# 1967

# OAT NEWSLETTER

## Vol. 18



May 1, 1968

Sponsored by the National Oat Conference

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# OAT NEWSLETTER

Volume 18

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J. Artie Browning, Editor

## ANNOUNCEMENTS

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

Available back issues - Back issues of all volumes since and including 1960 are available on request.

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

## PLEASE DO NOT CITE THE OAT NEWSLETTER IN PUBLISHED BIBLIOGRAPHIES

Citation of articles or reports of Newsletter items apparently is causing some concern. The policy of the Newsletter, as laid down by the oat workers themselves and later reiterated, is that this letter is to serve as an informal means of communication and exchange of views and materials between those engaged in oat improvement. Just as definitely, no material is wanted which is of a nature that fits a normal journal pattern. Each year's call for material emphasizes this point. Unless there has been a change of thinking the oat workers do not aspire to a newsletter that would in any way discourage informality, the expression of opinions, preliminary reports, and so forth.

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

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

One suggestion which may help: if there is material in the Newsletter which is needed for an article, contact the author. If he is willing, cite him rather than the Newsletter. This can be handled by the phrase "personal communication."

# IN APPRECIATION

by

H. C. Murphy, Chairman, National Oat Conference

All oat workers and others interested in oat improvement owe a heavy debt of gratitude to Dr. Neal F. Jensen, Professor of Plant Breeding at Cornell University and retiring Editor of the Oat Newsletter. Dr. Jensen had full responsibility for editing, assembling, and issuing volumes 1-17, inclusive, of the Newsletter. Starting from scratch, he developed one of the first and most outstanding of the several crop newsletters now being issued. It is only fitting that, after 17 years of outstanding service, Neal should request to be relieved of responsibility for editorship of the Newsletter.

It is important to emphasize that Dr. Jensen's contributions to oats and oat improvement have not been confined to editorship of the Newsletter. He played an important role in the organization of the National Oat Conference, was a member of the first formal Executive Committee, and served as the third Chairman of the Conference. In addition, he was a member of the Oat Monograph Committee which conceived and outlined the Oat Monograph, and he was an author of one of the chapters. Dr. Jensen also served as a member of the National Oat Conference committee which developed and published "A Standardized System of Nomenclature for Genes Governing Characters of Oats."

In addition to his service to the National Oat Conference, Dr. Jensen has developed and distributed a number of outstanding varieties, including Craig, Mohawk, Niagara, Oneida, Orbit, and Tioga. He first proposed the multiline method of small grain breeding and is responsible for numerous other publications pertaining to oat improvement.

Appreciation also should be expressed to Dallas E. Western and the Quaker Oats Company, Chicago, Illinois, for their financial support of the Oat Newsletter since it was initiated. It is doubtful whether a Newsletter would have been possible without the encouragement and support received from Dal and Quaker Oats.

It is also important to emphasize that Dallas Western's and the Quaker Oats Company's contributions to oats and oat improvement have not been limited to financial support for the Oat Newsletter. They have been active for many years in supporting and obtaining support for research in oats. The Quaker Oats Company recently established a "Dallas E. Western Research Assistantship in Agriculture" at Iowa State University in recognition of Dal's outstanding contributions. This is only one of many research assistantships they support. One of their primary objectives has been to train future oat workers. Dal has been effective in obtaining increased Federal and State support for oats and other field crops research and has received much recognition and many significant awards for his outstanding contributions to agriculture.

We thank you, Neal and Dal, for all you have done for oats.

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| Chairman | - | H. C. Murphy |
| *Past Chairman | - | J. E. Grafius |
| *Secretary | - | F. L. Patterson |
| *Editor Newsletter | - | J. A. Browning |

Representatives:

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

*Non-voting
**New representatives are to be elected May 15-17, 1968.

## REPORT OF THE COMMITTEE ON OAT GENE NOMENCLATURE

by M. D. Simons

The committee is functioning, and requests the cooperation of all investigators in furnishing information on all new genes in oats. Information on genes governing reactions to disease organisms should be sent to M. D. Simons; information on genes governing all other characters should be sent to F. J. Zillinsky or N. F. Jensen. Two genes for crown rust reaction (Pc-36 and Pc-37), two for halo blight reaction (Psc-2 and Psc-3), and three for morphological characters (pt, cluster panicle; fl, floretless; and mg, multiglumes) have been recorded since publication of the original list in 1966. (Simons, M. D., F. J. Zillinsky, and N. F. Jensen. 1966. A standardized system of nomenclature for genes governing characters in oats. Crops Research, ARS 34-85, 22 pp.).

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# II. ABSTRACTS OF PAPERS PRESENTED AT THE NORTH CENTRAL OAT CONFERENCE, MADISON, WISCONSIN, JANUARY 25-26, 1968.

## TRANSGRESSIVE SEGREGATION IN OATS FOR THE REACTION TO BYDV

by C. M. Brown and H. Jedlinski

Oat selections that originated from a 5-parent diallel were evaluated for their reaction to two BYDV strains, Champaign -6 and Southern Illinois -1, in the field at Urbana, Illinois. The 5 parents (Albion, C. I. 5068, Ill. 30959, C.I. 1915 and C.I. 6975) were selected on the basis of their tolerance to the two strains and their differential reaction to them. Evaluations were made in $F_2$, $F_3$, $F_4$ and $F_5$ generations. In general, there was good correlation for BYDV reaction among the generations indicating high heritability.

The reaction of the 5 parents and of certain selections from each cross is presented in Table 1. Data for parent varieties represents the mean of 2 years with 6 replications in 1966 and 2 replications in 1967. Data for selections represents the mean of 2 years with 6 replications of each $F_4$ in 1966 and 2 replications of each $F_5$ in 1967. Each $F_4$ selection originated from a single $F_3$ plant while each $F_5$ originated from a bulked $F_4$ progeny. Evaluations were made in hill plots with 6 plants per hill.

The data in Table 1 definitely indicate transgressive segregation for BYDV reaction since progenies with higher and lower levels of tolerance than the respective parents were identified. This suggests that the parents possessed diverse genes for tolerance and that continued crossing and selection should improve the level of tolerance to the virus.

Table 1. Effect of the Southern Illinois -1 and Champaign -6 Strains of BYDV infection on parents and selection derived from a 5- parent diallel

| Parent or Selection | BYDV Strain | | | |
|---|---|---|---|---|
| | Champaign -6 | | Southern Illinois -1 | |
| | Disease[1/] severity | Grain[2/] Yield % | Disease[1/] Severity | Grain[2/] Yield % |
| Albion | 1.4 | 42 | 1.4 | 44 |
| C.I. 5068 | 1.4 | 28 | 3.4 | 4 |
| Ill. 30959 | 1.4 | 55 | 1.6 | 59 |
| C.I. 1915 | 1.6 | 50 | 1.9 | 36 |
| C.I. 6975 | 2.2 | 24 | 2.2 | 32 |
| Albion x C.I. 5068 | 1.1 | 64 | 1.5 | 55 |
| Albion x C.I. 5068 | 3.0 | 5 | 3.8 | 1 |
| Albion x C.I. 5068 | 1.2 | 51 | 3.6 | 1 |
| Albion x Ill. 30959 | 1.0 | 88 | 1.2 | 59 |
| Albion x Ill. 30959 | 1.5 | 35 | 1.8 | 20 |
| Albion x C.I. 1915 | 1.4 | 76 | 1.2 | 70 |
| Albion x C.I. 1915 | 1.4 | 33 | 1.4 | 43 |
| Albion x C.I. 1915 | 2.1 | 36 | 2.9 | 8 |
| Albion x C.I. 6975 | 1.2 | 75 | 1.3 | 57 |
| Albion x C.I. 6975 | 2.1 | 21 | 3.3 | 2 |
| Albion x C.I. 6975 | 3.2 | 3 | 3.3 | 4 |
| C.I. 5068 x Ill. 30959 | 1.4 | 63 | 1.2 | 69 |
| C.I. 5068 x Ill. 30959 | 1.3 | 39 | 3.3 | 2 |
| C.I. 5068 x C.I. 1915 | 1.2 | 51 | 1.2 | 40 |
| C.I. 5068 x C.I. 1915 | 2.2 | 20 | 3.6 | 3 |
| C.I. 5068 x C.I. 1915 | 1.6 | 18 | 3.3 | 2 |
| C.I. 5068 x C.I. 6975 | 1.0 | 82 | 1.0 | 61 |
| C.I. 5068 x C.I. 6975 | 2.1 | 18 | 3.5 | 3 |
| Ill. 30959 x C.I. 1915 | 1.3 | 97 | 1.4 | 82 |
| Ill. 30959 x C.I. 1915 | 1.5 | 56 | 1.4 | 49 |
| Ill. 30959 x C.I. 6975 | 1.1 | 80 | 1.3 | 65 |
| C.I. 1915 x C.I. 6975 | 1.8 | 35 | 1.2 | 52 |
| C.I. 1915 x C.I. 6975 | 2.5 | 11 | 2.7 | 11 |

1/ Based on visual evaluation using scale of 0 - fully tolerant to 4.0, intolerant. Figures for parents based on mean of 2 years, 1966-67 and for selections on mean of $F_4$, 1966 and $F_5$, 1967.

2/ Grain yield equals percent of uninoculated check and is based on 2 year means as in footnote 1.

## DEPLOYMENT OF OAT RUST RESISTANCE GENES

by J. Artie Browning, M. D. Simons, K. J. Frey, and H. C. Murphy

Widespread production in Central North America of oat varieties with the same rust resistance genes has resulted in a rapid turnover of oat varieties and rust races.

Central North America is an epidemiological unit for wind disseminated pathogens such as the cereal rusts, with the fungi overwintering in the South and moving North into the Upper Mississippi Valley and Canada in the spring. It seems logical, therefore, that deploying rust resistance genes so that those utilized in commercial varieties in the Northern United States and Canada differ from those utilized in the Southern United States and Northern Mexico, will help block the seasonal interregional movement of rust spores that has jeopardized crops both North and South. Interregional movement of spores would still occur, but the spores should be those of races avirulent on crops in the other region.

Therefore, we propose that intra- and inter-regional oat rust research be undertaken to test the validity of this theory; if the theory proves valid, perhaps oat workers can agree to a means of limiting the geographical area in which rust resistance genes can be utilized in commercially grown varieties.

We have crossed circa 25 crown rust resistance genes into 2 recurrent lines. We have used 14 different genes in 2 multiline varieties for release this year. Ten of these 14 have not been used previously in varieties for commercial production. We have an additional 9 crown rust resistance genes in recurrent lines which have not yet been utilized in commercial varieties. Additionally, there are, apparently, many more resistance genes that will be available from _Avena sterilis_ and other wild oats. Never before in history have so many different crown rust resistance genes been available for release or incorporation in commercial varieties at one time. If these genes are used piecemeal, history will repeat itself and the usefulness of each gene when used over a wide area will, in time, be lost. Thus, the time for research and decision on how to "use" the 10 resistance genes we are releasing, the 9 additional ones not yet released and new still uninvestigated genes is critical. We invite discussion and ideas from oat workers upon the subject of limiting the geographical areas in which these genes will be used.

## CROWN RUST INTENSIFICATION WITHIN AND DISSEMINATION FROM PURE LINE AND MULTILINE VARIETIES OF OATS

by Blanche M. Cournoyer, J. Artie Browning and David Jowett

Most oat-rust studies have consisted of observations and data taken on and from the host. The parasitic relationship might be better elucidated if the pathogen itself were observed, thereby providing insight into the dynamics of a crown rust epiphytotic and permitting additional testing of the multiline hypothesis. We observed the pathogen by trapping spores with Rotorod spore samplers at the perimeters of eight 50' x 50' experimental plots. Four plots were planted to a 7-component multiline variety and 4 to a pure line variety. Two plots of each variety were subjected to crown rust race 264 and 2 to a mixture of 6 crown rust races, including race 264. The statistical method of least squares was used to analyze the data. Daily collectional urediospore counts were added cumulatively, thereby analogizing the progress of the epiphytotic to population increase in a limiting environment.

Our results clearly indicated that the multiline variety supported less rust early in the season than did the pure line variety, that the progress of the epiphytotic was vastly slower in the multiline variety, and that the mixture of 6 rust races attained slightly more growth in the multiline variety, but slightly less growth in the pure line variety.

These results support the theory that, by virtue of its genetic diversity, a multiline variety serves as a system of checks and balances against the development of any one disease, a phenomenon probably attributable to the "disease-escape" mechanism. The multiline variety, by virtue of the vertical resistance of its components to each of several races, reduced the effectiveness of early inoculum. It also delayed the progress of the epiphytotic, thereby behaving like a pure line variety with horizontal resistance. The combined effect was that the epiphytotic did not develop to completion in the multiline variety, but was stopped by host maturity. In a farmer's field, this would have been expressed as increased yield of grain as the susceptible plants (and most plants were susceptible to one race or another) filled their grain without severe damage by rust.

## AGRONOMIC PERFORMANCE OF 6x-AMPHIPLOID x A. SATIVA BACKCROSS-DERIVED LINES IN A PRELIMINARY NURSERY TRIAL

by R. A. Forsberg and H. L. Shands

The agronomic performances of several 6x-amphiploid x A. sativa backcross-derived lines were compared with those of several cultivated oat varieties in a 1967 nursery trial. Most test lines were $F_6$, $F_7$ or $F_8$ of the first or second backcross to the A. sativa parent. The yielding ability of 12 test entries was very encouraging. Their yields were not significantly different from those of the high yielding varieties, Portal, Orbit, Sauk, and Lodi. Bushel weights of 37-40 pounds were common. Some high yielding test lines received snap-back readings of 6.8-7.4 compared to 6.9 and 7.5 for Portal and Holden, respectively. The high yielding lines usually, but not always, had more lodging than Portal or Holden. It is doubtful that these lines possess resistance to crown rust derived from their amphiploid ancestor.

## CHARACTERISTICS OF C.I. 7232 (2N=28) x BLACK MESDAG (2N=42) PENTAPLOID $F_1$ PLANTS

by R. A. Forsberg and S. Wang

Seven pentaploid $F_1$ plants of the cross Abd. 101, C.I. 7232 (2N=28) x Black Mesdag (2N=42) were grown and observed in 1967. Five of six plants examined for self fertility were completely sterile; one seed was obtained from the sixth plant. In all, only one seed was obtained from 3,316 spikelets. The panicles were not enclosed in any manner. Preliminary cytological observations on three $F_1$ plants verified that they possessed 35 chromosomes, as expected, and an average of 5.83 bivalents per cell. This performance is typical of $F_1$ plants from tetraploid x hexaploid oat crosses and is contrary to other reports (Pl. Dis. Rptr. 43: 772-776; 1960 Oat Newsletter) that $F_1$ plants of the same parentage were completely fertile.

## SYSTEMIC FUNGICIDES FOR CONTROL OF OAT SMUTS

by Earl D. Hansing

Kanota oat seed was inoculated by the partial vacuum method with a suspension of chlamydospores of loose smut (Ustilago avenae) and covered smut (U. kolleri). After the seed was dried 500 cc lots were treated with the systemic fungicides Plantvax 75 (75% 2,3-Dihydro-5-carboxanilido-6-methyl-1, 4-oxathiin-4-dioxide) at 1.33 and 2.67 oz/bu; Vitavax 75 (75% 2,3-Dihydro-5-carboxanilido-6-methyl-1,4-oxathiin) at 0.67, 1.33 and 2.67 oz/bu; and duPont 1991 (50% 1-(butylcarbamoyl)-2-benzimidazole carbamic acid, methyl ester) at 2, 3, and 4 oz/bu. Seed treated with chloranil (2 oz/bu) was included as a nonvolatile-nonsystemic control, and Ceresan L (0.5 oz/bu) and Panogen 15 (0.75 oz/bu) were included as volatile-nonsystemic mercurial controls. During 1966 (except duPont 1991) and 1967 nontreated seed and treated seed of each entry were planted each year on 2 different dates in 3 replicated 10-foot rows. Data were taken on smutted panicles during June.

When the seed was not treated during 1966 and 1967, 34% and 67% smutted panicles developed, respectively. When the seed was treated with chloranil 25% and 36% smut occurred which indicated that a high level of infection took place underneath the lemmas and paleas. Good control of oat smut was obtained with the methyl mercurial fungicides in both 1966 (trace to 1%) and 1967 (2 to 3%).

Good control of oat smut was obtained with Plantvax 75 in 1966 (1.33 oz/bu, 1 to 2%, and 2.67 oz/bu, 0 to trace %) and in 1967 (1.33 oz/bu, 3 to 4%, and 2.67 oz/bu, 2%). Complete control of oat smut was obtained with Vitavax 75 (1.33 and 2.67 oz/bu) in 1966 and 1967, but when the seed was treated at 0.67 oz/bu (1967) 1% smutted panicles developed. Good control of oat smut was obtained in 1967 when the seed was treated with duPont 1991 at 2 (trace to 1%), 3 (trace to 1%) and 4 (0%) oz/bu.

During the last 3 decades control of oat smut in susceptible varieties of oats has been primarily by seed treatment with volatile mercurial fungicides. Control of oat smut with systemic seed treatments, which are less toxic to warm blooded animals, could well be the beginning of a new era and replace mercurials for control of these diseases.

## THE NATURE AND EFFECT OF ADULT PLANT RESISTANCE TO CROWN RUST IN SEVERAL COMMERCIAL OAT VARIETIES

by Allen Streeter Heagle

The varieties Portage, Ajax, Minhafer, Lodi and Rodney have consistently been moderately resistant to moderately susceptible to crown rust in the Minnesota buckthorn plot, whereas most other commercial varieties including Coachman have been completely susceptible. The pathogenic diversity of inoculum in this plot suggests that this may be a generalized resistance. In 3 years of tests the spread of crown rust from inoculated centers was much less in plots of the moderately resistant varieties.

In detailed comparisons of rust development in adult plants there were fewer infections, hyphal growth was retarded, the number of days to onset of sporulation was greater, pustules were smaller and fewer spores were produced per pustule in Portage than Coachman. This was so at low and moderate temperatures with each of the two races used. The same relationship existed in seedling plants of the two varieties but to a lesser degree. Present indications are that this moderate resistance is largely nonspecific, that it increases with the age of the plant, and that it may be of considerably greater value in large commercial fields and geographic areas than would be indicated by small plot tests where there is a large amount of extraneous inoculum.

# RESISTANCE TO BARLEY YELLOW DWARF VIRUS IN *AVENA STERILIS*

by H. Jedlinski, C. M. Brown and H. C. Murphy

One hundred selections of *Avena sterilis* from the Mediterranean Region obtained from Dr. J. C. Craddock were tested for their reaction to two strains of barley yellow dwarf virus, Champaign -6 and Southern Illinois -1 at Urbana, Illinois in 1967. A general summary of the results is given in Table 2. The effect of the two strains of the virus on a number of yield components of certain more promising selections and one fully susceptible selection is presented in Table 3. The reaction among the selections ranged from full susceptibility to a high degree of tolerance. Evidence was obtained to indicate a differential response of certain selections to the two strains of the virus. It is suggested that *Avena sterilis* may represent a good source of divergent germ plasm for resistance to the barley yellow dwarf virus.

Apparent breakdown of resistance to crown rust as a result of the virus infection was also observed in some selections under field conditions.

Table 2. Field reaction of 100 *Avena sterilis* selections to the Southern Illinois-1 and Champaign-6 strains of barley yellow dwarf virus (BYDV) at Urbana, Illinois in 1967.

| Disease severity[a/] | C.I. or P.I. Number[b/] BYDV-Ch.-6 | BYDV-So. Ill.-1 |
|---|---|---|
| 0.5 | 4968 267989 287208 287217 287218 292556 295915 295919 296252 | 282741 282747 287217 292558 296240 296258 296261 |
| 1.0 | C.D.8263 220374 282732 282733 282737 282740 287212 287224 292550 292558 295911 295930 295934 296233 296237 296240 296245 296258 296261 | 5V.C. 267989 282731 282737 282739 282780 287207 287218 287223 287224 292550 295924 295933 296236 296237 296245 296262 |
| 1.5 | 2684 282746 282747 282777 282780 287210 287211 287214 287215 287216 287221 292555 295924 295927 296248 | 2684 220374 282740 282746 282749 282750 282778 287208 287211 287212 287214 287215 287221 287227 287228 292556 295915 295919 295930 |
| 2.0 | 5V.C. 1780 2049 2318 2321 282731 282735 282736 282741 282745 282778 287207 287209 287219 287222 287223 287227 287228 292551 292554 292560 295906 295935 296236 296251 | 4V.C. 2318 2321 4968 282734 282742 287226 292564 295905 295907 295927 295935 296248 296252 |
| 2.5 | 268215 282734 282742 282744 282749 282750 287226 295905 296243 296262 | 1780 2518 219574 282732 2923555 295912 |
| 3.0 | 4V.C. 6V.B. 219574 266831 282738 282739 282743 282748 282779 282781 287206 287213 287220 292564 295907 295912 295913 295936 295937 | 6V.B. C.D. 8263 266831 282736 282743 282779 282781 287206 287209 287210 295911 295933 295936 296233 296243 296251 |
| 3.5 | 2518 182487 295933 | 2049 268215 282733 282735 282738 282745 282748 282777 287213 287216 287219 292551 292554 292560 295906 295937 |
| 4.0 | | 182487 295913 282744 287220 287222 |

a/ Based on visual evaluation using the scale of 0 - fully tolerant to 4.0, intolerant.

b/ C.I. and P.I. refer to accession numbers of U. S. Department of Agriculture, ARS, CR.

