Jensen

1972

OAT NEWSLETTER

Vol. 23

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

July 1, 1973

Sponsored by the National Oat Conference

1972

OAT NEWSLETTER

Volume 23

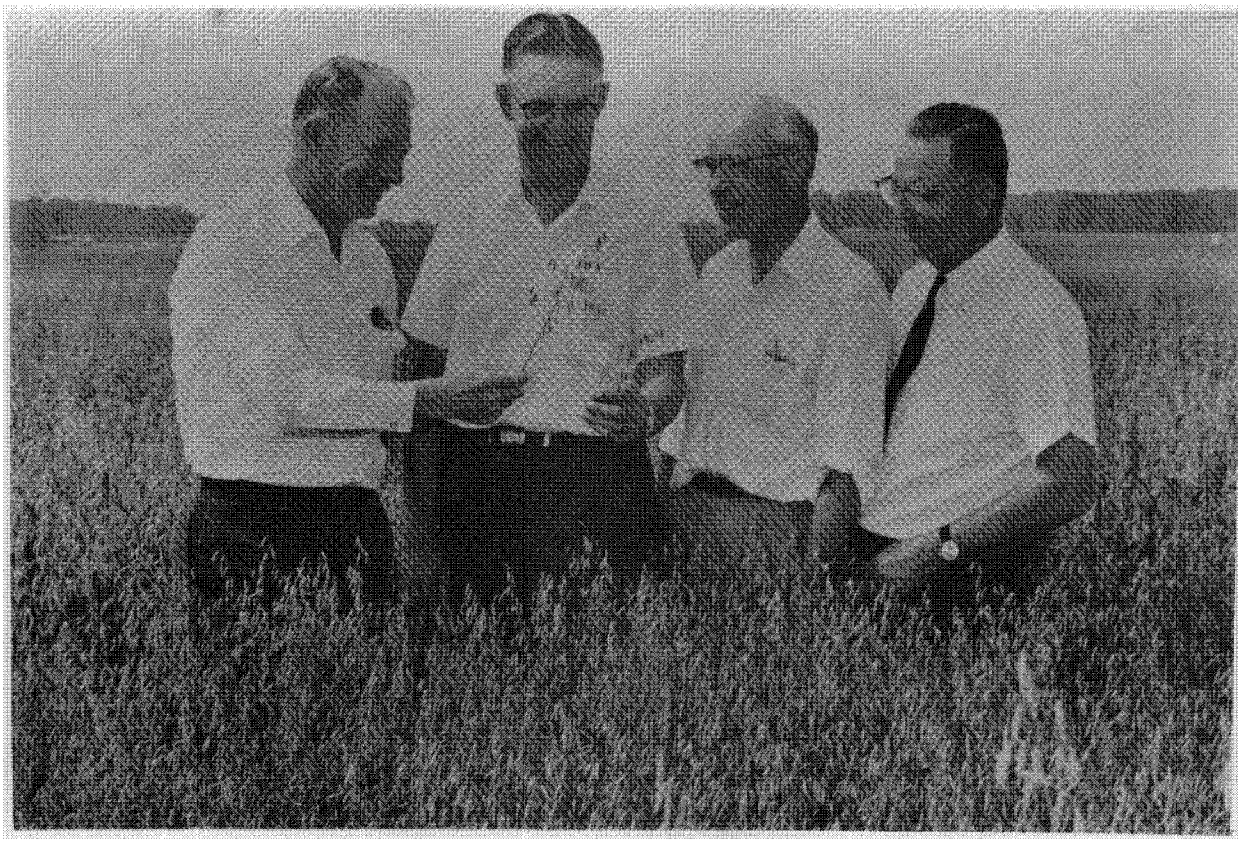
Edited and multilithed by the Department of Botany and Plant Pathology, Iowa State University, Ames, Iowa 50010. Costs of preparation financed by the Quaker Oats Company, Chicago, Illinois 60654.

The data presented here are not to be used in publications without the consent of the authors and citing of material in the Oat Newsletter should be avoided if at all possible because of the general unavailability of the letter.

July 1, 1973

Sponsored by the National Oat Conference

J. Artie Browning, Editor



Mr. Dallas E. Western and Friends

"Real portraiture, the interpretation of a personality, is far more than the mere recording of a face." Thus, no real portrait of Dallas Western is possible without his favorite crop and some of the associates he worked with to improve that crop. This picture of Mr. Western (left) and his friends, Dr. H. C. (Pat) Murphy, Dr. Ralph M. Caldwell, and Dr. Kent Ellis examining an improved oat cultivar at Purdue is a true protrait of Dallas Western. Unfortunately, one ingredient important in his life is missing, Mrs. Irene Western (But the oat cultivar is 'Diana'!).

DEDICATION

To Mr. Dallas E. Western

On October 1, 1972, an era came to an end. The era began with oats of low quality, decimated by rusts and smuts, and badly contaminated with barley and mixed varieties; it ended with superior, disease resistant, high test weight, 150 bushel, 25% protein oats an actuality or in the offing. It is no accident that this era coincided with the active professional career of Mr. Dallas E. Western. It is to this man who "moved mountains" to facilitate oat improvement that, on the occassion of his retirement, this 1972 Oat Newsletter is dedicated.

Dallas E. Western was born September 1, 1907. He grew up on a farm in Union County, Iowa, and attended a one-room country school. Graduating from Creston High School in 1925, he enrolled at Simpson College, Indianola, Iowa, planning to study business administration. But, because of his interest in agriculture, he transferred to Iowa State College to study vocational agriculture and education. In 1929 he graduated from Iowa State with a Bachelor of Science degree.

Mr. Western began teaching vocational agriculture at Jesup, Iowa, August 1, 1929. As coach of a 4-H Club, he developed a champion demonstration team at the Waterloo Dairy Congress. In December, 1933, he moved to Independence, Iowa and became County Extension Director of Buchanan County. He foresaw the benefits of Rural Electrification and was directly responsible for the establishment of the R.E.A. in his county. He also organized a county crop improvement council. He enlisted the cooperation of elevator operators in the county to work toward improving the quality of grain grown in their county. This crop improvement council was instrumental in the establishment of an experimental farm near Independence. Impressed by his crop improvement work, the Quaker Oats Company in January, 1939, hired Mr. Western to establish a Grain Development Department at its headquarters in Chicago.

At the time Mr. Western began his new job, most oats going to market were of very poor quality. Production practices were poor and rusts and smuts ravaged much of the crop. Disease resistant varieties were becoming available, however, and Mr. Western felt that the answer to the problem was to convince farmers to grow these improved varieties and follow recommended production practices. In 1942, he presented the plan to his company and a massive educational program was begun. He presented his story on the radio, in newspapers, magazines, pamphlets, and on posters. Although this program was sponsored by the Quaker Oats Company, the company's name was never mentioned. The complete absence of any form of advertisement of the Quaker Oats Company and the close cooperation between science and industry represented an entirely new concept. In the four-year period from 1942 to 1946, midwestern farmers switched, almost entirely, to improved varieties and, by 1946, most oats going to market were of high quality. This program represented a new standard of public service and Mr. Western received national recognition from such sources as Time Magazine and Business Week.

As the need for such an educational program diminished, Mr. Western devoted more time to support agricultural research. He started a practice of using Quaker Oats funds to support graduate assistantships on oats and corn improvement. Through this contribution many young scientists have obtained graduate training at Purdue University, University of Minnesota, Iowa State University, University of Wisconsin, University of Illinois, University of Missouri, Kansas State University and other educational institutions, his primary objective being to enable promising young agronomists and plant pathologists to obtain graduate education. Men and women trained under his program have become leaders in agricultural research in the United States and throughout the world from Cambodia to Colombia.

Mr. Western used Quaker Oat funds and his own time in a constant effort to support and encourage agronomic research. This support was provided in diverse ways. For example, he used Quaker funds to finance the publication of the Oat Newsletter from its inception to the present time. For many years he wrote a weekly summary of the condition of major crops in the United States and Canada which was read by nearly 2000 agricultural workers and quoted by major news services. His final crop summary, published each year at Christmas, was a masterpiece. He wrote, with W. R. Graham, Jr., a chapter in the A.S.A. Oat Monograph: "Marketing, Processing, Uses and Composition of Oats and Oat Products." (p. 552-578. In F.A. Coffman (Ed.). 1961. Oats and Oat Improvement. Am. Soc. Agron. Monograph 8. Madison, Wisc. 650 pp.)

Mr. Western's interest in the improvement and maintenance of high yielding, high quality cereal crops was not limited to the United States. His influence extended into Mexico, South America, and India. He collaborated with the Rockefeller Foundation in Mexico and Colombia in oat improvement work. Mennonite farmers in Chihuahua, Mexico, are growing superior new oats instead of inferior 50-year-old varieties as a result of his alertness to their needs. He was active in obtaining support and in establishing cereal rust nurseries in Puerto Rico for testing with new, virulent races of wheat and oat rusts.

Mr. Western has appeared repeatedly before Congressional Committees to request increased funds for field crops research in the United States Department of Agriculture. This effort resulted in the establishment of several new research positions and in the achievement of which he is most proud, getting "all the money" to establish the USDA oat quality laboratory at Madison, Wisc. His life-long concern with quality also resulted in grants from his company (to Iowa State, Minnesota, and Wisconsin) to improve oat protein percentage. This rare ability to "get the job done," fortuitously coupled with the discovery of sources of high protein and disease resistance in *Avena sterilis*, and the scientific knowledge, enthusiasm, and leadership of his life-long friend, the late Dr. H. C. (Pat) Murphy, make possible the statement in the opening paragraph about the type of oat that is in the offing.

Because Dallas Western "got things done," he received many honors and held many prominent positions with local, state, and federal agencies and organizations. His many activities included a term as President of the Student Council at Iowa State University in 1928; President of the Agricultural Council of the Chicago Association of Commerce in 1948; member of the American Farm Bureau Federation from 1929 to the present; President of the Grain Improvement Council in Minneapolis, 1953-54; member of the Agricultural

Business Committee, Illinois State Chamber of Commerce from 1944 to the present; Chairman, Illinois State Chamber of Commerce for two years; member of the U.S. Department of Agriculture Advisory Committee for Grain and Marketing Research, 1958-62 (Vice-Chairman 1961, Chairman 1962); member of the Agricultural Relations Council from 1958 to 1970; member of the Agricultural Advisory Committee of the Grocery Manufacturers of America from 1946 to 1972 (Chairman 1959-62); trustee of the Renner Research Foundation in Texas; and other assignments.

Mr. Western is an active member of the Iowa State University Alumni Association and served as chairman of that organization in the Chicago area. In 1964 he received the Iowa State University Club Service Key. Iowa State University presented him with an Alumni Merit Award in 1967. The Quaker Oats Company established the Dallas E. Western Assistantship in Agriculture at Iowa State University in 1968 in recognition of his numerous significant contributions to progress in agriculture. Kansas State University named him recipient of "The Distinguished Service in Agriculture Award" in 1967. Mr. Western is a member and Fellow (1956) of the American Society of Agronomy, and received the Society's Agronomic Service Award in 1963. He is a member of Gamma Sigma Delta, the honor society of agriculture. In 1970 he was recognized and honored for "Distinguished Service to Oat Improvement" by the National Oat Conference. An outstanding oat cultivar, 'Dal,' was named in his honor.

Nearly 200 friends and colleagues from Quaker, agricultural experiment stations, and government agencies gathered in Chicago September 21, 1972, to honor Dallas and Irene Western on the occasion of his well earned retirement from Quaker. His frank but friendly council and annual visits to our nurseries and national and regional meetings will be missed. But the industry-state-federal cooperation he started will continue, and his example of "moving mountains" to facilitate needed crop improvement cannot be forgotten. His larger oat family wishes Dal and Irene a long and happy retirement at their new home in Florida, on their Wisconsin lake, and on their continuing travels about the world.

CONTENTS

CONTENTS

CONTENTS

CONTENTS

I. CONFERENCE AND REGIONAL NOTES

ORGANIZATION OF THE NATIONAL OAT CONFERENCE

EXECUTIVE COMMITTEE

Chairman - C. M. Brown
*Past Acting Chairman - J. E. Grafius
*Secretary - L. W. Briggle
*Editor Newsletter - J. A. Browning

REPRESENTATIVES

North Central Region - J. A. Browning, Dale Sechler, D. D. Stuthman
Northeastern Region - N. F. Jensen, H. G. Marshall
Southern Region - M. C. McDaniel, C. F. Murphy
Western Region - C. F. Konzak, D. M. Wesenberg
U.S.D.A. Technical Adviser - L. W. Briggle
Cereals Staff Scientist
National Program Staff - L. P. Reitz

*Non-voting.

H. K. Hayes 1884-1972

Dr. H. K. Hayes, former Head of the Division (now Department) of Agronomy and Plant Genetics at the University of Minnesota passed away September 9, 1972. Recognizing his long and productive career, the 1970 National Oat Conference selected Dr. Hayes as one of the first individuals to be honored for "Distinguished Service to Oat Improvement". (A brief biography is included in the 1970 issue of the Oat Newsletter.)

Many of the leaders of Agronomy, and especially Plant Breeding, in various parts of the world studied under Dr. Hayes. With that in mind, a scholarship for graduate students in Agronomy at the University of Minnesota has been established. Donations should be sent to the Hayes Scholarship Fund, Department of Agronomy and Plant Genetics, University of Minnesota, St. Paul, MN 55101.

U.S.D.A. Award to

Dr. H. C. (Pat) Murphy (deceased)

Secretary of Agriculture Earl L. Butz on May 1, 1972, conferred Awards of Appreciation upon five outstanding cereal scientists who collectively have given over 200 years' service to the U.S. Department of Agriculture (USDA). The Secretary's Certificate of Appreciation stated, in part: "One of five research investigations leaders of the Agricultural Research Service who, within the same era . . . have established the Department as a world leader in cereal crops research."

The ARS scientists honored are: Dr. C. Roy Adair, research agronomist and Rice Investigations Leader; Dr. Hickman C. Murphy (deceased), research plant pathologist and former Leader of Oat Investigations; Dr. Louis P. Reitz, research agronomist and Leader of Wheat Investigations; Dr. George F. Sprague, research agronomist and Leader of Corn and Sorghum Investigations; and Dr. Gustav A. Wiebe (retired), research agronomist and former Leader of Barley Investigations.

Dr. Murphy's award was accepted by his son, Dr. Charles F. Murphy, an associate professor in the Department of Crop Science at North Carolina State University, Raleigh.

The U.S.D.A. announcement of the award stated: "The late Dr. Murphy had given 40 years of service to the Department before his tragic drowning in 1968 at the age of 66. Appointed Investigations Leader in 1951, Dr. Murphy received the USDA Superior Service Award in 1967. Dr. Murphy figured prominently in international oat research for developing disease resistant oat varieties and in spearheading programs to improve oat quality. Recently, the new cereal rust research laboratory of the University of Tel-Aviv was named in his honor. He was first to screen the world oat collection for resistance to crown rust, one of the most destructive diseases of oats, and to establish a standard procedure for identifying pathogenic races of the crown rust fungus. Dr. Murphy was born in Montrose, W. Va., and received his Ph. D. from Iowa State University, Ames. He was a member of ASA, the Crop Science Society of America, and the American Phytopathological Society."

An extensive writeup on Dr. Murphy appeared in the 1968 Oat Newsletter.

ANNOUNCEMENTS AND INSTRUCTIONS

Errata

M. T. Barradas of Elvas, Portugal, authored a paper, "Some Brief References to Portuguese Oat Problems" on pages 37 and 38 of the 1971 Oat Newsletter. The editor regrets his mistake of assigning authorship of this paper to Miguel Mota, also of Portugal.

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

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

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", in accordance with the rules of the journal concerned.

II. SPECIAL REPORTS

ANALYSIS OF PERCENT PROTEIN OF OATS

Arthur Horberg
Operations Research
The Quaker Oats Company

The objectives of the analysis are to detect differences between varieties of oats and between nursery locations relative to percent protein in the groat. The data are presented in Exhibit 1. It would be desirable to have more data to enhance our precision; however, we were able to establish the following conclusions and make a crude ranking of the varieties and of locations:

1. Variety has a significant effect on percent protein.
2. Location of the nursery has a significant effect on percent protein.
3. Year has a significant effect on percent protein.
4. Variety and location do not interact.
5. Variety and year do not interact.
6. Location and year do interact.

The rankings are presented in Exhibit 2.

METHOD OF ANALYSIS

The percent protein data were first analyzed using analysis of variance on the three factors.

	Factor	Number of levels
A	Years	4
B	Varieties	6
C	Nursery locations	4

ANALYSIS OF VARIANCE TABLE

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares
A	30.289	3	10.096
B	113.418	5	22.684
AB	8.192	15	0.546
C	25.799	3	8.600
AC	66.429	9	7.381
BC	9.462	15	0.631
ABC	37.323	45	0.829
TOTAL	290.912	95	

Assuming the three factor interaction is not significant, its mean square was used as the measure of statistical error.

The variance ratio test was used to test the main effects and interactions.

The ranking of varieties was obtained by averaging percent protein over years and locations for each variety and analyzing the difference of means between varieties. Thus, the varieties were listed in order of decreasing percent protein, and differences between adjacent values were tested for significance.

The ranking of nursery locations was obtained by averaging percent protein over years and varieties for each location and analyzing the difference of means between locations. Thus, the locations were listed in order of decreasing percent protein, and differences between adjacent values were tested for significance.

In both cases, each minimum significant difference was calculated from

$$d = 1.96 \left[(S_1^2 + S_2^2) / N \right]^{1/2}$$

where S_1^2 = variance of one variety (location)

S_2^2 = variance of the other variety (location)

For varieties N= 16 and for locations N = 24.

Exhibit 1

DATA EXTRACTED FROM UNIFORM MIDSEASON OAT PERFORMANCE NURSERIES

Variety		Year	Ames, Ia Percent Prot	Ames, Ia Percent Yield	Brookings, S.D. Percent Prot	Brookings, S.D. Percent Yield
Clintland 64	1	67	21.5	117.9	20.3	114.4
Diana	2					
Gopher	3		17.7	97.0	20.1	105.6
Jaycee	4		20.5	107.2	19.3	100.6
Lodi	5		17.9	119.3	20.2	93.4
Orbit (check)	6		17.5	101.8	17.2	111.6
Clintland 64	1	68	19.1	115.0	21.1	58.4
Diana	2		19.4	92.0	23.5	49.9
Gopher	3		16.8	121.0	19.8	54.2
Jaycee	4		19.3	101.0	22.1	49.8
Lodi	5		17.9	116.0	20.7	60.4
Orbit (check)	6		15.1	113.0	18.6	66.5
Clintland 64	1	69	19.0	70.0	19.4	47.4
Diana	2		19.3	62.0	19.0	51.4
Gopher	3		20.6	41.0	17.0	39.3
Jaycee	4		18.7	57.0	17.1	58.8
Lodi	5		17.4	45.0	17.3	43.6
Orbit (check)	6		16.7	52.0	16.1	70.8
Clintland 64	1	70	19.4	112.0	19.0	70.8
Diana	2		19.0	112.0	17.6	67.8
Gopher	3		17.2	102.0	15.2	58.6
Jaycee	4		18.4	108.0	17.5	59.1
Lodi	5		17.6	117.0	16.3	69.4
Orbit (check)	6		16.7	111.0	15.4	77.9
Clintland 64	1	71	18.8		18.9	102.8
Diana	2		19.8		18.3	96.8
Gopher	3		18.9		15.3	92.0
Jaycee	4		19.3		18.3	90.4
Lodi	5		17.0		17.3	84.5
Orbit (check)	6		18.4		15.3	108.9

% protein Units: percentage - Yield: bushels/acre

Exhibit 1 - Continued

DATA EXTRACTED FROM UNIFORM MIDSEASON OAT PERFORMANCE NURSERIES

Variety		Year	Fargo, N.D. Percent Prot	Fargo, N.D. Percent Yield	Morris, Minn. Percent Prot	Morris, Minn. Percent Yield	Rosemount, Minn. Percent Prot	Rosemount, Minn. Percent Yield
Clintland 64	1	67	19.7	94.0			19.2	81.5
Diana	2							
Gopher	3		21.1	88.0			16.5	57.4
Jaycee	4		21.8	82.6			19.3	49.5
Lodi	5		18.7	100.2			17.0	77.6
Orbit (check)	6		18.2	79.4			15.6	76.9
Clintland 64	1	68	19.8	105.1			18.0	110.5
Diana	2		20.4	87.0			18.3	103.8
Gopher	3		18.0	94.3			16.2	84.8
Jaycee	4		20.4	89.7			18.5	104.4
Lodi	5		18.9	97.5			16.9	103.8
Orbit (check)	6		18.2	91.3			16.3	89.8
							(St. Paul)	
Clintland 64	1	69	18.5	84.4			17.6	98.1
Diana	2		19.2	89.0			19.7	98.1
Gopher	3		16.5	100.8			14.9	86.3
Jaycee	4		18.7	62.2			18.0	83.9
Lodi	5		17.5	116.4			17.6	96.3
Orbit (check)	6		15.4	114.2			15.6	108.0
Clintland 64	1	70	19.7	63.0	19.4	81.6	17.8	78.4
Diana	2		20.6	73.2	19.9	73.9	19.1	75.9
Gopher	3		19.1	80.2	15.4	89.8	15.8	37.3
Jaycee	4		20.5	56.4	19.0	76.9	18.2	60.2
Lodi	5		18.0	74.8	17.4	94.9	14.9	54.2
Orbit (check)	6		18.2	45.4	17.2	100.9	15.8	68.1
Clintland 64	1	71	18.9	108.6	18.4	107.6	18.6	70.0
Diana	2		17.3	111.5	13.6	91.3	18.4	66.6
Gopher	3		15.4	89.2	17.6	94.7	16.8	50.6
Jaycee	4		17.9	87.7	17.3	84.2	15.1	56.8
Lodi	5		16.4	88.6	16.4	96.2	17.9	55.0
Orbit (check)	6		15.1	110.3	16.4	99.6	13.6	46.3

% protein Units: percentage - Yield: bushels/acre

Exhibit 2

RANKING OF VARIETIES BY AVERAGE PERCENT PROTEIN

Variety	Average Percent Protein	Rank	Minimum Significant Difference
Diana	19.3	1	
			0.8
Clintland 64	19.0	1	
			0.9
Jaycee	18.6	1	
			1.0
Lodi	17.5	2	
			1.0
Gopher	17.1	2	
			1.1
Orbit	16.3	2	

RANKING OF NURSERY LOCATIONS BY AVERAGE PERCENT PROTEIN

Location	Average Percent Protein	Rank	Minimum Significant Difference
Ames, Ia.	18.3	1	
Fargo, N. D.	18.3	1	
			1.1
Brookings, S. D.	18.2	1	
			1.1
Rosemount, Minn.	17.1	2	

Response of Stiff-Straw Oats to Nitrogen Fertilization and Seeding Rate

C. E. Collins and C. F. Murphy

Early observations of stiff-straw oat types indicated that there might be some tendency for low tillering potentials among the more stiff-strawed types. This study was intended to indicate such tendencies and to show whether increased seeding rates might compensate for low tillering. Additionally, we were interested in the effects of increased nitrogen rates on these types.

In 1968 and 1969 an experiment was conducted near Clayton, North Carolina, to study the response of stiff-straw oat varieties to varied seeding rates and nitrogen fertilization. The seeding rates used were .75, 1.00, and 1.25 grams of seed per foot of row, and the nitrogen treatments were 70, 100, and 130 pounds per acre. Data were collected on seed yield, test weight, lodging, snap test, height, and tillers per plant. The snap test reading is a subjective measure of resistance of the culm to breaking with 0 being no resistance and 10 signifying high resistance.

The varieties tested were Carolee, N.C. 2469, N.C. 2534, Ora, Nora, X49-1, Clintford, and Milford. Carolee was included as a check variety. N.C. 2469 and N.C. 2534 were advanced breeding lines from a cross of Carolee x Fulgrain. N.C. 2534 has since been released by the North Carolina AES as Yancy. X49-1 is a stiff-straw line from Arkansas.

The experiment included 6 replications of 4 row plots, 8 feet long with 1 foot spacing. Tillers per plant were determined by pulling a two foot section of an outside row and counting the plants and tillers.

The results of the experiment are shown in tables 1 and 2. Yield tended to decrease with an increase of either seeding rate or nitrogen fertilization. Test weight was lower at the highest nitrogen level, but was not affected by the other treatments. Plant height was apparently not affected by the treatments used. Lodging was greater at higher nitrogen levels and higher seeding rates and the snap test data confirmed this.

Dwarf wheats tend to tiller more profusely in response to increased nitrogen fertilization, however, these oat lines did not respond in this manner. It is discouraging to note that there was no yield increase due to tillering at higher nitrogen rates or higher seeding rates. In fact, the high seeding rates tended to decrease total yield as well as tillers per plant.

Table 1. Effects of nitrogen rates on yield, test weight, tillers per plant, lodging, snap test, and height of selected oat cultivars (2 year average).

