to inbreeding depression was 55 and 68% for McGregor and Temple, respectively.

These results indicate that appreciable yield heterosis may be quite common among oat crosses.

Washington

C. F. Konzak and K. J. Morrison

Oat acreage in Washington State increased in 1968 to 50,000 acres compared to 37,000 acres in 1967. The average for 1962-1966 was 73,000 acres. The yield/acre has decreased from 53.2 bu/acre for the five year average to 45 bu for 1967 and 46 bu for 1968. The lower yields the last two years probably indicate the below average rainfall in Washington. In spite of this lower over-all average oat yield, new varieties have given increases over old. This increased yield probably is responsible for the recent increase in acreage.

Cayuse was again the top yielder. Only in Western Washington the later variety Au Sable yielded slightly more. In some dry land locations, Cayuse outyielded Park by nearly 50%. Pettis performed poorly in the Pullman trials, whereas C.I. 2874 was again in second rank. Yellow dwarf infestation was light but notable in most nurseries and in most varieties. No disease other than yellow dwarf was evident.

Spraying for weed control using the chemical Bromoxynil at 3/8 lb/A successfully controlled weeds and was a tremendous help. Unlike 2,4D, the effect of the chemical on the oats was very short-lived, even though a few varieties showed what appeared to be a striking sensitivity. The variety Cayuse was injured most by the weed control spray in our tests but was still the highest yielding variety.

Intercrosses of the oat smut differential varieties is almost complete. F_1 plants of most crosses were grown in 1968. We would like to know of others wishing seed of the F_3 lines for genetic studies so we can plan to grow a sufficient quantity of stock in 1970. Also, we are willing to share F_2 seed of the cross Cayuse x C.I. 2874. The cross was made to combine the yellow dwarf tolerance of the two varieties which also have been top yielders in the Northwestern Regional Oat trials.

Wisconsin

H. L. Shands and R. A. Forsberg

Wisconsin State Oat Yields and Variety Performance

The 1968 season was very good for production of small grains. The planting season was early but was interrupted by rains causing delays in some areas of Wisconsin. Moisture was limited in May but adequate in other months. With this good growing season, oats averaged near 61 bu/A for the entire state, according to the State Crop Reporting Service. This equals the highest average yields on record.

Storms in mid-July caused severe lodging in some areas of southern and eastern Wisconsin. Lodging and leaf rust infection caused lower bushel weight and lower yields in certain areas. Oats in other areas of Wisconsin had good grain quality.

Exact information concerning acreages sown to the different varieties is not available. Lodi and Beedee continue to be the most popular varieties. Acreages of Ajax, Dodge, Sauk, and Goodfield continue to decline.

Portal and Holden, two recent varieties, are increasing in acreage. These varieties were first released for certified seed production in early 1967. Their performance is very close to the predicted in that Holden outyields Garland about 5 bushels per acre. Yields of Garland and Holden were depressed by crown rust in the Madison area in 1968. Portal went ahead of Holden in yield by 1.5 bushels per acre. Portal has benefited by improved crown rust resistance.

Early Generation Results of Improving Oat Groat Protein

In the spring of 1967, H. C. Murphy sent Wisconsin workers seed of A. sativa Garland x A. sterilis (6-76-4-9), A. sterilis (6-76-4-4) x Diana, and Portal x A. sterilis (6-76-4-3) for producing spaced F_2 plants. In the fall of 1967 Roger Smith and H. C. Murphy analyzed groats for protein content and returned residue seeds of higher protein selections to Madison along with similar F_3's from C.I. 7920 x A. sterilis and Fla. 500 x A. sterilis.

Groats from F_3 rows grown at Madison in 1968 were only intermediate in protein content. A few selections of the Fla. 500 x A. sterilis not grown previously at Madison had fairly high protein and crown rust resistance, but had weak straw.

In the spring of 1967 spaced F_2 plants of a few A. sativa varieties crossed with A. sterilis varieties were grown at Madison and were selected for better agronomic type with rust resistance. Groats were analyzed and residue seed lots of those with higher protein were planted in F_3 rows in 1968. Some with lower protein were included also. The correlation between the F_2 protein and that of certain bulk F_3's was +.62 indicating moderate heritability. The range of F_3 protein was from 14.5 to about 20 percent. Garland averaged 16.7 and Lodi 14.7 in the same test in 1968. Garland protein at Aberdeen, Idaho, as verbally reported by H. C. Murphy, is higher than that found at Madison. The following A. sterilis selections obtained from H. C. Murphy and J. C. Craddock--C.I. 8077, P.I. 295932, P.I.295909, P.I. 292561, I-6-224, I-6-328, and 6-76-4 have been used as parents with several A. sativa varieties grown in midwestern states. R. D. Duerst has been active in this work.

Personnel Items

R. D. Duerst became a Specialist in Agronomy by means of gift funds. He is emphasizing the improvement of groat protein. Miss Wang continues in cytogenetics of oats. Roberto Ritter of Rio Grande do Sul is assisting in breeding with an eye on types suitable in southern Brazil. Other small grain graduate students are Paul Lyrene, H. G. Nasr, J. J. Schreck, Paul Sun, and Olav Stolen. D. M. Wesenberg completed the Ph.D. degree and joined the USDA at Aberdeen, Idaho.

V. NEW OAT VARIETIES.

A. Alphabetical List

Name	C.I. No.	Origin	Described on Page
Cortez	7650	Texas	27
Kota	8178	South Dakota	30
Montezuma	8419	California	31
Yancey	8420	North Carolina	32

B. Descriptions

Kota

Kota, C.I. 8178, is a new spring oat variety developed at the South Dakota Agricultural Experiment Station and released in January, 1969. It combines high yield of good quality grain with good disease resistance and a large area of adaptation.

Kota is a selection from the cross Clinton ^{6}x Landhafer 2x RL 2120 3x Garry. RL 2120 is a rust-resistant strain from the cross Victoria 2x

Hajira x Banner 3x Victory x Hajira 4x Roxton. The initial selection from which Kota originated was made by D. D. Harpstead. Final selection and purification were done by R. S. Albrechtsen. Various state and federal agencies participated in the final agronomic and pathologic evaluation of Kota in regional tests coordinated by the USDA.

Kota is a midseason variety, similar to Portal in height, heading date, maturity date, test weight and kernel size. It has moderately good straw strength. Approximately 75% of the kernels are yellow in white light and dark brown under ultra-violet; the remaining 25% are lighter yellow in white light and fluoresce blue-white under ultra-violet. Protein content of the grain is good. Preliminary milling tests suggest Kota to be a suitable milling oat.

Data from the Uniform Midseason Oat Performance Nursery over a 3-year period (1965-67) show Kota to be equal to Holden in crown rust and stem rust resistance. Both are resistant to the prevalent older races but susceptible to some of the new races. Kota is resistant to the oat smuts and has shown some yellow dwarf tolerance.

Kota has given high yields of good quality grain and appears to have a large area of adaptation. It was the second highest yielding strain of 26 entries in the Uniform Midseason Oat Performance Nursery grown at 19 locations in 1967. Clintford was the only strain in these tests that exceeded Kota in test weight in 1967. Kota appears best adapted to eastern South Dakota but has the highest state-wide and regional average yield of the 6 check varieties with which it was compared.

Kota seed was increased and released by the South Dakota Foundation Seed Stock Division to County Crop Improvement Associations and to the South Dakota Seed Trade Association for registered and certified seed production in 1969. Some neighboring states also participated in a simultaneous increase and release of Kota seed.

Montezuma

'Montezuma' (C.I. 8419), a red oat, was released by the University of California Agricultural Experiment Station in 1967. Previously known as CAS 5022, it was selected at Davis from a bulk of A. byzantina crosses with A. fatua L. (California C.C. 11 oat germplasm) in 1965. Grain production of Montezuma in comparison with other varieties has been evaluated.[1/]

Montezuma has the highest test weight of any oat variety recommended for direct combine harvesting in California. A seed size separation based on seed produced at three diverse locations showed 84% of Montezuma seeds retained over a 5/64 x 3/4 inch screen compared to 'Curt', 62%, and

1/ Suneson, C. A., C. O. Qualset, J. D. Prato, J. T. Feather, W. H. Isom. 1969. High Test Weight Featured in Montezuma Oats. California Agriculture, Vol. 23, No. 2.

'Sierra', 78%. Other features include good shatter resistance and a three-year yield record averaging 17% more than Sierra at two locations in north-central California.

Montezuma is a semiwinter to spring-type red oat similar to 'Kanota' in growth characteristics. In California, oats are best adapted to the central and south coast districts but also are grown in the Sacramento and San Joaquin Valleys. Montezuma matures 8 to 15 days earlier than Sierra and is rated slightly earlier than Curt and Kanota. Montezuma may be useful in the drier, hotter interior valleys but will be less desirable than later maturing cultivars for fall planting where late frost is common at flowering. Montezuma's productivity as a forage oat is satisfactory for growers needing an earlier maturing cultivar but one that is similar in forage quality to 'California Red.'

Breeders and Foundation seed stocks are maintained by the Department of Agronomy and Range Science, University of California, Davis.

Yancey

Winter oat, C. I. 8420, tested as N. C. 2534 has been named Yancey and was released in 1968. Yancey was selected from a cross of Carolee x Fulgrain made by W. H. Davis in 1958. Selections were made by C. F. Murphy, G. K. Middleton and T. T. Hebert.

Yancey is a very stiff-strawed variety which has given comparable yields to the high yielding varieties Carolee and Coker 242. It was released primarily for its lodging resistance and adaptability to high fertility conditions. Comparative performance data is presented in the following table.

Four year (1965-1968) varietal performance in N.C. Official Variety Test.

Variety	Piedmont		Coastal Plains		Lodging
	Yield bu/A	Test Wt. lbs/bu	Yield bu/A	Test Wt. lbs/bu	%
Yancey	102.8	34.2	96.5	35.2	21.7
Carolee	105.7	33.0	101.3	34.1	40.2
Coker 242	101.2	35.9	99.8	36.7	30.2

VI. GERM PLASM MAINTENANCE

USDA Small Grains Collection

J. C. Craddock, USDA, Beltsville, Maryland

The emphasis continued to be on the accumulation of specimens of the non-cultivated species of Avena. The discovery of characteristics in A. sterilis that are desirable in cultivated oats has demonstrated the need and

value of having this type of germplasm available to the plant breeders. During 1968, 1,665 seed samples of Avena species were accessioned to the oat collection. Most of these are samples of Avena sterilis collected in the eastern Mediterranean region, especially Israel. The species and number of samples received are as follows: A. sterilis - 1,204; A. barbata - 241; A. sativa - 91; A. hirtula - 26; A. byzantina - 2; and one each of A. abyssinica, brevis, fatua and strigosa.

The Oat Gene Bank is in operation and welcomes both contributions and seed requests. Please keep the gene bank in mind when considering what to do with excess seed from F_1 and F_2 plants. This seed is needed; during the past year the Oat Gene Bank received only 200 grams.

If, during the year you have dropped a variety or selection from your program, please consider contributing it to the collection by submitting a 5-200 gram sample and declaring it open stock.

Cereal Investigation (C.I.) numbers were assigned to 99 varieties and are listed.

