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OAT NEWSLETTER

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April 1, 1975

Sponsored by the National Oat Conference

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Volume 25

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Marr D. Simons, Editor

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ANNOUNCEMENTS AND INSTRUCTIONS

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

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

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

PLEASE DO NOT CITE THE OAT NEWSLETTER IN PUBLISHED BIBLIOGRAPHIES

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

Citing the Newsletter creates a demand for it 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".

MEETING OF INTEREST TO OAT WORKERS

Dr. G. P. Redei, Professor of Genetics, University of Missouri, has asked us to announce the following meetion:

7th STADLER GENETICS SYMPOSIUM

APRIL 18-19, 1975 — COLUMBIA, Mo.

E. Chargaff: Impact of Biochemistry on Genetics.
R. B. Helling: Eukaryotic Genes in Prokaryotic Cells
O. L. Gamborg: New Advances in Somatic Cell Hybridization in Plants.
F. Flavell: Genome Organization in Higher Plants.
N. Sueoka: Chromosome Replication and Gene Expression in Bacillus subtilis.
C. D. Miles: Genetic Analysis of Photosynthesis.
A. C. Wilson: Relative Rates of Evolution of organisms and Genes.
G. B. Johnson: Enzyme Polymorphism and Adaptation.
D. E. Metter: Natural Selection and Adaptive Resemblances.

Detailed Program can be obtained from Conferences and Short Courses, University of Missouri, 348 Hearnes, Columbia, Mo. 65201.

Proceedings of this and previous Symposia are available from Stadler Genetics Symposia, 117 Curtis Hall, University of Missouri, Columbia, Missouri, 65201. Vols. 3-5 $4.00, vols. 6 and 7 $4.50, each. For postage and handling 50¢ is due per order.

II. SPECIAL REPORTS
General

The Peter Principle Applied to Small Grains
Darrell D. Morey

About two years ago, Dr. Robert Littrell, Plant Pathologist and fellow worker at the Georgia Coastal Plain Experiment Station, brought me a paper-bound book entitled, "The Peter Principle". He suggested I might find it interesting. I'm not a very avid reader, especially of things highly scientific; so after noticing a few uninteresting and somewhat old fashioned pictures, I laid the book aside.

Sometime later, I noticed Margaret Clements, our secretary, was reading the book with an occasional eye on me as if she had discovered something. When she left the room, I picked up the book and this is the passage she had just read, "In a hierarchy, every employee tends to rise to his level of incompetence".

It seemed to me this must be a misprint so I checked the front of the book again. The title read, "The Peter Principle" (with the last E printed backwards) and the sub-title, "Why things always go wrong".

After a careful reading of this little book, I could certainly see how the salutary science of Hierarchiology would fit many of the people I knew. Remember, "in a hierarchy, every employee tends to rise to his level of incompetence". Sooner or later he will achieve or be promoted to his level of incompetence. This would fit most department heads, division chairmen, deans, directors, an occasional soils man, entomologists and possibly some pathologists, engineers, home economists and animal scientists. But I couldn't believe agronomists or plant breeders could possibly be incompetent enough to be classified under The Peter Principle.

It was more than a year later, while moving my books to a new location, I rediscovered "The Peter Principle" and decided there might possibly be a few agronomists "who have risen to their level of incompetence". It was a difficult decision, especially to admit that I was one of them. It slowly dawned on me what Dr. Littrell and Margaret had known all along.

With your indulgence, I intend to show by personal example how The Peter Principle can be applied to small grains.

My first success came about the time that Willis Chapman (now Director of the North Florida Experiment Station at Quincy) introduced Southland oats. While Chapman was selling Southland oats at $2.50 per bushel and building a sound and lasting reputation, I was giving away oats by the handsful to eager plant pathologists. The word had gotten around that Morey had some oats that would grow more kinds and varieties of Helminthosporium and do it better than any oat so far discovered. The petri-dish flurry was over about like a winter snow storm, but I had tasted my first success under The Peter Principle.

In all modesty, I must tell you I had three Triticales long before the name became a household word. I crossed Bledsoe wheat with rye and then lightning struck or somehow the chromosomes were doubled to produce a triticale. This triticale was remarkable! It was the only small grain I have ever seen which rusted before it came out of the ground. The plumules were covered with rust when they broke the surface. I have not reported this phenomenon before for fear of causing terrible dissention among plant pathologists, who generally do not believe that rust is seed-borne.

The second triticale was a success in a different sort of way. One day a friend of mine asked me if that particular triticale was cross pollinated or self pollinated. I didn't know, but any good agronomist would rise to that kind of bait so I decided to find out. I bagged a few plants and left some open to the April breezes. It didn't make any difference because when I threshed the bagged plants, I didn't get any seed, and when I threshed the "April breezes" I didn't get any seed either. That triticale wound up where it should have been--eliminated!

The last triticale was eliminated a little differently but just as successfully. The weed specialist passed my door one spring day to say "man you are gonna ruin the agronomy farm if you don't get rid of that wild wheat out there". I went to see what he was raving about and sure enough my last triticale had shattered in a stiff breeze and the ground was covered with spikelets. I scooped some up and put them in my shirt pocket--which was a mistake. When I got back to the lab, I couldn't get the hairy, bearded things out of my shirt. Finally, I got some lined up on the lab table, all scientifically facing east, and gave them the old thumb test. Sure enough, there wasn't any seeds in any of them. The Peter Principle had proved itself again.

Several years ago I had a short wheat which proved to be resistant to leaf rust and mildew. I decided it must be good enough to increase and release, so I planted 3 acres in a back field. It looked pretty good for awhile, then it turned a sickly yellow. I poured on the nitrogen in 2 or 3 applications and it stayed stunted and yellow all winter long. About harvest time it appeared there might be some grain so the 3 acres were harvested. I had made arrangements with Dr. Otho Hale, our swine man, to run a wheat feeding test with pigs. Several bags of wheat were delivered to the swine barn and trials began. Some days later he said, "I'm about out of wheat, I'd like another load". When I told him one load of 40 bushels was the entire crop, he went away (muttering about agronomists) to finish his pigs on corn--as he should have done in the first place.

The Peter Principle has been used to produce a wheat which has been requested in Florida and Oklahoma as a tester for certain virus diseases. I understand it's in the running for "virus of the year" award.

Anyone who is anyone these days has a barley composite. It is one of the strongest status symbols now in vogue. Not to be outdone, I have had Tifton barley composite for 2 seasons. I figure spot blotch, barley yellow dwarf virus and other famous diseases and insects will finish it off in 1975. That will be another working demonstration of The Peter Principle at its best.

The Peter Principle will work with rye, rice, sesame, sunflowers and even amaryllis. In experienced hands, it might work with other things.

Reference: The Peter Principle by Laurence J. Peter and Raymond Hull, Bantam Books, William Morrow and Co., Inc., New York.

ISOGENIC LINES, A TOOL FOR RESEARCH

I. M. Atkins[1/]

Several times before his death, Dr. H. K. Hayes and I discussed the idea of isogenic lines. Later he wrote me that he was preparing a review of the idea and asked for help on literature review, which I sent him in 1966. Apparently he never finished the report. Dr. Hayes expressed these thoughts, "studies using isogenic lines are extremely important to the plant breeder and we have too little such research on genes for yield". Having had a part in the original suggestion, (2) Atkins and Mangelsdorf, I shall attempt to finish what he proposed to do.

Some have objected to the term "isogenic lines" and have preferred to call them "near-isogenic", "isolines", "closely related lines", "back-crossed lines" or have simply described the phenotypes and how they were derived. It matters not which term is used or exactly how they are developed (within limits), if they are comparable. In our original paper, we used the example of crossing an awned with an awnless variety of wheat, then selecting through the awn-tipped heterozygote for several generations to develop awned and awnless isogenic lines. This method does not lend itself to use with more complex characters or those which cannot be easily recognized. The backcross method has been used extensively to produce isogenic lines. Perhaps the most perfect method is one reported by Schertz (4) where a haploid sorghum plant was doubled and then mutated to produce two height classes. The selection of apparent isogenic lines from advanced generations and from mutations have been used but these frequently differ in more than one gene or characteristic.

As Dr. Hayes also pointed out, "We realize that so-called isogenic lines may not be completely isogenic, as the transfer of a factor or factors by back crossing to a recurrent parent may, and probably does, carry a few closely linked genes along with the main gene being transferred. However, the method seems excellent to me as a means of learning the importance of specific genes".

After the method was suggested in 1942, the idea lay dormant for some time. In 1952, Wiebe (5) reported on studies of barley using isogenic lines. Since that time, the method has been used by many research workers and results reported in more than 150 publications.*

[1/] Retired Professor Emeritus, Texas A & M University, College Station, Texas. Now employed by Grain Research Associates.

* A list of about 150 publications is available from my office. See Newsletter for address.

Isogenic lines have been extensively used in disease studies, especially the cereal rusts and mildew; and, in rusts of flax, corn and sorghum. As Anderson (1) pointed out in 1961, "the single gene lines can be maintained as ideal tester stocks to determine whether or not a variety being tested possesses the gene or allel. Also, these are excellent tools for dosage effects and they could be used as differential hosts". Since that time, the phenominal progress which has been made in surveys, physiology and the biochemistry of host:pathogen associations and genetics, is due to the use of isogenic lines. Most of the national rust laboratories now maintain many isogenic lines carrying single rust genes for their research. Also lines with specific rust genes are used in the production of multiline varieties; and, in the production of corn and sorghum hybrids by commercial companies. Isogenic lines are ideal tools for measuring disease losses in crops. Control of diseases with fungicides for disease loss estimates introduces other factors and may control diseases other than the one being studied.

Isogenic lines have been extensively used for comparing the effect of simply inherited characters on development of plants, grain and forage yields, test weight and quality of grain. In wheat, the effect of awns, seed color, the compactum head type, leaf and blade characters etc. have been studied. Similar studies have been made in sorghum and rice. Height of the plant has been of special interest as semidwarf wheat and sorghum were developed and came into commercial use. The effect of height is important, not only on grain yield and quality, but on root development, leaf area and exposure and on forage production. Recently, Washington State University made available to other workers some 20 lines, isogenic for four height classes, for use as parental stock or test material for appropriate morphological, genetic, physiological, developmental and biochemical studies. Isogenic lines were used to study pollen spread in different types of wheat as part of the hybrid wheat effort. Quality of grain has been studied using isogenic lines in both bread and durum wheats.

Isogenic lines have been used in barley to evaluate the importance of awns, awn length, barbing of the awn, hooded glumes, naked seed, aleurone color, 6 vs 2-rows of seed, rachilla and plant characters etc.; plus, lines with single genes for disease studies. In 1971, Mosemanm Wiebe, Hockett and Ramage placed 96 pairs of isogenic lines in the U.S. Barley Collection (16001-16192). These are available for studies of plant environment, plant-pathogen interactions as well as quantative genetics, physiological, morphological and biochemical properties of seeds and plants. In 1972, Reid placed an additional 146 pairs of winter barley isogenic lines in the collection (16193-16484). The effect of nodulation in soybeans has been studied using isogenic lines. Numerous mutant genes for seed, lint and plant characters were studied in cotton and the effect of leaf shape was studied in flu-cured tobacco using isogenic lines.

Recently, the use of isogenic lines has developed in the field of crop physiology. Among those recorded are studies of high and low coumarin in sweet clover; the effect of pubescent vs glabrous leaves on transpiration and phytosynthetic rate in sorghum; early vs late maturity in pearl millet; efficient and inefficient uses of iron in soybeans; the effect of leaf area on phytosynthetic rate and light penetration in soybeans; growth analysis and light interception in tomatoes; pigment and lignin content in peas; physiology of awns in barley and wheat; the development of reducing sugars and sucrose in rust resistant and susceptible isogenic lines of wheat; leaf area index in barley; endosperm carbohydrate synthesis in corn and the physiology of growth and agronomic characters with alien cytoplasm in male sterile tobacco. Recently a study was made of the development of weevils in opaque-2 and floury-2 isogenic lines of corn, the only observed use of this tool in entomology.

The development of suitable materials for studies of so-called "yield genes" is more complex. Dr. Hayes also stated that "isogenic lines for the study of yield genes offers opportunities not yet explored or exploited". Recently Frey (3) published a paper in this general field. Even more recently, (private correspondence) his group is extending the isogenic line idea to isogenic populations. To do this he states "they are creating a group of 'genetic probes' in which each chromosome carries a unique marker gene. The idea is to cross a given unknown oat line with 21 probes, one for each chromosome, and then test isogenic populations for the quantitatively inherited trait. By comparison of means and variances between populations in the 21 series created by crossing the probes with the unknown lines, they should be able to detect the occurrance of chromosomes that are especially significant in the inheritance of so-called 'Quantitatively inherited traits', including yield".