NAME OF CULTIVAR	NITROGEN RATE (lbs./A.)	YIELD (bu./A.)	TEST WT. (lbs./bu.)	TILLERS PER PLANT	LODGING %	SNAP TEST	HEIGHT (in.)
CAROLEE	70	70.9	31.7	2.1	6.8	4.2	31.8
	100	74.6	31.6	2.0	5.2	3.8	32.6
	130	68.6	31.3	2.2	8.1	4.0	32.4
N.C. 2469	70	65.4	31.0	2.2	1.9	6.0	30.8
	100	65.4	30.0	2.4	.6	5.9	30.5
	130	68.6	30.1	2.6	2.8	5.7	31.4
N.C. 2534	70	71.4	30.7	2.8	2.6	4.3	29.4
	100	71.2	30.1	2.8	4.8	4.2	29.2
	130	70.5	30.3	2.7	4.6	4.4	29.4
ORA	70	75.4	32.4	3.0	3.9	4.4	30.4
	100	74.6	32.4	2.8	6.4	3.8	30.8
	130	69.5	31.7	3.0	7.9	4.8	30.2
NORA	70	82.5	33.1	3.2	3.0	4.4	29.2
	100	77.0	32.2	2.8	6.4	4.3	28.6
	130	77.9	31.9	2.9	9.5	3.8	28.7
X49-1	70	63.2	31.7	2.0	1.2	6.8	38.2
	100	51.4	31.8	2.4	2.4	6.7	38.6
	130	60.2	31.4	2.6	4.2	6.6	38.2
CLINTFORD	70	41.2	32.4	2.0	6.1	6.0	29.2
	100	43.4	32.4	2.2	6.2	6.0	29.4
	130	44.8	31.3	2.0	6.0	5.7	30.1
MILFORD	70	45.8	26.2	2.3	4.8	7.2	28.4
	100	43.6	28.1	2.4	3.6	7.0	29.2
	130	42.4	28.2	2.6	2.0	7.1	29.6
ALL VARIETIES	70	64.6	31.5	2.5	3.8	5.4	30.8
	100	62.6	31.0	2.4	4.4	5.4	31.1
	130	62.8	30.8	2.6	5.6	5.2	31.2

Table 2. Effects of seeding rates on yield, test weight, tillers per plant, lodging, snap test, and height of selected oat cultivars (2 year average).

NAME OF CULTIVAR	SEEDING RATE (gms./ft.)	YIELD (bu./A.)	TEST WT. (lbs./bu.)	TILLERS PER PLANT	LODGING %	SNAP TEST	HEIGHT (in.)
CAROLEE	.75	79.2	31.4	2.3	5.0	4.2	32.8
	1.00	72.0	31.5	1.9	6.1	4.0	32.4
	1.25	63.1	31.8	1.8	8.9	3.8	31.5
N.C. 2469	.75	65.9	30.6	2.6	1.1	6.0	30.8
	1.00	66.8	30.0	2.4	2.6	6.0	30.8
	1.25	66.7	30.6	2.2	1.6	5.6	30.9
N.C. 2534	.75	73.2	30.4	2.9	4.7	4.6	29.7
	1.00	70.5	30.2	2.8	3.5	4.4	29.1
	1.25	69.5	30.4	2.6	3.8	4.0	29.2
ORA	.75	75.7	31.6	3.2	2.5	4.2	30.3
	1.00	71.2	32.4	2.8	6.4	4.0	30.3
	1.25	77.6	32.4	2.8	9.3	4.2	30.8
NORA	.75	86.9	32.6	3.7	4.3	4.4	29.8
	1.00	76.3	32.0	2.8	8.4	3.9	28.4
	1.25	74.2	32.5	2.6	6.1	4.2	28.3
X49-1	.75	64.1	31.1	2.6	2.0	6.8	38.6
	1.00	62.9	31.4	2.4	2.4	6.7	38.8
	1.25	61.1	32.0	2.0	3.4	6.5	38.2
CLINTFORD	.75	42.3	32.2	2.0	2.4	6.2	29.8
	1.00	45.8	32.8	2.0	5.0	5.8	29.8
	1.25	41.5	31.6	2.2	11.0	5.8	29.0
MILFORD	.75	48.0	28.8	2.4	4.7	7.2	29.0
	1.00	47.7	28.4	2.5	2.4	7.0	29.0
	1.25	41.6	28.6	2.4	3.4	6.9	29.2
ALL VARIETIES	.75	66.9	31.1	2.8	3.4	5.4	31.3
	1.00	63.5	31.1	2.8	4.6	5.2	31.1
	1.25	61.3	31.2	2.4	5.9	5.1	30.9

Developments and future prospects in oat breeding.

M. Marwan

Agricultural Research Station, Glen Innes. N.S.W. 2370

Oat breeding techniques have undergone numerous changes and have become more complicated and exacting. Improvement generally deals with two aspects; breeding and agronomic testing, and pathologic testing. The breeding tests are mainly the pedigree and the bulk methods.

Mass selection was man's first attempt in oat breeding. Single plant selection was next employed for the production of pure lines. Single panicle selection followed in the pedigree method scale. Single seed selection is now being used in the pedigree and the modified pedigree method for high productivity. In the latter, a collection of one seed from each plant in the progeny is proceeded with, in the first few generations (19).

Selection for seed quality without affecting viability is now possible. The non - destructive analysis of oil content through nuclear magnetic resonance (N.M.R.) is in practice for maize (1) and soybeans (4). Furthermore, although the non - destructive analysis of protein is still under test (32), yet the evaluation of protein quality through the dye-binding capacity test (D.B.C.) using endosperm scrape only, is now possible (26). All are applicable to oats and enable proceeding with the offspring after screening.

Hybridization in oats became an accepted technique for improvement. Success in crossing is influenced by many factors, either inherent in the plant or environmental which are sometimes uncontrollable. Ageing through cold storage of pollen is one of the attempts towards raising the percentage of seed set (2).

The back cross method is becoming important. It is primarily used for adding some gene for a simply inherited characteristic to an already desirable variety (A x B = AB, AB x A = A^2B). Usually from 4-8 backcrosses are sufficient to recover the prototype of the recurrent parent (17).

Covergent breeding has been little used in oat improvement. The method is essentially a systematic series of single crosses A x B, C x D, E x F, G x H followed by double crosses (AB) x (CD), (EF) x (GH), then quadruples; (ABCD) x (EFGH). Results obtained give evidence that convergent breeding has real possibilities and should not be overlooked (16). A modification based on transgressive recombination; A x B, A x C, A x D, A x E has been proposed (23). Another modification based on combined transgressive recombination and back crossing has further been described. The series of single crosses are first backcrossed to (A) before the double crosses are made A^2 x B, A^2 x C, A^2 x D. If additional intensification of A is desired, additional backcrosses are made before the double crosses (24).

Considerable interest in the use of mutagenic agents to enhance mutation breeding has developed since 1945. Acenaphthene (3, 27) and colchicine (33) as chemical mutagenics have been used to induce polyploids in oats. This is a general practice to obtain fertile amphidiploids from sterile intergeneric

hybrids. Back crossing to the desired parent may be followed (28). Segments of the non-recurrent parent would be retained through crossing over.

Mutagenesis through irradiation has also been applied to oats (9, 12). The suitable dose for seed treatment was found to be between 10-20 K.r. of x - rays, while for pollen, it was between 300-900 r units (13). Chronic gamma rays (29) and fast neutrons on seeds proved to be effective (18, 20, 21, 22). Soaking of seeds in solutions of radioactive phosphorous (P^{32}) simulated radiomimetic effects (7).

Some investigators (5, 6, 8, 15) presented evidence showing that different mutagenic agents could be used to direct or channelize the mutation process. It has also been reported (14) that the utilization of chemical mutagenesis alone, or in combination with ionizing radiation enables the improvement of agricultural plants by the artificial induction of mutations intentionally by design. The use of low radiation doses in combination with low concentrations of chemicals is worth trying for controlled mass improvement through gene mutations in oats.

The main breeding efforts have been towards the production of pure line varieties with vertical resistance which usually took a long time and tremendous effort. Endeavours to cut time short through single head and seed selections, as well as the success in raising three generations per year in the glasshouse using 18 hours photoperiod (10) were successful. However, the change in disease and rust races have limited the effective life of a pure line variety to almost five years in some areas. Multiline varieties (10) produced through back crossing and screened for rust resistance have been recently produced. They consist of genetically different lines mixed mechanically in prescribed proportions. They are also characterized by high productivity and horizontal resistance.

Haploid androgenetic plants, through another culture in Antirrhinum (25), Datura (11) and Tobacco (30) have been lately generated. They are of great importance for plant and oat breeding since homozygosity could be attained in the shortest possible time, even in self sterile plants. Mutagenesis and selection can occur directly in the vegetative stage, thus mutants which can not pass through the sexual phase can be obtained. Whole plants can be regenerated vegetatively from isolated mesophyll protoplasts (31) when few haploids are produced.

References

1. Alexander, D.E., L. Silvela, F.I. Collins, and R.C. Rodgers. 1967. Analysis of oil content of maize by wide - line N.M.R. Amer. Oil Chem. Soc. 44:555-558.

2. Brown, C.M., and H.L. Shands. 1955. Factors influencing seed set of oat crosses. Agron. J. 48:173-177.

3. Cameron, D., and H.D. Garvin. 1952. Acenaphthene as an agent for production of polyploidy in Oats. Scot. Plant Breed. Sta. Ann. Rep. 1952, Edinburgh.

4. Collins, F. I., D.E. Alexander, R.C. Rodgers, and L. Silvela. 1967. Analysis of oil content of soybeans by wide - line N.M.R. J. Amer. Oil Chem. Soc. 44:708-710.

5. D'Amato, F., and A. Gustafsson. 1948. Studies on the experimental control of the mutation process. Hereditas 36:181-192.

6. Ehrenberg, L. 1951. Mutation studies with radioactive isotopes. Rad. Technics. 1:1-10.

7. Ehrenberg, L., A. Gustafsson, A. Levan, and U. von Wettstein. 1949. Radiophosphorous, seedling lethality and chromosome disturbances. Hereditas 35:469-489.

8. Ehrenberg, L., and N. Nybom. 1954. Ion density and biological effectiveness of radiations. Acta. Agr. Scand. 4:396-418.

9. Frey, K.J. 1954. Artificially induced mutations in oats. Agron. J. 46: 49.

10. Frey, K.J., J.A. Browning, and R.L. Grindeland. 1970. New multiline oats. Iowa Farm Sci. 24. (8):3-6.

11. Guha, S., and S.C. Maheshwari. 1966. Cell division and differentiation of embryos in the pollen grains of datura in vitro. Nature (London) 212:97-98.

12. Gustafsson, A. 1944. The x - ray resistance of dormant seeds in some agricultural plants. Hereditas 30:165-178.

13. Gustafsson, A. 1947. Mutations in agricultural plants. Hereditas 33: 1-100.

14. Gustafsson, A. 1963. Mutations and the concept of viability. Recent Plant Breeding Research. pp. 89-104.

15. Gustafsson, A., and N. Nybom. 1949. Colchicine, X-rays and the mutation process. Hereditas 35:280-284.

16. Harlan, H. V., M. L. Martini, and S. Harland. 1940. A study of methods in barley breeding. U.S.D.A. Tech. Bul. 720.

17. Harrington, J. B. 1952. Cereal breeding procedures. F.A.O. development paper N. 28. F.A.O. of U.N., Rome, Italy.

18. Jensen, N.F., G. C. Kent, E. J. Kinbacher, R. B. Musgrave, and L. J. Tyler. 1955. Winter oat breeding. Oat Newsletter 6:62.

19. Kaufman, M. L. 1970. The random method of oat breeding for productivity. Can. J. Plant Sci. 51:13-16.

20. Konzak, C. F. 1954. Stem rust resistance in oats induced by nuclear radiation. Agron. J. 46:538-540.

21. Konzak, C. F. 1955. Helminthosporium victoriae blight resistance in oats induced by ionizing radiations. Agron. Abst. p. 52.

22. Koo, F.K.S., and W.M. Myers. 1955. Induction of resistance and susceptibility in oats to rusts by ionizing radiations. Agron. Abst. p. 52.

23. Mackey, J. 1951. Metodik vid voradling au sjalvbefruktare. Sevensk vaxtforadling. (ed. Akerman et al). Natur V Kulture, Stockholm 1:67-84.

24. Mackey, J. 1959. Morphology and genetics of oats. In handbuch der Pflanzenzuchtung 2:467-494 Paul Parey W. Berlin.

25. Melchers, G. 1972. Haploid higher plants for plant breeding. Z. Pflanzenzuchtg. 67:19-32.

26. Munck, L. 1970. Basic research for development of the nutritional value in cereal protein exemplified by studies of the Hi - ly character. I.A.E.A. Vienna.

27. Nishiyama, K. 1952. Artificial amphidiploids of pentaploid oat hybrids. Bul. Res. Inst. Food. Sci. No. 9 Kyoto Univ.

28. O'Mara, J.G. 1940. Cytogenetic studies on Triticales. A method for detecting the effect of individual Secale chromosomes on Triticum. Gen. 25:401.

29. Singleton, W. R. 1955. A contribution of radiation genetics to agriculture. Agron. J. 47:113-117.

30. Sunderland, N., and F.M. Wicks. 1969. Cultivation of haploid plants from tobacco pollen. Nature (London). 224:1227-1229.

31. Takebe, I., G. Labib, and G. Melchers. 1971. Regeneration of whole plants from isolated mesophyll protoplasts of tobacco. Naturwissenschaften 58:318-320.

32. Weber, C. R. 1970. Dept. Agronomy - Iowa State Univ., Ames, Iowa. Personal communication.

International Oat Rust Nurseries, 1954-1970

R. A. Kilpatrick

Inclusion of oats in the International Rust Nursery Program began in 1954 and has continued through 1972. The objectives were the same as for wheat, that is: (1) to find new genes or combinations of genes in oats which condition resistance to rust and other diseases throughout the world and (2) to test new varieties and promising selections of oats developed by plant breeders and pathologists for reaction to rust fungi.

Data from the International Oat Rust Nursery (IORN) reports were examined to determine the name and number of entries with a disease coefficient of 5.0 or less to crown (leaf) and/or stem rust, origin of material, and to see if a Cereal Investigation (C.I.) number had been assigned to the selection. A summarization of this information is presented herein.

Seventeen IORN reports were examined. The nurseries were composed of a diversity of germplasm. Entries were submitted from Argentina, Australia, Brazil, Canada, Colombia, England, Ethiopia, France, Israel, Poland, Rhodesia, Romania, Russia, Turkey, United States (25 states), Uruguay, Wales, and Yugoslavia. Since 1970, from 77 to 87% of the entries in the yearly nurseries were submitted by breeders and pathologists with in the U.S.

The size of the nursery varied each year. The largest nursery was in 1959 with 203 entries; the smallest occurred in 1962 with 50 entries. Between 1954 and 1972, 2,368 selections were tested or re-tested for reaction to the rusts.

Examination of all nurseries showed that only 38 entries had an average disease coefficient of 5.0 or less to crown rust while 63 entries had a disease coefficient of 5.0 or less to stem rust. Only one entry had a coefficient of 5.0 or less to both of the rusts (Table 1). Further examination of the data showed that all of the low coefficients to stem rust occurred between 1954 and 1958. Since 1958, none of the entries have had a disease coefficient of 5.0 or less to stem rust. The number of entries with a disease coefficient of 5.0 or less to crown rust varied from 1 to 10 in all but four of the years; within these four years, none of the entries had disease coefficients of 5.0 or less to crown rust. Examination of sources reveal that entries with low disease coefficients came from six countries and 11 states (Table 1). Within the United States, selections from Minnesota have been outstanding.

Oat Protein Concentrates From a Wet-Milling Process: Composition and Properties

Y. Victor Wu, James E. Cluskey,

Joseph S. Wall, and George E. Inglett

Protein concentrates, starch, and residue fractions produced by a wet-milling process from ground oat groats with moderate- and high-protein contents were analyzed for amino acid composition, protein, starch, fat, fiber, ash, and various neutral carbohydrates. The concentrates, which have a bland taste, contain up to 75% protein (nitrogen X 6.25) with good lysine and adequate total sulfur amino acids. The concentrates are low in fiber, have around 4% ash and no starch, and contain up to 23% total carbohydrate. Fat content of protein concentrates from nondefatted groats is around 14%, whereas that from defatted groats is less than 2%. The starch fraction is essentially pure. The protein concentrates have good nitrogen solubility around pH 2.5 and above 8, good storage stability, reasonable hydration capacity, and emulsion stability. The groats with higher protein content gave a protein concentrate with better yield, higher protein content, and better total sulfur amino acids than a protein concentrate from moderately high-protein oats.

Oat Protein Concentrates From a Wet-Milling Process: Preparation

James E. Cluskey, Y. Victor Wu,

Joseph S. Wall, and George E. Inglett

A wet-milling process has been developed that produces a protein concentrate, starch, and residue fractions from ground oat groats having moderate- and high-protein contents. Different solvents and pH values were evaluated for their effectiveness in extracting oat protein. The optimum yield of protein was achieved in a dilute alkali solution at pH 9. Starch and protein were separated from bran by sieving the alkaline dispersion. After the fine suspension was centrifuged to separate pure starch, the protein solution was neutralized and freeze-dried. The concentrate had a maximum of 89% protein (nitrogen X 6.25) and up to 88% of the total protein in the starting material. This simple process for producing an oat protein concentrate may have commercial potential.

Protein Concentrates from Oat Groats and Flours by Air Classification

Y. Victor Wu and Arthur C. Stringfellow

Defatted oat groats, as well as derived first and second flours, from two varieties representing normal and high levels of protein content were finely ground and air-classified. Fractions were obtained with protein contents (nitrogen X 6.25) ranging from 4 to 88%. The exceptionally high-protein fraction recovered from oat groats and flours was not previously observed for wheat, rye, corn, sorghum, or triticale flours. This unique fraction accounted for a maximum of 5% by weight, corresponding to 15% of total protein in the starting material. The next fraction (around 27% by weight) had a maximum of 39% protein, corresponding to 43% of the total protein. First and second flours gave fractions with a wider range of protein content than did ground groats, and the high-protein variety gave better results than the normal-protein variety. Amino acid analysis of the fractions indicated good lysine levels and adequate total sulfur amino acids. Data suggest that air classification of oat flours and ground groats can produce protein concentrates which have good amino acid composition and which could be new food ingredients suitable for many uses.

Screening for Protein Content in Oats

Gosta Olsson

A part of the oat entries received from Dr. J. C. Craddock, USDA World Collections, for screening for stem rust resistance (Mac Key and Mattsson, Oat Newsletter, vol. 22 p. 13) has also been used for screening for high protein content. Protein contents in samples with about 90% dry matter are given in table 1 for the entries with the highest protein value. As all entries are not cultivated the same years, protein values are given for every year. The mean values for the years 1969, 1971, and 1972 and for 1970, 1971, and 1972 are given separately.

Many of the entries reviewed of Briggle and Smith in Oat Newsletter, vol. 22 p. 18-20 are not yet investigated under Swedish conditions. Burke 0.120 (CI 4120) and selections from Clinton^2 x Santa Fe, however, have high protein content in both investigations.

Of the tested entries, 4 have an average of 17.0% or more protein. In Sweden, cultivated oat varieties such as Titus, Sun II, Condor, and Selma have in the same trials a protein content of 12.8 - 11.3%. It must, however, be remembered that the high protein varieties are much lower yielding than the cultivated varieties. The investigation will be continued.

Table 1. Some oat varieties with high protein content in Sweden.

Variety	CI or PI No.	Protein content % in sample					
		1969	1970	1971	1972	Mean 1969-71	Mean 1970-72
Forvic x X 216-22	7108	17.7	-	18.0	18.1	17.9	-
Burke O 120	4120	18.2	17.6	17.2	-	(17.7)	-
Klein Va 50-2694	198225	18.3	-	17.0	17.0	17.4	-
Trippecanoe	7680	-	17.0	17.0	-	-	-
Clinton^2 x Santa Fe	6801	17.8	17.0	15.9	-	(16.9)	-
Moutcalm	2564	17.1	-	16.7	16.7	16.8	-
Nemaha x (Neosho - Lanhafer)	7195	17.2	-	16.0	17.1	16.8	-
(D 69 - Bond) x Vanguard	5860	17.9	-	15.7	16.5	16.7	-
Cole	834	18.3	-	16.0	15.7	16.7	-
Purdue 5328 - A3-5P-1-5		-	17.4	16.2	16.6	-	16.7
Arl. x (Wintok x Clinton^2 x Santa Fe)	7220	17.3	-	16.0	-	-	-
Clinton x Kanota	5032	17.3	-	15.6	-	-	-
Copperfield	2338	-	17.4	15.4	-	-	-
Iowa Selection 8	4465	17.8	-	14.9	16.1	16.3	-
Fulghum	998	15.4	16.8	15.9	16.8	16.0	16.6
Fulghum x Laggan	4735	17.5	-	16.2	14.8	16.2	-
Swedish Select	213	17.4	-	16.2	-	-	-
(Mindo - Landhafer) x Clinton	6568	17.8	-	15.7	15.0	16.2	-
(Fulghum x Markton) x (Victoria x Richland)	4141	17.5	-	15.8	-	-	-
(Richland - Bond) x CI 4271	6790	17.9	-	15.4	-	-	-
Green Russian	1891	17.7	-	15.3	-	-	-
Herisson 02812	174553	17.3	-	15.6	-	-	-
Canuck	6816	17.4	-	15.4	-	-	-
From Cambridge	7488	-	15.7	16.0	15.6	-	15.8
Fulghum	1962	17.0	-	15.7	14.5	15.7	-
Andrew x Clinton	5966	17.0	-	15.0	14.5	15.5	-
Early Pearl	1268	17.2	-	13.8	15.4	15.5	-
Silva		-	13.4	13.6	14.1	-	13.7
Titus		14.0	11.7	12.5	14.3	13.6	12.8
Sun II		12.6	12.1	12.0	13.6	12.7	12.6
Condor		-	10.8	10.7	12.8	-	11.4
Selma		-	10.6	11.1	12.1	-	11.3

Progress in Search of Resistance to Crown Rust and Stem Rust of Oats in *Avena sterilis* in Israel

I. Wahl, U. Brodny, Z. Eyal and J. Manistersky

Our recent studies corroborate the results of previous investigations demonstrating that the geographic distribution of race specific resistance to crown rust in populations of *A. sterilis* shows definite patterns. Locations with high concentrations of resistance in past years provided many new promising lines with resistance varying in race specificity. Over 100 of the new selections are highly resistant in seedling trials to races 276, 264, 263, and 238 employed in screening work. Race 263 was included because of its wide host range in populations of *A. sterilis*. The more promising selections are being inoculated with additional races at different stages of growth in order to assess the scope of their protection value. Preliminary data show that some of the selections resistant to the mentioned four races react in the same fashion to races 206, 207, 209, and 230. Resistance manifested at the seedling stage has been preserved in adult plants.

The heterogeneity of *A. sterilis* populations even in small stands in some locations was brought out in the following test. Single panicles were harvested from 33 plants growing along a 30 m ridge and resistant to crown rust in nature. Sets of seedlings derived from individual panicles exhibited diverse reaction spectra to races 276, 264, 263, and 238 in greenhouse inoculation trials. While all seedlings of nine panicles were resistant to each of the four races, progenies of seven panicles were susceptible to any one of them. Seedling sets from the remaining 17 panicles comprised plants resistant either to three races, two races or one race. Similar results were obtained from studies with plants from other locations.

An intensive search for stem rust resistance in *A. sterilis* resulted in our selecting 53 lines which have displayed slow rusting in test plots under conditions of heavy epidemics, caused by artificial inoculation of spreader rows with races 2, 8, 40(=6E), and 72(=6F) of *Puccinia graminis avenae*. Selections which behaved as slow rusters in 1966-68 performed in the same manner in 1970-72.

The new slow rusters are being studied in the greenhouse for their performance to each of the four mentioned races at various stages of growth. A number of these selections, when infected with races 2, 40, or 72, produced hypersensitive reactions as seedlings and on some plant portions at the adult stage, while on other plant portions small pustules developed. None of the selections produced hypersensitive reactions to race 8. It has been proven that certain stem rust isolates elicit hypersensitive reactions on some plant parts and small pustules free of hypersensitivity symptoms on others. The phenomenon of slow rusting is more pronounced in field tests than in the greenhouse experiments.

The predominance of stem races 6F and 8, and of crown rust race group 276-264 since 1950, when a systematic race survey was initiated, cannot be ascribed to preferential selection pressure of the host nor does it support the contention that the so-called excessive genes for virulence reduce the fitness of the races to survive.

Effect of Adult Plant Resistance to Oat Mildew on Grain Yield

I. T. Jones

Welsh Plant Breeding Station, Aberystwyth, U.K.

Breeders are aware of the shortcomings of using major gene controlled immunity or hypersensitive types of reaction to foliar diseases. Consequently, at the Station we have been investigating the possibilities of developing techniques to increase the level of other types of resistance which are less complete in expression, but which may be more durable in their effect.

An experiment was conducted during 1971 and repeated in 1972 to assess the effect on grain yield of selecting for high levels of mildew resistance in early generations of a breeding programme.

F_2 plants and the progenies of F_3, derived from crosses between parents differing in adult plant resistance, namely Maldwyn (moderate infection), Milford, and Sun II (fairly susceptible), were selected for low and high levels of mildew infection under controlled conditions in the laboratory and glass-house, and their progenies tested in field trials as bulked F_8 and F_9 lines.

Plots in which mildew was controlled by spraying with the systemic fungicide tridemorph (Calixin) showed no inherent yield differences between the low and high mildew lines within a cross. In the unsprayed plots in 1972 there was a moderate level of mildew. When scored at growth stage 10 (boot stage), the low and high mildew lines had 12% and 28%, respectively, of the leaf area infected. Nevertheless, the low mildew lines showed a 17% superiority in yield. In 1971, in which mildew attack was more severe, there was an average difference of 41% in grain yield.

So far, the adult plant resistance of the parent Maldwyn, a variety which was in commerce 20 years ago, has proved to be race non-specific, but this resistance is effective only in the later stages of growth.

In both seasons there was a difference between crosses in tolerance as measured by grain yield loss, and important factor in assessing the true merits of varieties with partial resistance.

A spring oat variety with a moderately high level of adult plant resistance has been submitted for registration in Britain under the name Aberystwyth Mandarin.

Survival of Rust Uredospores During Airmail Shipments

J. B. Rowell

Occassionally recipients of spore shipments from the Cereal Rust Laboratory claim the spores arrive in a nonviable condition because they fail to produce infections. Success of infection is a poor criterion of spore viability, particularly when environmental conditions during incubation are uncontrolled. Therefore, tests were made to determine the viability of uredospores of *Puccinia graminis tritici*, *P. recondita tritici*, and *P. coronata* after round trip shipment between St. Paul, Minnesota and Manhattan, Kansas during 1971.