C. I. Numbers Assigned in 1968

C.I. number	Name or Designation	Pedigree	Source
8320	D-83-S67-AB-2976	Selection from PI 287208	Beltsville
8321	6-1-S67-AB-2986	Selection from PI 292545	Beltsville
8322	6-5-S67-AB-3022	Selection from PI 292549	Beltsville
8323	6-5-S67-AB-3026	Selection from PI 292549	Beltsville
8324	6-5-S67-AB-3037	Selection from PI 292549	Beltsville
8325	6-5-S67-AB-3042	Selection from PI 292549	Beltsville
8326	6-5-S67-AB-3047	Selection from PI 292549	Beltsville
8327	6-13-S67-AB-3078	Selection from PI 292555	Beltsville
8328	6-27-S67-AB-3086	Selection from PI 292561	Beltsville
8329	6-27-S67-AB-3105	Selection from PI 292561	Beltsville
8330	MAGNA		Morocco
8331	CW 525-S67-AB-3462	Selection from PI 324828	Beltsville
8332	CW 525-S67-AB-3495	Selection from PI 324828	Beltsville
8333	6-28-S67-AB-3142	Selection from PI 292562	Beltsville
8334	6-42-1-S67-AB-3157	Selection from PI 295908	Beltsville
8335	6-42-2-S67-AB-3184	Selection from PI 295909	Beltsville
8336	6-71-2-S67-AB-3228	Selection from PI 295932	Beltsville
8337	6-71-2-S67-AB-3235	Selection from PI 295932	Beltsville
8338	6-145-1-S67-AB-3270	Selection from PI 296274	Beltsville
8339	6-145-4-S67-AB-3286	Selection from PI 296276	Beltsville
8340	6-286-S67-AB-3314	Selection from PI 320780	Beltsville
8341	6-321-S67-AB-3345	Selection from PI 320788	Beltsville
8342	6-339-S67-AB-3379	Selection from PI 320800	Beltsville
8343	6-392-S67-AB-3384	Selection from PI 320823	Beltsville
8344	6-434-S67-AB-3416	Selection from PI 320846	Beltsville

C.I. number	Name or Designation	Pedigree	Source
8345	Multiline E68	Mechanical mixture of 8 isogenic lines using C.I. 7970 as recurrent parent	Iowa
8346	Multiline M68	Mechanical mixture of 8 isogenic lines using C.I. 7555 as recurrent parent	Iowa
8347	ETA	Selection from Eaton, C.I.3908	Beltsville
8348	MOSTYN	05443 x Condor	Wales
8349			Ethiopia
8350			Ethiopia
8351	SC 60-C16	Wtk 2x Ctn ^{2}x SF 3x Lee x Vtra 2x Fwn 4x Ctn ^{2}x SF	S.Carolina
8352	Ky 64-10090	C.I. 7162-3 x Ballard	Kentucky
8353	Fla 65Q801-2	Tif 9079 3x Vg 2x Coker 52-22 x CI 6671 4x KML 48 5x PI 174544	Florida
8354	Fla 65Q1800-1	Florad x Coker 58-7	Florida
8355	Fla 65Q2248-49	Frl x 61AB436 3x Sg x M2R 4735 2x Bhm x PI 174544	Florida
8356	Fla. 65Q1016	Florad x Coker 58-7	Florida
8357	Fla 65Q1896-7	Sg x 58AB284 3x CI 7172 2x 0-200-10 x Sld	Florida
8358	Fla 65Q2092-93	Florad x Coker 58-7	Florida
8359	Fla 65Q2096-97	Florad x Coker 58-7	Florida
8360	Minn 66-B998-505	LMHJA x Cld 2x Rdy 3x BM x Ab 101	Minnesota
8361	Minn 66-B1411-1442	LMHJA ^{3}x Rxt x RL 1276 2x Aj x RL 1276 4x BM x Ab 101	Minnesota
8362	Minn 66-B1430-1442	LMHJA ^{3}x Rxt x RL 1276 2x Aj x RL 1276 4x BM x Ab101	Minnesota
8363	Minn 67-B986-989	Minhafer x PI 267989	Minnesota
8364	Minn 67-B1641-1646	II-53-81 x Ab5044	Minnesota
8365	Minn 67-Ob.273	LMHJA 3x Rxt x RL 1276 2x Aj x RL 1276 4x BM x AB 101	Minnesota
8366	Minn. 670B.276	Ab5025 x II-53-81	Minnesota
8367	Minn. 68Ag.4112, Sel 823	Gld x PI 267989	Minnesota
8368	Minn. 680b.8012	LMHJA x Ctn 2x Rdy 3x BM x Ab 101	Minnesota
8369	Minn. 680b.8038	LMHJA x And 2x Rdy 3x BM x Ab 101	Minnesota
8370	Belts 66AB460		Beltsville
8371	Belts 66AB495		Beltsville
8372	Belts 66AB749		Beltsville
8373	Belts D137-GH68-774	Selection from PI 287226	Beltsville
8374	Belts 6-153-S67 AB2708-9	Selection from PI 320747	Beltsville
8375	Belts 66AB765		Beltsville
8376	Belts 66AB1023		Beltsville
8377	Belts 66AB1076		Beltsville

C.I. Number	Name or Designation	Pedigree	Source
8378	Belts D109-S67-AB2482-3	Selection from PI 287217	Beltsville
8379	Belts D25-GH68-769	Selection from PI 282738	Beltsville
8380	Belts D38-S67AB-2433-4	Selection from PI 282744	Beltsville
8381	Belts 6-174-S67-AB2716-7	Selection from PI 320738	Beltsville
8382	Belts D128-S67-AB2492-3	Selection from PI 287222	Beltsville
8383	Belts 6-184-GH 68-802	Selection from PI 320750	Beltsville
8384	Belts 6-6-S67-AB2565-6	Selection from PI 292550	Beltsville
8385	Belts 6-212-GH 68-804	Selection from PI 320752	Beltsville
8386	Belts 6-160-GH68-952	Selection from PI 320753	Beltsville
8387	Belts 6-53-GH68-778	Selection from PI 295919	Beltsville
8388	Belts 6-64-S67-AB2525-6	Selection from PI 295927	Beltsville
8389	Belts 6-71-S67-AB2527-8	Selection from PI 295930	Beltsville
8390	Belts 6-81-S67-AB2539,2541	Selection from PI 296233	Beltsville
8391	Belts 6-82-GH68-1099	Selection from PI 296234	Beltsville
8392	Belts 6-89-S67-AB2542-3	Selection from PI 296236	Beltsville
8393	Belts 6-107-GH68-1094	Selection from PI 296244	Beltsville
8394	Belts 6-93-5-GH68-783	Selection from PI 296262	Beltsville
8395	Belts 6-101-5-GH68-786	Selection from PI 296264	Beltsville
8396	Belts 6-105-5-GH68-788	Selection from PI 296266	Beltsville
8397	Belts 6-110-2-S67-AB2209-2210	Selection from PI 296270	Beltsville
8398	Belts 6-115-2-GH68-794	Selection from PI 296272	Beltsville
8399	Belts 6-783-GH68-820	PI 298209	Israel
8400	Belts 6-785-GH68-821	PI 298211	Israel
8401	Belts D40-31-GH68-946	PI 311534	Israel
8402	Belts 6-76-4-9-GH68-890	PI 311567	Israel
8403	Belts 6-174-5-2-GH68-799	PI 311652	Israel
8404	Belts 6-1753-1-GH68-846	PI 318243	Israel
8405	Belts 6-188-GH68-803	Selection from PI 320757	Beltsville
8406	Belts 6-222-GH68-956	Selection from PI 320760	Beltsville
8407	Belts 6-272-S67-AB2769-2770	Selection from PI 320770	Beltsville
8408	Belts 6-290-GH68-1110	Selection from PI 320781	Beltsville
8409	Belts 6-296-GH68-809	Selection from PI 320782	Beltsville
8410	Belts 6-281-S67-AB2779, 2781	Selection from PI 320792	Beltsville
8411	Belts 6-298-GH68-810	Selection from PI 320793	Beltsville
8412	Belts 6-328-GH68-813	Selection from PI 320797	Beltsville
8413	Belts 6-358-GH68-1123	Selection from PI 320827	Beltsville
8414	Belts 6-395-GH68-1118	Selection from PI 320833	Beltsville
8415	Belts 6-423-GH68-1101	Selection from PI 320839	Beltsville
8416	Belts 6-473-S67-AB2942-3	Selection from PI 320859	Beltsville
8417	CHIBINO No. 2		Canada
8418		RR x Vtra 3x Fwn 2x Lee x Vtra (sel 3826) 4x Bd x Rb 2x Hj x Jt 3x Lh	Texas

VII. EQUIPMENT AND TECHNIQUES

Use of VHO Cool-White Fluorescent Lights in Greenhouse

D. D. Stuthman, O. D. Smith, M. B. Moore, P. C. Rothman and D. M. Stewart

Oat workers in the Upper Midwest have experienced considerable difficulty growing plants in the greenhouse during the fall and winter. The plants were abnormally tall and spindly and seed set (probably because of poor pollen) was very low. Supplementing natural radiation with incandescent bulbs did not seem to correct the situation. Minnesota oat workers, as well as several others, had essentially given up trying to grow crossing blocks during this time of the year. Differential varietal sensitivity had been noted but crossing results were such as to be classified as a waste of time.

In the winter and again in the fall of 1968 we used cool-white VHO fluorescent lights (14 hours total daylength) which are shaded on the upper 135° of the tubes for supplemental light. We also attempted to keep the temperature in the greenhouse below 70°F. Under these conditions near normal plants were produced and crossing was accomplished in both winter and fall without difficulty.

We have now planted the F_1 seed produced this last fall in the greenhouse, rather than having to wait until this summer to grow the F_1 plants.

Methods and Materials for Protein Analysis of Oat Groats

R. T. Smith and J. R. Scott, Crops Research Division, ARS, USDA

Five gram oat samples are dehulled by a modified laboratory scale Quaker Oats impact dehuller. In order to dehull small kernels, the funnel-shaped intake container should be cut off 1.5 to 2 inches above the threaded area. This will leave a 3- to 4-inch diameter to accommodate a plastic coffee can lid. Seed breakage is reduced and more effective groat-chaff passage is achieved if the plastic lid is placed over the intake immediately after the sample has been poured in. All nuts and bolts inside the dehuller should be "smoothed over" with a commercial auto-body filler, and the motor assembly covered by a conical shield. This will reduce breakage and prevent seeds from accumulating on flat surfaces. A strong jet of air is passed through the intake from a blower-vacuum cleaner between samples to insure that all kernels have passed through the dehuller. The groats and chaff are routed directly into a small Vogel cleaner. Approximately 30% of the sample is lost in dehulling and cleaning. If the moisture level is abnormally low, (below 10%) more groats are broken in the dehulling process.

The Quaker Oats dehuller can only be used for non-hairy, plump Avena species. Species such as the A. sterilis, A. fatua, A. barbata, and related intra-interspecific hybrids can be dehulled by passing the kernels through a small Vogel head thresher several times at above moderate speeds. Minimal

groat breakage occurs when the "teeth" of the thresher are covered with rubber or plastic tubing.

The Udy dye binding method and modified Udy apparatus are used to test for protein content. Four hundred and eighty milligram samples of whole, primary groats are placed in a Udy reaction tube with 40 ml of reaction dye. The reaction tubes are placed in tightly fitting capsules on a shaker assembly and shaken for 3 minutes. Using two shakers with two reaction tubes each, 300 samples can be processed per 8 hour day. After reaction, the dye-sample solution is adjusted to 25°C in a water bath. The filtered solution is then passed through a Udy color analyzer (colorimeter) to measure percent of protein.

