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1975

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Volume 26

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April 1, 1975

Sponsored by the National Oat Conference

Marr D. Simons, Editor

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I. NOTES

ORGANIZATION OF THE NATIONAL OAT CONFERENCE

EXECUTIVE COMMITTEE

Chairman	C. F. Murphy
*Past Chairman	C. M. Brown
*Secretary	L. W. Briggle
*Editor of Newsletter	M. D. Simons

REPRESENTATIVES

North Central Region	D. D. Stuthman D. T. Sechler M. D. Simons
Southern Region	C. F. Murphy M. E. McDaniel
Western Region	D. M. Wesenberg C. F. Konzak
North Eastern Region	H. G. Marshall N. F. Jensen
U.S.D.A., Technical Advisor	H. G. Marshall
U.S.D.A., National Program Staff (Small Grains)	L. W. Briggle

*Non-voting members

ANNOUNCEMENTS AND INSTRUCTIONS

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

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

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

PLEASE DO NOT CITE THE OAT NEWSLETTER IN PUBLISHED BIBLIOGRAPHIES

Citation of articles or reports 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 wouside the oat workers' group. For example, libraries send several requests a year for it and we refuse them (if the Newletter 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".

Report of Oat Gene Nomenclature Committee

M. D. Simons

In 1966, a committee consisting of Neal Jensen, Frank Zillinsky and M. D. Simons, together with help from many of you, published a handbook giving a standardized system of nomenclature for genes in oats, and a listing of such genes. Since the original publication, up-dating of this has taken the form of notes in the Oat Newsletter. It was recently pointed out that the original publication was now in need of up-dating to include the new genes, and that some minor revisions of the rules were needed. Ten years (1966-76) seemed like a good time to do it.

A new committee consisting of the following, is now working: McKenzie (Canada), Thomas (England), Sadanaga (USA), Sebesta (Czechoslovakia), Nishiyama (Japan), Martens (Canada), Krivchenko (USSR), and Simons (USA). A letter soliciting suggestions was sent to all the names on the mailing list of the Oat Newsletter and we got some good suggestions. We have tentative approval for publication of it as a USDA Handbook, so it should look better than the original. The final report should be published soon.

Incidentally, this 1966 publication is recognized as the authority on the subject by the Council of Biology Editors Style Manual.

Reorganization of the American Oat Workers Conference

C. F. Murphy

A motion was passed at the February 14, 1974 meeting in Ames, Iowa, directing the American Oat Workers Conference Chairman to appoint an ad hoc committee to: 1) study the organization of the Conference, 2) make recommendations for reorganization in light of contemporary oat work and regional and national representation, 3) incorporate our colleagues from Canada into the structure of the reorganized Conference and 4) complete this assignment in time for study prior to the 1978 meeting of the American Oat Workers Conference.

In January 1975, such an ad hoc committee was appointed. The membership of this committee is:

John E. Grafius, Chairman
Vernon E. Burrows
Harold G. Marshall

This committee has functioned efficiently and a draft statement of the purpose and organization of the American Oat Workers Conference has been prepared. The final proposal from this committee will be published in the next Oat Newsletter and will be acted upon at the 1978 meeting in College Station, Texas.

PROGRAM
NORTH CENTRAL OAT CONFERENCE

Columbia, Missouri February 2-3, 1976

Feb. 1, p.m.	Check-in and registration at Broadway Motor Inn
Feb. 2	All activities will be in Room S4 of the Memorial Student Union
8:00 am	Registration
8:30 am	Business meeting. Dale T. Sechler presiding.
9:00 am	Paper session. Dale Ray presiding.
	K. J. Frey. Yield genes from _Avena sterilis_.
	D. D. Stuthman. Results of recurrent selection for yield.
	Marshall Brinkman. Analysis of isolines that produce different grain yields.
	R. A. Forsberg and O. M. Taha. Selection for panicle length and number of spikelets per panicle in six oat crosses.
10:00 am	Break
10:15 am	Glenn Smith. Superior oat cultivars as parents for yield and protein recombinations.
	J. E. Graphius. Short cuts in variety trial averaging.
10:45 am	Discussion session. V. L. Youngs presiding.
	Dale Reeves. Significance of hull percentage in oat breeding.
	Herbert Ohm. Male gametocides.
	K. J. Frey. Progress in breeding for high protein.
	J. C. Craddock. Collection of non-cultivated species of oats.
12:00 am	Lunch
1:30 pm	Paper session. Marshall Brinkman presiding.
	J. A. Browning and M. F. McDaniel. Epidemiology studies with Iowa multiline and Texas cultivars on the Texas coastal plain.
	Henry Jedlinski. Tolerance of BYDV among some new accessions of oats.
	Paul Rothman. The occurrence of oat stem rust in 1975.
	M. D. Simons. Pathogenicity of crown rust in the US in 1974 & 1975.
	M. B. Moore. History of Minnesota buckthorn nursery.
	Mike McMullen. Cytogenetic relationships of _Avena sativa_ and _A. sterilis_.
3:00 pm	Break
3:15 pm	Dale Sechler. Dry matter accumulation in oats.
	Vernon Youngs. Oat lipids.

3:45 pm Discussion session. Paul Rothman presiding.
- R. A. Forsberg. Summer oat meetings.
- Dale Reeves. Development of special varieties for specific purposes (milling, feed, low oil, high oil, etc.).
- Deon Stuthman. Uniform nurseries.

6:30 pm Dinner (Location to be announced).

Feb. 3

8:00 am Paper session. Henry Jedlinski presiding.
- L. W. Briggle. ARS National Research Program on Oats.
- D. J. Schrickel. Progress on forming a milling oats improvement association to support oats research.
- Dale Reeves. Chick feeding trials with oats.
- Harold Marshall. Laboratory measurement of feed grain quality in oats.
- D. M. Peterson. Relation between protein concentration, protein fractions, and amino acid balance in oats.
- R. A. Forsberg, M. A. Brinkman, D. M. Peterson, and R. D. Duerst. The influence of grain: straw ratios on agronomic, physiologic, and economic factors in oats.
- Herbert Ohm. Response of 21 oat cultivars to N fertilizer.
- C. M. Brown. Intercropping of spring oats with soybeans and sorghums.

10:00 am Break

10:15 am Special reports. Dale Sechler presiding.
- M. D. Simons. Revision of oat gene nomenclature bulletin.
- Vernon Youngs. Oat Quality Lab.
- Dale Reeves. Planting equipment.

10:30 am State reports. Dale Sechler presiding.
- Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin.

11:30 am Business meeting. Dale Sechler presiding.

12:00 am Adjourn.

Minutes of NCR-15 Meeting, Columbia, Mo., Feb. 2-3, 1976

Chairman Dale Sechler presided.

In Attendance:

a) NCR-15 Committee Representatives

C. M. Brown	Illinois
Robert Forsberg	Wisconsin
Ken Frey	Iowa
E. G. Heyne	Kansas
Herbert Ohm	Indiana
Dale Reeves	South Dakota
John Schmidt	Nebraska
Dale Sechler	Missouri
Glenn Smith	North Dakota
Deon Stuthman	Minnesota
Dale Ray	Ohio

b) Others

L. W. Briggle	Maryland (USDA)
Marshall Brinkman	Wisconsin
Artie Browning	Iowa
J. C. Craddock	Maryland (USDA)
Tim Flanders	Missouri
Mark Iwig	Indiana
H. Jedlinski	Illinois
Paul Langse	Minnesota
Harold Marshall	Pennsylvania (USDA)
Mike McMullen	Minnesota
Leonard Michel	Iowa (USDA)
Matt Moore	Minnesota
David Peterson	Wisconsin
J. M. Poehlman	Missouri
Paul Rothman	Minnesota (USDA)
Paul Rowoth	Missouri
Don Schrickel	Illinois (Quaker Oats)
M. D. Simons	Iowa (USDA)
Ron Skrdla	Iowa
Sam Weaver	Illinois (Quaker Oats)
Victor Wu	Illinois (USDA)
Vernon Youngs	Wisconsin (USDA)

Dr. R. J. Aldrich, Administrative Advisor for NCR-15 welcomed the group and spoke on the Regional and National Agriculture Research Planning System as it applied to oat research.

Committee members were reminded to send in their contributions for the NCR-15 Annual Progress Report.

Election of officers: A nominating committee proposed Robert Forsberg for secretary, with M. D. Simons to become chairman. These nominations were passed by unanimous ballot.

Next meeting site and date: The NCR-15 Committee will meet in conjunction with the American Oat Worker's Conference at College Station, Texas, in 1978.

State reports:

Illinois: 800 bushels of Ill. 67-1514 are available for 1976. This early line has fair resistance to yellow dwarf, and is outstanding for stiff straw and high yield.

Indiana: The pubescence obtained from *Avena sterilis* that has been transferred to agronomic oat lines is being tested. It appears to protect the older leaves from damage by the cereal leaf beetle, but not the younger leaves.

Iowa: Oat acreage in Iowa has increased appreciably in the last three years. The composition of the early multiline E-series is being changed, and about 800 bushels of seed will be available. E-77, now in the foundation seed stages, will contain five new isolines. An experimental multiline based on Clintford is being developed. A good part of the oat acreage of Iowa is planted to early multiline varieties.

Kansas: There is no breeding program, but the Station cooperates in growing Uniform Performance Nurseries.

Minnesota: 71-101 will be named and released soon. A small increase of 71-211, which has good yield, is being started. Purification of 73-231, which was developed from a cross of Lodi and a slow rusting strain, is beginning. An increase in Arizona is being considered for 74-230, which combines a protein percentage as high as Goodland with high yield.

Missouri: The state now grows 180,000 acres of oats. Smut is becoming a problem. Mo. 0-6072, now named Bates, is being increased. It has good yellow dwarf tolerance, and is resistant to crown rust and smut.

Nebraska: Oat acreage in Nebraska in increasing, and is currently in about 750,000 acres. They have no breeding program, but participate in cooperative testing. Bates has looked good in their tests.

N. Dakota: Oat acreage has lost ground to wheat. Mike McMullen has been hired to take the lead in developing an oat breeding program.

Ohio: Only .2 of a man year is devoted to oat research. No new varieties are ready at this time.

S. Dakota: Selections being made out of Spear will have better quality.

Wisconsin: X2456 is a potential candidate for release.
X18-39-1 is susceptible to Lodi smut.
X20-78-1, mixed for maturity, is being purified.

Representatives of Michigan and Alaska were not present.

Discussion of summer meetings:

It was decided that there will be an oat field day to view field research work in progress in June or July, 1976. Both the Illinois and Indiana Stations probably will be visited. Herbert Ohm and Charles Brown will work out the details and inform the North Central oat workers.

We were informed that Dr. Clarence Grogan is now our CSRS advisor.

A resolution introduced by K. J. Frey expressing our appreciation to Drs. Sechler and Poehlman and their associates at Columbia for their efforts in making our meeting a pleasant and profitable one was passed unanimously.

Meeting adjourned.

Respectfully submitted,

Marr D. Simons
Secretary

II. SPECIAL REPORTS

Agronomy

Evaluation of Backcrossing in a Polygenic System

R.J. Baker and R.I.H. McKenzie

Lawrence and Frey (1975, Euphytica 24: 77-85) found that backcrossing *Avena sterilis* to adapted cultivars of *A. sativa* resulted in the production of backcross lines which surpassed the recurrent parent in yield. They concluded that "Backcrossing successfully accomplished the recombination required to introgress complexly inherited traits." In this article, we wish to present results of a few simple calculations that relate to the general problem of the effect of backcrossing on complexly inherited traits.

Effect of backcrossing on recombination of linked genes

To evaluate the effect of backcrossing on recombination of linked genes, we considered a cross between genotypes AAbb and aaBB with subsequent backcrosses to AAbb. In Table 1 we have tabulated the expected frequency of inbred lines, derived by selfing after various numbers of backcrosses, which are homozygous for the recombinant genotype AABB.

Table 1: Frequency of AABB genotypes expected in lines derived by inbreeding various backcross generations of the cross AAbb (recurrent parent) with aaBB (donor parent).

Probability of recombination	Number of backcrosses 0	1	2	3
.05	.034	.168	.045	.011
.10	.063	.154	.044	.011
.15	.089	.143	.042	.011
.20	.113	.134	.041	.011
.25	.135	.128	.040	.010
.30	.158	.124	.039	.010
.35	.179	.120	.039	.010
.40	.202	.119	.038	.010

The data in Table 1 indicate that backcrossing may be expected to increase the frequency of recombinant genotypes if the probability of recombination between linked genes is less than 0.25. The data also indicate that there is no advantage in proceeding beyond a single backcross.

Effect of backcrossing on independent genes

The effect of backcrossing is to increase the frequency of the allele of the recurrent parent. Thus, at loci where the recurrent parent has the plus allele, backcrossing will increase the frequency of genotypes having that allele. At loci where the plus allele is derived from the donor parent, backcrossing will have the effect of reducing the frequency of that allele and of genotypes possessing that allele. Since we would improve our chances of obtaining transgressive segregates if we were able to increase the frequencies of plus alleles at both types of loci, we should expect that there will be some optimum number of backcrosses and that the optimum will depend upon the number of plus alleles contributed by both the recurrent and the donor parents.

Consider that the recurrent parent has M plus genes and the donor parent has N plus genes. In Table 2, we have tabulated the frequency of inbred lines, derived after various number of backcrosses, that would be expected to contain more plus genes than the recurrent parent. For example, if the recurrent parent has 5 plus genes and the donor parent has 2 plus genes (all independent), we expect .063 or 6.3 percent of the inbred lines derived from the F_2 (0 backcrosses) to have 6 or 7 plus genes. After 1 backcross, we would expect .129 or 12.9 percent of the inbred lines to have 6 or 7 genes.

Table 2: Frequency of inbred lines derived by inbreeding after various numbers of backcrosses expected to have more plus genes than the recurrent parent.

Number of plus genes		Number of backcrosses						
Recurrent parent	Donor parent	0	1	2	3	4	5	6
2	1	.125	.141	.096	.055	.029	.015	.008
3	2	.188	.211	.161	.100	.056	.030	.015
3	1	.063	.105	.084	.051	.028	.015	.008
5	3	.145	.203	.185	.130	.078	.043	.022
5	2	.063	.129	.126	.089	.053	.029	.015
6	4	.172	.230	.217	.160	.099	.056	.029
6	1	.008	.044	.056	.042	.027	.014	.007
8	3	.033	.104	.131	.109	.071	.041	.022
10	8	.240	.293	.289	.242	.169	.102	.056
10	4	.029	.103	.140	.127	.088	.052	.029
10	1	.000	.014	.033	.033	.023	.013	.007
20	2	.000	.015	.019	.034	.033	.023	.013
20	1	.000	.000	.009	.017	.016	.011	.006

It appears that backcrossing can be expected to substantially increase the frequency of inbred lines exceeding the recurrent parent particularly if there is a large difference in the number of plus genes contained in each parent. In all cases considered, there appears to be little advantage to continuing beyond the second backcross. Where the number of gene differences is large, four, five and sometimes six backcrosses can be expected to increase the frequency of transgressive segregates above that expected with no backcrossing, but, in these cases, the expected frequency of desirable segregates is very low.

Effect of screening against undesirable genes

In oat breeding programs such as that outlined by Lawrence and Frey, a plant breeder will usually want to eliminate undesirable genes such as those controlling black lemma, hairy lemma, sucker mouth, etc. from the population as soon in the breeding program as is possible. If such genes are not linked with plus yield genes, the frequencies given in Table 2 should apply to that portion of the population retained after culling for undesirable genes.

Effect of backcrossing on linked and independent genes

On seeing that one backcross seems to be the maximum number of backcrosses for obtaining recombination between linked genes and that two backcrosses appears to be optimum in the case of independent genes, one wonders what the situation would be if one of the genes from the recurrent parent is linked with one from the donor parent. Our preliminary calculations suggest that in the presence of independent genes, linkage between one gene of the recurrent parent and one gene from the donor parent will tend to reduce the number of backcrosses required to give the best chances of obtaining transgressive segregates. To illustrate this conclusion, consider a situation in which there are three genes in the recurrent parent and one in the donor parent and that the gene in the donor parent is linked to one in the recurrent parent with a probability of recombination of .05. The frequency of inbred lines containing all four plus genes will be expected to be .008 after 0 backcrosses, .094 after 1, .039 after 2 and .010 after 3 backcrosses. The optimum number of backcrosses is still one. A similar calculation with 10 plus genes in the recurrent parent and one in the donor parent indicates that, with linkage, the optimum number of backcrosses is one while, without linkage, two or three backcrosses are indicated.