Table 3. Effect of the Southern Illinois-1 and Champaign-6 strains of barley yellow dwarf virus (BYDV) on yield components of certain *Avena sterilis* selections at Urbana, Illinois in 1967

| C.I. or P.I. No.[a] | Disease severity[b] | | Percent reduction[c] | | | | | | | | | | Non-inoculated | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | BYDV strain | | | | | | | | | | | | | | |
| | Ch.-6 | So. Ill. -1 | Ch.-6 | | | | | So. Ill.-1 | | | | | | | | | |
| | | | Ht. (inches) | No. panicles | No. spikelets | Wt. (g) panicles | Wt. (g) Stems & leaves | Ht. (inches) | No. panicles | No. spikelets | Wt. (g) panicles | Wt. (g) Stems & leaves | Ht. (inches) | No. panicles | No. spikelets | Wt. (g) panicles | Wt. (g) Stems and leaves |
| 2684 | 1.5 | 1.5 | -4 | 11 | 15 | -21 | -60 | -19 | 33 | 3 | 37 | -81 | 25 | 18 | 153 | 6 | 8 |
| 4968* | 0.5 | 2.0 | 6 | 6 | 10 | 18 | -12 | 22 | 64 | 78 | 77 | 59 | 32 | 36 | 755 | 22 | 25 |
| 220374 | 1.0 | 1.5 | 16 | -45 | 28 | 23 | 24 | 3 | 29 | 50 | 27 | -57 | 32 | 17 | 582 | 15 | 14 |
| 267989 | 0.5 | 1.0 | 31 | -36 | 15 | -2 | -4 | 8 | 36 | 56 | 11 | -52 | 32 | 14 | 263 | 12 | 22 |
| 282733* | 1.0 | 3.5 | 4 | -13 | 23 | 11 | 2 | 23 | 80 | 83 | 82 | 73 | 22 | 20 | 124 | 4 | 8 |
| 282737 | 1.0 | 1.0 | 6 | 53 | 50 | 61 | 46 | 3 | 38 | 32 | 87 | -40 | 31 | 32 | 323 | 21 | 17 |
| 282739* | 3.0 | 1.0 | 34 | 58 | 76 | 88 | -54 | 17 | 6 | 23 | 59 | -92 | 35 | 36 | 269 | 23 | 4 |
| 282740 | 1.0 | 1.5 | 26 | 32 | 51 | 49 | 7 | 19 | 44 | 55 | -47 | 22 | 31 | 32 | 430 | 14 | 22 |
| 282741* | 2.0 | 0.5 | 25 | 61 | 77 | 67 | 85 | 13 | 35 | 28 | - 8 | 45 | 32 | 26 | 295 | 12 | 24 |
| 282747* | 1.5 | 0.5 | 24 | 73 | 82 | 87 | 49 | 5 | 38 | 42 | 73 | 42 | 37 | 48 | 380 | 29 | 37 |
| 282777* | 1.5 | 3.5 | 13 | 37 | 62 | 36 | 53 | 24 | 66 | 85 | 31 | 11 | 29 | 35 | 479 | 18 | 23 |
| 282780 | 1.5 | 1.0 | 3 | -25 | 36 | 31 | 33 | 10 | -50 | -10 | -19 | -48 | 29 | 9 | 100 | 5 | 4 |
| 287208 | 0.5 | 1.5 | 28 | 37 | 58 | 65 | 75 | 36 | 44 | 68 | 68 | 68 | 39 | 41 | 534 | 38 | 43 |
| 287210* | 1.5 | 3.0 | -4 | 0 | -24 | -15 | 10 | 30 | 57 | 43 | 22 | -75 | 27 | 14 | 106 | 5 | 6 |
| 287214 | 1.5 | 1.5 | 30 | 48 | 64 | 63 | 65 | 4 | 14 | 15 | -10 | -13 | 30 | 50 | 498 | 19 | 20 |
| 287215 | 1.5 | 1.5 | 18 | 22 | 39 | 43 | 18 | 4 | -16 | 8 | -13 | -44 | 28 | 27 | 336 | 13 | 11 |
| 287217 | 0.5 | 0.5 | 34 | 51 | 73 | 69 | 65 | 39 | 35 | 61 | 49 | 42 | 41 | 49 | 710 | 38 | 39 |
| 287218 | 0.5 | 1.0 | 5 | -38 | -16 | -13 | 28 | -21 | -38 | -32 | -71 | -39 | 22 | 13 | 162 | 5 | 18 |
| 287221 | 1.5 | 1.5 | 0 | 63 | 74 | 76 | 73 | 4 | 74 | 76 | 79 | 71 | 28 | 64 | 652 | 28 | 22 |
| 292550 | 1.0 | 1.0 | 22 | 63 | 62 | 76 | 73 | 24 | 61 | 64 | 63 | 57 | 37 | 59 | 1060 | 38 | 37 |

Table 3 continued.

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 292556 | 0.5 | 1.5 | 3 | 12 | 27 | 47 | 20 | 28 | 44 | 52 | 54 | 18 | 29 | 34 | 399 | 19 | 16 |
| 292558 | 1.0 | 0.5 | -3 | -11 | 12 | 9 | 7 | 13 | 10 | 4 | -8 | 33 | 32 | 31 | 323 | 15 | 22 |
| 295915 | 0.5 | 1.5 | 21 | 3 | 30 | 42 | 37 | 19 | 49 | 64 | 68 | 60 | 38 | 37 | 597 | 37 | 36 |
| 295919 | 0.5 | 1.5 | 7 | -8 | 4 | 15 | -20 | 18 | 29 | 41 | 44 | -4 | 28 | 34 | 390 | 20 | 13 |
| 295924 | 1.5 | 1.0 | -4 | 52 | 55 | 47 | 65 | -4 | 3 | 12 | -11 | -11 | 26 | 31 | 267 | 12 | 15 |
| 295930 | 1.0 | 1.5 | 7 | 10 | 38 | 42 | 39 | 23 | 19 | 47 | 47 | 41 | 31 | 32 | 392 | 22 | 20 |
| 295934 | 1.0 | 1.0 | -14 | -65 | 65 | -59 | -57 | -17 | -79 | -80 | -86 | -84 | 25 | 7 | 62 | 3 | 3 |
| 296233* | 1.0 | 3.0 | -4 | -10 | 34 | 36 | 44 | 37 | 78 | 91 | 88 | 59 | 27 | 27 | 295 | 15 | 22 |
| 296237 | 1.0 | 1.0 | 13 | 23 | 43 | 26 | 65 | 3 | 18 | 36 | 20 | 10 | 31 | 22 | 211 | 9 | 11 |
| 296240 | 1.0 | 0.5 | -25 | -53 | -58 | -61 | -62 | 38 | -78 | -87 | -86 | -90 | 18 | 7 | 44 | 2 | 2 |
| 296245 | 1.0 | 1.0 | 0 | -37 | -10 | -23 | 5 | 3 | -54 | -43 | -55 | -21 | 31 | 12 | 123 | 5 | 9 |
| 296252 | 0.5 | 2.0 | -10 | 37 | 53 | 45 | 44 | 15 | 37 | 40 | 44 | 43 | 26 | 46 | 494 | 19 | 18 |
| 296261 | 1.0 | 0.5 | 10 | -4 | 19 | 25 | 28 | 20 | -39 | -27 | -29 | -20 | 30 | 25 | 235 | 13 | 12 |
| 182487 | 3.5 | 4.0 | 70 | 100 | 100 | 100 | 83 | 80 | 100 | 100 | 100 | 90 | 30 | 20 | 431 | 12 | 72 |

a/ C.I. and P.I. refer to accession numbers of U. S. Department of Agriculture, ARS, CR.

b/ Based on visual evaluation using the scale of 0 - fully tolerant to 4.0, intolerant.

c/ Based on hill plantings of six plants per hill; inoculated with the two BYDV strains and non-inoculated in separate blocks. The plants were started from seed in $2\frac{1}{4}$ inch peat pots containing composted soil. In a one-leaf stage, the plants were inoculated with the BYDV strains using Rhopalosiphum padi as a vector under controlled greenhouse conditions. After inoculation feeding of approximately 3 days, the aphids were eliminated and the plants were transplanted into the field.

* Selection with differential response to the virus strains.

\- Indicates percent increase.

# SOME EFFECTS OF BARLEY YELLOW DWARF VIRUS ON THE PHYSIOLOGY OF CLINTLAND 60 OATS

by Stanley G. Jensen

In a series of studies with Clintland 60 oats, photosynthesis, respiration, fresh weight, dry weight, chlorophyll, and area were determined on the second and third leaves of healthy and barley yellow dwarf virus (BYDV) infected plants. Seedlings were infested with viruliferous aphids ten days after planting and the physiological measurements were made on the second leaf from about the 5th to the 15th day after inoculation and on the third leaf from about the 14th to the 24th day after inoculation. In BYDV infected seedlings, there was a sharp increase in the dry weight per unit fresh weight, a decrease in chlorophyll content, a decrease in photosynthetic rate, and a decrease in area per unit fresh weight. Respiration was above normal based on fresh weight or area but below normal based on dry weight. In Table 4 the average percent change induced by BYDV infection is shown not only for the highly susceptible Clintland 60 oats but also for a susceptible barley, a susceptible wheat, and a group of 10 hard red spring wheats which cover the range of susceptibility. Special attention is drawn to photosynthesis per unit chlorophyll which is frequently above normal in the upper leaves of the plant. This means that a chlorotic plant may recover its productive capacity through a higher photosynthetic efficiency and therefore chlorosis is not an accurate measure of the damage to a plant.

Table 4. The average effect of BYDV on the physiology of the various leaves of oats, barley, and wheat.

| | C/F Wt | %D Wt | P/F Wt | P/C | R/F Wt |
|---|---|---|---|---|---|
| Clintland 60 Oats | | | | | |
| Leaf 2 | 62* | 155 | 35 | 52 | 118 |
| Leaf 3 | 52 | 141 | 64 | 119 | 115 |
| Black Hulless Barley | | | | | |
| Leaf 2 | 75 | 150 | 58 | 74 | 142 |
| Conley X ND 81 Wheat | | | | | |
| Leaf 2 | 59 | 154 | 37 | 59 | 134 |
| Leaf 3 | 54 | 138 | 34 | 58 | 150 |
| Ten Varieties Wheat | | | | | |
| Leaf 2 | 83 | 147 | 65 | 78 | 148 |
| Leaf 4 | 73 | 113 | 75 | 105 | 93 |
| Flag leaf | 78 | 99 | 106 | 143 | 104 |

*(BYDV INFECTED/HEALTHY) x 100
C = chlorophyll in mg.
F Wt = fresh weight in gm
D Wt = dry weight in gm
P = photosynthesis in ul $CO_2$/min
R = respiration in ul $CO_2$/min

All determinations made during the period of 3 to 25 days after inoculation were averaged together. This minimizes the extreme effects seen in the late stages of infection.

## THE OCCURRENCE OF VIRUS-LIKE PARTICLES IN BARLEY YELLOW DWARF VIRUS INFECTED PLANT CELLS

by Stanley G. Jensen

Electron microscopy of barley yellow dwarf virus (BYDV) infected cereals has revealed that certain cells in the phloem area of a vascular bundle are filled with particles which are interpreted to be BYDV particles. These particles differ from ribosomes which are roughly the same size, shape, and composition in several ways. First, ribosomes normally occur in small clumps or polyribosomes scattered throughout the protoplasm, while the virus particles frequently occur at very high concentrations sometimes in a compact mass occupying large areas of the cell. Secondly, ribosomes appear as dense bodies with indistinct and irregular margins while the BYDV particles are discrete dense spheres frequently showing a hollow center. Thirdly, ribosomes never appear in crystalline arrays while crystals of the virus particles have been found. Ribosomes occur in all cells and are frequently in association with endoplasmic reticulum. These cells also show a normal array of other cell organelles such as mitochondria, dictyosomes, etc. while the cells containing BYDV masses do not have any distinguishable cell organelles. BYDV particles can also be easily distinguished from phytoferritin and slime fibers which may occur in cells of this type. Young leaves, old leaves, and roots of BYDV infected CI 666 barley have been examined and found to contain cells with these virus masses in them. Normally, only one or two cells in a vascular bundle are found with virus particles. Since the internal organization of the cell is completely disrupted by these virus masses, a positive identification of the cell type has not been possible.

## *AVENA STERILIS*, A SOURCE OF HIGH PROTEIN AND DISEASE RESISTANCE, AND THE INHERITANCE OF PROTEIN CONTENT

by H. C. Murphy and R. T. Smith

Apparently new and valuable sources of various levels of resistance to crown rust, stem rust, barley yellow dwarf virus, soilborne oat mosaic, smut, mildew, and probably other oat diseases have been found among collections of the hexaploid *Avena sterilis* from Israel and other Mediterranean countries. Unusually high protein content of groats and high groat weight have been found among certain lines of *A. sterilis* and in the new tetraploid species *A. magna*. Various limited combinations of disease resistance, high protein content, and high groat weight have been observed, but in general, these characters will need to be combined through hybridization.

A relatively high protein line of *A. sterilis* (6-76) was crossed with Garland, Portal, Diana, C.I. 7920, and Florida 500. Spaced $F_2$ populations were grown at Aberdeen, Idaho, in 1967. Populations of certain crosses were grown also at Madison, Wisconsin, and in the growth chamber at Beltsville, Maryland. Notes on groat protein content, groat weight, spikelet characteristics, etc., were obtained in the $F_1$ and $F_2$ generations. Groat protein content of the $F_1$s and the means of the $F_2$ populations were generally intermediate between the respective parents. There was a strong expression of heterosis for groat weight in the $F_1$s and transgressive segregation for groat protein content and groat weight in the $F_2$ generations. High groat protein and high groat weight tended to be associated with the shattering character of *A. sterilis*. The $F_2$ distributions for groat protein resembled a normal distribution with some evidence of skewness toward the *A. sterilis* parent. The distributions indicate that the majority of genes for high protein are possessed by the *A. sterilis* parents. It appears that oat groat protein content is controlled by multiple genes in the crosses studied to date.

A statistical analysis of the $F_2$ protein inheritance data is now underway. $F_3$ populations will be grown and studied.

Environment is a major factor in oat groat protein content. It appears evident that protein content is heritable and probably on a multigenic-environmental basis. There appears to be a significant negative correlation between high protein content and high yield, but the correlation is neither absolute nor unduly high. Although it will be difficult to achieve, the outlook for utilizing genes from A. sterilis for improving the protein content and protein yield of commercial oat varieties appears bright.

## OBSERVATIONS ON BYDV IN SPRING OATS AT COLUMBIA, MISSOURI IN 1966 AND 1967

by J. M. Poehlman

Heavy natural BYDV epiphytotics were present in the spring oats nurseries at Columbia, Missouri in 1966 and again in 1967. These were the first major appearances of BYDV in oats in Missouri since 1959. In 1966, two visual evaluations of the severity of BYDV were made, (a) percent leaf discoloration at heading time, and (b) percent damage from dwarfing, tiller reduction, panicle size reduction and blasting prior to harvest. The correlation coefficient for the two evaluations made approximately one month apart was .625. Higher correlation coefficients were obtained for percent discoloration and yield than for percent damage and yield. Estimates of discoloration ranged from 9 to 59% for 264 entries with a mean of 28.7%. Yields ranged from 42 to 104 bushels with a mean of 75.7 bushels.

In 1967, estimates of discoloration of 277 entries ranged from 5 to 38% with a mean of 17.5% and yields ranged from 46 to 115 bushels with a mean of 77.4 bushels.

Over the two years, strains with high yields tended to be low in BYDV and strains with low yield had high BYDV readings. This relationship appears good enough that considerable progress for BYDV resistance appears possible by selection of the high yielding strains under BYDV epiphytotics with the intensity of those at Columbia in 1966 and 1967.

## CHROMOSOME ASSOCIATIONS IN TRIPLOID, TETRAPLOID, AND PENTAPLOID HYBRIDS OF AVENA MAGNA (2n = 28)

by

K. Sadanaga, F. J. Zillinsky, H. C. Murphy and R. T. Smith

There was no cross-incompatibility between A. magna and the diploid species, A. strigosa and A. wiestii, the tetraploid species, A. abyssinica, and the hexaploid species, A. sativa and A. sterilis. All hybrids, however, were sterile. Partial homology of the A genome of the diploid species with one genome in A. magna was indicated by an average per cell of 12.73 I, 3.04 II, 0.68 III, and 0.04 IV in the hybrid with A. wiestii and 12.57 I, 3.26 II, 0.54 III, and 0.07 IV in the hybrid with A. strigosa. In the tetraploid hybrid, an average per cell of 13.75 I, 3.93 II, 1.64 III, 0.21 IV, and 0.11 higher associations (up to association of 8 chromosomes) suggest that the two species have one genome partially common. It is also possible that the two species have two genomes partially homologous. An average of 9 bivalents (including multivalents) was observed in the hybrid between A. magna x Egdolon, 11 bivalents in the hybrids between Eta x A. magna, Carolee x A. magna, and A. sterilis x A. magna, and 12 bivalents in a 34-chromosome hybrid of *A. sterilis* x *A. magna*. The frequencies and kinds of chromosome associations observed suggest that *A. magna* may have two genomes partially in common with two genomes in the hexaploid species or two genomes in *A. magna* partially in common with the three genomes in the hexaploids.

## WEED CONTROL IN OAT NURSERIES

by M. M. Schreiber, F. L. Patterson, and J. F. Schafer

We have conducted weed control experiments on spring grains for six years to determine materials and rates which would adequately control grasses and broad-leaf weeds in oat nurseries. In 1967 we measured the influence on yield of five spring oat varieties, two spring wheat varieties, and Atlas barley of five pre-emergence treatments and four post-emergence treatments in comparison with the unweeded control.

Treatments were whole plots and varieties were sub-plots. Sub-plots consisted of four rows, 1 foot apart and 6 feet long with the center two rows harvested for yield.

Table 5. Analysis of variance.

| | df | M.S. |
|---|---|---|
| Replications | 3 | 4363 |
| Treatment | 9 | 5153 NS |
| Error (a) | 27 | 5040 |
| Varieties | 7 | 526092 ** |
| T x V | 63 | 1172 NS |
| Error (b) | 210 | 1942 |

Table 6. Variety means

| Variety | bu/A |
|---|---|
| Clintford oats | 112.5 |
| Tyler oats | 102.9 |
| Tippecanoe oats | 107.1 |
| Clintland 64 oats | 104.7 |
| Jaycee oats | 111.2 |
| Justin wheat | 32.1 |
| M1 wheat | 14.8 |
| Atlas barley | 68.8 |

Table 7. Treatments (pre-emergence except where noted)

| Treatment | Rate/ acre | Yield gm | Control *** Grasses | Broad-leaf weeds |
|---|---|---|---|---|
| 1. Check (unweeded) | | 345 | No | No |
| 2. D986 | 10 lb | 349 | No | No |
| 3. D986 | 15 lb | 358 | No | No |
| 4. D986 | 20 lb | 385 | No | No |
| 5. *Chloroflurazole | 12 oz | 350 | No | No |
| 6. * " | 18 oz | 343 | No | No |
| 7. * " | 10 oz | 355 | No | No |
| 8. * " | 15 oz | 341 | No | No |
| 9. Ramrod | 2 lb) | | | |
| and Dicamba** | $\frac{1}{4}$ lb) | 363 | Yes | Yes |
| 10. Ramrod | 3 lb) | | | |
| and Dicamba | $\frac{1}{4}$ lb) | 355 | Yes | Yes |

*Pre-emergence was sprayed on surface after seeding but before emergence.
Post-emergence was sprayed about two weeks before heading.
**Dicamba sold as Banvel D.
***Principal grasses controlled:
Foxtails
Barnyard grass
Principal broad-leaf weeds controlled:
Lambs quarters
Pigweed
Smartweed
Flower of the hour

Treatments 9 and 10 gave excellent control of grasses and broad-leaf weeds for three years with no injury to any of the small grains, measured in 1967. The level of weeds in the check plot probably decreased yield but little in a very dry year but was at a nuisance level for nursery work. Dicamba was at the top of the tolerance level. Ramrod is at levels used on corn.

Ramrod is not cleared for commercial oats but residue samples were submitted by us this year. There are no restrictions on non-food crops.

## SECOND REVIEW OF OAT IMPROVEMENT IN RIO GRANDE DO SUL, BRAZIL
by H. L. Shands

A change of crown rust races, especially noticeable in 1967, has necessitated a change of oat-variety usage in Rio Grande do Sul. Some Garland and Dodge plantings were plowed up after being attacked by rust in 1967. This was not a surprise since these varieties were infected in 1965. But what was unexpected was infection in Portal, C.I. 8072 and Diana. Of these three, only Diana (C.I. 7921) may be useful since it appears to combine some virus and crown rust tolerances. These conditions suggest that native varieties, such as Amisade IAS2, Pelotas 129, Yellow Common, Quaker 604, Magnif 29, Bage, IAS5, and Charrua, will continue to be most suitable for production, though each has shortcomings.

The young oat breeding program is considered sound with adequate crown rust resistance on the horizon and moderate tolerance for "red leaf" (barley yellow dwarf) available. These two valuable attributes hopefully are being combined. The best sources of crown rust resistance are Ascencao, A. sterilis, and native varieties assembled in the Quaker collection.