The three rusts were increased on seedlings of suitable susceptible varieties in the greenhouse. Spores were harvested with a cyclone collector, put into 25 x 5 mm vials, and stored in liquid nitrogen. On the day of shipment, 4 vials of each rust species were retrieved from the cryostat, heat shocked, and opened. Two vials were retained at the laboratory; one was used to determine germination immediately and the other was held at room temperature and tested after the spores shipped to Manhattan had returned. One vial was placed in an insulated container of foam plastic (a shipping container for blood samples) and the fourth in an uninsulated cardboard box. The two containers were bound together and shipped by airmail immediately to Manhattan. On receipt there, the containers were reshipped back to St. Paul, where they were opened immediately on arrival at the laboratory and the spores tested for germinability. Three shipments per week were scheduled in late January, mid-May, and mid-July to encompass extremes of weather. The transit time for the various shipments ranged from 4 to 10 days.

Some variation in germinability was found from vial to vial of each rust in the initial germination tests. The range in percentage of initial germination was 70 to 93, 73 to 91, and 67 to 83 for *Puccinia graminis tritici*, *P. recondita tritici*, and *P. coronata*, respectively. Presumably, this variation arose from variations in excessive heat exposure in sealing vials prior to storage. The germination of the uredospores after shipment is listed in Table 1 as a percentage of the initial germination before shipment. No appreciable loss was observed in the germination of the control samples of uredospores held at room temperature for the duration of the shipment except in one vial of *P. coronata*. Germination of all spore samples shipped during May and July was unaffected by the shipment conditions. Severe injury to the spores was apparent, however, after shipment in January. In two of these three shipments, less injury was apparent in the spores enclosed in the insulated container. In addition, sealed vials of spores were included in five of the shipments to determine possible deleterious effects on survival in opened or unopened containers. No differences existed between these containers in the spore germination observed for any of the three rusts.

On the basis of these results, all shipments of rust uredospores made by the Cereal Rust Laboratory will consist of heat shocked spores in sealed vials enclosed in a foam plastic container.

Table 1. Summary of the physiologic races of oat stem rust identified in 1972 from 213 collections and a total of 596 isolates.

	Percentage isolates of physiological race														
Type of collection	1	2	7	8	18	31	32	61	72	76	77	78	87	88	94
Field collections	*	1			*	60	7	31	1						
Inoculated nurseries	2	2	*	4		37	6	25	1	1	3	3	8**	*	5**

* Less than .6%
** Only from the Pennsylvanian barberry nursery

Table 2. Frequency of the most prevalent races of oat stem rust during the last three years.

	Percent of the most prevalent races identified				
Year	7	31	32	61	87
1970	*	63	1	2	11
1971	12	63	5	3	7
1972	*	47	6	27	5

* Less than .6%

Oat Rust in 1972

A. P. Roelfs and P. G. Rothman

Crown rust continued to be the most serious pathological cause of loss in oats. In the winter of 1972, severe crown rust occurred on winter oats in southern Texas. Although few of these oats are grown for grain, they are utilized as winter pasture for cattle. The epidemic killed leaves, reducing forage, and not until a freeze killed the top growth was the epidemic stopped. Crown rust was not a serious problem again during the rest of the growing season except in the major oat growing area of Minnesota and the eastern Dakotas, where a cold wet spring delayed the planting of oats. Generally, crown rust was light in these areas except for a section in west-central Minnesota and east-central South Dakota where crown rust severities reached 50 to 100% by the early milk stage. This severity was sufficient to reduce yields and resulted in test weights as low as 19 lbs per bushel. Fortunately, this section was only a small part of the major oat producing area. There are many known genes for crown rust resistance, but the commercial varieties in this area are susceptible.

Oat stem rust is a difficult disease to explain epidemiologically. All the major commercial varieties in the north-central area of the U.S. except Froker are susceptible to race 31, the most common race since 1965; however, oat stem rust currently is a minor disease of oats. In the past 12 years there has not been a serious oat stem rust epidemic in the U.S., although in 1970 it became severe in Canada and caused some losses in late planted fields in Minnesota and the Dakotas. Also, other races such as 61 and 32 which are avirulent on the commercial varieties in the major oat production areas continue to make up a high percentage of the isolates received on wild oats, Avena fatua. This might relate to a poor competitive ability of the more virulent race 31. There are few known genes for stem rust resistance, but lines are now being developed which are resistant to the current races.

Only traces of oat stem rust were present during 1972. In mid-April of 1971, oat stem rust was observed across southeastern Texas and southern Louisiana with moderate to high severities in many nurseries and trace amounts in commercial fields. At the same time in 1972, trace amounts of rust infection were present over a larger area extending northward into Arkansas and Mississippi, but none was found in commercial fields.

From 213 uredial collections received, 596 isolates were identified. Race 31 again predominated, making up 47% of all isolates. Race 61 greatly increased in prevalence, accounting for 27% of the isolates identified in 1972. The two other most prevalent races, 32 and 87, made up 6% and 5% of the isolates, respectively. All races of stem rust identified in 1972 are listed in Table 1. The frequency of the most prevalent races identified during the period of 1970-72 are presented in Table 2.

Table 1. Survival of uredospores of three cereal rusts after round trip airmail shipment between St. Paul, Minnesota and Manhattan, Kansas.

Date		% of initial germination								
		P. graminis tritici			P. recondita tritici			P. coronata		
Sent	Rec'd	Control	Uninsul.	Insul.	Control	Uninsul.	Insul.	Control	Uninsul.	Insul.
January										
25	28	99	0	38	91	15	40	86	1	36
27	1 Feb	107	12	27	125	65	69	125	2	119
29	1 Feb	117	59	48	128	115	82	53	43	31
May										
17	24	105	105	98	107	105	101	110	98	99
19	25	92	98	99	95	107	103	105	103	103
23	26	97	100	102	96	89	98	95	105	105
July										
17	26	88	95	91	92	94	95	81	103	101
21	27	88	94	86	97	88	87	95	85	98
23	28	87	100	101	103	110	105	100	101	99

Collecting Wild Oats on the Canary Islands

D. R. Sampson

After an 18-year absence from Avena taxonomy it was my privilege to make the field collections of a new diploid species, A. canariensis Baum, Rajhathy and Sampson (Can. J. Bot. 51, 1973, in press). My original mission was to obtain viable seed of A. occidentalis, an extreme form of A. fatua which, in favorable sites, has three or four instead of two florets per spikelet. Durieu first described it in 1865 from the Canary island of Hierro (see Baum, Can. J. Bot. 49:1055-1057:1971). I had 14 map locations on 4 islands of recent collections of A. occidentalis by the late Dr. Johannes Lid, Oslo, thanks to Dr. B. Baum who examined Dr. Lid's herbarium sheets (no ripe seed) and to Mr. Per Sunding, Univ. of Oslo, who provided maps. The plan was to take a one-week return charter flight to the island of Tenerife (3 of the 14 Lid collections) and visit the other western islands from there.

Three weeks before departure, I was in England at the time, I received exciting letters from Drs. Baum and Rajhathy. Baum had discovered two unusual herbarium specimens collected on the islands of Lanzarote and Fuerteventura in 1846. Their spikelets looked like miniature A. magna: very hairy, floret attachment like A. sterilis and lemma tips ending in teeth. Possibly a new species! These two islands were not on my original plan but were now a must. The next week brought bad news from the air line that the charter would be shortened by one day. Mentally I removed the most remote islands of Hierro in the west and Lanzarote in the east from my itinerary.

Thursday afternoon, April 27, 1972, I arrived in Tenerife. As almost all of the rainfall is in winter, this was at the end of the growing season. The rest of that day and the next were spent making travel arrangements and exploring by rented car the northeastern part of the island between Puerto de la Cruz and Santa Cruz. A. barbata was common everywhere, mature and mostly shattered in the lowlands, still green at high elevations and ideal for collecting in between. I was privileged to see a two-acre field of A. strigosa, with some rye admixed, in the uplands near the Los Rodeos airport. Until then I had thought that this ancient crop was no longer cultivated. The plants were 5 feet tall, and too green to obtain seed. The swath cut around the perimeter of the field suggested that it was being grown for forage. Two green clumps of A. sterilis were seen in the area. Finally, in a hot dry valley at sea level just north of Santa Cruz, I found my first plants of A. occidentalis. These could be distinguished at a distance from A. barbata by their more compact mass of yellow glumes.

Saturday I took the two-hour boat trip from Los Cristianos to the island of Gomera and explored the outskirts of the port and capital San Sebastian. The town was parched and barren whereas the mountainous interior, visited by taxi the next day, was a cool, lush paradise. Wild oats were abundant along the roadside and edges of barley and potato terraces. A local youth said that the wild oats were called "balango." The island yielded 13 seed collections of A. occidentalis and 9 of A. barbata whereas no A. sterilis was seen. Gomera was the last port of call of Christopher Columbus on his way to discover America. He purchased here, on his second voyage, the livestock and seeds to begin Spanish agriculture in the New World. In all likelihood there is a direct connection between the wild oats of this island and those introduced into Mexico and California.

Monday I flew from Tenerife, made a brief stop on Gran Canaria where A. occidentalis and A. barbata were collected at the airport, and arrived in Fuerteventura in time to explore the central third of the island by taxi that day. The northern third was visited the next day. In contrast to the moist cool mountains of Gomera, Fuerteventura with its blazing sun and searing wind was a parched treeless land of broad plains and wide valleys, sparse yellowed grass, rocks and a horizon of volcanic cones.

The new species, A. canariensis, proved quite common and occupied a diversity of sites in the interior, usually at elevations above 200 meters. It was picked up on the first stop, and in all at 15 of the 24 localities examined on the island. On asking its local name, I was given the Spanish "avena." A. barbata, A. occidentalis and A. sterilis were also common, the latter two being serious weeds in the small irrigated fields of wheat, barley and lentils. Harvesting was just beginning and I saw one field where the wild oats were carefully pulled and the straw piled for forage prior to taking the wheat. A. canariensis was common along field margins but it was not seen in the fields. It prefers drier and more stony ground. I soon learned to distinguish it from the other species from about ten feet away by its shorter stature and by its greater tendency for the plump, hairy spikelets to remain on the panicles when ripe.

Wednesday I flew back to Tenerife and from there to London with 91 packages of seed, a few herbarium specimens, rich memories and a burning curiosity whether A. canariensis is also present in the drier parts of Tenerife, which I did not visit, as well as on the other islands and neighboring Morocco.

Greenbug Resistance in Oats

Norris E. Daniels and Kenneth B. Porter

Texas Agricultural Experiment Station
Bushland, Texas 79012

Of the 4533 selections in the World Oat Collection, 2384 have now been tested for resistance to the biotype C greenbug, Schizaphis graminum (Rondani). The 10 selections with the following C.I. numbers possess substantial resistance: 1579, 1580, 3223, 4485, 4767, 4770, 4888, 5061, 5068, and 5069.

Report of Progress in International Standardization of Methods of Crop Research Data Recording and Management of Information on Genetic Resources

C. F. Konzak

In cooperation with staff at the Agricultural Research and Introduction Centre, Izmir, Turkey, an improved form for recording information on plant collections was developed, printed at the Centre and used for 1972 collections by the plant exploration staff. Data on the Izmir collections are being made computer retrievable and will soon become more readily available. The principles for an illustrated bulletin of standard methods, codes, and terms for describing variations in important plant characteristics were described at an EUCARPIA Symposium on European and Regional Gene Banks held in Izmir during April, 1972. A report on progress of international standardization in managing information on genetic resources was presented at the 1972 Crop Science meetings in Miami, and Dr. W. E. Walden, Director, W.S.U. Systems and Computing, presented a joint paper on the developing international network for management of information on genetic resources at the 1972 American Society for Information Science meetings in Washington, D. C.

At a meeting of EUCARPIA on breeding and quality of durum wheats to be held in Bari, Italy, in May, 1973, a proposal will be made concerning the development of internationally standardized procedures and rapid screening methods for estimating quality factors of durum wheats via collaboration of breeders, cereal chemists, and the processing industry.

An improved version of the computer information retrieval system TAXIR was installed at Washington State University by R. C. Brill, a co-developer of the system. This newer, more powerful system, now supports USDA Plant Introduction services on the Phaseolus Collection at Pullman, and data banks on Pisum and wheat are being compiled for research and training programs. The new version of TAXIR was provided to Genetic Resource Centers in Ottawa, Canada; Cambridge, England; Braunschweig, Germany; Bari, Italy; and Canberra, Australia, where it is being tested for managing useful information on germplasm collections.

New data on dwarf and common bunt reactions of plant introductions and selections have been made machine readable but a data bank has not been recompiled. Information from the USDA plant inventories and data on the geographic origin of barleys from Turkey and Ethiopia in the USDA World Barley Collection likewise have been made machine readable and will be used for mapping. We are indebted to Firket Demirkan, A.R.I.C., Izmir, Turkey, and colleagues for estimating the sites for the Turkish barleys and to Tareke Berhe, a Rockefeller Foundation Research Fellow at W.S.U. for estimates of the collection sites for Ethiopian barley and for corrections and updates of place names.

T. T. Chang, International Rice Research Institute, Manila, The Philippines, has completed a data bank on the main characteristics of the World Rice Collection maintained by I.R.R.I. Dr. E. Porceddu, Director, Laboratorio del Germoplasma, Consiglio Nazionale delle Ricerche, Bari, Italy is currently

coordinating the assignments of accession series codes used by germplasm centers on behalf of the FAO-IAEA Working Group on International Standardization in Crop Research Data Recording. This function is expected to be transferred to an international coordinating agency when possible.

Rust Fungus Culture Collection of the American Type Culture Collection

W. Q. Loegering

A collection of Plant Rust Fungus cultures was initiated by the American Type Culture Collection in 1964. These cultures are maintained in liquid nitrogen. Urediospores stored for 10 years have shown no drop in germination and it appears that storage under these conditions is permanent. Several cultures of *Puccinia graminis avenae* and *P. coronata avenae* have been deposited to date. Dr. J. B. Rowell, St. Paul, Minn. and Dr. M. D. Simons, Ames, Ia. are on the Advisory Committee to the ATCC Collection of Plant Rusts and advise on the *P. graminis avenae* and *P. coronata avenae* collections, respectively. For cultures available see the ATCC catalogue in most plant pathology departments, or a copy can be obtained from The American Type Culture Collection, 12301 Parklawn Dr., Rockville, Maryland 20852 for $3.00. A Plant Quarantine Shipping Permit must accompany an order for cultures.

It is important that any new or significant cultures be deposited. To do this send a minimum of 10 mg. (more would be desirable) to: Curator of Fungi at the above address. Mark the package PLANT RUST to insure immediate handling. A submission sheet with pertinent data should accompany the shipment. The ATCC can furnish one upon request. A copy of correspondence and the submission sheet should be sent to Dr. J. B. Rowell, if the culture is *P. graminis avenae* or Dr. M. D. Simons if *P. coronata avenae*. No Plant Quarantine Shipping Permit is necessary to send materials to ATCC. There is no charge for depositing a culture.

The American Type Culture Collection is a non-profit service organization dependent on the scientific community for its source of funds. Sale of cultures furnishes only about 50 percent of its income. The rest has been obtained from contracts, grants, and gifts. The present director, Dr. W. A. Clark, has modernized the collection and cultures distributed are as true to type as modern technology permits. At present the ATCC is conducting a Development Program to survive a current financial crisis and develop long term support. The moral and financial support of all who are concerned with agriculture is needed.

OATS PRODUCES CHOICE BEEF

T. J. Conlon

Self-feeding mixed rations of 75% oats, 20% crested wheatgrass-bromegrass hay, 5% alfalfa and mineral supplement to both steers and heifers from weaning to slaughter weights has produced good daily gains and high grades of finished beef for very reasonable feed costs.

Table 1 to 3 summarize data from self-feeding trials conducted during the feeding seasons of 1970-71 and 1971-72 at the Dickinson Branch Station, North Dakota Agricultural Experiment Station.

Table 1. Rations fed, cost and return from feedlot trials with steers and heifers.

Data on:	1970-71 Steers	1971-72 Steers	1971-72 Heifers
Ration fed lb./head/day			
Oats	12.3	13.6	12.8
Alfalfa hay	0.9	0.9	0.9
Tame hay	3.4	3.7	3.5
Minerals	0.2	0.2	0.2
Total	16.8	18.4	17.4
Ration cost/head, $	92.12	93.33	88.00
Return/head over feed, $	227.52	241.58	211.04
Avg. cost/100 lbs. gain, $	13.82	14.80	14.34

Table 2. Weights and gains from feedlot trials with steers and heifers fed rations shown in table 1.

Data on:	1970-71 Steers	1971-72 Steers	1971-72 Heifers
Avg. initial wt., lb.	433	436	353
Avg. final wt., lb.	1099	1067	975
Gain/head, lb.	666	631	622
Days fed	331	302	302
Avg. daily gain/lb.	2.01	2.09	2.06

Table 3. Carcass data from feedlot trials with steers and heifers fed rations shown in table 1.

Data on:	1970-71 Steers	1971-72 Steers	1971-72 Heifers
Hot carcass wt., lb.	654	626	581
Avg. grade 1/	9.1	11	11
Avg. dressing %	59.5	58.7	59.7
Avg. carcass value, $	319.64	334.91	299.04

1/ USDA grades, 9= high good; 11= choice.

Breeding for Earliness and High Forage Yield

T. Kumagai and S. Tabata

Japan

In research to improve oat varieties for both forage yield and early maturity, varietal differences in forage yield and the association of yield with related characters were examined by use of varieties.

When the varieties tested were clipped 74 days after planting (the heading date of Hiuga Kairyō Kuro, a variety commonly grown in the southern part of Japan), Bond and Columbia produced 25 and 22% more forage than Hiuga Kairyō Kuro, respectively. Kanota produced 33% more regrowth than Hiuga Kairyō Kuro and Griesing Winter Hafer 16%, when cut on 5 August. Varieties whose yield was higher at both the first and the second clipping were not found. Rating characters that are components of forage yield showed the culm weight was 40%, leave weight 22%, leave sheath 21% and panicle weight 17%. Water content varied from 67% in the panicle to 81% in the culm. As for heritabilities, the following characters showed the higher estimate: Total weight, width of leaf, length of sheath, leaf weight, and panicle weight. On the contrary, length of leaves, number of leaves, and thickness of culm showed lower estimates. Correlations between forage yield and related characters showed that the results based on fresh weight were different from those based on dry weight. It was found that the weight of dry main culms was associated with both the fresh yield and the dried one. The weight of dry main culms should be noted as an important component of forage yield.

III. CONTRIBUTIONS FROM OTHER COUNTRIES

Oat Production and Problems in Western Canada 1972

J. W. Martens, R. I. H. McKenzie and D. J. Samborski

Production 1972

In 1972, 4,723,000 acres of oats were harvested for grain in western Canada. Average yields of 51.0 bushels were obtained according to Statistics Canada. These yields were well above the long time average despite below normal rainfall in most areas. However, seeding had been early because of a warm month of May. This was followed by a very cool summer which compensated for the low rainfall. There was also very little rust or other disease which certainly was a factor in the good yields. In addition to the 4.7 million acres harvested for grain there were another 1 million acres cut for hay and silage or were pastured.

Oat Rusts 1972

Oat stem and crown rust infections were light or absent on most uniform rust nurseries grown across Canada in 1973, with only 4 out of 27 locations having more than 30% infection to either rust. By the end of August light infections of both rusts were present throughout Manitoba and eastern Saskatchewan, but damage to the crop was negligible.

The stem rust race distribution in Western Canada was the simplest since 1942 with only 2 races, C10 and C23, comprising 99% of all isolates from the area. The rapid increase of race C23, which is avirulent on most commercial cultivars, from a trace in 1969 to 46% of all isolates in 1972 is surprising. The new source of resistance derived from *Avena sterilis* gene pg 13 was resistant to all field cultures in 1972.

Twenty-four races of crown rust were isolated in Canada in 1972. Race 295 was dominant (46%) in Western Canada and race 203, 216 and 326 were also important. The 12 isolates obtained from Eastern Canada comprised 9 different races. All 1972 crown rust isolates were also tested to a new set of differentials based on 10 single resistance gene lines derived from *Avena sterilis*. The frequency of virulence on these lines was low in most cases. No cultures attacked Pc 39 or Pc 48. Seventy-seven percent of all isolates were avirulent on 9 or more of the lines and only 8% were virulent on more than 2 of the new differentials.

Grey Speck

In 1972 the presence of grey speck (manganese deficiency) was verified at Glenlea, our main test location. Some of our more promising lines proved to be very susceptible and their yields were reduced by up to 35%. Random which has proved to have a very stable high yield appears quite resistant. Possibly some of our variety x station interactions are due to grey speck which often can go unrecognized. A close watch for grey speck is planned in 1973.

MULTIFLORET COVERED OAT IN AUSTRALIA

P. A. Portmann

The multi-floret character associated with naked oats has been found in a covered oat selection, XB 181, in our general oat breeding program. In high rainfall situations there can be as many as 6 florets on the one pendulous spikelet. The character ranges from maximum expression under high rainfall (20 inches or more annual) to no expression under low rainfall conditions (12-13 inches or less annual).

Not all plants express the character, even under high rainfall conditions, but it is not known whether this is due to restricted character expression or just incomplete selection for the character. Reselection will have to be carried out to check this.

Tracing of the parents is difficult because the cross is part of a lot of material inherited with the programme.

The cross is M127/Curt. M127 is a selection from the cross Kent/Ballidu, both locally produced varieties which do not show the character. Curt was obtained from the University of California, Davis, California. Both parents are covered varieties.

I have not seen any reference to this character occuring in covered oats, but unsuccessful attempts to transfer it from naked oats have been reported.

Seed of the selection can be made available to anyone who is interested, but will not be pure as it is harvested from yield trials.

The selection is very early maturing under our conditions and is, therefore, best suited to the areas where the character is least expressed. In these areas it is one of our highest yielding selections; better than our current commercial varieties. It would appear to be poor in test weight.

OAT PRODUCTION AND VARIETIES IN VICTORIA, AUSTRALIA

H. J. Sims

The area sown to oats in Victoria has remained relatively stable during the past few years. In 1971/72, approximately 1¼ million acres were sown, of which 825,000 acres were harvested for grain, producing 25,030,000 bushels - an average yield of 30.3 bushels per acre. The remainder of the oat crop was cut for hay, or utilised for complete grazing.

Drought conditions prevailed over Victoria during 1972, and the 1972/73 oat grain harvest will be only a fraction of that of the previous year. A production of only 7 million bushels has been estimated by the Department of Agriculture. Oats are normally grown on non-fallowed land, and production per acre is subject to much greater variation than is the case with wheat, about 85% of which is grown on fallowed land.

The variety Avon, which has been the leading oat variety in Victoria for several years, was displaced in 1972/73 by Swan. The precentage of Avon dropped to 29.3 compared with 35.7% in the previous year, while Swan increased from 31.5 to 40.7%. The other main varieties, in order of popularity, are Irwin, Algerian, Orient, Kent, Cooba, Coolibah, Algeribee, Ballidu, Alpha and Lampton.

Progress report on breeding naked oats in England

G. Jenkins and J.D. Johnson

In 1972, the most advanced selections from our naked oats program were included in yield trials for the first time. All these selections were from the cross AJ 107 (Manu x AJ 20/292), with the *Avena sativa* variety Mostyn and the *A. nuda* variety Caesar included as controls. A summary of the prinipal observations on the best of these selections, compared with the control varieties, is presented in the following table.

No adjustment for husk content has been made to the figures for grain yield since these analyses are not complete at the time of writing. However, an assumed husk content of AJ 107/12/29. This selection was also the highest yielding naked oat at two other centres at which it was included in trials.

We have, therefore, reached the stage when it is possible to grow a naked oat variety which gives approximately similar yields of caryopsis, protein, and oil per hectare as a standard, husked control variety. However, the grain, as harvested, represents a more concentrated feed than that from a normal variety, especially in terms of protein and oil. There is little doubt that further progress could be made — this particular selection is late maturing, for example, and has small grains. The commercial cultivation of naked oats will depend on how advantageous the genetic removal of the husk appears to the farmer, especially the poultry farmer, and the processor.

Performance of naked oats selection at Cambridge, 1973

Variety	Grain Yield (Kg/ha)	Grain Protein Content (%N x 6.25)	Grain Protein Yield (Kg/ha)	Grain Oil Content (%)	Grain Oil Yield (Kg/ha)	No. Days to 50% Panicle Emergence	Straw Height (cm)	Mildew infection (0 - 9)	1000 Kernel Weight (g)
Mostyn	4981	14.2	707	6.7	336	99	90	6.2	24.6
Caesar	3161	16.7	530	9.3	289	96	93	7.8	17.5
AJ 107/12/29	3648	19.3	704	9.1	332	107	89	4.0	20.4
LSD (p = 0.05)	424	0.7	81	0.6	33	1.6	4.6	0.9	1.1

ARKANSAS

F. C. Collins and J. P. Jones

Production. According to the Crop Reporting Service, Arkansas farmers produced an average of 78 bu/A from 100,000 acres of oats. These high yields reflect good management on the part of the grower and the absence of diseases in the major oat growing area. Ora, Nora, and Florida 501 appear to be the most widely grown varieties in the state. Since Nora is apparently equal to Ora in yield and it has slightly more winter hardiness than Ora, we have discontinued the production of Ora Foundation Seed. The Experiment Station at Stuttgart is producing Foundation Seed only of Nora.

Fungicide tests. Seed treatment tests of several fungicides for the control of covered smut of oats were again carried out. Test data are presented in the following table.

Table 1. Seed treatment for covered smut (*Ustilago kolleri*)[1/] of oats at Fayetteville, Arkansas, in 1971-72.