Sample size in backcrossing with complexly inherited traits

In traditional backcrossing programs, one attempts to transfer a single gene from the donor parent to the recurrent parent. In such cases, sample sizes during the backcrossing program need only be large enough to assure that the single gene is not lost. For example, we expect one-half of the gametes from the F_1 plant to contain the allele from the donor parent. To be 95 percent confident that the allele will be represented in at least one of the BC_1F_1 plants, we need to produce n backcrosses where n is the solution to the equation $(1 - \frac{1}{2})^n = 0.05$. Five BC_1F_1 plants should be sufficient to assure that the allele from the donor parent is present in at least one of them.

With complexly inherited traits, larger sample sizes may be required. Consider two genes being contributed by the donor parent and consider the sample size required in the second backcross. Of the gametes produced by the BC_1F_1 plants, we would expect 1/16 to contain both genes from the donor parent. To be reasonably sure of obtaining both in the second backcross we would require approximately 47 BC_2F_1 plants. One can argue that one gene would be all that would be required to result in transgressive segregates for complexly inherited traits. However, most would agree that larger backcrosses populations should be the goal if one is hoping to obtain improvement in multigenic traits in a backcrossing program as proposed by Lawrence and Frey.

Summary

We have attempted to rationalize the findings of Lawrence and Frey by considering expected genotype frequencies for both linked and independent genes. It appears that backcrossing can increase the frequency of transgressive segregates for complexly inherited traits by optimizing the balance of gene frequencies at loci in which the plus alleles come from the recurrent parent and of gene frequencies at loci in which the plus alleles are contributed by the donor parent. It appears that two backcrosses will generally give near optimum results. The presence of linkage between the genes of the recurrent and donor parents will tend to reduce the chances of obtaining transgressive segregates and less backcrossing will be required to maximize the chance of success.

Grain Yields of Oat Genotypes on Summerfallow and Stubble Land

J.D. Berdahl

Approximately 70% of the commercial oat acreage in Saskatchewan is sown on land that has been cropped the previous year, and there is a trend toward increased use of stubble land for oats. All of our early generation selection and subsequent yield testing is conducted on land that has been in summerfallow the previous year. Twenty-five genotypes with a wide range in genetic diversity were grown in replicated performance tests for three years at Saskatoon on summerfallow and stubble land (cropped with wheat the previous year) to determine if a yield interaction existed between genotypes and these cropping practices. Averaged over years and practices, heading date among genotypes ranged from 46 to 54 days and plant height ranged from 67 to 108 cm. Averaged over three years, yields among genotypes ranged from 29.1 to 38.5 kg/Ha on stubble and from 33.9 to 44.6 kg/Ha on summerfallow. Genotype x cropping practice (GP) and genotype x cropping practice x year (GPY) interactions were not significant. Three year mean yields of the 25 genotypes on summerfallow were highly correlated (r=0.91) with yields on stubble land. Thus, we conclude that performance of oats on summerfallow gives a reliable indication of performance on stubble.

Analysis of Oat Isolines that Produce Different Grain Yields

M. A. Brinkman and K. J. Frey

Yield component and growth analysis studies were made on a set of four early and four midseason oat isolines that had significant grain yield deviations from the recurrent parent within each series. The lines in each series were nearly isogenic except for crown-rust resistance genes transferred from three unadapted donor parents: a) C.I.8079, an *Avena sterilis* L. introduction from Israel; b) C.I.7171, an *Avena sativa* L. line from Argentina; and c) C.I.7232, a derived-tetraploid that originated from the cross of the diploid C.D.3820 (*Avena strigosa* L.) with the tetraploid C.D.4549, (*Avena abyssinica* L.). All isolines were formed after a minimum of five backcrosses to the respective recurrent parent.

Grain yield and yield component experiments were conducted at two Iowa locations during each of three years. In both isoline sets, the C.I.8079- and C.I.7171-derived isolines were significantly higher yielding than their respective recurrent parents, while both C.I.7232-derived isolines were significantly low yielding. Apparently, "yield loci" tightly linked to the crown-rust resistance loci were transferred into the recurrent parent background through linkage drag, remained linked to the rust loci during backcrossing, and subsequently resulted in significant grain yield deviations in the derived isolines.

Results of the yield component trials delineated morphological causes for these yield deviations. Increased yields of both the early and midseason C.I.8079-derived isolines were caused by increased tillering, while yield advantages of the C.I.7171-derived isolines were attributable tillering in the early background, and to tillering and seed weight improvements in the midseason. The early C.I.7232-derived isoline was low yielding because it had substantially fewer spikelets per panicle, while moderate reductions of both spikelet numbers and seed weight were responsible for the low yields of the midseason C.I.7232-derived isoline.

Results of the growth analysis studies, conducted for two years at Ames, Iowa, indicated that the morpho-physiological mechanism responsible for grain yield deviations was leaf area duration (LAD), which in both maturity groups was high in the high-yielding isolines, but low in the low-yielding isolines. These LAD deviations were due primarily to growth of the fourth, fifth, and sixth leaves of the plant canopies. Presumably, the isolines with increased LAD's had increased photosynthate production, which ultimately increased plant growth rates, and grain yields.

Because the genic sources of improved grain yields were unadapted types, we suggest continued evaluation and utilization of exotic germplasm for growth genes which, when isolated from undesirable traits through backcrossing, may increase grain yields of adapted types.

Influence of Grain: Straw Ratios on Agronomic, Physiologic, and Economic Factors in Oats

R. A. Forsberg, M. A. Brinkman, D. M. Peterson, and R. D. Duerst

Harvest index (HI) ratios (grain weight/bundle weight) are useful indicators of varietal responses to changing environments, e.g., different planting dates or different fertilizer treatments, and they can aid in studies of dry matter accumulation. In 1975, HI ratios were determined for 97 entries in the primary Madison oat performance trial. In this test grain yields ranged from 47.1 to 105.0 B/A with a mean of 76.0; straw yields ranged from 2590 to 6039 Lbs./A, averaging 4316 Lbs.; and harvest index ratios ranged from .253 to .454 with a mean of .364.

There were three high-harvest-index types: (1) Ill. 69-7669 (.430) and Hudson (.417) had high grain yields and good straw yields; (2) Jaycee (.440) had a low grain yield and a very low straw yield; and (3) Spear (.415) had above-average grain yield and below-average straw yield, typical of many of the selections with above-average HI values.

As expected, straw yield was negatively correlated with HI (r=-.52**). The relationship between grain yield and HI was not as intense (r=.25*). Although HI values were negatively correlated with groat protein percentages (r=-.37**), straw yield and grain yield were not correlated with groat protein (r=.05 and -.02, respectively).

The ranks for total crop value, based on current market prices for both grain and straw, among the 11 entries with the highest harvest index ratios ranged from 2 (Ill. 69-7669) to 94 (Jaycee). Hudson ranked 4th and Spear 63rd. The entry with the highest total value was a test selection which ranked 1st for straw yield (6039 Lbs./A), 12th for grain yield (87.4 B/A), and 86th for HI (.318).

Intercropping of Spring Oats with Soybeans and Sorghums

C. M. Brown

Intercropping, the growing of two or more crops in the same field at the same time, may provide a method for improving the success of growing two crops in one season. The important advantages of intercorpping as a method of double cropping appear to be (1) establishment of the second crop (intercrop) occurs earlier in the season when moisture is more likely to be sufficient, (2) the second crop has a better chance of maturing prior to frost damage in the fall, (3) cost of establishment might be much less, particularly if some of the equipment and herbicide costs can be eliminated or reduced, and (4) the northern limit of successful double cropping might be extended.

In view of the potential advantages of interseeding, experiments were conducted in 1975 with spring oats as the first crop and either soybeans or sorghum as the intercrop. Otee variety of oats was drilled on March 21, 1975, at 2 bu/A in 7-inch rows with a conventional grain drill. On April 29, 1975, Williams variety of soybeans was cross-drilled in the oats at the rate of 1.2 bu/A in rows 8 inches apart. In one treatment, the oats were harvested as silage on June 19 while in another treatment the oats were harvested for grain on July 10.

The silage yield of oats grown without the intercrop was 3590 lbs/A dry matter with 9 percent protein and 24 percent dry matter while that of oats interplanted with soybeans was 3777 lbs/A dry matter with 9.6 percent protein and 25% dry matter. Thus, the interplanted soybeans appeared to slightly increase the yield and protein content of the silage.

Grain yield of oats grown alone was 95 bu/A while that of oats interplanted with soybeans was 83 bu/A. Part of the reduction in grain yield where soybeans were interplanted was likely caused by harvest problems but the competition from the soybeans could also have been a factor.

Soybean yields following the removal of an oat silage crop was 40 bushels per acre while that of soybeans following removal of an oat grain crop was 28 bushels per acre. Although soybeans grown alone were not included as one of the check treatments in this experiment, the yield of Williams soybeans on plots in a nearby area was approximately 55 bushels per acre.

Sorghum x sudangrass and grain sorghum were successfully established in spring oats by using approximately the same method as was used for the interseeded soybeans. Briefly, the sorghum was cross-drilled in the oats at 20 pounds per acre in 8 inch rows. Part of the oats was harvested as silage and the remainder was harvested as grain. Upon removal of the oats, 75 pounds of nitrogen per acre were applied to each interseeded sorghum treatment. Oat silage yields averaged 3590 pounds per acre and oat grain yields average 94 bushels per acre. Two cuttings of sorghum x sudangrass following oats harvested as silage produced 7298 pounds of forage dry matter while two cuttings following oats harvested as grain produced 6388 pounds dry matter per acre. Grain sorghum grain yields were 3900 pounds per acre following oat silage and 2700 pounds following oat grain.

Although the 1975 results established that soybeans and sorghums can be successfully intercropped with spring oats, much research is needed to determine the feasibility of such a cropping system. We need to determine whether successful results are possible when winter wheat is substituted for spring oats as the first crop. Further research will be required to determine the best time and method for introducing the intercrop in order to get maximum combined performance. Planting rates, row widths, and varieties of both crops will need investigation to arrive at optimum production and profit.

We will need to know if unfavorable weather conditions will drastically alter these findings. Various weed control systems will need to be evaluated to determine whether or not adequate weed control is possible in such an intercropping system.

Selection for Panicle Length and Number of Spikelets Per Panicle in Six Oat Crosses

R. A. Forsberg and O. M. Taha

Recent studies at Wisconsin have indicated that among six oat panicle characteristics, panicle length (PL) and number of spikelets per panicle (NSP) have the most promise as grain-yield selection indices. These two traits had high heritability estimates, and estimates of their additive gene effects were stable over years [Crop Sci. 15(1975):457-460; Agron. Abstr. (1974):50]. These predictions were based on analyses of data from F_1 and F_2 generations of several oat crosses, and verification that such a selection scheme has merit is contingent upon the ultimate development of higher yielding homozygous lines.

High correlations between individual panicle data and their respective line means in both F_3 and F_4 generations supported the earlier estimates of high heritability for PL and NSP. Standard unit heritability estimates for NSP, based on F_3 plant-F_4 line correlations, were .63** for Lodi x C7 (intermediate x high) and .70** for C7 x Beedee (high x intermediate). In 1975, NSP and PL were highly correlated with grain yield in 28 F_3-derived bulk F_4 populations from these two crosses, giving r values of .68** and .93**, respectively. On a prediction basis, 1974 F_3 line means for NSP and PL correlated well with 1975 bulk F_4 grain yields for 13 Lodi x C7 lines, r=.79** for NSP and .54* for PL. The corresponding values for 15 C7 x Beedee lines were considerably lower and nonsignificant. Over all 28 lines, the 1974 NSP-1975 yield and 1974 PL-1975 yield correlation coefficients both equalled .47**.

The relationships between 1973 F_3 plants and their respective 1975 F_4 progeny lines for NSP and PL were also evaluated in six other crosses among diverse parents. Standard unit heritability estimates were lower than for the two previous crosses, with values for NSP ranging from .14 for C5 x C7 (high x high) to .41** for C7 x Jaycee (high x low). Values for PL ranged from .15 for Jaycee x Froker (short x intermediate) to .41** for C5 x Beedee (long x intermediate).

Grain-yield improvement based on selection for increased number of spikelets per panicle may be difficult if there is reverse compensation in the form of lower seed weight or decreased tillering. The relationships among these traits will be monitored in future generations.

Short Cuts in Variety Trial Averaging

J. E. Grafius

Are you tired of calculating averages for reports on variety tests? We are too! But we've recently devised a scheme which greatly simplifies the process and may be of interest to others.

Finlay and Wilkinson (Aus. J. Agr. Res., 1963) proposed regression techniques for measuring adaptation. Eberhart and Russell (Crop Sci., 1966) added the concept of deviations from regression as a measure of varietal stability. I wish to add the concept of using a sample of cultivars from the area (lines from the Corn Belt, the Northern tier of States and Canada) as a measure of the gene pool available for the area.

In our scheme, this sample is used as a base of comparisons for all varieties. We regress each variety against the average yield of the say, 30 varieties in the test, ignoring geographic locations within the state. Not only do we ignore geographic locations but we allow yearly changes in the 30 varieties of the test, just so long as the varieties represent the offerings of the surrounding States and Canada as well as our own, thus consitituting a good sample of the gene pool presently in vogue. Surprisingly this works - and very well. The regression line explains from 80-90% of the variation in yield for most varieties. A very few varieties were in the 60-70% range - these are considered unstable in Michigan. Table 1 gives a sample of the results.

Table 1. Expected yield given an average yield of 50, 70, 104, 120, or 130 bu/acre for all varieties in the test. Reliability column refers to % of the variation in varietal yield explained by the average yield.

		Reliability(r^2)	Yield in bu/acre				
Variety	No. of Observations	%	50	70	104	120	130
AuSable	40	88	57	74	103	117	125
Mariner	40	89	53	74	109	126	136
Korwood	33	84	54	75	110	127	138
Mackinaw	30	81	50	71	106	122	132
Rodney	40	67	55	66	93	109	120
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Clintland 64	40	77	49	63	87	99	106
Dal	13	91	41	63	99	116	127
64-152-123	40	89	57	77	111	127	137

Table 1 interjects a management phase into varietal recommendation. A different set of varieties can be recommended when the expected yields are low (say 70 bu/acre) than where expected yields are in the 120 bushel range. Also the percent reliability indicates which varieties are most consistent. Such things as susceptibility to lodging or to intermittent pests would show up in the r^2 column and these varieties can be discriminated against.

It is an easy matter to file the data for a variety together with the test mean on punch cards for convenient retrieval whenever new regression equations are needed. For annual comparisons one needs to run only newer varieties since after several years testing, regression lines in the older varieties will tend to stabilize. Tabulation of yield results as in Table 1, probably gives a more reliable picture of variety performance than several tables of 2 and 3 year averages with a large portion of the data missing.

A "Golden" Seed Phenomenon in Winter Oats

John P. Jones
University of Arkansas

During the three consecutive crop years 1964-67, we observed a seed color modification in several varieties and lines of winter oats in Arkansas which was referred to locally as "golden seed". The condition likewise occurred in the 1971-72 season but was absent during the intervening years.

We first observed the condition in 1964-65 in a increase seed lot of the variety Ora which was grown on the experiment station at Stuttgart Arkansas. The affected seed were bright lemon-yellow in appearance as compared to Ora's normal light tan color. During the 1965-66 season, seed from foundation fields of Ora and Nora grown at Stuttgart showed 11.2 and 17.8 percent golden seed respectively.

Individual golden and normal seeds of Nora were examined to determine the distribution of the golden color. The lemma and palea of each seed, 371 golden and 223 normal, were removed and examined along with the naked caryopses. Yellowing was not observed in any of the caryopses and was entirely confined to the lemma and palea of the golden seed.

Seed of several of the entries in the Uniform Central Oats Nursery grown at Stuttgart during 1965-66 were also examined for golden seed. Ten entries had golden seed in percentages ranging from 4.1 to 8.5 (Table 1). No golden seed was observed in the entries CI1815 (Appler), CI7513 (Carolee), CI7890 (Arlington 23), CI7886 (Sumter), CI8027, CI8136, CI8221, CI8222, CI8223, CI8224 and CI8225.