I.A.S.2 x Magnif 29 had 12 selections harvested for further evaluation. Six selections from X849-1, originally from a 16-parent Wisconsin multiple cross offered promise enough to warrant further testing. Wisconsin selection X1012-1, though tall and somewhat weak in straw, offered some hope of usefulness in Rio Grande do Sul. Parents entering X1012-1 are Garland, Rodney, and C.I. 4795-3.

New $F_2$ hybrid material, and advanced selections from Wisconsin, will be available in 1968. New breeding material is becoming available from Rio Grande do Sul sources. States other than Wisconsin, and the U.S.D.A., are contributing oat selections for evaluation.

## PROGENY OF OCTAPLOID AND HEXAPLOID *AVENA* CROSSES
by H. L. Shands, R. A. Forsberg and I. Nishiyama

In 1961 Wisconsin workers received some stabilized octaploid *Avena* progenies of decaploid origin from I. Nishiyama, then located in Japan. Crosses were made with 5 common oat parents. Two additional "common oat" parents having limited amphiploid ancestry were also crossed with octaploids. Progenies of the seven crosses were carried through the $F_5$ generation in 1966. In 1967 only lines of X1381 were studied as advanced selections in the $F_6$ generation. The parents of X1381 are Octaploid 60-5003-16, from the amphiploid (amphidiploid) of *A. abyssinica* x *A. sativa* var. Aurora and Wis. X666-3.

Sterility encountered in the $F_1$ generation enhanced outcrossing as evidenced by plants resembling non-parental types as to hull color, lemma hairiness, etc. in the $F_2$ and subsequent generations. Cytological examinations were made in the $F_4$ and $F_5$. P.M.C.s revealed 21 pairs often, but also other chromosome numbers such as 43, 53, 59, etc. An X1381-1 selection was tested preliminarily for yield in 1966 and again in 1967. Kernels were enlarged over those of the X666-3 parent and better filled than those of the crown rust susceptible and unadapted octaploid. Yields were below the average of named varieties in each year except for having greater yield than Garland in 1967, a season when Garland was having an off-year. These studies suggest that octaploids of Nishiyama could be utilized successfully as a breeding stock.

## REPORT ON THE CROWN RUST RACE SITUATION
by M. D. Simons

No new races of special significance have been discovered in the United States in the last two years. Races of race group 290, which parasitize Landhafer but not Trispernia, have continued to increase in prevalence and now make up about three-fourths of all isolates. Race 264, which in general parasitizes all sources of seedling resistance, has not increased appreciably in recent years. C.I. 8081 continues to show good seedling resistance to race 264, and Wahl #2 continues resistant to all races except 264.

## INHERITANCE OF CROWN RUST RESISTANCE OF NEW STRAINS OF *A. STERILIS*
by M. D. Simons

Preliminary studies of the inheritance of the cool temperature seedling resistance of five new strains of *A. sterilis* to crown rust race 264 suggest that the two of the strains showing the highest resistance (6-105-5-15 and

5-112-1-15) carry the same, single gene for resistance. Two others (6-82-5-4 and 6-90-3-5) appear to carry distinct alleles of another gene, and one (6-257-1-22) may carry two genes, both independent of all other genes found in the study. Dominance and degree of resistance of these genes appears to vary with relatively small environmental differences.

## THE USE OF EMS TO MODIFY THE RESPONSE OF OATS TO CROWN RUST
by M. D. Simons

In a study that was basically designed to test the effect of chemical mutagens on quantitatively inherited tolerance to crown rust, seed of 'Clintland 60' oats was treated with ethyl methanesulfonate. Seed was increased and undesirable types were eliminated from $M_1$ through $M_4$, and a crown rust tolerance test with non-rusted checks was run in $M_5$. Preliminary results suggest that few if any lines will be as good or better than 'Clintland 60', and that many will be significantly less tolerant. A few field-resistant plants were observed in the $M_5$, and progeny of these proved seedling-resistant to crown rust race 264 and other races.

## TOXIGENICITY AND HOST RANGE STUDIES ON PSEUDOMONAS CORONAFACIENS
by S. L. Sinden and R. D. Durbin

The oat halo-blight toxin produced by *Pseudomonas coronafaciens* and the wildfire toxin from *P. tabaci* are apparently identical. In synthetic media *P. coronafaciens* produces high yields of a ninhydrin-reactive toxin which during purification and chromatography, is indistinguishable from the wildfire toxin. When the two toxins are co-chromatographed on paper or on an amino acid analyzer, only one chlorosis-inducing compound can be found. Both toxins are heat and alkali labile, and the ninhydrin-reactive inactivation products are likewise identical. The two toxins also produce identical chlorotic lesions on oats, tobacco, tomato and beans.

Three of ten isolates of *P. coronafaciens* produced large chlorotic lesions on tobacco when droplets of washed inoculum were applied to watersoaked areas on a tobacco leaf. Only one of fifteen isolates of *P. tabaci* produced significant lesions on oat. These results suggest that *P. coronafaciens* and *P. tabaci* may be very closely related or even host adapted strains of the same bacterial species.

When the oat varieties Clinton 59, Milford, Cc4146, Hancock, Saia and Andrew were spray inoculated with the most virulent strain of *P. coronafaciens*, all the varieties except Saia and Cc4146 were equally susceptible, as judged by both lesion number and size.

## RACES OF OAT STEM RUST IN 1967
by Donald M. Stewart and Paul G. Rothman

Race 6AF with virulence for oat varieties carrying genes A, B, D, E, and F for stem rust resistance continued its upward swing as the most prevalent race again in 1967 (72%) (Table 8). This race attacks essentially all commercial oat varieties currently grown and appears to be an aggressive race which surpassed race 6F in prevalence in 1965.

Another trend in the race population is the decrease in prevalence of race 6F from 70% in 1963 to 23% in 1967. Although a differential carrying host gene F was first used in the race survey in the United States in 1962, evidence based on re-identification of stored cultures of race 6 indicated virulence for gene F was associated with this race as early as 1957.

The virulent race 6AFH first identified near barberry in Pennsylvania in 1965 and found six times in 1966 from Iowa, Minnesota, Pennsylvania, and Texas, was not found in 1967. However, the virulence equivalent of race 6AFH still persists in the rust pathogen population when or if the pathogenic capabilities of race 6AH are combined with 6AF. In 1967, race 6 AH comprised 3% of the total isolates identified.

Although the prevalence and wide distribution of races 6F and 6 AF have nullified the effectiveness of gene F in breeding programs, gene H is effective against these two races.

Table 8. Physiologic races of *Puccinia graminis* var. *avenae* identified from oats and grass collections in the United States in 1965, 1966 and 1967.

| | Year and percentage of isolates | | |
|---|---|---|---|
| Race | 1965 | 1966 | 1967 |
| 6AF | 40 | 58 | 72 |
| 6F | 37 | 17 | 23 |
| 6A | 8 | 3 | 3 (6AH) |
| 13A | 2 | 2 | 1 (13AH) |
| 13AF | Trace | 2 | 0 |
| 6AFH | 1 | 3 | 0 |
| 2 (with 5) | 3 | 9 | Trace 2 (iso. 2H) |
| 7A, 7AF | 3 | Trace | 0 |
| Other | 6 | 6 | 1 |

## SOURCES OF RESISTANCE TO OAT CROWN RUST IN *AVENA STERILIS* POPULATIONS IN ISRAEL[1]/

by I. Wahl and A. Dinoor

*Avena sterilis* L., the presumed ancestor of cultivated oats, is very common and extremely variable in Israel. Populations of this species constitute a very heterogenic reservoir of resistance sources to *Puccinia coronata* f. sp. *avenae*. Even small stands comprise in some regions a rich pool of genes affording protection from this parasite.

A similar heterogeneity was revealed in the race populations of the crown rust fungus. So far, about 100 races of *P. coronata avenae* were identified, with the race group 263-267-276, and race 202 being most prevalent. The multiplicity of crown rust races is attributed to the common occurrence of the alternate host *Rhamnus palaestince* Boiss. Stands of *A. sterilis* near the alternate host seem to be particularly abundant in plants resistant to crown rust, such plants also appear to be protected against a wider array of races. Efficacy of

1/ Research supported by U.S.D.A., P.L. 480, FG-1s-138.

various methods of selection for crown rust resistance from populations of A. sterilis was compared. Preliminary data indicate that plants selected on the basis of their resistant reaction of P. coronata avenae in natural habitats, yield a high percentage of resistant progenies. It is also recommended that A. sterilis be selected in these locations where seed carrying seedling resistance to crown rust was collected in previous years.

It was demonstrated that the geographic distribution of resistance to crown rust in A. sterilis falls into definite patterns. Resistance to crown rust, although scattered over wide areas, is more concentrated in special regions.

## GRAIN QUALITY FACTORS AND RELATED PLANT CHARACTERS IN CERTAIN OAT CROSSES

by D. M. Wesenberg

A study was conducted of grain quality components and related plant characters in $F_1$ through $F_5$ populations of certain oat crosses. Quality components were defined as bushel weight, plump kernel percentage (percent by weight over a $5\frac{1}{2}/64$ x 3/4 inch screen), kernel and caryopsis weight, and caryopsis percentage, with the major emphasis placed on caryopsis percentage. Randomly selected primary kernels were used to evaluate caryopsis percentage. The mean caryopsis percentage of $F_1$ and $BCF_1$ closely approximated the mid-parent expectations and the data suggested that several factors influence caryopsis percentage and that the effects are additive without dominance effects. Forty-six $BCF_1$ plants, five hundred ninety-five $F_2$ plants, and three hundred eighty-six lines in $F_3$ and $F_4$ were evaluated for caryopsis percentage. No transgressive segregation was found for the character with all segregates falling within the parental limits. Heritability estimates in the broad sense by variance components and by the standard unit method were generally high, often exceeding .90. No consistent significant relationship was found between caryopsis percentage and height, yield, or bushel weight. Significant negative correlations were found between caryopsis percentage and heading date, ripening date, and plump kernel percentage. Correlations between caryopsis percentage and plump kernel percentage were generally low, however, and not consistent during two years of the study.

# III. SPECIAL REPORTS

## THE 1967 OAT CROP

H. C. Murphy - USDA

A near record oat yield of 49.0 bushels per acre was obtained in the United States in 1967. It was second only to the record high yield of 50.2 bushels in 1965. This near record yield was produced on only 15,970,000 harvested acres, the smallest since 1879. The 1967 oat crop of 781,867,000 bushels was the smallest since 1934. Test weight of the 1967 crop was excellent.

Most of the 1967 oat crop was planted fairly well on time, although planting was delayed in the eastern portion of the North Central Region and in the North Atlantic States due to a wet, cold spring. Diseases were not a major limiting factor for maximum oat yields in 1967, although there were appreciable losses from barley yellow dwarf virus in certain areas, especially to winter oats, and crown rust caused some damage, especially in portions of Iowa, Nebraska, the Dakotas, and Minnesota.

The striking increase in U.S. oat yields and steady decline in oat acreage during the past 14 years is obvious in the data presented below. Ten of the highest oat yields ever recorded in the United States were obtained during this period. Oat yields and harvested acreages for the past 14 years have been as follows:

| Year | Bushels | All-time rank | Harvested acres (000) | |
|---|---|---|---|---|
| 1967 | 49.0 | 2 | 15,970 | Near record yield |
| 1966 | 44.9 | 5 | 17,861 | Some delayed seeding and heat damage |
| 1965 | 50.2 | 1 | 19,106 | Record yield, delayed spring seeding |
| 1964 | 43.1 | 8 | 20,419 | Delayed spring seeding |
| 1963 | 45.2 | 3 | 21,683 | Record yield, delayed seeding |
| 1962 | 45.0 | 4 | 22,675 | Record yield, delayed seeding |
| 1961 | 42.2 | 9 | 23,994 | Delayed spring seeding, winter killing |
| 1960 | 43.4 | 7 | 26,646 | Delayed spring seeding |
| 1959 | 37.6 | - | 28,368 | BYDV |
| 1958 | 44.5 | 6 | 31,834 | Record yield |
| 1957 | 37.5 | - | 34,646 | Crown rust |
| 1956 | 34.5 | - | 34,984 | Drought in Midwest |
| 1955 | 38.3 | 10 | 39,243 | Record yield |
| 1954 | 35.4 | - | 42,291 | Some rust damage |

A loss of about one bushel per day in yield for each day delay in spring seeding is an old axiom in oat production. Record and near record U.S. oat yields have been obtained during recent years when seedings have been delayed 10 days or more in the heavy producing spring oat areas. These unexpected high yields could be explained in part by unusually favorable late season weather, general freedom from major diseases, improved disease resistance, and possibly better adaptation of the new varieties now being grown.

## OXATHIINS AND OTHER CHEMICALS FOR CONTROL OF RUSTS AND SMUTS OF OATS

Eleanor Butler and Willard Crosier, Geneva, N. Y.

During 1966 and 1967 several oxathiins were compared with other chemicals as seed treatments of small grains. Three formulations, coded as Uniroyal D-735, F-849, and G-696 eliminated or reduced loose smuts of barley and wheat, and common bunt of wheat. Uniroyal F-461 or Plantvax was only slightly effective against loose smut and bunt but was very fungitoxic to the oat smut organisms (Table 9).

As a seed treatment duPont 1991, a benzimidazole derivative, materially reduced loose smut of barley and wheat. This formulation also reduced common bunt but less effectively than Dexon, Merck's TBZ (thiabendazole); Morton EP 279, PCNB, or the organic mercurials.

As shown in Table 10 duPont 1991 was excelled by only the oxathiins for the control of oat smuts. The benzimidazoles--Bayer 33172 and Merck TBZ--reduced the incidence of these smuts.

For experiments conducted in 1967 seed of the Anthony and States Pride varieties was inoculated with spores of *Ustilage avenae* and *U. kolleri* taken from the 1964, 1965, and 1966 crops. By overheating the moist inoculated seeds only those spores which lodged at the basal end of the groats remained viable and infectious. These seeds produced only 3.16 to 4.02 percent of smutted panicles as contrasted to 30 percent for seeds dried without overheating.

The chemical formulations were applied to the seed at two dosage rates as indicated in Table 9 or at only one rate as indicated in Table 10. The treated seed lots were held in 1-pint parafinned containers for three days prior to planting.

The data indicate that every non-mercurial was more fungitoxic than the non-volatile mercurial, Mistomatic MR, and several, including the oxathiins, were as effective as the volatile mercurial, Panogen 15. The dosage rates should be considered, however, before evaluating the several formulations in Table 9. Phytotoxicity, especially in the oxathiins and Chemagro 4497P may necessitate a revision of the dosage rates.

Control of oat smuts with a small group of formulations (Table 10) was attempted by soil as well as seed treatments. Since only 100 plants per formulation were grown in the treated soil experiment as compared to 4000 from treated oats the former were produced from heavily infested seeds. The seeds were planted in 6-inch pots and the stands were thinned to 10 seedlings per pot.

The formulations at rates shown in Table 10 were distributed in the soil about 3 weeks before panicles emerged. The rates for soil treatments expressed as pounds/acre supplied from 13 to 240 times the amounts of chemical that the treated seeds introduced into the soil. Seven days after soil treatment the pots were placed in the field under a canopy of heavily rusted foliage of Anthony oats.

On both a seed and soil treatment basis Uniroyal G-696 and Chemagro 4497P were very effective. The former material also reduced but did not eliminate rust sori. On a dosage basis the two Morton formulations would also be considered as promising systemic fungicides.

Table 9. Control of oat smuts by chemical seed treatments, 1967

| Chemical formulation | | Per cent smutted panicles | | | |
|---|---|---|---|---|---|
| | | Anthony | | State's Pride | |
| Name of other identification | Oz./bu. 1 R rate | 1/2 R | 1 R | 1/2 R | 1 R |
| Am. Hoechst 2874 | 3.0 | 0.12 | 0.00 | 0.22 | 0.20 |
| Chemagro 4497P | 2.0 | 0.08 | 0.06 | 0.16 | 0.15 |
| Merck 122A | 3.0 | 0.14 | 0.10 | 0.34 | 0.24 |
| Merck 124A | 3.0 | 0.32 | 0.18 | 0.30 | 0.16 |
| Merck TBZ | 2.0 | 0.84 | 0.30 | 0.14 | 0.12 |
| Mistomatic MR | 0.8 | 1.78 | 1.16 | 1.70 | 0.84 |
| Morton EP 279 | 1.0 | 0.18 | 0.06 | 0.38 | 0.20 |
| Morton EP 347 | 1.5 | 0.54 | 0.50 | 0.96 | 0.36 |
| Morton Panogen 15 | 0.8 | 0.14 | 0.10 | 0.50 | 0.16 |
| Olin thiourea p.t. | 2.0 | 0.08 | 0.00 | 0.58 | 0.34 |
| Uniroyal D-735 | 2.0 | 0.00 | 0.06 | 0.04 | 0.04 |
| Uniroyal F-461 | 2.0 | 0.04 | 0.04 | 0.00 | 0.00 |
| Check | 0.0 | 4.02 | 3.58 | 3.24 | 3.16 |

Table 10. Control of oat rusts and smuts by seed and soil treatments

| Chemical formulation: Name or other identification | Seed oz./bu. | Soil lbs./A. | Percent smut, treatment by: Seed | Soil | Rust* sori |
|---|---|---|---|---|---|
| Am. Hoechst 2844 | 3.0 | 50 | 0.3 | 31 | ++ |
| Bayer 33172 | 3.0 | 38 | 1.7 | 21 | ++ |
| Chemagro 4497 | 2.0 | 50 | 0.09 | 5 | ++ |
| Chevron PP 781 | 6.0 | 50 | 2.1 | 11 | ++ |
| duPont 1991 | 3.0 | 90 | 0.04 | 16 | ++ |
| Merck 147D | 2.0 | 40 | 0.3 | 17 | + |
| Morton EP 346 | 3.0 | 5 | 1.78 | 21 | + |
| Morton EP 352 | -- | 15 | -- | 5 | + |
| Uniroyal F-849 | 2.0 | 40 | 0.03 | 12 | + |
| Uniroyal G-696 | 2.0 | 40 | 0.00 | 0 | + |
| Check | 0.0 | 0 | 3.55 | 39 | ++ |

* The sori were mainly the uredinia of crown rust. A + sign indicated about 50 sori per square inch of leaf surface in 1 field, and a ++ sign in each of 2 fields.

## POPULATION PROVING POTENT IN GRAIN PRODUCTION

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

The population of the United States is increasing at a rate of well over four mouths per minute. Yet our rate of increase is slow compared with some other parts of the world. Thus major shifts in our food and feed crops are readily understood. Cereal agronomists are aware of what is taking place among their crops, but few in any segment of our population have many statistics at hand. Hence an attempt has been made to assemble acreage and production figures on our cereals, together with those on soybeans. Use was made of the United States Department of Agriculture reports "Annual Summary - Crop Production" for 1956 and 1957, comparing them with 1966 and 1967. The data assembled are included in Table 11 and Table 12 which include the figures on 7 cereal grains and soybeans. The latter for the sake of comparison. The figures on cereals presented reveal:

1. Total acreages of the cereals have dropped more than 9 percent.
2. Total yields have increased nearly 27 percent.
3. Average yields in pounds per acre have increased for every crop included.
4. Acreages have decreased for all cereals except wheat and rice.
5. The yields per acre have increased more in grain sorghum, corn and rice (in that order) than in any of the other cereals or in soybeans.
6. Barley ranks fourth in increased yield per acre.
7. Increases in wheat, rye and oats were the least spectacular. In general the increase in these 3 crops was close to 20 percent of that for grain sorghum but even so was, in general, about twice the increase in soybeans.

In any discussion of this nature soybeans should be mentioned. The expansion of soybeans has been tremendous. Agronomists are aware that soybeans have supplanted cereals, especially oats, on millions of acres in the North Central area, but the expansion of between 325 and 350 percent in the acreage sown to soybeans in the South is less well known. Thus data on soybeans have been included in Tables 11 and 12.

The figures presented show that the increase per acre in soybeans is about half that for wheat. Both thresh "clean". Soybeans have given the lowest increase in yield of any of the 8 crops included. This prompts the questions: Could the yields per acre of soybeans be prophetic? Will any further expansion of the acreage of soybeans result in a decline in the over-all average acre yield for the crop? Farmers of this country are realistic and when the culture of one crop proves less profitable than that of another they lose both interest and enthusiasm. Changes result. Another decade, at least, should give us the verdict. We await it with interest.

Table 13 presents the figures showing what has been taking place in oats in the different areas of the United States, in the two, 2-year periods. The acreages devoted to oats have declined in all areas. The steepest decline has been in the South, followed by that in the North Central area--still the most important in the United States. The decline in the latter area has been much greater in acres, percentagewise, in the southern than in the more northern states. The decline in North Dakota has been only some 5 percent. Minnesota now ranks first in oat production and Wisconsin has moved up also. The well known fact that "oats are a cool weather crop" is becoming evident now even in the United States. Corn and soybeans may drive oats out of the more hot and humid areas, but farther north "the going" for those two crops becomes really rugged.

In short, those four added mouths per minute are making crop competition "stern stuff".