Treatment[2/]	No. of smutted heads[3/]
1. No treatment	430
2. Panogen 15 0.06 oz	6
3. Thiram 4 oz	242
4. Thiram 6 oz	312
5. Vitavax T 3 oz	0
6. Vitavax T 4 oz	0
7. Vitavax T 6 oz	0
8. Benlate T 3 oz	0
9. Benlate T 4 oz	0
10. Benlate T 6 oz	0
11. BASF - 3191 3.5 oz	0
12. BASF - 3191 7 oz	0
13. RH - 124 ST 1 oz	259
14. RH - 124 ST 2 oz	370
15. Milstem 6.7 oz	220
16. Milstem 13.4 oz	523
17. TCMTB - 30 0.5 oz	53
18. TCMTB - 30 0.6 oz	67
19. B - 1843 4 oz	27
20. B - 1843 6 oz	84

1/Naturally infected seed 19% smut. Variety Compact.
2/Active material per 100 lbs. of seed. Dry formulations applied as slurries.
3/Per plot of five 15 foot rows. Planted September 28, 1971, counted May 9, 1972.

The systemic fungicides Vitavax (carboxin), Benlate (benomyl) and BASF-3191 (2,5-dimethyl-3-furylanilide) eradicated smut at all rates tested. Vitavax and Benlate have previously shown control of smut in earlier tests. The other two systemic fungicides, RH-124 (4-n-butyl-1,2,4-triazole) and milstem (5-butyl-2-ethylamino-4-hydroxy-6-methylpyrimidine), exhibited no control of smut. With the exception of Panogen-15, the remaining compounds showed varying degrees of smut reduction. Apparently, TCMTB-30 (2-thiocyanomethylthio-benzothiazole) and B-1843 (trans-1,2,-bis n-propylsulfonyl ethylene) eradicated the spores on the seed surface but failed to affect those located beneath the glumes.

Tests were also conducted with the systemic fungicides Plantvax (oxycarboxin), El-273 (a-2,4-dichlorophenyl-a-phenyl-5-pyrimidinemethanol) and El-279 (a-2-chlorophenyl-a-cyclohexyl-5-pyrimidinemethanol) for control of crown rust. The compounds were applied as single foliage sprays at early jointing. Application rates of active material per acre were 3 and 4 lbs of Plantvax, and 4 and 8 oz of El-273 and El-279. Adequate rust control was not obtained with any of the treatments.

Fertilization. A nitrogen fertilizer study on Nora oats was conducted at the Rice Branch Experiment Station near Stuttgart by Dr. Bobby Wells. The experiment consisted of 18 treatments representing nine levels of nitrogen with split applications at the higher N levels (Table 2).

Table 2. Response of Nora oats to 18 nitrogen fertilizer treatments at Stuttgart, Arkansas, in 1972.

Fertilizer treatment in lbs N/A					
Total	Application date			Grain yield	Protein
rate	3/9/72	3/31/72	4/14/72	lb/A*	%*
0	0	0	0	2999 a	12.85 a
20	20	0	0	3066 a	12.80 a
40	40	0	0	3489 bc	14.18 b
60	60	0	0	3359 bc	14.15 b
60	30	30	0	3463 bc	14.58 bc
80	80	0	0	3511 bc	15.30 cde
80	40	40	0	3476 bc	14.90 bcd
100	100	0	0	3456 bc	15.98 efg
100	50	50	0	3488 bc	15.38 def
120	120	0	0	3415 bc	16.10 fgh
120	60	60	0	3619 bc	16.50 ghi
120	40	40	40	3486 bc	16.55 ghi
140	140	0	0	3328 bc	16.33 ghi
140	70	70	0	3653 c	16.60 ghi
140	47	47	46	3577 bc	16.75 ghi
160	160	0	0	3489 bc	17.00 i
160	80	80	0	3613 bc	16.88 hi
160	54	53	53	3454 bc	16.90 hi

*Duncan multirange range test was used to compare means; any two means followed by the same letter are not significantly different at the .05 level.

Urea was the form of N fertilizer used. Yields were not increased significantly by applying more than 40 lb of N per acre; however, percentage protein tended to increase with increased rate of N. Yield and percentage protein were correlated ($r = 0.77$). Seed weight was not affected by the N treatments; the mean 1000 seed weight was 36.2 grams. The apparent lack of N response was probably due to the late spring drouth which was more severe than normal. Percentage protein was based on Udy analysis conducted by the Oat Quality Lab. We appreciate their services.

Germplasm. A "hairy" leaf trait, which was found in *Avena sterilis*, is being backcrossed into Nora. We hope the pubescence will provide resistance to the cereal leaf beetle. If sufficient seed is available this fall, Dr. J. A. Webster has agreed to evaluate some of the lines for beetle resistance. The inheritance of the trait appears to be relatively simple; the F_2 segregation ratio fit a 3 to 1 ratio very closely. Pubescence was dominant. Leaf pubescence may be linked with the fatuoid type of seed, but we are finding an occasional hairy plant that has normal seed. There is a considerable variation among plants for the amount of pubescence; just how much of the variation is due to genetic and environmental factors has not been determined.

An interesting dwarf oat was found in a segregating population from a cross between Diana and a sister line of Nora. Plant height in the field is about 15 in for the dwarf compared to 37 in for Nora while the height of both is very similar in the greenhouse. Both grow about 30 in tall in the greenhouse. Since the dwarf has a head type similar to Diana, it may have some value in breeding programs where additional dwarf genes are needed.

Personnel. Leon Clement completed his Ph.D. studies and accepted a position with Delta and Pineland Company. Tracy McGraw has joined us and will be working on an M.S.

FLORIDA

R. D. Barnett, H. H. Luke, and W. H. Chapman

Rye continues to replace oats for much of the acreage of small grains grown for forage production. Only 13,000 acres were harvested for grain in 1972, yielding on average of 32 bu/A, down sharply from the 49 bu/A harvested in 1971.

The 1971-72 growing season was very unfavorable for oat production. Dry weather prevented planting in early fall and excess moisture delayed the soybean harvest into late fall, resulting in a further delay in planting. The December-January period of the 1971-72 season was the warmest in 40 years. A severe freeze on January 15 and 16 caused considerable winter killing because the oat plants were in a tender condition due to the unusually warm weather which had preceded the freeze.

Crown rust and Helminthosporium avena were both very severe and caused significant yield reductions. Florida 500 and 501 were damaged by crown rust in commercial plantings for the first time in Florida this past year. Several newer varieties (Elan and Georgia 7199) have been released, but they have Fla. 500 as one parent and are no better for crown rust resistance than Fla. 501. Florida 501 and Elan are the most disease resistant varieties available to Florida growers and they are the only two varieties currently being recommended.

In the 1972 yield nurseries, only 5 of 50 lines tested, yielded above 80 bu/A. Most of top yielders were advanced Coker lines. The top yielding varieties were Florida 501, Elan, and Cortez.

A one-half acre increase block of an advanced oat line (FL67AB113) that was being considered for release was grown this past year. It had been completely resistant to crown rust in four years of previous testing, but it too developed crown rust and also appeared susceptible to culm rot. The decision was made not to release it at the present time. A sample of the crown rust was submitted to Dr. Marr D. Simons at Iowa State University for race identification. On the standard differential varieties, it key out to race 325, currently one of the most common races. The reaction of certain supplemental differentials, however, showed it to be a rare biotype that parasitized several sources of resistance that are resistant to most biotypes of race 325. Other seedling test showed FL67AB113 to be highly resistant to races 202, 264B, 290, and 326; and moderately resistant to race 264A.

Groat samples from 125 lines from our 1972 nurseries were submitted to the National Oat Quality Lab for protein analysis. Protein content ranged from 15.0 to 23.7% with a mean of 19.8%. This compared with a mean of 16.3% for 70 samples from our 1971 nurseries. The higher protein content of the 1972 samples is probably due to the lower yield level. Four PI296266(A. sterilis)/Fla. 500 lines which had above 22% protein were included in a yield test for the first time this year.

The following data show the percent protein in the groats of ten lines for three year period.

Line	1970	1971	1972	3 Year Avg.
Florida 501	15.4	14.4	17.1	15.6
F167AB113	14.9	15.1	17.5	15.8
FL69HR652	16.4	14.9	17.3	16.2
FL66AB43	16.6	16.3	17.7	16.8
FL67OIR125-8	16.3	16.3	18.4	17.0
FL67AB596	15.5	17.3	20.1	17.6
FL68Q2764-7	16.3	19.1	19.7	18.3
FL67AB599	16.8	17.8	20.6	18.4
FL67OIR113-6	17.6	17.4	20.7	18.5
FL69HR1446	19.7	18.8	21.9	20.1

There was some shifting in the rankings, but generally the low protein lines were consistently low and the high protein lines were consistently high.

We have one diploid oat (A. strigosa) that may have potential as a forage oat in the deep south. We are planning expanded forage tests with it this coming year.

GEORGIA

Acton R. Brown (Athens), Lloyd R. Nelson (Experiment),
Darrell D. Morey and Robert H. Littrell (Tifton)

In 1972, approximately 2 1/2 million bushels of oats were produced on 65,000 harvested acres in Georgia. The average yield was only 38 bushels per acre because of crown rust, barley yellow dwarf virus, other diseases and spring drought.

Preliminary tests with seed treatments to replace panogen and ceresan show the most effective non-mercurial cleared for farmer use to be captan 37.5 + maneb 37.5 used as a slurry 2 oz/cwt or as a dust 4 oz/cwt. Our 1972-73 seed treatment results show other materials to be equivalent but not superior to the captan + maneb combination. Seedling survival in the field was increased approximately 12-14% by treating the seed with fungicides as compared to non-treated. Materials used in addition to captan + maneb included captan + thiram (4 oz/cwt), vitavax + thiram (4 oz/cwt), vancide 51 (4 oz/cwt) and captan + maneb + terracoat (2 oz/cwt). Laboratory results show that treating the seed with vitavax + captan, vancide 51 or captan + thiram reduced seed inhabiting fungi over that of other materials in the test. Oat seed not treated with fungicide contained approximately 37% Helminthosporium avenae and other seed inhabiting fungi. Additional testing will be necessary but research results to date indicate suitable replacement materials are available and should be equivalent or superior to the standard panogen or ceresan treatment.

IDAHO

D. M. Wesenberg and R. M. Hayes

'Cayuse' averaged 91.0 bu/A and ranked first in yield among 20 entries in the Uniform Northwestern States Oat Nursery at 14 nonirrigated stations. 68Ab710 (Cayuse x 'Orbit') ranked first in yield at 9 irrigated stations with an average of 156.6 bu/A. Cayuse averaged 151.1 bu/A in the 1972 irrigated trials. 'Dal' was highest in protein content among the 20 entries in the Uniform Northwestern States Oat Nursery. It averaged 19.8 percent protein based on Kjeldahl determinations for groat samples from four locations. Protein content of the 20 entries ranged from 14.1 to 19.8 percent.

Cayuse and 'Park' continue to be the most popular oat varieties in Idaho. A number of selections yield more than Cayuse and Park in replicated trials in southern Idaho; however, low test weight and low protein content are unfortunately often associated with high yield.

63Ab5100-1 ('Clinton' x^2 'Overland' 2x 'Sauk' x 'Simcoe'), a Park-type oat, is being considered for release as a Park replacement. 63Ab5100-1 averaged 8 percent higher than Park in yield at 23 irrigated and nonirrigated locations in 1972. It is superior to Park in test weight and about two days earlier in maturity.

ILLINOIS

C. M. Brown, H. Jedlinski and M. C. Shurtleff

Approximately 470,000 acres of oats that produced an average yield of 61 bushels per acre were harvested in 1972 in Illinois. Although spring oat seeding was delayed by wet weather, the crop developed rapidly and grain yields and test weights were generally good. Frequent rains that began prior to maturity and continued throughout the harvest season caused severe lodging and delayed harvest particularily in Northern Illinois.

Garland and Jaycee continue to be the most widely grown varieties in Illinois. The variety Otee, Ill. 66-2287A, C.I. 9086, that was distributed to certified seed growers for planting in spring 1973 is expected to occupy a significant acreage in future years. Otee is described in the new variety section of this newsletter.

With the exception of halo and stripe blights, there was a conspicuous absence of diseases in spring oats in Illinois during the 1972 growing season. A wet and cool spring with late planting was a contributing factor to higher than average incidence and severity of these two blights in most varieties and selections. The variety Dal appeared to be more susceptible than other varieties in drill plots at Urbana.

A severe outbreak of barley yellow-dwarf occurred in winter barley and winter wheat but was very mild in winter oats. The distribution patterns and occurrence of infections suggested that the virus spread in the fall and that vectors preferentially avoided oats. These observations were made in winter barley and winter wheat nurseries, in adjacent winter oats and in surrounding fields of spring oats. Although an aphid survey was not made, visual observations indicated that Rhopalosiphum maidis was the most predominant aphid species present in the fall. Transmission tests showed that the barley yellow-dwarf virus isolates were of a vector-non-specific type and were readily transmissible by the corn leaf aphid. Absence of barley yellow-dwarf virus in spring oats was attributed to temperatures apparently unfavorable for aphid overwintering and to a very low aphid migration in the spring.

Indiana

F. L. Patterson, H. W. Ohm, D. N. Huber, G. E. Shaner, J. J. Roberts, R. E. Finney (Breeding, Genetics and Pathology), Kelly Day, O. W. Luetkemeier (Variety Testing) and B. J. Hankins (Extension).

The 1972 Season. Due to very wet field conditions in Indiana during April of 1972, oat grain acreage was drastically reduced to 201,000 acres harvested--67% of that in 1971. Some of the oat acreage was planted unusually late. Our nursery plots at Lafayette were planted on April 26 and 27. Fortunately, wet and cool weather conditions prevailed throughout the growing season resulting in state average yields of 59 bu/a. Disease incidence was generally very light. Crown rust and stem rust infection occurred late in the growing season. Probably due to the late planting (longer days, warmer temperatures) many of the A. sterilis derived high-protein lines showed uneven heading in our nurseries.

Research. Two studies (in press) on gene action for groat protein indicate that the high protein in Avena sterilis is moderately heritable, recessive and that the genetic variation is primarily additive. These studies involved sterilis X sterilis and sativa X sterilis crosses. Two additional studies initiated in 1972 and which involve high protein (21 to 22% - groats) sativa X sterilis - derived lines intercrossed in a diallel fashion and one high-protein line crossed to 15 A. sativa diverse varieties, support the above results.

Nitrogen and two chemicals, tenoran and simatryne, were applied to 'Diana' and 'Clintford'. Available N in unfertilized plots was 42 lb/a (1/2 as NO_3 and 1/2 as NH_4) measured at planting and at heading. Nitrogen was applied to the fertilized plots at the rate of 80 lb/a at planting and 25 lb/a in the late boot stage. Chemicals were applied at late boot and immediately after heading at two rates, 0.1 and 0.2 lb/a active ingredient. Nitrogen tended to increase yield and protein content. Application of the chemicals increased percent protein but decreased yield.

In another study, high levels of fertility increased yields of tall and short strawed oat genotypes. The taller genotypes tended to lodge more, however, lodging was not severe in 1972.

We have been unsuccessful in finding levels of pubescence which result in effective resistance to the cereal leaf beetle (CLB). Certain of the A. sterilis genotypes exhibit low levels of pubescence. We have intercrossed various sources of this pubescence hoping to increase the levels of pubescence.

We have also treated several lots of seed with gamma radiation (at Oak Ridge, Tenn.) and dES. We are presently screening M_2 seedlings for pubescence. We hope to conduct an induced mutation program for CLB resistance on a much larger scale beginning in 1973 by planting a large M_2 population in the field in a beetle-infested area.

Varieties. Seed of two new oat varieties, Purdue 6215A2-1-2 and Purdue 5939B1-3-9-3-5 has been increased for probable release in 1973. Names and CI numbers are pending.

Purdue 6215A2-1-2 is an improved Tippecanoe type. It has been in the 1971 and 1972 USDA Uniform Midseason Spring Oat nurseries. It is moderately resistant to the BYD virus disease, but has limited resistance to the rusts being susceptable to current predominant races. It has high yielding ability and good lodging resistance.

Purdue 5939B1-3-9-3-5 has been grown in the USDA Uniform Midseason spring oat nursery since 1969. It is a short, stiff-strawed line with a compact panicle (from Milford) and will be recommended for growing on highly productive oat land. It has crown rust resistance from PI174544 and the B and D genes for stem rust resistance. It is moderately susceptable the BYD virus disease.

A more complete description of both lines will be presented in the 1973 Newsletter.

IOWA

K. J. Frey, J. A. Browning, M. D. Simons, and K. Sadanaga

One reported successful avenue for increasing protein percentage in the grain of cereals is mutation breeding. Scholz increased barley protein by 2.0 to 3.0%, but none of the mutant lines yielded as high as the parent cultivars. Tanaka and Takagi found mutant rice lines with 16.0% protein from a parent cultivar that had 6.0%.

We tested mutant and check lines from 11 cultivars for groat-protein percentage via the Kjeldahl procedure. From 2 cultivars, Goodfield and Tippecanoe, it appears that we have isolated several high-protein mutant lines. In 1970, the Goodfield check had a mean groat-protein of 20.9%, and 6 mutant lines had contents between 23.5 and 25.3. The mutant lines grown in 1972, ranged from 21.6 to 24.4% groat protein, whereas the Goodfield check averaged 21.3%.

The check mean groat-protein percentage for Tippecanoe in 1970 was 16.7 and 13 mutant lines had percentages between 19.0 and 20.9. In 1972, these mutant lines ranged from 19.8 to 22.9% groat protein, whereas the Tippecanoe check averaged 16.9%.

From the 1970 experiment, several other cultivars produced mutant lines which had high groat-protein content, but upon rechecking them in 1972, their groat-protein percentages were no greater than the highest check lines.

Mutant and check lines of Tippecanoe, Goodfield, and several other cultivars will be tested in a rod-row yield trial at Ames in 1973. Additionally, mutant populations of Dal, Clintford, Grundy, and X434II (C.I. 9170) have been started. Seed from M_3 spaced plants from these populations will be ready for analyses after the 1973 season.

Ray Shorter, from Brisbane, Queensland, Australia, has joined the oat project as a graduate assistant.

KANSAS

E. G. Heyne and E. D. Hansing

Oats were seeded on 225,000 acres in Kansas in 1972. The average yield per acre of 44 bushels was the second highest on record (45 bushels in 1971) but was the sixth smallest crop since records have been kept in Kansas. There has been an increase in use of oats for pasture under irrigation in some western areas of the state. Much of the seed is shipped into the state and is of the Cherokee-Nemaha type. However, there is an increase in the amount of late maturing types that have been used primarily for grazing.

The oat research program in Kansas has been reduced to a testing program of material developed in other states. Cultivars that performed well in 1972 include Trio, jointly released in 1971 by Nebraska and Kansas; Pettis and Nodaway 70, two Missouri cultivars; and Neal and Andrew that have been grown for a number of years.

Winter oat bulk hybrids are being grown in southern Kansas locations. There was no winter killing in winter oats in our 1972 tests and yields over 100 bushels were obtained in tests at Hutchinson in south central Kansas in 1972.

Loose smut and covered smut of oats, once major diseases of this crop, have been kept well under control, principally through resistance. Except for a small acreage of Kanota, all of our spring cultivars have sufficient resistance to be virtually free from these diseases under field conditions.

In addition to the fungicides carboxin (Vitavax) and benomyl (Benlate), combinations of carboxin and thiram (Vitavax-Thiram), and benomyl and thiram (Benlate-T), when applied to the seed, have been equal to or better than volatile mercurial fungicides for control of these smuts. Although volatile mercurial fungicides have been cancelled, through research we now have fungicides which not only are highly effective for the control of these smuts, but we have systemic fungicides which do not add heavy metals to the soil.

Michigan

J. E. Grafius and Dimon Wolfe

We will release Mariner oats to growers of certified seed in the spring of 1973. This oat was tested in the uniform mid-season nursery as 60-106-78.

Mariner is a medium early, high performance white oat from the cross of 56-22-1493 x Garry. It is earlier and shorter than Garry and has had a better record of yield, test weight and lodging resistance. It is susceptible to common races of leaf and stem rust.

Foundation seed is available through the Michigan Foundation Seed Association, Inc., P. O. Box 466, East Lansing, Michigan, 48823.

MINNESOTA

D. D. Stuthman, M. B. Moore, and L. W. Briggle

The harvested oat acreage was 2.5 million acres, down .5 million from 1971. Total production was 130 million bushels, also a decrease. Many farmers in the west central area of Minnesota experienced considerable difficulty seeding because of excess moisture. Much of the planting was delayed at least one month and many fields were not planted at all. Crown rust infection in that area was extremely heavy and caused considerable damage in many fields. Growing conditions in the balance of the state were favorable, however, resulting in average yield for the state of 53 bushels per acre.

The performance of several varieties at the Morris station (west central) relative to other locations in the state is noteworthy. The varieties E72, M72, Dal, and Chief, all having good crown rust resistance, were the highest yielding at Morris. State wide (six locations) Chief and Dal also yielded well (third and fourth of 32 entries), but E72 and M72 yielded less (26th and 13th). We feel that the crown rust protection of the multiline varieties was partially responsible for their higher performance at Morris. In contrast, Sioux and Lodi were the lowest yielding at Morris, but were ranked 16th and 21st state wide. Neither variety is resistant to crown rust in our buckthorn nursery. Large differences between resistant and susceptible varieties for bushel weight and groat percentage were also observed.

Many F_6 lines derived from P.I. 277989 have been resistant to crown rust in the buckthorn plot up to and through the 1972 regular season. However, all of a number of them in a late planting (June 26) were more or less susceptible suggesting a late season build-up of a race or races not detected in earlier plantings. Greenhouse tests indicate that diverse races are involved and that the P.I. 267989 derivatives are definitely susceptible to some races.

PERSONNEL ITEMS

Dr. L. W. Briggle has joined the Minnesota oat group as a result of the recent USDA reorganization. He will continue to coordinate regional performance nurseries as he did while located at Beltsville, MD. Lee will also be conducting basic studies supporting the oat variety development program at Minnesota.

Professor M. B. Moore will retire on June 30, 1973, after a number of years on the staff of the Department of Plant Pathology. Responsibility for research on the rust diseases of oats will be transferred to the Cereal Rust Laboratory and will be under the direction of Drs. J. B. Rowell and P. G. Rothman. Research on the non-rust diseases of oats will be the responsibility of Dr. R. D. Wilcoxson.

In Agronomy Robert Granger and Robert Steidl have completed their degrees. Dr. Granger is now employed by Cargill Inc. Steidl received his M.Sc. and is working with Dr. J. E. Grafius at Michigan State University on his Ph.D.

In Plant Pathology Mr. Larry Singleton will complete his Ph.D. work in August and Mr. Howard Schwartz his M.S. in June.

MISSOURI

Dale Sechler, J. M. Poehlman, Leo Duclos, Paul Rowoth, and Lewis Meinke

1972 Production. Harvested oat acreage was down to 175,000 acres, the lowest since 1969 and the second lowest in record. Average yield was also down to 44 bu/acre. Apparently there is an increased interest in the use of oats for hay, however. Grain quality was poor in many areas due to the extremely dry weather late in the season and to various disease problems.

Diseases. The BYDV disease was extremely severe in Southern Missouri with some fields being abandoned. Damage was more moderate in the central area of the state but grain yield and quality were reduced. Crown rust was present in many areas and a little stem rust came in very late in the season. Smut was prevalent in many fields. Halo blight was also prevalent in the northern part of the state.

Varieties. Jaycee, Pettis, and Nodaway 70 have been the most widely grown spring oat varieties. The new Otee variety has done extremely well in Missouri tests, however, and will likely become a major variety as seed becomes available. Only a few winter oats are grown and these are in the extreme southern part of the state.

Breeding. A series of very severe winters have almost eliminated winter oat seedstocks but it is hoped that this surviving nucleus of material will offer a base from which to improve on winterhardiness. In the spring oat program some selections with improved BYDV disease resistance and improved plant type are showing very good yield potential. Low test weight appears to be a problem in some of the very short lines. High protein sativa and sterilis lines are being used to improve protein content in the high yielding, BYDV resistant material.

NEW YORK

N. F. Jensen

ASTRO - Current Status. From 1972 production approximately 2,000 bushels of Foundation Seed will be distributed to growers for 1973 Certified Seed production. Thus, it might be anticipated that first sales to farmers for the 1974 season would be in the neighborhood of enough to plant 30 to 40 thousand acres.

Cornell Oat Crown Rust Resistant Composite.

Seed from the 1972 crop in 1-lb. lots are available on request from Jensen. A description of this germplasm stock, developed in cooperation with Dr. G. C. Kent, Dept. of Plant Pathology, follows.

This broad germplasm composite was developed at Aurora, New York where the alternate host of crown rust, buckthorn, is endemic (as indeed it is throughout most of New York) in hedges, woodlots and forest. For perhaps two decades we have used this area for oat research and about five years ago we began serious formulation of a composite which would be recycled annually with growth at Aurora and seed processing at Ithaca. The present composite has gone through 3 formal cycles at Aurora and Ithaca, although much of the original material derived from previous work at Aurora.

The composite is based upon the assumption that mature, plump, hard oat seeds could only develop in an epiphytotic crown rust environment if they had some form of resistance, whether general or specific. The composite derives from such varied inclusions as collections, winter oats, hundreds of hybrids in the early generations; further, annual or periodic additions of hybrid seed and M2 seeds (x-ray) are made. Annual processing of the seeds results

in a discard of 85-90% of the crop. For example, 60 bushels of the 1971 crop was reduced to 6 bushels of plump hard seed. Processing procedures are many and varied and include initial screening and blowing, 6 hours in an augur soil-mixing wagon, further screening, gravity grading, and so forth. The test weight of the processed 1972 crop is 44 lbs. per bushel. For plant selection purposes the composite may be considered heterogeneous homozygous (that is, treat selections as presumed pure lines and disregard or further select in lines that segregate).