Literature Cited

1. Anderson, R. G. 1961. The inheritance of leaf rust resistance in seven varieties of wheat. Canad. J. Pl. Sci. 41:343-359.

2. Atkins, I. M. and P. C. Mangelsdorf. 1942. The isolation of isogenic lines as a means of measuring the effect of awns and other characters in small grains. Agron. J. 34:667-668.

3. Frey, K. J. 1972. Stability indexes for isolines of oats. Crop Science 12:809-812.

4. Schertz, Keith F. 1973. Single height-gene effects in hybrids of doubled haploid, Sorghum bicolor (L) Moench.

5. Wiebe, G. A. 1952. Isogenic analysis in barley. Amer. Soc. Agron. Meeting, Cincinnati, Ohio.

Collection and Evaluation of Avena fatua L.

L. W. Briggle and V. L. Youngs

In 1974 an extensive collection of plants of Avena fatua L. was made in western Minnesota, North Dakota, South Dakota, Montana, Wyoming, Idaho, and Utah. We did not cover as large an area as planned because of time limitations and did not adequately sample all areas in the above-listed states. Next summer (1975) we would like to complete those states and also collect in Washington, Oregon, and possibly northern California. Perhaps the following year (1976) we can cover the southern part of California and such states as Arizona and Texas.

We now have 2336 A. fatua collections. Some of these were contributed by R. N. Anderson, USDA-ARS and University of Minnesota, C. O. Qualset and S. K. Jain, University of California, D. M. Wesenberg, USDA-ARS and University of Idaho, V. D. Burrows, Agriculture Canada, Ottawa, A. P. Roelphs, USDA-APHIS and University of Minnesota, Douglas Baker, North American Plant Breeders, Ames, Iowa, and D. M. Stewart, formerly USDA-ARS and University of Minnesota. We had about 450 of the 2336 prior to the collection trip in 1974.

Approximately 400 collections were grown in a special increase nursery near Aberdeen, Idaho in 1974, in cooperation with Dr. J. C. Craddock, Beltsville, Maryland and Dr. D. M. Wesenberg, Aberdeen, Idaho. Seed of each collection must be increased to an amount sufficient for numerous evaluation tests to be conducted. Our plans are to increase up to 1,000 collections in the same area near Aberdeen, Idaho in 1975.

Evaluation tests are already underway on the 400 increased in 1974. This group is in crown rust nurseries in Puerto Rico this winter (1974-75). Dr. M. D. Simons plans to include the set in crown rust resistance and tolerance tests in 1975. Dr. H. Jedlinski plans to test the plants for Barley Yellow Dwarf Virus (BYDV) tolerance at Urbana, Illinois in 1975. We plan to test seedlings of this set at St. Paul to specific races of crown rust this winter and Dr. Rothman will include them in stem rust tests. Various quality tests (protein content, oil content, amino acid profile, groat weight, groat %, etc.) will be conducted at the National Oat Quality Laboratory, Madison, Wisconsin.

Avena fatua is one of the most common and obnoxious weeds in our North Central Region. It occurs nearly wherever spring small grains are grown, and to some extent where winter small grains are grown (Texas, for example).

This large area encompasses the North Central, Western, and Southern Regions. Very little use has been made of this wild species as a source of genetic variability or as a source of specific desirable characters. It can be crossed readily with A. sativa, our common commercially grown oats. Recently we found resistance to crown rust race 203 in five collections from California. Characters of possible utility in A. fatua include disease resistance, early maturity, rapid growth rate, seed dormancy, high seed protein, and high groat percentage.

The principal reason that little work has been done on collecting and testing A. fatua is that it is such a difficult species to work with. A great deal of care and labor is required in growing plants in a nursery, for example. Seed shatters readily when it ripens. Plants have to be bagged prior to maturity or seed must be picked from the plants almost daily during the maturation period. In spite of such difficulties, we believe there is tremendous potential in the use of A. fatua for improvement of A. sativa, our common oats.

Genetic Variation for Photosynthetic Activity in Oats

D. A. Lawes
Welsh Plant Breeding Station, Aberystwyth

In a series of experiments, using the Warburg manometric technique, varietal differences in photosynthetic activity of seedling leaves, flag leaves and glumes have been established. Analysis of the genetic system controlling this character has been further studied in a diallel cross and results have indicated i) the highly significant genetic variability for photosynthetic activity and ii) the apparently high level of dominance, and perhaps duplicate gene type epistasis, both directed towards low photosynthetic activity.

Frequency, size and diffusion resistance of stomata have also been examined on flag leaves and glumes. Varietal differences for stomatal diffusion resistance were established but there was no evidence in this material that low stomatal resistance was associated with high photosynthetic activity.

MILLING QUALITY CHARACTERISTICS OF OATS

Donald J. Schrickel
Quaker Oats Company

Milling quality characteristics of oats are the result of several factors including the following:

1. Heredity.
2. Climate.
3. Availability of plant nutrients.
4. Cultural practices.

In many cases, these characteristics are a combination of two or more of these factors, but the first described below are those which deal primarily with heredity.

The desirable oat kernel should be relatively large, plump and uniform in size with a groat percentage approximating 75%, and a test weight per bushel of 36 pounds or more.

A great deal of emphasis has been placed on plumpness and groat percentage in recent years, but with the current demands for higher protein percentage we now would be willing to compromise slightly on kernel plumpness, size and hull percentage in order to obtain higher protein. This does not mean we would be willing to accept extremely thin oats of high hull percentage and low test weight, but within reason some sacrifice could be made of these milling characteristics which we have stressed a great deal in the past.

The quantity of oil in oat groats for milling has traditionally been restricted to a maximum of 8% because of storage problems developing at higher levels. However, we have been able to increase the maximum to 10% without encountering serious difficulty. This was done to accommodate situations in which high protein lines were high in oil content.

Double oats or bosom oats are high in hull percentage and result in low milling yield, and the elimination or reduction in number of double oats would be extremely beneficial toward improved milling yields. This characteristic is typical of the type which is influenced by several of the factors mentioned earlier.

Groat color is of extreme importance in the furnishing of an attractive product. This characteristic is more influenced by climate than any other, although heredity is certainly involved.

Most of the oats which do not meet milling quality specifications in the marketplace today are rejected for the following reasons:

1. Mixtures with other grains - particularly barley.
2. Excessive amounts of foreign material - particularly weed seeds.
3. Thin oats - which would provide extremely poor milling yields.
4. Low test weight.
5. Weathering.
6. Contamination - such as rodent pellets.

Moisture content has not been included in any of the reasons for rejection of oats in the marketplace since it represents such a small quantity factor, but our milling requirements specify 13% moisture or less.

Milling quality characteristics of oats delivered on our 1973 High Protein Oat Contract Program were substantially better than oats generally available on the open market. This is attributed to the use of certified seed, better cultural practices, and separate handling at the country elevator level.

Protein Production of a Partially Day Length Insensitive Oat when Harvested for Grain and Forage in Mexico

F. J. Zillinsky and Mat McMahon

Editorial note: Drs. Zillinsky and McMahons pointed out that oats must have some degree of day length insensitivity to produce seed in Mexico. In 1973-74 they ran a clipping experiment on a partially day length insensitive oat at Navojoa, Mexico, to see if they could increase total forage production. The young oats had 30% protein when clipped at the early growth stage, and the fiber content was so low that they can be used as a protein supplement for poultry and swine. The data are shown summarized below.

Protein Production from a Partially Daylength Insensitive Oat Strain (Mayo Velley Station, Navojoa, 1973-73)

Treatment	Grain yield Kg/ha	Forage yield DM Kg/ha	Forage protein Kg/ha	Total protein Kg/ha
Harvested for grain	4000	0	0	720
Clipped once	4000	2500	750	1470
Clipped twice	3500	4000	1200	1830
Clipped 3 times	not harv.	5000	1500	1500
Harvested (milk stage)	0	10000	1700	1700

Relative Nutritional Value of Barley, Corn and Oat Cultivars. Two Tests.

Max Rubin, J. W. Johnson, D. R. Schoonover, U. of Md., College Park,
R. T. Smith, USDA, Beltsville, Md.

The search for nutritionally improved cereal cultivars is a continuing process. The only reliable method to measure this value is still the use of an experimental animal for biological assay.

The basic diet used by Mertz, Bates and Nelson to demonstrate the nutritional value of opaque-2 corn was used for two tests. A commercial rat chow, winter barley 'Barsoy', normal corn '3369A' and opaque-2 corn 'D2202' were included in both tests.

The table includes: cultivar identification and gain in weight (final-initial) during a four week growing period for both tests. Because the initial mean weight of rats in test 1 was higher than that of test 2, the tests were analyzed separately.

Table: Four week weight gain for rats fed diets containing barley, oat or corn cultivars. Two tests.

Test 1 Gain (g)	Test 1 Cultivar	Test 2 Cultivar	Test 2 Gain (g)
199.8	Rat Chow - Check	Rat Chow - Check	173.8
91.8	Barsoy - WB 1)	Barsoy - WB 1)	61.0
139.8	D2202 - o2	D2202 - o2	85.3
29.7	3369A - N	3369A - N	13.7
88.5	3369L - o2	Rapidan - WB	46.6
60.2	M65 - N	Naked x Dayton - WB	83.5
118.2	R8024-OH43 - o2	Large Naked - SO	103.2
107.0	X-099L - o2	Hinoat Sib - SO	30.8
116.2	X-02 - o2	Hinoat - SO	83.7
93.6	Birgitta - SB	Hinoat x Roanoke 2)	69.9
108.1	Ingrid - SB	Roanoke x Hinoat 2)	56.3
108.4	Kristina - SB	Roanoke - WO	40.1
104.2	Glacier - Ac38 - SB		
94.3	Glacier - Ac39 - SB		
11.2	L.S.D. (.05)	L.S.D. (.05)	12.9

1) - WB = Winter Barley, - WO = Winter Oat, - N = Normal Corn
- SB = Spring Barley, - SO = Spring Oat, - o2 = Opaque-2 Corn

2) F_2 bulk selfed thru F_4.

It is evident that measurable differences exist within and between cereal genera. The lower yielding opaque-2 corns have higher gains than the normals. There are discrete differences within the two normal corns and within the opaque-2 corns. There are differences within and between the spring and winter barleys. 'Rapidan' barley is inferior to Barsoy but is grown more extensively. The naked barley and naked oat show good gain but again yield will limit use. The Hinoat - Roanoke series show good differences for gain even within the same cross.

Though nutritionally superior cultivars exist within each crop, as long as economic reward for production is dependent entirely on weight, nutritional quality improvement must parallel yield for quality improvement to be commercially meaningful.

OATS FOR DAIRY CATTLE

James W. Crowley
University of Wisconsin-Madison

Oats for the dairy cow is usually interpreted as the whole grain. For other species, oat groats may be the assumed feed. The dairy cow can certainly utilize oat groats but because of her ability to utilize the whole grain efficiently, this extra processing is not necessary. When the other ingredients in the grain ration are very low in crude fiber (shelled corn and soybean oil meal), the extra fiber provided by 20 to 25 percent whole oats can improve the ration. Research work, chemical composition, and conclusions given here refer to whole oat grain rather than groats used in other papers.

Although most of the comments refer to oat grain, the efficient use of the whole plant is a very significant factor in the utilization of home-grown oats. The straw is a valuable by-product for bedding. Also, potential for using the whole plant for silage adds an additional way to increase the returns from oats on the dairy farm.

Nutritional Value of Oats.....

The nutritional value of a feedstuff must include several factors. The primary one is nutrient content, but acceptability by the animal, safety to the animal, no harmful effect on milk or meat, and convenience in feeding must also be assured. When these requirements are satisfactory, then competetive cost becomes the final factor to consider.

The general textbook statement on oats for dairy cows is "Oat grain is an excellent dairy feed." This general statement essentially concerns the acceptability, safety and convenience of utilizing oats in the dairy concentrate. The fact that oats are an excellent feed may also be correctly interpreted as a feed with no special value or use other than its nutrient content. In other words, it is not an especially good protein supplement, energy supplement, nor does it contain any unknown factor that stimulates extra performance.

As shown in Table 1, oats are chemically nearly ideal as a complete feed for dairy cows.

Table 1. Nutrient Content of Oats and Requirements of Cow

	Chemical Composition	
	Oats(1)	Total Ration(2)
Crude protein	13.2	14
T.D.N.	75	65
Crude fiber	11.9	13
Calcium	0.1	0.5
Phosphorus	0.37	0.35

(1)N.R.C. - 100% dry matter basis.
(2)N.R.C. - 100% dry basis for cow producing 44-66 lb. milk.

As shown in the table, oats would not be an especially good supplement to correct a nutrient deficiency. For example, if the forage was low in protein, oats could not be used to correct the deficiency. Although higher in energy than the requirement, the surplus is not great enough to correct a major deficiency unless large quantities are used. Thus, oats are an excellent feed for dairy cows but used as a major ingredient in the ration rather than a special supplement. To correct an energy shortage, corn at about 90 percent T.D.N. would be a better supplement than oats. To correct a protein shortage, one of oil meal would have more potential.