Table 11. Differences in the acreages of the cereals and soybeans; 1956-1957 vs. 1966-1967.

| Crop | Average acres 1956-1957 (000 omitted) | Average acres 1966-1967 (000 omitted) | Difference (000 omit.) |
|---|---|---|---|
| Corn | 63,971 | 58,659 | 5,312* |
| Wheat | 46,761 | 54,436 | 7,675 |
| Grain Sorghum | 14,446 | 13,962 | 484* |
| Oats | 33,699 | 16,916 | 16,783* |
| Barley | 13,862 | 9,697 | 4,165* |
| Rice | 1,455 | 1,969 | 514 |
| Rye | 1,647 | 1,174 | 473* |
| All cereals | 175,841 | 156,813 | 19,028* |
| Soybeans | 20,739 | 38,144 | 17,375 |

*Declined.

Table 12. Changes in production (tons and pounds) of cereals and soybeans, 1956-1957 to 1966-1967.

| Crop | Production 1956-57 (Mean) Tons (000 omitted) | Production 1956-57 (Mean) Lbs. per A. | Production 1966-67 (Mean) Tons (000 omitted) | Production 1966-67 (Mean) Lbs. per A. | Differences Tons (000 omitted) | Differences Lbs. per A. |
|---|---|---|---|---|---|---|
| Corn | 85,690 | 2680 | 123,754 | 4214 | 38,064 | 1534 |
| Wheat | 29,420 | 1260 | 42,541 | 1563 | 13,121 | 303 |
| Grain Sorghum | 10,813 | 1433 | 20,729 | 2982 | 9,916 | 1549 |
| Oats | 19,530 | 1158 | 12,666 | 1502 | 6,864* | 344 |
| Barley | 9,833 | 1418 | 9,161 | 1891 | 672* | 473 |
| Rice | 23,098** | 3178 | 43,667** | 4436 | 20,569** | 1258 |
| Rye | 697 | 832 | 726 | 1240 | 29 | 408 |
| Soybeans | 13,939 | 1350 | 28,518 | 1497 | 14,579 | 147 |

* Decline
** Total Tons (000 not omitted)

Pounds per bushel: Wheat 60, Soybeans 60, Corn 56, Rye 56, Grain Sorghum 56, Barley 48, Rice 45, Oats 32

Table 13. Oat acreages and production in the different geographic regions of the United States in 1956-57 and 1966-67, and changes that have resulted.

| Region | States (No.) | Acreages (000 Omitted) 1956-1957 | Acreages (000 Omitted) 1966-1967 | Change (%) Decline | Production (Bus.) 1/ (000 Omitted) 1956-57 | Production (Bus.) 1/ (000 Omitted) 1966-1967 | Change (%) Decline |
|---|---|---|---|---|---|---|---|
| North East | 12 | 1,839 | 1,185 | 33.55 | 69,483 | 45,893 | 33.95 |
| North Central | 12 | 30,289 | 16,189 | 46.55 | 972,919 | 669,759 | 31.16 |
| Western | 11 | 2,229 | 1,359 | 39.02 | 84,242 | 56,377 | 33.08 |
| Southern | 13 | 9,500 | 3,208 | 66.23 | 138,787 | 47,757 | 65.59 |

1/ National average acre yields were 34.5 and 37.4 in 1956 and 1957 for a mean yield of 35.95 bushels. In 1966 and 1967 acre yields were 44.9 and 49.0 for a mean yield of 46.95 bushels or an acre increase of 30.6 percent for the two most recent years.

## INTERNATIONAL RUST NURSERIES

R. A. Kilpatrick, U.S.D.A.

The International Cereal Rust Nurseries (wheat, oats, and barley) are grown at many locations throughout the world. The objective of this cooperative program is to determine the reaction of cereal varieties or selections to various populations of leaf, stem, and stripe rusts throughout the world. In harmony with this objective, nurseries are furnished upon request to persons associated with agricultural research institutions and/or experiment stations. When disease data are not received from a location for two consecutive years, and no explanation is given, additional nurseries may be withheld from this location. Nursery reports will be sent each year to cooperators.

### Use of Nursery Entries for Breeding or other Purposes

Entries in the nurseries are generally early generation lines with rust resistance and are included to obtain their reaction to the world rust population.

Some varieties may be desirable for commercial increase or for use as parental lines. Entries used for breeding purposes should in all cases be credited properly and fully to the station which developed them. Anyone using an entry in these nurseries for commercial purposes is expected to obtain permission from and give credit to the institution or individual that developed the selection. I will help you in any way possible to obtain such clearance.

### Entries

The number of entries that a cooperator may submit is not fixed. Since there is a limit to the number of entries that can be handled effectively, cooperators are expected to exercise restraint in the number of entries submitted.

### Procedures for Sending Seed

Foreign cooperators are asked to provide 20-30 grams of clean, viable seed of each entry along with its complete pedigree and a distinctive selection number. In order to avoid delay in having an entry included in the nursery due to quarantine regulations the seeds should be shipped to arrive at Beltsville, Maryland no later than September 30. Normally, seeds from Canada and Mexico are not delayed by quarantines. The shipment should be addressed as follows:

Plant Inspection House
Auditor's Building
14th and Independence Ave., S.W.
Washington, D.C. 20025, U.S.A.
Attn.: R. A. Kilpatrick

Seeds of domestic origin and from Canada and Mexico are timed more closely to our schedule of nursery preparation and should be sent to me when requested. The request specifies the full amount of seed needed. The complete pedigree and distinctive selection numbers must be provided for each entry included in the nursery.

## PROGRESS TOWARD A WORLD PLANT GERM PLASM RECORD SYSTEM

C. F. Konzak (Pullman)

An FAO Technical Conference on Exploration, Utilization and Conservation of Plant Gene Resources was held in Rome September 18-26, 1967 in cooperation with the International Biological Program. At that meeting, a paper on information retrieval as related to plant collections authored by K. W. Finlay and C. F. Konzak was read by Finlay at the scientific sessions, and a proposal for the development of a world plant germ plasm record system coordinated by FAO was presented by Konzak.

The proposal received much favorable comment and the conference recommended the project to FAO. Members of the FAO-IAEA Working Group on International Standardization in Crop Research Data Recording who were present at this meeting, T. T. Chang, K. W. Finlay, A. F. Kelly, C. F. Konzak and C. F. Krull, as well as FAO Secretary G. Delhove and FAO-IAEA Secretary B. Sigurbjörnsson, met in an informal session with special guests, Dr. H. Lamberts, S.V.P. Netherlands representing EUCARPIA and Dr. S. W. Zagaja, Director of the U. N. Crop Research and Introduction Center at Izmir, Turkey. At this informal session progress made since the first Working Group meeting was reviewed, notable being the successful completion of experiments on a trial model information retrieval system and international cooperative field experiments utilizing uniform recording procedures.

The composition of the proposed plant resource record formats was reviewed and revisions were recommended. The principle of a crop "general" form to cover essential identification details common to all crops was approved, and the list of information for which space would be made available was revised. Also approved was the principle of a crop specific record form on which characteristics and classified responses of a particular crop would be recorded. It was emphasized that the first features recorded should be those of most usefulness to plant breeders, and a list was made of traits and responses for which scoring systems were to be developed as guides. Specific action on the development of guides was to be taken by A. F. Kelly in connection with programs of the Plant Breeders' Rights Convention Working Party meeting in Wageningen, February, 1968.

Standard growth stage codes with pictorial or diagrammatic guides are being developed (a Feekes scale adaption) for cereals cooperatively by Dr. S. Broekhuizen and J. C. Zadoks, The Netherlands Grain Center, T. T. Chang, IRRI, and J. Hanway, FAO/IAEA, Vienna.

Recommended standard information recording procedures and formats for the records are now in the process of final review. The recommended procedures are adapted to, but do not require the storage, retrieval and processing of information by computers.

Holders of a number of the major world collections of wheat and rice will be asked to participate in a world scale test included as a cooperative project under Section UM of the International Biological Program. The system will be used in plant exploration and adaptation projects of IBP and in programs coordinated by FAO and FAO-IAEA and in several national projects concerned with the practical application of the genetic resources information system. A project on the germ plasm record system has been included among the U. S. projects participating in the IBP. This project has been endorsed by the National Research Council.

The principal emphasis of the over-all program will be on the standardization of procedures with the aim toward universal intelligibility of recorded information. This effort is to encompass existing collections of germ plasm now maintained at stations over the world, as well as new germ plasm from plant explorations, from induced mutation research and from plant breeding projects.

In preparation for the planned all-out effort on germ plasm registration, U. S. workers could begin to standardize their records in at least three ways that should be compatible with their present work: accession number systems can be established, designations applied to varieties and selections could be made compatible for length (23 spaces) and complete pedigrees for accessions could be recorded according to a standardized method of illustrating plant pedigrees proposed by Purdy et al. to be submitted to Crop Science.

Further information on the program can be obtained by writing to Dr. C.F. Konzak, Coordinator, FAO-IAEA Working Group on International Standardization in Crop Research Data Recording, Washington State University, Pullman, Washington 99163, to Mr. G. Delhove, Seed Exchange Officer, Plant Production and Protection, FAO, Rome, Italy or to Dr. Björn Sigurbjörnsson, Head, Plant Breeding and Genetics Section, International Atomic Energy Agency, Vienna, Austria.

(Part of the research conducted on this project was supported by funds from the Washington State Department of Agriculture Hay and Grain Fund and the U. S. Atomic Energy Commission Contract AT-(45-1)-353 and conducted at Washington State University under projects 1568 and 4068).

## CODES FOR UNIFORM OAT NURSERIES

C. F. Konzak and K. J. Morrison,
Washington State University, Pullman
and
H. C. Murphy, U.S.D.A.

Computers are coming into regular use throughout the country for processing experimental data including U.S.D.A. regional nurseries conducted by cooperating state personnel. To avoid disorder in the identification codes applied to uniform oat nurseries established by the U.S.D.A., a list of code numbers and official names of established oat nurseries has been prepared. This list is given below:

| No. | Name |
|---|---|
| 01 | Uniform Early Oat Performance Nursery |
| 02 | Uniform Midseason Oat Performance Nursery |
| 03 | Uniform Northwestern States Oat Nursery |
| 04 | Uniform Southern Winter Oat Nursery |
| 05 | Uniform Central Winter Oat Nursery |
| 06 | Uniform Northern Winter Oat Nursery |
| 07 | Uniform Elite Hardy Oat Nursery |
| 08 | Uniform Winter Hardiness Oat Nursery |
| 09 | Uniform Oat Rust Nursery |
| 10 | International Oat Rust Nursery |
| 11 | Uniform Oat Smut Nursery |
| 12 | Uniform Oat Soilborne Mosaic Nursery |
| 13 | Uniform *Avena sterilis* Crown Rust Nursery |
| 14 | Uniform *Avena sterilis* Stem Rust Nursery |
| 15 | Uniform *Avena sterilis* Disease Nursery |
| 16 | Uniform Oat Protein Nursery |

We suggest further that the remaining numbers up to 30 be reserved for future uniform or regional U. S. nurseries; that State nurseries be allocated numbers 31 to 60, while the remaining numbers be used for nurseries which include a combination of the U.S.D.A. uniform nursery with a State nursery. The distinction is made in order that the entries of combination nurseries may be readily distinguished on processing the data. Future assignments of uniform nurseries should be coordinated through the U.S.D.A. office in Beltsville.

# THE LATE RUSTING CHARACTER OF RED RUSTPROOF OATS: NO. II

H. H. Luke and W. H. Chapman, U.S.D.A. and the
Florida Agricultural Experiment Station

Certain strains of Red Rustproof oats, under field conditions, exhibit signs of crown rust infection 12-16 days later than other types of oats. The nature of this late rusting phenomenon has been studied for several years (see the 1965 Oat Newsletter for details of objectives and approaches to this problem). Previous results show that experiments, concerning the late rusting phenomenon must be carried out under field conditions--moreover, the late rusting character is conditioned by a delicate balance between host physiology and environment (light and temperature).

Another objective of this study is to incorporate the late rusting character into a variety that matures earlier. The object here is to produce a rust escaping variety, thereby, eliminating the problem of breeding varieties resistant to new crown rust races that continually evolve. Two selections (developed in cooperation with Dr. D. T. Sechler of the North Florida Experiment Station) that appeared to carry the late rusting character were used in the 1966-67 Red Rustproof Nursery. One of these (Q 412) was selected from a cross between Red Rustproof-14 and Florad, and the other (Q 827) from a cross between Red Rustproof-14 and Indio. These 2 selections as well as 4 varieties (Red Rustproof-14, Burt-A, C.I. 3934, and Fulghum) were planted on November 20, 1966 and at monthly intervals through January 20, 1967. This material represents early, intermediate, and late maturing varieties of the Red Rustproof type. This nursery was grown at Gainesville and Quincy, Florida.

Due to the staggered planting dates, all entries were at various stages of development when (March and April) crown rust occurs naturally. Crown rust readings (percentage of plant coverage) were made on April 18 and 28 at Gainesville and on April 7, 12, 20, and 29 at Quincy.

Results (see Tables 14 & 15) again confirm the late rusting character of Red Rustproof-14. Moreover, Burt continues to be intermediate when compared with early and late rusting types. At Gainesville Q827 reacted more like Red Rustproof than did Q 412. This may have been caused by the "masking" of the late rusting character by the Florad type resistance--moreover, some of the plants in Q 412 were heading on 2/5/67. This selection matures earlier than Fulghum and is perhaps too early. Selection Q 827 exhibited a crown rust reaction somewhat similar to Red Rustproof during the early part of April but exhibited a higher percentage of infection at the last reading dates (4-29-67). Variable crown rust reactions were observed in selection Q 827. Some plants exhibited a reaction very similar to Red Rustproof, therefore, reselections will be made from this line.

Table 14. Percentage of crown rust infection at various stages of growth[a] at Gainesville, Florida.

| Test variety | Planting dates[b] | Dates of reading at various stages of growth[a]: April 18 | April 28 |
|---|---|---|---|
| Red Rustproof-14 | 11/20/66 | 0,FH | 0,FH |
| | 12/20/66 | 0,LB | T,EH |
| | 1/20/67 | 0,J | 0,EB |
| Fla.-65, Q412 | 11/20/66 | 0,FH | -,M |
| | 12/20/66 | 5,FH | 5,FH |
| | 1/20/67 | 0,FH | 10,FH |

Table 14. Continued

| Test variety | Planting dates[b] | Dates of reading at various stages of growth[a] April 18 | April 28 |
|---|---|---|---|
| Burt-A | 11/20/66 | 5,EH | 20,FH |
| | 12/20/66 | 10,LB | 50,FH |
| | 1/20/67 | 5,LB | 20,FH |
| Fla.-65, Q827 | 11/20/66 | 0,FH | T,FH |
| | 12/20/66 | 0,EH | T,EH |
| | 1/20/67 | 0,J | 5,EH |
| C.I. 3934 | 11/20/66 | 10,FH | 30,FH |
| | 12/20/66 | 10,EH | 30,FH |
| | 1/20/67 | 10,LB | 20,FH |
| Fulghum | 11/20/66 | 70,FH | -,M |
| | 12/20/66 | 70,FH | 90,FH |
| | 1/20/67 | 60,FH | 90,FH |

[a] Stages of growth: J, juvenile; EB, early boot; LB, late boot; EH, early head; FH, full head; M, mature.

[b] A severe freeze on 2-20-66 killed some of the entries planted on 10/20/66. Thus readings from this planting date were not made. Q412 was 50% killed, and Q827 was 25% killed.

Table 15. Percentage of crown rust infection[a] observed at Quincy, Florida.

| Test variety | Planting dates | Dates readings were made 4/7/66 | 4/12/66 | 4/20/66 | 4/29/66 |
|---|---|---|---|---|---|
| Red Rustproof-14 | 10/24/66 | 0 | 0 | T | 30 |
| | 11/23/66 | T | T | 20 | 70 |
| | 12/27/66 | 0 | T | T | 60 |
| | 1/24/67 | T | 5 | 20 | 70 |
| Fla-65, Q412 | 10/24/66 | T | T | 10 | 10 |
| | 11/23/66 | T | T | 5 | 10 |
| | 12/27/66 | 0 | T | T | 5 |
| | 1/24/67 | T | T | T | 20 |
| Burt-A | 10/24/66 | 30 | 60 | 80 | 100 |
| | 11/23/66 | 10 | 10 | 50 | 100 |
| | 12/27/66 | 10 | 10 | 60 | 100 |
| | 1/24/67 | 0 | 10 | 70 | 80 |
| Fla. 65, Q 827 | 10/24/66 | T | 10 | 40 | 70 |
| | 11/23/66 | T | 10 | 30 | 70 |
| | 12/27/66 | T | 5 | 50 | 90 |
| | 1/24/67 | T | T | 40 | 70 |
| C.I. 3934 | 10/24/66 | 40 | 70 | 90 | 100 |
| | 11/23/66 | 30 | 30 | 60 | 100 |
| | 12/27/66 | T | T | T | 100 |
| | 1/24/67 | 5 | 5 | 40 | 70 |
| Fulghum | 10/24/66 | 90 | 100 | 100 | 100 |
| | 11/23/66 | 70 | 70 | 90 | 100 |
| | 12/27/66 | 10 | 10 | 60 | 100 |
| | 1/24/67 | 20 | 70 | 90 | 100 |

[a] T, represents a percentage of infection of less than 5%.

# THE EFFECT OF CROWN RUST RACE 326 ON CURRENT LINES AND VARIETIES OF OATS

L. J. Michel, U.S.D.A., Ames

Race 326 has been the most prevalent race of crown rust since 1965, but since there have been no major outbreaks of crown rust during that period, little is known of the destructive potential of this race. Seedling tests and data from field observation nurseries indicate that most named varieties currently being grown and also probably most experimental lines in oat breeding programs are susceptible in terms of reaction type. However, little information on the actual destructive potential of this race in the field is available. It is quite possible that some of the varieties rated as susceptible in reaction type are actually much more tolerant than others.

To provide some information on this subject, the entries of the 1967 Iowa Oat Variety Trial, the 1967 Uniform Early Oat Performance Nursery, the 1967 Uniform Midseason Oat Performance Nursery, and a part of the 1967 Iowa Elite Oat Trial were planted in a hill plot test in eight replications at Ames. Rust spreader hills of the highly susceptible variety Richland were hypodermically inoculated with a pure culture of race 326. Infection developed rapidly and was uniform and heavy throughout the nursery.

Heading date data were taken on three replications, crown rust reaction on one replication and the yields of all replications were measured.

Table16 summarizes the data for 41 of the total of 100 lines that were tested. As would be expected, the lines showing resistant field reactions came out at the top of the array. Most of these are experimental lines that are being used in the Iowa multiline variety development program. The performance of the lines that were rated susceptible is of greater interest. These lines showed more variation than might have been expected, with some being obviously less tolerant of heavy infection than others. Some of these lines yielded as little as the old varieties Clinton and Richland, which are now regarded as extremely susceptible to crown rust damage.

Relative heading dates of these lines were of interest primarily because they showed little relationship between heading date and crown rust damage. The latest maturing line, Lodi, for example, fell near the middle of the range for yield, while the early Tippecanoe was near the bottom.

Table 16. Performance of selected strains of oats exposed to infection of crown rust race 326 at Ames, Iowa, in 1967.

| Variety or selection No. | C.I. No. | Nursery and No. | Yield (grams) | Crown rust reaction | Heading date--June |
|---|---|---|---|---|---|
| Iowa X421 I | | Elite 4 | 32.5 | 5 | 19 |
| Iowa X434-190-67 | | Elite 50 | 31.4 | 10 | 17 |
| Iowa X424-110-21 | | Elite 48 | 30.1 | 10 | 17 |
| Iowa X424 III | | Elite 6 | 29.4 | 10 | 18 |
| Iowa X475 | | Elite 9 | 29.4 | 60 | 19 |
| Portal | 8040 | Mid 24 | 29.3 | 40 | 20 |
| Iowa X470-362 | | Elite 43 | 29.3 | 10 | 19 |
| Iowa X423 | | Elite 24 | 28.8 | 5 | 19 |
| Iowa X475 II | | Elite 46 | 26.6 | 60 | 19 |
| Iowa X270 I | | Elite 3 | 26.0 | 20 | 20 |
| Kelsey | 8171 | Elite 63 | 22.1 | 60 | 21 |
| Holden | 7978 | Mid 22 | 21.6 | 40 | 21 |

Table 16. Continued

| Variety or Selection No. | C.I. No. | Nursery and No. | Yield (grams) | Crown rust reaction | Heading date-June |
|---|---|---|---|---|---|
| Garland | 7453 | Mid 21 | 20.5 | 60 | 19 |
| Mo. 04978 | | Early 12 | 20.4 | 40 | 15 |
| SD RRO II B-60-2-149 | 8178 | Mid 20 | 19.9 | 40 | 18 |
| Santee | 7454 | Variety 13 | 18.5 | 40 | 18 |
| Nodaway | 7272 | Early 9 | 17.9 | 40 | 16 |
| Wyndmere | 7552 | Variety 23 | 16.1 | 60 | 19 |
| Dawn | 8029 | Variety 22 | 15.8 | 40 | 15 |
| Lodi | 7561 | Mid 23 | 13.6 | 40 | 26 |
| Burnett | 6537 | Variety 11 | 13.1 | 40 | 16 |
| Bonkee | 7563 | Variety 2 | 12.9 | 60 | 16 |
| Orbit | 7811 | Mid 9 | 12.0 | 60 | 19 |
| Cherokee | 5444 | Variety 3 | 11.3 | 60 | 16 |
| Andrew | 4170 | Early 7 | 10.9 | 60 | 18 |
| Neal | 7440 | Variety 4 | 10.6 | 60 | 16 |
| Mo. 0-205 | 4988 | Early 8 | 9.6 | 60 | 17 |
| Pettis | 7805 | Early 10 | 9.5 | 60 | 16 |
| Columbia | 2820 | -- | 9.5 | 60 | 18 |
| O'Brien | 8174 | Variety 6 | 9.4 | 60 | 19 |
| Stormont | 8170 | Variety 24 | 8.9 | 60 | 19 |
| Taylor | 8269 | Variety 8 | 7.8 | 60 | 18 |
| Jaycee | 7971 | Mid 1 | 7.5 | 60 | 15 |
| Clintford | 7463 | Mid 12 | 6.9 | 60 | 18 |
| Clintland 64 | 7639 | Mid 14 | 6.8 | 60 | 18 |
| Gopher | 2027 | Mid 7 | 6.6 | 60 | 20 |
| Goodfield | 7266 | Elite 58 | 6.1 | 60 | 19 |
| Richland | 787 | Variety 1 | 5.8 | 60 | 17 |
| Clinton | 3971 | -- | 5.6 | 60 | 19 |
| Tippecanoe | 7680 | Variety 15 | 5.4 | 60 | 16 |
| Tyler | 7679 | Variety 14 | 4.6 | 60 | 19 |

LSD at .05: 2.7 grams
LSD at .01: 3.5 grams

## REGISTRATION OF ELITE OAT GERM PLASM

H. C. Murphy

The voluntary registration of field crop cultivars by the Crop Science Society of America was expanded in 1967 to include (1) lines released for use as parents of hybrids, and (2) elite germ plasm released for breeding purposes by public and private breeders.