Using the above methods and utilizing 100 man hours, 1,000 samples can be analyzed per 40-hour work week at an overall labor and supply cost of 35 cents per sample.

Complementary Experience with a Dehulling Apparatus

Lars Eskilsson, Sweden

In Oat Newsletter, Vol. 18, 1967 p. 33, Per-Johan Persson reports about "Determination of the content of pure kernels in oats by using a dehulling apparatus." Such a machine was used at the Swedish Seed Association in Svalöf in 1968 for pure kernel determination in samples from the oats trials.

We had samples of 50 g each and an air pressure of 5-6 kgs was used. When oats matured normally, the dehulling was quick and one minute was enough for complete dehulling. Green kernels and not fully developed kernels had to be treated a somewhat longer time. In no case, however, we had to dehull more than two minutes. With two persons working at the apparatus, a normal day routine was 150 dehulled samples.

On uniformly cleaned material the agreement between parallel estimations was very good. We think this dehulling apparatus in most cases works safer than dehulling by hand and is able to catch in small differences between samples. We have also compared hand-dehulling and apparatus-dehulling on oats material from quality investigation in Sweden in 1968. The pure kernel content varied between 60 and 77%. The values of estimations of kernel content agreed very well and we got a coefficient, $r = 0.94^{xxx}$, for the correlation hand-machine dehulling.

Work on quality problems in oats is getting more and more necessary in Sweden. For breeders' purposes, this dehulling apparatus is very helpful.

A Micro Cleaning and Polishing Machine for Small Samples of Oats and Barleys

D. W. Speed, Scotland

We found that the grain used with the Automatic Self-Propelled Seed Drill for Cereal Plots (D. Cameron, J. B. Milner and J. Carruthers (1967) J. of Agric. Eng. Res., 12 (2), 142-146) had to be well polished with no tails or awns and free from dust.

Two machines, differing only in size, have been developed to do this; the smaller is used for samples of up to 300 gm and the larger for those of 500-2,500 gm/filling. The time of treatment, for average grain, is 30-40 seconds.

Both consist of an 8-inch length of thick-walled steel pipe mounted vertically. The smaller has a diameter of 4½ inches and the larger 9 inches. The top of this cylinder is closed by a metal disc having provision for the addition of grain, for dust extraction and for a beater, which is driven at 900-2,000 rpm. The base is closed by a hinged plate which is dropped open to discharge.

A Short-Cut Useful to Oat Agronomists

Franklin A. Coffman, Collaborator USDA

Few present day Agronomists are aware of some of the many contributions made by J. B. Norton, a Kansas State graduate and the first man placed in charge of oats in the USDA. This writer was acquainted with Norton's father and family in Manhatten, but did not meet J. B. Norton until the late 1920's when he was connected with the Coker's Pedigreed Seed Company at Hartsville, South Carolina. He was then past 50, still active and very alert.

One of Norton's contributions it seems was the "rod-row" method for testing cereal crops. Doubtless, what prompted that idea was the laborious task of converting yields per small unit areas into bushels per acre. Today's cereal agronomists are well aware of the basics of the methods apparently outlined by Norton and the availability of electric machines makes calculations so easy they can little appreciate the problems of agronomists of that early pencil and paper era when rod-row techniques were just then becoming accepted.

Some 10 years ago we devised a short-cut method for calculating straw, forage and/or silage yields from 15-foot rod-rows of oats into tons per acre. With increased interest in such, this might well be of interest to some agronomists, although of scant value as compared with Norton's contribution noted above.

The steps are as follows:

1. Determine yield in pounds and decimal fractions for a 15-foot row. (If scale used is graduated in tenths of pounds -- fine. If not, convert 1/4 lb. to 0.25; 1/2 lb. to 0.50, etc., and if in ounces multiply number of such by 6.25).
2. Multiply yield in pounds and fractions by the constant 2904 (Based on area of acre).
3. Divide by 2000 (lbs. per ton) which gives tons per acre plus decimals for fractions of tons.

A second and still shorter method which is almost as accurate is to multiply yield in pounds; plus decimal fractions per 15-ft. row by the constant 1.45 to get tons per acre.

Present day agronomists with calculators at hand can quickly calculate constants for use in determining yields in tons plus decimals of straw, forage or silage for other cereals as well as forages.

A Tractor-Mounted Sprayer and Seeder for Experimental Plots from South Carolina

A sprayer suitable for application of 2-4D on plots was developed and mounted on Allis Chalmers Model G tractor. A Hypro, Inc. pump was mounted on Briggs and Stratton gasoline motor to move material. Spray material is carried in a 25 gallon drum. Our plots are for the most part 14 ft. long with 6 ft. of alley on either end. The tractor is driven down the alleys perpendicular to rows and the spray boom reaches over the plot. In this manner the tractor does not run on the test material.

On the same tractor a seeder was developed utilizing a double disc opener with press wheels manufactured by Chain Machine and a four cone unit obtained from Craftsman Machine Company. Row length is adjustable by Sprocket changes. Marked improvement in seed distribution over hand planting has been observed and labor requirements substantially reduced.

Versatile Planter for Small Grains Experimental Plots or Production Trials

L. H. Edwards, E. L. Smith, and J. S. Ripley

We, at Oklahoma State University, have recently completed a versatile cone planter unit which we use in planting our small grains tests. Information and suggestions on the development of this unit have come from many sources, particularly from research workers at North Dakota State University and Dekalb Agriculture Association.

A table listing basic parts of this planter along with information on our cost for each item appears at the end of this article. All items were purchased in 1968 and were F.O.B. Stillwater. Also, considerable time and effort of our research technician were utilized in the development and construction of this planter.

The Allis Chalmers G tractor is ideal as a carrier for the planter because of its light weight, small size, and rear engine which allows mounting of planter units in front of the tractor driver. The driver can aid in the planting operation, check for mistakes, and engage the planters directly over the row starting point. This becomes particularly important in a continuous planting where the driver does not stop at the end of each row. We lengthened the frame of the Allis G 19 inches in order to accommodate the planter units.

The planter units consist of four cones and four flexiplanters. Each cone was precision made by Chain Machine Company, Haven, Kansas and consists of the components listed in the table. The solenoid trip mechanism may be operated by the tractor driver permitting continuous planting of long rows. However, for short rows the solenoid does not appear to offer advantages over a hand trip mechanism. The cone units may be interchanged with the

regular flexiplanter seed hoppers for planting production trials or seed increase plots. Our cone units were satisfactory for planting wheat; however, modifications are needed for planting oats and barley. The grain track at the base of the cones needs to be made wider by additional machining of the cone. Also, the seed opening in the plexiglass was enlarged for oats and and barley. We found that an application of graphite periodically between the cone base and the plexiglass seed box improved the efficiency of the cone units.

Each flexiplanter unit contains its own drive mechanism and is independent of the other units. A special nine-toothed sprocket is required for row lengths as short as 4½ feet. Maximum row length of 30 feet is obtained with regular sprockets supplied with each unit. Units may be spaced as close as 12 inches on a single tool bar. Other advantages of the flexiplanter units include a short seed drop, versatile planting depths and seeding rates, and excellent planting mechanism.

The hydraulic system was particularly difficult to develop. We are not completely satisfied that we have the best and most economical system. However, we certainly have enough lifting power. The Char-Lynn unit which we chose contains both the pump and control mechanism in one unit. This unit is fairly large (10.5 inches diameter x 11.75 inches long) and mounting presented a problem. We mounted the unit directly above the tractor belt pulley system. The pump is driven from the tractor belt pulley by two V belts. We needed a large pulley on the pump in order to operate the pump at the proper rpm. A pump with an rpm requirement near the rpm output of the tractor belt pulley system would have been better. Any good, lightweight hydraulic cylinder should work well with this hydraulic unit. We chose one with a 3-inch bore, 12-inch stroke, and piston rod diameter of 1 1/8 inches.

We mounted the seed dividers in the center of the tractor and directly above the cone units. Four plastic tubes carry the seed to the seed funnels of the individual planter units. The division of the seed into four equal parts was satisfactory for all small grains. Although we purchased the plastic divider and divider funnels from two companies, we later learned that Chain Machine Company could supply the entire divider mechanism with the planter units. The plastic dividers which we obtained had only 1/4 inch clearance through which the seed passed. This clearance was satisfactory for wheat but too small for oats and barley. The clearance was widened to 1/2 inch and has proven satisfactory for all small grains.

These planter units could have been mounted on a tool bar and used with a 3-point hook-up on any suitable tractor. If a suitable tractor were available, this would eliminate much of the cost of constructing this tractor mounted planter. However, disadvantages would include a more inconvenient and inefficient rear mounting and the timely availability of a suitable tractor.

We feel that this tractor mounted cone planter is excellent for our needs and that our cost was moderate.

Description of components and their cost for building a tractor mounted 4-row cone planter.

Item and Description	Cost
Tractor	
Allis Chalmers Model G (used and reconditioned)	$550.00
Planter units	
4 John Deere Model 71 Flexiplanters with depth bands, covering chains, and special 9-toothed sprocket	629.20
4 Precision Cone Units complete with cone (1/4 inch seed track), Plexiglass seed box, seed drop funnel, solenoid seed release, and mounting mechanism to fit flexiplanter units.	354.00
Hydraulic system	
Char-Lynn Hi-Lo Power Pac (E600) Hydraulic Pump and control in one unit. Control valve for double acting cylinder. Dukes 233-12 double action hydraulic cylinder	147.78
Belts, pulleys, etc.	33.95
Seed divider	
Plastic divider of 1/8 inch clear plastic, side plates 4 inches wide x 9 3/4 inches long, 3 interior plates 4 1/4 inches long attached at 55° angle with verticle side plates and opening at lower end of 1/4 inch.	40.00
Divider funnels made of copper with 4 down spouts for hose connections, to fit above plastic divider	15.00
Rework plastic divider to 1/2 inch opening	6.00
Plastic hose to fit divider funnels	10.00
Mounting	
Labor and supplies to lengthen tractor, build lift mechanism, and mount planter units	120.00
3-deluxe tractor seats	47.85
TOTAL	$1,953.78

Instead of Marking out Plots

T. J. R. O'Sullivan

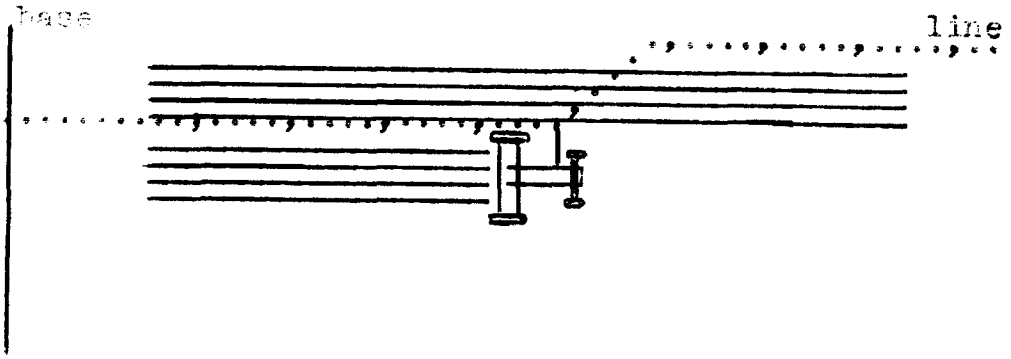
Instead of marking out plots prior to drilling, the following method has been used at Ballinacurra, Ireland, during the past three years and has been found satisfactory, especially when numbers of relatively short plots are drilled on each run.