Random seed samples of golden and normal seed from eight lines (CI's 7757, 7888, 7927, 8025, 8026, 8095, 8220 and 8228) were then examined to determine if any seed-borne microflora might have been responsible for the golden discoloration. Fifty golden and normal seed of each line were surface sterilized in 0.5% sodium hypochlorite for three minutes, rinsed through four changes of sterile distilled water, plated onto bean pod agar (Difco) and then incubated at room temperature for seven days. No obvious differences in microflora pattern was apparent between the golden and normal seeds in any of the eight lines (Table 2).

The possibility that the discoloration may have been associated with barley yellow dwarf virus infection was also investigated, since the disease was quite prevalent during this period. Seed samples were obtained from plants selected from two BYDV infected and adjacent healthy areas in each of two fields of Ora and Nora oats at Fayetteville in May 1967. Examination revealed that the seed from the Ora healthy areas averaged 5.4% golden seed and the BYDV areas 6.0%. The Nora seed similarly averaged 5.1% golden seed from the healthy areas and 5.2% from the comparable BYDV areas.

Three separate plantings of paired golden and normal seed were made in 1966-67 to determine if the golden discoloration was heritable. Golden and normal seed were selected from Nora foundation seed which had been grown at Stuttgart during 1965-66 and which contained 17.8% golden seed.

The first planting was made in greenhouse soil benches in October 1966. Twenty paired, three-foot rows were planted and thinned to four plants per row and grown to maturity. The plants were harvested in February 1967 and the seed examined. A total of 10,700 seed were produced by the golden seed plants and 9025 by the normal plants. No golden seed was found in either seed lot and no other obvious physical differences in the seed were observed.

A second planting of the Nora golden and normal seed was made in a field at Fayetteville in October 1966. The first week in December, 50 randomly selected plants were transplanted from each treatment into a greenhouse soil bench and grown to maturity. The plants were harvested in April 1967 with the golden plants producing 4650 seed and the normal 3925. Examination of the seed showed golden seed in both seed lots with the original golden plants producing 19.4% golden seed and the normal plants 12.0%. In all other respects the two seed lots appeared similar.

The third paired planting was made in the field at Stuttgart in two 3x16 foot, 4 row plots in October 1966. Seed was harvested from the two inner rows in May 1967 and examined for golden seed. The golden seed plants produced 20,150 seed with 0.2% golden seed and the normal plants 17,725 seed with no golden seed.

It was apparent from the investigations that the development of the golden condition was essentially "cosmetic" and did not damage seed production and viability. The condition did not appear to be caused by any of our presently known plant pathogens or other common seed microflora. Furthermore, the evidence indicated that the condition was not directly heritable as such but, that a predisposition towards the discoloration was associated with certain genotypes and was only expressed under certain environmental conditions. What these environmental conditions may be is conjectural, although we suspect drought stress.

Although this condition is no problem in itself, it can produce problems with seed certification agencies if the tendency toward the discoloration is not recognized and described in the original variety description. We are interested in whether other oat workers have observed this condition in their oat lines and varieties.

Table 1. Oat lines grown during 1965-66 at Stuttgart Arkansas showing "golden" seed.

Lines	no. seed examined	no. golden seed	% golden seed
CI7417 (Fairfax)	2176	165	7.6
CI7624 (Jefferson)	2148	162	7.5
CI7757 (Belts 61-73)	2532	104	4.1
CI7888 (Bruce)	1780	151	8.5
CI7927 (Coker 242)	2348	116	4.9
CI8025 (Coker 62-11)	1932	116	6.0
CI8026 (Delta 3507)	1720	147	8.5
CI8095 (Ark 3-74-74)	1644	116	7.1
CI8220 (Ark 3-68-551)	1708	101	5.9
CI8228 (Delta 61140-5)	1684	118	7.0

Table 2. Combined totals of microorganisms isolated from each of 50 "golden" and normal seed of the oat lines CI7757, CI7888, CI7927, CI8025, CI8026, CI8095, CI8220, and CI8228.

	No. and type of microorganism					
Type seed	Alt.[1/]	Fus.	Hel.	Misc.	Bacteria	None
Golden	121	5	8	44	79	143
Normal	159	2	13	22	60	144

[1/] Alt. (*Alternaria* sp.), Fus. (*Fusarium* sp.), Hel. (*Helminthosporium avenae*), Misc. (miscellaneous non-pathogenic fungi).

RESPONSE OF TWENTY-ONE OAT CULTIVARS TO FERTILIZER NITROGEN

H. W. Ohm

Experiments were conducted for three years to determine responses to fertilizer N of 21 oat cultivars differing widely for several agronomic characters, yield, and groat protein level. Two N treatments: one, no added N (40-50 kg available N/ha in the soil); and two, 110 kg N/ha in a split application (at seeding, 85 kg N/ha as ammonium nitrate sulphate and 2 to 5 days prior to heading 25 kg N/ha as urea) were assigned at random to main plots. The 21 cultivars were assigned at random to subplots.

Application of N resulted in significant increases for plant height, lodging score, level of protein, and yield; it did not affect heading date or seed weight; and it reduced test weight. Short-strawed types increased in plant height more than several taller cultivars although plant height increases were greatest for other tall types. Lodging scores of weaker strawed cultivars did not always increase more with N application than those of stronger strawed cultivars. Protein level in certain low protein cultivars increased more than that of some high protein cultivars with fertilizer N. A given cultivar may not respond similarly to N for level of protein and/or yield.

More extensive testing of potential new cultivars to determine specific fertility x cultivar interactions is recommended.

Recurrent Selection for Yield in Oats

D. D. Stuthman and R. E. Stucker

Twelve high yielding well adapted cultivars and lines were crossed in diallel combination (except two for a total of 64 crosses) to produce the initial segregating populations for this study. Ten F_2 seeds from each cross were advanced to F_4 via single seed descent; F_5 seed from individual F_4 plants was bulked and then increased one generation. The resultant F_6 and F_7 generation lines were evaluated for yield. Based on F_6 generation grain yield, 21 lines were chosen to initiate the second cycle of recurrent selection. Eighteen of these lines were chosen using both cross and line within cross performance and three were chosen on line performance only. The 21 selections were intercrossed in a circulant partial diallel crossing scheme; each line was crossed to six others to make a total of 63 crosses. The progeny were advanced following the procedure used in the first cycle and evaluated in the F_6 generation for yield, maturity and seed weight. Both sets of parents were also included. A comparison of second cycle progeny yields with yields of the first set of parents showed a 33.4% gain. Maturity was delayed 2.4 days, an insufficient amount to account for the observed increase in yield. Seed weight was not affected. Thus, we conclude that this selection process has successfully accumulated favorable genes for yield. Combining ability analyses of both sets of progeny revealed considerable additive by additive genetic variance relative to additive variance. We believe that the large amount of epistasis provides a plausible explanation for a low relationship between parent and near homozygous progeny yields. Another set of 21 parents has been identified for intercrossing to initiate the third cycle.

Oat Quality, Protein, and Nutritional Value

PROGRESS ON FORMING A MILLING OATS IMPROVEMENT ASSOCIATION TO SUPPORT OATS RESEARCH

Donald J. Schrickel
The Quaker Oats Company

As a major miller of oats, our Company has long been concerned about the need of federally funded oats research. This concern came into sharp focus last summer when it was proposed by the Agricultural Research Service that two scientific research positions in oats be terminated--one at Ames, Iowa, and one at Champaign, Illinois. This action convinced us at Quaker that our individual efforts to communicate the needs of industry to members of Congress and the ARS did not have sufficient impact. We felt the proper approach to create greater impact would be through a responsible trade organization. Consequently, in August we proposed a meeting with other oats millers--La Crosse Milling Company, Cochrane, Wisconsin; General Mills, Minneapolis; Fruen Milling Division of ConAgra, Minneapolis; National Oats Company, Cedar Rapids, Iowa; and Checkerboard Division, Ralston Purina Company, Minneapolis.

Background information on the subject was prepared and sent to each company. On December 4, 1975, we met in Minneapolis, Minnesota. Two ARS people and one State Experiment Station plant breeder were invited to attend as informed guests--Drs. Lee Briggle and Ken Lebsock of ARS and Deon Stuthman, University of Minnesota. The response from the millers was excellent. All invited firms were represented. There was a good exchange of information between those present.

Now we are attempting to define objectives and determine such basics as the name of the proposed organization. Should it be the "Oats Improvement Association" or the "Milling Oats Improvement Association"? Will the only function of our association be to communicate research needs to Congress and ARS?

We decided to consider these matters further and get together here at Columbia, Missouri, during the North Central Oats Conference. Each prospective member has been asked to submit his idea of the major objective of the organization. I have listed ours at Quaker as follows: "To appear before Congressional Appropriation Committees when hearings are held for Agriculture appropriations and communicate our need for adequate funding of oats research."

Relationship among Protein Concentration, Concentration of Protein Fractions, and Amino Acid Balance in Oats

David M. Peterson

The relationships among protein concentrations and fractional protein composition in oat (Avena sativa L.) groats were investigated, using samples from two locations in Wisconsin, a rate and type of N experiment in Arkansas, and a rate and time of application of N experiment in Michigan. The Michigan samples were also analyzed for amino acid composition. Results indicated that an increase in total protein was primarily related to an increased level of the globulin fraction. In the Wisconsin experiment, samples of six cultivars from Waupaca County were higher in protein than those of the same cultivars from Rock County. The mean globulin percentage was significantly higher in the high protein samples, and accounted for nearly half of the increase in total protein. The prolamin fraction was also significantly higher at the Waupaca County location. In samples of 'Nora' groats from Arkansas, globulins, prolamins, and glutelins all increased with increasing protein concentration. Regression analysis revealed that the rate of increase per unit increase in protein for the prolamins and glutelins ($\underline{b}$ = 0.06 and 0.13, respectively) was less than for the globulins ($\underline{b}$ = 0.39). In the Michigan experiment, all three cultivars receiving a high rate of N (250 kg/ha) at planting had a higher groat protein concentration than did their respective controls (53 kg/ha of N). Only 'Clintland 64' responded significantly in total protein concentration to a supplemental foliar application of 90 kg/ha urea-N after anthesis, in addition to the 53 kg/ha rate at planting. The globulin fraction was highly correlated with total protein for all three cultivars. In Clintland 64, the percentage of glutelins was also strongly associated with total protein. As percent total protein increased the amino acid balance was unchanged in the samples grown in Michigan. It was concluded that the amino acid balance in oat groats is relatively stable over a wide range of protein concentrations because the globulin fraction, whose amino acid composition is similar to that of the total protein, is the one that varies most. The oat samples were provided by Dr. S. K. Ries, Michigan State University, Dr. F. C. Collins, University of Arkansas, and Dr. E. S. Oplinger, University of Wisconsin. Their assistance is gratefully acknowledged.

Chick Feeding Trials with Oats

D. L. Reeves and H. S. Sraon

Three oat varieties which differed in protein levels were used in feeding trials with day old chicks. All diets were adjusted to about 21.5% protein by adding soybean meal. Each oat variety had a second diet to which lysine and methionine were added to determine if this would improve the feed efficiency. The most important factors affecting the rate of gain were the fiber percentage and gross energy per gram of feed. Addition of methionine and lysine to the diets either had no effect, increased gains or decreased gains depending upon the specific variety. The protein source, whether from oats or soybeans made no difference. The greatest and most efficient gains were made by chicks fed the diets lowest in fiber and highest in gross energy.

A Summary of Chick Feeding Trials Using Oats

Diet	Fiber (%)	Gross Energy (cal/gm)	Weight Gained (g)	Feed Consumed/ Weight Gained
Control Diet	2.9	4139	335	2.53
Spear*	11.0	3714	213	3.85
Spear + M, L	10.3	3767	235	3.29
Kelsey*	9.2	3781	234	3.54
Kelsey + M, L	9.3	3752	216	3.43
Froker*	8.3	3812	283	2.54
Froker + M, L	8.4	3755	242	3.20
LSD (.05)			40	0.61

* Three commonly grown oat varieties in this region. Whole grain protein percentages were Spear, 14.3; Kelsey, 11.0; and Froker, 14.9; with groat protein being 18.2, 14.0, and 17.6 percent, respectively.

Protein Content and Amino Acid Composition in Groats and Hulls of Developing Oats (*Avena sativa*)

Y. Pomeranz, H. L. Shands, G. S. Robbins and J. T. Gilbertson

Protein content and amino acid composition were determined in groats and hulls of three oat cultivars harvested at four stages of development. Protein content was slightly higher in mature than in immature groats. In the hulls, protein content decreased during development to about one-third the content of immature hulls. The large decrease in protein content of the hulls was accompanied by little change in amino acid composition. In the groats, however, there were consistent and large decreases in concentrations of lysine, threonine, and aspartic acid and an increase in glutamic acid. The results suggest that in addition to deposition of storage protein in the groat, amino acids are translocated from the hulls to the groats.

Variation in Fatty Acid Composition Among Oat Groats

V. L. Youngs and Halis Püsküllcü

Relative concentration of six fatty acids was measured in oat groats from 15 cultivars grown in three locations in two crop years.

Palmitic, oleic and linoleic acids comprised over 95% of the acids measured. Ranges were: palmitic, 16.2-21.8%; oleic, 28.4-40.3%; linoleic, 36.6-45.8%. Correlations between the three major fatty acids and total lipids were palmitic, r = -0.76**; oleic, r = 0.91**, linoleic, r = -0.85**. All fatty acids, except stearic showed highly significant differences among cultivars. Broad-sense heritabilities of the three acids were high; palmitic, 91.4%, oleic, 98.6%, linoleic 95.7%.

Distribution of Lipid Components in Two Oat Cultivars.

V. L. Youngs and Mukerrem Püsküllcü

Groats from the oat cultivars Dal and Froker were ground and extracted first with ethyl ether to obtain free lipids (78%), and then with water-saturated butanol to obtain bound lipids (22%). Thin-layer chromatography and reflectance densitometry were used to separate and measure these lipid components in groats: triglycerides, 1,2- and 1,3-diglycerides, free fatty acids, sterols, sterol glucosides, monogalactosyl monoglycerides, digalactosyl diglycerides, phosphatidyl choline, phosphatidyl ethanolamine, lipophosphatidyl choline, and lysophosphatidyl ethanolamine. Lipids also were extracted and lipid components measured in four fractions from oat groats: bran, starchy endosperm, scutellum, and embryonic axis. The triglyceride component was most abundant. It accounted for 41% of the lipids in groats, and 39 to 58% in the four groat fractions, with the scutellum and embryonic containing 50 to 58% respectively. The next most abundant fraction was digalactosyl diglyceride; 7% in the groats, and 8 and 9% in the endosperm and bran, respectively. Insufficient amounts were present in the embryo to measure. The other components, measured individually, each accounted for 5% or less of the total lipids. All components measured equalled 72% of the total lipids extracted.

Relative fatty acid composition of the free lipids extracted from four groat fractions, and of the bound lipids extracted from bran and endosperm, was measured by gas chromatography. Free lipids averaged more oleic acid and less palmitic (each about 7 percentage points) than bound lipids. Linoleic acid showed little change.

Laboratory Measurement of Feed Grain Quality in Oats

H. G. Marshall[1/]

The comparatively high cost of producing digestible energy is a primary factor which has led to a decrease in the importance of oats as a feed grain. Genetic increases in grain protein and total digestible nutrients, without any loss in yield, would be beneficial; but the magnitude of this need is related to the nutritional requirements of the livestock to be fed. In general, there probably is a greater need to increase grain yield per acre than to increase the percentage of nutrients in the grain. Oat grain is not a high-energy feed, primarily because of the high percentage of low energy hulls. Variables that are subject to genetic change to improve the total digestible energy are groat composition, hull composition, and the hull/groat ratio. One of my program objectives is to develop oat varieties with improved whole grain nutritional value and to improve the stability of this characteristic under various environmental stresses. Semidwarf germ plasm under development in my program is especially poor for grain quality.