Oat breeders are not yet involved in the development of hybrid oats will not be currently interested in the first category. The expanded registration system will, however, give them an opportunity to register elite oat germ plasm possessing at least one attribute which has distinct potential for use in oat improvement. In addition to possessing one characteristic which provides merit, the item must also possess distinctiveness.

Application for registration should be made concurrently with formal release. Registration of elite oat germ plasm is intended primarily for those released after January 1, 1960. However, the Oat Registration Subcommittee may recommend the registration of selected, valuable materials useful for breeding purposes released prior to this date. Application for oat registration should be made on a form provided by the Chairman of the Oat Registration Subcommittee and accompanied by a brief, descriptive article for publication in Crop Science. The Oat Registration Subcommittee will review the application and registration article and recommend whether the material should be registered.

The registration article must be concise and include the following:

a. Name or identification assigned at time of release.
b. Botanical name, including the author of the binomials.
c. Experimental number or designation used during development.
d. Names of agencies and organizations involved in the development and evaluation of the plant.
e. A brief description including distinguishing characteristics and breeding procedures.
f. Probable region of adaptation, generations of seed increase and area of seed production, where applicable, for cultivars.
g. The institution or organization that will maintain basic stocks of these materials.
h. Any limitation on the availability of parental lines or elite germ plasm.

Registration of elite oat germ plasm by publication of descriptive articles in Crop Science will provide a permanent record of their origin and pertinent characteristics. Registration should enhance preservation of superior oat germ plasm, foster greater utilization of released materials, and provide appropriate recognition for the responsible individuals and institutions or organizations. Details concerning the new registration plan are being published in a 1968 issue of Crop Science. Oat workers interested in registering elite oat germ plasm should contact a member of the Oat Registration Subcommittee.

The current Oat Registration Subcommittee consists of H. F. Harrison, H. L. Shands, and H. C. Murphy, chairman.

## METHOD FOR PREPARING AND SPACE PLANTING <u>AVENA STERILIS</u> AND OTHER OAT SPECIES

R. T. Smith and J. R. Scott, U.S.D.A., Beltsville

<u>Avena sterilis</u> and <u>A. barbata</u> are examples of oat species possessing pubescent hulls and heavy awns, which eliminate normal seed preparation and planting. Two methods of seed preparation were considered for space planting the <u>Avena</u> species.

The first method was to place the seed in tissue-type envelopes and to space-plant the entire envelope containing the seed. This method worked satisfactorily in the greenhouse but was not considered practical for field use, where moisture may be limited.

The second method involved using a wool string with the desired number of seeds attached to it at desired intervals. The seed was attached to the string by using strips of masking tape. The desired number of seed for each hill was spaced at 2-foot intervals on a 200-foot length of wool string. 200-foot lengths of the string were laid down on a 10-foot table in a zigzag pattern. Pegs were used at the ends of the bench to anchor each turn of the string. Two-foot intervals were marked on the table for spacing the seed on the string.

The seed was attached to the string with a 1/4 inch wide - 3 inch long strip of masking tape at 2-foot intervals. The 1/4 inch tape allowed exposure of the embryo end of the seed to soil moisture. The first and last two hills on the 200-foot string and every twentieth hill in between was used for a cultivated check variety. This prevented border effects and aided note taking and harvesting. The 200-foot length of wool string with seed attached was then rolled onto a 1-inch diameter, 1-foot long, wooden dowel for storage and transporting to the nursery. The seed was planted by unrolling the string into an open furrow.

Using the string method at Aberdeen, Idaho, in 1967, 5,000 hills of Avena sterilis and A. barbata were space-planted in about 4 hours. The time required to prepare the seed for the string method, compared with using envelopes, was increased by about one half. The string method has been used for space planting A. sterilis and $F_2$ material at intervals ranging from 1 inch to 2 feet. Wool string and masking tape were used because they disintegrate very soon after planting and do not interfere with cross-cultivation.

## THE BEHAVIOR OF THE MILDEW RESISTANT GENE OF AVENA HIRTULA IN CULTIVATED OAT BACKGROUND

Hugh Thomas and I. T. Jones
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A genotype of the wild diploid species Avena hirtula, originally collected in Spain and designated Cc 3678 (W.P.B.S. number), is completely resistant to all known races of powdery mildew in the U.K. The transfer of this gene into cultivated oats would be a significant contribution to the improvement of the oat crop since mildew is responsible for considerable losses in yield in the U.K.

Recent studies undertaken on the cytogenetic relationships of the diploid and hexaploid species have thrown some light on the feasibility of transferring the hirtula gene into cultivated varieties. From the progeny of the hybrid between the amphiploid (A. hirtula x A. sativa 8x) and A. sativa we have isolated genotypes with 43 chromosomes which combine the complete complement of sativa chromosomes and single chromosomes of A. hirtula. Manod, the recipient variety of A. sativa used in this investigation is susceptible to race 2 while the single chromosome addition line of ST 7 of A. hirtula shows some resistance to this particular race. The degree of resistance to Race 2 is greatly enhanced when the pair of hirtula ST 7 chromosomes are added to Manod. When tested for mildew reaction 30% of the leaf area of the genotype with a single hirtula ST 7 chromosome was covered with mildew compared with 12% when a pair of ST 7 was added. In the same test 80% of the leaf area of Manod was covered with mildew. The resistance of the addition line is more effective at the adult plant than at the seedling stage. The hirtula gene which controls the resistance of the diploid species is only partly expressed in the sativa background. Nevertheless it is desirable to introduce the degree of resistance attained by a double dose of the hirtula gene into the cultivated varieties.

Some chromosome pairing takes place between the hirtula chromosome and its equivalent chromosome in sativa, and it should thus be possible to isolate recombinants from the progeny of the single addition line. Large populations of selfed progenies from addition lines are being screened for mildew resistance at present. Once the segment of hirtula chromosome carrying the mildew gene is established in an euploid plant (2n = 42), conventional plant breeding techniques can be followed to utilize this new variation in oat breeding programmes.

The morphology of the addition lines of ST 7 does not indicate that the mildew resistant gene is linked to any undesirable factors of the diploid species.

## AVENA MAGNA, A POSSIBLE RELATIVE OF CULTIVATED OATS

F. J. Zillinsky, K. Sadanaga, H. C. Murphy and R. T. Smith

The recent discovery of a new tetraploid species of oats *Avena magna* Murphy and Terrell (Science Vol. 159 No. 3810, 1968) has provided another milestone in material and information required in establishing the evolutionary origin of cultivated oats. Seed of this species (CW 525) was collected in Western Morocco in 1964. It was incorrectly listed under *A. sterilis* because of its resemblance to this species. It was not until hybrids between *A. sativa* and CW 525 were observed to be sterile in 1966 that the new species was investigated more closely.

The natural range of adaptation of *A. magna* is probably quite limited since it had not been reported previously and it was observed in only one area during the Canada Wales Collection Expedition in the Mediterranean Region in 1964. Although existing in close association with at least two other *Avena* species (*A. sterilis* and *A. barbata*), and within 50 miles of at least 3 more (*A. longiglumis*, *A. claudа*, and *A. pilosa*), the species appear to be effectively isolated genetically, as indicated by the lack of naturally occurring intermediate forms and by the sterility observed among artificially produced hybrids.

The unusually high compatibility of *A. magna* with species in each of the three ploidy groups which possess the "$A_s$" genome (and *A. longiglumis*) suggests that the species carries the "$A_s$" genome or a modified "A". However, the sterility of hybrids between *A. magna* and species or forms possessing "$A_s$", "$A_sB$" or "$A_sA_s$" genomes, and also the lack of similarity in some important morphological characteristics between *A. magna* and the latter forms, indicate that this species either does not possess the "$A_s$" genome or that it has modified considerably during its evolution. On the other hand since *A. magna* resembles *A. sterilis* more closely than any of the known diploid and tetraploid species, and since it is highly compatible with the hexaploid species, perhaps one of its genomes more closely resembles either the C or D genome of cultivated oats than it does the A. genome.

Sampson, Rajhathy and Zohary have each suggested that the diploid species *A. ventricosa* may have contributed a genome to cultivated oats. This species is highly incompatible with species possessing either the "A" or "A B" genomes. *A. magna* may be sufficiently compatible to overcome this problem and to help establish evolutionary relationships. Unfortunately we have not yet attempted crosses between these two species.

# DETERMINATION OF THE CONTENT OF PURE KERNELS IN OATS BY USING A DEHULLING APPARATUS

Per Johan Persson, Skara, Sweden

Up to now determination of pure kernel content in oats has been performed by hand. This has taken much time and required experienced people. Hence, in the breeding work with oats, it has not been possible to carry out analyses of pure kernel content to the extent desired. The Swedish Seed Association in Skara has now tested a machine for hulling small oat samples.

The hulling is arranged so that kernels under high air pressure (4-5 kgs) are slung against the walls in a conial plate holder. Kernels and hulls are collected separately.

The results from this method have turned out satisfactory. Hulls and kernels have been separated well and the kernels have not been broken. However, some kernels have not been hulled, but the number is not too large for easy removing before weighing. Both hulls and kernels must be weighed for calculating the pure kernel content.

Differences in pure kernel content between hulling occasions, sample quantities

| Date | Quantity grams | Blenda pure kernels % | Condor difference from Blenda |
|---|---|---|---|
| | | Machine hulling | |
| 11/19 | 100 | 75.6 | -2.7 |
| 12/19 | 100 | 73.8 | -2.4 |
| 12/19 | 50 | 72.4 | -2.6 |
| | | Hand hulling | |
| | 400 kernels | 76.3 | -2.7 |

The pure kernel content for the variety Sun II was 74.7 and 74.9 resp. 74.8 and 75.0 when the sample of 50 grams was treated during 2 resp. 3 minutes.

A suitable quantity is 50 grams, which is treated during 3 minutes. Duplicates made have shown the reproductibility to be good.

The difference between duplicates in pure kernel content (50 gram samples)

| Differences | 0-0.2 | 0.3-0.4 | 0.5-0.6 | 0.7-0.8 | 0.9-1.0 | 1.1-1.5 | 1.6-2.0 |
|---|---|---|---|---|---|---|---|
| Number of sample | 24 | 20 | 12 | 11 | 4 | 5 | 3 |

In most cases the pure kernel content has been lower by machine-hulling than hand-hulling because of a certain amount of polishing of the kernels. However, the variety relationships have been rather constant compared with hand-hulling, The machine-hulling has given less variable results than the hand-hulling for the same variety from different plots harvested at the same locations.

| Plot No. | | Pure kernels % Hand-hulling | | Pure kernels % Machine-hulling | |
|---|---|---|---|---|---|
| Sun II | Condor | Sun II | Condor | Sun II | Condor |
| 6 | 10 | 74.1 | 73.6 | 75.2 | 72.9 |
| 15 | 20 | 75.6 | 72.7 | 73.9 | 73.5 |
| 25 | 30 | 72.9 | 72.1 | 73.8 | 73.3 |
| 35 | 41 | 73.4 | 72.8 | 74.0 | 73.7 |
| Mean Value | | 74.0 | 72.8 | 74.2 | 73.4 |
| Variation range | | 2.7 | 1.5 | 1.4 | 0.8 |
| Sun II - Condor diff. | | 1.2 | | 0.8 | |

It is important that the blower-pressure is kept constant. This hulling method means that larger samples can be analysed and in a much shorter time than by hand-hulling.

## PROTEIN CONTENT OF IRRIGATED SPRING OATS GROWN FOR WINTER PASTURE IN ARIZONA

A. D. Day, R. K. Thompson and W. F. McCaughey[1/]

The protein content of simulated pasture forage was determined for spring oats planted in the fall and clipped throughout the winter growing season at Mesa, Arizona.

Markton oats were planted in a moist seedbed on October 22, 1960 at the rate of 100 pounds of seed per acre. Elemental nitrogen was applied at the rate of 150 pounds per acre (50 pounds at planting time and an additional 25 pounds after each of the first four clippings). The first post-planting irrigation was applied prior to the first clipping to firm the soil. Subsequent irrigations were made after each clipping. Clippings were made two and one-half inches above the ground, at the onset of jointing, when the plants were 12 to 14 inches tall. Harvest dates were December 23, January 26, February 18, March 15, April 3, April 20 and May 8. Representative samples of forage were taken from each clipping and analyzed for total protein.[2/] Green and dry weights were secured for each clipping.

The total protein content of oat simulated pasture forage increased from 19.2% on December 23 to a high of 24.2% on February 18 and then decreased to a low of 14.2% on May 8 (Table 17). The average forage moisture content was 84% for the seven cuttings, with an average total yield from four replications of 3.3 tons per acre of oven-dry pasture forage containing 1418 pounds of total protein.

Table 17. Clipping dates, oven-dry forage, and total protein in simulated pasture forage from Markton oats planted in October and clipped at the onset of the jointing stage of growth throughout the winter growing season at Mesa, Arizona in 1960-61.

| Clipping date | Oven-dry forage (lb./acre) | Total protein (%) | Total protein (lb./acre) |
|---|---|---|---|
| 12/23/60 | 1202 | 19.2 | 231 |
| 1/26/61 | 1394 | 23.6 | 330 |
| 2/18/61 | 1089 | 24.2 | 264 |
| 3/15/61 | 1019 | 22.5 | 229 |
| 4/3/61 | 1004 | 21.8 | 219 |
| 4/20/61 | 583 | 19.6 | 114 |
| 5/8/61 | 215 | 14.2 | 31 |
| Grand Total for season | 6506 | | 1418 |

1/ Agronomist, Research Associate in Agronomy, and Biochemist, Arizona Agricultural Experiment Station, The University of Arizona, Tucson, Arizona, respectively.

2/ Kirk, P.L. 1950. Kjeldahl method for total nitrogen. Anal. Chem. 22: 354-358.

## IV. CONTRIBUTIONS FROM OTHER COUNTRIES

### AN INTERESTING DWARF OAT VARIETY

By J. L. McMullan, Plant Breeder,
West Australia, Department of Agriculture

In Western Australia an extremely dry finish to the season was experienced in 1967 with little rain being received over the last 12-14 weeks of the growing period. Consequently there was virtually no development of oat diseases and lodging was rarely recorded.

Among several new oat varieties grown was the shortest and best looking dwarf I have seen to date. This was obtained from the Victorian Department of Agriculture and is called Dwarf Palestine. As it has grain of reasonably good quality, I expect it will make a very useful parent variety in the breeding programme.

### OAT BREEDING FOR NEW SOUTH WALES

P. M. Guerin

The type of oat in which I am specializing is one suitable both for grazing and grain production in areas with a trend to more rainfall in summer than in winter. Quite severe frosts after grazing often cause winterkilling--warm winter days may not provide sufficient cold-hardening. Heavy night dews in spring and early summer inevitably induce rust, firstly as crown rust sometimes though not always and, more important here, stem rust. Very high temperatures can prevail for short spells in late spring and alternate with cool cloudy spells. Varieties must be adaptable to a wide range of conditions--long dry periods alternate with long wet periods, sometimes there are hot dry winds and sometimes flooding.

As I see it there are two approaches to the problem: (1) Use irrigation to control the environment somewhat and make oat selections on this basis; (2) Concentrate on sparsely sown high tillering oats lines with emphasis on strong rugged individual plants and take a long period of time to produce the "perfect" oat variety. No. 1 approach requires a great deal of engineering know-how and equipment, which would not be justified unless it could be used also for a high yielding summer crop like sorghum or millet--the whole concept being based say on a cattle fattening enterprise. No. 2 approach would allow of greater specialization in oat breeding as the area of non-irrigated winter crops like wheat, and oats will always be greater than the irrigated area.

Up to the present I have only been able to follow the second approach and some observations made during the past two seasons are recorded here:

The Swedish oat 'Same' exhibited a very short phase between flowering and ripening off and was used for crossing with a large-grained winter-hardy local selection. Crosses between the U. S. line with ABCDEF rust genotype and local winter-hardy lines and with 'Novascdsky', the hardy introduction I obtained from Cambridge breeder, Mr. Genkins, who got it from Yugoslavia, have given rise to numerous mutation types in the $F_2$ generation. Of these the forked main branch type is the most promising one. The Swedish oat, Same, has also produced such a type, so perhaps our environment here may sometimes "stir" up the "long-day" spring oats quite a bit. For this reason, I have'nt bothered to try irradiating oat material as I can hardly handle what I have.

Some extra large grained types are being developed but for this characteristic to be properly expressed, skillful use of irrigation would be necessary. Would any oat breeders experienced in various irrigation techniques care to share their experiences relative to oat, e.g., flood versus spray-line irrigation?

## CROWN RUST IN EASTERN ONTARIO IN 1967
by R. V. Clark, Ottawa

Crown rust of oats was heavy throughout Eastern Ontario in 1967. An estimate of the loss in yield due to this disease was obtained in preliminary tests with the fungicide Daconil 2787. Four varieties were treated at the rate of 2 pounds of 75% wettable powder per 100 gal. of water. Daconil 2787 was applied four times at weekly intervals starting at approximately the time of heading. Infection in the treated areas was rated as a trace amount. The increase in yield due to treatment averaged 25%. Seed of one variety from treated plants showed a slight drop in kernel weight but there was no difference between the other three. These results show that crown rust can cause sizeable losses in yield and that Daconil 2787 might be a useful fungicide to control the disease.

## RED LEAF OF OATS IN THE PLAINS OF INDIA
K. S. Vashisth

With the introduction of high yielding dwarf varieties of wheat in India, oats is to gain more importance as a fodder crop. Recently an extensive survey was carried out to know the presence of virus diseases of oats in Northern India. Red leaf disease, reported to be caused by yellow dwarf virus of cereals, was observed in the plains of many states during the survey. The occurrence of yellow dwarf virus from wheat and barley has already been reported from Simla Hills by Nagaich and Vashisth in 1962. During 1967-68 the disease was first observed in oats at the farms of Indian Agricultural Research Institute in Delhi State and later was found in Uttar Pradesh and Haryana. At the farm of this Institute, oat varieties Kent, Algerian and Khersai were showing typical symptoms. Two varieties of oat, Kent and Branker, at Hissar in Haryana state, were found diseased. At the farm of Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh, four varieties, namely, Kent, Algerian, Early Miller, Nip, and two selections, F.O.L. 29 and W. 11, were found with typical symptoms. Algerian variety of oat was observed to be most susceptible. At Jhansi, where Algerian oat is grown in several hectares, hardly any plant was without red leaf symptoms.

The symptoms of this disorder are more pronounced along the borders of the fields and patches of the diseased plants can be seen scattered all over the fields.

Transmission trials carried out with the aphids (Rhopalosiphum spp.), collected from wheat and barley fields, proved the disease is of virus origin. Healthy seedlings of a number of oat varieties (Kent, N.P. 101, Algerian, Flaming Gold) were used as test plants. All the test seedlings developed typical symptoms after 2 to 4 weeks of transfer, of viruliferous aphids, under glasshouse conditions.

For the present, the strain of the virus isolated from field samples of oats appears to be more severe for oats only and not to commonly grown varieties of wheat and barley. With increase in area under oats and also the change in the varietal pattern of wheat varieties in India, the widespread presence of yellow dwarf virus of cereals in oats may be a potential threat to food production. Further work has been taken up at the Indian Agricultural Research Institute.

## OATS IN KENYA
by E. J. Guthrie

The oat crop is comparatively a minor one in this country and we do not feel justified in launching a breeding programme but, on the other hand, are always very keen to screen any materials we can lay our hands on. The main problems are of course stem rust and crown rust with races 4, 4a, 6, 6a and 13a of stem rust identified in the country but no information on the crown rust races.