Assuming that genetic changes in nutrient content would primarily be quite small, there is not much hope that oats will have a special value in the dairy ration. Since oats would be produced as a feed crop in areas that also produce hay, especially alfalfa, they would be needed more for energy than protein. The possibility of using oats to correct the protein deficiency of corn silage and corn grain looks rather difficult. However, improving energy content by assurances of high quality grain, decreased fiber and more fat could improve the potential for oats as a supplement to hay crops.

The acceptability, or palatability, of oats in dairy rations is very good at present. A new variety would not likely result in a change but must be considered. Generally the cereal grains are quite acceptable to cows, although very fine grinding, especially of barley and wheat, can present some problems. Limitations on the amount of cereal grains previously suggested in the grain mixture have largely been removed when processing such as rolling, coarse grinding or crushing are used. A new low fiber, high fat oats might be less palatable than present oats but could probably be corrected by changing preparation methods. Unsaturated fats could decrease storage time, especially after grinding, because of rancidity. This problem is currently experienced with high oil seeds such as soybeans. The difficulty or problem is overcome by more frequent grinding and in some complete feeds anti-oxidants are used.

Safety of oats to the cows and milk quality is not a problem with current varieties. Molds and fungi, however, can be a problem. These are usually present when weather or other environmental factors are adverse. However, new or different varieties that have more resistance, or at least as much as current varieties, are needed. The need for chemicals to control pests or diseases on any crop can present special problems to dairy farmers because of the strict controls on milk.

Grinding or other processing of oats is, again, very good with present varieties. High oil feeds such as whole soybeans do present some problems with hammer-mill grinding. It is not likely that an increase in oil content of oats will cause any problem.

From a nutrition aspect, the primary factor that limits the use of oats in the dairy ration is comparative cost. Even when given extra credit for the additional protein, oats must essentially be purchased or produced at the same cost as corn. When used as an energy source, oats are worth about 90 percent the value of corn. Table 2 shows the value of a hundred pounds of oats, using the factors published in "Feeds and Feeding" for cows receiving oats as the chief grain.

Table 2. Value of Oats Compared to Corn and S.O.M.
(Factors from Table 11, "Feeds and Feeding")

Price of 100 lbs corn	Value of 100 lbs S.O.M. $8	$10	$12
3.00	3.18	3.37	3.56
4.00	3.98	4.17	4.36
5.00	4.79	4.98	5.17

When the price of S.O.M. is about twice the value of corn, then oats and corn are of equal dollar value. If the value of soybean oil meal is the same as corn, which would be the case if no extra protein is needed in the ration, then oats are worth 90 percent of the value of shelled corn.

Factors That Determine Oat Production For Feed.....

Most dairy farmers in this area produce a large part of the feeds used. The crop producer is concerned with additional factors. Obviously he produces feeds for the nutritional value and is concerned with the cost of producing the nutrients. The cost of producing protein and energy in oats compared to corn is one of the reasons for increased corn at the expense of oat acreage. However, there are other factors that still make oats a major crop. The new varieties of corn have expanded the corn belt several miles north but there is still a large area where climatic conditions favor oat production. Oat varieties should continue to meet the requirements for grain production in areas that can not produce corn.

In the areas that must produce oats, there is the problem of more critical timing in oat harvesting. If weather conditions prevent corn harvesting for a month or two, the loss is relatively small. However, if oat harvest has to be delayed for even a week or two, the crop can be lost. Likewise, when used for silage making, corn can be harvested quite efficiently over a long period, but oats must be cut almost the day they are ready. A desirable improvement, then, would be an increase in the ability of oats to stand longer when necessary without excessive losses.

Although oats have a tough time competing with corn on yield per acre and convenience of harvesting, many farmers in the corn belt still produce oats. One factor responsible is the value of oats as a nurse crop for alfalfa. Frequently dairymen comment that they only grow oats because it is a good nurse crop for new seedlings. This factor frequently overcomes the disadvantage of limited grain yields and is a desirable characteristic to maintain. Long growing or late varieties that yield more might not meet the needs of those using oats as a nurse crop.

The value of straw is the second reason given by many for growing oats. Corn stalks are used for bedding but oat and other small grain straw has a definite advantage. Very short straw varieties could decrease oat production on livestock farms. Erosion control and winter cover in some areas are other desirable characteristics that are important to crop producers.

Oats for Silage or Extra Crop.....

All of the cereal grains make excellent silage for dairy cattle. In the corn belt oats do not compete with corn as a silage crop. However, in northern areas oats can be a substitute for silage. Varieties that yield total silage rather than just grain are important. The critical timing needed does result in difficulties of harvesting for good quality when weather is unfavorable. Both plant genetists and agronomists should continue to work on varieties, production and harvesting practices that help improve the use of oats for silage.

The double cropping system is another practice that could be important in the future of oat production. Rather than competing for corn acres, there is a potential for getting both oats and corn from the same acre. Varieties which mature early enough for grain, or at least silage, so that corn or another crop can be planted after harvesting the oats, offer a good opportunity for increasing feed per acre.

Summary.....

Oats are an excellent feed for dairy cows. The primary reason for decreasing oat acreage and oats in the dairy ration is the comparative cost of purchasing or producing nutrients from oats. Increasing yields of nutrients per acre is of greater need than changing percent of nutrients. Higher protein or digestible nutrient on a percentage basis would have to be done without any sacrifice in yield.

Use of oats can be strengthened or maintained primarily because of its adaptation to specific climatic areas and potential as a nurse crop, as a source of straw, and as one crop in a multiple per year cropping system.

NUTRITIONAL LABELING

Scott E. Seibert
National Oats Company, Inc.

During 1974, many consumer foods, including hot and cold cereals containing oats, are appearing with their nutrients labeled in a new format. This new labeling is required under U.S. Food and Drug Administration regulations published in the Federal Register of March 14, 1974 (Volume 38, Pages 6950-6973).

The labeling is voluntary, except that it is triggered by:

1. The addition of vitamins, minerals, or proteins.
2. Any nutritional claim (except sodium or cholesterol) on labeling or in advertising.

All labels ordered after January 1, 1974 and all products shipped after December 31, 1974 must be in compliance with these new labeling regulations. Thus, 1974 is the year of transition from the old non-standardized formats in various package locations and using Minimum Daily Allowances (MDR's) to a standardized format in a specified location incorporating U.S. Recommended Daily Allowances (U.S. RDA). These U.S. RDA's are established in the regulation and, in general, are the highest values for each nutrient established by the National Research Council for the various age, weight, and sex groupings. Thus, the U.S. RDA values tend to exceed the needs of some segments of the population.

The regulation requires that the information appear to the right of the principal display panel and be expressed on the basis of a single serving. The serving size must be defined along with the number of servings per container. The number of calories and the grams of protein, carbohydrate and fat must be indicated per serving. In addition, the percent of the U.S. RDA of protein, Vitamins A, C, B_1 and B_2, and Niacin, and the minerals, calcium and iron supplied by each serving must be indicated.

Additional vitamins and minerals may be labeled, but must appear in a specified order following the mandatory list. A second column giving nutritional information on the product as prepared may be shown. An example of this would be a cereal plus the added milk.

A sample nutritional label is shown for rolled oats.

NUTRITION INFORMATION

SERVING SIZE - 1 OUNCE
SERVINGS PER CONTAINER - 16

CALORIES	110
PROTEIN	4 G.
CARBOHYDRATE	19 G.
FAT	2 G.

PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCE (U.S. RDA)

PROTEIN	6	RIBOFLAVIN	*
VITAMIN A	*	NIACIN	*
VITAMIN C	*	CALCIUM	*
THIAMINE	10	IRON	6

*CONTAINS LESS THAN 2% OF THE U.S. RDA OF THESE NUTRIENTS

The numerical increments to be used for the various elements is specified in the regulation. For example, in the U.S. RDA section, increments of 2% RDA are to be used up to and including 10%; 5% increments from 10% to 50%; and 10% increments from 50% - 100%. The protein U.S. RDA is modified by the Protein Efficiency Ratio (PER) of the protein. For protein with a PER of less than 2.5, the U.S. RDA is set at 65 g, while for those with a PER equal to or greater than 2.5, the U.S. RDA is 45 g.

Compliance will be determined by selecting twelve consumer packages from different shipping cases. Naturally occurring nutrients (designated as Class 2 nutrients) must be present at a level of at least 80% of that declared, while Class 1 (added nutrients) such as vitamin fortification must be present in an amount equal to the claim. The addition of a material such as Vitamin C for technical reasons without nutritional claims does not require nutritional labeling.

Oats contain goodly amounts of protein with significant increases in this percentage for several new varieties making possible the labeling of higher amounts. Oats are a significant source of thiamine (Vitamin B_1) and phosphorus and contain appreciable amounts of iron and magnesium along with smaller amounts of other vitamins and minerals. The significance of these valuable constituents must not be lost sight of in the quest for higher protein contents.

Pathology

Procedures for Shipment of Stem Rust Cultures By the Cereal Rust Laboratory

J. B. Rowell

The Cereal Rust Laboratory receives many samples and fills many requests for cultures of *Puccinia graminis* each year. State and federal quarantine laws regulate interstate shipments of living materials of *P. graminis*. Physiologic characteristics of uredospores affect the survival during transit and successful use of inoculum. This note summarizes the procedures followed by the Cereal Rust Laboratory to effectively fill requests for stem rust cultures.

Within the United States, Plant Quarantine Regulations and Procedures require that shipments of designated plant pests be marked with a permit label as evidence that the movement is authorized. The director of the Cereal Rust Laboratory has a blanket authority under these regulations to receive cultures and collections of stem rust from anywhere in the U.S. for the annual race survey. Under this authority, we supply donors of stem rust samples with collection forms (CR Form 10 or ARS 186) and self-addressed envelopes marked with the permit stamp which states "Cereal Rusts for Scientific Purposes, Shipped under authority of the Federal Plant Pest Act of 1957 and the Plant Quarantine Act of 1912, as Amended." Submission of rust samples to the Cereal Rust Laboratory in this manner fulfills the regulatory requirements.

Shipments by the Cereal Rust Laboratory to supply cultures of races of stem rust to be used in research or teaching must be authorized by a permit. Requests by qualified individuals can be handled routinely if the race occurs regularly in the state of usage and it is not deemed a hazard to commercial crops. An Application for Permit to Move Living Plant Pests, PPQ Form 526, is submitted to Pest Survey and Technical Support, Plant Protection and Quarantine Programs, Animal and Plant Health Inspection Service, USDA, Room 526, Federal Building, Hyattsville, MD 20782, to obtain authorization and a permit for the shipment of the rust sample. In addition, the following states have statutes that govern the movement of pathogenic materials or pests:

Alabama	Hawaii	New York
Alaska	Louisiana	North Carolina
California	Massachusetts	Ohio
Colorado	Michigan	South Carolina
Florida	Mississippi	Tennessee
Georgia	Nebraska	Wisconsin

Applicants in these states route the application on PPQ Form 526 to the state quarantine official and request that the approved application be sent directly to Pest Survey and Technical Support, APHIS.

Since many applicants do not have PPQ Form 526 available, we submit the application for a permit. We need to know the approximate date of shipment and the intended use for these non-hazardous cultures. Requests generally are approved and permits are issued within two weeks after submission of an application. The culture can then be shipped in compliance with quarantine regulations.

The director of the Cereal Rust Laboratory has authority to ship cultures under a blanket permit to a small group of approved, qualified investigators who have an average of several requests per year. This blanket permit only authorizes shipment of stem rust races known to occur regularly in the state of usage.

Requests for rust cultures of unusual virulence or of races not regularly present in the state of usage are submitted to the Rust Release Committee for assessment of the potential hazard that might ensue to commercial crops. This committee is composed of cereal rust pathologists in Mexico, Canada, and the United States. Such requests must be accompanied by information on the intended use of the culture, the precautions to be made to prevent escape and dissemination to commercial crops, and the methods of disposal of all inoculum and diseased materials. A request disapproved by this committee is returned to the investigator and the request is not filled. Approved requests are forwarded to Pest Survey and Technical Support, APHIS, with an application for a permit.

When an authorized shipment is made, the safeguard requirements to prevent hazards to commercial crops during use of the rust cultures in research or teaching are the responsibility of the recipient and not the shipper. Interstate movement of a culture by the recipient is a violation of quarantine regulations. The Cereal Rust Laboratory documents all requests for rust cultures that are processed.