We have sampled the composite the past 2 years with selected heads. The 1972 head rows were predominately characterized by high resistance in a wide range of plant types.

We suggest space planting in wide rows for plant (head) selection. We use a seeding mixture of a ratio of 6 dead seeds to 1 live seed from the composite and plant through the 2-3 and 7-8 holes of a 9-hole farm drill. This gives adequate random spacing within rows and walking space between rows.

The composite's intended function is to serve as a source of crown rust resistant lines for testing and use either as parents or a released variety.

We wish the widest public use of this material and retain no rights to selections a breeder may make (but it's always nice to receive source credit). The germplasm stock will be available at all times; a requester will always receive the latest cycle of processed seed.

NORTH CAROLINA

C. F. Murphy and T. T. Hebert

After record yields for seven of the past eight years, the 1972 crop year was disastrous. Record high temperatures were recorded through December and half of January, when we suddenly experienced a drop from 70° to 4° in a twenty-four hour period. This one cold spell effectively eliminated the piedmont oat crop and severely damaged the coastal plains acreage. Additionally, barley yellow dwarf virus was common and rains from Tropical Storm Agnes hindered harvesting and further reduced yields. This combination of factors cut production from 6.4 million bushels in 1971 to 3.4 million bushels in 1972.

David M. Kline -- We are sad to report the sudden death, on December 23, 1972, of Dave Kline. While Dr. Kline was employed by the USDA to work on barley diseases, he was an important contributor to the total small grain effort in North Carolina and in the region. He will certainly be missed by those of us who had the privilege of knowing him and working with him.

NORTH DAKOTA

J. R. Erickson and D. C. Ebeltoft

Oat acreage in North Dakota in 1972 was 2.1 million acres, very close to the five year average. Yield per acre was estimated at 51 bushels, resulting in a total production of 107.5 million bushels. The varieties Kelsey, Sioux and Cayuse occupy the majority of the acreage.

Some oat breeding was started in 1972 after a five year period during which only testing was conducted. Currently 1/4 PMY is directed to oat breeding with possible future expansion. Mr. Dennis Miller has begun graduate work on a study of the effect of production variables on oat quality for food and feed purposes. The Dickinson Experiment Station is conducting a feeding trial with feeder cattle comparing high protein Froker vs. lower protein Kelsey.

OHIO

Dale A. Ray

Production. The 1972 harvested oat acreage and production estimates for Ohio of 367,000 acres and 22,387,000 bushels, respectively, represented decreases of approximately 30 per cent when compared with the 1971 figures. The state average yield of 61.0 bushels per acre in 1972 also was about 7 bushels below the 1971 average. Cool, very wet conditions prevailed through the normal period for seeding and early vegetative development. Late spring and early summer weather was excellent for oat growth. Most of the crop was harvested on schedule but late-summer rains in some areas delayed harvest and reduced yields with shatter loss. Oat diseases generally were light. Cereal leaf beetles were evident state-wide in oat fields but did not appear to cause serious effect on yield.

Oat Varieties. Clintford was the most widely grown variety. Clintland 60, Garland and Jaycee varieties also were recommended. Results of the state-wide variety yield trial showed Orbit, Holden and Jaycee highest for average grain yield and Clintford highest in rank for bushel weight and for the lowest lodging score. Otee and Dal varieties performed well in the yield trial and are being considered for recommendation.

Oat Breeding. Thirteen selections from the crosses of *Avena sterilis* x common oat varieties were compared with standard varieties in a replicated rod-row yield nursery. Several selections were promising for yield but were only fair for bushel weight and kernel quality. Thirty-five additional selections from this material were observed in small multiplication plots for reselection. Selections from the Clintland 60-Rodney x Putnam 61 material continue to be promising in rod-row performance tests. Mr. Leonardo Corral, graduate associate, is conducting field and greenhouse tests on the chemical induction of male sterility with Clintford oats. Results to date have been somewhat inconsistent in regard to producing effective sterility but may prove interesting for other restrictions on plant growth and development. Breeding and selecting for improved survival continues to be the major objective in the work with winter oats.

OKLAHOMA

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

Production

Prospects for the 1972 oat crop were very promising in December, 1971, but the outlook began to fade when a winter drought extended into early spring. Freezing temperatures in late March and then unseasonably hot weather in early April caused further deterioration. These bleak prospects began to improve when late April rains, along with cool May temperatures, helped fill heads and compensated for some of the earlier losses. This year's oat crop totaled 5.8 million bushels, compared with the 1971 production of 5.4 million bushels. Harvested acreage of 155,000 was down 6 percent from a year ago, but the average yield of 37.5 bushels per acre was up 5.0 bushels from the previous year.

Oat Varieties

Checota and Chilocco continue to gain in acceptance by the Oklahoma farmer. Ora and Nora continue to be popular varieties, however, their performance was reduced in 1972 as the result of severe winter killing.

Breeding

Major emphasis is placed on obtaining greenbug resistance in winter hardy types. Crosses have been made to incorporate the greenbug resistance from P.I.186270 into adapted winter oats. In preliminary screening of these crosses there seems to be some resistance in these populations.

PENNSYLVANIA

H. G. Marshall

Production. Pennsylvania farmers planted 400,000 acres of oats during 1972, but only 362,000 acres were harvested for grain. This is down 69,000 acres from 1971. Weather conditions were generally unfavorable for oat production because of hurricane Agnes during the month of June and subsequent heavy rainfall that extended into July. Many fields were abandoned because of severe lodging. In addition, a considerable acreage was green chopped because of feed shortages associated with the unfavorable weather. The estimated average yield over the state was only 46 bushels per acre.

Cultivars. The Pennsylvania Agricultural Experiment Station recommends the cultivars Garry, Pennfield, Orbit, Russell, Clintford, and Jaycee spring oats; and Norline and Pennlan winter oats. Pennwin (C.I. 8312) winter oats was recently released, and is described in the New Oat Cultivars section of this newsletter.

Breeding. The cooperative USDA-Pennsylvania program to develop cultivars with sufficient winter hardiness and straw strength for northern areas of winter oat production was continued. Winter survival was generally poor in Pennsylvania, and a breeding nursery near University Park was completely winterkilled. Most of the winterkilling at a location in Lancaster county (southeastern Pennsylvania) was associated with snow mold caused by *Fusarium* species. The importance of this component of winterkilling and possible controls are being studied.

Many of the winter oat bulk populations produced in this program now have been blended into composites for efficient handling during future years. These populations will be grown near University Park each year where the rigorous winters should favor natural selection of the more winter-hardy genotypes. Lines will periodically be extracted by selection among individual plants in space planted blocks. Also, selection pressure for short plant height and early maturity will be periodically applied to early generation composites to prevent undesirable natural selection changes toward tallness and lateness.

Thousands of multiple crosses have been made in this program during the past 14 years, and the progeny have been handled by the bulk or bulk composite approaches. Based on the winter hardiness of my populations as well as that of the Uniform Bulk Composite, which contains elite germ plasm from various states, it seems unlikely that those gene pools will provide the winter hardiness breakthrough that is needed to make winter oats a safe crop in the current fringe areas of northern winter oat production. Some continued improvement for winterhardiness will undoubtedly result from transgressive segregation in these or similar populations, but a big, rapid improvement for this characteristic is not likely to result from the continued intercrossing of present winter oat cultivars. One source of genetic diversity is the wild hexaploids. *Avena ludoviciana* is a weed species associated with winter oat culture in certain areas of the world. *A. fatua* shows an affinity for the colder climates, and is a common weed in wheat culture. We are devoting some effort to screening the wild hexaploids for high freezing resistance. Several outstanding collections have been crossed with winter oat tester parents and the F_3 bulk populations are in the field this winter. Hopefully, the wild oat genes will complement those from the winter oat cultivars, and result in significant transgressive segregation for winter hardiness. We would be interested in receiving seed of any wild hexaploid which might contribute to genetic diversity for winter hardiness.

SOUTH DAKOTA

D. L. Reeves

Production. Oat production was reduced by a late, wet spring. The total production is estimated at 99,862,000 bushels with an average yield of 49 bushel per acre. Oats in the eastern edge of the state were severely infected with crown rust. Fortunately the weather remained cool and wet; therefore, losses due to crown rust were only a fraction of the damage that was possible from the infection present. The severe crown rust infestation combined with excess rainfall caused many fields to completely lodge in the eastern edge of the state. Stem rust incidence was very low.

Breeding. Major emphasis is being placed on improving straw strength and crown rust resistance. Most of the resistance being used in this program is from cultivated oats; however, a few crosses do utilize resistance derived from *Avena sterilis*. Most of the material is being analyzed for protein to select lines which are high in protein.

Personnel. Mr. David Hanson recently joined the oat project. He will be working on simulated hail study on oats. These studies may also help in understanding the problem of blast. This research is possible through a grant from the Hail Insurance Adjustment and Research Association.

U T A H

R. S. Albrechtsen

Utah's oat acreage has reached a new low, primarily because of the inability of oats to compete favorably with barley as a feed crop. Renewed interest in oats for the human food market shows some possibilities for expanded production. Indications are that oats could compete much more favorably with other crops in the state through widespread use of improved varieties and the adoption of improved cultural and management practices to utilize the potential of these varieties. The 1972 state-average yield was estimated at 52.0 bushels per acre. Average yield of all entries in the 1972 Uniform Northwestern States Oat Nursery grown at Logan was 171.3 bushels per acre; Cayuse, the top-ranking entry yielded 201.0 bushels per acre. This is an unusually large gap between yields realized by growers and those possible and obtained in the nursery.

A number of Aberdeen selections performed well in the Uniform Nursery. Park, one of the more widely grown varieties in the state, yielded 35 bushels per acre less than Cayuse. Bannock and Markton yielded poorly, at least partially due to lodging of 40 and 30 percent, respectively, in these two varieties. Other entries showed little or no lodging. Diseases were absent in the nursery and were of little consequence in commercial production.

Our involvement with oats is presently confined to evaluation of entries in the Uniform Northwestern States Oat Nursery, plus additional varieties or advanced selections of interest to us.

In studies of crosses between cultivated oats and A. sterilis, we have observed several interesting characteristics:

1. Leaf pubescence was discovered and stabilized in Texas breeding material derived from A. byzantina x A. sterilis crosses. A detailed description of this character will be published (Crop Science -- January - February, 1973). A variety having this trait has been increased for release (New Oat Cultivar section).

2. Repeated studies of crosses of PC45, a crown rust resistance gene derived from A. sterilis (See 1971 Oat Newsletter, page 2) with several susceptible cultivated oats have shown that the expression of this gene is very different in different genetic backgrounds. When crossed with Pendek, the gene is dominant (as reported by Fleischmann, et. al.). When crossed with C.I. 6994, the gene is partially dominant. In a cross with 239-58-6 (Texas experimental line), the gene is recessive. Pendek, C.I. 6994, and 239-58-6 are all completely susceptible to the culture of race 264 B of Puccinia coronata f. sp. avenae used in these studies. This observation may explain why we have sometimes found it easier to maintain the A. sterilis resistance if resistant F_2 plants were used as the resistant parent in backcrosses rather than F_1 plants.

3. Albino seedlings have been observed in a few lines derived from A. sterilis x cultivated oat crosses. Ratios of normal: albino seedlings vary widely in selections taken from lines in which albino plants were first observed. We can supply small quantities of seed of lines segregating for this trait if anyone is interested.

OATS RESEARCH IN WASHINGTON

C. F. Konzak, E. Donaldson, M. A. Davis, K. J. Morrison and G. W. Bruehl

Variety Development: Advanced yield trials were conducted on F_5 lines of Cayuse/CI2874 and reciprocals. These lines were selected for yellow dwarf tolerance with the cooperation of Dr. C. O. Qualset, University of California at Davis, California, and for agronomic seed quality traits in Washington. A number of the lines proved to yield significantly higher than Cayuse at Pullman, and under irrigation at Royal Slope. Several of these will be entered in the Northwestern States Regional Oat Nursery in 1973. Many lines at Royal Slope yielded above 180 bu/acre and were competitive with the better spring wheat varieties.

Cayuse was bested in trials at several locations in Washington, but no single variety had the wide adaptability and high over-all performance shown by Cayuse in these trials.

Future Directions: A small number of new crosses were made using the better Cayuse/CI2874 lines in combinations with other sources of yellow dwarf tolerance, and with high protein germplasm sources. Day-insensitive lines derived from Med 147 were received from Canada and will be used in 1973 crosses. The ten best winterhardy winter oats (received from H. G. Marshall, Penn. State) were tested for survival at Pullman in the 1971-72 winter. The best two lines survived only about 50 percent, one was a winter oat and the other a fully spring habit line, as determined from a planting in May, 1972. The formation of crowns near and above the soil surface is considered a possible reason for the poor showing of winter oats. Some advanced spring habit wheat lines showed 95 to 100 percent survival in the same locations.

Induced Mutation Research: A cooperative effort was developed with Darrell Wesenberg at the Aberdeen Station to isolate mutants useful for oat improvement. Samples of a mutagen (EMS, MNU) treated M_2 generation of the Aberdeen selection 63Ab5280-7 were grown under irrigation at the Royal Slope station, and a few promising short semidwarf selections were isolated, although a low number of mutants were present in the population. However, a sample of the M_2 lot was again treated in 1972 and will be screened in 1973. Oat hulls seem to increase the difficulty of getting adequate chemical mutagen treatments. One or two of the new mutants should be useful parents for straw shortening and straw strength improvements especially for irrigated oat production. It was hoped the material would be suitable to select for protein increases but anticipated that the 1973 M_2 may have a higher mutation yield and be better for that purpose as well. An M_2 of oats treated with azide will be tested also in 1973. Azide has proved to be an efficient mutagen in barley and is extremely inexpensive and easy to use.

WISCONSIN

H. L. Shands, R. A. Forsberg, R.D. Duerst, and Z. M. Arawinko

Wisconsin State Oat Yields and Variety Performance

The 1972 season started out very wet and delayed planting of spring grains in Wisconsin much later than usual. After planting, there was a period of drought for several weeks which was broken about mid-July. After mid-July, rains came frequently and in heavy amounts and continued well into the harvest season. Production capability for the state was generally high because there were many fields that had heavy grain in panicles. Unfortunately, rains continued beating down fields and allowing weeds to grow. Perhaps as much as 10% of the fields were not harvested. Even in late November there were some farmers trying to harvest grain and straw. Grain was usually stained and yields were reduced over that which might have been had if the harvest season had been good. Even so, harvested grain yielded only 7 bushels per acre less than the all-time high. There are many reports of stained seeds with low germination. Wisconsin nursery yields at Madison were relatively high, being among the highest in several years. The 1/60 acre plot yields were somewhat lower, being more affected by the early season drought than the later-planted nursery. Most of the oat diseases made their appearances but probably did not greatly influence yield.

In the breeding program there is considerable emphasis being placed on producing selections with high groat protein. There has been excellent cooperation by the Oat Quality Laboratory. It appears as though test selection X1656-1 has higher groat protein than Dal.

Application has been made with the U.S. Department of Agriculture for variety protection of Dal oats. Under this arrangement, it is expected that Dal may be sold only as a class of certified seed. If protection is granted and if only certified seed may be sold using the Dal name, it appears to some of us that multiplication of this variety may be much less rapid than with prior oat varieties distributed from Wisconsin.

Dal Oats

Brief description and history.

Dal oats was developed from a series of crosses, the final one being X660, an unnamed selection, crossed with Beedee. Yields in Wisconsin have been very similar to those of Froker. Heading and ripening are midseason to late, and straw height and strength are almost identical to that of Froker. Grain color, plumpness, and bushel weight resemble those of Beedee. Limited mixtures of fluorescing grain, and taller strawed plants are recognized. Groat protein has averaged about 2 percent more than Froker. Dal has more leaf rust resistance and a little more stem septoria susceptibility than Froker. Dal is resistant to smut and has host genes AB for stem rust resistance. A leaf spot appears more on Dal than Froker; yet yields of Dal have been satisfactory.

Performance as reported by seed growers.

Seed of Dal oats was released by the Wisconsin Agricultural Experiment Station to 117 growers in 1972. Certified seed is available for general farm production in 1973. Of growers reporting their results for 1972 to Professor Reuben James, 93 had an average of 69.7 bushels per acre for Dal compared to 66.9 for Froker. There were some abandoned fields, primarily because of poor harvest conditions. In paired comparisons where Dal and another variety of oats were grown by the same person, Dal exceeded the yields of other varieties, ranging from 2.4 bushels per acre to as much as 11.2 bushels per acre. The seed growers probably were generous to Dal in reporting their yields, especially when compared to Experimental Station results where Dal was slightly below Froker in yield.

Personnel Items

Paul Lyrene, after being with the armed forces for about 18 months, rejoined the oat workers at Madison and is continuing his graduate studies. Gordon Cisar, a graduate of Platteville State University, joined the Wisconsin group in early 1972. Mr. Y. A. Chae and D. C. Sharma are involved in oat investigations as graduate assistants.

Support

Gift funds provided by the Quaker Oats Company are gladly acknowledged.

Wisconsin growers of certified seed reports of their oat yields, 1972.

Variety	Number of reports	Bu. per A average	Variety	Number of reports	Bu. per A average
Beedee	32	62.4	Holden	49	62.9
Dal	93	69.7	Lodi	31	59.3
Froker	93	66.9	Portal	15	62.9
Garland	10	61.3	Rodney	15	56.9
Garry	23	62.8	Orbit	7	62.1

Varieties compared	Number pairs	Bu. per A	Varieties compared	Number pairs	Bu. per A
Dal	31	72.5	Froker	12	61.4
Beedee		61.5	Portal		62.2
Dal	84	70.0	Froker	14	56.1
Froker		66.4	Rodney		56.6
Dal	22	68.5	Beedee	30	61.8
Garry		62.7	Froker		66.8
Dal	43	68.3	Beedee	14	57.4
Holden		63.9	Garry		61.1
Dal	30	66.0	Beedee	20	60.7
Lodi		59.8	Holden		65.0
Dal	13	64.0	Beedee	17	56.1
Portal		61.6	Lodi		56.8
Dal	13	64.7	Garry	18	63.3
Rodney		53.5	Holden		62.2
Froker	20	64.2	Garry	16	62.1
Garry		63.2	Lodi		61.3
Froker	46	66.7	Holden	20	58.9
Holden		63.7	Lodi		55.7
Froker	29	63.0			
Lodi		59.1			

Wisconsin
Oat Quality Laboratory (USDA)
V. L. Youngs, K. D. Gilchrist, and D. M. Peterson

The National Oat Quality Laboratory (USDA) is continuing its cooperation with U.S. oat breeders in an attempt to increase the protein quantity in oat groats without sacrificing quality. This Laboratory will analyze or supervise the analysis of approximately 26,000 samples during the 1973 fiscal year (July 1, '72-June 30, '73)--an increase of 44% over the last fiscal year. These samples are being submitted from breeders in 15 states.

This year we are using a dye binding method for most of the analyses. In this method, acid orange 12 dye binds to the three basic amino acids of the oat protein, and percent protein is related to the change in dye concentration due to the binding. We included 117 checks at two protein levels in the first 10,000 samples analyzed. Sixty-seven of these had a mean protein concentration of 15.4%, and the remainder, 19.5%. Standard deviations from these means were 0.36 and 0.21, respectively. About 4% of the 10,000 samples were selected either at random, or specifically selected because of a dubious value, and re-analyzed by macro Kjeldahl. Correlation between all Kjeldahl and dye binding protein values was 0.97, and the difference between the means of the two methods was only 0.2%.

WISCONSIN

Y. Pomeranz, G.S. Robbins, and J.T. Gilbertson
Barley and Malt Laboratory, U.S. Department of Agruiculture, Madison

Oat investigations in the laboratory can be conveniently divided into three groups:

a) studies on the structure of the oat kernel by scanning electron microscopy,
b) changes in maturing and malted grains, and
c) amino acid composition.

Studies on maturing grain are conducted in cooperation with Dr. H. L. Shands. Changes in malted oats are part of comprehensive-comparative investigations on modifications in malted cereals.

Amino acids in oat species, oat tissues, and oat products are determined in a study conducted in cooperation with Dr. V. L. Youngs. Surveys of amino acid contents of oats include studies on the effects of protein contents and N-fertilization (in cooperation with Drs. L. W. Briggle, H. G. Marshall, H. L. Shands, and D. H. Wesenberg).

TEXAS

M. E. McDaniel, F. J. Gough, J. N. Henshaw, J. H. Gardenhire, K. B. Porter, Norris Daniels, K. A. Lahr, M. J. Norris, Earl Burnett, Lucas Reyes, and A. R. Shank.

Production: The 1972 season was not favorable for oat production in Texas. Of the 2,100,000 acres planted, only 360,000 acres (17% of that planted) were harvested. The average yield of the harvested acreage was only 27.0 bushels per acre. Abandonment was abnormally high in the primary oat seed production area of Texas, the Central Blackland region. Extremely mild temperatures prevailed throughout this region until the first week in January; then, a sudden freeze severely damaged or completely killed the oat crop.

At College Station, no sub-freezing temperatures were recorded until a low of 17°F was reached January 3. Day temperatures had ranged from 60-80°F for several weeks just prior to this time. Oats could not withstand the shock of the sudden and extreme temperature change. Winter wheat varieties were damaged less seriously.

Due to low grain prices and exceptionally high livestock prices, a higher percentage of the oats (as well as the other small grains) has been utilized exclusively for winter and spring forage in Texas in recent years. Since properly managed oat pasture in Central and South Texas may produce over 500 pounds of animal gain per acre (worth over $200 at current livestock prices), this trend seems justified.

Rusts: Crown rust was extremely severe in South Texas in 1972, and caused serious damage to all commercial varieties. Florida 500 and Florida 501 yielded only 10-12 bushels per acre at Beeville because of crown rust damage. Ora was completely killed in the juvenile stage. Cortez and Suregrain produced the best grain yields of any of the commercial varieties tested. However, these varieties produced less than 50% as much grain as resistant experimental lines. Yields of 60-70 bushels per acre were common for experimental lines with resistance derived from *Avena sterilis*. Two rust-resistant *A. sterilis* derivatives developed by the Texas Agricultural Experiment Station are being increased for release in South Texas (see New Oat Cultivars Section).

Stem rust infection was late and caused little damage in any Texas oat production area.

Breeding and Genetics: Extensive studies of oat photosynthesis have been completed by J. N. Henshaw, PhD graduate Student. Rates of photosynthesis were measured in oat varieties and hybrids. Genotypic differences in photosynthetic rates were significant. No appreciable heterosis for rate of photosynthesis was observed in any of the F_1's tested. Reciprocal F_1 data indicate a maternal effect on photosynthetic rate. The correlation between photosynthetic rate and grain yield was poor. Broad-sense heritability estimates of photosynthetic rate in oats were very low.

V. OAT CULTIVARS

Status of F. A. Coffman's Oat Classification

Oat workers of the United States and elsewhere, will be interested in knowing that the long-delayed Oat Classification manuscript has now reached the USDA editors.

Hopefully it will shortly be approved by USDA officials and passed to the typesetters.

Material for an International Oat Register.* Ottawa 1973

B. R. Baum

The main part of this reference book is a list of 4200 oat cultivar names with homonyms, synonyms and commercial synonyms in use in different countries, translations and transliterations. In addition there is a foreword, an introduction which deals with relevant problems such as oat cultivar classification and nomenclature, and with the sources upon which the work is based, including personal communications.

The work was begun in 1968 and completed last year. A preliminary account was published in 1969 (Baum, B.R. Pedigrees and other basic data of cultivars of oats: world-wide material that is needed for identification and registration.) and since then oat breeders and others from very many institutes and stations across the world have sent valuable information to the author helping him to make this work more complete. All the names, including the homonyms, synonyms, commercial synonyms translations from 24 different languages and transliterations are cross-referenced, and the authority for the assignment of synonyms cited where possible. In other cases these have been ascertained by the author. In most cases a pedigree chart for each individual cultivar has been elaborated, with the parentage traced back as far as possible. The computer system which was used for retrieving the information and for elaborating the register with the pedigree charts was described earlier (Baum, B.R. and B.K. Thompson. Registers with pedigree charts for cultivars: their importance, their contents, and their preparation by computer. Taxon 19: 762-768. 1970).

*Material for an International Oat Register, C.D.A., 266 pp. 1973. Available from Information Canada, Ottawa; Catalogue no. A52-4772; Price $9.00.

Registration of Oat Varieties

J. C. Craddock and F. A. Coffman

Interest in the registration of crop cultivars started 50 years ago. In 1923, a "Memorandum of Understanding" to register crop cultivars was signed by the American Society of Agronomy and the U. S. Department of Agriculture. T. R. Stanton, Fred Griffee, and W. C. Etheridge formed the first "Registration Committee" for oats. This committee assembled applications and information needed for the registrations. Their first report was published in 1926 by the Journal of the American Society of Agronomy: Volume 18, Number 10, pages 935-947. The report listed 62 varieties that had been registered.

T. R. Stanton was the senior author of the reports for 1927, 1928, and 1929, but changes occurred in the other committee members. The oat registration committee was discontinued after the 1929 report. However, T. R. Stanton continued to prepare the reports through 1952 (Reports IV through XVI).

In 1955, H. C. Murphy assumed the responsibility for the oat registrations. He continued the reports through 1961 (Reports XVII-XXIII). The last report to appear in the Agronomy Journal was Report XXIII published in 1961: Volume 53, pages 402-403. By 1961, registration articles for 172 oats had been published by the American Society of Agronomy.

Following the 23rd report, the procedure for registering oats changed. It became the responsibility of the developer to prepare his own registration article that would be published in "Crop Science" rather than the "Agronomy Journal." During the past decade, an additional 78 varieties have been registered. Over the fifty year span a total of 250 oats have been registered. These varieties are listed.