The varieties in use here at present are Grey Algerian for porridge and Suregrain, Lampton, 3003F and RL 1734 for feed. We are at present screening our oat collection to select good forage types but generally find that those which show promise early on set very poor seed as a result of rust attack. We have one new variety, CI 7114 (Clinton$^2$ x Arkansas 674) at the Pedigree stage this year which looks promising as a feed variety.

## OATS IN MEXICO
Uriel Maldonado A.

Oats have been grown in Mexico for about the last 50 years but breeding work to obtain varieties more adequate for different agricultural zones was only started recently, about 1961.

The oats crop covers in Mexico from 90,000 to 130,000 hectares a year, mostly grown without irrigation and with fair to poor agricultural practices as to weed control and fertilization. Under such conditions yields are poor, the over all average being about 800 kgs per acre.

As oats are grown in the summer and exposed both to shortage of precipitation and early frosts, our main problem is to develop early material, and we have material in early generations that shows both earliness and good yield potential.

When we started our work in oats, the only important disease was crown rust, but in the last three years we have been getting heavy infections of stem rust, which has been identified at Minnesota as race 6AF and which is very virulent under our conditions.

We have an extensive program of crossing using about the same breeding methods that we use for wheat.

Table 18 shows the yields of some of our best strains of oats grown without irrigation in our main oat growing area. We have started some trials to grow oats under irrigation and we have some lines that show a good yield potential as indicated in Table 19. The reaction to *P. coronata* is a response to an induced epiphytotic.

Table 18. Average grain yield in kgs/hectare without irrigation at Cuauhtemoc, Chih., in 1966

| Line or variety | Yield kgs/hectare | Date to flowering | Height cm | *P. graminis* % |
|---|---|---|---|---|
| 7149x7531 I-15-5c-3R-2c | 3665** | 90 | 105 | 0 |
| Opalo²xCurt I-6-1R-3M-3R-1H | 3490** | 91 | 110 | 0 |
| 7149x7531 I-15-11c-1R-2c | 2976** | 91 | 100 | 0 |
| Checks: | | | | |
| Opalo | 2783* | 95 | 100 | 0 |
| Putnam 61 | 2688 | 91 | 90 | 0 |
| Burt | 2516 | 90 | 110 | 20S |

** Significant at 1% level
* Significant at 5% level

Table 19. Average yield of oats in kgs/hectare under irrigation at Celaya, Gto., in 1966

| Name or Variety Number | Yield kgs/hectare | Maturity days | Height cm | *P. coronata* % |
|---|---|---|---|---|
| 74 Opalo$^2$-Curt | 6333** | 145 | 125 | 40R |
| 60 Opalo-Curt | 5920** | 150 | 125 | 50MR |
| 87 Opalo$^2$-Curt | 5833** | 139 | 115 | 60MR |
| 73 Opalo$^2$-Curt | 5800** | 150 | 150 | 50MR |
| 65 Opalo-Curt | 5673** | 139 | 115 | 50MR |
| Checks: | | | | |
| Putnam 61 | 3540 | 145 | 140 | 40MR |
| Burt | 2913 | 138 | 110 | 80S |
| Opalo | 2673 | 140 | 115 | 20R |
| Nodaway | 2140 | 140 | 115 | 50MR |

** Significant at 1% level.

## OATS IN THE REPUBLIC OF SOUTH AFRICA

D. J. Rossouw (Plant Pathologist)
B. E. Eisenberg (Oat Breeder)

1. During the spring of 1967, severe outbreaks of loose smut were observed on oats in the Philadelphia area of the Cape Province. An experiment to determine the efficiency of Vitavax 75 (2-3-dihydro-5-carboxanilido-6-methyl-1, 4-oxathiin) and Plantvax (2-3-dihydro-5-carboxanilido-6-methyl-1, 4 Oxathiin-4, 4-dioxide) against *Ustilago avenae* was conducted in the summer of 1968. Although final results are not available yet, readings so far taken indicated that excellent control of the disease can be obtained.

Crown rust is the most serious disease of oats in the Republic of South Africa. A survey was undertaken to gain some insight into the crown rust race situation in the country. Eleven races were found, five of which correspond to International races 215, 236, 264, 269 and 276. Previously undescribed physiologic races are the South African races HK/1, HK/2, HK/3, HK/4, HK/5 and HK/6.

2. The Northwesterly section of the Winter Rainfall Region is the more important grain oat producing area of the Region. This area is characterized by a variable

rainfall in space and time with annual averages ranging from 10-20 inches, although the effective amount may be as low as 5 or 6 inches. The growing season may be severely truncated by spring drought which may seriously affect yield. The Southwesterly area of the Region generally enjoys a higher rainfall and a relatively extended growing season.

Selection of higher yielding early maturing types for the first-named conditions have resulted in the release of two varieties, i.e. Anita and Olympia. In trials at the Langgewens Experiment Station these lines yield approximately 11% more than the standard for that area. In lower rainfall areas these varieties increase their lead over the standards by approximately 20%. These varieties emanate from a cross of (Jongensklip x Boon) x Victorgrain and a number of other crosses with Victorgrain appear to have potential, i.e. Victorgrain x Mulga, Victorgrain x (Southland x Victoria) and 612-4 x Victorgrain.

In the second-named region, oats is used both for haymaking as well as for grain production. The early maturing varieties and lines outyield the standards by as much as 30% which is probably due to the fact that they are able to escape crown rust attacks. However, their hay maturing value is low so that a later variety, Sonja, has been released which maintains the improved grain yield but is accompanied by a greater total dry matter yield. This variety is a selection from the progeny of the cross Quincy Gray x Blanka Klein.

## OAT DISEASES IN SOUTHEASTERN YUGOSLAVIA

B. Kostic and H. Smiljakovic (Plant Pathologists)
Institute for Small Grains, Kragujevac, Yugoslavia

In the project "The improvement of the Agricultural Production in the hilly and mountainous areas of Serbia" the Institute for Small Grains at Kragujevac is in charge of wheat, barley and oats improvement.

In 1965, 1966 and 1967, Plant Pathologists of the Institute made inspection trips to survey the severity of plant diseases in Serbia and Macedonia.

During these trips, no bacterial or virus diseases of oats were discovered. The following fungi were found to parasite oat plants: Ustilago avenae, Ustilago levis, Erysiphe graminis avenae, Puccinia graminis avenae and Puccinia coronata avenae.

The first three parasites in the order have been met in the oat fields in trace amounts, causing little damage to crops. Meanwhile, the rusts of oats were very common and their severity in some plots were high enough to be of economic importance for the oat growers.

The Uniform Oat Disease Nursery is being sown every year in Rudnik (The hilly area of central Serbia) and in Mountain Zlatibor in west Serbia. The entries of the nurseries come mostly from the International Oat Disease Nurseries.

There was found a good difference in the susceptibility to rusts among the varieties even in the natural infection in the two areas.

In the spring of 1968 the home and foreign varieties are planned to be artificially inoculated with stem and crown rust as well as with powdery mildew in the Nursery at the experimental field of the Institute at Kragujevac.

In 1965, 1966 and 1967 the physiologic specialization of the oat stem rust was studied. In 1965, three races were identified from the uredosamples: 6, 7 and 8. The predominant one was race 6. In 1966, four races were isolated in the following order of prevalence: 6, 8, 2 and 7. In 1967, the same races were determined as in the previous year. Race 6 was still the most prevalent one.

In the spring of 1968 the uredosamples of crown rust are to be analyzed for race isolation.

## OATS AND OAT DISEASES IN CANADA

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

The 1967 Oat Crop averaged 38 bushels per acre on 5,160,000 acres in Western Canada. Yields were generally down a little from 1966, but still extremely good considering that many areas had only a quarter of the normal growing season rainfall. Saskatchewan was particularly dry but even there the yield averaged 32 bushels per acre. A combination of factors resulted in these reasonably satisfactory yields including good spring moisture reserves, few days with high temperatures or high winds and very little evidence of disease.

In 1967 Stem and crown rust of oats were less prevalent in Western Canada than in any year since 1961. Adverse climatic conditions and the late arrival of primary inoculum restricted disease development resulting in negligible losses to the oat crop.

Stem rust was first found in Manitoba on July 17 and no stem rust was found in Saskatchewan or Alberta. In Eastern Canada stem rust incidence was also very low. By contrast crown rust was prevalent in the east indicating that climatic conditions were favorable for disease development. The reduced incidence of stem rust is probably attributable to the barberry eradication program which has reduced this primary source of inoculum.

Physiologic race C 10 (6 AF) continued to predominate (65%) in Western Canada with races C 3 (7a) and C 5 (6F) comprising the remainder. The race distribution in Eastern Canada changed relatively little between 1958 and 1966 when C 9 (6A) and closely related races, typical of the barberry area were prevalent. A shift appears to have occurred in 1967. In Ontario 47% of the isolates were of western affinity (race C 3, C 5 and C 10). This shift may be the result of the barberry eradication program in Ontario.

Among the crown rust isolates identified in the west, there was, however, a marked increase in virulence on the differential oat varieties 'Landhafer', 'Santa Fe', 'Trispernia', and 'Bondvic'. The 2 first-mentioned varieties were attacked by 68% of the isolates identified this year but by only 24% of the isolates in 1966. 'Trispernia' and 'Bondvic' were attacked by 24% and 37% respectively of the 1967 isolates compared with only 2% of the isolates in 1966. The virulence of the crown rust population on these 4 varieties was greater in Western Canada in 1967 than it had ever been since the introduction of these differentials in 1952. The present situation undermines the utilization of these sources of crown rust resistance in the oat breeding program. Good sources of resistance to these races have been found in the _Avena sterilis_ collections made by the Canada-Wales expedition to the Mediterranean area in 1964 and by G. Fleischmann in Israel in 1966. Cultures of rust have not been found that are capable of attacking 2 of the resistance genes isolated from the first 3 wild oats to be studied genetically.

## MONOSOMIC INTERNATIONAL

by Tibor Rajhathy, Ottawa

Monosomic International, a project based on interlaboratory and international cooperation and aimed at the rapid production of a complete monosomic series in common oats has been started at Ottawa. A collection of all classified as well as unclassified monosomics at one laboratory seemed to be the most efficient way to accomplish this. The response of the workers having monosomics has been most cooperative and enthusiastic and we have already received a great number of lines.

The lines received including our own lines are being registered under a code which shows the genotype, mode of production and laboratory of origin. The list of the classified lines serves also as an inventory of the different lines available and indicates the missing ones. We shall attempt to verify previous classifications by nullisomic morphology combined with karyotype analysis and if needed, by intercrossing. The verified lines will be backcrossed to the variety Garry until sufficient homozygosity is reached. Garry was chosen simply because this is the most common genotype represented by the material.

Once the inventory of verified lines is established the search for the missing lines in the unclassified material must begin. It appears at the present that only six lines are missing; however, this has to be verified. It is quite possible that all 21 lines are already in existence. A cooperative project such as this should reveal this in a relatively short time.

I would like to take this opportunity to call upon those oat workers who have or may have chromosome deficient lines, regardless of the genotype and heterozygosity, to send seed samples of such lines to Ottawa for inclusion in this project.

## VITAVAX: A SYSTEMIC FUNGICIDE FOR CONTROL OF LOOSE SMUT AND COVERED SMUT IN OATS

Edmundo Beratto M., Agronomist (Carillanca Experimental Station, Chile)

Two of the most common and extensive oat diseases in Chile are the loose smut (Ustilago avenae (Pers.) Rostr.) and the covered smut (Ustilago kolleri Wille) respectively. Favorable environmental conditions for the development of these Basidiomycetes have caused around the 15% loss in grain. Actually, most of oat varieties grown in the country are susceptible to smut.

An experiment to achieve an effective control of the disease was planned. The treatments were: Agrosan G.N., Granozol M, Uspulum, Vitavax and Check (without fungicide). "Peragold" was the oat variety used in the experiment (very susceptible to smuts). The seed was artificially inoculated with viable spores of U. avenae and U. kolleri and dried by exposure to air. Afterwards the fungicides were applied to the seed in a powder form and in the following rates:

| | | |
|---|---|---|
| Agrosan | : | 200 gr/100 kg. of seed |
| Granozol | : | 200 gr/100 kg. of seed |
| Uspulum | : | 200 gr/100 kg. of seed |
| Vitavax | : | 500 gr/100 kg. of seed |

Seed germination was checked before the application of the fungicides and after the mean emergence period. Finally the oats were sown in the field and when the grain was ripe panicle smut infection was determined. (Table 20)

Table 20. Control of oat smuts by seed treatments.

| Fungicide | Number of smutted panicles | Number of healthy panicles | Percentage control of oat smuts (%) |
|---|---|---|---|
| VITAVAX | 0 | 829 | 100 |
| GRANOZOL M | 6 | 825 | 99 |
| AGROSAN G.N | 38 | 688 | 95 |
| USPULUM | 48 | 656 | 93 |
| CHECK | 108 | 642 | 86 |

The results show that "Vitavax" completely controlled the attack of smut and helped the growing and development of a great number of oat plants by unit of surface in relation to Agrosan and Uspulum.

Following "Vitavax" the best second fungicide is "Granozol M", which has a low attack of smut (72%) and a high number of plants by unity of the surface.

## PERFORMANCE TRIALS OF FIVE OAT VARIETIES IN CALDAS, COLOMBIA
by Reinaldo Reyes

Five varieties were tested for grain yield and forage production in Caldas. The oats were planted in March 1967 in a randomized block experiment with four replications, and using the seeding rates of 60 and 75 kg per hectare.

The performance was excellent as shown in the following tables.

Table 21. Grain yield in kg/ha of five oat varieties at Tesorito (Caldas) 1967

| Variety | Seeding Rate | |
|---|---|---|
| | 45 kg/ha | 60 kg/ha |
| Ica - Bacatá | 4970 | 4580 |
| CI 6969 | 3770 | 4800 |
| R x (Sac-HJxCk/5919-S/Mo 811) | 3800 | 3743 |
| Sac - HJ x Ck/Fla - L Sel | 4630 | 4200 |
| Sac - HJ x Ck/Fla - L | 4100 | 3740 |

Table 22. Dry forage production in kg/ha of five oat varieties at Tesorito (Caldas) 1967

| Variety | Seeding Rate | |
|---|---|---|
| | 45 kg/ha | 60 kg/ha |
| Ica - Bacatá | 11.0 | 10.8 |
| CI 6969 | 10.7 | 11.4 |
| R x (Sac-HJ x Ck/5919-S/Mo 811) | 12.1 | 13.1 |
| Sac - HJ x Ck/Fla - L Sel | 10.4 | 11.1 |
| Sac - HJ x Ck/Fla - L | 11.3 | 13.5 |

## OAT RESEARCH IN JAPAN
by T. Kumagai and S. Tabata

Weather conditions have been very favorable for oat growing in Hokkaido. Oat performance tests at our station produced 43.2 kilogram per 10 acres (385 lb. per acre), the highest record for our field, which was an increase of 24% over the ordinary year.

The oat acreage continues to decline in recent years. The 1967 oat production for grains in Hokkaido was 38,500 hectare, the lowest in this decade. Farmers are growing more forage crops or potatoes in place of oats, wheat and soybeans.

In the present season there was little rust and northern virus disease, but heavy lodging occurred locally. Much more improvement for better straw strength is needed. Breeding work in progress is for improvement of straw strength, better forage types, grain quality, and winter hardiness. A new oat variety, Otsuku, which was licensed in 1966 (see Newsletter Vol. 17), was increased for seed. The seed will be turned over to seed growers and farmers for the first time. Otsuku has performed well at many cooperating local branches in Hokkaido in this season. The variety has superior stiff straw although it is not so short.

Oats have been used as a winter forage crop in southern Japan. A trend toward the increased utilization as a green-chop has continued. Attention has not yet been given to the development of varieties adapted widely for Southern Japan. As there is not another oat breeding station in Japan, our station needs to make some contribution to oat improvement in this area. However, most emphasis in our breeding program is on grain production in Hokkaido and it is not easy to assume full research activity for this purpose at the same time. It is of urgent importance to establish a cooperative research system between our station and some southern prefectural stations. The pressing major problem here is to improve forage yield potential, crown rust resistance, recovery and survival. It will be necessary to search for superior germ plasm of diverse origin from world sources.

## OATS RESEARCH IN NEW ZEALAND
by G. M. Wright

A new forage oat, Amuri, has been released (description under "New Oat Varieties").

The milling oat Mapua, released in 1965, established a new New Zealand yield record in 1967 with a yield of 166.2 bushels per acre (40 lb. bushels) from a 10.2 acre paddock. The crop was grown in Canterbury province on a medium-fertility soil with moderate rainfall, from autumn sowing, and is a challenge to farmers in Southland, where yields are generally highest and the record had been held by a crop of Onward 56.

Evidence of unexpected natural crossing has been obtained during the production of pure seed of Amuri. Single-plant progenies flowered in 1965 in close proximity (minimum 6 feet) to breeding plots of black oats. This was thought safe because Amuri flowers early. A small proportion (1/10,000?) of black oats was found in the bulk progeny the following season, and progenies of 48 of these black oat plants all segregated for husk colour (total 881:274, a good 3:1 ratio) and for height and/or panicle type.

V. CONTRIBUTIONS FROM THE UNITED STATES
(Note: Some contributions appear in other sections)

## ARKANSAS

Rex L. Smith and J. P. Jones

The 1967 oat acreage, 73,000 acres, showed a decrease of 25% from that of 1966 and 16% from the 5 year average. The decrease was due mainly to the strong competition of wheat for the small grain acreage. The wheat acreage increased from 367,000 acres in 1966 to 661,000 acres in 1967, an 80% increase.

Yields were good, averaging 59 bu./acre, this being 11.8 bu./acre above the 1961-1965 average but 6 bu./acre lower than the 1966 high.

Ora, an Arkansas release in 1964, is the most popular variety. Nora, released in 1966, is gaining popularity because of its high performance and wider range of adaptability due to greater winter hardiness.

Work initiated by the late Dr. R. L. Thurman is being continued. Several hundred of his lines are being tested throughout the state.

BYDV disease was severe, especially in the northwest part of the state. The research plots at Fayetteville were extensively damaged. Crown and ste rust were of no consequence.

## GEORGIA

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

The winter in South Georgia has been mild to mid-January. Winter oats have made considerable growth and stand a chance of cold damage later on. Aphids have been plentiful and have done some damage to young oats. Diseases have not been serious but the potential is here.

Promising material has been selected from the cross Fairfax x Florida 500 made by Dr. U. R. Gore. In this cross Dr. Gore has combined the high forage and grain production of Fairfax with the disease resistance of Florida 500.

We have continued the selection of superior plants from the crosses and backcrosses of adapted Southern varieties crossed with *Avena sterilis*. Good resistance to crown rust can be obtained from these crosses and we hope to obtain other good qualities such as higher protein in the forage and grain, better forage yields and additional resistance to diseases.

A previously unreported pathogen (*Pythium myriotylum*) of oats and other small grains was studied in the greenhouse this fall. The fungus was originally isolated from diseased rye plants and was found to be highly virulent to Wrens Abruzzi rye and Florida 500 oats. *Pythium myriotylum* and *P. aphanidermatum* are similar with regard to environmental conditions favoring infection and disease development. These pathogens are most serious under relatively high soil temperatures (80-85°F.). Chemical control of crown rust was studied last year using Plantvax (2 lbs/A) as a foliar spray. Highly significant increases in grain yields were obtained using Fairfax, a variety susceptible to the race of the crown rust pathogen present in the nursery at Tifton. We are continuing our efforts in chemical control of crown rust this year.

# INDIANA

by F. L. Patterson, J. F. Schafer, R. M. Caldwell, L. E. Compton, B. C. Clifford, J. J. Roberts, M. J. Bitzer, R. D. Barnett (Breeding, Pathlogy, and Genetics), R. K. Stivers, Kelly Day, and O. W. Luetkemeier (Varietal Testing), W. D. Reiss and B. J. Hankins (Extension)

The 1967 Season: Wet soils in March and April were generally unfavorable for the commercial crop and only 299,000 acres were seeded in Indiana in 1967 as compared to 360,000 acres in 1966. Good moisture and cool weather promoted excellent early development of the oat crop. The 60-day period from May 15 to July 15 was low in rainfall and a drouth had developed in most of the oat-growing areas by heading time. Little disease developed under the very dry conditions except for barley yellow dwarf which was moderately severe in some areas of the state. The average state yield was estimated at 48 bu/A as compared with 52 bu/A in 1965 and 51 in 1966.

In nursery trials early varieties were not superior to later varieties and test weights were not seriously lowered.

Oat Varieties: The newer recommended varieties made up the majority of certified seed acreage. Clintford and Tyler were in the first year of commercial production. Jaycee, developed in Illinois, was in the first year of certification. No new varieties were proposed for release.

| Variety | First season of commercial production | Percent of Indiana acreage | Certified seed acres in Indiana in 1967 |
|---|---|---|---|
| Newton | 1957 | 16 | 123 |
| Goodfield (Wis.) | 1960 | 6 | 19 |
| Putnam 61 | 1962 | 4 | 9 |
| Clintland 64 | 1965 | 39* | 200 |
| Tippecanoe | 1966 | 16 | 428 |
| Clintford | 1967 | 10 | 1225 |
| Tyler | 1967 | 2 | 135 |
| Jaycee (Ill.) | 1968 | - | 1044 |
| Norline (Winter) | 1961 | 3 | 95 |

*Includes other Clintland types.