Accurate measurement of grain quality components at an efficient rate is essential for success in a program to improve feed grain quality. In order to learn the relationships of various grain quality components, seed weight, bushel weight, percent groats, groat percent crude protein, whole grain percent crude protein, percent in vitro dry matter disappearance (IVDMD), percent fiber, and percent lignin data were collected for grain from 16 spring oat varieties during 2 years at two locations in Pennsylvania. Bushel weight, the long time measure of grain quality, did not show a strong relationship to digestible energy as determined by the IVDMD technique. There was no relationship (maximum r=0.2247, 16 d.f.) when bushel weights were in the normal range (28-35 lbs) for the varieties studied; but when bushel weights varied widely (24-35 lbs) because of environmental stress on the later maturing varieties, that characteristic was of some value to predict IVDMD (maximum r=0.7541, 16 d.f.). The characteristics most closely correlated with IVDMD were percent fiber (maximum r=-0.9225, 16 d.f.) and percent groats (maximum r=0.9139, 16 d.f.). Whole grain protein and groat protein values were correlated in all experiments, but this relationship was influenced by location and was of marginal value for predictive purposes.

All of the laboratory procedures used (Kjeldahl nitrogen, IVDMD, acid detergent fiber, permanganate lignin) were inefficient relative to the number of selections that should be screened in a breeding program. A laboratory method for rapid prediction of feed grain quality is sorely needed to expedite genetic improvement. Infrared reflectance spectroscopy has recently been applied to the prediction of grain and forage quality and has considerable potential for use to rapidly screen experimental germ plasm. A multipurpose computerized spectrophotometer recently was obtained for cooperative crop quality research by ARS and The Pennsylvania Agricultural Experiment Station. The quality data collected in the experiments described above will be used to study the application of infrared reflectance to the measurement of feed grain quality in oats.

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Some Observations on Dry Matter Accumulation in Oats

Mehdi Nasseri, Paul Rowoth, Tim Flanders and Dale Sechler

The accumulation of dry matter in the roots, tops, and panicles of the 'Mo. 0205' and 'Elan' oat varieties was observed under greenhouse conditions. The effect of leaf pruning on response was also studied.

Recoverable root weight exceeded that of the tops for only three weeks after planting but root weight continued to increase until the plant reached maximum plant height. Maximum dry matter in the leaves and stem, as a percentage of the total, occurred at the time of flowering. Mo 0205 accumulated more dry matter in the tops, in relation to the roots, than did Elan.

Mo 0205 is a significantly taller variety than Elan but the internode elongation that resulted in this difference was not evident until about one week prior to the appearance of the first panicle. The Elan variety tends to tiller more than Mo. 0205 and usually has one more leaf per plant. The Elan variety flowered about one week later than Mo. 0205 and the flowering extended over about a one week longer period.

The removal of one-half of each leaf as they fully elongated resulted in less dry matter accumulation in all plant parts. On plants where leaves were pruned the recoverable root dry weights averaged 88% of the control, dry weights of tops 89%, and dry weights of panicles 84%. The top: root ratio remained about the same.

Pathology and Entomology

The Transfer of Mildew Resistance from *Avena barbata* (2n = 28) into the Cultivated Oat

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Resistance to mildew infection has been found in a number of wild species of *Avena* - in the diploid species *A. prostrata* and *A. hirtula*, the tetraploids *A. barbata* and *A. murphyi* and in the hexaploid species *A. sterilis*. Mildew resistance from the hexaploid *A. sterilis* can be readily introduced into the cultivated oat by backcrossing and this has been accomplished in the cultivar Mostyn bred at the Welsh Plant Breeding Station. However, the transfer of genes from diploid and tetraploid species into the cultivated species is more difficult since strong sterility barriers which isolate these species of lower ploidy from *A. sativa* have to be overcome.

A genotype of *A. barbata* collected in Algeria is resistant to all prevalent races of mildew in the United Kingdom. The F_1 hybrids between *A. barbata* and *A. sativa* are sterile, but the amphiploid produced by doubling the chromosome number of the hybrid restores fertility to a level which makes it possible to use the amphiploid in crosses with *A. sativa*. The amphiploid was backcrossed twice to *A. sativa* (cv. Manod) and from the selfed progeny of the second backcross hybrid a mildew resistant genotype with 44 chromosomes was isolated. This genotype combines the full complement of the cultivar Manod and a single pair of *barbata* chromosomes on which the gene conferring mildew resistance is located. The disomic addition line is fertile and does not show any of the undesirable wild characters of *A. barbata*, but its breeding behaviour is not sufficiently regular to consider developing cultivars with 44 chromosomes.

Seeds of the disomic addition line were irradiated with gamma rays using a Co^{60} source. If a translocation involving the *barbata* chromosome and a *sativa* chromosome were achieved, the formation of a multivalent or a bivalent between incompletely homologous chromosomes could give rise to gametes in which the gene for mildew resistance was absent. The fusion of such gametes during fertilization would result in occasional susceptible progeny in the I_2 generation. Of the 391 I_2 lines tested, 19 showed segregation for mildew resistance with some susceptible seedlings, but the remainder produced only resistant seedlings, as expected from a normal disomic addition line. Some of the I_3 progenies derived from the resistant plants of the segregating populations of I_2 gave ratios of 3 resistant : 1 susceptible seedlings when tested for mildew resistance. All these segregating lines had 44 chromosomes which shows that the susceptible seedlings were not the result of the complete loss of the *barbata* chromosome and a chromosome of *A. sativa*.

One of the 44 chromosome lines including a translocation was crossed with Manod and the progenies of the 43 chromosome plants again gave a monofactorial segregation. Resistant seedlings in the F_2 population had the euploid chromosome number of 42. The *sativa* chromosome involved in the translocation was readily identified by karyotype analysis as being chromosome 21, the smallest chromosome of the complement according to the standard karyotype proposed by Rajhathy. The fact that plants heterozygous for the translocated chromosome produce selfed proganies, which segregate into 3 resistant : 1 susceptible seedlings, shows that gametes including the translocated chromosome can compete effectivly with gametes containing the normal haploid set of sativa chromosomes. It should thus be possible to transfer the mildew resistance to other cultivars of oats by a simple backcrossing programme.

This resistance is expressed as slight hypersensitivity in the seedling stage whilst the upper leaves of the adult plant show almost complete immunity. As this reaction is apparently simply controlled, the permanency of the resistance may be questioned, but, since this source is from a tetraploid oat it may prove more durable than resistance from hexaploid types. However, in order to safe-guard new cultivars against a possible 'Vertifolia effect' it is proposed to incorporate the resistance into partially resistant lines with moderate to high levels of 'race non-specific' resistance by several backcrosses to the recurrent partially resistant parents, followed by segregation. Furthermore, to ensure that high levels of partial resistance have been combined with the barbata resistance, the degree of partial resistance in each F_2 line will be assessed on the susceptible segregants in the F_2 progeny.

This combination of two types of resistance should thus produce a more complete and stable form of mildew control and slow down the multiplication of any barbata virulence that might arise.

More About Loose Smut

D. C. Arny

Stuthman and Wilcoxson (1974 ONL) reported smut susceptibility in some newer varieties. We also have noted this in our tests; 1975 results for certain named varieties and the smut differentials are given in the table below. Inoculation was by the partial vacuum method. The "Old" collection has been carried in our smut-selection trials for several years. The "New" collection was obtained from natural infection in Lodi.

Beedee, Hudson, Lodi and Orbit are very susceptible to the new collection, while Dal, Froker, Holden and Wright appear to be intermediate. We have found natural infection in Froker. Goodland and Jaycee continue to be resistant. From the reactions of the differentials, it is evident that a wider range of virulence than previously described has developed. However, resistance is still available, and seed treatment, at least of foundation seed, can preserve the usefulness of the improved varieties which are showing susceptibility.

Variety	No. smutted panicles/1.5 m Old	New	Variety	No. smutted panicles/1.5 m Old	New
Allen	39	47	Korwood	63	50
Beedee	0	80	Lodi	5	80
Chief	17	26	Mackinaw	7	7
Clintland 64	14	21	M73	30	40
Dal	0	13	Noble	0	Tr
Froker	12	29	Orbit	0	69
Garland	13	7	Portal	31	39
Goodland	0	1	Stout	15	22
Gopher	58	70	Spear	2	8
Holden	3	12	States Pride	67	59
Hudson	0	53	Wright	0	32
Jaycee	1	2			
Anthony	83	51	Markton	1	Tr
Black Diamond	37	40	Monarch	38	37
Black Mesdag	39	36	Navarro	0	Tr
Camas	0	0	Nicol	0	4
Fulghum	24	4	Victoria	0	40
Gothland	7	22	Victory	36	33

Greenbug Resistance in Oats

Norris Daniels

Three-hundred-twelve oat selections of the World Collection were tested in the greenhouse during 1975 for their resistance to biotype C greenbug. Thirty to forty seeds were planted per row in large flats. The plants, when about an inch tall, were infested with greenbugs. After the plants were heavily damaged, ratings of 1 through 6 were made. A rating of 1 = no damage; a rating of 6 = a dead plant.

Of the selections tested four had ratings of 3.7 or below as follows:

C.I. Number	Designation	Source	Rating
8122		USA-KY	3.7
8148		USA-MO	3.7
8250	KYTO-64SP68	--	3.5
8251	KYTO-64SP71	--	3.7
8290	6984	Turkey	3.5
8291	7449	Turkey	3.5

To date, 3932 selections have been tested.

Tolerance to Barley Yellow Dwarf Virus Among Some New Accessions of Oats

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A part of the USDA World Collection consisting of 825 entries representing new accessions received from Dr. J. C. Craddock was tested under field conditions at Urbana, Illinois for their reaction to two strains of barley yellow dwarf virus (BYDV) that exhibited in the past different levels and spectra of virulence in Albion, CI5068 and CI1915. In 1973 experiments with two replications and 12 plants per replication, 84 selections out of the group were found to possess a satisfactory level of tolerance to the two virus isolates. These selections were retested in 1974 using four replications and the same hill method of planting. The results are presented in Table 1. The mean values for the reaction of the oat selections to the isolates of BYDV, Southern Illinois-1 and Champaign-6 are given separately. However, the presented values are combined for both years. The degree of tolerance varied with the selection and the virus isolate. There were some entries, such as CI8089 and PI294687, that were tolerant to both virus isolates. A great diversity was noted among the selections in respect to height and growth habit. A number of them were of winter or very late type. Some differences in disease resistance to crown rust and stem rust were also observed among the selections warranting their evaluation to these pathogens. In general, it may be concluded that the group represents a very interesting divergent source of oat germplasm with many desirable characteristics.

Table 1. New sources of tolerance to barley yellow dwarf virus (BYDV) among some recent accessions of oats as determined under field conditions at Urbana, Illinois.

Entry No.	CI or PI No.[a]	Name or Designation	Source	Disease Severity[b] BYDV Strain So. Ill.-1	Ch.-6
1	8089	Autotetraploid sais	USA ID	2	2
2	8150		USA MO	4	4
3	8158	Tifton 6028	USA GA	3	4
4	8181	Angus	Canada	3	3
5	8187	05071	USA MO	2	3
6	8210	63-16-7764	USA PA	3	3
7	8239	Minn. 65-B-2494-2507	USA MN	2	4
8	8273	Iowa X103	USA IA	3	4
9	8287	Rodney	USA MD	3	4
10	8311	Checota	USA OK	3	3
11	8417	Chibinoz	043432	3	3
12	8419	Montezuma	USA CA	3	3
13	274607		Poland	3	4
14	285080	Caravelle	France	3	4
15	285572	Ligowo Sielecki	Poland	4	4
16	285574	Proporczyk	Poland	3	5
17	285575	Zlotniak	Poland	3	5
18	287315	Rauhhafer aus Neustadt	Germany	3	4
19	287319	Eckendorfer Fruhhafer	Germany	3	4
20	287323	Wadsacks Gelb	Germany	4	5
21	287335	Engelens Ingo	Germany	4	6
22	287360	St. Schlanstedter gelb II	Germany	3	4
23	287378	105/59	Germany	5	3
24	287382	Gelber Riesenfohnen	Germany	4	4
25	287386	Beseler II	Germany	4	5
26	287387	Edlers Gottinger	Germany	5	5
27	287390	Wirchenblatter NR16	Germany	4	5
28	287394	Badberger	Germany	3	3
29	287401	Gelb Bergrannter	Germany	3	5
30	287408	104/59	Germany	3	4
31	287416	Mandorfer Fruh.	Germany	4	3
32	287427	Alter Sachs. Fruh.	Germany	5	3
33	287437	Hornings Weiss	Germany	4	4
34	287445	Kraffts Rheinischer Weiss	Germany	3	4
35	287456	Dahlenburger	Germany	4	4
36	287463		Germany	4	4
37	287465	Hohenheimer V	Germany	4	4
38	287491	Lischower Hedwig	Germany	3	3
39	287497	Westfinnischerschwarz	Germany	4	3
40	287498	Schwarzer President	Germany	3	3
41	287500	Moorhafer SH	Germany	4	4
42	287505	Sobotkaer Fahnen	Poland	3	3
43	289585	Orion III	England	4	5
44	290041	Rychlik	Hungary	4	5
45	290042	Moszkovszkij A-315	Hungary	4	6

Table 1. Continued

Entry No.	CI or PI No.[a]	Name or Designation	Source	Disease Severity[b] BYDV Strain So. Ill.-1	Ch.-6
46	290062	Krimszkij 90	Hungary	3	4
47	290076	Legany 137	Hungary	4	4
48	290082	Bellyei 89	Hungary	4	4
49	290087	Eezterhazi 16	Hungary	4	4
50	290101	Sisu	Hungary	3	3
51	292765	No. 16428	Sweden	4	4
52	294666	Peragis	Bulgaria	5	4
53	294675	Ligeva AGU	Bulgaria	3	3
54	294677	Primorec	Bulgaria	4	4
55	294682	Wichenblatter 16	Bulgaria	4	5
56	294685	Mestaii	Bulgaria	4	4
57	294686	Huzar	Bulgaria	6	3
58	294687	Mongolia	Bulgaria	2	2
59	294698	Bulgarien 905	Bulgaria	4	3
60	295955	RR 180	Israel	3	4
61	296144	Juleilejnyj 507	USSR	6	4
62	296160	3726	USSR	3	4
63	296161	3728	USSR	4	7
64	296168	4885	USSR	4	3
65	297823	Diamanthavre	Sweden	3	4
66	297825	Penderhavre	Swden	3	2
67	306388	Goldhafer II	Rumania	5	5
68	306395	Algerian Red	Rumania	3	4
69	306399	ARD	Rumania	3	3
70	306400	2567	Rumania	3	3
71	306411	2548	Rumania	4	4
72	306412	Pelso	Rumania	3	3
73	306416		Rumania	4	6
74	313115		Wales	4	4
75	314837	Honami	Japan	5	4
76	314838	Kuromi	Japan	4	3
77	315910	Ariane	France	3	3
78	315917	Gelinotte	France	3	3
79	315921	Naire De Moyencourt	France	3	3
80	315925	Premices	France	4	4
81	321694		Australia	3	4
82	323351	Grizzly	Canada	4	4
83	326224	Rustekindlam	USSR	3	6
84	326236	Skorospelks	USSR	3	3

a/ CI and PI refer to accession and plant introduction numbers, respectively of U.S. Department of Agriculture, ARS.

b/ The values represent means based on visual evaluation within a scale of 0 = fully tolerant to 10 = intolerant; two replications in 1973 and four replications in 1974 with 12 plants per replication planted in a hill. The plants were inoculated at an early tillering stage by exposing them to approx. 20 viruliferous *Rhopalosiphum padi* (L.) per plant for a period of 3 days.

Oat Rust Diseases in 1975

A. P. Roelfs

Oat crown rust.--In early April trace amounts of crown rust were present in commercial fields along the Gulf Coast. Crown rust was severe in nurseries from Robstown, Texas to Baton Rouge, Louisiana. Crown rust became severe in commercial oat fields in south Texas by mid-May. However, at that time crown rust had not been found north of Dallas, Texas. The varieties Coker 227, Coker 234, TAM-0-301, and TAM-0-312 were highly to moderately resistant at all locations. Florida 501 had rusted in the Florida panhandle. Collections of crown rust made in the Gulf Coast area were identified as physiological races 264B and 276 (Simons).

Traces of crown rust were present in Missouri through Ohio by mid-June and extended into West Virginia and Michigan by late June. No crown rust was observed in western Iowa and eastern Nebraska until late June. By mid-July prevalence and severity of crown rust were erratic in the major oat production area of Iowa, Minnesota, Wisconsin, and the Dakotas due to a July drought. By the end of July, crown rust was still limited to wild oats in western North Dakota and Montana.

Aecia were noted on buckthorn in early June in Dane, Racine, and Rock Counties in Wisconsin and in the buckthorn nursery at St. Paul, Minnesota. A spread from buckthorn to oats was reported in Yellow Medicine County of Minnesota in mid-June.