Cultures of the predominant stem rust races found in the annual survey are available in limited quantities from the Cereal Rust Laboratory. The cultures generally are pure for reaction on the test differentials indicated by the CRL code. Stock cultures are stored in sealed glass vials, 5 mm in diameter, under liquid nitrogen after the uredospores are harvested and dried in air at 20% R.H. for several days. The amount of inoculum shipped is determined by the intended use: 5 to 10 mg of spores is supplied to start cultures on seedlings in the greenhouse, and 50 to 100 mg of spores is supplied for hypodermic inoculation of spreader plants in disease nurseries. Limitations in the facilities and manpower at the laboratory dictate that larger quantities may be supplied only through special arrangements. Consultation with the scientists in the laboratory will indicate the best cultures available for a particular use.

Rust cultures are shipped in accordance with quarantine regulations that specify use of a stoutly constructed container of approved materials to prevent breakage in transit and danger of plant pest dissemination. The culture is heat-shocked when retrieved from liquid nitrogen, and the sealed vial is placed in a foam plastic shipping container along with information on race, culture number, and a warning of precautions to be used in handling the vials.

Generally, shipments are airmailed on Mondays or Tuesdays so they will arrive at the destination during the regular work week. Round-trip shipments to representative destinations within the U.S. established that spores survive this shipment well except in extremely cold winter weather (see Wheat Newsletter 29: 101-102 and Oat Newsletter 23: 23-24). Shipments made during winter (December through February) when a high probability of exposure to extreme cold exists, are protected by enclosing the vials in damp sawdust inside the plastic foam containers. This procedure gave reliable protection in test shipments with exposures to -30° C when unprotected cultures were severely damaged.

Protective gloves and eye shields should be worn when handling the sealed vials on receipt of the shipment. Sealed vials have exploded on rare occasions while being opened several days after retrieval from liquid nitrogen storage.

The inoculum should be used as soon as possible on receipt of the shipment. Successful infection is best assured when plants can be inoculated in the week that the shipment is received. We recommend rehydration of the spores for several hours at a relative humidity of 50% or higher before use. The rapid hydration of dry spores on contact with free water can cause a marked loss in germination. Rehydration of dry spores in moist air will prevent this damage.

Do not store the vials at temperatures near or below 0° C. Spores generally will remain viable for several weeks in the sealed vial at 5° C or at room temperature. Some spore lots or cultures, however, lose viability more rapidly.

The procedures for requesting and using stem rust cultures from the Cereal Rust Laboratory, University of Minnesota, St. Paul, MN 55108 can be summarized as follows:

1. Send requests for cultures to the laboratory at least 3 weeks before the date of planned use.

2. Requests should specify the race or virulence desired, the intended use, and the expected date of inoculation.

3. On receipt of the cultures, use recommended precautions in handling sealed vials.

4. Inoculate plants with rehydrated spores within 1 or 2 days after receipt of the culture shipment.

Oat Rusts in the United States in 1974

A. P. Roelfs

Oat crown rust.--In mid-April crown rust was severe along the Gulf Coast from southern Texas to Florida; however, 100 miles inland the disease severity was much lighter than normal. The only commercial varieties with resistance in this area were Coker 227, Coker 234, TAM-0-301, and TAM-0-312. Crown rust had spread northward into Kansas and Missouri by early June, and had become severe in north-central Texas and also on wild oats in Sutter County, California. Furthermore, an unusually large number of aeciospores were being produced on buckthorn in Minnesota and Wisconsin. Thus, with the late oat plantings in Minnesota and the Dakotas, it appeared in early June that crown rust could be severe. However, hot dry weatner in June and July greatly reduced the amount of green plant tissue, thereby reducing the expected disease intensity. Little loss in yield occurred in this area due to crown rust, but test weights and yields were reduced by the drought.

Oat stem rust.--Stem rust was reported to be heavy in centers in the nursery at Beeville, Texas in late March. By mid-April, oat stem rust was light and scattered in plots in southern and central Texas, Louisiana, southern Mississippi, and the Florida panhandle. This prevalence and severity was less than normal for April. By early June, stem rust had spread into north-central Texas, Georgia, and South Carolina in trace amounts, and was also present on wild oats in Sutter County, California. The northward movement of stem rust was later than normal with stem rust found in central Oklahoma on June 2, and at Manhattan, Kansas on June 26. Apparently oat stem rust overwintered only in south Texas and the area adjacent to the Gulf Coast, further south than normal, resulting in a later northward spread than normal. By mid-July stem rust was present in trace amounts throughout most of the Great Lakes states. A reduction in the disease potential was caused by the dry weather in June and July in the north-central states that reduced the number of primary infections and prevented secondary spreads. This year was the only one from 1971 through 1974 when no oat stem rust was reported in Nebraska, indicating its scarcity. The major oat-producing states of Minnesota, Iowa, South Dakota, North Dakota, and Wisconsin produced 13,569,000 acres for harvest in 1974, while the next ten states in rank produced 3,605,000 acres. We received 203 stem rust collections from the major producing states but only 94 collections from the next ten states as follows: Illinois, 4; Indiana, 0; Kansas, 1; Michigan, 8 from 2 locations; Montana, 0; Nebraska, 0; New York, 0; Ohio, 1; Pennsylvania, 2; and Texas, 78. With the exception of Texas, we obviously know little about the distribution and occurrence of stem rust races in most of these states.

Races 31 (6AF) and 61 (7F) still comprise the major portion of the oat stem rust population in the United States (Table 1).

Losses from the oat rusts vary in the United States from year to year; however, in recent years crown rust has been by far the more damaging disease (Table 2).

Table 1. Preliminary Results of the 1974 Oat Stem Rust Survey.[1/]

	% of Isolates of Each Race								
States	1	2	6	8	31	61	70	72	76
Southeastern		40			27	33			
Northeastern	6				44	24			
South-Central	*	*		*	93	7			26
Central					100				
North-Central	*	*		*	93	7			
Western	42		8	50					
Total	2	1	*	1	82	11	1	1	1

1/ Data from all types of artificially inoculated nurseries omitted.

Table 2. Losses Due to Oat Rusts in 1,000 Bushels.

Year	Stem rust	Crown rust
1966	307.0	4,460.0
1967	221.3	2,045.7
1968	825.0	20,863.3
1969	402.6	8,868.7
1970	2,017.4	52,633.9
1971	1,885.7	27,565.9
1972	268.1	29,068.9
1973	340.0	18,018.6
1974	(100)[1/]	(10,000)[1/]

1/ Preliminary estimates

Additional Genes for Disease Resistance in Oats

P. G. Rothman

A wealth of untapped but useful genes for disease resistance are available in the lesser oat species that are not known to exist in the hexaploid species. With the near exhaustion of the effective genes for oat stem rust resistance at the hexaploid level, the exploitation of these genes for stem rust resistance in particular would be desirable.

An interspecific cross between the species Avena magna (4X) and a stem rust resistant A. longiglumis (2X) offers some promising possibilities along these lines. In addition, the big caryopses of A. magna with its high protein content and excellent resistance to crown rust would augment the overworked A. sterilis species so widely used at present for the improvement of these two characteristics.

The triploid F_1 plant of the interspecific cross was sterile but was successfully treated with colchicine resulting in the setting of a single seed. The derived plant from this seed was partially fertile and proved to be a synthetic hexaploid. Progenies through the third generation have not been found with the desired stem rust resistance, but field reaction to crown rust is from highly resistant to immune.

The juvenile growth of the synthetic hexaploid is more prostrate than either parent with leaves and stems sparsely villous. Plants are about 30 inches tall and tiller profusely but produce few spikelets per panicle.

The progeny lines are only partially fertile; however, crosses have been made with the hexaploid species A. fatua, A. orientalis, A. nuda, A. sativa, and A. sterilis; and the tetraploid species A. murphii, A. magna, and the autotetraploids of A. strigosa. Seed failed to set in any attempted crosses with the diploid species.

Unfortunately most of the crosses were sterile, but seed was found among the A. sativa and A. sterilis hybrids. With limited testing of the F_2 and F_3 progenies of these crosses, segregation for stem rust resistance to race 94 was found -- evidence that resistance was recovered from A. longiglumis. Crown rust resistance also was recovered in the progeny lines.

MORE ABOUT THE HORIZONTAL RESISTANCE OF OATS TO CROWN RUST

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

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As previously mentioned, certain cultivars of Red Rustproof (RRP) oats have a very pronounced and distinct form of horizontal resistance (HR). This resistance may be subdivided into "late-rusting" and "slow-rusting." Late-rusting is the expression of crown rust symptoms 10-14 days later than susceptible cultivars. Slow-rusting is expression of a low percentage (10-40%) of infection at the end of the growing season.

We have studied this phenomenon for a number of years and find that there are at least three levels of HR in genotypes of oats with diverse genetic constitutions. Red Rustproof-14, a Florida line (Fl 67-OIR-113-116), Purdue 50, and Purdue 54 were the most resistant. Delta Red, Rosen's Mutant, Ukraine Mutica, and Purdue 48 were intermediate in resistance. Two selections (Q827-7, Q827-8), obtained from a cross of RRP-14 X Fulghum, were more resistant than the susceptible check (Fulghum), but less resistant than the intermediate group. The Florida selection, Fl 67-OIR-113-116, also has vertical resistance. The crown rust resistance of this selection appears to be superior to those that have only HR.

Selections Q827-7 and Q827-8 matured 8 days earlier than the RRP-14 parent and 10 days later than the Fulghum parent. Selections maturing 8 to 10 days earlier than the HR parent expressed partial late-rusting but did not express slow-rusting characteristics. It therefore appears that maturity is linked to the late-rusting character. The relationship between late-rusting and maturity is valid only when several cultivars are compared. It should be pointed out that the time of maturity of a single cultivar does not influence its HR reactions. If plantings are arranged so that a single cultivar is at different stages of development in the spring, plants in the juvenile stage will have the same percentage of infection as those in the heading phases.

The genetics of HR was examined using F_1 and F_2 progeny derived from a cross of RRP-14 X Fulghum. The observed mean of the F_1 and F_2 generations were slightly above the calculated arithmetic mean, indicating a partial dominance for rust susceptibility in each generation. The distribution of the F_2 generation did not fit a theoretical normal curve (X^2=49.39**, df=7). The deviations occurred primarily at the 10, 30, and 50% infection levels, with an excess at the 10 and 50% level and a shortage at the 30% level. Evidence for slight partial dominance was indicated by the frequency distribution of the F_2 generation (skewness=0.65).

The gene number and broad-sense heritability value was 87%, which is relatively high. Using the assumptions discribed by Burton, the gene number was estimated to be 2.16. This value is relatively low.

Does Smut Resistance Merit More Emphasis

D. D. Stuthman and R. D. Wilcoxson

The results from Minnesota's 1974 Smut Nursery were sobering. They represent a distinct contrast from the oat smut situation just a few years ago when most varieties were resistant. The inoculum used for this nursery was a composite of smut collections from previous smut nurseries and from fields mainly in Minnesota, all increased on Anthony. Thus, we believe that the inoculum was diverse but typical "field races".

The inoculation procedure was rather simple. The spores were suspended in water. This suspension was poured over the seed which was held in a test tube. A partial vacuum was effected and then suddenly released to force the spores under the hulls. The seed was then spread on filter paper and allowed to dry at room temperature. The dry seed was stored at 5°C prior to planting. Disease estimations were based on visual estimates of percentage of heads smutted in a 3.3 meter row. Two plantings, May 17 and May 24, 1974, were made at Rosemount, Minnesota. The data presented are from the first planting. Several random entries were checked in the second planting, but no significant departure from the first planting was detected.

We believe the results presented in the accompanying table necessitate additional emphasis by oat breeders on smut resistance. We are particularly concerned about Froker, our most popular variety. In the past, smut could be controlled with several seed treatments but the continued availability of such treatments is now somewhat uncertain.

Variety	% smutted heads
Smut differentials	
Anthony	70
Black Mesdag	1
Cameo	5
Clintland 64	4
Gothland	0
Markton	0
Monarch	15
Navarro	2
Nichol	5
Victory	80
Commercial varieties and checks	
Andrew	2
Astro	0
Chief	20
Clintford	5
Dal	0
Diana	25
E74*	35,30
Froker	50
Garland	2
Goodland	0
Hudson	10
Jaycee	0
Korwood	40
Lodi	6
M73	30
Mariner	6
Noble	2
Otee	15
Otter	0
Portal	30
Stout	10

* duplicate plots

Are Bacterial Diseases a Real Problem?

C. W. Roane and T. M. Starling

The 1974 oat crop was estimated at 1,848,000 bu or 44 bu/ac on 42,000 ac. In view of this small acreage, we have, for several years, devoted no effort to breeding oats but have continued to grow regional nurseries and a small statewide yield trial of promising cultivars. In recent years, we have experienced severe stunting of oats in some of these nurseries.

In our 1974 nurseries, much yellowing and reddening was associated with stunting up through the time of the jointing stage. With the onset of warm weather, partial recovery was observed and new foliage was green. The bacterium causing halo blight (*Pseudomonas coronafaciens*) has been associated with these symptoms previously. There is some question as to whether the symptoms are caused by barley yellow dwarf virus or *P. coronafaciens*, or both. There should be no recovery from BYDV infections. We are attempting to shed light on this problem with an experiment designed to control aphids and bacteria with insecticides and antibiotics.