Research - Aneuploids. Results of 5 years research with aneuploids were published in a paper given at the meetings of the Indiana Academy of Science by F. L. Patterson (see publication). Yields of $F_1$ hybrid monosomic oats were much reduced in the severe drouth year of 1967 as was the case also in 1966. The monosomic Clintland 60 type yielded only about 70% of the disomic and 10 $F_1$ hybrid monosomics averaged only 73% as much as the Clintland 60 parent in the 10 crosses. The percent selfing on nullisomics was 16.7% and the percent crossing under cloth bags was 14.5%.

Research - Epidemiology of Crown Rust. In Ph.D. thesis research B.C. Clifford studied the epidemiology of crown rust in different plant populations (see publications). He used 18-ft. circular plots and introduced urediospore cultures of specific races at the centers of plots. The oat populations studied included: (1) susceptible varieties, (2) resistant varieties, (3) a 50:50 mixture of resistant and susceptible varieties, (4) susceptible but slow rusting varieties, and (5) a tolerant variety.

Log.-log. transformations were used to describe rust spread and intensification with time. Rust increased at first in a limited focus on lower leaves this increase being slower in populations with resistance. The initial increase was the same on the susceptible plants in the mixture and in pure stand. The gradient of a slow rusting variety, Purdue 461A1-6-8-1, was steeper than the fast rusting Cartier. This was true for 3 different races of P. coronata suggesting the mechanism it possesses may be generalized in nature.

Research - Nature of Slow Rusting. Additional research was done on the nature of the slow-rusting character by Clifford. Results of yield and kernel weight data indicated that tolerance and slow rusting are distinguishable. Andrew and Benton developed comparable rust levels throughout the season but Benton tolerated this level of rust better than Andrew. Both varieties rusted at rates slower than Clinton 59. Epidemiology gradients in a mature-plant resistant type improved with time relative to Cartier, reflecting its maturative nature.

Slow rusting could be detected in 3-ft. nursery rows using a composite of races or a single race if evaluations were made at several times during the season. This technique, in conjunction with yield and kernel weight data, may allow identification of and distinction between slow rusting and tolerance, for plant breeding purposes.

Studies on the mechanisms of slow rusting, using quantified inoculum and controlled environmental conditions, indicated that post-infection processes are involved in its expression. Slow rusting is characterized by slower development of fewer, smaller pustules as compared to fully susceptible varieties, from a given quantity of inoculum.

## MISSOURI

J. M. Poehlman, George Berger, Shu-Ten Tseng, Wm. Anson Elliott (Columbia) and Leo Duclos (Portageville), University of Missouri.

1967 was the second consecutive year that BYDV caused heavy damage in the oat breeding nursery. In only one previous year, 1959, had damage from BYDV been as heavy. As in 1966, there was a high negative correlation between percent of leaf discoloration and yield in oat varieties and strains.

The new variety, Pettis, being released from Missouri in 1968, and the Illinois variety, Jaycee, were the two varieties in the nursery with greatest tolerance to BYDV. Nodaway, Macon, Tippecanoe, Clintland and 64 and Iowa Multiline M68 were among the more susceptible varieties. Mo. 04978, a reselection from Nodaway, showed considerably less leaf discoloration than Nodaway and yielded 90 bushels in comparison with 72 bushels for Nodaway during the two-year period, 1966 and 1967. Mo. 04978 is being increased for possible distribution in 1969 as a replacement for Nodaway.

## FLORIDA

W. H. Chapman

Oat acreage for the 1966-67 crop was similar to the previous year but average yield was 3 bushels lower with an average of 37 bushels per acre reported by the Crop Reporting Service. Approximately 80% of the oats are grazed completely. An additional 15% of the harvested acreage is grazed prior to being harvested for grain. Conditions for early seeding for grazing were unsatisfactory because of extended periods of dry weather.

Fall and early winter growth of the 1966-67 nursery was excellent. Moisture supplies were ample and temperatures mild; however, sub-freezing temperatures in late January and February resulted in considerable abnormal plant growth. Helminthosporium avenae was severe on the weakened plants. Good resistance to H. avenae was found in C.I. 7220 x Florad material and to crown rust and soil-borne virus in Avena sterilis.

A selection, Q8994, is showing the most promise for forage and improved cold hardiness in the diploid breeding material.

## ILLINOIS

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

The 1967 season was generally favorable for oat growing in Illinois. Our state average yield was reported at 59 bushels per acre and this is only one bushel below the record yield recorded in 1966. Some oats were seeded on the late side, but a favorable growing season appeared to erase the usual adverse effect of late planting. Delayed harvest due to wet weather at harvest time caused probable reductions in yield and grain quality in parts of northern Illinois.

Barley yellow dwarf was the only disease that caused any significant reduction in oat yields in 1967. As in 1966, this disease caused considerable damage in central and southern Illinois. The varieties Jaycee and Newton again showed a rather high degree of tolerance to the virus strains that occurred.

The Illinois oat acreage continued a downward trend with 780,000 acres harvested in 1967. This compares to 907,000 acres harvested in 1966. The variety, Newton, continued by a slight margin to be the most common variety grown, accounting for 26% of the state's acreage. Garland was in second place with 25%. Goodfield and Namaha were tied for third with 6% each. Brave, Clinton, Clintland, Clintland 60 accounted for 4% each while Clintland 64 accounted for 3%.

## IOWA

J. Artie Browning and Marr Simons, Ames

The epiphytology of the 1967 Iowa oat rust season was noteworthy. A late spring delayed planting for about two weeks beyond the average date, until the third week in April. Richland spreaders, small from the late planting and very dry conditions, were injected with urediospores suspended in Tween-20 on May 24. A slow 2 inch rain fell May 28-30. Rain again fell on June 4 and on every day thereafter through June 15, totaling about 7.3 inches for this period. An additional one inch fell June 24. This extended period of wet weather with favorable temperatures was apparently near optimum for rust development because experiments injected on May 24 had reached rust climax by June 24, about 10 days earlier than normal. One month from injection to rust climax, allowing time for a maximum of 3 cycles after the opening of primary uredia is, in our experience, a new record for rapidity and severity of rust development in central Iowa.

Fortunately, this experience was confined to experimental plots in which rust was artificially initiated, and rust was of little consequence in the state as a whole.

Personnel: Dr. K. J. Frey is spending a 6-month Faculty Improvement Leave at the Waite Agricultural Research Institute in Australia and traveling in the Far East. Dr. Isaak Wahl, Head, Department of Plant Pathology, The Hebrew University, Rehovot, Israel, is spending 6 months of his sabbatical leave at Iowa State working on rust tolerance and "slow rusting" in oats, and attempting to culture the crown rust fungus. The first part of his leave from Israel was spent at St. Paul, Minnesota.

## KANSAS

E. G. Heyne, Manhattan

We are living in an everchanging era. Some changes we do not like, others we favor. In general, the changes that have occurred have been beneficial. Some feel that a lifetime of effort on oat research has been wasted. This is not so for most of the past work has already paid generous dividends. In most areas the oat acreage continues to decline. This is the story in Kansas. Unfavorable weather at seeding time reduced the seeded acreage (218,000) and much above average rainfall reduced the harvested area to 161,000 acres. Kansas records are available since 1866 and only the years 1866 through 1870 had smaller harvested acres. The yield was high for Kansas, 36.0 bushels per acre. Only in 1883, 39.5 bushels and in 1869, 37.5 bushels, have higher per acre yields been reported.

Even though the production declines perhaps other changes may occur particularly if productive high protein and nutritious varieties can be developed and utilized as food.

A small increase of CI 7805 was produced in 1967. This cultivar was named Pettis and released for farm production by the Missouri Experiment Station in 1968. This cultivar has unusually high test weight and in general better performance than Mo. 0-205. The limited amount of seed available in Kansas will be increased in 1968.

Two other lines, CI 7674, Bond / Rainbow 2/ Hijara / Joanette 3/ Landhafer 4/ 3 Andrew, and CI 7698, Improved Garry 5/ Landhafer 3/ Mindo 2/ Hijara/ Joanette 4/ Andrew, have shown promise in Kansas and will be considered for initial increase in 1968.

There have been two consecutive years of high survival of winter oat entries in southcentral and southeastern Kansas. When winter oats survive the yields are generally much better than spring-sown oats. Several winter oat bulk populations are being grown in southeastern Kansas.

No damaging disease problems were present in 1967 although both stem rust and crown rust became common at the end of the season.

The spring oat cultivars recommended for Kansas are Andrew, Mo. 0-205, Minhafer, Neal, and Tonka. The winter oat cultivars are Arkwin and Cimarron for several counties in the southeastern part of the state.

## MICHIGAN

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

In general, the oat crop in Michigan was good. Again, there was an absence of foliar diseases although sufficient inoculum of leaf rust was present in southeastern Michigan to permit reading for resistance.

In spite of the absence of rust in the past few years, the threat of an epiphytotic is always present and breeding for leaf and stem rust resistance is an important part of our program. Yield tests were conducted on backcross materials having Coachman and AuSable as recurrent parents. These lines have added resistance to race complexes 6, 7, 8 and 13 of stem rust and 292 and 286 of leaf rust. The resistances were incorporated via the sponge imprint method developed by M. B. Moore of the University of Minnesota. Using this method a single backcross plant could be inoculated with 6 races simultaneously. We hope there will be sufficient seed for the Uniform Oat Nursery.

As yet no real resistance to the Cereal Leaf Beetle has been found in oats. New material is being tested. The beetle continues to spread but a vigorous three-pronged research attack in areas of chemical control, biological control and host resistance will pay off.

## MINNESOTA

Deon Stuthman, M. B. Moore, Olin Smith

A number of $F_5$ lines tracing back to 4 selections from crosses of PI 267989 X Garland, PI 267989 x Lodi, and Wahl #2 x Garland (page 49, 1966 Oat Newsletter) were grown in the 1967 buckthorn plot. In addition to the pathogenically diverse crown rust inoculum produced on the buckthorn, the nursery was heavily inoculated with races 216, 217, 264, 276, 290, 326 and 2 virulent unidentified isolates. The selected lines were resistant, highly resistant or immune thereby suggesting a fairly broad base of resistance. A very few of the lines were of winter growth habit. The PI 267989 x Garland populations continue to look the most promising, especially agronomically. Seed type of three-way crosses involving PI 267989 x Garland is much superior to those of PI 267989 x Lodi.

Some 216 lines of A. fatua have been increased from single panicle collections made in the Red River Valley area of Minnesota and North Dakota by Dr. Robert Andersen, U.S.D.A. Plant Physiologist, for tests of herbicide tolerance. Seed of each of these lines was planted in the buckthorn plot to test plant reactions to crown rust. All lines were very susceptible and 100 percent rusted.

### Oat Variety Survey

A variety acreage survey was conducted by the Minnesota Crop and Livestock Reporting Service in 1967. Some of the results are as follows:

| Variety | Origin | Stem rust genotype | % |
|---|---|---|---|
| Lodi | Wisconsin | AB | 38 |
| Garland | Wisconsin | AB | 22 |
| Rodney | Canada | B | 16 |
| Tippecanoe | Indiana | AB | 4 |
| Garry | Canada | AB | 3 |
| Harmon | Canada | AB | 3 |
| Minhafer | Minnesota | AB | 2 |
| Portage | Wisconsin | A | 1 |
| Others | | | 11 |
| | | | 100 |

Acreage Data is by courtesy of the Minnesota Livestock and Crop Reporting Service.

Thirty-five percent of the acreage was planted as a nurse crop. Approximately 13% were seeded with certified seeds.

Lodi, Garland, Tippecanoe and Minhafer are the recommended varieties for 1968.

### Personnel Items

Dr. Paul G. Rothman joined the Cooperative Rust Laboratory in replacement of Bill Roberts. Dr. I. Wahl of Israel is spending about 6 months with the Minnesota group working on generalized or moderate stem rust resistance.

## NEW YORK

N. F. Jensen, Cornell University, Ithaca

Varieties: This is my guess as to variety use in New York: Garry 35%, Orbit 30%, Niagara 10%, Russell 10%, Rodney 5%, Tioga 5%, and others 5%; it is expected that Orbit use will increase proportionately. There is a possibility that Cayuse may be brought in and we are looking over the Wisconsin varieties which do well in New York.

Breeding: No selections are being increased for introduction at this time. Lines which show promise are two sibs of Orbit, one very short and strong; the other with Rodney-quality grain, and a short high-yielding line from the cross of Early Clinton x project selections. A large number of Egdolon selections are also under test.

Crown Rust: More than usual crown rust was evident in 1967. Excellent field resistance was noted in populations from crosses involving Alamo-X, Florida 500 and Suregrain.

Acreage: 1967 oat acreage (harvested) in New York was 429,000 and the estimated mean acre yield was 52.0 bushels. A continued decline in acreage is anticipated by the writer.

Research direction in breeding: Almost all new crosses are pointed towards medium to short height and strong straw, minimum of AB stem rust resistance, increased crown rust resistance and Orbit or Rodney grain quality. The high protein *Avena sterilis* lines are being brought into the crossing pattern.

## NORTH CAROLINA

C. F. Murphy, T. T. Hebert, D. M. Kline (USDA)
J. G. Clapp and M. F. Newton (Raleigh)

Conditions in North Carolina were generally favorable for small grain production. The oat acreage remained constant and the average yield of 46.0 bushels per acre was 2 bushels per acre below the record yield of 1966 but 6.9 bushels per acre above the 5 year average.

### Stiff Straw Nursery

An informal stiff-straw nursery has been initiated and several workers have submitted lines for inclusion. While the nursery is being continued, it is obvious that our North Carolina winters are generally too severe for meaningful testing of many of the spring oat lines. It is still hoped that a formal cooperative nursery of this type can be established at a more desirable location.

## OKLAHOMA

L. H. Edwards, E. L. Smith, E. A. Wood, Jr., H. Pass, J. W. Johnson, and
H. C. Young, Jr. (Stillwater)

Production: Oklahoma oat production continued to decline as 3.4 million bushels (smallest crop on record) were produced on 112,000 acres. This harvested acreage represented about half of the planted acreage since the crop is utilized for forage as well as grain production.

C. I. 8183 and C.I. 8311: A Wintok Early Sel. x LeConte selection, C.I. 8183, has performed well in Oklahoma tests over a period of several years. The strain yielded 4.0 bu/A more than Cimarron on a 10-station average over a 3-year period. Also, it was 2.2 lbs/bu higher in test weight than Cimarron. C.I. 8183 is superior in straw strength to any of the winterhardy varieties currently grown in the state and its winter hardiness approaches that of Wintok.

An Arlington x Wintok selection, C.I. 8311, has an exceptionally good yield record in Oklahoma tests. This strain yielded 19.1 bu/A more than Cimarron on a 13-station average over a 4-year period. C.I. 8311 averaged 1.0 bu/A lower in test weight and eight inches taller than Cimarron on a 10-station basis.

Greenbug Resistance: A spring-type oat selection, P.I. 186270, has shown a high degree of tolerance to the greenhouse or "tiger" strain of greenbug. Previous to this discovery, no oat line had been found which had any degree of resistance to the "tiger bug." $F_1$ plants from crosses between P.I. 186270 and adapted, susceptible oat varieties were all susceptible. This would indicate that resistance in this strain is conditioned by a recessive gene(s). P.I. 186270 has also shown resistance to the yellow sugarcane aphid, *Sipha flava* (Forbes). All oats tested against this aphid have reacted with almost complete immunity.

Personnel: Dr. C. L. Moore accepted a foreign service position with the Rockefeller Foundation effective in April 1967. He will be stationed in Bangkok, Thailand, and will conduct research in corn and sorghum breeding and genetics.

Diseases: The tests for tolerance to crown rust that were initiated in the 1964-65 crop season were continued in 1966 and 1967. Out of the 107 lines which performed well in 1965, 16 were selected for yield tests in cooperation with Dr. M. E. McDaniels and Dr. I. M. Atkins at College Station Texas. These lines were being compared with varieties carrying the highest level of specific resistance now available for that area.

Crosses were made between 6 of the most tolerant lines derived from the original observations, and bulk $F_2$ populations are now being subjected to the most extreme crown rust epidemic that can be developed in the greenhouse at Stillwater. This test is not complete but it is hoped that plants without high levels of tolerance will be killed before heading.

## OHIO

Dale A. Ray (Columbus)

1967 Production: Cool, wet weather conditions prevailed in the early spring months, causing late seeding and considerable diversion of acreage planned for spring oats. Although excellent temperatures and moisture for vegetative growth occurred in the middle of the growing season, the oat crop was more than a week later than normal in heading and ripening. Oat rust infection was light and barley yellow-dwarf was evident in localized areas of oat fields.

The acreage seeded to oats in Ohio was the lowest figure on record for the state and was a decline of nearly one-fourth from the previous year. The state average yield of 50.0 bushels per acre is only one bushel under the 1966 yield but 15 bushels less than the 1963 record figure. Generally, oat-kernel quality was high. There is some concern that a shortage of seed may occur for supplying the demand in 1968.

Oat varieties: Although Clintland 60 continued as the predominate variety seeded in Ohio, Clintford and Garland occupied increased acreages. Jaycee was added in recommendation and looked very promising in seed fields. Goodfield and Brave declined markedly in acreage.

Spring oat varieties recommended in Ohio for 1968 are Brave, Clintford, Clintland 60, Garland, Goodfield, and Jaycee for grain and Rodney for forage. The state-wide oat variety yield trial showed Jaycee, Brave and Garland, in that order, with the highest yield averages.

Oat Breeding Studies: Head-row plantings from advanced-generation selections were screened closely for uniformity before bulking for preliminary yield test entry. Particular selection was made on the basis of agronomic type, straw strength and adapted maturity. Several promising lines have resulted from the cross of Clintland 60 x Rodney 2 x Putnam 61 with excellent straw and high yield potential. These lines must be evaluated more extensively before consideration is made on potential release.

Gary D. Jolliff completed work for the M.S. degree, submitting a thesis in report of studies on field techniques in the multiplication of seed oats. These results will be published soon and should provide assistance in planning breeder's seed increase.

Continued effort has been given to screening winter oat selections for increased winter survival. With the high correlation of yield with survival, several selections appear promising in preliminary yield tests.

## PENNSYLVANIA
H. G. Marshall

Conditions were generally favorable for oat production during 1967 with adequate rainfall. However, the oat acreage continued to decline and was estimated at only 450,000 acres. Lodging was prevalent throughout the state because of severe rainstorms and the average yield was estimated to be only 45 bushels per acre. No serious disease problems were apparent. All figures are based on spring oats since no estimates are made for winter oats.

Winter Oats: The cooperative USDA-Pennsylvania program to develop oat varieties with improved winter hardiness and straw strength was continued. Winter survival was good in experimental plots at three locations in Pennsylvania but yields were reduced by severe lodging that occurred prior to maturity because of several severe rainstorms.

The bulk population approach is used in our breeding program and a total of 1249 different $F_2$ through $F_7$ bulks were grown during 1967. $F_2$ bulks are grown at the Eastern Virginia Research Station near Warsaw, Virginia, but subsequent generations are grown under our rigorous conditions here in Pennsylvania. Entire populations are eliminated on the basis of poor winter survival or poor agronomic potential or both in replicated experiments during the $F_3$ and $F_4$ generations. We begin taking 35 to 50 panicle selections from each population in the $F_5$ generation, and these are grown in short rows or hills at the Virginia location. Rows to be saved are selected early in June and their identification submitted to a high speed computer to learn which populations yielded promising selections. Those which did not are dropped during the July harvest in Pennsylvania. We believe this use of the computer to facilitate sampling of our bulk populations will be a useful tool in our breeding program. Populations with a high selection potential will be carried for several generations and subjected to further winter survival stress.

Our crown freezing technique continues to be useful in our program. We were able to classify 900 $F_3$ lines plus parents in about 2 weeks during November without losing a single experiment. The material is part of a study searching for reciprocal differences in populations involving winter and spring oat parents. Other experiments have been concerned with the evaluation of the freezing resistance of the wild oats Avena fatua and A. sterilis. Twenty-one collections of A. ludoviciana were recently obtained from Australia as part of our effort to find useful genes for winter hardiness in wild hexaploid oats. A. ludoviciana is a weed species in winter oats in Australia and in certain other regions of the world. Its natural germination time is in the fall.

The variety C.I. 7881 (Ballard 6 x C.I. 6700 5 x Osage 3 x Bonda 2 x Hijari x Joanette 4 x Santa Fe) was released to growers during 1967 and named Pennlan. Pennlan has winter hardiness and lodging resistance similar to Norline and is shorter in plant height, earlier in maturity, and more uniform for morphological characteristics. Pennlan is not expected to replace Norline in Pennsylvania, but does provide the farmer with some choice for maturity and plant height. Dubois is no longer grown by seed producers in this state.

## SOUTH CAROLINA

Doyce Graham, Jr., E. B. Eskew, and G. C. Kingsland (Clemson)

Oat acreage harvested in South Carolina was 95,000 acres in 1967. A substantial additional amount is sown for fall and winter grazing but not harvested. Below normal temperatures damaged oats in late February, probably accounting for slightly below normal per acre yields.

Recommended oat varieties in South Carolina are Moregrain, Bruce, Sumter 3, and Suregrain. In the Piedmont, Suregrain is unsuitable because of soil-borne oat mosaic. Arlington 23 is recommended for forage production as are the above varieties.