Losses due to crown rust were moderate in south Texas and light elsewhere except for a few local areas. A few late-planted fields were observed in the north-central states that were not yet in the milk stage when the August rains came, and disease increased rapidly in these fields and caused moderate losses. There were also some fields in southeastern Minnesota and the adjacent area of Wisconsin where a heavy rain occurred in early July and resulted in moderate crown rust severities and losses.

Oat stem rust.--Stem rust was scarce in east Texas and Louisiana in early April and was found only in nurseries near Robstown, Beeville, and Temple, Texas. In late April an area of widespread stem rust was found south and west of San Antonio, Texas. Stem rust spread by late May into north-central Texas and Louisiana and by early June as far north as Stillwater and Woodward, Oklahoma and Fayetteville, Arkansas. Stem rust was present in the eastern two-thirds of Kansas and southeastern Nebraska by the end of June.

East of the Mississippi River the only stem rust found in early April was a few scattered infections at Gainsville, Florida; however, by late April stem rust was also found at Quincy, Florida. Stem rust was not reported again until it was found at Hartsville, South Carolina in early June.

By mid-July stem rust occurred from eastern Nebraska to southern Minnesota, and in West Virginia. Stem rust was present in each field of oats examined in southern and west-central Minnesota, northeastern South Dakota, and southeastern North Dakota during late July. Wild oats were diseased throughout this area, westward into Montana and north to the Canadian border at that time. Stem rust occurred farther west than normal in 1975, from Kansas to Montana, which may be related to the early rust near San Antonio, Texas; whereas in other recent years, oat stem rust was heavier farther east, i.e. in eastern and north-central Texas, Louisiana, and southern Arkansas.

Primary infections from aeciospore spread from barberry had sporulated on oats in Centre County, Pennsylvania by May 29, about the same time primary infections had sporulated on oats from uredospore spreads in north-central Texas and Oklahoma.

The principal physiologic races identified from collections in the United States were 31 and 61 (Table 1). The erratic distribution of the infrequently identified races is probably due to inadequate sampling. The oat nursery in Pennsylvania was associated with a planting of barberry bushes; thus, races 87 and 94 that readily produce teliospores dominated, as is common.

Losses due to oat stem rust will be light throughout the United States. The potential for moderate losses in the north-central states was averted because of a July drought. Severities of up to 30% were observed in scattered fields in southern Minnesota where a heavy rain occurred in early July.

Table 1. Physiological races identified from uredial collections analyzed in the 1975 oat stem rust race survey.

State	Collection source	Number of Collec- tions	Number of Iso- lates	Percentage of isolates of each race 1	2	24	31	61	72	77	87
Arkansas	Nursery	2	4				50	50			
Florida	Nursery	3	9				67	33			
Illinois	Nursery	2	2					100			
Indiana	Field	1	2				50	50			
Iowa	Field	55	137				100				
	Nursery	9	22				54	45			
Kansas	Field	12	33				73	27			
	Nursery	1	3					100			
	Wild oats	1	2					100			
Louisiana	Nursery	2	4	75			25				
Michigan	Field	1	3					100			
	Nursery	1	3				33	67			
Minnesota	Field	60	163				100				
	Nursery	64	169				90	9			
	Wild oats	13	35				51	48			
Missouri	Nursery	3	7				100				
Montana	Wild oats	3	6				83	17			
Nebraska	Field	19	53				57	43			
	Nursery	6	15				67	33			
North Dakota	Field	12	27				100				
	Nursery	15	33				91	6	3		
	Wild oats	38	86				35	62	3		
Oklahoma	Nursery	6	18				50	50			
Pennsylvania	Field	9	8				100				
South Carolina	Field	2	6		50		17	17		17	
	Nursery	2	5					20		80	
South Dakota	Field	15	44				100				
	Nursery	23	65				49	51			
	Wild oats	13	39				18	82			
Texas	Field	21	47	4	2		8	85			
	Nursery	134	344	1	*		42	55		2	
	Wild oats	1	0								
Washington	Wild oats	1	0								
West Virginia	Field	2	0								
Wisconsin	Field	57	157			1	98				1
	Nursery	3	9				100				
	Wild oats	1	3				100				
USA	Field	266	680	*	*	*	87	11		*	*
	Nursery	276	712	1	*		58	39	*	1	
	Wild oats	71	171				37	61	2		
	Total	613	1563	*	*	*	69	29	*	1	*

* Less than 0.6%.

Useful Genes from Other Oat Species for Disease Resistance

P. G. Rothman

Genes for disease resistance in the diploid and tetraploid *Avena* species have been prized by many oat breeders and plant pathologists. Although schemes for manipulating their successful transfer into hexaploid germplasm are numerous, results have been limited.

Further studies with the interspecific cross between the species *A. magna* (4x) and *A. longiglumis* (2x) with resistance to the present races of crown rust and stem rust (see 1974 Oat Newsletter) were conducted with the derived synthetic hexaploid line obtained by colchicine treatment of the interspecific hybrid triploid plant.

The typical synthetic hexaploid plant is fine-leaf, prostrate, and tillers profusely. Spikelet size exceeds that of *A. magna* or *A. sterilis* but number fewer per panicle. Segregation for plant type was noted in a single progeny C_2 line. Plants were not of the *A. magna* growth habit but were rather upright. Crown rust resistant lines were numerous in the C_3 progenies but were always associated with late matufity and stem rust susceptibility. Resistant-type stem rust pustules were noted for a single plant selection, suggesting it might have both crown rust and stem rust resistance.

The synthetic hexaploid line crosses readily with hexaploid oats. Of the 110 successful crosses made, only six F_1 plants set one or more selfed seeds. Minhafer was the pollen parent in four of the crosses; however, two of these crosses failed to survive beyond the F_2 generation. Segregating plants from the two surviving Minhafer crosses with resistances to both rusts were found. Progenies of the remaining two putative crosses in which seed set on the F_1 plants are being tested for affirmation of a cross.

Tiller propagules of surviving F_1 plants which failed to set seed, but tiller freely and are easily cloned, were treated with colchicine without results.

The Occurrence of Oat Stem Rust in 1975

P. G. Rothman and A. P. Roelfs

1975 losses due to stem rust were light throughout the USA. The incidence of stem rust, however, was more widespred than usual, occurring this year westward into Montana. In previous years, early oat stem rust outbreaks were frequently in eastern Texas, Louisiana, and southern Arkansas, but in 1975 the early outbreaks were reported instead in the area southwest of San Antonio, Texas. This might be the reason for the extreme western movement of stem rust reported for this year in the northern states. The potential for moderate losses in the major oat production areas where inoculum was widespread was prevented by the summer drought.

A total of 649 stem rust collections were received by the Cereal Rust Laboratory from nurseries, commercial fields, other grasses, and barberry aecia in 1975, from which we identified 17 physiologic races of *Puccinia graminis avenae*. For the eleventh consecutive year, race 31 was the most prevalent race, making up 67% of all isolates identified. Race 31 constituted 83% of all isolates identified from commercial oat fields, 37% of those from wild oats (*Avena fatua*), and 4% of those from barberry. Race 61, the second most prevalent race, made up 28% of all isolates identified, but it made up 15% of the isolates identified from commercial fields, 61% of those from wild oats, and was not identified in aecial collections. Race 77 was identified from collections received from Texas, Florida, and South Carolina, while races 87 and 94 were an important part of the rust population in the barberry region of Pennsylvania and Appleton, Ontario.

Percentage of prevalent races identified from all stem rust collections received in the 1975 race survey.

Race No.:	1	2	18	20	22	24	31	61	72	76	77	80	86	87	89	91	94
Old Race No.:	1	2	4A	6A	8A	11A	6AF	7F	6F	1H	2H	7H	4AH	6AH	8AH	11AH	6AFH
Percentage	*	*	*	*	*	*	67	28	*	*	1	*	*	1	*	*	1

* Less than 1%.

Pathogenicity of Crown Rust in the US

M. D. Simons

Identification of isolates of crown rust obtained from oats on the standard 10 differentials over the past few years has shown a steady increase in relative prevalence of races of race group 264B. There races, which now make up 90% of the total, all parasitize Bond, Landhafer, Santa Fe, Trispernia and Bondvic, as does the old race 264A. The 264B races, however, do not have as wide a host range on other varieties, in general, as does 264A. Crown rust increased from aecial collections from buckthorn was only about 55% 264B, but the proportion of this race group has been steadily increasing, as with the uredial material.

Crown rust isolates obtained in the race survey are also used to test strains of oats that either are being used in commercial varieties or breeding programs, or which are of potential value as sources of resistance to crown rust. The results of such testing in recent years are shown summarized in Table 1. Two lines that have been available only recently (Coker 234 and TAM 0-301) have both looked very good. Their resistance was derived from *Avena sterilis*.

In view of the present increased interest in field resistance to crown rust, and the knowledge that information derived from seedling tests may be very misleading, we have been evaluating the entries of the Early and Mid-season Performance Nurseries for relative susceptibility to damage from crown rust in the field. These tests subject the host lines to a very severe epiphytotic of crown rust. Non-rusted controls are used to provide a measure of the reduction in yield attributable to rust infection. The data shown in Table 2 are representative of the results of these tests. It can be seen that some of our current oat varieties would be much more severly damaged under conditions of heavy crown rust attach than would others.

Table 1. Percentage of crown rust isolates virulent on certain resistant lines.

Line	Year			Line	Year		
	1972	1973	1974		1972	1973	1974
Ascencao	3.4	6.0	1.4	PC-38	0.2	0.6	1.3
X421	2.1	1.7	2.9	PC-39	2.5	1.7	2.3
H382	5.1	10.9	10.7	PC-45	13.6	13.4	13.1
H441-R-28	0.4	0.7	0.0	PC-46	12.3	11.9	12.3
X475 II	25.5	28.2	26.4	PC-50	5.8	5.9	10.7
X434 II	18.7	12.9	22.3	Coker 234	-	0.0	1.1
				TAM 0-301	-	-	0.0

Table 2. % reduction due to crown rust infection (ave. of 1973, 74, 75).

Line	Yield	Seed wt.	Line	Yield	Seed wt.
Gopher	83	47	Cherokee	43	31
Richland	77	49	Nodaway-70	36	29
Noble	66	47	Iowa M-73	33	20
Jaycee	60	43	Mo. 06072	27	22
Clintford	58	41	Iowa E-74	21	18
Grundy	52	40	Iowa X-421	16	13
Lodi	49	41			

III. CONTRIBUTIONS FROM THE UNITED STATES AND PROVINCES

Oats in Western Canada 1975

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

The 1975 Prairie oat crop was moderately good. Seeding in many areas was normal and spring rains were adequate. However, in Manitoba detrimental effects were caused by excess moisture late in June, very hot dry weather during July and August, and wet weather during harvest.

A total of 5.5 million acres of oats were sown on the Prairies. Of these, 4.75 million acres were harvested for grain and most of the remainder were cut for forage. Yields in Manitoba and Saskatchewan were 44 bushels and in Alberta 53 bushels per acre. The acreages were below the ten-year average while the yields were near average.

Oat Stem Rust

The first oat stem rust pustules were found in Manitoba in mid July, which is earlier then normal. The dry hot weather stopped further development until mid August when crops were well advanced and little damage resulted.

Races C10 (Pg 9, 13 / Pg 1, 2, 3, 4, 8) and C23 (Pg 2, 4, 9, 13 / Pg 1, 3, 8) comprised roughly 70% and 25%, respectively, of the cultures identified from Western Canada. In Eastern Canada race C9 (Pg 8, 13 / Pg 1, 2, 3, 4, 9) predominated. A number of rare races were also found, most of which were not widely virulent. However, one biotype found in both eastern and western Canada could attack all the differentials except Pg 8, and is thus a very serious threat if it should become established.

Oat Crown Rust

In most localities in Manitoba and Saskatchewan crown rust did not cause significant losses in oat crops in 1975. Buckthorn infection was light, thus general infection did not occur until mid July. During much of July and August the weather was very warm and dry, limiting rust spread. In a few localities, isolated showers occurred which allowed crown rust to attain moderately severe levels in some late-sown fields.

Crown rust collections were tested on both the "standard" set of differential varieties and a set of substituted single gene (Pc) lines. As in previous years, races 295 and 326 predominated in western Canada, and race 210 predominated in Ontario and Quebec. The percentage of isolates from Western Canada containing virulence on the lines carrying Pc genes is as follows: Pc 35 - 31.7%; Pc 38 - 1.5%; Pc 39 - 0; Pc 40 - 41.5%; Pc 45 - 4.6%; Pc 46 - 6.1%, Pc 47 - 0; Pc 48 - 0.3%; Pc 50 - 18.6%; Pc 54 - 13.1%. Of the isolates, 19.2% were avirulent on all of the Pc lines. Of Eastern Canadian isolates, the percentage virulence on the Pc genes was as follows: Pc 35 - 35.2%; Pc 38 - 0; Pc 39 - 0; Pc 40 - 7.4%; Pc 45 - 9.2%; Pc 46 - 11.1%; Pc 47 - 0; Pc 48 - 0; Pc 50 - 5.6%; Pc 54 - 5.6%.

Barley Yellow Dwarf Virus

Thirteen hybrid lines of oats were recently screened in growth cabinets to a virulent non-specific isolate of barley yellow dwarf virus. One of these lines (M-921) originating from New Zealand, showed the highest degree of tolerance to the virus, with a seed yield loss of 20%. Two other promising entries from the province of Quebec, FF-6474 and FF-89-74, suffered losses of 42% and 57%, respectively. Losses on Fulghum, used as a semi-tolerant control, and on Clintland 64, used as a susceptible control, averaged 48% and 94%, respectively. A loss of 98% resulted on RL-3017, a rust resistant strain from the breeding program.

Oat Smut

Over a 5-year period, 5485 entries in the USDA World Oat Collection were tested for their reaction to smut. They were inoculated with combinations of races that were virulent on all differential cultivars including Atlantic (with Victoria-resistance) and Clintland. There were 448 immune or highly resistant entries. Many of these may be similar to other sources of resistance that have been and are extensively used in breeding programmes, e.g. those from the cultivars Markton and Bond. However, it is hoped that some collections represent new sources of resistance that can be used as soon as the present ones are no longer effective. In a test of the reaction to smut of 1497 entries (mainly *A. sterilis*) in the Canada avena (CAV) Wild Oat Collection, 553 entries were immune or highly resistant. Resistance to smut is thus widespread in *A. sterilis*. It would be advantageous to also utilize the smut resistance of *A. sterilis* collections where they are used in breeding for other characteristics.

ARKANSAS

F. C. Collins, J. P. Jones, and W. T. McGraw

Oat production in Arkansas was down considerably from previous years. This reduction was probably due to many farmers in the Grand Prairie being unable to plant oats because of unusually late soybean harvest.

Oat diseases were of little consequence during the 1974-75 season. Barley yellow dwarf virus was sporadically distributed throughout the commercial oat acreage but substantial damage occurred only in fields planted early for fall forage production. Crown rust likewise was of minor importance throughout the area although it did develop uniformly in our nursery plots. Races 264-B, 325 and 263, 276 were identified from nursery rust collections. A number of experimental fungicides were found to be effective as seed dressings in controlling covered smut (*Ustilago kolleri*) including the previously reported compounds Vitavax, Benlate, Granox and Busan 30.

We are increasing a selection from the cross between Nora and Florida 501, Ark 99-190, for possible release in 1977. It has outyielded Nora by 20 bu/A at Stuttgart based on a three-year average.

Florida

R. D. Barnett and H. H. Luke

The previous three years the acreage planted in oats has been around 32,000 acres with about 12,000 acres being harvested for grain. Statewide grain yields have been below the national average (47 Bu/A) during the past three years ranging from 35 - 41 Bu/A. The acreage planted in oats is up this year because of the unavailability and high cost of rye seed. The predominant cultivars grown in Florida continue to be Florida 501, Coker 227, Elan, and TAM 0-312. This winter farmers have been disappointed with the fall forage production of Coker 227 and TAM 0-312. Neither of these two cultivars grow as well in the early part of the forage season as Florida 501. Farmers in this area need a new crown rust resistant cultivar with the fall forage production characteristics of Florida 501. Farmers also continue to like Florida 501 because of it's early grain maturity which is important in the multiple cropping systems used here.