Bacterial infections have been detected in isolated leaves of spring oat cultivars growing at Blacksburg. No halo blight symptoms suggest that *P. striafaciens* was the causal agent. No determinative studies have been conducted on the bacteria isolated from oats. The severity of the problem suggests that bacterial diseases and BYDV require re-evaluation and that a comparative study of bacteria causing the various symptoms is needed. Although T. F. Manns made such a study, many believe that he confused bacterial disease symptoms with BYD which he did not recognize but which may have been present. In addition, he did not have color photography and some of the other technological advantages presently available. However, some of his color paintings clearly illustrate symptoms we observe annually and which he attributed to bacteria.

OAT CYST NEMATODE IN OREGON

J. G. Moseman, H. J. Jensen, and J. C. Craddock

The oat cyst nematode (Heterodera avenae) was found in the foothills of Washington County, Oregon. The nematode was identified by H. J. Jensen, Professor of Nematology, Oregon State University, and M. Golden, Beltsville Agricultural Research Center. A survey by the Animal and Plant Health Inspection Service (APHIS) for the oat cyst nematode will continue in Oregon in 1975 and will also be expanded to include California and Washington to determine if the nematode is present in those states.

The oat cyst nematode is present in several counties in southern Ontario, Canada. Crop losses of over 50 percent have been observed in some fields. The nematode is most severe on oats, barley and wheat. A crop rotation omitting oats, barley or wheat for at least 3 years is recommended in Canada as the most practical means of control.

The oat cyst nematode is present in many other countries. It is known to exist in practically all of the European countries. More recently, it has been found in Japan, Morocco, South Africa, Australia and India. Variations in the pathogenicity of the nematode and in the resistance of the host have been studied extensively by individuals in those countries. Several pathotypes of the nematode and sources of resistance in oats, barley and wheat have been identified.

A cooperative study has been initiated to determine the pathotype and characteristics of the oat cyst nematode present in Oregon, and to identify sources of resistance in oats, barley and wheat to those pathotypes. Host material reported to be resistant to the nematode in other countries, already in the Small Grains Collection at Beltsville Agricultural Research Center, are being tested in the nematode infested field in Oregon. Some of those resistant lines are also being tested in the nematode infested field in Oregon. Some of those resistant lines are also being tested in the greenhouse this winter. We have included varieties or selections with most of the known genes for resistance in these tests. Individuals in the other countries have furnished seed of additional host materials which they have found resistant to the pathotypes of the nematode in their country. Those materials are being increased in quarantine and will be tested to the pathotype of the nematode present in Oregon. Commercial varieties of oats, barley and wheat grown in the Pacific Northwest, or possibly adapted for growing in that area, are also included in the field tests. The results from our tests will be made available to individuals who request that specific information.

III. CONTRIBUTIONS FROM OTHER COUNTRIES

Oat Production and Varieties in New South Wales, Australia

R. W. Fitzsimmons

The area sown to oats for all purposes in New South Wales in 1974-75 was 1,625,000 acres (about 10% less than the area in 1973-74) of which about 914,000 acres were harvested for grain. The remaining area was cut for hay or grazed out. Grain production totalled almost 25,300,000 bushels (nearly 30% above the production in (1973-74) and the highest total since 1968-69). The average yield was 28 bushels per acre (compared with 16 bushels per acre in 1973-74). The area sown to oats was less than intended because of very wet weather in the south of the State and dry conditions in the north at the optimum sowing time. Seasonal conditions for the oat crop were mostly quite good. Disease incidence was quite low mainly because of the prolonged cool conditions during the spring. This was in contrast with the previous season when a severe outbreak of stem rust in October severely affected the yield and grain quality. An interesting observation made during the season was the very effective tolerance to stem rust displayed by the varieties P4315, P4319 (since named and released for 1975 sowings as Blackbutt) and Cassia released in 1974. All three varieties are susceptible to one or more strains of stem rust but grain yields and test weight were little affected.

The end of the 1974-75 season saw the final retirement of Dr. Fred Mangersen, Australia's first full time oat breeder. Dr. Mengersen laboured at Wagga and Temora Research Stations for over 20 years and produced 3 excellent commercial varieties in that time. First was Cooba, released in 1961, and which became the leading variety in New South Wales in 1965 and according to the latest statistics now occupies 39% of the total area. Cooba is the best variety for early sowing for grazing followed by grain recovery on the Slopes and Plains of N.S.W. Coolabah, suitable for later sowing for lenient grazing followed by grain recovery or later sowing for grain only was released in 1967. It is now the second variety in N.S.W. with 14% of the acreage. Cassia, suitable for late sowing for grain only was released in 1974.

Dr. Mengersen is the senior author of the publication "Identification of Oat Varieties in New South Wales". Copies of this publication are available to interested plant breeders and agronomists.

Oats in Western Canada 1974

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

1974 will long be remembered as the year of frustrations for oat growers in Western Canada. A late cold wet spring delayed seeding until early June. Then the rains stopped and the heat came. Suddenly drought was an important concern. Many oat fields in the Red River valley had lodged flat before heading because crown roots had not formed in the dry surface soil. And finally, much of the prairie oat crop was frozen on August 30th. Supplies of good seed oats for 1975 may be hard to obtain.

Production

In 1974, six million acres of oats were sown in the Canadian Prairie Provinces according to Statistics Canada with 4,800,000 acres being harvested for grain. The yield was 41.2 bushels per acre, down about 10 bushels from yields in recent years. Yields in Alberta Saskatchewan and in Manitoba were 47, 40 and 36 bushels per acre respectively.

Varieties

Harmon continues to be widely grown on about 38% of the prairie oat acreage followed by Rodney at about 12%. The new variety Hudson was distributed for seed increase in 1974 and appeared to do well. The moderate stem and crown rust resistance of this variety stood up to rust attack very well in eastern Manitoba. Several strains of naked oats have outyielded Vicar, the presently recommended naked oat variety, by about 15% in trials conducted over the past three years. The best of these strains is expected to be licensed within a year.

Oat rust

Oat stem rust infections were light or absent on most uniform rust nurseries grown across Canada but 6 out of 28 nurseries from Ontario and Manitoba developed light to heavy infections. Rust was first observed in western Canada in late July and light infections developed on crops throughout Manitoba and eastern Saskatchewan. However, in south-eastern Manitoba a moderate epidemic with infections of up to 60% caused moderate crop losses particularly on Random oats. Race C10 (pg9/Pg1,2,3,4,8) comprised about 90% of all field cultures from western Canada. In eastern Canada race C9 (pg8/Pg1,2,3,4,9) was dominant and some cultures of this race were virulent on resistance conferred by gene pg 13. Virulence on pg 13 resistance also occurred in a few cultures of C1 (Pg1,2,3,4,8/pg9) but this does not at present constitute a threat to resistance in commercial cultivars or advanced breeding lines because they are protected by additional resistance genes.

Oat crown rust infection was general but light throughout Manitoba and south eastern Saskatchewan. There were no significant losses due to crown rust except near buckthorn, where heavier infections were observed. Infection of oats near buckthorn occurred by mid-June, whereas general infection by inoculum from external sources was not observed until mid-July.

The 'standard' set of differential varieties was not used to identify crown rust races in 1974. Instead 1974 was a trial period using only a number of substituted single gene (Pc) lines. There was a major shift in the rust population to virulence on Pc40 resistance (49% of isolates in western Canada in 1974 as compared to 4% in 1973). There was no change in virulence on resistance conferred by genes Pc38 and Pc39, which are presently the major crown rust resistance sources in the oat breeding program. No field cultures have yet been found that are virulent on gene Pc39.

IV. CONTRIBUTIONS FROM THE UNITED STATES

ARKANSAS

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

According to the Crop Reporting Service, Arkansas farmers planted about 100,000 acres of oats during the 1973-74 growing season; grain was harvested from 74,000 which had an average yield of 55 bu/A. Damage from Barley yellow dwarf virus was widespread; many fields were almost completely destroyed by this disease. Although crown rust was prevalent in our nursery plots, it was insignificant in production fields. Races 264B and 325 were the most prevalent in our nurseries.

Most of the acreage was planted to Ora, Nora, Florida 501, and Moregrain 211. Limited amounts of TamO-312 and Coker 227 were also grown; both varieties appear well adapted to central Arkansas.

The major emphasis of our research program continues to be on development of high yielding cultivars that are early and resistant to BYDV and crown rust. We have begun to also emphasize increasing groat protein; it appears that we can make large gains in protein by breeding and the use of different management practices. Crosses have been made with our material and the high protein spring oat cultivars and we are evaluating the effects of various levels of different sources (amominium nitrate, urea, sulfur-coated urea, and isobutylidene diurea) of nitrogen and stages of application on groat protein. This research is a cooperative effort involving Dr. Wells at Stuttgart, Dr. Youngs at the Oat Quality Lab, and ourselves.

Don Adams has been promoted to state extension agronomist for wheat, oats, and other feed grains. Nur Miah has begun work on a PhD program; his research will be on oat protein improvement. Surapong Sarkarung is conducting a PhD thesis on oat puberscence. Ron Cox is evaluating the effects of oat and wheat straw and root residue on growth of double-cropped soybeans.

FLORIDA

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

In recent years, races 264B and 325 have increased and are now the two predominant crown rust races in Florida. Consequently, cultivars with the Landhafer, Santa Fe, or Trispernia genes will have to be replaced soon. Fortunately there are several oat cultivars adapted to this area that are resistant to races 264B and 325. The resistant cultivars (TAM-O-301, TAM-O-312, and Coker's 227) have crown rust resistance from *Avena sterilis*. Coker's 227 is better adapted than the TAM selections and is a better grain yielder. In west Florida, large plantings (140 acres) of Coker's 227 produced 50 to 80 bu/acre. Over the past two years, Coker's 227 has been the highest grain yielding cultivar tested in Florida. The average yield for 1973 and 1974 was 60 bu/acre. Hopefully, Coker's 227 and TAM-O-301 will successfully replace Florida 500 and Florida 501.

Georgia

L. R. Nelson, A. R. Brown, D. D. Morey and B. M. Cunfer
(Breeding and Pathology) J. H. Massey (Fertility)

The oat acreage in Georgia during the 1973-74 growing season totaled about 200,000 acres of which 90,000 acres were harvested as grain and the remaining being utilized as forage. The estimated oat yield for 1974 was 46 bu/A which was down slightly from the previous year. The 1973-74 growing season was extremely warm, however diseases were generally not the limiting factor to higher yields. The recommended oat varieties in Georgia for the 1974-75 growing season are Elan, Fla 501, Coker 67-22, Coker 66-22, Nora, Ga 7199 and Coker 227.

The oat breeding program in Georgia is very limited, however efforts are being made to screen crosses between *A. sterlis* and *A. sativa* for crown rust resistance, protein and fat content as well as agronomic characters. Oat groat protein (crude) of 174 experimental lines ranged from 15.9 to 27.5% while crude fat ranged from 3.9 to 7.4%. It is also hoped that a greater degree of resistance to red leaf virus (barley yellow dwarf) can be obtained from the *A. sterlis* germplasm. Several of the *A. sterlis* x *A. sativa* crosses appear to have very high potential as forage oats. Studies on the varietal interaction with nitrogen levels are also being investigated with several of the recently released commercially available varieties.

ILLINOIS

C. M. Brown and H. Jedlinski

Illinois farmers harvested 440,000 acres of oats in 1974, which represented a small increase over 1973 and equal to the 1972 harvest. Average yield was 51 bushels per acre, 5 bushels higher than 1973 but 12 bushels lower than in 1972.

Most of the oat crop was seeded late but conditions were generally favorable throughout the season in most of Illinois. BYDV was very severe in southwest Illinois. It was also present in other parts of the state but caused less damage than in most recent years. The tolerant varieties, Otee and Jaycee, performed much better than other varieties under the severe epidemic in southwest Illinois. Downey mildew occurred in severe proportions in some areas where water-logged conditions prevailed in the spring. Crown rust was prevalent on some varieties but appeared to cause little damage.

A new selection, Illinois 67-15414, from the cross Tyler x Orbit is being increased for probable release. An initial increase will be made in 1975 for distribution to interested states for production of foundation seed in 1976 and release to certified seed growers in 1977. 67-1514 is an early maturing variety with high yield potential and excellent lodging resistance. It was included in the Uniform Early Oat Nursery in 1972-74 and in the Uniform Midseason Nursery in 1974.

Indiana

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

Growing Season: An average yield of 50 bushels per acre was obtained from 215,000 acres (down 18% from 1973) of oats harvested for grain in Indiana in 1974 according to the Indiana Crop and Livestock Reporting Service.