A three-year study by Dr. Graydon Kingsland conducted in South Carolina between 1961 and 1964 found twenty-seven species of fungi representing 17 genera on wheat, barley, and oat seed stocks. (See publications).

## SOUTH DAKOTA

R. S. Albrechtsen (Brookings)

1967 Season and Production: The 1967 South Dakota oat crop varied from poor to excellent, resulting in a good year on the average. Most of the seeding was accomplished on schedule but germination and early growth were slow in many areas because of a cold spring. Some varieties suffered stand reductions from 20°F. temperatures on three consecutive nights in late April. Unfavorably low temperatures and very limited rainfall during May were detrimental. Above-normal, well distributed rains during June and continued below normal temperatures in June and July made the difference between failure and a good oat crop.

South Dakota is one of the few states in which the 1967 harvested oat acreage exceeded that of the previous year. An estimated 2,357,000 acres of oats were harvested in 1967 compared to 2,288,000 acres in 1966. An average yield of 46.5 bushels per acre resulted in a total production of 109,600,000 bushels which was 45% above the 1966 production and 17% above the 1961-65 average.

Crop losses from disease were very small. Stem rust and crown rust were present but became established too late to do extensive damage to varieties possessing a reasonable degree of resistance.

Seed Increase and Distribution: The South Dakota Foundation Seed Stock Division participated in the increase of Kelsey and Sioux in 1967. Seed of these varieties is being released to County Crop Improvement Associations to be distributed to qualified growers of their associations.

## TEXAS

I. M. Atkins, M. E. McDaniel, Neal A. Tuleen, TAMU, Soil and Crop Sciences; R. A. Kilpatrick (USDA), and Robert W. Toler (Plant Sciences); K. B. Porter and Norris Daniels (USGPRS-Bushland); K.A. Lahr (Chillicothe); J. H. Gardenhire (Denton); M. J. Norris (McGregor); E.D. Cook (Temple); J. P. Craigmiles, R. H. Brown, G. R. Wood (Beaumont); and Lucas Reyes, Beeville.

The seeded acreage of oats for the 1967 crop was 1,357,000 acres, down 17% from 1966. Owing to severe winter and spring drouth, large acreages were abandoned or grazed to maturity by livestock. The harvested acreage was only 302,000 acres which averaged 22.0 bushels per acre for a total production of 6,444,000 bushels. The winter was uniformly cool so no winterkilling of importance occurred. Diseases were not major factors in yield owing to the dry spring.

Performance trials were grown at 8 locations. Yield data were extremely variable owing to the unfavorable season. No great change in commercial varieties was observed. The experimental strain C.I. 8260 from the cross (Santa Fe-Clinton$^2$-Sac-Hajira Joanette x New Nortex-Landhafer, QHR 8104) x (Black Mesdag x Ab 101, C.I. 7650) has now been named Coronado and some 600 bushels of foundation seed was placed with growers. Two additional strains from this cross are being increased for possible substitution or supplementary use.

Denton (J.H.G.): Crown rust races identified from the nursery were 202, 325, 326 and 327. Very little stem rust was observed at Denton in 1967. Studies were continued of forage evaluation of oat varieties. Plots were clipped three times, then allowed to mature a seed crop. Data by clipping dates and total follow:

| | Pounds of a dry forage per acre | | | |
|---|---|---|---|---|
| Variety | Dec. 1 | Jan. 1 | Feb. 24 | Total |
| Norwin | 522 | 502 | 881 | 1905 |
| New Nortex | 358 | 337 | 679 | 1374 |
| Moregrain | 604 | 469 | 721 | 1794 |
| Ora | 382 | 334 | 692 | 1408 |
| Alamo-X | 538 | 393 | 645 | 1576 |
| Bronco | 350 | 361 | 745 | 1451 |
| Elbon rye | 678 | 459 | 1231 | 2368 |

Beaumont (JPC., R.H.B., J.R.W.): Small grain variety forage clipping tests have continued for three years at Beaumont and oats have produced more total forage than wheat, barley or rye. Oats, when grown for grain, make low yields of poor quality. Oats make good growth during the season but produce a light seed crop of low test weight. This apparently is due to climatic conditions (especially high moisture during and after pollination) and to heavy populations of stink bugs.

College Station (M.E.M., N.A.T.): Outstanding success was again attained in oat crossing using the approach method. More than 500 $F_1$ seed of each of 6 oat crosses were made for heterosis studies which are now in progress. Each plot consists of 30 plants spaced approximately $1\frac{1}{2}$ inches apart in a row. Five replicates of each plot are planted at each of three locations. Other tests to measure the competitive ability of $F_1$'s vs. parents as a possible source of bias in yield-heterosis estimates are planted.

A diallel cross among 6 crown rust-resistant Avena sterilis lines was made to determine linkage relationship (if any) among the genes conditioning resistance in these lines. Crosses with Frazier were made to determine the number of genes conditioning resistance in each. Linkages between crown rust resistance loci and genes conditioning undesirable morphological characteristics will also be studied. A search for an easier method of breaking dormancy in A. sterilis and other oats is being made. Male sterility in crosses derived from hexaploid backcrosses to the A. barbata x A. byzantina cross appears to be due to aneuploidy with 80% of progeny having less than 40 chromosomes. One plant having 61 chromosomes was observed.

College Station (R.W.T. and I.M.A.): The feral oat collection is being screened for reaction to the barley yellow dwarf virus. A number of lines appear to have resistance or tolerance. These will be retested.

Bushland (N.D.): The World Collection is being retested for sources of resistance to the greenbug. Preparation has been made to remove single resistant plants and grow them to maturity for retesting. Several lines with resistance have been observed and are being retested.

Dr. Neal A. Tuleen, Cytogeneticist, graduate and formerly on the staff at the University of Minnesota, joined our staff on September 1, 1967.

## WISCONSIN

H. L. Shands and R. A. Forsberg

Wisconsin State Oat Yields and Variety Performance: The planting season of 1967 was late in Wisconsin. This was followed by a cool season with moderate to low rainfall. The state average yield of 61 bushels per acre ties two previous all-time highs in 1958 and 1965. There was considerable lodging in midseason, causing poor filling and low bushel weight on some occasions. The yield estimates were by the Wisconsin Statistical Reporting Service.

Wisconsin harvested acreage was near 1 3/4 million, still on the down trend in spite of high state average yields in recent years. No varietal survey has been made since 1964 at which time Beedee was the leader. Lodi has been increasing in popularity and it is not known whether Beedee was the leader in 1967. Assuming that Beedee was ahead in 1967, this would be the 9th consecutive year for leadership of this variety. Such a record may not be be surpassed in the next 10-20 years. Beedee's crown rust resistance derived largely from Victoria sources is part of the reason for popularity along with plump kernels and virus tolerance. Portage maintains a good grade of crown rust resistance also obtained from Victoria sources, yet Portage has been a wallflower among varieties. Sauk is losing popularity, yet there have been no poor yield reports since this variety was the Wisconsin leader in 1957 and 1958.

A limited number of growers of certified seed reported yields of oat varieties in 1967. Average yields reported for 7 varieties are as follows:

| Variety | Number reports | Bu. per/A average | Variety | Number reports | Bu.per/A. average |
|---|---|---|---|---|---|
| Beedee | 36 | 70.4 | Lodi | 55 | 77.0 |
| Garland | 35 | 71.8 | Portal | 39 | 79.9 |
| Garry | 26 | 74.2 | Rodney | 16 | 76.6 |
| Holden | 61 | 77.5 | | | |

Where 20 or more paired comparisons by growers were available, Lodi, Portal and Holden made good showings. Comparisons of pairs are listed below:

| Variety compared | Number pairs | Yield bu/A | Variety compared | Number pairs | Yield bu/A. |
|---|---|---|---|---|---|
| Beedee | 20 | 68.6 | Garry | 23 | 74.6 |
| Garland | | 71.3 | Holden | | 79.3 |
| Beedee | 32 | 70.4 | Garry | 24 | 75.8 |
| Holden | | 79.2 | Lodi | | 80.0 |
| Beedee | 28 | 70.5 | Holden | 49 | 77.4 |
| Lodi | | 75.4 | Lodi | | 77.8 |
| Garland | 30 | 71.6 | Holden | 38 | 78.7 |
| Holden | | 80.5 | Portal | | 80.9 |
| Garland | 25 | 72.0 | Lodi | 31 | 81.3 |
| Lodi | | 77.7 | Portal | | 78.7 |

In less numbers of pairs Portal was ahead of Beedee, Garland, Garry and Rodney. Holden had 3.3 bushels more than Rodney, and Lodi had a 5-bushel advantage over Rodney.

Crown and Stem Rust: Neither stem nor crown rust was serious in Wisconsin in 1967. Often stem rust infection was found on varieties with AB resistance. An infection pocket was found near Sparta in Monroe County. Near a small buckthorn nursery, originall established by D. C. Arny, most of the named varieties showed high crown rust infection.

Miscellaneous: Two Wisconsin selections show moderate crown rust resistance to local races that are highly infectious on most named varieties. These selections will be placed in the Uniform Midseason Performance Nursery.

Foundation seed of Orbit was made available to growers of certified seed in 1967. Orbit grain yields in Experimental Farm tests have been near those of Lodi.

Personnel items: Dr. I. Nishiyama completed more than 2 years work in Wisconsin, and has continued his *Avena* work at the University of Missouri. Z. M. Arawinko conducts larger plot studies and is responsible for early increases prior to foundation seed production. D. M. Wesenberg expects to complete a thesis on oat grain quality in early spring and join the USDA in small grain work at Aberdeen, Idaho. Miss Wang is continuing work on cytogenetics of oats. Other small grain graduate students are H. G. Nasr, J. J. Schreck, Paul Sun and Olav Stolen.

## OAT RESEARCH AT WASHINGTON STATE UNIVERSITY

C. F. Konzak, K. J. Morrison and G. W. Bruehl (Pullman)

Cayuse, C.I. 8263, released by Washington State University in 1966, was again in 1967 the highest yielding oat variety not only in Washington, but also in the Northwest region. Notable is the fact that it has shown this outstanding performance under both dryland and irrigated conditions, as well as in the absence of appreciable yellow dwarf disease. We compliment Dr. Neal Jensen for his good work in developing such an outstanding genotype.

The other yellow dwarf tolerant selection identified originally, Minn II-22-220, C.I. 2874, ranked second in most of the same tests. Since Minn II-22-220 is more tolerant to yellow dwarf, we have made crosses of the two oat varieties and expect to have $F_3$ lines for exposure to yellow dwarf in 1969.

## VI. NEW OAT VARIETIES

A. Alphabetical List:

| Name | C.I. Number | Origin | Described on page # |
|---|---|---|---|
| Amuri | -- | New Zealand | 51 |
| Florida 501 | 8226 | Florida | 52 |
| Mostyn | 8348 | Wales | 52 |
| Multiline E68 | 8345 | Iowa and USDA | 52 |
| Multiline M68 | 8346 | Iowa and USDA | 52 |
| Pennlan | 7881 | Pennsylvania and USDA | 53 |
| Pettis | 7805 | Missouri | 53 |

b. Descriptions

### AMURI

Amuri was bred at the Crop Research Division, D.S.I.R., New Zealand and released in 1967. It was selected from $Milford^3$ x (Victoria-Richland-Algerian). The first cross was made in 1954, with the intention of producing a rust-resistant strain of Milford, and the original single-plant selection was made in 1958.

Amuri is a white oat with a fairly small equilateral panicle and a rather thin grain with a low husk content. It is short-strawed and resistant to lodging, early-ripening, and fairly susceptible to straw break when ripe. It is resistant to crown rust and fairly tolerant to late infection with BYDV.

It is expected to replace much of the main forage variety, Algerian, as it is considerably more productive for early grazing, has stronger straw and gives higher grain yields. Samples have been sent to some overseas oat breeders under the selection number 80,02.

## FLORIDA 501

Florida 501 (C.I. 8226) is a selection from a cross (Florad 5 x Fulgrain-3 x Suregrain 4 x Victorgrain$^2$ 2 x Fulghum 3 x Suregrain) made by W. H. Chapman in the spring of 1959. The first variety released from this cross was Florida 500 which was variable, especially in maturity and glume color. Twenty-five selections representing variability in the line, later released as Florida 500, were made by Dr. Dale Sechler in the spring of 1963 and grown at Aberdeen during the summer. The selection, grown in row 378 at Aberdeen, was found to be uniformly resistant to race 264 of crown rust in Puerto Rico, and observations at Quincy and Gainesville indicated that it represented a high level of field tolerance to H. avenae.

Florida 501 is medium early (slightly earlier than Suregrain), short (2 inches shorter than Suregrain), comparable to Suregrain in winter hardiness, tillers profusely, and exhibits an intermediate to upright growth habit. The variety was the top grain yielder and had the highest test weight of all entries in the Uniform Southern Winter Oat Nursery (9 locations) in 1966. It appears to be better adapted east of the Mississippi River. Over a three-year period Florida 501 produced more early forage at an early date (first clipping in December) than other recommended varieties.

Florida 501 is highly resistant to the prevalent races of crown rust, tolerant to soil-borne virus, and exhibits an intermediate reaction to H. avenae under greenhouse conditions.

Foundation seed is available from the Florida Foundation Seed Producers, Inc. in the fall of 1968.

## MOSTYN

J. D. Hayes and D. A. Lawes
Welsh Plant Breeding Station, Aberstwyth

Mostyn (C.I. 8348) is a spring oat variety which was developed at the Welsh Plant Breeding Station, Aberystwyth, involving the wild oat Avena sterilis var. ludoviciana, which contributed mildew resistance, Powys, Pennant and Condor. It was tested in National Institute of Agricultural Botany Trials in Britain from 1965 to 1967 under the code number 05689/1/70.

Mostyn has resistance to races 1, 2 and 3 of mildew (Erysiphe graminis f. sp. avenae) and under conditions of severe mildew infection is markedly superior to other non mildew resistant varieties. The straw of Mostyn is slightly shorter and stiffer than that of Condor, the variety which it most closely resembles. Mostyn is a white grained variety which combines high grain yield with mildew resistance and is suited to a wide range of fertility conditions.

Mostyn was granted Plant Breeder's Rights in December 1967 and appeared as the highest yielding spring oat variety on the British Recommended List for 1968.

## MULTILINE E68 and MULTILINE M68

Multiline E68 (C.I. 8345) and Multiline M68 (C.I. 8346) were developed for use in Iowa and other areas of the North Central States where crown rust is a major threat to oat production. They are mechanical mixtures of isogenic lines each of which has "vertical resistance" to crown rust, to give a cultivar which behaves as if it were a pure line with "horizontal resistance." This should delay the onset of rust epidemics and provide longer lasting resistance to crown rust.

Eight isogenic lines were developed using the recurrent parent, C.I. 7970, which has the B gene for stem rust resistance and the Garry gene for crown rust resistance. C.I. 7970 and a sister line (C 237-89V) were selected on the basis of their agronomic similarity and their different combinations of genes for crown and stem rust resistance. These 10 lines were selected for agronomic performance at four Iowa locations in 1966 and 1967 and were found to be essentially identical in yield, grain quality, and standing ability. They expressed different reactions to 13 prevalent races of crown rust. The 8 isogenic lines derived from backcrossing and the 2 lines selected directly were combined in different proportions to make the cultivar 'Multiline E68.'

For Multiline M68, 8 isogenic lines were developed using the recurrent parent C.I. 7555, which has the A and B genes for stem rust resistance and the Landhafer genes for crown rust resistance. These 8 lines, with different genes for crown rust resistance, were tested at 4 Iowa locations in 1966 and 1967. All equaled or were better in yield than the recurrent parent. When tested for reaction to 13 prevalent crown rust races, they expressed differential responses. The 8 lines were mixed in various proportions to provide breeders seed of cultivar 'Multiline M68.'

Multiline E68 is very early in maturity, short in height, and produces large, plump ivory-colored seed with a bronze basal tip. Multiline M68 is midseason in maturity, medium in height, and produces medium size, yellow seed. Both multilines carry A and B genes conditioning resistance to stem rust races 6, 7, 7A and 8, but susceptibility to more virulent biotypes like races 6AF and 6 AFH. They are heterogeneous in reaction to crown rust. As individual lines, they were tested once in 1967 at 7 locations in Iowa. They were also tested in other states in the Midseason and Early Uniform Nurseries in 1967.

## PENNLAN

Pennlan, C.I. 7881, is a new winter oat with short straw and early maturity for production in southcentral and southeastern Pennsylvania and other areas with similar climatic conditions. The parentage is Ballard 6 x Landhafer x Clinton$^4$ 5 x Osage 3 x Bonda 2 x Hajira x Joanette 4 x Santa Fe. The final cross was made by F. A. Coffman (X56BP) at Aberdeen, Idaho, in 1956. Subsequent growing and selecting was done at Beltsville and Aberdeen until 1962 when seed from 5 rod rows were turned over to H. G. Marshall for testing in Pennsylvania.

Pennlan was evaluated in replicated yield trials in Pennsylvania from 1963 through 1967 and in the Uniform Northern Winter Oat Nursery from 1963 through 1966. In Pennsylvania, Pennlan was equal to Norline, the major recommended variety for winter survival, yield and lodging resistance. The grain tends to have a slightly lighter bushel weight than that of Norline. Pennlan is about 3 inches shorter than Norline and about one week earlier in maturity.

## PETTIS

Pettis, C.I.7805, Mo. 04935, is from the cross Victoria 2x Hajira x x Banner 3 x Victory 2 x Hajira x Ajax 4 x$^3$ Mo. 0-205. An oat selection, R.L. 2100, from Dr. J. N. Welsh, Canadian Department of Agriculture, Winnipeg was crossed with Mo. 0-205 in 1949 at the Missouri Agricultural Experiment Station, Columbia. Reselections were subsequently backcrossed to Mo. 0-203 in 1953 and 1954 with the final selection made in 1958. Pettis has high grain yield, high groat percentage, heavy test weight, earliness, AB genes for stem rust resistance, and excellent tolerance to BYDV. Seed is red and moderately plump and heavy. Straw is about 1 inch shorter and slightly weaker than Mo. 0-205. Pettis has been tested in the U.S.D.A. Uniform Early Oat Performance Nursery from 1962 through 1967.

## VII. GERMPLASM MAINTENANCE

### USDA SMALL GRAIN COLLECTION

J. C. Craddock, USDA, Beltsville, Maryland

The Small Grain Collection accessioned 1,133 oats from foreign sources during 1967. These accessions included 776 specimens of *Avena sterilis*, 264 *A. barbata* and the remainder *A. sativa*. Emphasis has been placed on obtaining samples of *A. sterilis*. Preliminary indications are that the *Avena sterilis* may possess valuable germ plasm for the improvement of cultivated oat varieties. Screening trials have revealed lines possessing outstanding resistance to disease organisms, particularly the rust fungi and/or with high percentage of protein.

Cereal Investigations (C.I.) numbers were assigned to 16 entries obtained from domestic sources. These are listed.

All entries in the Small Grain Collection are open stock and will be distributed for research purposes. Only those varieties that have been declared open stock by their originator and/or agency are accepted in the collection. Please review your breeding material for selections that can be declared open stock. I urge you to submit these lines to the collection so that outstanding germ plasm will not be lost.

A reminder that seed from $F_1$ and $F_2$ plants surplus to your needs is solicited for the Gene Bank. During 1967 there were nine pounds of seed contributed to this bank. Seed is available for distribution.

C. I. NUMBERS ASSIGNED IN 1967

| C.I. number | Name or Designation | Pedigree | Origin and/or source |
|---|---|---|---|
| 8304 | Minn. II-54-109 | Landhafer 3 x Mindo 2 x Hajira x Joanette 4 $x^2$ Andrew 5 x Rodney | Minnesota |
| 8305 | Minn. II-54-120 | Landhafer 3 x Mindo 2 x Hajira x Joanette 4 x Clinton 5 x Rodney | Minnesota |
| 8306 | Quaker '604' | | Brazil |
| 8307 | Common Yellow | | Brazil |
| 8308 | | CD 3820 x CI 2515 | Canada |
| 8309 | Mo. 05128 | Clinton x Hairy Culberson | Missouri |
| 8310 | Mo. 05145 | Dubois x Wintok | Missouri |

C.I. NUMBERS ASSIGNED IN 1967, continued

| C.I. Number | Name or Designation | Pedigree | Origin and/or source |
|---|---|---|---|
| 8311 | Stw. 594376 | Arlington x Wintok | Oklahoma |
| 8312 | Pa. 64-18-1099 | Craigs after lea x CI 8126 2 x Ballard x Dubois | Pennsylvania |
| 8313 | Pa. 63-16-9195 | Wintok Selection (C.I. 5849) x Clintland 60 | Pennsylvania |
| 8314 | Fla. 66AB25 | Southland x Silva 2 x Coker 61-24 | Florida |
| 8315 | Fla. 66AB41 | Delair 2 x 0-200-10 x Southland 3 x Florida 500 | Florida |
| 8316 | Fla. 66AB43 | Delair 2 x 0-200-10 x Southland 3 x Florida 500 | Florida |
| 8317 | Fla. 66AB-46 | Floriland x Florida 500 | Florida |
| 8318 | FRASER | Eagle 2 x R.L. 1574 x Roxton | Canada |
| 8319 | CABOT | Fundy x Garry | Canada |

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