Multiple Cropping Systems: We are conducting research in the multiple cropping area with oats being an important component. We are studying the effects of plow layer soil water management (irrigation), soil fertility, and other management factors on the various components of these systems. The use of irrigation in crop production in the southeast is rapidly expanding and we need to know how to manage small grains when grown under irrigation. An outline of the sequences of crops we are studying is outlined below:

Multiple Cropping Systems

2 Crops/Year		3 Crops/Year	
Alternative 1	Alternative 2	Alternative 1	Alternative 2
Wheat-grain	Rye-wintergrazing	Oats-silage	Oats-silage
Soybeans-grain	Corn-grain	Corn-silage	Corn-grain
		Sorghum-silage	Millet-grazing

These systems involve field crops adapted to the lower southeastern part of the U. S. They are 1 year cycles and can be repeated on the same land year after year. A farmer would probably switch from one to the other depending on market, seed availability, profit margin, livestock situation, etc. A single farmer probably would not be able to double or triple crop his entire farm and he would probably want to include some fallow in his cropping system to avoid problems with diseases, weeds, insects, phytotoxic crop residues, residual herbicides, etc.

Forage Potential of *Avena strigosa*: We have conducted some management studies on a diploid breeding line of *Avena strigosa* as a possibility for winter forage. This oat line is immune to crown rust and produces a tremendous amount of forage in the fall and early winter but it does have a rather short season of production and lacks winter hardiness. Work has been conducted on seeding rates, fertility levels, and clipping intervals and we are now comparing it's performance with regular hexaploid oats in various blends with ryegrass. It might have some potential for sod seeding in permanent pastures and might help fill the gap in forage availability in October, November, and December. The diploid A. strigosa can be seeded considerably earlier than rye in the fall because of its resistance to soil-borne pathogens. Additional work is planned to see just how early this type of oat can be seeded.

Small Grain Forage Screening Nursery: We are presently coordinating a Regional Small Grain Forage Screening Nursery which is grown in 25 locations in 13 states. This nursery normally contain about 150 entries including 20 ryes, 60 wheats, 10 triticales, 40 oats, and 20 barleys. The two main goals of this nursery are to give the cooperators an opportunity to evaluate potential new cultivars of small grains for forage and to provide the originator of the entries with information on the potential usefulness and adaptability of his material. Because of the relatively large number of entries in this nursery only a single 8 - 12 ft. row of each entry is grown at each location. Forage estimates are made at least three times during the season and winter-hardiness and disease resistance information is also obtained. This nursery has been well received by cooperators and the third nursery is being grown during the 1975-76 season. Summary reports of the first two nurserys are available and the report on the third nursery will be available in August of 1976. Entry into the nursery is open and only 1 pound of seed of each entry is required.

Legume interseeded with Small Grains: We are conducting a small experiment in which we are interseeding a winter legume (blue lupine) with small grains to determine if the small grain crop can utilize some of the nitrogen fixed by the legume thus eliminating the necessity of adding nitrogen fertilizer as a topdressing. The plots will be sprayed with a herbicide to kill the legume at the time you would normally add nitrogen topdressing. Several control treatments of various levels of N topdressing are included to determine how much nitrogen from the legume becomes available to the small grain crop.

Florida Oat Released in South Africa: The Florida 501 oat cultivar has been released in South Africa by the Department of Agricultural Technical Services and has been renamed "Perdenberg". The new name has something to do with the region in South Agrica where it is best adapted. Dr. B. E. Eisenberg at Stellenbosch was in charge of testing and releasing Florida 501.

Spore Concentration and Slow-Rusting: As often mentioned certain cultivars of Red Rustproof (RRP) oats have a pronounced form of horizontal resistance (HR). This form of HR has been divided into two components, "Late-rusting" and "Slow rusting". Late-rusting is the development of crown rust symptoms 10 - 14 days later than susceptible cultivar. Slow-rusting is the slow spread of rust during the growing season. Slow-rusting types usually have 10 to 30% rust at the end of the growing season. We observed that RRP cultivars located adjacent to a heavily infected susceptible cultivar became heavily infected, but RRP types that were located 3 or 4 rows from the susceptible cultivar expressed a typical low percentage (20%) of infection. This observation seemed to indicate that the inoculum concentration influenced crown rust development on cultivars that have HR. The following results were obtained when controlled quantities of spores were applied to leaves and the plants maintained is an air conditioned greenhouse:

Spores/ cm^2	Pustules/cm^2	
	Fulghum (susceptible)	Red Rustproof-14 (HR)
18	1.4	0.7
12	2.5	0.8
6	1.7	0.8

When about 50 spores/cm^2 were applied the HR cultivar developed just as many pustules as the highly susceptible cultivar. The following results were obtained, in the field, when the degree of infection was measured at various distances from an inoculum source on 3-12-75.

Distance from inoculum	Pustules/cm^2		
	Fulghum (susceptible)	Burt (intermediate)	Red Rustproof-14 (HR)
2 ft.	2.0	0.7	0
4 ft.	1.4	0.2	0
8 ft.	0.9	0.1	0

Greenhouse and field results indicate that a given quantity of spores results in fewer pustules on cultivars that have HR than occur on susceptible and intermediate cultivars.

GEORGIA

L. R. Nelson, B. M. Cunfer, J. H. Massey (Experiment)
D. D. Morey, W. H. Marchant (Tifton), A. R. Brown (Athens)

The oat acreage in Georgia during the 1974-75 growing season totaled about 260,000 acres, an increase of 13% over the previous year. About 95,000 acres of oats were harvested for grain with the remainder being harvested as forage. The state average yield was estimated at 48 bu/acre up from 44 in 1973-74. The 1974-75 growing season was warm and no winter-killing occurred. No serious disease problems occurred with a low severity level of crown rust being observed. Acreage for the 1975-76 crop is expected to increase slightly. Winters have been so warm and mild during the past 5 years we have tended to overlook cold hardiness. The importance of cold hardiness was brought to our attention recently in a forage trial conducted at Tifton, Georgia. Soon after clipping 8 cultivars of oats to simulate grazing, they were subjected to 18°F cold on December 19, 1975. Nora oats sustained little damage from cold while three common cultivars were completely destroyed. The oat cultivars and their average survival are shown below:

Variety	% Survival	Variety	% Survival
Nora	90	Coker 74-16	25
Coker 74-22	70	Fla. 501	0
Coker 227	60	Elan	0
Coker 234	50	Ga. 7199	0

Halo blight, a disease common to oats, was found throughout Georgia on rye in 1975. All rye cultivars observed were susceptible and complete defoliation occurred at the heading stage at many locations. All bacterial isolates tested were pathogenic to rye and oats. The disease was not serious on oats and does not appear to be a threat to oats at this time.

Indiana

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

Oat acreage in Indiana in 1975 was 250,000 acres (up 16% from 1974). Yields averaged 52 bu/A according to the Indiana Crop and Livestock Reporting Service. Much of the acreage was seeded early -- by April 1. However, cool soil temperatures delayed emergence until about April 10 to 15.

Foundation seed of Allen, a new high yielding, stiff strawed spring oat variety with a high groat % was produced in 1975.

Several agronomically promising lines with new sources of crown rust resistance and which developed no crown rust pustules were identified under severe field epidemic conditions.

Genetic and breeding studies for resistance to the yellow dwarf virus disease were continued.

Studies with agronomically acceptable *A. sativa* x *A. sterilis* lines on gene action for groat protein were completed. Additive gene effects predominated for % protein. High % protein was recessive. These results support those of earlier studies which involved *A. sterilis* only or progeny of direct crosses of *A. sativa* x *A. sterilis*.

A high-protein line (21% groat protein at maturity) from a cross of *A. sativa* x *A. sterilis* and Noble (18.5% protein) expressed similar patterns of dry matter and protein accumulation in developing seeds. The high-protein line maintained a higher level of protein throughout seed development. Concentrations of globulins and glutelins were higher in the high protein line.

Six recently developed varieties each of spring oats, spring wheat and spring barley and three varieties of spring triticale yielded 539, 418, 681, and 402 g grain/plot when seeded March 21 and 542, 322, 517, and 400 g/plot when seeded April 18.

Leaf hairs develop as each succeeding leaf matures on current pubescent oat lines. This appears to concentrate feeding by the cereal leaf beetle to younger leaves.

Applications of gametocide DPX-3778 at 1, 2 and 4 lb/A AI at 6 or 1 day prior to heading on two oat cultivars (Clintford and 65256C4-38 -- *A. sterilis* derivative) showed little or no effect for % seed set on bagged heads.

Mark Iwig has completed his MSc degree requirements and is continuing studies toward the Ph.D. degree.

KANSAS

E. G. Heyne

The past eleven years the harvested oat acreage in Kansas has averaged 174,000 acres and varied between 100,000 a. (1973) to 215,000 a. (1974 and 1966). 1965 was the first year the acreage was below 300,000 a. since 1873. One may conclude that this is the level of production that will continue as the soybean acreage has also become more stable. The yield per acre has shown a large change when comparing the last eleven years, 1965-1975, with the preceding eleven, 1953-1964. The average yield per acre was 27.1 during the 1953-1964 period and 37.7 during 1965-1975. The increased yield probably represents better choice of cultivars and more care in production procedures. The presently recommended cultivars are Andrew, Pettis, Trio, Neal, and Minhafer.

No breeding work is conducted at the present time other than the growing of several bulk populations.

Tests of winter oats have been conducted for a number of years in southern Kansas. One extension man said the yields have been disgustingly good - approaching 100 bu/a. However, the farmers have not increased the acres sown to winter oats as they can seed winter wheat without restrictions.

Oat seeding conditions were delayed in the spring which reduced the acreage but the weather following the late seeding was good for oat production. There were no major disease problems in 1975.

MICHIGAN

J. E. Graphius

The line designated as 64-152-123 is being considered for possible release in the spring of 1977.

MINNESOTA

D. D. Stuthman and R. L. Thompson

Oat production in Minnesota in 1975 was approximately one million bushels from two million acres. The average yield was estimated at 50.5 bushels per acre. Initial seeding dates for our nurseries were the latest in the last ten years.

A major increase of Minnesota 71101 is planned for summer 1976 with release anticipated for the 1977 season. This selection has exceeded Froker and Lodi, our two most popular varieties, by almost five bushels per acre in 24 trials grown in 1972-75. It is also more resistant to smut and crown rust than these two varieties.

We are currently involved in preliminary evaluations of some 1000 collections of *Avena fatua* which were collected by L. W. Briggle and Richard Halstead. The geographic origin of these collections is as follows:

South Dakota	225
North Dakota	205
Montana	139
Minnesota	118
Wyoming	113
California	73
Idaho	70
Utah	47
Iraq	6
Egypt	2
Colorado	1
Texas	1

We are now in a position to make small amounts of seed available to scientists who are interested in the species. Please address all requests for seed to:

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

It would be helpful if you included in your request an indication of the minimum amount of seed necessary for your purposes.

Dr. L. W. Briggle left our group in April to join the U.S.D.A. National Program Staff. We hope to obtain a replacement soon. Mike McMullen will be completing his Ph.D. graduate work soon and has accepted the oat breeding position at North Dakota State University.

MISSOURI

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

The Missouri state-wide average oat yield was 43 bu/acre in 1975, considerably above yields the previous two years but still below that of the early 1970's. The oat acreage in Missouri is very erratic depending largely on weather conditions at the time of seeding. The 105,000 harvested acres was down by 25% from 1974 and represents only 55% of the acreage seeded. A considerable acreage is cut for hay.

The BYDV disease was less damaging in 1975 than in previous years but was still the worst problem where susceptible varieties were used. Crown rust was very damaging in Central Missouri but was prevalent only in late varieties further south. Stem rust came in late but contributed to straw deterioration in some late varieties. A Fusarium infection was observed for the first time on the stems of several varieties in the Columbia nursery. Severe straw deterioration was associated with this problem also.

Resistance to the BYDV disease continues as the major focus in our oat breeding program. Improved rust resistance must be combined with the BYDV resistance. Our activity includes work with both spring and winter types but the effort on winter oats is minimal.

The oat selection Mo. 06072 (Pettis X Fla. 500) will be increased by Missouri Foundation Seedstocks in the spring of 1976. It has a very good yield record in Missouri where it has shown excellent tolerance to BYDV and resistance to prevalent races of crown rust.

NEBRASKA

John W. Schmidt

A 49 bu/a oat crop was harvested on 570,000 acres in Nebraska in 1975. For the period 1971-75, oats has averaged 49 bu/a. Production has increased the past three years. In 1973 Nebraska ranked 8th in the U. S. oat production, 7th in 1974 and 6th in 1975. The 1976 planting intentions are the highest since 1964. Thus oats are far from dead in Nebraska.

Losses from diseases have been minimal during this period. Both crown and stem rust have developed late in the grain filling period. The new early season oat experimentals, Il.67-1514 and Mo. 06072 performed well in 1975 tests. Both will be increased for production in Nebraska when seed supplies become available.

NEW YORK

Neal F. Jensen

Astro seems to be well received by New York farmers. While Orbit is the dominant variety in New York, Garry retains a surprisingly large acreage, especially for a variety that has been in production for more than 20 years. A few of our selections appear promising but I think we are some time away from even tentative thoughts about release. We hope to have two or three new selections in the 1976 Uniform Midseason Nursery.

The high test weight line mentioned last year, NY 61139-26, is not high enough in yield for variety consideration here so our principal use of it will be to use it as a parent. A number of persons have requested and received this for parent use.

Quality, of kernel in all its aspects, seems to be a principal bottleneck in our breeding work. We are trying to pay more attention to choice of parents so as to turn out better quality seed lines.

NORTH CAROLINA

C. F. Murphy and T. T. Hebert

There is a resurgance of interest in oat production in North Carolina. Disease problems have reduced wheat yields and oat prices are now comparing more favorably with wheat. As more and more farmers come to expect 100-120 bu/A oat yields, the crop is becoming increasingly popular. Oats also offer somewhat earlier maturity than wheat for those farmers who double crop with soybeans. Some of the farming operations which are being developed in our tidewater region are really huge (encompassing most of several counties) and they rely on a lot of small grain double cropped with soybeans, along with corn and large livestock operations.

Some of our most interesting breeding material is derived from the French line TF 1012, which was obtained from the Iowa program some years ago as a source of straw strength. The Carolee x TF 1012 material with which we have worked most is quite susceptible to crown rust and has only moderate winter-hardiness, but it is characterized by short, stiff straw; large numbers of relatively small seeds per panicle; rather low hull percentages and some very early segregates. This material appears to have more yield potential, better seed quality and earlier maturity than any of the "dwarfish" material with which we have previously worked.

Salem continued to perform extremely well and it is expected to be a popular variety.

NORTH DAKOTA

Groat Protein Deviations from Regression on Yield as a Varietal Characteristic in Umon Oat Cultivars

Glenn S. Smith and Dennis Miller

There was a significant negative correlation between protein and yield, based on a study of the Uniform Midseason Oat Performance Nurseries for 1972, 1973 and 1974. However, there were wide deviations from the regression line of protein on yield, and these protein deviations from regression ("PD values") were very consistent over widely differing environments. In 1972, 13 out of 27 entries deviated from the regression line by more than the LSD. Analyses of variance of "PD" values showed they were highly significant and unaffected by environment. The "PD" value removes the negative influence of yield on protein, and gives a statistic which should be useful in designing appropriate crosses to give cultivars combining higher protein with higher yielding capacity. Transgressive segregation should give progeny with PD values beyond the parents, particularly in crosses between unrelated positive PD parents.

OHIO

Dale A. Ray

Production. The Ohio oat crop in 1975 was estimated at 30.5 million bushels. The 61 bushels per acre state-wide yield average on the 500,000 acres harvested provided an increase of about one million more bushels than produced in 1974. Although oat seedings were completed early, the cool, wet spring slowed establishment and early growth. Midseason weather conditions speeded development and maturity, generally resulting in excellent yields but some reduction in bushel weights. Oat diseases were light and with the exception of barley yellow dwarf virus in a few fields of susceptible varieties did not affect yields.

Oat Varieties. Clintford, Clintland 60, Dal, Garland, Noble, Otee and Stout spring oat varieties currently are recommended in Ohio. Clintford continues as the most popular variety, although Otee and Noble gained rapidly in acreage seeded in 1975. Noble was the top-yielding variety in the six-location variety trial and exceeded 150 bushels per acre in the combine-harvested test in northwestern Ohio.