Seeding of oats was generally delayed due to wet field conditions during April. Many fields intended for oats seeding were finally planted to corn or soybeans. Moisture was ample and temperatures were favorable til a week beyond heading or about the end of June. Conditions during the latter part of the grain filling period in July were hot and dry. Test weights and particularly seed weights were reduced. Late varieties were more severely affected than earlier varieties. Little or no lodging occurred.

Yellow dwarf virus infection occurred throughout Indiana but it was especially severe in some fields in the southern and central areas of the state. Yellow dwarf virus has been the most serious disease the past three years in oats in Indiana. Crown rust was present in moderate amounts and may have contributed somewhat to yield reductions in some fields, especially with the existing moisture stress conditions. Stout has demonstrated excellent resistance to prevalent races of crown rust. Stem rust was generally sparse throughout the state in 1974.

New Varieties: Breeder's seed of Purdue 61353B3-9-3, C.I. 9217 (proposed name 'Allen') is being offered for sharing with other North Central states. Purdue 61353B3-9-3, similar to Stout in maturity, has the Ceirch du bach source of crown rust resistance which is different from the P.I. 174544 source in Stout or the Grey Algerian source in Clintland 64. The new variety has been in the Uniform Midseason Oat Performance Nursery for 4 years (1971-1974).

Nehuen, a new variety from the same F_3 plant as Stout was jointly released in 1974 in Chile by Instituto De Investigaciones Agropecuarias, Estacion Experimental La Platina and Purdue University. Nehuen is used primarily as a food in Chile.

Breeding Program: We are continuing efforts toward development of varieties with higher levels of protein. At present, we have several lines (with *Avena sterilis* as the source of higher protein) which have 20 to 21 percent protein but are not competitive (10-15% yield disadvantage) in yield yet. Mark Iwig, M.S. graduate assistant, is continuing genetic studies with protein improvment.

We have expanded efforts in development of varieties resistant to the yellow dwarf virus disease. This disease has become increasingly severe in Indiana the past several years.

F_1 plants of crosses between pubescent (leaf pubescence) and glabrous parents are intermediate to the parents for number of hairs per mm^2. At present, our selections which have the most hairs per mm^2 are still marginal in effectiveness for resistance to the cereal leaf beetle. Our most pubescent types have about 40 hairs per mm^2.

Iowa Contribution to 1974 Oat Newsletter

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

Oat acreage in Iowa increased in 1974 by 20%, bringing the area harvested for grain to 1.6 million acres. Productivity was 57 bushels per acre to give a total Iowa production of 91 million bushels. A trait of considerable and increasing economic significance to oat growers in Iowa is oat straw. It is our estimate that over 95% of the oat acreage harvested for grain in Iowa in 1974 was also harvested for straw. There is no established central market for pricing and sale of straw, but we hear various reports of straw selling from \$1.00 to \$2.00 per 40-pound bale. The 1974 season produced especially bright straw, since we had no rain or inclement weather during the entire harvest season.

As a result of the renewed interest in harvesting and sale of oat straw, we have begun to select oat varieties on an index basis with components of the index being both grain and straw yields. As an estimate of straw worth, we use a price of one half that of grain. For the first time, the Iowa Oat Variety Trial Summaries for 1973-74 carry straw yields for the various varieties tested.

Because measuring oat straw yields on nursery plots is cumbersome and oftentimes difficult, we have worked out an estimation method (worked out by Arnold Rosielle, a Ph.D. candidate on our project) to estimate straw yields from the grain yield and harvest index for a plot. The grain yield is measured on the entire harvested area of a plot, and the harvest index is estimated from a small sample, usually 30-50 culms taken from a border row. The harvest index is estimated with good accuracy with a sample size of 25 to 50 culms, and this harvest index value is then multiplied by the grain yield to calculate straw yield. The estimated yields for straw can be subjected to an analysis of variance.

We have had several changes in personnel in the Iowa small grain project during the past year. Peter Lawrence, an Australian, received his Ph.D. degree in January, 1974, and currently is a sorghum breeder with ICRISAT at Hyderabad, India. Marshall Brinkman finished his Ph.D. degree in Fall, 1974 and has replaced Dr. H. L. Shands, long-time oat breeder at the University of Wisconsin. Howard Eagles also finished his Ph.D. degree in Fall, 1974, and he has taken a position with DSIR Laboratory as a forage maize breeder located at Palmerston North, New Zealand. Diana Bloethe and Kathy Carvey, the first two American female advisees on our small grain project, joined the graduate student group in June, 1974. Mr. Ventura Gonzalez, a sugar cane breeder from Venezuela, and Mr. Majid Rezai, a plant breeder from Iran, have joined the small grain project to study toward Ph.D. degrees in plant breeding. Additionally, Mr. Sami Saad El-Din, an Egyptian wheat breeder from the University of Alexandria, arrived in December, 1974 to begin Ph.D. studies. Recently, Dr. K. Takeda, a rice breeder from Japan, has joined our project as a Visiting Scientist for a one-year tenure.

Michigan

J. E. Grafius and Dimon Wolfe

Seed of Korwood CI9167 will be available to Michigan farmers in the spring of 1975. This variety derives from recurrent selection based on populations stemming from Beaver, Garry, Clintland, CI5103 and CI5163. Korwood has been grown under the nursery number 60-101-1-20 and was grown in the Uniform Midseason Oat Nursery for three years.

This is part of a series of three new oats for Michigan (Mariner CI9165, Mackinaw CI9166, and Korwood CI9167). Korwood is mid-way between Mariner and Mackinaw in maturity and is shorter. It has good lodging resistance and has had excellent yields in Michigan.

Korwood has field tolerance to red-leaf and Septoria black stem, our two most serious diseases. It is susceptible to common races of leaf and stem rust but these two diseases have not been a problem in lower Michigan in 20 years.

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

Minnesota

D. D. Stuthman, L. W. Briggle and R. L. Thompson

Oat production in Minnesota in 1974 approximated 107 million bushels, 25% less than in 1973. The acreage of 2.2 million was 14% lower than in 1973 and the yield of 49 bu/A was the lowest of recent years. 1974 was a very unusual year and far from ideal for oat production. A late spring delayed, and in some areas, prevented seeding. A midsummer drought added to the problems responsible for the lower yield.

We have initiated cooperative research to provide the added capacity of obtaining bioassay evaluations of our promising protein selections. Both rats (Food Science cooperator) and pigs (Animal Science cooperator) will be used as assay animals. We believe that the added dimension of animal response is important in determining the usefulness of oats as a feedstuff.

Another new area of research for us is that of tissue culture. This activity is a cooperative one with Dr. C. E. Green in Agronomy and Plant Genetics. Recently, we successfully grew oat plants from callus tissue developed primarily from immature embryos. Presently, we are perfecting the procedure including recovery of fertile plants upon transfer to soil.

MISSOURI

Dale Sechler, J. M. Poehlman, Paul Rowoth, Charles Kruse, Lewis Meinke, and Boyd Strong

Production. Missouri farmers harvested 140,000 acres of oats in 1974, up from the low of 41,000 acres in 1973. The 1974 harvested acreage represents only 56% of the estimated acreage seeded, reflecting considerable abandonment due to poor performance as well as the increased use of oats for hay. An average yield of 34 bu/A, down from 46 bu/A in 1972 (the last reasonably good oat year); indicates the severity of the disease problems.

Diseases. The BYDV disease continues to be the most widespread problem in the state. The virus is apparently being carried over in other grass species therefore, once the vectors come in, the disease moves rapidly. Crown rust also was damaging to oats in some areas.

Varieties. Otee and Jaycee are the more widely grown spring oat varieties. Because of the low 1973 oat acreage and the resulting short seed supply, however, many acres in 1974 were seeded to northern and older varieties which were quite susceptible to the BYDV. The limited winter oat acreage in Southern Missouri is seeded primarily to varieties from Kentucky and Oklahoma.

Oat Breeding. Resistance to the BYDV disease continues to be the major focus. Selections are made from space plantings in infected areas and evaluated for resistance at all stages of testing. By intercrossing among the better materials we hope to improve on the level of tolerance and combine this with other desired agronomic traits and higher groat protein.

Emphasis in the winter oat program is on greater winter hardiness and on combining this hardiness with good agronomic type and disease resistance. Winter oats are early enough to escape most of our disease epidemics but the most hardy materials tend to be tall and weak strawed.

The spring oat selection Mo 06072 (Pettis X Fla 500) will be increased in 1975. Under Missouri conditions it has shown slightly improved BYDV tolerance, resistance to prevalent races of crown rust, and a very good yield record.

Personnel. Mr. Mehdi Nasseri completed the MS degree and returned to Iran.

NEBRASKA

John W. Schmidt

A 47 bu/a oat crop was harvested on 560,000 acres in Nebraska in 1974. The spring oat crop, comparatively, performed much better than either spring barley or spring wheat under the adverse weather conditions. Crown rust was moderately heavy in the nurseries in eastern Nebraska but was not severe enough to cause lodging or much yield loss. This was the only disease of any consequence.

We are not doing any breeding work with oats. In our wheat breeding program we have adapted and developed equipment for threshing, planting and harvesting fairly large numbers of head selections. We believe this can be adapted to oat breeding also. The single head thresher and the seed indexer (Plastic tray for holding seed from individual heads and for placing these into individual row cones or directly into planter units) were developed by and are available from Precision Machine Co., Lincoln, Nebraska. The field thresher used for threshing of individual plant or head rows is the intermediate-sized thresher built by Bill's Welding Shop at Pullman, Washington. The use of these three components, the individual head thresher, the head row seeder, and the intermediate-sized head row thresher has enabled us to handle between 45,000 and 60,000 head selections annually in our wheat breeding program. We believe thse can be adapted to an oat breeding program also.

NEW YORK

Neal F. Jensen

Oats continues to be popular in New York as a feed grain for the livestock and poultry industry. Orbit is the dominant variety. Other varieties grown, in estimated declining order of importance, are Garry, Russell, Rodney and Harmon. Our new Astro, which is a selection from the cross of Alamo 4X Garry NY Sel. 5 3X Goldwin 2X Victoria X Rainbow and therefore a sib of Orbit, went into first commercial production in the 1974 crop. Astro is described in a registration article in the July-August 1974 Crop Science.

Astro fields and grain looked very good to me this year. I must admit that it is my favorite of the Cornell varieties and the one I expect the most of. Appearance, lodging resistance and grain quality are better than I anticipated. However, the worth of a variety is decided in the final analysis by growers and the market so I will await their judgment.

We have in the project an oat selection, NY 61139-26, which is consistently the highest in test weight of all oats we test. Over years it has averaged above 44 pounds per bushel. We are not sure whether its performance level is high enough for variety release but to help find out we plan to enter it in the 1975 USDA-State Midseason nurseries. We are using it extensively as a parent in the breeding program. The breeding origin of 61139-26 was the now-defunct Cornell winter oat improvement project. Its complete pedigree is: Pendek 3X Dubois 2X Advance X Nysel 4X C.I. 7461. Breeders interested in this as a parent in their breeding program may write.

Currently in the breeding program we are using a relatively small number of parents, plus F_1s, in diallel selective mating schemes to try to put together what we judge to be the important characteristics of a superior variety. The usual things: high yield, protein improvement, grain quality, stem and crown rust resistance, lodging resistance, and so forth. No more than six of the parents are of Cornell origin and these include Orbit, Astro, Cayuse and 61139-26 mentioned above.

NORTH CAROLINA

C. F. Murphy and T. T. Hebert

The growing season for the 1974 oat crop included the warmest winter in 74 years. Although aphid populations were high and BYDV infections were rather common, the state average yield of 53 bushels per acre was the second highest ever.

A continuing effort to utilize higher protein contents from the species *Avena sterilis* appears to be productive. Samples from two F_3 populations grown at Aberdeen, Idaho, in 1973, were analyzed at the Oat Quality Laboratory. Both populations originated from crosses of Carolee to *A. sterilis*, with one backcross to Carolee, selection for high protein and a cross to the dwarf N.C. 2469-3. Yields had been measured prior to dehulling. The relationships were as follows:

Population I

	Protein %		Yield (grams/plot)
n		192	
$\bar{x}$	20.40		217.63
r		-.28	

Population II

	Protein %		Yield (grams/plot)
n		168	
$\bar{x}$	21.94		169.65
r		-.36	

Some of the best lines (all from Population II) were as follows:

State No.	% Protein	Yield (gms.)	Expected Yields (gms.)
207	24.2	307	113
210	23.0	348	143
228	23.8	217	123
229	24.6	208	103
282	23.6	228	128
312	23.2	208	138
349	24.9	278	95

The variety Salem, C.I. 9204, is scheduled for release in August 1975 and is described elsewhere in this newsletter.