1. Easily observed marks are attached at plot length intervals along a strong line the length of which is in excess of the drill run. A nylon line somewhat less than pencil thick is suitable.
2. An arm, extending at a right angle, is attached low down to the fore part of the tractor on the side which, as work proceeds, plots have already been sown.
3. A base track (say a wheel track) and first run track are laid down.
4. One end of the line is ground anchored on the base track and the line is laid along beside the first run track. It is not anchored at the other end.
5. To begin drilling the tractor is lined up on the first run track, the line is rested on the arm and the tractor is driven forward until the first mark rests on the arm. The first plot is then sown, the tractor stopping when the next mark passes over the arm, and so on. At the far end the line is dropped off the arm and the tractor returns to base.
6. Before beginning the next run the anchor is moved along the base track a distance approximately equal to the drill width. The line is again rested on the arm and the next run is drilled. The arm, which has an outer vertical spur, will gather the line to itself as drilling proceeds.

In order to avoid errors, the following precautions are necessary:
(a) The arm length must be such that the line is kept out from under the tractor wheels which would cause line creep.
(b) The anchor must be firm.
(c) The marks must be very firmly secured on the line as continued use may shift them.

Drilling may be done in both directions, in which case all of the equipment described is duplicated. It is possible to operate the two lines.

The location of the base track is not critical, as the distance of the plots from it is determined by the length of line from anchor to the first mark and this is readily adjusted in the field.



A Plot Label

T. J. R. O'Sullivan

The following label has been devised and used at Ballinacurra for the past six years.

Materials: Galvanized wire, S.W.G. No. 8 (0.160 inch) and 'Flovic' 031 foil (0.02 inch). 'Flovic', an I.C.I. product, makes a tough, durable, easily inscribed label.

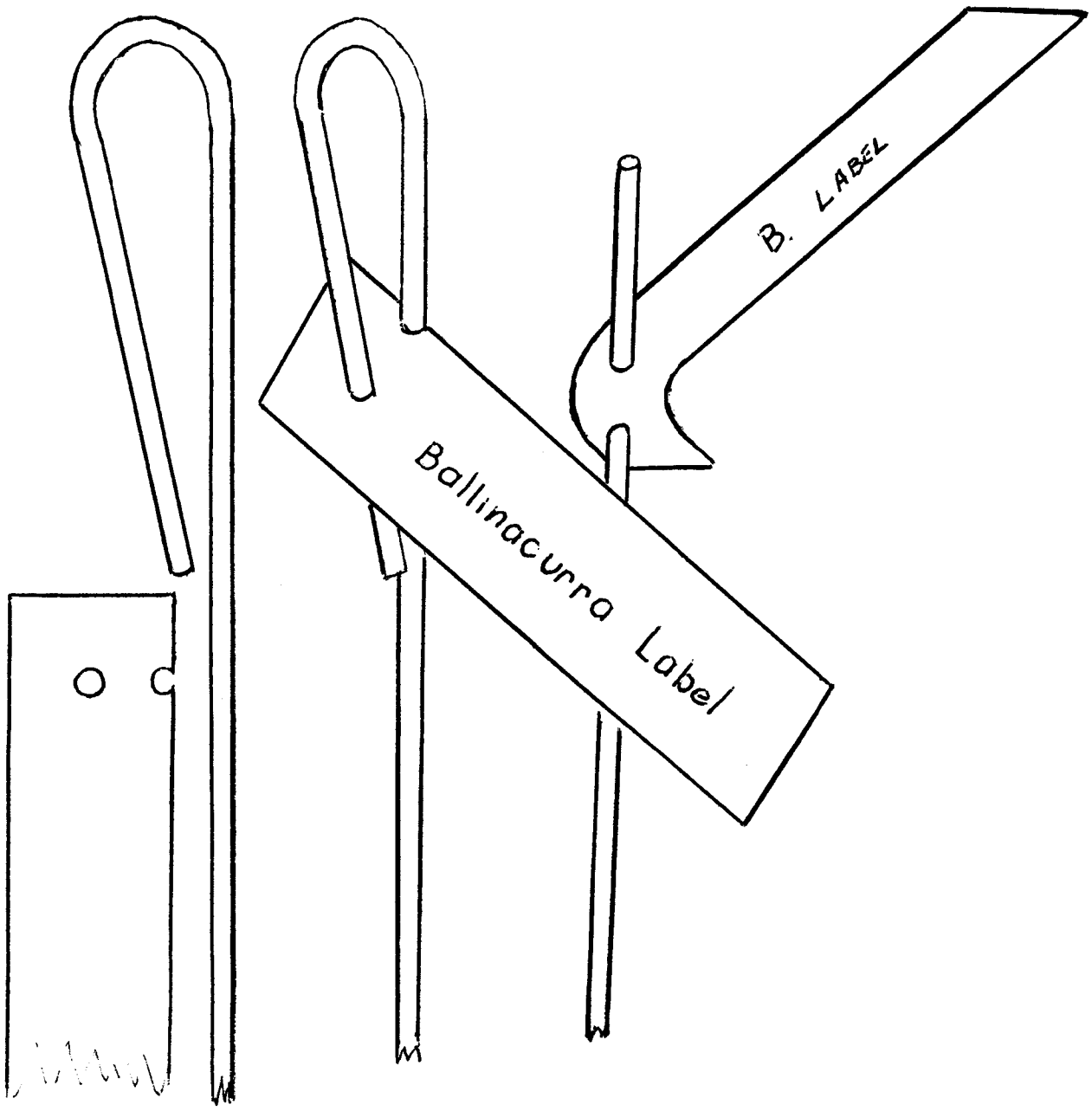
We use a two-foot length of wire with a 3½ inch crook at one end. Our standard label is a 4 inch x 1 inch 'Flovic' strip drilled centrally ½ inch from one end and also, but not necessarily, on one edge. The latter forms a nick.

The label is inserted edgeways into the crook mouth, the nick towards the long leg and the short leg is fitted into the center hole. In this position the face of the label is directed towards the observer and may be read without stooping. The crook forms a convenient hand grip for pushing the wire into the ground.

It is important that the legs of the crook are straight and that the mouth is practically closed, and that the hole in the label is a fairly close fit on the wire.

Properly made, this label will not become detached during the season. It is readily pulled off at harvest and is suitable for tying on a sack or sheaf.

Using the same materials another type (B) has just been devised. It has not been field tested but it appears unlikely to become detached in the field. The straight wire could be a hazard to persons in the field and it would not be as easily pushed into the ground as the crooked wire.


B. LABEL
Ballinacurra Label

VIII. PUBLICATIONS

1. Albrechtsen, R. S., et al. New varieties of small grain. S. Dak. Farm and Home Res. 19(1):22-24. Winter, 1968.

2. Atkins, I. M. 1968. Performance of spring-sown wheat, oats and barley in Texas. Texas Agr. Expt. Sta. Progress Report 2545.

3. Atkins, I. M., et al. 1968. The 1968 Texas Intra-State Small Grains and Flax Performance Trials. Texas A&M University, Agr. Expt. Sta., Soil and Crop Sciences Department Technical Report No. 25.

4. Browning, J. A. Genetic diversity in plant disease control. In McGraw-Hill Yearbook of Sci. & Tec., pp. 304-306. 1968.

5. Cournoyer, B. M., Browning, J. A., and Jowett, D. Crown rust intensification within and dissemination from pure-line and multiline varieties of oats. (Abstr.) Phytopathology 58:1047. 1968.

6. Day, K. M., R. K. Stivers, F. L. Patterson, O. W. Luetkemeier, W. D. Reiss, R. M. Caldwell, J. J. Roberts and R. L. Gallun. 1969. Performance and adaptation of small grains in Indiana. Purdue Univ. Agr. Exp. Sta. Res. Bul. 846.

7. Dinoor, A., J. Khair and G. Fleischmann, 1968. Pathogenic variability and the unit representing a single fertilization in Puccinia coronata var. avenae. Can. J. Bot. 46: 501-508.

8. Dinoor, A., J. Khair and G. Fleischmann. 1968. A single-spore analysis of rust pustules produced by mixing isolates of two races of Puccinia coronata var. avenae. Can. J. Bot. 46: 1455-1458.

9. Eyal, Z., B. C. Clifford, and R. M. Caldwell. 1968. A settling tower for quantitative inoculation of leaf blades of small grain plants with urediospores. Phytopathology 58:530-531.

10. Fisher, H. M. 1968. New Varieties Top 1967 Yield Tests. J. Dept. Agric. W. Aust. (4 Ser.) 9(10) 480-488.

11. Frey, K. J. Mass selection for seed width in oat populations. Euphytica 16:341-349. 1967.

12. Frey, K. J. Expected genetic advances from three simulated selection schemes. Crop Sci. 8:235-238. 1968.

13. Frey, K. J., Grindeland, R. L., and Browning, J. A. Oat variety performance - 1967-68. Iowa State University Leaflet AG 10-8. 1968.

14. Hansing, E. D., P. S. Rao and J. C. Reyes. 1968. Effect of seed treatment on control of oat smut. Fungicide-Nematocide Tests. Results of 1967. 23:118-119.

15. Hansing, E. D., P. S. Rao and J. C. Reyes. 1968. Effect of seed treatment on control of oat and sorghum diseases, 1967. Kansas State Univ. Ext. Serv. Chemical Task Force Reports.

16. Hathcock, B. R., M. E. McDaniel and D. J. McDonald. 1968. Oat heterosis. 1968 Agronomy Abstr. pp. 9.

17. Heagle, A. S. 1968. The nature and effect of adult plant resistance to crown rust in several commercial oat varieties. Unpub. Ph.D. Thesis. Univ. of Minn. Libr., Minneapolis, Minn.

18. Jones, I. T., and Hayes, J. D. 1968. The effect of seed rate and growing season on four oat cultivars. II. Culm morphology and panicle conformation. J. Agric. Sci., Camb. 70: 405-410.

19. Joshi, S. N. and Frey, K. J. Genetic variability in oats from recurrent and alternate treatment with physical and chemical mutagens. Rad. Bot. 7:513-520. 1967.

20. Kim, Heung Bae, I. M. Atkins and P. E. Pawlisch. 1968. Inheritance of anther size and spikelet characteristics. Crop Sci. 8: 101-104.

21. Kingsland, G. C. 1968. Influence of crop sequence and soil-borne oat mosaic virus on yield and test weight of oats in South Carolina. Plant Dis. Report. 52: 430-432.

22. Kumagai, Takeshi. 1968. Studies on the variability and correlation of characters in the genus Avena in relation to plant breeding. Hokkaido Nat. Agr. Exp. Sta. Rpt. 72: 1-129. (Japanese summary).

23. McDaniel, M. E., B. R. Hathcock, and D. J. McDonald. 1969. Effect of stigma mutilation on oat seed set. Crop Sci. 9 (In press). 1968 Agronomy Abstr. pp. 14.

24. McMullan, J. L., Fisher, H. M., and Parish, J. A. 1967. Swan Oats. J. Dept. Agric. W. Aust. (4 Ser.) 8(12) 499-501.

25. Marshall, H. G. 1968. Winter hardiness looks promising in oats. Sci. for the Farm 16: 8.

26. Marshall, H. G., and F. A. Coffman. 1968. Registration of Pennlan winter oats. Crop Sci. 8: 640.

27. Mengersen, F., and Fitzsimmons, R. W. 1968. Identification of Oat Varieties in New South Wales. Sc. Bull. 79, N.S.W. Dept. Agric.