Oat Breeding. Several advanced-generation selections from parentage of Clintland 60-Rodney x Putnam 61 had appeared promising for yield, straw strength and barley yellow dwarf tolerance in rod-row tests but continued to exhibit some segregation for plant type. Also, replicated tests had shown that selected lines from *Avena sterilis* x Garland and Florida 500 had promise for combining yield and groat protein improvement. Extensive field plantings were made of panicle-to-row for reselection and multiplication of this material.

OKLAHOMA

H. Pass, L. H. Edwards, E. L. Smith and E. A. Wood

Production. Oat acreage and yield fluctuate from year to year. The 1975 oat crop was up 1 percent from 1974, totaling 3,960,000 bushels, while the harvested acreage declined 14 percent from the previous year to 120,000 acres. The average yield was 33.0 bushels per acre, an increase of 5.0 bushels from last year but 8.0 bushels below 1973. Barley yellow-dwarf was present in many oat fields in 1975.

Oat Varieties. Most of the oat acreage is seeded to Cimarron, Checota, Chilocco and Nora varieties. Nora acreage has been increasing each year by the grain farmers but it is susceptible to winterkilling in some of our winters. Checota and Chilocco are preferred for hay production.

Oat Breeding. The oat breeding program is very limited, however, efforts are being made to incorporate greenbug resistance into our locally adapted varieties. We are working with two sources of resistance, P.I.186270 and two C.I. numbers 1579 and 1580. Preliminary tests of F_2's indicates that P.I.186270 is resistant to both biotype "B" and "C" strain of greenbug and shows a recessive inheritance. The two C.I. numbers are susceptible to "B" and resistant to "C" strain and has a dominant type inheritance.

PENNSYLVANIA

H. G. Marshall, R. E. Hite, R. T. Sherwood

Production. The estimated oat acreage harvested for grain in Pennsylvania during 1975 was 375,000 acres. Production was estimated at 19,125,000 bushels with an average yield of 51 bushels per acre. Oat diseases apparently were not serious in commercial fields. Cereal leaf beetle infestations were spotty and apparently less severe than during 1974. Although no data were collected, it was apparent, from aerial observations across the state, that lodging was the most serious damaging factor in oat production.

Cultivars. The recommended cultivars for Pennsylvania for 1976 are Astro, Orbit, Otee, Jaycee, Clintford, Dal, Russell, Garry, Noble, and Pennfield. Jaycee, Russell, Orbit, and Pennfield probably will be dropped from the recommended list for 1977. Mariner and Chief have performed well in Pennsylvania over the past two years and are promising candidates for recommended use in the state.

Spring oat research. A Spring Oat Performance Test was grown at two locations in Pennsylvania during 1975--near University Park in central Pennsylvania and near Landisville in southeastern Pennsylvania. Yields were good at University Park with a high of 3210 pounds per acre for the variety Spear. Chief, Otee, and Mariner were other relatively new top yielding varieties in the test but none were significantly superior to old Garry. Whole grain crude protein ranged from 14.2% for Mariner to 17.4% for Dal. In vitro dry matter disappearance (IVDMD) ranged from 64.5% for Pennfield to 75.8% for Russell. Yields were considerably lower at the Landisville location because of the combined effects of *Septoria* and severe lodging during the grain filling period. The average yield was only 2138 pounds per acre; and the top ranking varieties for yield were Astro, Orbit, Noble, Otee, and Dal. Bushel weights ranged from 23.5 for Pennfield to 30.3 lb/bu for Clintford. Whole grain crude protein ranged from 15.7% for Orbit to 18.0% for Dal. IVDMD ranged from 66.2% for Pennfield to 73.0% for Clintford.

Data on various grain quality components of 16 spring oat varieties have now been collected at two locations for two years. The closest relationship found was that between groat percentage and IVDMD (r=0.93). The data on IVDMD, groat protein, oat protein, groat percentage, fiber, and lignin will be used to study the application of infrared reflectance spectroscopy to the prediction of feed grain quality in oats. A multipurpose computerized spectrophotometer was recently obtained for cooperative crop quality research by ARS and The Pennsylvania Agricultural Experiment Station.

A major part of the spring oat breeding effort is devoted to the development of semidwarf experimental varieties. Most of the current spring oat cultivars have been crossed to three dwarf oats (C.I.8447, P.I.338347, and O.T.184) and numerous F_2 populations were grown during 1975. A few semidwarf lines from crosses originally made for genetic studies were grown in 5-row observation plots during the summer. These lines withstood several severe storms that flattened the rest of the nursery. However, these short-strawed lines have high susceptibility to leaf and stem blighting caused by *Helminthosporium* and *Septoria*.

Winter oat research. The winter oat breeding program was continued with primary emphasis on winter hardiness and lodging resistance. The BC_5 generation was completed in a program to combine the short straw from C.I.8447 with the best levels of winter hardiness available. Two semidwarf lines were tested in southeastern Pennsylvania at levels of nitrogen (N) up to 100 lb/acre. There was no lodging associated with N treatments and linear increases in straw and grain yields occurred. Winter oat yields were generally poor, and average grain yields of the best semidwarf line only ranged from 1344 lb/acre at 20 lb/N/acre to 2624 lb/acre at 100 lb/N/acre. As N was increased, straw yield (dry basis) went from 2800 to 6000 lb/acre. Increased straw yield was primarily associated with increased tillering rather than culm elongation. There was no elongation of the lower three internodes in response to increased N. Unfortunately, one barrier to utilization of these short lodging resistant varieties is the disease susceptibility mentioned above in the spring oat material. Some variability for severity of *Helminthosporium avenae* was observed in the field and we currently are testing a number of these lines in the laboratory for reaction to *Helminthosporium avenae*, *Septoria avenae*, and *Colletotrichum graminicolum*.

Other studies with winter oats are concerned with measuring the range of freezing resistance and winter hardiness in bulk composite populations of crosses involving cold hardy collections of *Avena sterilis*, *A. Ludoviciana*. Some of these unselected composites have shown field survival equal to the most winter hardy check varieties, and we are optimistic about isolating types with transgressive winter hardiness.

Disease problems. Considerable anthracnose (*C. graminicolum*) was observed in the oat breeding nurseries near University Park during 1975. The disease was much more prevalent on the semidwarf oat selections than on the more conventional taller oats in adjacent plots. The fungus attacked the leaves, sheaths, stems, and panicles; and caused the plants to be unusually dark in color during and after ripening. Studies are underway to determine the nature of the apparent high susceptibility of semidwarf germ plasm.

Powdery mildew was virtually nonexistent in both the winter and spring oats nurseries in 1975 in contrast with 1974 season when mildew was of epidemic proportions in the nurseries. The absence of mildew was thought to be possibly associated with the frequent rainfalls throughout the growing season as opposed to the previous year which was relatively dry.

Personnel. Dr. Raymond E. Hite, Research Plant Pathologist, will devote full time to oat pathology beginning in 1976. He previously was assigned to the oat improvement program on a half time basis.

SOUTH DAKOTA

D. L. Reeves

Production: Oat acreage continues to remain quite stable with 2,530,000 acres planted in 1975. Although moisture was quite limiting, total production was 98.1 million bushels which was an increase of 21% over the previous year. The average yield was 44 bu. per acre. Disease problems were minimal. Burnett remains the most popular variety in the western part of the state while Froker, Chief, and Noble were more popular in the eastern part.

Research: Feeding trials with different oat varieties were done using chicks. The results are reported elsewhere in this newsletter. The breeding program continues to have major emphasis on yield, protein, and grain quality. Disease resistance and straw strength have been difficult to evaluate in recent years due to the dry weather. *A. sterilis* is being used only in a few crosses. Animal Science personnel have obtained excellent results feeding hogs with rations up to 60% oats.

Personnel: Dr. H. S. Sraon has left the project for a teaching position in the Canby Vocational-Technical school in Canby, Minnesota. Mr. Peter Chmay joined the project at the end of the year as a graduate student.

TEXAS

M. E. McDaniel, J. H. Gardenhire, K. B. Porter,
Norris Daniels, M. J. Norris, Earl Burnett, and Lucas Reyes

Production: The seeded acreage of oats in Texas fell from 1,800,000 acres in 1974 to 1,300,000 acres in 1975. On the other hand, the harvested acreage of 650,000 acres in 1975 was more than double that of the 1974 season, when only 300,000 acres were harvested. The percentage of the crop harvested in 1975 (an even 50%) is the highest percentage of the total acreage harvested in Texas since 1961. The average oat yield was estimated to be 30 bu/a in 1975, an increase of 3 bu/a over the 1974 crop. The oat acreage may become more stable; the sowed acreage of wheat is estimated to be slightly lower than that planted last year. In addition, lightweight stockers were "cheap" this year, and considerable acreage of small grains is being grazed intensively; more oats likely were planted for this purpose this year.

Research: A large-scale South Texas crown rust epidemiology study was conducted at Robstown and Beeville, Texas in 1974 and at Robstown in 1975. This research was a joint effort of the Iowa and Texas Agricultural Experiment Stations; it was supported by the Stations and The M. G. and Johnnye D. Perry Foundation of Robstown. Dr. J. Artie Browning, Iowa State University Oat Pathologist, spent several months at Robstown during the late winter and spring of both 1974 and 1975 to monitor crown rust epidemic progress throughout the long period of disease activity in South Texas. The research was designed to test the effectiveness of various diversified oat populations, including multiline cultivars, against crown rust in the South Texas rust "hotbed". Large plots (1-1/4 acres) of 12 test entries were separated from each other by larger strips of immune cultivars and/or spatial separation of 1/4 mile to minimize plot-to-plot rust transfer. Significant results of this work include: 1. Iowa multiline cultivars provided excellent protection against crown rust, even though only 50-60% of the plants were resistant to all rust races present. Multilines provided better protection than a two-component mixture of 75% immune and 25% susceptible plants; thus the more complex multiline population provided much better disease buffering than simple mixtures. Part of the multiline protection may be due to generalized resistance or tolerance of the multiline recurrent parent. 2. Rust collections taken from pure-lines and multilines had similar virulence, but a slightly larger number of virulence genes were detected in collections taken from multilines. 3. Crown rust appears capable of surviving much lower temperatures than had previously been thought; there was no indication of differences in temperature sensitivity of collections made following sub-freezing temperatures in Texas and collections made in Iowa under much milder conditions.

Possible differential varietal reaction to iron chlorosis was observed at Beeville in 1975. Increase and purification of five *Avena sterilis* derivatives is underway; at least one of these lines probably will be released to provide a crown rust resistant oat adapted in North Central Texas.

Rusts: Crown rust races identified from 67 Texas collections in 1975 were as follows: 264B, 49%; 325, 26%; 276, 11%; 263, 8%; 264A, 3%; 290, 1%; 388, 1%; 442, 1%. This race distribution is very similar to that observed in 1974.

Stem rust races identified from 167 Texas collections showed the following distribution: 61, 60%; 31, 33%; 1, 3%; 77, 2%; 2, 1%; 98, 1%. Races 61 and 31 continued to predominate, but the frequency of race 61 increased drastically in 1975.

UTAH

R. S. Albrechtsen

Prolonged cold, wet spring weather necessitated unusually late seeding of Utah's 1975 oat crop. However, continued cool, wet conditions following planting allowed the crop to tiller well and resulted in respectable yields of good quality grain. Acreage remained constant and yields per acre were slightly higher than those of the past two years.

We are not presently carrying on an active oat breeding program. We do grow the Northwestern States Oat Nursery and additional varieties and advanced breeding lines of particular interest to us. For the past two years we have evaluated a number of hulless lines from various sources. Some of these show considerable promise. Cayuse is the top-yielding named variety on a long-term average. It has become very prominent in the variety picture. Park and some of the older varieties still occupy considerable acreage.

OAT RESEARCH AT WASHINGTON STATE UNIVERSITY

C. F. Konzak, M. A. Davis

Oat research barely survives in Washington. Only two trials were grown at Pullman in 1975, the Northwestern Regional Oat Nursery and trial advanced selections and mutants. In addition, four oat varieties were grown at several locations in extension trials. A new Cayuse/CI2874 line, WA6014 appeared to show a general yield and slight test weight advantage over Cayuse, and plants pulled in 1975 will be used for a proposed Breeder seed increase.

The only other work on oats was some selection in a bulk M_3 mutagen treated population of a highly BYDV tolerant, but small seeded line from Cayuse/CI2874. The harvested M_2 was screened for plump grains, then the best were grown under irrigated conditions and about 75 fertile large seeded single plant selections were made. These will be grown in plant rows at two locations in 1976. Several selections made from two lines of Cayuse/CI2874 segregating for BYDV tolerance still await testing for BYDV since cooperative plans for tests by Drs. C. O. Qualset and G. W. Bruehl failed in 1975 due to excessive rains in California, and lack of aphids at the critical time in Western Washington. Hopefully, 1976 will be more successful.

WISCONSIN

R. A. Forsberg, M. A. Brinkman, Z. M. Arawinko, E. S. Oplinger, and R. D. Duerst (Agronomy), and D. C. Arny (Plant Pathology)

The 1975 oat season in Wisconsin was characterized by late planting, followed by above-normal temperatures during much of the entire season. Although planting was notably delayed in the southern half of the state by a cold, wet spring, warm temperatures and abundant moisture after planting resulted in excellent stands throughout the state. Stands in the northern half of the state were considerably above average in potential. The continued high temperatures reduced yields and test weights where moisture was limiting. The state-wide average yield of 55 bushels per acre was down from early-season expectations of 63 B/A and from the 1974 average of 61 B/A.

Leaf rust infection was much reduced compared to that in the two previous years. The cool spring caused a restricted development of the rust organism on buckthorn, and this in turn contributed to a delayed and less-serious infection in the 1975 Wisconsin oat crop.

The army worm caused extensive damage in northcentral Wisconsin in an area centering around Lincoln and Marathon Counties. Oat grain losses were substantial. Also disconcerting was the discovery of the cereal leaf beetle in several oat fields in southeastern Wisconsin in 1975. The beetle has not been active in Wisconsin, and its activity in 1976 will be monitored closely.

The prevalence and severity of oat loose smut have been increasing in Wisconsin in recent years. Also, a new race has been appearing in several previously resistant varieties. Lodi and Beedee are particularly susceptible; Froker, Portal, and Wright are intermediate; and Dal, Garland, Goodland, and Holden continue to have good resistance.

Goodland was grown on Wisconsin farms for the first time in 1975. It has high groat protein but it must be grown on fertile soils to produce above-average grain yields. In 1975 performance trials, it was among the yield leaders at Marshfield (Central Wisconsin) with 81.1 B/A. Comparatively, it did not yield as well at other locations.

Wright, a Beedee-type oat, will be grown on Wisconsin farms for the first time in 1976. Wright has high test weight and is intermediate in maturity. Although 2-3 inches taller than Beedee, Wright has stiffer straw and lodges less than Beedee.

Personnel:

Dr. H. L. Shands is actively engaged in a U.S.A.I.D. program concerned with the development and utilization of oat germ plasm in developing countries. Mr. Osman Taha (The Sudan) is completing his M.S. program and thesis research concerned with the utilization of number of spikelets per panicle as a yield selection index. Mr. Wesley R. Root began his Ph.D. graduate program in June, 1975, and his thesis research will deal with the classification and inheritance of oat-groat conformation. Mr. James A Radtke, Mr. Arlei Terres (Brazil), and Mr. David K. Langer all initiated M.S. programs in January, 1976. Mr. Radtke's thesis research will be concerned with the cytogenetic evaluation of three oat translocation lines, and Mr. Terres will study the influence of nitrogen on grain-straw ratios.

IV. OAT GERMPLASM AND NEW OAT CULTIVARS

Stem Rust Germplasm Release

P. G. Rothman

Germplasm line C.I. 9221 is a bulk of four progeny rows descended from four individual F_6 plants. The cross *Avena sterilis*/Kyto combined the late-rusting trait of *A. sterilis* (C.I. 8377) with the recessive gene *pg*-12 for seedling resistance to stem rust.

Germplasm line C.I. 9222 is a bulk of 19 F_7 progeny rows derived from individual F_4 plants. The cross Kyto/SES Sel. 52 combines the recessive gene *pg*-12 for seedling resistance with the recessive gene *pg*-11 for adult resistance to stem rust.

Both germplasm lines mature late, possess the *A. sativa*-type yellow kernel, and are fully fertile. Plants, however, are tall and weak-strawed. Both lines are resistant in seedling tests to all presently known physiologic races of oat stem rust and under field conditions were more resistant than were any other lines in both the 1973 and 1974 International Oat Rust Nurseries.