OHIO

Dale A. Ray

Production. The 1974 oat crop harvested in Ohio was estimated at 29,890,000 bushels from 490,000 acres. Although the harvested acreage was slightly below the figure for 1973, the 61.0 bushels per acre average yield was responsible for a 4 million bushel increase in production. Although some areas of the state experienced excessive early-season moisture and the amounts and distribution of rainfall were variable during the growing season, the oat crop generally made good development and was harvested on an early schedule. The cereal leaf beetle again was widespread in occurrence but fed for only a short period and did not affect yields to a measurable extent. Crown rust infection was light and localized. Barley yellow dwarf probably reduced the yield in some fields but was not a major factor in reducing the state yield average.

Oat Varieties. Noble and Stout varieties were outstanding in the 1974 yield trial and were added in recommendation for 1975. Clintford continued to be the most popular variety and is included with Otee, Dal, Garland, and Clintland 60 in recommendation for Ohio production.

Oat Breeding. Several selections from Garland x *Avena sterilis* performed well in a replicated rod-row test that consisted of high-protein materials. Ten bulk populations from crosses involving *Avena sterilis* were continued and individual panicle selections were collected.

PENNSYLVANIA

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

Production

The estimated oat acreage harvested for grain in Pennsylvania during 1974 was 405,000 acres. This represents an increase of about 12 percent over the 1973 total. Production was estimated at 20,655,000 bushels with an average yield of 51.0 bushels per acre. Oat disease problems apparently were not severe in commercial fields, but cereal leaf beetle infestations were present in many areas of the state. These infestations were severe enough in some fields in Western and Central Pennsylvania to cause farmers to spray.

Cultivars

The recommended cultivars for Pennsylvania for 1975 are Astro, Orbit, Otee, Jaycee, Clintford, Russell, Garry, and Pennfield. Noble was outstanding in performance tests during 1974, and probably will be recommended for 1976. Dal and Mariner also performed well during 1974 and look promising as replacements for certain of the above varieties. Production of winter oats is no longer recommended in Pennsylvania.

Research

Spring Oats. The USDA/ARS oat improvement program at University Park has been devoted entirely to winter oats. Starting with 1974, spring oat improvement was added to the program in cooperation with The Pennsylvania Agricultural Experiment Station. Numerous crosses were made to launch the program, and cultivar performance tests were grown at three locations in the state. One test was lost because of damage by birds, but data were collected near University Park in Central Pennsylvania and near Landisville in Southeastern Pennsylvania. Yields were excellent at both locations, and Noble was the top yielding variety with an average of 3199 pounds per acre. Drought and heat stresses occurred at Landisville during the grain filling period and lowered the performance of the late maturing varieties. This resulted in bushel weights ranging from 24.2 for Garry (late) to 34.6 for Clintford (early). In vitro dry matter disappearance (IVDMD) and whole grain protein percentages were determined as a measure of feed grain quality. Clintford was the top cultivar for IVDMD with an average of 72%. IVDMD percentages were positively correlated with groat percentages at both locations and with bushel weights at Landisville where the range for the latter characteristic was wide. Dal had the highest whole grain protein with an average of 15.4% over both locations.

Epidemics of powdery mildew, caused by *Erysiphe graminis*, developed in the nurseries at both locations. Entries showed highly significant differences in the amount of infection. Entry scores were correlated between locations. At the full heading to milk stages, when most entries showed moderately severe mildew, the following entries showed a trace to slight infection: Dal, Gopher, Wis 16412 (Trispernia/Belar//*3Beedee), C.I. 9207 (Portage/Clintland 60), C.I. 9206 (Gemini/CAV 2700//Rodney), and Min 71202 (Portal/Clintland 60). In Lancaster County, the disease intensified and at the dough stage all entries were moderately to severely infected, except Dal which had slight infection. Early browning of leaves was associated with mildew intensity at Landisville. Dal shows promise as a source of mildew resistance. We plan to study the effect of plant age and environment upon the infection of Dal oats.

A leaf spot also was widely distributed throughout the nurseries, and was more prevalent on some entries than on others. Cultures from the leaf lesions produced a fungus tentatively identified as *Helminthosporium avenae* which proved to be highly pathogenic when inoculated on several oat varieties. Because of the highly virulent nature of the organism, future screening trials will be conducted to determine the degree of natural resistance to this organism as it occurs in our present cultivars.

Winter Oats. Our winter oat breeding program was continued with primary emphasis on winter hardiness and lodging resistance. Several dwarf and semi-dwarf lines in preliminary tests were higher yielding than the taller check cultivars Norline and Pennwin. At Landisville, one dwarf line averaged 119 bu/A compared to 89 for Pennwin and 85 for Norline. Based on limited field survival and freezing test data, some of our dwarf lines are in the same hardiness class as the check varieties. Backcrossing is being used to combine this short plant height with the best levels of winter hardiness available.

Winter oat lines were evaluated at the Landisville location for forage yield because of possible value in double cropping systems. Average yields of up to 6.4 tons (oven dry) of forage per acre were harvested in the milk stage during mid-June.

Personnel

The ARS oat improvement program at University Park is part of Research Unit #4 (Forages and Cereals) which is under the leadership of Dr. Robert T. Sherwood, Research Plant Pathologist. Dr. Raymond E. Hite, Research Plant Pathologist in that unit, will devote approximately half time to oat pathology. Dr. H. G. Marshall will continue to be responsible for the genetic and breeding phases of the oat improvement program. Research Unit #1 (Forage Crops Quality Evaluation Research) which is under the leadership of Dr. Robert F. Barnes, Research Agronomist, will cooperate in studies concerned with the grain quality of oats.

SOUTH DAKOTA

D. L. Reeves and H. S. Sraon

Production. The oat crop was substantially reduced by dry weather in 1974. The planted acreage remained about the same but the yields were low. The production for 1974 is estimated at 80,800,000 bushels for an average yield of 40 bushels per acre. Our major problems of lodging plus crown and stem rust were no problem due primarily to our very dry conditions.

Research. Roxton, Kelsey, Spear, and a *Avena steriles* line were crossed in a complete diallel. Data were analyzed for F_3 plants. Additive gene action for protein content with partial dominance for low protein was suggested. Groat percentage and number of panicles showed partial dominance. *A. sterilis* manifested dominance for early heading, low groat percentage and a large number of panicles. However, it exhibited recessiveness for yield, plant weight, and groat weight.

Narrow sense heritability estimates for protein content varied from 41 to 83 percent while broad sense heritability estimates varied from 0 to 98 percent depending upon the genotype, environment, and method of computation used. Genotype x environment interactions for protein content were significant.

Protein content of the groats was negatively correlated with grain yield, plant weight, height, groat percentage, 50 groat weight, height, and days to head. The number of factors affecting protein content ranged from 15 to 19 for crosses between the high and low protein parents.

Personnel. Mr. David Hanson completed his M.S. degree. His research was on the effects of simulated hail damage on oats.

TEXAS

M. E. McDaniel, J. H. Gardenhire, K. B. Porter, Norris Daniels
M. J. Norris, Earl Burnett, Lucas Reyes, Gary Janke, and A. R. Shank

Production: The seeded acreage of oats in Texas fell from 2,100,000 acres in 1973 to 1,800,000 acres in 1974. The year was unfavorable for oat production due to prolonged and widespread drought. This caused drastic reductions in both the acreage harvested for grain and the yield of grain per acre. Only 300,000 acres were harvested in 1974 (less than half the 1973 harvested acreage of 650,000). The average yield of 27 bushels per acre also fell far short of the record yield of 41 bushels per acre established in 1973.

Other Texas small grains were similarly affected by the adverse season. Although favorable wheat prices and relaxation of wheat acreage restrictions caused an appreciable increase in planted wheat acreage from 4,600,000 acres in 1973 to 5,600,000 acres in 1974, the harvested acreage fell from 3,400,000 acres in 1973 to 3,300,000 acres. The average yield of 16 bushels per acre was drastically lower than the 1973 yield of 29 bushels per acre. Thus the total grain production was down 46% despite the 22% increase in planted acreage. Texas farmers were not able to capitalize on the record small grain prices received in 1974; they did not have enough grain to sell.

Two factors probably will reduce the oat acreage in Texas in 1975. Some acreage is being shifted from oats to wheat as wheat acreage is no longer under government allotment control. In addition, the unbelievable turnaround in cattle prices and increases in fuel, fertilizer, and seed costs have drastically cut profits from small grain forages. The acreage of small grains planted exclusively for forage in Texas is being reduced, and wheat may be substituted for oats as a dual-purpose crop (limited grazing plus grain production) in areas previously devoted to oat pasture.

Rusts: Crown rust races identified from 103 Texas collections in 1974 were distributed as follows: 264B, 55%; 325, 23%; 276, 16%; 263, 3%; 290, 2%; 326, 1%. Crown rust was damaging in South and Central Texas in 1974. The varieties TAM 0-301, TAM 0-312, and Coker 234 remained resistant. The acreage planted to these varieties is increasing rapidly.

Stem rust races identified from 71 Texas collections showed the following distribution: 31, 73%; 61, 22%; 70, 3%; 76, 1%; and Race 1, 1%.

Helminthosporium avenae: Oat leaf blotch was severe in some nurseries in South and Central Texas in 1973 and in 1974. It also caused considerable damage in some commercial fields. Unfortunately, the new crown rust resistant variety TAM 0-301 is very susceptible to *H. avenae*. Discontinuation of use of the mercury seed fungicides may have contributed to the increased incidence of this disease in Texas.

UTAH

R. S. Albrechtsen

Utah's oat acreage decreased again slightly in 1974. Barley and wheat hold a more favorable position from an economic standpoint. State-average per-acre yields are regularly lower for oats than are those for barley and only slightly higher than those for irrigated spring wheat on a bushel basis. This is likely at least partially due to the relegation of oats to the less favorable acreages and poor management practices utilized. The large disparity between the estimated state-average yield of 53.0 bushels per acre in 1974 and the 127-bushel average obtained in the 1974 nursery tends to confirm this conclusion.

We are not presently involved in an active oat breeding program. We do grow and evaluate the Northwestern States Oat Nursery and additional varieties and advanced breeding lines of particular interest to us.

Cayuse continues to be our top-yielding named variety over the long-term average. A number of selections from Aberdeen and Pullman look promising. Diseases are generally of little or no consequence under our dry environmental conditions.

WASHINGTON

C. F. Konzak, M. A. Davis, G. W. Bruehl, K. J. Morrison, P. Reisenauer

The acreage sown to oats in Washington State has varied from about 48,000 to 112,000 acres during the past ten years. The average acreage is nearer 60,000. The unusually high acreage in 1973 was due largely to the severe freeze out of winter wheat in Eastern Washington areas, and limited availability of spring wheat seed. We estimate one 1974 area in oat production to be between 60,000 and 80,000 acres, with further reductions likely in 1975.

Oat breeding work has been minimal, but because of the occasionally severe BYDV problem, we are continuing to evaluate lines and reselections from cross Cayuse/CI2874 and its reciprocal. Lines with higher levels of BYDV tolerance than Cayuse or CI2874 have been isolated through the kind cooperation of Dr. C. O. Qualset, University of California at Davis. Some derivative lines appear to be higher yielding than Cayuse, but we seem to have made little progress in improving test weight. The Aberdeen, Idaho crosses involving Orbit seem to be better in this respect. Also the highest yielding derivatives selected so far do not have the highest levels of BYDV tolerance. Lines from two progenies that were segregating for high BYDV tolerance may have better potential, but will only be in preliminary yield tests in 1975. White lemma derivatives with BYDV tolerance have had small seeds.

We have initiated a mutation study with one small seeded BYDV tolerant line of Cayuse/CI2874 aiming to increase seed size and test weight via bulk selection methods. Seed harvested from M_2 populations will be screened on seed sorting equipment and the M_3 sown in 1975.

Mutation methods also have been applied for the induction of mutants with semidwarf straw height. About 50 lines ranging in height from 50 to 80 cm have been isolated from Ab5280-7 and Fraser. One short semidwarf mutant of Ab5280-7 appears to have a single dominant semidwarf height factor. Most interesting, its height under irrigation was not greatly different (50-55 cm) than under the 20" rainfall conditions at Pullman. A number of the semidwarf mutants will be increased in preliminary yield trials during 1975.

Three Cayuse/CI2874 lines show promise for yield performance in the uniform Northwestern States Oat Nursery, WA6013, WA6014, WA6015. One or more will be considered for possible Breeder's Seed Production in 1976.

WISCONSIN

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

The Wisconsin state-wide average oat yield in 1974 was 61 bushels per acre, only two bushels below the record set in 1970. The total 1974 production of 85.4 million bushels (from 1.4 million acres) was an increase of 52% above the poor 1973 crop which averaged only 41 bushels per acre. Planting in 1974 was timely, and cool temperatures with ample soil moisture in May and early June resulted in excellent tillering and vegetative growth. Some moisture stress occurred toward the end of June and early July in central and southeastern parts of the state causing shorter plant height, lower test weight, and yield reductions. For the second year in a row, leaf rust was a serious problem in some areas of southern Wisconsin. Although losses were not as great as in 1973, susceptible varieties had clear-cut reductions in yield and bushel weight. The red leaf virus also caused some losses in southeastern Wisconsin in 1974. Extensive surveys by the Wisconsin Department of Agriculture in the southern half of Wisconsin did not find any cereal leaf beetles in 1973 or in 1974.