In addition to the registering of oat cultivars, the registration of oat "Germ Plasm" (G.P.) was started in 1969. A "G.P." oat possesses some documented merit, but need not be commercially valuable in its present form (see Crop Science 11:936-937.1971). Germplasm oats are considered promising parental material for hybridization. Four such oats have been registered:

Variety	C.I. No.	G.P. No.	Reference
Calif. C.C. II	-	3	Crop Sci. 9:527.1969
Dade	7495	1	Crop Sci. 9:396.1969
Eta	8347	4	Crop Sci. 10:212.1970
Hickory	7490	2	Crop Sci. 9:396.1969

Registered Oat Varieties

Variety	CI No.	Reg. No.	Reference
AB-110	7148	173	Crop Sci. 2:531.1962
Ajax	4157	162	Agron. J. 52:663-665.1960
Alamo	5371	133	Agron. J. 47:535-538.1955
Alamo-X	7648	174	Crop Sci. 2:531.1962
Albion	729	46	J. Amer. Soc. Agron. 18:935-947.1926
Andrew	4170	113	Agron. J. 44:144-153.1952
Anthony	2143	75	J. Amer. Soc. Agron. 21:1175-1180.1929
Arkwin	5850	157	Agron. J. 50:701-707.1958
Arlington	4657	122	Agron. J. 44:144-153.1952
Arlington 23	7890	236	Crop Sci. 10(4):458-459.1970
Atlantic	4599	123	Agron. J. 44:144-153.1952
AuSable	7670	214	Crop Sci. 7(3):278.1967
Awnless Probsteier	1888	28	J. Amer. Soc. Agron. 18:936-947.1926
Bannock	2592	86	J. Amer. Soc. Agron. 30:1030-1036.1938
Beedee	6752	187	Crop Sci. 5(4):377-378.1965
Belyak	1630	5	J. Amer. Soc. Agron. 18:936-947.1926
Bentland	6930	147	Agron. J. 50:701-707.1958
Benton	3910	106	Agron. J. 42:46-52.1950
Bingham	7588	210	Crop Sci. 7(2):167.1967
Black Diamond	1878	6	J. Amer. Soc. Agron. 18:936-947.1926
Black Mesdag	1877	7	J. Amer. Soc. Agron. 18:936-947.1926
Black Norway	1874	8	J. Amer. Soc. Agron. 18:936-947.1926
Black Tartar	991	35	J. Amer. Soc. Agron. 18:936-947.1926
Blount	7769	175	Crop Sci. 2:531.1962
Bonda	4329	108	Agron. J. 42:46-52.1950
Bonham	4676	161	Agron. J. 50:701-707.1958
Bonkee	7563	211	Crop Sci. 7(2):168.1967
Boone	3305	87	J. Amer. Soc. Agron. 32:76-82.1940
Branch	5013	188	Crop Sci. 5(4):378.1965
Brave	7690	196	Crop Sci. 6(1):94-95.1966
Bridger	2611	102	J. Amer. Soc. Agron. 35:242-244.1943
Bronco	6571	171	Agron. J. 53:402-403.1961
Bruce	7888	235	Crop Sci. 10(4):458.1970
Brunker	2054	73	J. Amer. Soc. Agron. 21:1175-1180.1929
Burnett	6537	140	Agron. J. 50:701-707.1958
Burt	293	1	J. Amer. Soc. Agron. 18:935-947.1926
Canadian	1625	9	J. Amer. Soc. Agron. 18:935-947.1926
Carleton	2378	85	J. Amer. Soc. Agron. 30:1030-1036.1938
Carolee	7513	180	Crop Sci. 4:114.1964
Cayuse	8263	221	Crop Sci. 8(3):399.1968
Cedar	3314	103	J. Amer. Soc. Agron. 36:445-446.1944
Centore	3865	141	Agron. J. 50:701-707.1958
Checota	8311	240	Crop Sci. 11(1):134.1971
Cherokee	3846	114	Agron. J. 44:144-153.1952
Chilocco	8183	241	Crop Sci. 11(1):134.1971
Cimarron	5106	134	Agron. J. 47:535-538.1955

Variety	CI No.	Reg. No.	Reference
Clarion	5647	163	Agron. J. 52:663-665.1960
Clintland	6701	148	Agron. J. 50:701-707.1958
Clinton	3971	105	Agron. J. 42:46-52.1950
Coachman	7684	215	Crop Sci. 7(3):279.1967
Coastblack	1025	2	J. Amer. Soc. Agron. 18:935-947.1926
Cody	3916	116	Agron. J. 44:144-153.1952
Colburt	2019	43	J. Amer. Soc. Agron. 18:935-947.1926
Colfax	7595	181	Crop Sci. 4:236.1964
Colorado 37	1640	53	J. Amer. Soc. Agron. 18:935-947.1926
Columbia	2820	78	J. Amer. Soc. Agron. 23:1013-1017.1931
Comewell	1317	54	J. Amer. Soc. Agron. 18:935-947.1926
Compact	8280	225	Crop Sci. 9(4):523.1969
Cornellian	1242	50	J. Amer. Soc. Agron. 18:935-947.1926
Coronado	8260	230	Crop Sci. 10(2):208-209.1970
Cortez	8421	231	Crop Sci. 10(2):208-209.1970
Craig	5332	128	Agron. J. 45:568-570.1953
Crater	7295	142	Agron. J. 50:701-707.1958
Culberson	273	10	J. Amer. Soc. Agron. 18:935-947.1926
Curt	7424	169	Agron. J. 52:663-665.1960
Danish Island	1684	11	J. Amer. Soc. Agron. 18:935-947.1926
Dawn	8029	216	Crop Sci. 7(4):402.1967
Delair	4653	132	Agron. J. 46:525.1954
DeSoto	3923	101	J. Amer. Soc. Agron. 35:242-244.1943
Dodge	7269	200	Crop Sci. 6(4):388.1966
Dubois	6572	149	Agron. J. 50:701-707.1958
Dupree	4672	154	Agron. J. 50:701-707.1958
Early Champion	1623	12	J. Amer. Soc. Agron. 18:935-947.1926
Early Mountain	1624	13	J. Amer. Soc. Agron. 18:935-947.1926
Eaton	3908	109	Agron. J. 42:46-52.1950
Elan	8443	248	Crop Sci. 12(1):127.1972
Empire	1974	55	J. Amer. Soc. Agron. 18:935-947.1926
Fairfax	7417	207	Crop Sci. 7(2):166.1967
Fayette	6916	189	Crop Sci. 5(4):378-379.1965
Ferguson 560	7161	158	Agron. J. 50:701-707.1958
Florad	7420	204	Crop Sci. 7(2):165.1967
Florida 500	8023	205	Crop Sci. 7(2):165.1967
Floriland	6588	136	Agron. J. 47:535-538.1955
Forkedeer	3170	110	Agron. J. 42:46-52.1950
Forvic	4164	190	Crop Sci. 5(4):379.1965
Forward	2242	56	J. Amer. Soc. Agron. 18:935-947.1926
Franklin	2892	79	J. Amer. Soc. Agron. 23:1013-1017.1931
Frazier	2381	65	J. Amer. Soc. Agron. 19:1031-1037.1927
Fulghum	708	3	J. Amer. Soc. Agron. 18:935-947.1926
Fultex	3531	92	J. Amer. Soc. Agron. 33:246-251.1941
Fulton	3327	84	J. Amer. Soc. Agron. 30:1030-1036.1938
Fulwin	3168	90	J. Amer. Soc. Agron. 32:76-82.1940

Variety	CI No.	Reg. No.	Reference
Garland	7453	201	Crop Sci. 6(4):389.1966
Garry	6662	164	Agron. J. 52:663-665.1960
Garton 5	1311	14	J. Amer. Soc. Agron. 18:935-947.1926
Garton 473	1883	15	J. Amer. Soc. Agron. 18:935-947.1926
Garton Gray	1864	36	J. Amer. Soc. Agron. 18:935-947.1926
Goldcrest	7596	182	Crop Sci. 4:236.1964
Golden Giant	1606	37	J. Amer. Soc. Agron. 18:935-947.1926
Golden Rain	1890	16	J. Amer. Soc. Agron. 18:935-947.1926
Goldfield	7597	183	Crop Sci. 4:236-237.1964
Goodfield	7266	198	Crop Sci. 6(4):387.1966
Gopher	2027	47	J. Amer. Soc. Agron. 18:935-947.1926
Gothland	1898	17	J. Amer. Soc. Agron. 18:935-947.1926
Green Mountain	1892	38	J. Amer. Soc. Agron. 18:935-947.1926
Green Russian	1978	18	J. Amer. Soc. Agron. 18:935-947.1926
Grundy	8445	249	Crop Sci. 12(2):256.1972
Hancock	3346	88	J. Amer. Soc. Agron. 32:76-82.1940
Holden	7978	224	Crop Sci. 9(3):394.1969
Houston	7912	219	Crop Sci. 7(6):682.1967
Huron	*3756	96	J. Amer. Soc. Agron. 33:246-251.1941
Idamine	1834	57	J. Amer. Soc. Agron. 18:935-947.1926
Indio	7292	138	Agron. J. 50:701-707.1958
Iogold	2329	72	J. Amer. Soc. Agron. 20:1323-1325.1928
Iogren	2024	51	J. Amer. Soc. Agron. 18:935-947.1926
Iowar	847	48	J. Amer. Soc. Agron. 18:935-947.1926
Irish Victor	1896	19	J. Amer. Soc. Agron. 18:935-947.1926
Ithacan	2141	58	J. Amer. Soc. Agron. 18:935-947.1926
Jackson	5441	159	Agron. J. 50:701-707.1958
James	5015	155	Agron. J. 50:701-707.1958
Japan	1889	20	J. Amer. Soc. Agron. 18:935-947.1926
Jaycee	7971	218	Crop Sci. 7(4):402.1967
Jefferson	7624	208	Crop Sci. 7(2):166-167.1967
Jewell	7598	184	Crop Sci. 4:237.1964
Joanette	1880	21	J. Amer. Soc. Agron. 18:935-947.1926
Kanota	839	66	J. Amer. Soc. Agron. 19:1031-1037.1927
Keystone	2146	68	J. Amer. Soc. Agron. 19:1031-1037.1927
Kherson	459	22	J. Amer. Soc. Agron. 18:935-947.1926
Kota	8178	227	Crop Sci. 9(6):849.1969
Lane	8435	250	Crop Sci. 12(2):256.1972
LeConte	5107	129	Agron. J. 45:568-570.1953
Lee	2042	64	J. Amer. Soc. Agron. 18:935-947.1926
Lenroc	3205	80	J. Amer. Soc. Agron. 27:66-70.1935
Letoria	3392	124	Agron. J. 44:144-153.1952
Lincoln	1262	23	J. Amer. Soc. Agron. 18:935-947.1926
Lodi	7561	202	Crop Sci. 6(4):389.1966

Variety	CI No.	Reg. No.	Reference
Macon	6625	168	Agron. J. 52:663-665.1960
Madrid	603	24	J. Amer. Soc. Agron. 18:935-947.1926
Mahaska	7599	185	Crop Sci. 4:237.1964
Marida	2571	100	J. Amer. Soc. Agron. 34:275-279.1942
Marion	3247	89	J. Amer. Soc. Agron. 32:76-82.1940
Markton	2053	52	J. Amer. Soc. Agron. 18:935-947.1926
Mesa	8277	209	Crop Sci. 7(2):167.1967
Miami	2245	76	J. Amer. Soc. Agron. 21:1175-1180.1929
Mid-South	6977	150	Agron. J. 50:701-707.1958
Mindo	4328	107	Agron. J. 42:46-52.1950
Minhafer	6913	143	Agron. J. 50:701-707.1958
Minland	6765	144	Agron. J. 50:701-707.1958
Minota	1285	59	J. Amer. Soc. Agron. 18:935-947.1926
Mission	2588	104	J. Amer. Soc. Agron. 37:643-644.1945
Mo. 0-200	4626	125	Agron. J. 45:324-325.1953
Mo. 0-205	4988	126	Agron. J. 45:324-325.1953
Mohawk	4327	127	Agron. J. 45:568-570.1953
Monarch	1876	25	J. Amer. Soc. Agron. 18:935-947.1926
Montezuma	8419	226	Crop Sci. 9(6):848-849.1969
Moregrain	7229	165	Agron. J. 52:663-665.1960
Multiline E68	8345	242	Crop Sci. 11(6):939-940.1971
Multiline M68	8346	245	Crop Sci. 11(6):940-941.1971
Multiline E69		243	Crop Sci. 11(6):939-940.1971
Multiline M69		246	Crop Sci. 11(6):940-941.1971
Multiline E70		244	Crop Sci. 11(6):939-940.1971
Multiline M70		247	Crop Sci. 11(6):940-941.1971
Mustang	4660	120	Agron. J. 44:144-153.1952
Neal	7440	192	Crop Sci. 5(5):484.1965
Nehawka	7194	170	Agron. J. 52(11):665.1960
Nemaha	4301	115	Agron. J. 44:144-153.1952
Neosho	4141	112	Agron. J. 42:46-52.1950
Newton	6642	151	Agron. J. 50:701-707.1958
Niagara	7528	194	Crop Sci. 5(6):604.1965
Nodaway	7272	179	Crop Sci. 2:533.1962
Nodaway 70	8442	239	Crop Sci. 11(1):134.1971
Nora	8163	222	Crop Sci. 8(4):516.1968
Nortex	2382	67	J. Amer. Soc. Agron. 19:1031-1037.1927
North Finnish	1882	26	J. Amer. Soc. Agron. 18:935-947.1926
O'Brien	8174	220	Crop Sci. 7(6):682.1967
Old Island Black	1756	27	J. Amer. Soc. Agron. 18:935-947.1926
Oneida	7458	176	Crop Sci. 2:532.1962
Ora	7976	195	Crop Sci. 5(6):604.1965
Orbit	7811	203	Crop Sci. 6(5):501.1966
Ortley	7473	186	Crop Sci. 5(3):289.1965
Osage	3991	111	Agron. J. 42:46-52.1950
Otoe	2886	98	J. Amer. Soc. Agron. 34:275-279.1942
Otter	8304	237	Crop Sci. 11(1):133.1971
Overland	4181	117	Agron. J. 44:144-153.1952

Variety	CI No.	Reg. No.	Reference
Palestine	2328	139	Agron. J. 50:701-707.1958
Park	6611	160	Agron. J. 50:701-707.1958
Patterson	2147	69	J. Amer. Soc. Agron. 19:1031-1037.1927
Pennlan	7881	223	Crop Sci. 8(5):640.1968
Pettis	7805	229	Crop Sci. 9(6):849.1969
Portage	7107	199	Crop Sci. 6(4):388.1966
Putnam	6927	152	Agron. J. 50:701-707.1958
Radar 1	7339	177	Crop Sci. 2:532.1962
Radar 2	7340	178	Crop Sci. 2:532-533.1962
Rainbow	2345	74	J. Amer. Soc. Agron. 21:1175-1180.1929
Ranger	3417	94	J. Amer. Soc. Agron. 33:246-251.1941
Ransom	5927	145	Agron. J. 50:701-707.1958
Rapida	8303	212	Crop Sci. 7(2):168.1967
Red Rustproof	1079	4	J. Amer. Soc. Agron. 18:935-947.1926
Richland	787	44	J. Amer. Soc. Agron. 18:935-947.1926
Roanoke	7413	206	Crop Sci. 7(2):165-166.1967
Rodney	6661	166	Agron. J. 52:663-665.1960
Rusota	2343	81	J. Amer. Soc. Agron. 27:66-70.1935
Rustler	3754	95	J. Amer. Soc. Agron. 33:246-251.1941
Santee	7454	193	Crop Sci. 5(5):484.1965
Sauk	5946	191	Crop Sci. 5(4):379-380.1965
Scottish Chief	1699	29	J. Amer. Soc. Agron. 18:935-947.1926
Seminole	5924	135	Agron. J. 47:535-538.1955
Shelby	4372	118	Agron. J. 44:144-153.1952
Sierra	7706	213	Crop Sci. 7(2):168.1967
Silvermine	1013	30	J. Amer. Soc. Agron. 18:935-947.1926
Simcoe	6767	167	Agron. J. 52:663-665.1960
Southland	5207	131	Agron. J. 45:568-570.1953
Sparrowbill	1604	39	J. Amer. Soc. Agron. 18:935-947.1926
Spooner	3165	82	J. Amer. Soc. Agron. 27:66-70.1935
Standwell	1975	60	J. Amer. Soc. Agron. 18:935-947.1926
State Pride	1154	45	J. Amer. Soc. Agron. 18:935-947.1926
Storm King	1602	40	J. Amer. Soc. Agron. 18:935-947.1926
Sumter	7509	233	Crop Sci. 10(4):458.1970
Sumter 3	7886	234	Crop Sci. 10(4):458.1970
Support	3180	83	J. Amer. Soc. Agron. 27:1001-1002.1935
Suregrain	7155	153	Agron. J. 50:701-707.1958
Swedish Select	134	31	J. Amer. Soc. Agron. 18:935-947.1926
Taggart	4652	130	Agron. J. 45:568-570.1953
Tama	3502	99	J. Amer. Soc. Agron. 34:275-279.1942
Tartar King	1599	41	J. Amer. Soc. Agron. 18:935-947.1926
Tech	947	63	J. Amer. Soc. Agron. 18(10):946.1926
Tennex	3169	91	J. Amer. Soc. Agron. 32:76-82.1940
Tioga	7524	197	Crop Sci. 6(3):303-304.1966
Tobolsk	1709	32	J. Amer. Soc. Agron. 18:935-947.1926
Tonka	7192	172	Agron. J. 53:402-403.1961

Variety	CI No.	Reg. No.	Reference
Upright	2142	61	J. Amer. Soc. Agron. 18:935-947.1926
Uton	3141	97	J. Amer. Soc. Agron. 33:246-251.1941
Vicland	3611	93	J. Amer. Soc. Agron. 33:246-251.1941
Victor	803	33	J. Amer. Soc. Agron. 18:935-947.1926
Victorgrain 48-93	5355	137	Agron. J. 47:535-538.1955
Victory	560	232	Crop Sci. 10(2):209.1970
Walken	8205	238	Crop Sci. 11(1):133.1971
Waubay	5440	156	Agron. J. 50:701-707.1958
Wayne	2567	77	J. Amer. Soc. Agron. 21:1175-1180.1929
White Cross	2026	49	J. Amer. Soc. Agron. 18:935-947.1926
White Tartar	1614	42	J. Amer. Soc. Agron. 18:935-947.1926
Winema	4373	146	Agron. J. 50:701-707.1958
Winter Turf	1570	34	J. Amer. Soc. Agron. 18:935-947.1926
Wintok	3424	121	Agron. J. 44:144-153.1952
Wisconsin Wonder	1645	62	J. Amer. Soc. Agron. 18:935-947.1926
Wolverine	1591	70	J. Amer. Soc. Agron. 19:1031-1037.1927
Worthy	1590	71	J. Amer. Soc. Agron. 19:1031-1037.1927
Wyndmere	7552	217	Crop Sci. 7(4):402.1967
Yancey	8420	228	Crop Sci. 9(6):849.1969
Zephyr	4800	119	Agron. J. 44:144-153.1952

*Huron - CI 3756: The CI number for Huron has been erroneously listed as 3656 in many publications.

Alphabetical List and
Descriptions of New Cultivars

Name	Origin	Described on page:
Dal	Wisconsin	56
Mariner	Michigan	46
Maris Tabard	England	70
Otee	Illinois	70
Pennwin	Pennsylvania	71
71 C 3090	Texas	71
71 C 3098	Texas	72

Maris Tabard (AJB 4/51/B1) Spring Oats

G. Jenkins and J. D. Johnson Cambridge, England, U.K.

This new cultivar from the Plant Breeding Institute, Cambridge, has been added to the Recommended List of the National Institute of Agricultural Botany for 1973.

First entered in Statutory Performance Trials in 1970, Maris Tabard has consistenly outyielded other spring oats and has been provisionally assigned a yield advantage of 15 per cent over the control varieties Astor and Condor. Maris Tabard has stiff straw, is slightly earlier and has grain of higher kernel content than that of the control varieties. It is a selection from the cross Cc 4146/4 x Condor, which has resistance to powdery mildew, inherited from the former parent, which is effective against races 1, 2 and 4.

Maris Tabard is included in the National List for the United Kingdom and will be eligible for inclusion in the Common Catalogue of the E.E.C. It is protected under the Plant Variety Rights Act and marketed jointly by the Plant Breeding Institute and the National Seed Development Organization.

Otee Oats

C. M. Brown and H. Jedlinski

'Otee' spring oats (Avena sativa L.), Ill. 66-2287A, C.I. 9086, was developed cooperatively by the Illinois Agricultural Experiment Station and the U.S. Department of Agriculture, Agricultural Research Service.

Otee resulted from a cross of 'Albion' x 'Newton' 2x 'Minhafer' 3x 'Jaycee'. The final selection was made in the F_5 generation following the final cross. Otee has been tested in replicated yield and disease nurseries in Illinois since 1968, in the Uniform Early Oat Nursery since 1969, and in the Uniform Midseason Oat Nursery since 1970. It has produced yields similar to the variety Jaycee in Illinois but its yields have been higher than Jaycee in the regional uniform trials. Its test weight has been similar to Jaycee and equal to the better varieties grown in Illinois. The grain of Otee has averaged 2-4 percent higher in protein than most other varieties. The hull color and kernel shape are similar to Jaycee and most of the kernels fluoresce under ultraviolet light.

Otee is early in maturity, has short straw and good lodging resistance. It is superior to Jaycee in after-ripening standability. The breeders' seed of Otee contained a very few (less than .2%) off type plants that were 8 to 12 cm taller and somewhat later in maturity.

Otee has resistance to most of the older races of crown and stem rust but is susceptible to some of the newer races. It has a high degree of tolerance to barley yellow dwarf virus, superior to any variety that is adapted for growing in Illinois. It has resistance to the prevailing races of covered and loose smuts

PENNWIN

'Pennwin' (C.I. 8312) is a new winter oat variety that has been released by The Pennsylvania Agricultural Experiment Station and the Agricultural Research Service, U. S. Department of Agriculture. Pennwin was derived from the cross Dubois x Pa. 5037 2x Ballard. Pa. 5037 was a Hairy Culberson x Nysel selection with outstanding winter hardiness. F_2 through F_4 bulk populations were grown near University Park, Pennsylvania, and Pennwin, Pa. 418-1099, traces to a single panicle selection made in a severely winter-killed F_4 plot during 1964.

Pennwin was grown in advanced tests in Pennsylvania from 1966 through 1971 and in cooperative regional trials from 1968 through 1971. The outstanding characteristic of Pennwin has been high grain yield. In Pennsylvania tests, the variety has averaged 21 percent higher yield than the variety Norline, but the two varieties were similar for other characteristics. In the cooperative regional trials, Pennwin averaged 9 percent higher grain yields than Norline. When only data from Pennsylvania and states with relatively severe winters (Illinois, Kentucky, Missouri, New Jersey, Ohio, and Virginia) are considered, Pennwin had a significant winter survival advantage over Norline of 5.4 percent and a 16 percent higher grain yield.

Breeders seed of Pennwin is maintained by The Pennsylvania Agricultural Experiment Station, University Park, Pennsylvania 16802. The U. S. Department of Agriculture does not have seed to distribute.

Proposed New Cultivars

Texas Agricultural Experiment Station

Two crown-rust resistant oat cultivars derived from *A. byzantina* x *A. sterilis* crosses are being increased at present, and probably will be released in the fall of 1973. TAES plans to release the varieties simultaneously to provide some diversity for crown rust resistance among varieties adapted in South Texas.

71C3090

71C3090 was increased from a single F_4 plant from the cross Ab 555/3/Ora/63C3868-4-2/2/Ora/PI 295919. It is similar in overall agronomic type to 'Cortez' oats, to which it is related. The variety is slightly taller than 'Coronado' or Cortez. Straw strength is excellent. Maturity of 71C3090 is similar to that of Cortez. 71C3090 was completely resistant to crown rust in field tests in Texas, Canada, and Puerto Rico in 1971 and 1972. Seedling, juvenile, and adult plants of 71C3090 are characterized by pronounced pubescence on all upper leaf surfaces, with less conspicuous pubescence usually noted on lower leaf surfaces. 71C3090 probably will be released as a grain and forage oat variety for South and South Central Texas.

71C3098

71C3098 was derived from a single F_4 plant from the cross Ab 555/3/Ora/63C3868-4-2/2/Alamo-X/PI 296244. Juvenile growth is rather prostrate (similar to 'Ora'). The maturity is similar to that of 'Ora', slightly later than 'Coronado', and approximately 6 days later than 'Cortex'. Straw strength is excellent. 71C3098 was completely resistant to crown rust in tests in Texas, Canada, and Puerto Rico in 1971 and 1972. It probably will be released as a grain and forage oat variety for South and Central Texas.

VI. OAT GERMPLASM

Accessions to the USDA Oat Collection

J. C. Craddock

During 1972, Cereal Identification (C.I.) numbers were assigned to 30 oat varieties. These varieties have been added to the Collection and seed will be available for distribution as soon as an increase can be obtained. These new accessions are listed.

Before discarding seed of varieties you have developed that are not suitable for release, consider contributing them to the Collection, particularly those lines with one or more outstanding characters. They may very well be of value as parental materials in the future. If you will submit a seed sample (10-400 grams) and a statement that the variety is open stock, a C.I. number will be assigned and your entry added to the Collection. Any information such as varietal designation, pedigree, and its outstanding characters that you care to offer will assist in the documentation.

Don't forget the Oat Gene Bank! Surplus seeds from F_1 and F_2 plants should be contributed to this bank. Last year no contributions were received. At the present time there are 60 pounds of seed on inventory. Your contributions are needed.