Seed stocks are available from the Cereal Rust Laboratory, University of Minnesota, St. Paul, MN 55108.

THE NATIONAL SEED STORAGE LABORATORY

Louis N. Bass

Our agricultural history is replete with losses of valuable germplasm. It is to prevent such future losses that the National Seed Storage Laboratory was established.

Preservation of germplasm is accomplished through the collection of seeds of known value. All agronomic, horticultural, forest, and esthetic types are qualified for storage, but only seeds are stored. Research men may submit obsolete varieties, current varieties, breeding lines, and genetic stocks. Once in the Laboratory, the seeds become the property of the Federal government and are available to research men in the United States when the Laboratory is the only known source.

The crop characteristics of the seeds stored are recorded on accession cards and through our computer program it is possible to locate seeds that have certain crop characteristics.

During periodic intervals over the years, the seeds are tested for germination in the germination laboratory. In the event that deterioration does occur, contracts will be made with some seed-producing agency to replenish the stocks with seeds obtained from controlled plantings of present stocks.

In addition to the preservation of germplasm, research work related to seed longevity is carried out.

The Laboratory provides backup storage for the working stocks in the four Regional Plant Introduction Stations as well as the working stocks in world collections, such as wheat, oats, barley, buckwheat, flax, soybeans, rice, sorghum, and tobacco.

Anyone who has varieties or breeding lines which he feels should be included in the germplasm collection in the National Seed Storage Laboratory is invited and encouraged to send a list of such materials to the Director who will check the submitted lists against the Laboratory's inventory and then request seed of those items not already in storage. Forms for providing the necessary documentation information will accompany the seed request.

USDA Oat Collection

J. C. Craddock

There were only 35 oats accessioned to the USDA Oat Collection during 1975. I believe most breeders have germplasm that could be submitted to the collection. This germplasm need not be suitable for release as cultivars. Your entry may be added to the collection by merely providing a 10 - 400 gram sample and a statement that it is open stock. Any specific information regarding the entry is appreciated. The more information you offer, the more complete our records will be.

Proposed names for new released cultivars should be cleared through the Trademark Division for possible name duplication and/or infringement on existing trademarks. I will be glad to make this check for you. Please submit three proposed names in order of preference, along with your station number and/or CI number.

OAT GENE BANK: If an oat gene bank is to be maintained, we must depend on you, the contributors, to submit your excess seeds from F_1 and F_2 plants to this very worthwhile project. There have been no contributions since 1968. PLEASE REMEMBER THE GENE BANK.

OAT CLASSIFICATION BULLETIN: F. A. Coffman reports that the Oat Classification Bulletin has been prepared in galley and is now in the hands of the printer. This publication will contain more than 200 pages giving history and descriptions of more than 400 oat varieties which will include about 200 registered cultivars and 220 literature citations.

The new accessions to the USDA Oat Collection are listed:

C. I. NUMBERS ASSIGNED IN 1975

C. I. Number	Name or Designation	Parentage	Source
9217	Allen	Clintford sib/9/Mo 0-205/7/Clinton 59*7/Landhafer/6/ Clinton 59*7/Landhafer/5/Clinton 59*7/Landhafer/4/ Clinton/2/Boone/Cartier/3/RL 2105/8/Tyler/4/ Clintland*5/Minn 313/2/Ceirch du Bach (CI 2923)	Indiana
9218	Wright	Trispernia/Belar/2/Beedee/3/Beedee/4/Beedee	Wisconsin
9219	OA 269	Gemini/CAV 2700/2/Kelsey	Canada
9220	OA 309	Dorval/3/Gemini/CAV 2700/2/5872-1	Canada
9221	MN 711029B	*Avena sterilis*/Kyto	Minnesota
9222	MN 72106-124	Kyto/CI 3034	Minnesota
9223	Cavell	Beacon/Laurel/2/Glen	Canada
9224	Firecracker	F_2 selection from Carolee/TF 1012	North Carolina
9225	MN 12001	Tippecanoe/65B1362	Minnesota
9226	MN 12002	Tippecanoe/65B252-6	Minnesota
9227	MN 12003	Lodi/65B252-6	Minnesota
9228	MN 12004	Tippecanoe//Tippecanoe/65B1362F_1	Minnesota
9229	MN 12006	Agron 27//Garland/PI 267989	Minnesota
9230	MN 12007	65B663/65B252-6	Minnesota
9231	MN 12008	Garland/PI 267989	Minnesota
9232	MN 12009	Tippecanoe/3/65B1362/Tippecanoe//65B252-6	Minnesota
9233	MN 12011	Tippecanoe/3/65B2417/Tippecanoe//65B252	Minnesota
9234	MN 12012	Garland/Portage	Minnesota
9235	MN 12013	72B495-4	Minnesota
9236	MN 12014	Agron 27/Lodi	Minnesota
9237	MN 12016	Tippecanoe/II 54-113	Minnesota
9238	MN 12017	Orbit//Garland/PI 267989	Minnesota
9239	MN 12018	Otter//Garland/PI 267989	Minnesota
9240	MN 12019	Stormont//Garland/PI 267989	Minnesota
9241	Diamante R-31		Mexico
9242	Huamantla		Mexico
9243	Paramo		Mexico
9244	Tarahumara		Mexico
9245	MN 756501	67B1157//Lodi/65B1362	Minnesota
9246	MN 756502	Tippecanoe/65B1362	Minnesota
9247	MN 756515	67B1157//Tippecanoe/65B1286	Minnesota

C. I. Number	Name or Designation	Parentage	Source
9248	MN 756555	67B1157/4/Lodi/65B1362//Tippecanoe/3/65B1362	Minnesota
9249	MN 756595-96	67B1157/4/Lodi/65B1362//Tippecanoe/3/65B1362	Minnesota
9250	MN 756637	Tippecanoe/65B1362/67B1157//Tippecanoe/65B1286	Minnesota
9251	MN 756693	Tippecanoe/3/65B1362/67B1157//Tippecanoe/65B1286	Minnesota

CAVELL

M. L. Kaufmann

Cavell spring oat (Avena sativa L.) was developed at the Lacombe Alberta Research Station from the cross (Beacon x Laurel) x Glen. It was tested as 337-99 in Alberta Regional Tests 1968-1974 and as O.T.719 in the Western Co-operative Oat Tests 1971-1973. In 1975 it was granted a license for sale in Canada and seed was allocated to seed growers in Alberta for increase for general distribution in 1977.

The main attributes of Cavell are good yielding ability, early maturity and good straw strength. It yields less than Random but is equal to, or slightly better than Fraser. Maturity is about 3 days earlier than Random and 5 days earlier than Fraser. Straw strength is equal to that of Random; 1000 K wt is medium, similar to Victory; and % hull low slightly less than Fraser and Rodney. The protein level of Cavell is higher than that of the commonly grown cultivars. Disease resistance is similar to that of Random. Cavell should prove of value in areas where early maturity and lodging resistance are important considerations.

TARAHUMARA

Philip Dyck Sudermann

Tarahumara, also an early dryland spring oats, was developed cooperatively by the geneticists and research agronomists of INIA and was released in the state of Chihuahua, Mexico in 1975.

The pedigree of Tarahumara is:

(7114-Chihuahua) x (Curt-Nodaway^3) (AB110-Indio) x (AB177-Curt)/7639
I-1078-7R-1C-0C-11R-0R

Tarahumara is a medium tall oats that produces a medium plump kernel with white glumes. It has a 55% groat and 23.1% protein content. Tarahumara matures in 86 days, yields from 2,000 to 3,000 kg/ha and has an average height of 90 cm. It is moderately resistant to Puccinia graminis avenae with a stem rust coefficient of 5%.

Although Tarahumara has a low groat content, it was released for its high protein content and resistance to rust.

GUELATAO

Philip Dyck Sudermann

Guelatao, an early spring dryland oats, was developed cooperatively by geneticists and research agronomists of INIA. It was released in the state of Chihuahua, Mexico in 1972.

The pedigree of Guelatao is:

Curt x (Nodaway)^3 I-163-2M-3R-1M-3R

Guelatao is an early variety that matures before early frosts and therefore could be seeded late should the rainy period begin late in July.

Guelatao is a moderately tall oats with a plump kernel that has a rather heavy hull. The glumes are cream colour. The kernel has 57% groat and 17.6% protein content. Guelatao matures in 84 days, yields from 1,500 to 2,500 kg/ha and it's average height is 105 cm. It is moderately susceptible to *Puccinia graminis avenae* with a stem rust coefficient of 30%.

Guelatao has 2 defects. It shatters easily and it has a heavy hull.

PARAMO

Philip Dyck Sudermann

Paramo is another early spring dryland oats developed cooperatively by geneticists and research agronomists of INIA. It was released in the state of Chihuahua, Mexico in 1975.

The pedigree of Paramo is:

AB177^2-Curt x (Curt-Nodaway^2) x (AB177^2-Curt)
I-799-4M-1R-1M-3R-0M

Paramo is a medium tall oats that produces a large plump kernel with light brown glumes like AB-177. The kernel has a 65% groat and 21.4% protein content. Paramo matures in 84 days, yields from 2,000 to 3,000 kg/ha and has an average height of 100 cm. It is moderately resistant to *Puccinia graminis avenae* with a stem rust coefficient of 5%.

Because Paramo is superior to Guelatao in all its plant characteristics except height, it could replace the latter.

V. PUBLICATIONS

In the past, editors of the Oat Newsletter have attempted to provide an annual list of publications dealing with oats by soliciting titles from the people who received the Newsletter. A much more comprehensive list (compiled using modern literature search techniques) is being provided in this issue.

Please note that the different categories are intended only as rough guides. For example, a paper on breeding for high protein may be listed under "Breeding" or under "Quality", but it will not be listed under both.

The editor would appreciate any comments you might have on this list of publications. Is it useful? Is it not useful? Suggestions to improve it?

Breeding, Genetics, and Taxonomy

ALLARD, R. W. 1975. The mating system and micro evolution. Genetics 79:115-126.

ALLARD, R. W. and A. L. KAHLER. 1974. Milti locus genetic organization and morphogenesis. Brookhaven symp biol 25:329-343.

ALMGARD, G. and D. Clapham. 1975. Isozyme variation distinguishing 18 Avena cultivars grown in Sweden. Swed J Agric Res 5:61-68. Biol Abstr 60, 058440.

AZAEL, A. 1973. Contributions towards the production of a trisomic series in oats Avena sativa. Z Pflanzenzuecht 70:289-305. Bio Abstr 59, 035029.

BAUM, B. R. 1974. Classification of the oat species (Avena, poaceae) using various taximetric methods and an information-theoretic model. Can J Bot 52:2241-2262.

BAUM, B. R. and E. J. BRACH. 1975. Identification of oat cultivars varieties by means of fluorescence spectrography--a pilot study aimed at automatic identification of cultivars toxonomy. Can J Bot 53:305-309.

BAUM, B. R. T. RAJHATHY, J. W. MARTENS, and H. THOMAS. 1975. Wild oat gene pool, a collection maintained by the Canada Department of Agriculture. Canada Avena (CAV), second edition. Publ Agric Can 1475, Rev., 100p.

BORGEN, L. 1974. Chromosome numbers of macaronesian flowering plants part 2. Norw J Bot 21:195-210. Biol Abstr 60, 029802

BRACH, E. J. and B. BAUM. 1975. Identification of oat cultivars by fluorescence spectroscopy. Appl Spectrosc 20:326-333. Biol Abstr 60, 064277

CHAE, Y-A and R. A. FORSBERG. 1975. Inheritance of node branch and spikelet number in oat panicles diallel analysis of F-1 and F-2. Crop Sci 15:457-460. Biol Abstr 60, 064228.

CHRISTINET, G. 1974. Experimental results with cereal varieties in 1973. Revue Suisse d'Agriculture 6:122-124.

CRAIG, I. L. B. E. MURRAY, and T. RAJHATHY. 1974. Avena canariensis: morphological and electrophoretic polymorphism and relationship to the Avena magna - Avena murphyi complex and Avena sterilis. Can J Genet Cytol 16:677-689.

DAY, K. M., F. L. PATTERSON, O. W. LUETKEMEIER, H. W. OHM, J. J. ROBERTS, L. S. BECKHAM, M. L. SWEARINGIN, G. E. SHANER, D. M. HUBER, AND R. E. FINNEY. 1975. Performance and adaptation of small grains in Indiana. Purdue Univ Agr Expt Sta Bull No. 104.

DONOVAN, J. W. 1975. Bristle oat in Pembrokeshire. Nat Wales 14:197-198.

DUBUC, J. P., F. M. GAUTHIER, H. R. KLINCK, C. A. ST-PIERRE, and G. PELLETIER. 1975. Alma oats. Can J Plant Sci 55:635-636. Biol Abstr 60, 023404.

EAGLES, H. A. and K. J. FREY. 1974. Expected and actual gains in economic value of oat lines from five selection methods. Crop Sci 14:861-864.

FATUNLA, T. and K. J. FREY. 1974. Stability indexes of radiated and non-radiated oat genotypes propagated in bulk populations. Crop Sci 14:719-724.

FOLKINS, L. P. and M. L. KAUFMANN. 1974. Yield and morphological studies with oats for forage and grain production. Can J Plant Sci 54:617-620. Biol Abstr 59, 052561.

FORAL, A. and K. TOMAN. 1974. Yielding capacity resistance to lodging and content of crude proteins in the best cultivar of the world collection of oats. Sb Uvti Genet Slechteni 10:77-86. Biol Abstr 59, 046803.

FREY, K. J. 1975. Heritability of groat-protein percentage of hexaploid oats. Crop Sci 15:277-279.

FREY, K. J. 1975. Backcross variability for grain yield in oat species crosses (Avena sativa L. x Avena sterilis L.). Euphytica 24:77-85.

FREY, K. J. and P. CHANDHANAMUTTA. 1975. Spontaneous mutations as a source of variation in diploid, tetraploid and hexaploid oats (Avena spp). Egypt J Genet Cytol 4:238-249.

GAMZIKOVA, O. I. and V. G. ILIUSHCHENKO. 1974. Laboratory evaluation of breeding material for drought and heat resistance. Wheat, Oats, Peas. Sel Semenovod 3:26-27.

GEADELMANN, J. L. and K. J. FREY. 1975. Direct and indirect mass selection for grain yield in bulk oat populations. Crop Sci 15:490-494. Biol Abstr 60, 058395.

GREEN, C. E. and R. L. PHILLIPS. 1974. Potential selection system for mutants with increased lysine threonine and methionine in cereal crops. Crop Sci 14:827-830. Biol Abstr 59, 046769.

GREENAWAY, W. T. and G. DAVIS. 1974. A discussion of test weight and construction of conversion tables relating test weight to hectoliter weight for wheat and other grains. Cereal Sci Today 19: 405.

GROSSE-BRAUCKMANN, E. 1973. The influence of restricted spacing on the growth of oats in pot trials. Z Pflanzenernaehr Bodenkd 136:97-103. Biol Abstr 59, 064237.

JACQUIN, F., J. BAUDEQUIN, P. BOURRET, and G. GLEITZER. 1974. Experimental verifications concerning so-called biological transmutations. Acad Agric Fr C R Seances 60:152-157.

KAUFMANN, M. L. 1974. Correlations among kernel characteristics and maturity in 5 oat crosses. Can J Plant Sci 54:735-738. Biol Abstr 59, 052559.

KITTLITZ, E. VON., M. UHLIG. 1974. Investigations on germinating capacity and on selection of threshing resistent forms of naked oats. Z Pflanzenzucht 72:305-316.

LAWRENCE, P. K. and K. J. FREY. 1975. Backcross variability for grain yield in oat species crosses Avena sativa x Avena sterilis. Euphytica 24:77-86. Biol Abstr 60, 017585.

LYRENE, P. M., and H. L. SHANDS. 1975. Associations among traits in progenies from Avena sativa L. x Avena sterilis L. crosses. Crop Sci 15:361-363.

LYRENE, P. M., and H. L. SHANDS. 1975. Heading Dates in six Avena sativa L. x Avena sterilis L. crosses. Crop Sci 15:359-360.

MEHRA, P. N. and M. L. SHARMA. Cytological studies in some Central and Eastern Himalayan grasses. Part 3. Cytologia 40:441-452. Biol Abstr 60, 064903.

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