28. Michel, L. J., and Simons, M. D. Comparison of zineb and maneb with a nickle-maneb mixture for control of oat crown rust. Plant Dis. Reptr. 52:205-208. 1968.

29. Murphy, H. C., Sadanaga, K., Zillinsky, F. J., Terrell, E. E. and Smith, R. T. 1968. Avena magna: An important new tetraploid species of oats. Science 159: 103-104.

30. Nishiyama, I., M. Tabata, R. A. Forsberg, and H. L. Shands. 1968. Twinning and chromosome anomalies in Kanota oats. Crop Sci. 8: 603-606.

31. Nishiyama, I., R. A. Forsberg, H. L. Shands, and M. Tabata. 1968. Monosomics of Kanota oats. Can. J. Gen. Cytol. 10: 601-612.

32. Poehlman, J. M., Norman Justus, George Berger, Anson Elliott and Shu-Ten Tseng. Varietal Tests of Spring Oats in Missouri. Univ. of Missouri Guide: No. 4310. 1968.

33. Ray, Dale A. Performance trials of spring oat varieties in Ohio including 1968 results. O. A. R. D. C. Agronomy Mimeo. Series 200, January, 1969.

34. Rothman, P. G., and Sadanaga, K. 1968. A 56-chromosome oat plant. Crop Sci. 8:635-636.

35. Sadanaga, K. Zillinsky, F. J., Murphy, H. C., and Smith, R. T. 1968. Chromosome associations in triploid, tetraploid, and pentaploid hybrids of Avena magna (2n=28). Crop Sci. 8: 594-597.

36. Sechler, Dale and W. H. Chapman. 1967. Small Grain Forage Observations in North Florida. I. Effect of Variety and Species Mixtures on Forage Yields of Oats and Rye. The Soil and Crop Sci. Soc. of Florida 27: 68-72.

37. Sechler, Dale and W. H. Chapman. 1967. Small Grain Forage Observations in North Florida. II. Effect of Rate of Seeding and Row Spacing on Forage Yields of Oat Varieties Differing in Growth Habit. The Soil and Crop Sci. Soc. of Florida 27: 72-77.

38. Sechler, Dale and W. H. Chapman. 1967. Small Grain Forage Observations in North Florida. III. Effect of Interseeding Legumes on Forage Yields of Oats and Rye. The Soil and Crop Sci. Soc. of Florida. 27: 78-81.

39. Sechler, Dale, W. H. Chapman, H. H. Luke. 1968. Florida 501 Oats. Agr. Exp. Stations, Institute of Food and Agricultural Sciences, University of Florida. Circular S-185.

40. Simons, M. D. and Murphy, H. C. Oat diseases and their control. USDA Agr. Handbook No. 343, 15 pp. 1968.

41. Simons, M. D. Additional sources of tolerance to oat crown rust. Plant Dis. Reptr. 52:59-61. 1968.

42. Simons, M. D. and Michel, L. J. Oat maturity and crown rust response. Crop Sci. 8:254-256. 1968.

43. Smith, R. L. and J. P. Jones. Registration of Nora Oats. Crop Sci. 8:516.

44. Sun, N. C., and Sadanaga, K. 1968. Handling oat chromosomes. Crop Sci. 8:767-769.

45. Suneson, C. A., and H. G. Marshall. 1967. Cold resistance in wild oats. Crop Sci. 7: 667-668.

46. Sztejnberg, A. and I. Wahl. 1967. A new and highly virulent race of oat stem rust in Israel. Plant Dis. Reptr. 51: 967-970.

47. Thomas, Hugh, and D. A. Lawes. 1968. Evaluation of the use of species hybrids and synthetic amphiploids in the improvement of the oat crop. Euphytica 17: 404-413.

48. Torres, E., and Browning, J. A. The yield of urediospores per unit of sporulating area as a possible measure of tolerance of oats to crown rust. (Abstr.) Phytopathology 58:1070. 1968.

49. Vela-Cardenas, M. Optimum environment for maximizing genetic gain from selection. Ph.D. Thesis. Iowa State University Library, Ames, Iowa. 1968.

IX. MAILING LIST

Aastveit, K., Norges Lantbrukshogskoles, Akervekstforsok, Vollebekk, NORWAY
Aberg, Ewart, Plant Husbandry Dept., Agr. College of Sweden, Uppsala 7, SWEDEN
Acevedo, Juan, Casilla 58-D, Temuco, CHILE
Albrechtsen, R. S., Agron. Dept., South Dakota State Univ., Brookings, S.D. 57006
Arias, Jesus, Agron. Dept., Iowa State Univ., Ames, Iowa 50010
Arny, Deane C., Dept. of Plant Path., Univ. of Wisconsin, Madison, Wis. 53706
Atay, Turhan, Plant Improvement Station, P.K. 17, Eskisehir, TURKEY
Atkins, I. M., Soil and Crop Sciences, Texas A & M University, College Station, Texas 77843
Atkins, R. E., Agronomy Dept., Iowa State University, Ames, Iowa 50010

Baines, Winton, Seed Coop., Plant Science Bldg., Cornell Univ., Ithaca, N.Y. 14850
Baker, E. P., Dept. of Agriculture, Univ. of Sydney, Sydney, N.S.W., AUSTRALIA
Ballantyne, H. R., Research Station, P.O. Box 1240, Melfort, Saskatchewan, CANADA
Barker, Roland, Dept. Botany and Plant Pathology, ISU, Ames, Iowa 50010
Barnett, R. D., Agronomy Dept., Purdue University, Lafayette, Indiana 47907
Baum, B. R., Canada Department of Agriculture, Plant Research Institute, Ottawa 3, Ontario, CANADA
Bengtsson, Anders, Dept. of Plant Husbandry, Agricultural College of Sweden, Uppsala 7, SWEDEN
Beratto M., Edmundo, Estacion Experimental Carillanca, Casilla 58-D, Temuco, CHILE
Berger, George, Dept. of Agronomy, Univ. of Missouri, Columbia, Mo. 65201
Bespalow, I. K., Agway Inc., 26 Central St., West Springfield, Mass. 01089

Bever, Wayne, Dept. of Plant Path., Univ. of Ill., Urbana, Ill. 61803
Beyer, Dr. E. H., Research Director, Farm Seed Research Corporation, San Juan Bautista, California 95045
LaBiblioteca, Facultad de Agronomia, Casilla de Correo 31, Calle 60 y 119, LaPlata, ARGENTINA
LaBiblioteca, Sta. Cataline Estocion Experimental, I.N.I.A.P., Apartado No. 2600, Quito, ECUADOR, SOUTH AMERICA
Biblioteca, Centro Nat. Investigaciones Agricolas "Tibaitata", Apartado Nal. 34-13, Bogota, D.E., COLOMBIA, SOUTH AMERICA
Bitzer, M. J., Agron. Dept., Georgia Agr. Exp. Sta., Experiment, Ga. 30212
Bolton, Floyd E., Farm Crops Dept., Oregon State Univ., Corvallis, Oregon 97331
Bonnett, O. T., Agron. Dept., Univ. of Illinois, Urbana, Ill. 61801
Borgeson, Carl, Agron. Dept., Univ. of Minn., St. Paul, Minn. 55101
Bowman, D. H., Delta Branch Exp. Station, Stoneville, Mississippi
Boyd, W. J. R., Agron. Dept., Univ. of Western Australia, Nedlands, WESTERN AUSTRALIA
Briggle, L. W., Leader Oat Investigations, Crops Research Division, Beltsville, Maryland 20705
Brinkman, Marshall, Agron. Dept., ISU, Ames, Iowa 50010
Britton, M. P., Univ. of Ill., Urbana, Ill. 61801
Brink, V. C., Plant Science Division, Univ. of British Columbia, Vancouver 8, CANADA
Browder, Lewis E., Botany and Plant Path. Dept., Kansas State Univ., Manhattan, Kansas 66502
Brown, A. R., Dept. of Agronomy, Univ. of Georgia, Athens, Georgia 30601
Brown, C. M., Dept. of Agronomy, Univ. of Ill., Urbana, Ill. 61801
Browning, J. Artie, Botany and Plant Pathology., ISU, Ames, Iowa 50010
Brown, R. H., Texas Agr. Exp. Station, Box 366, R#5, Beaumont, Texas 77706
Bruehl, G. W., Dept. of Plant Pathology, Washington State Univ., Pullman, Washington 99163
Burca, Eng. St., Economic Secretary, Embassy of the Socialist Republic of Romania, Washington, D.C.
Burrows, Vernon D., Research Station, Central Experimental Farm, Ottawa, Ontario, CANADA
Bustamente, E., Instituto Colombiano Agropecuario, Apartado Aereo 79-84, Bogota, COLOMBIA
Buttress, F. A., Cambridge University, Downing Street, Cambridge, ENGLAND
Byrd, W. P., Experimental Statistics Division, Clemson Univ., Clemson, S.C. 29631

Caldwell, R. M., Botany and Plant Pathology, Purdue Univ., Lafayette, Indiana 47907
Cameron, Donald, Scottish Plant Breeding Station, Penlandfield, Roslin, Midlothian, SCOTLAND
Camper, H. M., Agr. Exp. Station, Warsaw, Virginia
Carbajo, Hector L., Estacion Experimental Agropecuaria, Bordenave, F.C.G.R., Republica ARGENTINA
Campbell, Arden, Agron. Dept., Iowa State Univ., Ames, Iowa 50010
Chada, H. L., Entomology Dept., Okla. State Univ., Stillwater, Okla. 74075

Chang, Te-Tzu, International Rice Res. Inst., Manila Hotel, Manila, PHILIPPINES
Chapman, W. H., North Florida Exp. Station, P.O. Box 470, Quincy, Fla. 32351
Clapp, John G., Agr. Ext. Service, North Carolina State Univ., Raleigh, N.C. 27607
Clark, B. E., Div. of Seed Investigations, N.Y.S. Agr. Exp. Sta., Geneva, New York 14456
Clark, G. H., Research Station, Harrow, Ontario, CANADA
Clark, R. V., Canada Dept. of Agriculture, Central Experimental Farm, Ottawa, Ontario, CANADA
Clement, E. L., Agron. Dept., Univ. of Arkansas, Fayetteville, Ark. 72703
Coffman, Franklin A., 4317 Woodberry St., University Park, Hyattsville, Maryland 20782
Compton, L. E., Botany and Plant Path. Dept., Purdue Univ., Lafayette, Indiana 47907
Conlon, Thomas J., Dickinson Experiment Station, Box 1117, Dickinson, North Dakota 58601
Cook, E. D., Agricultural Experiment Station, Temple, Texas 76501
Coon, B. F., Entomology Dept., Pennsylvania State Univ., University Park, Pennsylvania 16802
Cournoyer, Blanche M., Dept. of Botany and Plant Pathology, ISU, Ames, Iowa 50010
Craddock, J. C., World Collection of Small Grains, USDA Plant Industry Station, Beltsville, Maryland 20705
Craigmiles, J. P., Texas Agr. Exp. Station, Box 366, R#5, Beaumont, Texas 77706
Criswell, Jerome G., Agron. Dept., ISU, Ames, Iowa 50010
Crook, Wayne C., Agron. Dept., Univ. of Missouri, Columbia, Mo. 65201
Crop Quality Council, 828 Midland Bank Bldg., Minneapolis, Minn. 55401
Crosier, Willard F., Dept. of Seed Investigations, N.Y.S. Agr. Exp. Station, Geneva, N.Y. 14456
Crowder, L. V., Plant Breeding Dept., Cornell Univ., Ithaca, New York 14850
Cummings, D. G., Georgia Exp. Sta., Experiment, Ga. 30212