C. I. NUMBERS ASSIGNED IN 1972

C. I. NUMBER	NAME OR DESIGNATION	PARENTAGE	SOURCE
9164	OA 123-44		Canada
9165	Mich. 60-106-1-78 (MARINER)	Beaver / Garry /2/ Clinton /3/ Clintland /4/ CI 5103 /5/ Garry	Michigan
9166	Mich. 60-104-1-34	Beaver / Garry /2/ Clinton /3/ Clintland /4/ CI 5103 /5/ Beaver / Garry /2/ Clinton /3/ Clintland /4/ CI 5163	Michigan
9167	Mich. 60-101-1-20	Beaver / Garry /2/ Clinton /3/ Clintland /4/ CI 5103 /5/ Beaver / Garry /2/ Clinton /3/ Clintland /4/2* CI 5163	Michigan
9168	Pa 822-7538		Pennsylvania
9169	X292II (Isoline E Series)	CI 8044 *4 /2/ CI 7555 *4 / Ceirch du Bach	Iowa
9170	X434II (Isoline E Series)	CI 8044 *5 /3/ Clinton / Garry /2/ CI 8079	Iowa
9171	X465 (Isoline E Series)	CI 8044 *5 /2/ CI 7555 / CI 8078	Iowa
9172	X466I (Isoline E Series)	CI 8044 *6 / CI 8001	Iowa
9173	X467 (Isoline E Series)	CI 8044 *6 / Victorgrain 48-93	Iowa
9174	X468II (Isoline E Series)	CI 8044 *6 / Moregrain	Iowa
9175	X469II (Isoline E Series)	CI 8044 *6 / Ascencao	Iowa
9176	X470I (Isoline E Series)	CI 8044 *6 / Ascencao	Iowa
9177	X539III (Isoline E Series)	CI 8044 *4 /3/ Clintland /2/ Chapman 178 / CI 7235	Iowa
9178	X541 (Isoline E Series)	CI 8044 *4 /3/ Bonkee /2/ CI 7154 / CI 7171	Iowa
9179	X719 (Isoline E Series)	CI 8044 *4 /2/ CI 7555 / CI 6665	Iowa
9180	X721 (Isoline E Series)	CI 8044 *4 /2/ CI 7555 / CI 7654	Iowa
9181	X766 (Isoline E Series)	CI 8044 *5 /2/ Clinton / CI 8081	Iowa
9182	X104C-7 (Isoline M Series)	CI 7555 *6 / Ceirch du Bach	Iowa
9183	X270I (Isoline M Series)	CI 7555 *6 / CI 8079	Iowa
9184	X421I (Isoline M Series)	CI 7555 *6 / CI 8001	Iowa
9185	X422 (Isoline M Series)	CI 7555 *6 / Victorgrain 48-93	Iowa
9186	X423 (Isoline M Series)	CI 7555 *6 / Ascencao	Iowa
9187	X424III (Isoline M Series)	CI 7555 *6 / Ascencao	Iowa
9188	X447 (Isoline M Series)	CI 7555 *4 /3/ Bonkee /2/ CI 7154 / CI 7171	Iowa
9189	X449I (Isoline M Series)	CI 7555 *6 / CI 6665	Iowa

C. I. NUMBERS ASSIGNED IN 1972 (Continued)

C. I. NUMBER	NAME OR DESIGNATION	PARENTAGE	SOURCE
9190	X475II (Isoline M Series)	CI 7555 *6 / CI 8078	Iowa
9191	X765 (Isoline M Series)	CI 7555 *5 /2/ Clinton / CI 8081	Iowa
9192	X117	CI 7232 / Burnett /2/ Clintland /3/ Cherokee /4/ Clintland /5/6* CI 7555	Iowa
9193	K71438	Cayuse / CI 2874-02	Washington

Elite Rust Resistant Oat Germplasm Added to World Collection of Small Grains

R. A. Kilpatrick, J. C. Craddock, P. G. Rothman, and M. D. Simons

Requests for seed of rust resistant selections of wheat necessitated the development of a bank of 'Elite Rust Resistant Wheat Germplasm'. This material was made available in 1969. Since then, breeders and pathologists have found this material valuable for rust resistant germplasm.

Each year, requests are received for rust resistant oats. Supplying requests requires time-consuming search of annual rust reports. Thus, the development of a bank of 'Rust Resistant Oat Germplasm' was established in 1972.

Selected entries have been in the International Oat Rust Nursery program (IORN) for a period of one or more years and have had a disease coefficient of 5.0 or less to crown (leaf) or stem rust or to both rusts. When the IORN program was first established, oat entries were included in the nursery mainly for one year. This was apparently due to the number of oat selections to be tested. Other selections were included in the nursery program by request as a check against the known population of rusts.

The population of crown and stem rust fungi has changed several times since 1954. Consequently, it was deemed necessary to test the entries to the prevalent and important races of crown and stem rust. The results obtained by M. D. Simons on crown rust (Table 1) and by P. G. Rothman on stem rust (Table 2) show the value of these

selections for rust resistance. Some selection were found to be susceptible to the more prevalent cultures in the U.S. However, their contribution to a breeding program in another country may be invaluable. All selections have been assigned Cereal Identification numbers (C.I.), seed is being increased, and selections will be available in 1973 upon request to: Dr. J. C. Craddock
Building 046
Agric. Research Center - West
Beltsville, Maryland 20705

Table 1. Seedling reaction of 'Elite Oat Selections' to seven races of crown rust (November, 1972; Ames, Iowa)

C.I. No.	Name or Selection	Race 203	298	294	326	264A	263	?
3815	Avena strigosa	R	R	R	R	R	R	R
6537	Burnett	S	S	S	S	S	S	R
6642	Newton	S	S	S	S	S	S	R
6918	Delta 5104-7	R	S	S	S	S	S	S
6920	Pentagon	R	S	S	S	S	S	S
6945	--	R	R	R	S	S	S	S
6952	Urugland	R	S	S	S	S	S	R
6953	Ascencao	R	R	R	R	R	R	R
6956	CD 3820 (Avena strigosa)	R	R	R	R	R	R	R
6964	--	S	R	S	S	S	S	R
6965	KS S11699	S	R	S	S	S	S	R
6968	Silva No. 1729-49-3	S	R	S	S	S	S	R
6990	Ascencao (reselected)	R	R	R	R	R	S	R
7005	Landhafer (reselected)	R	S	S	S	S	S	S
7010	Saia (reselected from C.I. 4369)	R	R	R	R	R	R	R
7013	--	S	S	S	S	S	S	S
7056	Sel. 189 Ins. S.F.	R	R	R	R	S	R	R
7146	Ascencao	R	R	R	R	R	R	R
7172	DLM 3	S	R	S	S	S	S	S
7453	Garland	R	R	R	R	S	R	S
7654	Magnif 28	R	R	R	S	S	R	R
8023	Florida 500	R	R	R	R	S	R	R
8150	Minn. 64-3114	R	R	R	R	S	S	R
8155	Minn. 64-Bf56	R	R	R	R	S	S	R
8234	Fla. 64-377	R	R	R	R	S	R	R
8235	Minn. 65-B1106-1113	R	R	R	R	S	S	R
8236	Minn. 65-B2165-2172	R	R	R	R	S	S	R
8238	Minn. 65-B2414-2426	R	R	R	R	S	S	R
8257	Minn. 65-B1989-1997	R	R	R	R	S	S	R
8360	Minn. 66-B498-505	R	R	R	R	S	S	R

Table 1. (Continued)

8361	Minn. 66-B1411-1442	R	R	R	R	S	S	R
8362	Minn. 66-B1430-1442	R	R	R	R	S	S	R
8363	Minn. 67-B986-989	R	S	S	S	S	S	R
8364	Minn. 67-B1641-1646	R	R	S	S	S	S	R
8367	Minn. 68 Ag 4112 Sel. 823	R	R	R	R	R	R	R
8368	Minn. 68ob 8012	R	R	R	R	S	S	R

Table 2. Seedling reaction of 'Elite Oat Selections' to three races of stem rust (December, 1972; St. Paul, Minnesota)

C.I. No.	Name or Selection	Race 31	Race 61	Race 94
2024	Iogren	S	S	S
4024	Canuck (aBdEfh)	RS	R	S
4639	Saia	R	R	0
5864	49-2357	S	R	S
5870	34-5-3-1	S	R	S
5927	Ransom	S	R	S
6569	--	S	R	S
6662	Gary	S	R	S
6666	--	S	R	S
6802	Wis. X421-1-1	S	R	S
6878	II-50-46	S	R	S
6879	II-50-47	S	R	S
6883	II-50-62	S	R	S
6912	II-50-26	S	S	S
6913	Minhafer (ABdefh)	S	S	S
6936	II-50-51	S	S	S
6946	--	S	R	S
6948	--	S	R	S
6949	--	S	R	S
6954	Saia	0	R	0
6956	CD 3820 (*Avena strigosa*)	0	R	0
6962	--	S	R	S
6976	Tex. 46-44-401	S	R	S
6995	Tex. 152-50-21	S	S	S
7013	--	S	R	S
7020	Nebr. 521710	S	R	S
7051	Sante Fe (abdefh)	S	R	RS
7066	Tex. 119-50-12	S	R	S
7069	Tex. 152-50-19	S	R	S
7080	Sel. 5126A3-73-3	S	R	S
7081	II-50-43	S	R	S
7082	II-50-54	S	R	S
7083	II-50-77	S	R	S
7084	II-50-82	S	RS	S
7085	II-50-92	S	RS	S
7086	II-50-93	S	R	S
7087	II-50-94	S	R	S
7088	II-50-7	S	R	S
7089	II-50-15	S	R	S
7090	II-50-16	S	R	S
7091	II-50-27	S	R	S
7092	II-50-68	S	R	S
7093	II-50-73	S	R	S

Table 2. (Continued)

7095	II-50-59	S	R	S
7096	II-50-60	S	R	S
7097	II-50-91	S	R	S
7098	II-50-104	S	R	S
7113	Wis. X532-1-1	S	R	S
7114	Jasiri (aBDefH)	R	R	S
7143	Tex. 119-50-12	S	R	S
7145	ABDA	S	R	S
7148	AB-110	S	R	S
7151	Nebr. 521465	S	R	S
7166	--	S	R	S
7167	--	S	R	S
7168	--	S	R	S
7169	--	SR	R	S
7171	Selecta DL 41372	S	S	S
7333	Tex. 245-53-188	S	R	S
7368	Tex. 245-53-187	S	R	S

Genes	A	B	D	E	F	H
Race 31	S	S	S	S	S	R
Race 61	R	R	S	S	S	R
Race 94	S	S	S	S	S	S

VII. EQUIPMENT AND TECHNIQUES

Tractor Suitable for Small Grain Plot Work

M. E. McDaniel

We have recently developed a new planting system for small grains. We are using a Kubota L 210 tractor with a rear-mounted belt-type tray planter and a 3-point tool bar which carries the row openers and a platform for the operator.

The Kubota tractor has the following features which we like:

21 Horsepower (diesel, 2 cylinder)
6 speed transmission (lots of flexibility)
Suitable tread width (we use 48 inch centers)
Good turn radius
Strong 3-point hitch and hydraulic system
(Compatible with Category #1 implements)
Center-line tractor with good visibility

The tractor is well-built and is similar in design to large farm tractors. We have been pleased with its performance.

An Intermediate Size Grain Drill

D. D. Morey, Tifton, Ga.

There has been a need for a plot grain drill to do the job between the 4-row nursery planter and the larger field grain drill. This season (1972-73) we have used such a drill at Tifton with good success. The drill was made by the H & N Equipment Company, Colwich, Kansas. It has several advantages we like in a plot grain drill. This drill has very accurate metering of seeds by use of a micro-dial and "wabble-slot" feeds. It can be accurately calibrated to plant any reasonable amount of wheat, oats, barley, rye and other similar seeds. By use of a larger feed shaft it can plant soybeans and similar larger seeds. It has accurate depth of planting under easy control. This drill has a tilt seed box with built-in dividers for quick and easy clean out. The width of the drill is 60 inches and it plants 7 drills wide with 7 inches between drills. It has a 3 point hitch and tracks well behind a Ford or MF-135 tractor set on a wheel width of 64 inches. It can be obtained with either double disc drills or hoe openers and either covering chains or rubber firming wheels. The grain box capacity is about 50 pounds (wheat) and the weight of the empty drill is approximately 500 pounds. Besides the accuracy and the ease of use in small areas, this H & N plot drill will be useful in increasing small amounts of valuable seed into maximum production. Those who have Hege or Chain machine combines may wish to consider this drill for planting yield nurseries.

GENERAL MECHANICS OF BREEDING PROGRAM

P. A. Portmann, Western Australia

An attempt has been made over the last few years to mechanize our plant breeding program in Western Australia as much as possible.

Routine and time consuming preparation of field books, field plans, seed lists and planting orders, are now handled by computer. Seed packet and harvest-bag labels are printed by computer on self-adhesive labels. Lists and labels can be printed in either accession list order or plot order as desired.

The square lattice design is used for yield trials and again the analysis and listing is handled by computer.

Selections bulked up for yield testing are quickly screened for sievings (on a 100 gm sample) and test wt. (wt. of 125 cc of grain) allowing us to discard any poor quality material prior to yield testing. Rows being bulked for yield testing are interspersed with a control variety every 10 rows and selections are made on the basis of these control samples.

Single plant selections are planted in double rows by a 6 bank cone-seeder. Each cone drops the seed onto a 2-way knife divider to produce the double row.

Six-row plots are planted in yield trials; 2 at a time with a 2-cone seeder. Each cone drops its seed into a 6-way centifugal divider. These machines have been built using as much as possible spare parts of commercial drills to facilitate repairs. Both incorporate commercial change-cog gear boxes which allow a ready adjustment of plot length between 6 and 60 meters. Fertiliser boxes are not incorporated in the machines as under our system it is easier to top dress prior to seeding. The seed scrapers on the cones are made from laminex and are spring loaded to sit firmly on the base plate, so overcoming problems previously encountered with awns, or chaff which can be present in some samples. The laminex wears slightly but no noticeable wear is evident on the base plate.

Harvesting of trials is carried out with German self propelled auto-harvesters (Hege 125) which have a 1.25 m. cut. These are essentially self-cleaning. Vogel-type threshers are used for single plants and rows are bulked up for yield tests with the Hege 125.

A boom spray using I.C.I. Vibrajet no drift low pressure spray nozzles is being developed. Initial tests have shown this to be an effective and fast method of weed control in single plant selection rows. Areas for trials and rows are blanket sprayed the previous season (before flowering and seed set) to reduce the seed-load and so assist in weed control.

VIII. Publications

1. Baker, R. J. and R. I. H. McKenzie. 1972. Heritability of oil content in Oats, Avena sativa L. Crop Sci. 12:201-202.

2. Barnett, R. D., W. H. Chapman, R. L. Smith, and R. L. Stanley, Jr. 1972. Small grain performance in Florida in 1972. Fla. Agri. Exp. Sta., Quincy, AREC Mimeo Report NF-1972-3, 7pp.

3. Baum, B. R., G. Fleischmann, J. W. Martens, T. Rajhathy, and H. Thomas. 1972. Notes on the habitat and distribution of Avena species in the Mediterraeanand Middle East. Can. J. Bot. 50:1385-1397.

4. Brown, C. M., and J. C. Craddock. 1972. Oil content and groat weight of entries in the world oat collection. Crop Sci. 12:514-515.

5. Browning, J. A. 1972. Corn, wheat, rice, man:endagered species. J. Environ. Qual. 1:209-211.

6. Bushnell, W. R. 1972. Physiology of fungal haustoria. Annu. Rev. Phytopathol. 10:151-176.

7. Campbell, A. R. and K. J. Frey. 1972. Association between groat protein percentage and certain plant and seed traits in interspecific oat crosses. Euphytica 21:352-362.

8. Campbell, A. R. and K. J. Frey. 1972. Amino acid percentages in the groat-protein of oat lines from an interspecific cross. Crop Sci. 12:391-392.

9. Campbell, A. R. and K. J. Frey. 1972. Inheritance of groat protein and interspecific oat crosses. Can. J. Plant Sci. 52:735-742.

10. Collins, F. C. and J. P. Jones. 1972. Arkansas oat variety tests, 1971-72. Arkansas Farm Research XXI:1.

11. Cotten, J. and J. D. Hayes. 1972. Genetic studies of resistance to the cereal cyst nematode (Heterodera avenae) in oats (Avena spp.). Euphytica 21(3):538-542.

12. Day, K. M., F. L. Patterson, O. W. Luetkemeier, H. W. Ohm, J. J. Roberts, M. L. Swearingin, G. E. Shaner, D. M. Huber, and R. L. Gallun. 1973. Performance and adaptation of small grains in Indiana. Purdue Agr. Exp. Sta. Res. Bull. 896.

13. Finney, K. F., M. D. Shogren, Y. Pomeranz, and C. L. Bolte. 1972. Cereal malts in breadmaking. Bakers' Digest. 46(1):36-38, 55.

14. Fleischmann, G. 1972. Crown rust of oats in Canada in 1971. Can. Plant Dis. Surv. 52:15-16.

15. Frey, K. J. 1972. Self- and cross-incumpatibility systems in plants. Egyptian J. Gen. Cytol. 1:122-139.

16. Frey, K. J. 1972. Stability Indexes of Isolines of Oats (Avena sativa L.). Crop Sci. 12:809-813.

17. Frey, K. J. and J. A. Browning. 1972. Registration of Grundy oats. Crop Sci. 12:256.

18. Frey, K. J., J. A. Browning, and P. Lawrence. 1972. Iowa Oat Test Results - 1971-72. Mimeo AG10-2 from the Iowa Agr. Exp. Sta.

19. Gurley, W. H., and W. H. Sell. Oct., 1972. Ga. 7199, A new forage oat for Georgia. Cooperative Extension Service, University of Georgia College of Agriculture, Athens. Leaflet 136.

20. Hsieh, S. C. and K. J. Frey. 1972. Serological predictions of genotypic relationships among rice Oryza sativa cultivars. Egyptian J. Gen. Cyto. 1:288:299.

21. Jedlinski, H. 1972. Tolerence to two strains of barley yellow dwarf virus in oats. Plant Dis. Reptr. 56:230-234.

22. Jensen, N. F. and W. D. Pardee. 1972. New small grains - Arrow and Astro. N.Y. Food and Life Sciences 5(3):15-16.

23. Johnson, Rebecca A., and W. F. Rochow. 1972. An isolate of barley yellow dwarf virus transmitted specifically by Schizaphis graminum. Phytopathology 62:921-925.

24. Lertmongkol, V. 1972. Effects of liquid air storage on pollen viability of certain agronomic species. M.S. Thesis. University of Arkansas.

25. Luig, N. H. and E. P. Baker. Variability in oat stem rust in Eastern Australia. Proc. Linn. Soc. N.S.W. (in press).

26. Luke, H. H., W. H. Chapman, and R. D. Barnett. 1972. The Harizontal resistance of Red Rustproof oats to crown rust. Phytopathology 62:414-417.

27. McKenzie, R. I. H., G. Fleischmann and J. W. Martens. 1971. Oat rust resistance through gene management. Proceedings of the sixth Congress of Eucarpia: 127-128.

28. Marchant, W. H., R. H. Littrell, D. D. Morey, L. R. Nelson, A. R. Brown, et al. 1972. Performance of small grain varieties in Georgia 1971-1972. Univ. of Ga., College of Agr., Expt. Sta. Res. Rpt. 14.

29. Martens, J. W. and P. K. Anema. 1972. Stem rust of oats in 1971. Can. Plant Dis. Surv. 52:17-18.

30. Martens, J. W. and R. I. H. McKenzie. 1973. Resistance and virulence in the Avena:Puccinia coronata host parasite system in Kenya and Ethiopia. Can. J. Bot. 51.

31. Nielsen, J. 1972. Occurrence in Western Canada of collections of loose smut, Ustilago avenae, virulent on oat varieties with resistance from Victoria. Can. Plant Dis. Surv. 52:56-57.

32. Pfahler, P. L. 1971. Heritability estimates for grain yield in oats (Avena sp.). Crop Science 11:378-381.

33. Pfahler, P. L. 1972. Relationship between grain yield and environmental variability in oats (Avena sp.). Crop Sci. 12:254-255.

34. Pomeranz, Y. and I. B. Saches. 1972. Scanning electron microscopy of the oat kernel. Cereal Chem. 49:13-19, 20-22.

35. Pomeranz, Y. and G. S. Robbins. 1972. Amino acid composition of malted cereals and malt sprouts. Proc. Am. Soc. Brewing Chemists. 15-21.

36. Rochow, W. F. 1972. The role of mixed infections in the transmission of plant viruses by aphids. Annual Review of Phytopathology 10:101-124.

37. Roelfs, A. P. 1972. Gradients in horizontal dispersal of cereal rust uredospores. Phytopathology 62:70-76.

38. Roelfs, A. P. and P. G. Rothman. 1972. Races of Puccinia graminis f. sp. avenae in the USA during 1971. Plant Dis. Reptr. 56:608-611.

39. Rowell, J. B. 1972. Fungicidal management of pathogen populations. Journal of Environmental Quality 1:216-220.

40. Sampson, D. R. 1971. Additive and nonadditive genetic variances and genotypic correlations for yield and other traits in oats. Can. J. Genet. Cytol. 13:864-872.

41. Sampson, D. R. 1972. Evaluation of nine oat varieties as parents in breeding for short, stout straw with high grain yield using F_1, F_2, and F_3 bulked progenies. Can. J. Plant Sci. 52:21-28.

42. Sampson, D. R. and V. D. Burrows. 1972. Influence of photoperiod, short-day vernalization, and cold vernalization on days to heading in Avena species and cultivars. Can. J. Plant Sci. 52:471-482.

43. Sěbesta J. 1970. Seedling resistance of oat assortment to oat crown rust. I. Reaction to physiologic races 228, 231, 239, 240 and CS 1. Vědecké práce VÚRV v Praze-Ruzyni 16:55-64. (Summ. Czech, Russian).

44. Sěbesta J. 1972. On the relation between virulence and aggressivness of oat crown rust. Ochrana rostlin (Praha) 8:161-168. (Czech, Summ. English, German, Russian).

45. Sěbesta J. 1972. Physiologic races of oat crown rust in Czechoslovakia and their epidemic importance. Proceedings of the European and Mediterranean Cereal Rusts Conference, Praha 1972(I):257-261. (Summ. Russian).

46. Sěbesta J., H. Mouchová, and J. Sýkora. 1972. Effect of rusts on protein and bound amino acids content in oat kernels. Ochrana rostlin (Praha) 8:5-10. (Czech, Summ. English, German, Russian).

47. Simons, M. D. 1972. Polygenic resistance to plant disease and its use in breeding resistant cultivars. J. Environ. Qual. 1:232-240.

48. Simons, M. D. 1972. Mass selection for tolerance to oat crown rust. Proc. European and Mediterranean Cereal Rust Conf., Prague, Czechoslovakia. pp. 271-275.

49. Steidl, Robert P. 1972. Observed gain feom visual selection for yield in diverse oat populations. M.Sc. thesis. University of Minnesota Library.

50. Stuthman, D. D. and G. C. Marten. 1972. Genetic variation in yield and quality of oat forage. Crop Science 12:831-833.

51. Taylor, G. A. and K. J. Frey. 1972. Influence of temperature on various growth stages of oat cultivars. I. Utilization of controlled environmental chambers, climatological data and developmental growth stages. Crop Sci. 12:450-453.

52. Vela-Cardenas, M. and K. J. Frey. 1972. Optimum environment for maximizing heritability and genetic gain from selection. Iowa Stat J. Sci. 46:381-394.

53. Wright, G. M. 1972. Taiko black oats. New Zealand J. Agriculture 124:65.

54. Wright, G. M. 1972. Selection and quality testing of Mapua 70 oats. New Zealand J. Agr. Res. 15:629-634.

55. Youngs, V. L. 1972. Protein distribution in the oat kernel. Cereal Chem. 49:407-411.

IX. MAILING LIST

UNITED STATES OF AMERICA

ALABAMA
- Normal 35792
  - Alabama A. & M. University
    - Department of Natural Resources and Environmental Studies
      - Sapra, V. T.

ALASKA
- Palmer 99645
  - University of Alaska
    - Institute of Agricultural Sciences
      - Taylor, Roscoe L.

ARIZONA
- Tucson 85721
  - University of Arizona
    - Department of Agronomy and Plant Genetics
      - Day, Arden D.
      - Thompson, R. K.
      - Tucker, T. C.
      - Vavich, M. G.

ARKANSAS
- Fayetteville 72701
  - University of Arkansas
    - Agronomy Department
      - Collins, F. C.
      - McGraw, T.
    - Plant Pathology Department
      - Jones, J. P.
- Little Rock 72200
  - Box 1069
    - Weir, H. L.
- Stuttgart 72160
  - Rice Branch Experiment Station
    - Wells, Bobby L.
    - Williams, Francis

CALIFORNIA
- Davis 95616
  - University of California
    - Department of Agronomy and Range Science
      - Jain, S. K.
      - Prato, J. D.
      - Qualset, D. O.
      - Rutger, J. Neil
      - Vogt, H. E.
- Riverside 92501
  - University of California
    - Agronomy Department
      - Isom, W. H.

Salinas 93901
330 Maple St.
Jenkins Foundation for Research
Jenkins, B. Charles
San Juan Bautista 95045
Box B
Farm Seed Research Corporation
Beyer, E. H.
Tulelake 96134
Tulelake Field Station
Puri, Y. Paul

COLORADO
Akron 80720
USDA Central Great Plains Field Station
Hinze, Greg
Takeda, Kenneth
Burlington 80807
Area Extension Agronomist, Box 218
Croissant, Robert L.
Schafer, Darrel
Ft. Collins 80521
Colorado State University
Department of Agronomy
Haus, T. E.
Stewart, Wm. G.
National Seed Storage Laboratory
Bass, Louis N.
Grand Junction 81501
P. O. Box 786
Western Slope Experiment Station
Shafer, Samuel L.
County Court House
Area Extension Agronomist, Box 580
Swartz, James W.
Hesperus 81326
San Juan Branch Exp. Station
Moore, Howard
Rocky Ford 81067
Arkansas Valley Branch Station, Route 2, Box 186
Swink, Jerre F.
Springfield 81073
S. E. Colorado Branch Exp. Station
Kim Rt.
Mann, H. O.