Dahms, R. G., Grain & Forage Insects Research Branch, USDA, ARS, Beltsville, Maryland 20705
Daniels, Norris, U.S. Great Plains Field Station, Bushland, Texas 79012
Davis, R., Dept. Entomology, Univ. of Georgia, Athens, Georgia 30601
Day, Arden D., Agron. Dept., Univ. of Arizona, Tucson, Arizona 85721
Day, Kelly, Agronomy Dept., Purdue Univ., Lafayette, Indiana 47907
de Stefano, Maximo Alcala, Inst. Nacional de Investigaciones Agricolas, Londres No. 40, Mexico 8, D.F.
Dewey, Wade G., Plant Science Dept., Utah State Univ., Logan, Utah 84321
Dinoor, A., Faculty of Agriculture, The Hebrew Univ., Rehovot, ISRAEL
Director, Res. Station, P.O. Box 400, Ste-Anne-de-la-Pocatiere, Cte de Kamouraska, P.Q., CANADA
Dischinger, R., Productos Alimenticios Quaker S.A., Cx. Postal 2501, Porto Alegre, BRAZIL
Dixon, G. E., Plant Breeding Station, Njoro, Kenya, AFRICA
Duclos, Leo, Delta Research Center, Univ. of Missouri, Portageville, Missouri 63873
Durbin, R. D., Plant Path. Dept., Univ. of Wisconsin, Madison, Wis. 53715
Dyck, P. L., Canada Dept. Agr. Res. Station, 25 Dafoe Road, Winnipeg 19, Manitoba, CANADA

Early, H. L., Agron. Dept., Univ. of Tennessee, Knoxville, Tennessee 37901
Ebeltoft, David C., Dept. of Agronomy, North Dakota State Univ., Fargo, N.D. 58102
Edgington, L. V., Botany Dept., O.A.C., Guelph, Ontario, CANADA
Edwards, L. H., Agronomy Dept., Oklahoma State Univ., Stillwater, Okla. 74075
Eisenberg, G. E., Dept. Agr. Tech. Services, Stellenbosch, Cape Province, Republic of SOUTH AFRICA
Ellingboe, Albert H., Dept. of Botany and Plant Path., Michigan State Univ., East Lansing, Michigan 48823
Elliott, Wm. Anson, Dept. of Agronomy, Univ. of Missouri, Columbia, Missouri 65201
Escobar-P., Raul, Colegio de Post-Graduados, Rama de Genetica, Chapingo, Mex., MEXICO
Eskew, E. B., Dept. of Agronomy and Soils, Clemson Univ., Clemson, S.C.29631
Eskilsson, Lars, Swedish Seed Association, Svalöf, SWEDEN
Eyal, Zahir, Department of Botany, Tel-Aviv University, 155 Herzl St., Tel-Aviv, Israel

Faris, Donald G., Research Station, Box 29, Beaverlodge, Alberta, CANADA
Feather, J. T., Agron. Dept., Univ. of Calif., Davis, Calif. 95616
Finkner, V. C., Agron. Dept., Univ. of Kentucky, Lexington, Kentucky 40506
Finney, R. E., Purdue Univ., Lafayette, Indiana 47907
Fitzgerald, Paul, CRD, Beltsville, Mo. 20705
Fleischmann, G., Research Station, 25 Dafoe Road, Winnipeg 19, Manitoba, CANADA
Foote, W. H., Dept. of Farm Crops, Oregon State Univ., Corvallis, Ore. 97331
Forsberg, R. A., Agron. Dept., Univ. of Wisconsin, Madison, Wis. 53706
Frey, K. J., Agronomy Dept., ISU, Ames, Iowa 50010
Friesen, H. I., Canadian Seed Growers Assn., G.P.O. Box 455, Ottawa 2, Ontario, CANADA
Futrell, Maurice C., USDA, ARS, Cereal Crops Research Branch, P.O. Drawer PG, State College, Miss. 39762

Gamble, E. E., Crop Science Dept., University of Guelph, Guelph, Ontario, CANADA
Gardenhire, J. H., Texas Agricultural Experiment Station, Denton, Texas 76201
Gauthier, F. M., Laval University, Quebec, CANADA
Gboriavhien, Dafe K., Dept. of Botany and Plant Pathology, ISU, Ames, Iowa 50010
Gill, C. C., C.D.A. Research Station, Winnipeg 19, Manitoba, CANADA
Gough, Francis J., Dept. Plant Science, Texas A&M Univ., College Station, Texas 77843
Grabe, D. F., Seed Laboratory, Mississippi State Univ., State College, Miss. 39762
Grafius, J. E., Dept. of Crop Science, Mich. State Univ., East Lansing, Michigan 48823
Graffis, D. W., Dept. of Agronomy, Univ. of Ill., Urbana, Ill. 61801
Graham, Doyce Jr., Dept. of Agronomy and Soils, Clemson Univ., Clemson, South Carolina 29631
Graves, C. R., Agronomy Dept., Univ. of Tennessee, Knoxville, Tenn. 37916
Green, G. J., Dept. Plant Pathology, Univ. of Manitoba, Winnipeg, Manitoba, CANADA
Griffeth, W. L., Agron. Dept., Cornell Univ., Ithaca, New York 14850

Griffiths, D. J., Welsh Plant Breeding Station, Plas Gogerddan, Nr. Aberystwyth, Cardiganshire, WALES, U.K.
Grindeland, R. L., Dept. of Agronomy, Iowa State Univ., Ames, Iowa 50010
Guerin, P. M., Hawkesbury Agricultural College, Richmond, N.S.W 2753 AUSTRALIA
Guthrie, E. J., Plant Breeding Station, P.O. Njoro, KENYA
Guitard, A. A., Experimental Farm, Beaverlodge, Alberta, CANADA

Hagberth, N. O., Oat Breeding Dept., Plant Breeding Institution, Weibullsholm, Landskrona, SWEDEN
Halisky, P. M., Plant Biology Dept., Rutgers Univ., New Brunswick, New Jersey 08903
Hall, Dorothy, Librarian, Canada Dept. Agr., Plant Research Institute, Ottawa, Ontario, CANADA
Hankins, B. J., Agronomy Dept., Purdue Univ., Lafayette, Indiana 47907
Hansen, Sv. E., Statens Forsogsstation, Tylstrup, DENMARK
Hansing, E. D., Dept. of Botany and Plant Path., Kansas State Univ., Manhattan, Kansas 66502
Harrison, Howard F., Coker's Pedigreed Seed Co., Hartsville, S.C. 29550
Haus, T. E., Dept. of Agronomy, Colorado State Univ., Ft. Collins, Colorado 80521
Hathcock, Bobby R., Dept. Soil and Crop Sciences, Texas A & M Univ., College Station, Texas 77843
Havelka, U. D., Agricultural Experiment Station, Temple, Texas 76501
Hayden, E. B., Cereal Institute, Inc., Chicago, Ill.
Hayes, J. D., Welsh Plant Breeding Station, Near Aberystwyth, WALES, U.K.
Hayes, Ralph M., Branch Experiment Station, Aberdeen, Idaho 83210
Hebert, T. T., Dept. of Crop Science, N.C. State Univ., Raleigh, N.C. 27607
Henriksen, B., Plant Science Dept., University of Idaho, Moscow, Idaho
Heyne, E. G., Agronomy Dept., Kansas State Univ., Manhattan, Kansas 66502
Hobbs, Clifford D., Eli Lilly and Company, 2301 Forest Lane, Suite 206, Garland, Texas 75040
Hooker, A. L., Dept. of Plant Path., Univ. of Ill., Urbana, Ill. 61801
Hoskins, P., Field Crops Dept., Univ. of Missouri, Columbia, Missouri 65201
Humphrey, A., Advance Seed Co., P.O. Box 5174, Tucson, Arizona 85721
Huntley, D. N., Ontario Dept. of Agriculture and Food, Parliament Buildings, Toronto, Ontario, CANADA
International Rice Research Institute, Manila Hotel, Manila, THE PHILIPPINES
Isom, W. H., Agron. Dept., Univ. of Calif., Riverside, Calif.

Jain, S. K., Agronomy Dept., University of Calif., Davis, Calif. 95616
James, Edwin, National Seed Storage Laboratory, Ft. Collins, Colorado 80521
Jedlinski, H., Dept. Plant Path., Univ. of Ill., Urbana, Ill. 61801
Jenkins, B. Charles, World Seeds, Inc., 320 Church St., Salinas, Calif. 93901
Jenkins, G., Plant Breeding Institute, Trumpington, Cambridge, ENGLAND
Jensen, Neal F., Dept. of Plant Breeding and Biometry, Cornell Univ., Ithaca, New York 14850
Jensen, Stanley G., Northern Grain Insect Research Laboratory, Brookings, South Dakota 57006
Johnson, J. W., Agronomy Dept., Texas Tech., Lubbock, Texas
Johnson, T., Dominion Lab. of Plant Path., Winnipeg, Manitoba, CANADA

Johnson, V. A., Agronomy Dept., Univ. of Nebraska, Lincoln, Nebr. 68503
Johnston, R. P., P. O. Box 231, Warwick, Queensland, AUSTRALIA
Johnston, T. H., Rice Branch Exp. Sta., Stuttgart, Arkansas 72160
Jondle, Robert, Agron. Dept., Iowa State Univ., Ames, Iowa 50010
Jones, Buford, State Seed Lab., 122 Capitol Bldg., Oklahoma City, Okla. 73105
Jones, J. P., Dept. Plant Path., Univ. of Arkansas, Fayetteville, Ark. 72703
Jowett, David, Dept. of Statistics, ISU, Ames, Iowa 50010
Justin, J. R., College of Agriculture and Environmental Science, Rutgers Univ., New Brunswick, N.J. 08903
Justus, Norman, S.W. Center, University of Missouri, Mt. Vernon, Mo. 65712

Kaufmann, M. L., Cereals Crops Research, Lacombe, Alberta, CANADA
Keaton, J. A., Coker's Pedigreed Seed Co., Hartsville, South Carolina
Kennedy, W. K., Assoc. Dean of Agriculture, Cornell University, Ithaca, New York 14850
Kent, G. C., Dept. of Plant Path., Cornell Univ., Ithaca, New York 14850
Kernkamp, M. F., Cooperative Rust Laboratory, Univ. of Minnesota, St. Paul, Minn. 55101
Kiesling, Richard L., Plant Path. Dept., North Dakota State Univ., Fargo, N. D. 58102
Kilpatrick, R. A., Crops Research Division, Beltsville, Maryland 20705
Kingsland, G. C., Botany and Bacteriology Dept., Clemson Univ., Clemson, S.C. 29631
Kivi, E., Plant Breeding Station, Tammisto, Helsingin pitaja, FINLAND
Klinck, H. R., Agronomy Dept., MacDonald College, Quebec, CANADA
Kline, D. M., Dept. of Crop Science, N.C. State Univ., Raleigh, N.C. 27607
Knott, Gayle, County Extension Office, County Court House, P.O. Box 543, Ft. Collins, Colorado 80521
Konzak, C. F., Agron. Dept., Washington State Univ., Pullman, Wash. 99163
Kostic, Borivoje, Plant Pathologist, Institute for Small Grains, Kragujevac, Jovanovacki put, YUGOSLAVIA
Krenzen, R., Agronomy Dept., 145 Emerson Hall, Cornell Univ., Ithaca, New York 14850
Kronstad, Warren E., Dept. of Farm Crops, Oregon State Univ., Corvallis, Oregon 97331
Kucharek, Thomas, Botany and Plant Pathology, Oklahoma State Univ., Stillwater, Okla. 74075
Kumagai, Takeshi, Hokkaido Nat. Agr. Exp. Sta., Dept. of Crop Science, Hitsujigaoka, Sapporo, JAPAN
Kusch, A. G., Experimental Farm, Scott, Saskatchewan, CANADA