D.C., WASHINGTON 20000
Exchange and Gift Division
Library of Congress

FLORIDA
Gainesville 32601
University of Florida
Plant Pathology Department
Luke, H. H.
Sarasota 33580
3365 Spring Mill Circle
Western, Dallas E.

Quincy 32351
P. O. Box 470
Agriculture Research and Education Center
Chapman, W. H.
Barnett, R. D.

GEORGIA

Athens 30601
University of Georgia
Department of Agronomy
Bitzer, M. J.
Brown, Acton R.
Department of Plant Pathology
Luttrell, E. S.
Department of Entomology
Davis, R.

Experiment 30212
Georgia Experiment Station
Agronomy Department
Cummings, D. G.

Tifton 31794
Coastal Plain Experiment Station
P.O. Box 748
Littrell, R. H.
Morey, D. D.

IDAHO

Aberdeen 83210
Branch Experiment Station
Hayes, Ralph M.
Wesenberg, Darrell M.

Mascow 83843
University of Idaho
Plant Science Department
Henriksen, B.

ILLINOIS

Chicago 60603
135 So. LaSalle St.
Cereal Institute, Inc.
Hayden, E. B., Jr.

Chicago 60654
The Quaker Oats Company
Merchandise Mart Bldg.
Schrickel, Don

Peoria 61604
1815 N. University St.
USDA Northern Regional Research Lab.
Wu, Victor

Urbana 61801
University of Illinois
Department of Agronomy
Bonnett, O. T.
Brown, C. M.
Graffis, D. W.
Pendleton, J. W.

Scott, W. O.
Department of Plant Pathology
Bever, Wayne
Britton, M. P.
Hooker, A. L.
Jedlinski, H.
Shurtleff, M. C.

INDIANA
Lafayette 47907
Purdue University
Agronomy Department
Day, Kelly
Hankins, B. J.
Luetkemeier, O. W.
Ohm, H. W.
Patterson, F. L.
Reiss, W. D.
Roberts, J. J.
Stivers, R. K.
Botany and Plant Pathology Department
Caldwell, R. M.
Compton, L. E.
Shaner, G. E.
West Lafayette 47906
DeKalb Soft Wheat Research Center
1211 Cumberland Avenue, P.O. Box D
Shands, Henry L.

IOWA
Ames 50010
Iowa State University
Agronomy Department
Atkins, R. E.
Brinkman, Marshall
Chandhanomutta, P.
Eagles, Howard
Fatunla, Tunde
Frey, K. J.
Grindeland, R. L.
Jondle, Robert
Lawrence, Peter
Patrick, George
Pesek, John T.
Rosielle, Arnold
Shibles, Richard M.
Skrdla, Ron
Tantivit, Apinya
Tiyawalee, Dumrong
Department of Botany and Plant Pathology
Barker, Roland
Browning, J. Artie
Michel, L. J.
Simons, Marr D.
Smith, Frederick G.
Politowski, Kathy
Torres, Erique

Department of Genetics
Sadanaga, K.
Welshons, W. J.

North American Plant Breeders, RR3
Baker, Douglas J.
Cedar Rapids 52402
National Oats Co., Inc.
Seibert, Scott
Fremont 52561
W. O. McCurdy & Sons
McCurdy, LeRoy

KANSAS
Hays 67601
Fort Hays Branch Station
Livers, Ronald W.
Fort Hays Experiment Station
Ross, W. M.
Manhattan 66502
Kansas State University
Plant Pathology Department, Dickens Hall
Browder, L.
Hansing, E. D.
Agronomy Department, Waters Hall
Campbell, Larry G.
Heyne, E. G.
1515 College Ave.
USDA/ARS Grain Marketing Research Center
Pomeranz, Y., Director

KENTUCKY
Lexington 40506
University of Kentucky
Agronomy Department
Finkner, V. C.
Shane, J. F.

MARYLAND
Beltsville 20705
Northeastern Region - ARC West
Plant Genetics & Germplasm Institute
Kilpatrick, R. A.
Oakes, A. J.
Smith, R. T.
Small Grains Collection, Bldg 046
Craddock, J. C.
U.S.D.A. National Agricultural Library
Current Serials Record
College Park 20740
University of Maryland
Agronomy Department
Rothgeb, R. G.
Schillinger, John

Hyattsville 20782
University Park
4317 Woodberry St.
Coffman, Franklin A.
6525 Belcrest Road
U.S.D.A. - Agricultural Marketing Service
Plant Variety Protection Office, Grain Division
Evans, Kenneth H.

MASSACHUSETTS
Northampton 01060
Clark Science Center
Smith College, Department of Biological Sciences
Osborne, Thomas S.

MICHIGAN
East Lansing 48823
Mighigan State University
Department of Botany and Plant Pathology
Ellingboe, Albert H.
Department of Crop and Soil Sciences
Elliott, F. C.
Grafius, J. E.
Entomology Department
Smith, David H.

MINNESOTA
Minneapolis 55401
828 Midland Bank Building
Crop Quality Council
Northrup, King and Co.
1500 Jackson Street, N.E.
Wold, Earl K.
Minneapolis 55402
Cargill Bldg.
Cargill Crop Bulletin
Newell, Cameron B.
Minneapolis 55415
Plant Protection and Quarantine Programs, USDA
310 Fourth Avenue South, Room 900
Campbell, M. A.
St. Paul 55101
University of Minnesota
Cereal Rust Laboratory
Roelfs, Alan P.
Rothman, Paul C.
Rowell, John
Department of Agronomy and Plant Genetics
Borgeson, Carl
Briggle, L. W.
McMullen, Mike
Stage, Jim
Strand, Oliver E.
Stuthman, Deon D.
Thompson, Roy L.

Department of Plant Pathology
Kernkamp, M. F.
Moore, M. B.
Schwartz, Howard
Singleton, Larry

MISSISSIPPI
State College 39762
Mississippi State College
Department of Agronomy
Gourley, Lynn
USDA ARS, Cereal Crops Research Branch
P.O. Brawer PG
Futrell, Maurice C.

MISSOURI
Columbia 65201
University of Missouri
Department of Agronomy
Poehlman, J. M.
Rowoth, Paul
Sechler, Dale
Wyllie, T. D.
Department of Plant Pathology
Loegering, W. Q.
Mt. Vernon 65712
University of Missouri
Southwest Center
Justus, Norman
Portageville 63873
University of Missouri
Delta Research Center
Duclos, Leo
Spickard 64679
University of Missouri
North Missouri Center
Meinke, Lewis

MONTANA
Bozeman 59715
Montana State University
Department of Agronomy
Taylor, G. Allan
Department of Botany and Microbiology
Sharp, Eugene L.

NEBRASKA
Lincoln 68503
University of Nebraska
Agronomy Department
Kinbacher, E. J.
Schmidt, John W.

NEW JERSEY
New Brunswick 08903
Rutgers University
Plant Biology Department
Halisky, Philip M.

Department of Soils and Crops
Justin, J. R.
Lund, Steve

NEW YORK
Geneva 14456
New York State Agricultural Experiment Station
Department of Seed Investigations
Clark, B.E.
Crosier, Willard F.
Nittler, L. W.

Ithaca 14850
Cornell University, College of Agriculture
Albert R. Mann Library
Plant Breeding Department
Baines, W.
Gilchrist, J.
Jensen, N. F.
Knauft, D.
Pardee, W. D.
Plant Breeding Library
Random, B. H.
Plant Pathology Department
Kent, G. C.
Millar, R. L.
Rochow, W. F.
Schultz, O. E.

New York 09676
Crop Specialist
USAID/IRI, Amcon - PA, APO
Schlehuber, A. M.

Syracuse 13201
P.O. Box 1333
Agway, Inc.
Matthews, David L.

Upton, L. I. 11973
Brookhaven National Laboratories
Biology Department
Smith, H. H.

NORTH CAROLINA
Raleigh 27607
North Carolina State University
Department of Crop Science
Hebert, T. T.
Hodges, S. J.

Murphy, C. F.
Newton, M. F.

North Carolina Crop Improvement Association, Inc.
State College Station
McLaughlin, F. W.

NORTH DAKOTA
Dickinson 58601
Dickinson Experiment Station
Conlon, Thomas J.

Fargo 58102
North Dakota State University
Department of Agronomy
Ebeltoft, David C.
Erickson, J. R.
Miller, J. D.
Plant Pathology Department
Kiesling, Richard L.
Pederson, V. D.

OHIO
Columbus 43210
1885 Neil Ave.
Ohio State University
Agronomy Department
Ray, Dale A.
Wooster 44691
Ohio Agricultural Research and Development Center
Agronomy Department
Lafever, H. N.

OKLAHOMA
Oklahoma City 73105
State Seed Lab
122 Capitol Building
Fenderson, Gail
Stillwater 74074
Oklahoma State University
Agronomy Department
Edwards, L. H.
LeGrand, F. E.
Oswalt, R. M.
Pass, H.
Smith, E. L.
Weibel, Dale E.
Botany and Plant Pathology
Kucharek, Thomas
Young, H. C. Jr.
Entomology Department
Chada, H. L.

OREGON
Corvallis 97331
Oregon State University
Farm Crops Department
Bolton, Floyd E.
Kronstad, Warren E.
Agricultural Experiment Station
Foote, W. H.
Pendleton 97801
P.O. Box 370
Kolding, Mathias F.
Rohde, Charles R.

PENNSYLVANIA
University Park 16802
Pennsylvania State University
Agronomy Department
Bryner, C. S.
McKee, Guy W.
Marshall, H. G.
Pfeifer, R.

SOUTH CAROLINA
Clemson 29631
Clemson University
Department of Agronomy and Soils
Eskew, E. B.
Graham, Doyce Jr.
Johnson, J. R.
Morton, B. C.
Palmer, James H.
Botany and Bacteriology Department
Kingsland, G. C.
Experimental Statistics Division
Byrd, W. P.
Hartsville 29550
Coker's Pedigreed Seed Co.
Harrison, Howard F.
Keaton, J. A.
Neely, J. W.
Stanton, J. J., Jr.

SOUTH DAKOTA
Brookings 57006
Northern Grain Insect Research Laboratory
Jensen, Stanley G.
South Dakota State University
Plant Science Department
Reeves, Dale L.
Sraon, Harbens S.
Wood, L. S.

TENNESSEE
Knoxville 37901
University of Tennessee
Agronomy Department
Graves, C. R.
Reich, Vernon H.
Martin 38237
University of Tennessee at Martin
School of Agriculture
Hathcock, Bob R.

TEXAS
Amarillo 79105
P. O. Box 9198
Petr, Frank C.
Beaumont 77706
Box 366, R#5
Texas Agricultural Experiment Station
Craigmiles, J. P.

Beeville 78102
Texas Agricultural Experiment Station
Reyes, Lucas
Bushland 79012
U. S. Great Plains Field Station
Daniels, Norris
Porter, K. B.
Canyon 79015
West Texas State Univ.
Agriculture Dept.
Green, Jimmie L.
Thomason, Ronald C.
Chillicothe 79225
Agricultural Experiment Station
Lahr, K. A.
College Station 77840
1215 Marsteller Street
Grain Research Associates
Atkins, I. M.
College Station 77843
Texas A & M University
Plant Sciences Department
Gough, Francis J.
Toler, Robert W.
Soil and Crop Sciences Department
Henshaw, John
McDaniel, M. E.
Tuleen, Neal A.
Lubbock 79400
Texas Technical University
Agronomy Department
Johnson, J. W.
McGregor 76659
Agricultural Experiment Station
Norris, M. J.
Overton 75684
Texas A & M University
Research and Extension Center at Overton
Shank, A. Robert
Renner 75079
Texas A & M University
Research and Extension Center at Dallas
Gardenhire, J. H.

UTAH

Logan 84321
Utah State University
Plant Science Department
Albrechtsen, Rulon S.
Dewey, Wade G.

VIRGINA
- Blacksburg 24061
  - Virginia Polytechnic Institute
    - Department of Agronomy
      - Starling, T. M.
      - Taylor, L. H.
    - Department of Plant Pathology and Physiology
      - Roane, Curt
- Warsaw 22572
  - Agricultural Experiment Station
    - Camper, H. M.

WASHINGTON
- Pullman 99163
  - Washington State University
    - Agronomy Department
      - Konzak, C. F.
      - Morrison, K. J.
    - Plant Pathology Department
      - Bruehl, G. W.
      - Schafer, John F.

WISCONSIN
- Madison 53706
  - University of Wisconsin
    - Agronomy Department
      - Forsberg, R. A.
      - Shands, Hazel L.
      - Peterson, D. M.
      - Youngs, Vernon L.
    - Department of Plant Pathology
      - Arny, Deane C.
      - Durbin, R. D.
- Milwaukee 53202
  - Malting Barley Improvement Association
    - 828 North Broadway
      - Pawlisch, P. E.

OAT WORKERS OUTSIDE THE UNITED STATES

ARGENTINA
- Buenos Aires
  - 3 er piso - Edificio "Bolsade Cereales", Corrientes 127
    - A.A.C.R.E.A.
      - Cazenave, Gorgeh
- LaPlata
  - Casilla de Correo 31, Calle 60 y 119
    - Facultad de Agronomia
      - La Biblioteca
- Tres Arroyos (Pcia. Buenos Aires)
  - Casilla Correo 216
    - Chacra Experimental de Barrow
      - Carbajo, Hector L.

AUSTRALIA
- New South Wales
  - Glen Innes 2370
    - Agricultural Research Station
      - Marwan, M.
  - Richmond 2753
    - Hawkesbury Agricultural College
      - Guerin, P. M.
  - Sydney 2006
    - Dept. of Agriculture
      - State Office Block
        - Walkden, Brown C.
    - Univ. of Sydney
      - Department of Agricultural Botany
        - Baker, E. P.
        - Watson, I. A.
  - Temora
    - Agricultural Research Station
      - Mengerson, Dr. F.
- Queensland
  - Warwick
    - P.O. Box 231
      - Johnston, R. P.
- South Australia
  - Roseworthy 5371
    - Agricultural College
      - Hollanby, G. J.
      - Krause, M. R.
- Victoria
  - Melbourne 3001
    - Department of Agriculture, G.P.O. Box 4041
      - Mullaly, J. V.
      - Sims, H. J.
  - Werribee 3030
    - State Research Farm
      - Brouwer, J. B.
- Western Australia
  - Nedlands
    - Agronomy Department, University of Western Australia
      - Boyd, W.J.R.
      - Stern, W. R.
  - South Perth 6151
    - Department of Agriculture, Jarrah Road
      - Portman, Peter A.
      - Reeves, J. T.

AUSTRIA
- A-1011 Vienna
  - P.O. Box 590
    - Joint FAO/IAEA, Division of Atomic Energy in Food and Agriculture
      - Plant Breeding and Genetics Section

BRAZIL
- Campinas - S.P.
  - Caixa Postal 673
    - Boklin, Ake
- Porto Alegre
  - Cx. Postal 2501
    - Productos Alimenticios Quaker S. A.
      - Dischinger, R.

CANADA
- Alberta
  - Beverlodge TOH OCO
    - Research Station, Box 29
      - Faris, Donald G.
  - Lacombe
    - Research Station
      - Kaufmann, M.L.
- British Columbia
  - Vancouver 8
    - University of British Columbia
      - Agriculture and Forestry Library
        - MacMillan Library
- Monitoba
  - Winnipeg R3T 2M9
    - Canada Dept. Agr., Res. Station, 25 Dafoe Road
      - Brown, D.
      - Gill, C. C.
      - Martens, J. W.
      - Mc Donald, W. C.
      - McKenzie, R.I.H.
      - Nielsen, J. J.
      - Samborski, D. J.
    - University of Manitoba
      - Dept. of Plant Science
        - McGinnis, R. C.
        - Shebeski, L. H.
- Ontario
  - Guelph
    - University of Guelph
      - Associate Dean
        - Tossell, W. E.
      - Botany Department
        - Edgington, L. V.
      - Crop Science Department
        - Gamble, E. E.
        - Reinbergs, E.
        - Young, W. S.
  - Harrow
    - Research Station
      - Clark, G. H.
  - Kemptville
    - Kemptville College of Agricultural Technology
      - Curtis, John D.
      - Skepasts, A. V.

Ottawa KIA OC6
- Canadian Seed Growers Association
  - Box 455, Station A
    - Clayton, O. M.
    - Friesen, H. I.
- Canada Dept. of Agriculture
  - Plant Research Institute
    - Baum, B. R.
    - Hall, Dorthy
- Research Station
  - Central Experimental Farm
    - Burrows, Vernon D.
    - Clark, R. V.
    - Morrison, J. W.
    - Rajhathy, T.
    - Sampson, D. R.
  - Plant Gene Resources of Canada
    - Loiselle, Roland

Ontario
- Guelph
  - University of Guelph
    - Crop Science Department
      - Walsh, Edward J.
- Toronto
  - Ontario Dept. of Agriculture and Food
    - Parliament Buildings
      - Huntley, D. N.

Prince Edward Island
- Charlottetown
  - P.O. Box 1210
    - Research Station
      - Sterling, J. D. E.

Quebec
- Cte de Kamouraska
  - P.O. Box 400, Ste-Anne-de-la-Pocatiere
    - Research Station
      - Director
- MacDonald College
  - Agronomy Department
    - Klinck, H. R.
- Sainte-Foy G1V 2J3
  - 2560, Chemin Gomin
    - Station de Recherches
      - Dubuc, Jean-Pierre

Saskatchewan
- Melfort
  - Research Station, P.O. Box 1240
    - Ballantyne, H. R.
- Saskatoon S7N OWO
  - Univ. of Saskachewan
    - Crop Science Department
      - Berdahl, J. D.
      - Slinkard, Alfred E.

CHILE
- Temuco
  - Estacion Experimental Carillanca
    - Casilla 58-D
      - Acevedo, Juan
      - Beratto, M., Edmundo
      - Biblioteca

COLOMBIA
- Bogota
  - Instituto Colombiano Agropecuario
    - Apartado Aereo 79-84
      - Biblioteca
      - Bustamante, Elkin
      - Reyes, Reinaldo

CZECHOSLOVAKIA
- Prague 6, Ruzyne 507
  - Ripp-Institute of Plant Protection
    - Sebesta, Josef

DENMARK
- DK 4920 Sollested
  - Abed Plant Breeding Station
    - Vive, Kurt
- Horsens
  - Landbrugets Kornforaedling
    - Sejet DK 8700
      - Munk, Aage
- Tylstrup
  - Statens Forsogsstation
    - Hansen, Sv. E.

ECUADOR
- Quito
  - Apartado No. 340
    - INIAP (Santa Catalina Estacion Experimental)
      - Biblioteca
      - Escobar-P, Raul

FINLAND
- Helsingin pitaja
  - Tammisto
    - Plant Breeding Station
      - Kivi, E.
- Jokioinen
  - Agricultural Research Center
    - Dept. of Plant Breeding
      - Inkilä, Oiba
      - Manner, Rolf
      - Multamäki, K.
- SF-36200 Kangasala
  - Exp. Farm Nikkilä
    - Plant Breeding Institute of Hankkija
      - Rekunen, Matti

GERMANY
- 4325 Gatersleben
  - Deutsche Akademie der Wissenschaften zu Berlin
    - Zentral institut für Genetik und Kulturpflanzenforschung
      - Lehmann, C.
- 2322 Waterneverstorf
  - Post Lutjenburgl ostholstein
    - "NORDSAAT" Saatzuchtgesellschaft m.b.H.
      - Frimmel, Dr.

HUNGARY
- Szeged, Alsokikotosor 5
  - Gabonatermesztesi Kutato Intezet
    - Sziertes, Janos

INDIA
- Jhansi (U.P.)
  - Indian Grassland and Fodder Research Institute
    - Ahmed, S. T.
    - Bhag, Mal
    - Katiyar, D. S.
    - Krishnan, R.
    - Magoon, M. L.
    - Menhra, K. L.
    - Misra, U. S.
- New Delhi-12
  - Indian Agricultural Research Institute
    - Director
      - Swaminathan, M. S.
    - Division of Botany
      - Rao, M. V.
    - Division of Plant Introduction
      - Singh, Herbhajan
- Orissa
  - Orissa Univ. of Agriculture and Technology
    - Bhubaneswar/3
      - Sinha, S.K.
- Poona 5
  - Agricultural College Estate
    - Plant Virus Research Station
      - Officer in Charge
        - Vashisth, K.S.

IRELAND
- Backweston, Leixlip
  - Co. Kildare
    - Dept. of Agriculture
      - Cereal Breeding Station
        - Purcell, J.
- Ballinacurra
  - Co. Cork
    - Dept. of Agriculture
      - Cereal Station
        - O'Sullivan, Thomas

ISRAEL
- Jerusalem
  - Hebrew Univ. of Jerusalem
    - Laboratory of Genetics
      - Zohary, D.
- Rehovot
  - Faculty of Agriculture
    - Dept. of Plant Pathology and Microbiology
      - Biali, M.
      - Dinoor, Amos
      - Eshed, N.
      - Ladizinsky, Gideon
      - Shoshan, Ch.
- Tel-Aviv (Ramat-Aviv)
  - Tel-Aviv University
    - Dept. of Botany
      - Eyal, Zahir
      - Wahl, I.

JAPAN
- Kyoto
  - Sakyuku
    - 18 Hazamacho Shugaku-in
      - Nishiyama, Ichizo
- Sapporo, Toyohira
  - Hitsujigaoka 061-01
    - Hokkaido National Agricultural Experiment Station
      - Laboratory of Oat Breeding
        - Kumagai, Tekeshi
        - Tabata, S.

KENYA
- Njoro
  - Plant Breeding Station
    - Guthrie, E.J.

MEXICO
- Chihuahua
  - Cuanuhtemoc
    - Aparto Postal 224
      - Campo Experimental de Comite Menonita
        - Dyck, Philip
  - Delicias
    - Apartado Postal 81
      - Campo Agricola Experimental
        - Rivera-M, Maximo
        - Urbina, Rafael
- Mexico 6, D.F.
  - Instituto Nacional de Investigaciones Agricolas
    - Londres No. 40
      - Maldonado A., Uriel
      - Vela-Cardenas, Mario
  - Centro Internacional de Mejoramiento de Maiz y Trigo
    - Londres 40
      - Apartado Postal 6-641
        - Biblioteca
        - Zillinsky, F. J.

NETHERLANDS
- Wageningen
  - Lawickse Alle 166
    - Institute of Plant Breeding
      - Niemans-Verdriee, W.C.
      - Slootmaker, L.

NEW ZEALAND
- Christchurch
  - Dept. Scientific and Industrial Research (Private Bag)
    - Crop Research Division, Lincoln
      - Smith, H. C.
      - Wright, G. M.

NORWAY
- Vollebekk
  - Agricultural College of Norway
    - Dept. of Genetics and Plant Breeding
      - Aastveit, K.
    - Dept. of Plant Husbandry
      - Strand, Erling
      - Mikkelsen, K.

PHILIPPINES
- Manila
  - International Rice Research Institute
    - Manila Hotel
      - Library
      - Chang, Te-Tzu

POLAND
- Blonie
  - Radzikow 05-870
    - Institute of Plant Breeding
      - Gielo, Stanislaw

PORTUGAL
- Elvas
  - Estacao Melhoramento de Plantas
    - Barradas, Manuel T.
- Oeiras
  - Estacao Agronomica Nacional
    - Departmento de Genetica
      - Mota, Miguel

ROMANIA
- Cluj
  - Str. Manastur Nr. 3
    - Institutul Agronomic
      - Popescu, Vidrel

SOUTH AFRICA, REPUBLIC of
- Stellenbosch (Private Bag 5023)
  - Dept. Agr. Tech. Services
    - Eisenberg, B.E.

SPAIN
Madrid 3
Ministerio de Agricultura I.N.I.A.
Centro de Cerealicultura
Avda. Puerta de Hierro
Martinez, Snr. Matilde
Departamento Nacional de Mejora del Maiz
Avda. Puerta de Hierro
Sanchez-Monge, E.

SWEDEN
530 20 Kvänum
Bjertorp
Weibullsholm Plant Breeding Intitute
Roland, Magnus
261 20 Landskrona
Weibullsholm Plant Breeding Institute
Oat Breeding Dept.
Hagberth, N. O.
532 00 Skara
Box 101
Swedish Seed Association
Persson, Per Johan
268 00 Svalöf
Swedish Seed Association
Oat and Wheat Breeding Department
Kristiansson, Bo
Mattsson, Bengt
Olsson, Gösta
Wiberg, Arne
Undrom
Lännäs
Swedish Seed Association
Wiklund, Kjell
750 07 Uppsala 7
Agricultural College of Sweden
Department of Plant Husbandry
Aberg, Evert
Bengtsson, Anders
Larsson, Rune
Department of Genetics and Plant Breeding
MacKey, James

TURKEY
Eskiesehir
Plant Improvement Station, P. K. 17
Atay, Turhan

UNITED KINGDOM
England
Cambridge CB2 2LQ
Cambridge University
Downing Street
Buttress, F.A.
Maris Lane, Trumpington
Plant Breeding Institute
Jenkins, G.

Lincoln
Rothwell
Weibullsholm Plant Breeding Institute
Eskilsson, Lars

Scotland
Midlothian
Penlandfield, Roslin
Scottish Plant Breeding Station
Cameron, Donald
Phillips, M.S.

Wales
Near Aberystwyth SY23-3EB
Welsh Plant Breeding Station
Plas Gogerddan
Griffiths, D.J.
Hayes, J.D.
Library
Thomas, Hugh

U.S.S.R.
Vilnius 27
N. Verkiu pl. 25
Academy of Sciences Lithuanian SSR
Institute of Botany
Namajunas, Bronius

YUGOSLAVIA
Kragujevac
Institute for Small Grains
Kostic, Borivoje
Popovic, Aleksa
Smiljakovic, H.