Ladizinsky, G., Laboratory of Genetics, The Hebrew Univ. of Jerusalem, Jerusalem, ISRAEL
Lafever, H. N., Agronomy Dept., Ohio Agr. Res. and Development Center, Wooster, Ohio 44691
Lahr, K. A., Agricultural Experiment Station, Chillicothe, Texas 79225
Lanizinsky, G., The Laboratory of Genetics, The Hebrew University of Jerusalem, Jerusalem, ISRAEL
Larsson, Rune, Plant Husbandry Dept., Agr. College of Sweden, Uppsala 7, SWEDEN
LeGrand, F. E., Extension Agronomist, Oklahoma State Univ., Stillwater, Okla. 74075
Lehmann, C., Deutsche Akademie Der Wissen schaften Zu Berlin, Institut Fur Kulturpflanzenforschung, 4325 Gatersleben, GERMANY

Loesch, P. J., Jr., Geneticist, USDA ARS, 106 Curtis Hall, University of Missouri, Columbia, Mo. 65201
Library - Albert R. Mann Library, Cornell University, Ithaca, New York 14850
Library of Congress, Exchange and Gift Division, Washington, D. C. 20540
Littrell, R. H., Coastal Plain Exp. Sta., P.O. Box 748, Tifton, Georgia 31794
Livers, Ronald W., Fort Hays Branch Station, Hays, Kansas 67601
Lofgren, James R., Northwest Univ. of Minn. Exp. Station, Crookston, Minnesota 56716
Lowe, C. C., Plant Breeding Dept., Cornell University, Ithaca, New York 14850
Luetkemeier, O. W., Agronomy Dept., Purdue Univ., Lafayette, Indiana 47907
Luke, H. H., Plant Pathology Dept., Univ. of Florida, Gainesville, Fla. 32601
Lund, Steve, Dept. of Soils and Crops, Rutgers Univ., New Brunswick, New Jersey 08903
Luttrell, E. S., Dept. Plant Pathology, Univ. of Georgia, Athens, Ga. 30601

McCurdy, LeRoy, W. O. McCurdy & Sons, Fremont, Iowa 52561
McDaniel, M. E., Soil and Crop Sciences, Texas A & M Univ., College Station, Texas 77843
McGinnis, R. C., Dept. Plant Science, Univ. of Manitoba, Winnipeg, Manitoba, CANADA
McKee, Guy W., Agron. Dept., Penn. State Univ., University Park, Pa. 16802
McKenzie, R. I. H., Research Station, 25 Dafoe Road, Winnipeg 19, Manitoba, CANADA
McLaughlin, F. W., North Carolina Crop Improvement Association, Inc., State College Station, Raleigh, N.C. 27607
McNeill, M. J., Agron. Dept., ISU, Ames, Iowa 50010
MacKey, James, Dept. of Genetics and Plant Breeding, Agricultural College of Sweden, Uppsala 9, SWEDEN
Maidonado A., Uriel, Instituto Nacional de Investigaciones Agricolas, Apartados 6-882, Mexico 6, D.F., MEXICO
Marshall, H. G., Dept. of Agronomy, Penn. State Univ., University Park, Pennsylvania 16802
Martens, J. W., Research Station, 25 Dafoe Road, Winnipeg 19, Manitoba, CANADA
Martinez, Snr. Matilde, Centro de Cerealicultura, Avda Puerta de Hierro, Madrid 3, SPAIN
Meiners, J. P., Crops Research Division, Beltsville, Maryland 20705
Michel, L. J., Dept. of Botany and Plant Path., ISU, Ames, Iowa 50010
Middleton, Gordon K., McNair Seed Co., Inc., Laurinburg, North Carolina 28352
Mikkelsen, K., Norges Lantbrukshogskoles, Akervekstforsok, Vollebekk, NORWAY
Millar, Roy L., Dept. Plant Path., Cornell Univ., Ithaca, New York 14850
Miller, J. D., Dept. Agron., North Dakota State Univ., Fargo, N.D.
Mock, J. J., Agron. Dept., ISU, Ames, Iowa 50010
Moore, M. B., Dept. of Plant Path., Institute of Agriculture, St. Paul, Minn. 55101
Morey, D. D., Coastal Plain Exp. Sta., P.O. Box 748, Tifton, Georgia 31794
Morrison, J. W., Research Branch, Central Experimental Farm, Ottawa, Ontario, CANADA
Morrison, K. J., Agron. Dept., Washington State Univ., Pullman, Wash. 99163.
Mota, Miguel, Genetics Dept., Estacao Agronomica Nacional, Oeiras, PORTUGAL

Muehlbauer, F. J., Dept. Agron., Penn. State Univ., University Park, Pa. 16802
Multamaki, K., Dept. of Plant Breeding, Jokioinen, FINLAND
Munk, Aage, Landbrugets Kornforaedling, Sejet, DK 8700, Horsens, DENMARK
Murphy, C. F., Dept. of Crop Science, N.C. State Univ., Raleigh, N.C. 27607
Musgrave, R. B., Agron. Dept., Cornell Univ., Ithaca, New York 14850
Neely, J. W., Coker's Pedigreed Seed Co., Hartsville, South Carolina
Newton, J. P., Forage Crop Section, Georgia Exp. Sta., Experiment, Ga. 30212
Newton, M. F., Dept. of Crop Science, N.C. State Univ., Raleigh, N.C. 27607
Nishiyama, Ichizo, 18 Hazamacho Shugaku-in, Sakyuku, Kyoto, JAPAN
Nittler, L. W., Dept. of Seed Investigations, NYS Agr. Exp. Sta., Geneva, New York 14456
Norris, M. J., Agr. Exp. Sta., McGregor, Texas 76659
Oakes, A. J., Plant Materials Investigations, CRD-ARS, USDA, Plant Industry Station, Beltsville, Maryland 20705
Oat Breeder, Department of Agriculture, Jarrah Road, South Perth, 6151, WESTERN AUSTRALIA
Oelke, Ervin, Agron. Dept., Univ. of Minn., St. Paul, Minn. 55101
Olsson, Gösta, Swedish Seed Association, Svalöf, SWEDEN
Osborne, Thomas S., Clark Science Center, Dept. of Biological Sciences, Smith College, Northampton, Mass. 01060
O'Sullivan, Thomas, Dept. of Agriculture, Cereal Station, Ballinacurra, Co. Cork, IRELAND
Oswalt, R. M., Dept. of Agron., Oklahoma State Univ., Stillwater, Okla. 74075
Pacucci, Giovanni, Instituto di Agronomia, Universita degli Studi, Via Amendola 165/A, 70126 BARI, ITALY
Palmer, James H., Dept. Agron. and Soils, Clemson Univ., Clemson, S.C. 29631
Pardee, W. D., Plant Breeding Dept., Cornell Univ., Ithaca, New York 14850
Pass, H., Dept. of Agron., Okla. State Univ., Stillwater, Okla. 74075
Patterson, F. L., Dept. of Agronomy, Purdue Univ., Lafayette, Indiana 47907
Pawlisch, P. E., Malting Barley Improvement Association, 828 North Broadway, Milwaukee, Wis. 53202
Pederson, V. D., Dept. Plant Pathology, N. Dak. State Univ., Fargo, N.D.
Pendleton, J. W., Agron. Dept., Univ. of Ill., Urbana, Ill. 61801
Persson, Per Johan, Box 101, Skara, SWEDEN
Pesek, John T., Agron. Dept., ISU, Ames, Iowa 50010
Peterson, J. L., Plant Pathology, Rutgers University, New Brunswick, N.J.
Petr, Frank C., P.O. Box 1558, Amarillo, Texas 79105
Peturson, B., Plant Path. Lab., Box 322, Univ. of Manitoba, Winnipeg, Manitoba, CANADA
Pfeifer, R., Agron. Dept., Pennsylvania State Univ., University Park, Pennsylvania 16802
Pifer, Elmer C., Cooperative Extension Service, University Park, Penn. 16802
Poehlman, J. M., Dept. of Agron., Univ. of Missouri, Columbia, Mo. 65201
Popovic, Aleksa, Plant Breeding Institute, Kragujevac, YUGOSLAVIA
Porter, K. B., U. S. Great Plains Field Station, Bushland, Texas 79012
Prato, J. D., Agron. Dept., Univ. of Calif., Davis, Calif. 95616
Purcell, J., Dept. of Agriculture, Cereal Breeding Station, Backweston, Leixlip, Co. Kildare, IRELAND
Qualset, C. O., Agron. Dept., Univ. of California, Davis, Calif. 95616
Rajhathy, T., Cytogenetics Section, Central Experimental Farm, Ottawa, Ontario, CANADA

Rao, M. V., Division of Botany, Indian Agricultural Research Inst., New Delhi 12, INDIA
Ray, Dale A., Agronomy Dept., Ohio State Univ., Columbus, Ohio 43210
Reeves, J. T., Department of Agriculture, Jarrah Road, South Perth, 6151, WESTERN AUSTRALIA
Reich, Vernon H., Dept. of Agronomy, Univ. of Tenn., Knoxville, Tenn. 37901
Reinbergs, E., Dept. of Crop Science, Univ. of Guelph, Guelph, Ontario, CANADA
Reiss, W. D., Agronomy Dept., Purdue Univ., Lafayette, Indiana 47907
Rekunen, Matti, Plant Breeding Institute of Hankkija, Exp. Farm Nikkilä, Kangasala, FINLAND
Reyes, Lucas, Texas Agr. Exp. Station, Beeville, Texas 78102
Reyes, Reinaldo, Instituto Colombiano Agropecuario, Apartado Aereo No. 7984, Bogota, COLOMBIA
Roane, Curt, Dept. Plant Path. & Physiology, Virginia Polytechnic Institute, Blacksburg, Virginia 24061
Roberts, B. J., The Rockefeller Foundation, Loudres 40, Apartado Postal 6-641, Mexico City 6, D.F. MEXICO
Roberts, J. J., Agronomy Dept., Purdue Univ., Lafayette, Indiana 47907
Rochow, W. F., Dept. Plant Pathology, Cornell Univ., Ithaca, New York 14850
Rodenhiser, H. A., The Rockefeller Foundation, Apartado Aereo 58-13, Bogoto, COLOMBIA, S.A.
Rohde, Charles R., P.O. Box 370, Pendleton, Oregon 97801
Roland, Magnus, Weibullsholm Plant Breeding Inst., Bjertorp, 530 20, Kvänum, SWEDEN
Romero, Galo, INIAP, Enriques 722, Quito, ECUADOR
Romig, R. W., Cooperative Rust Laboratory, Univ. of Minnesota, St. Paul, Minn. 55101
Ross, W. M., Fort Hays Experiment Station, Hays, Kansas 67601
Rossouw, D. J., Dept. Agr. Tech. Services, Stellenbosch, Cape Province, Republic of SOUTH AFRICA
Rothgeb, R. G., Agronomy Dept., Univ. of Maryland, College Park, Maryland
Rothman, P. C., Cooperative Rust Laboratory, Univ. of Minnesota, St. Paul, Minn. 55101
Rutger, J. N., Plant Breeding Dept., Cornell University, Ithaca, New York 14850
Sadanaga, K., Dept. of Genetics, ISU, Ames, Iowa 50010
Sampson, D. R., Research Station, Central Experimental Farm, Ottawa, Ontario, CANADA
Sanchez-Monge, E., Ministerio de Agricultura I.N.I.A., Centro de Mejora del Maiz, AVDA Puerta De Hierro, Madrid, 3 SPAIN
Schafer, Darrel, Area Extension Agent, Box 218, Burlington, Colorado 80807
Schafer, J. F., Dept. of Plant Pathology, Kansas State Univ., Manhattan, Kansas 66502
Schillinger, John, Agron. Dept., Univ. of Maryland, College Park, Maryland
Schlehuber, A. M., Crop Specialist, USAID/IRI, Amcon - PA, APO, New York 09676
Schmidt, John W., Dept. of Agronomy, Univ. of Nebraska, Lincoln, Nebr. 68503
Schultz, O. E., Plant Path. Dept., Cornell University, Ithaca, New York 14850
Scott, J. R., Cereal Crops Research Branch, Crops Research Division, Beltsville, Maryland 20705
Scott, W. O., Dept. of Agronomy, Univ. of Ill., Urbana, Ill. 61801
Shafer, Samuel L., Western Slope Experiment Station, P.O. Box 786, Grand Junction, Colorado 81501
Shane, J. F., Agron. Dept., University of Kentucky, Lexington, Kentucky 40506
Shands, Hazel L., Dept. of Agronomy, Univ. of Wisconsin, Madison, Wis. 53706
Shands, Henry L., DeKalb Soft Wheat Research Center, 1211 Cumberland Avenue, P.O. Box D, West Lafayette, Indiana 47906

Shaner, G. E., Purdue University, Lafayette, Indiana 47907
Shebeski, L. H., Dept. of Plant Science, Univ. of Manitoba, Winnipeg, Manitoba, CANADA
Shibles, Richard M., Agronomy Dept., ISU, Ames, Iowa 50010
Shurtleff, M. C., Dept. of Plant Path., Univ. of Ill., Urbana, Ill. 61801
Sigurbjornsson, Bjorn, Plant Breeding and Genetics Sec., FAO/IAEA, Karntner Ring 11, A-1010, Vienna, AUSTRIA
Simons, Marr D., Botany and Plant Pathology Dept., ISU, Ames, Iowa 50010
Singh, Bhisham P., Dept. Botany and Plant Path., Iowa State University, Ames, Iowa 50010
Singh, Herbhajan, Division of Plant Introduction, Indian Agricultural Research Institute, New Delhi-12, INDIA
Singh, Mukhtar, Director, Indian Grassland and Fodder Research Institute, Jhansi (U.P.), INDIA
Sinha, S.K., Orissa Univ. of Agriculture and Technology, Bhubaneswar/3, Orissa, INDIA
Skepasts, A. V., Field Husbandry, Kemptville Agr. School, Kemptville, Ontario, CANADA
Slinkard, Alfred E., Dept. of Plant Science, Univ. of Idaho, Moscow, Idaho 83843
Slootmaker, L., Stichting voor Plantenveredeling, Lawickse Alle 166, Wageningen, THE NETHERLANDS
Smiljakovic, H., Plant Pathologist, Institute for Small Grains, Kragujevac, YUGOSLAVIA
Smith, David H., Entomology Dept., Michigan State Univ., East Lansing, Michigan 48823
Smith, E. L., Dept. of Agronomy, Okla. State Univ., Stillwater, Okla. 74075
Smith, Frederick G., Dept. Botany and Plant Pathology, ISU, Ames, Iowa 50010
Smith, H. C., Plant Diseases Division, D.S.I.R., P.B. Christchurch, NEW ZEALAND
Smith, H. H., Biology Dept., Brookhaven National Laboratories, Upton, L.I., New York
Smith, O. D., Dept. Agronomy and Plant Genetics, Univ. of Minnesota, St. Paul, Minnesota 55101
Smith, Rex L., Dept. of Agronomy, Univ. of Arkansas, Fayetteville, Ark. 72703
Smith, R. T., Cereal Crops Research Branch, Crops Research Division, Beltsville, Maryland 20705
Speed, D. W., Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, SCOTLAND
Spilde, LeRoy A., Agron. Dept., South Dakota State Univ., Brookings, S. D. 57006
Stanton, J. J., Jr., Coker's Pedigreed Seed Co., Hartsville, South Carolina
Starling, T. M., Dept. of Agronomy, Virginia Polytechnic Institute, Blacksburg, Va. 24061
Sterling, J.D.E., Research Branch, P.O. Box 1210, Charlottetown, P.E.I. CANADA
Stern, W. R., Agronomy Dept., Univ. of Western Australia, Nedlands, WESTERN AUSTRALIA
Stewart, Don M., Cooperative Rust Laboratory, Univ. of Minnesota, St. Paul, Minn. 55101
Stewart, Wm. G., Extension Agronomist, Colorado State Univ., Ft. Collins, Colorado 80521

Stiles, J. W., Director of Research, Agway, Inc., Syracuse, New York
Stivers, R. K., Agronomy Dept., Purdue Univ., Lafayette, Indiana 47907
Strand, Dr., College of Agriculture, As, NORWAY
Strand, Oliver E., Extension Agronomist, Univ. of Minnesota, St. Paul, Minn. 55101
Stuthman, Deon D., Dept. of Agronomy and Plant Genetics, Institute of Agriculture, St. Paul, Minn. 55101
Suneson, Coit A., East Lakeshore, Bigfork, Montana 59911
Swaminathan, M.S., Director, Indian Agricultural Research Institute, New Delhi-12, INDIA
Swartz, James W., County Court House, Area Extension Agronomist, Box 580, Grand Junction, Colorado 81501
Swearingen, M. L., Agron. Dept., Purdue Univ., Lafayette, Indiana 47907
Sztejnberg, A., Dept. of Plant Path., Faculty of Agriculture, P.O. Box 12, Rehovot, ISRAEL
Tabata, S., Hokkaido Nat. Agr. Exp. Sta., Sapporo, Hokkaido, JAPAN
Takeda, Kenneth, USDA Central Great Plains Field Station, Box K, Akron, Colorado 80720
Tatum, L. A., Crops Research Division, Beltsville, Maryland 20705
Taylor, G. Allan, Dept. of Agronomy, Montana State Univ., Bozeman, Montana 59715
Taylor, L. H., Dept. of Agronomy, Va. Polytechnic Inst., Blacksburg, Virginia 24061
Thomas, Hugh, Welsh Plant Breeding Station, Plas Gogerddan, near Aberystwyth, WALES
Thomason, Ronald C., Agron. Dept., Univ. of Missouri, Columbia, Mo. 65201
Thompson, R. K., Dept. of Agronomy, Univ. of Arizona, Tucson, Arizona 85721
Thorpe, H. C., U. N. Wheat and Barley Project, P.O. Box 3305, Teheran, IRAN
Toler, Robert W., Dept. of Plant Sciences, Texas A&M Univ., College Station, Texas 77843
Tossell, W. E., Assoc. Dean, Ontario Agr. College, Guelph, Ontario, CANADA
Tramel, J. L., Agron. Dept., VPI, Blacksburg, Virginia 24061
Tseng, Shu-Ten, Dept. of Agronomy, University of Missouri, Columbia, Missouri 65201
Tucker, T. C., Agron. Dept., Univ. of Arizona, Tucson, Arizona
Tuleen, Neal A., Dept. of Soil and Crop Sciences, Texas A & M Univ., College Station, Texas 77843
Tyler, Leon J., Dept. of Plant Path., Cornell Univ., Ithaca, N.Y. 14850
USDA National Agricultural Library, Current Serial Record, Washington, D. C. 20250
Van Zanden, T., Plant Pest Control Div., USDA, 400 S. 4th St., Room 809, Minneapolis, Minn. 55415
Vashisth, K. S., Division of Mycology and Plant Path., Indian Agricultural Research Inst., New Delhi-12, INDIA
Vavich, M. G., Agron. Dept., Univ. of Arizona, Tucson, Arizona 85721
Vela-Cardenas, Mario, CIANO, Apartado Postal No. 515, Cd. Obregon, Sonoro, MEXICO
Vernon, Reich, Dept. of Agronomy, Univ. of Tenn., Knoxville, Tenn. 37916
Vestergaard, H.A.B., Abed, Sollested, DENMARK
Vogt, H. E., Agron. Dept., Univ. Calif., Davis, Calif. 95616
Wahl, I., Dept. of Botany, Tel-Aviv University, Tel-Aviv (Ramat-Aviv), ISRAEL

Wallace, A. T., Plant Science Section, Univ. of Florida, Gainesville, Florida 32601
Watson, I. A., Dept. of Agriculture, Univ. of Sydney, Sydney, AUSTRALIA
Weerapat, P., Agron. Dept., Univ. of Missouri, Columbia, Mo. 65201
Weibel, Dale E., Dept. of Agronomy, Oklahoma State Univ., Stillwater, Okla. 74074
Weir, H. L., Box 1069, Little Rock, Arkansas
Welsh Plant Breeding Station, Plas Gogerddan, near Aberystwyth, WALES
Welshons, W. J., Head, Genetics Dept., ISU, Ames, Iowa 50010
Wesenberg, Darrell, Branch Experiment Station, Aberdeen, Idaho 83210
Western, D. E., The Quaker Oats Company, Chicago, Illinois 60654
Wetter, P., Northrup, King and Co., 1500 Jackson Street, N.E., Minneapolis, Minnesota 55413
Wieberg, Arne, Swedish Seed Association, Svälof, SWEDEN
Wiklund, Kjell, Lannas, Undrom, SWEDEN
Williams, Frank, Agron. Dept., ISU, Ames, Iowa 50010
Wold, Earl K., Northrup King and Co., 1500 Jackson St., N.E., Minneapolis, Minn. 55413
Wood, G. R., Texas Agr. Exp. Station, Box 366, R#5, Beaumont, Texas 77706
Wood, L. S., Plant Path. Dept., South Dakota State College, Brookings, South Dakota 57007
Wright, G. M., Dept. Scientific & Industrial Research, Crop Research Division, Christchurch, NEW ZEALAND
Wylle, T. D., Field Crops Dept., Univ. of Missouri, Columbia, Mo. 65201
Young, H. C., Jr., Dept. of Botany and Plant Pathology, Okla. State Univ., Stillwater, Okla. 74075
Young, W. S., Crop Science Dept. O.A.C., Guelph, Ontario, CANADA
Zillinsky, F. J., International Maize and Wheat Improvement Center, Loudres 40, Apartado Postal 6-641, Mexico 6, D.F. MEXICO