'Goodland' oats, Wisconsin X1656-1, C.I. 9202, was distributed in 1974 and will be available for general farm production in 1975. Goodland is stiff-strawed and has high groat protein. A complete description may be found elsewhere in this Newsletter.

'Wright' oats, Wisconsin X1641-2, C.I. 9218, will be distributed to Wisconsin growers of certified seed in 1975. Wright is a Beedee-type oat but is taller, lodges less, and has higher yields than Beedee. A complete description may be found elsewhere in this Newsletter.

Every fifth year, an oat varietal-acreage survey is conducted in Wisconsin by the State and U.S. Departments of Agriculture. The percentages of total oat acres in 1974 are tabulated below:

Froker	22.7%	Rodney	9.3%
Lodi	12.6	Garry	9.1
Dal	11.0	Others	24.3
Holden	11.0		

The leading variety was Froker which was first seeded by farmers in 1970. Dal accounted for 11% of the 1974 crop, a commendable distribution for a variety first grown in 1973. Resistance to leaf rust, high grain yields, and high groat protein have contributed to Dal's rising popularity in Wisconsin. The main acreages of Rodney and Garry are in the northern half of Wisconsin.

Personnel:

Although Dr. H. L. Shands officially retired in July, 1974, after more than 40 years of service, he is continuing an active program concerned with the development and utilization of oat germ plasm in developing countries.

Dr. Marshall A. Brinkman joined the Wisconsin small grain team in August (1974). Dr. Brinkman was raised in Iowa and obtained his Ph.D. in 1974 at Iowa State University under the direction of Dr. K. J. Frey.

Graduate students completing their degree programs include Paul M. Lyrene (Ph.D.), now working with sugarcane at the University of Florida, Sugar Field Station, Canal Point, Florida; Young Am Chae (Ph.D.), now participating in wheat and rye improvement programs at the Technische Universität München, Institut für Pflanzenbau und Pflanzenzüchtung, 805 Freising-Weihenstephan, West Germany; Dinesh C. Sharma (Ph.D.), now a D. F. Jones Postdoctoral Fellow in the Department of Agronomy, University of Nebraska, working with Dr. Rosalind Morris; and Gordon L. Cisar, who completed his Masters program.

V. OAT CULTIVARS

USDA Oat Collection

J. C. Craddock

There were only ten oat varieties assigned CI numbers during 1974. I believe most breeders have germplasm that could be submitted to the collection. This germplasm need not be suitable for release as cultivars. Your entry may be added to the collection by merely providing a 10-400 gram sample and a statement that it is open stock. Any specific information regarding the entry is appreciated. The more information you offer, the more complete our records will be.

We have an OAT GENE BANK, but no contributors. The last contribution to this bank was in 1968. This bank is dependent on breeders contributing their surplus seeds from F_1 and F_2 plants. Without your help, there will be no gene bank.

Clearing names for future release cultivars is my responsibility. Please submit three proposed names in order of preference. I will be glad to check them for duplication and/or possible infringement on existing trademarks.

The new accessions to the USDA Oat Collection are listed on the following page.

C. I. NUMBERS ASSIGNED IN 1974

C. I. Number	Name or Designation	Parentage	Source
9207	Cumberland		Tennessee
9208	Super Tall		Idaho
9209	Elgin (Canada)	Stormont / (Garry / Simcoe)	Canada
9210	Arkansas 15	Selection from Arkwin	Arkansas
9211	Mo 06072	Pettis / Florida 500	Missouri
9212	MNRL 2629	CW90-2 / Rodney 0^2 reselection	Minnesota
9213	MN PPV-10	65B633 / 65B252-6	Minnesota
9214	MN 746001-B	Omega / MN RL 2629 (CI 9212)	Minnesota
9215	MN 2761-B	Minhafer // Gopher / MN RL 2629	Minnesota
9216	Alma	Glen / Q. O. 16.2	Canada

Registration of Varieties and Hybrids of Oats

Franklin A. Coffman
USDA Collaborator

In Oat Newsletter, Volume 23, pages 62 - 68, J. C. Craddock and F. A. Coffman presented information on all oat varieties registered by the American Society of Agronomy up to that time. The latest variety included in that list appeared in Crop Science 12(2), 1972.

Additional varieties have been registered since then. Herewith are those additional varieties and hybrids.

ADDITIONAL REGISTERED OAT VARIETIES

Name	CI No.	Reg. No.	References
Astro	9160	258	Crop Science 15(4):605.1974.
Chief	9080	255	Crop Science 14(1):127.1974.
Otee	9086	251	Crop Science 13(3):397.1973.
Pennwin	8312	253	Crop Science 13(5):581.1973.
TAM 0-301	9198	256	Crop Science 14(1):127-128.1974.
TAM 0-312	9199	257	Crop Science 14(1):128.1974.
Trio	7698	252	Crop Science 13(5):581.1973.
Windsor	9140	254	Crop Science 13(5):581.1973.

ADDITIONAL REGISTERED G.P. (GERMPLASM) OAT VARIETIES

Variety	CI No.	G.P. No.	Reference
X117	9192	5	Crop Science 13(2):290.1973.
N. Y. Oat Composite I		6	Crop Science 14(4):612.1974.

ISOLINE E SERIES (EARLY)

Crop Science 13(2):291-292.1973.

CI No.	Cross	Parentage
9169	X292II	CI 8044^4 2x CI 7544^4 x Ceirch du Bach
9170	X434II	CI 8044^5 3x Clinton x Garry 2x CI 8079
9171	X465	CI 8044^5 2x CI 7555 x CI 8078
9172	X466I	CI 8044^6 x CI 8001
9173	X467	CI 8044^6 x Victorgrain 48-93
9174	X468II	CI 8044^6 x Moregrain
9175	X469II	CI 8044^6 x Ascencao
9176	X470I	CI 8044^6 x Ascencao
9177	X539III	CI 8044^4 3x Clintland 2x Chapman 178 x CI 7235
9178	X541	CI 8044^4 3x Bonkee 2x CI 7154 x CI 7171
9179	X719	CI 8044^4 2x CI 7555 x CI 6665
9180	X721	CI 8044^4 2x CI 7555 x CI 7654
9181	X766	CI 8044^5 2x Clinton x CI 8081

ISOLINE M SERIES (MIDSEASON)

Crop Science 13(2):291-292.1973.

CI No.	Cross	Parentage
9182	X104C-7	CI 7555^{6} x Ceirch du Bach
9183	X270I	CI 7555^{6} x CI 8079
9184	X421I	CI 7555^{6} x CI 8001
9185	X422	CI 7555^{6} x Victorgrain 48-93
9186	X423	CI 7555^{6} x Ascencao
9187	X424III	CI 7555^{6} x Ascencao
9188	X447	CI 7555^{4} 3x Bonkee 2x CI 7154 x CI 7171
9189	X449I	CI 7555^{6} x CI 6665
9190	X475II	CI 7555^{6} x CI 8078
9191	X765	CI 7555^{5} 2x Clinton x CI 8081

IDENTITY OF PARENTS USED IN CROSSES

CI No.	Parentage
6665	(Kherson x Liberty Hulless) x Kherson
7154	(Markton x Rainbow) x (D69 x Bond)
7171	Selecta D.L. 41372 (PI 185783)
7235	Rodney x (Landhafer x Forvic)
7544	[Osage 4x (Bonda 2x Hajira x Joanette) 3x Santa Fe] 5x CI 6702
7555	Clintland 5x Victoria 2x Hajira x Banner 3x Victory x Hajira 4x Roxton
7654	Magnif 28
8001	Wahl No. 2 [(*Avena sterilis*) (Israel)]
8044	Clintland x Garry Sel. 5
8078	Wahl No. 7 (Iowa)
8079	Wahl No. 8 (Iowa)
8081	Sel. from [(*Avena sterilis*) (Iowa)]

Status of Oat Classification Manuscript

Franklin A. Coffman
USDA Collaborator

In November 1974, the long-delayed Oat Classification Manuscript had been edited by the U. S. Department of Agriculture Staff and passed on to the officials and printers.

Hopefully, it will shortly appear in the "galley" form and eventually copies will be available to oat scientists.

BLACKBUTT

The new grazing variety Blackbutt (Accession No. P4319) was released by the New South Wales Department of Agriculture in 1974. It was bred by Mr. P. Guerin at Glen Innes Agricultural Research Station from the cross Fulghum/Garry/5/Victoria/Richland/2/Algerian/3/Fulghum/4/Victoria/Richland/2/Sunrise/3/Fulghum. It was released for heavy grazing and grain on the Tablelands.

Blackbutt is classed as a late maturing variety but is earlier than Acacia, Klein 69B and Mugga the varieties it is designed to replace. Its maturity is similar to that of Algerian. It has fairly strong straw of medium height, is resistant to oat smuts and although susceptible in laboratory tests to some races of stem rust in the seedling stage, it has good field tolerance at later stages. Blackbutt has good resistance to frost damage after grazing. The grain is small to medium in size, of high test weight, but not suitable for milling.

For green feed production Blackbutt is equal to Klein 69B, equal to or better than Acacia and better than Mugga. For grain recovery it is much superior to Klein 69B, Acacia and Mugga.

Goodland

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

'Goodland' spring oats (*Avena sativa* L.), Wisconsin X1656-1, C.I. 9202, was developed primarily by workers at the Wisconsin Agricultural Experiment Station. Seed was distributed to Wisconsin growers of certified seed in 1974 and Goodland will be available for general farm production in 1975.

The pedigree of Goodland is: Trispernia x Belar 2x Goodfield 3x Goodfield 4x Garland. Yield testing of Goodland began in 1968 at Madison, Wisconsin. It has been tested at several Wisconsin Experimental Farms since 1970 and was in the USDA Midseason Uniform Performance Nursery in 1971-1973.

Three reasons for distributing Goodland oats are an increase in straw standability, resistance to races of leaf rust now prevalent in Wisconsin, and a slight increase in groat protein. Goodland has the highest groat protein percentage of any variety now available in the U.S., averaging about one-half a percent higher than Dal. Straw strength and lodging resistance are better than those of most available varieties. Grain color is yellow, and Goodland is about 6 cm shorter than Holden. Heading and ripening of Goodland are midseason, being a little earlier than either Dal or Froker. Grain yields have been lower than those of some other varieties, but Goodland is competitive with most varieties for pounds of groat protein produced per acre. Goodland is resistant to races of smut and stem rust now present in Wisconsin, is intermediate in response to Septoria, and is susceptible to the red leaf virus. Goodland is adapted for use only on fertile soils.

Maris Oberon

G. Jenkins

The spring oat variety Maris Oberon, bred at the Plant Breeding Institute, Cambridge, England has been added to the 1975 Recommended List of the National Institute of Agricultural Botany.

Maris Oberon was selected from the cross Manod x (Astor x AB 203/187) and joins another Institute selection, Maris Tabard, as the joint highest yielding spring oat available at present on the NIAB List, having an average yield of 115 per cent of the control varieties (Condor and Astor) in national trials. Maris Oberon is the stiffest strawed spring oat variety grown at present. It is seedling resistant to races 1, 2 and 4 of powdery mildew but is susceptible to crown rust and it is slightly later than Astor and Condor. Maris Oberon has a high 1000-corn weight but has a slightly lower kernel content than Maris Tabard.

Salem

C. F. Murphy

'Salem' winter oats (Avena sativa L.), C.I. 9204, was developed by the North Carolina Agricultural Experiment Station. It is derived from the cross Goodfield x Moregrain which was made in 1964. Final selection (F_6) was made in 1969. It was tested as N.C. 43.

Salem is especially well adapted to the piedmont section of North Carolina. It is slightly late in both heading and maturity and it has exceptionally good straw strength and high test weight. It has good resistance to crown rust and powdery mildew.

SPEAR

D. L. Reeves

'Spear" spring oats, SD 955, CI 9203, was developed at the South Dakota Agricultural Experiment Station. It was selected from a Neal/Clintland 64 cross. The original selection was a single F_2 plant. The line was later rogued to remove less desirable plants such as those which were most susceptible to crown and stem rust.

Spear is a midseason oat of medium height that shows very good lodging resistance. It was tested in the Uniform Midseason Oat Performance Nursery in 1968 to 1971 and in 1973. In these tests it consistently had one of the highest groat protein levels. In South Dakota trials it has been one of the highest producers in terms of pounds of groat protein produced per acre. The test weight and groat percentage are good, although perhaps not as high as might be desired. Oil content averages seven percent. The grain is white although there may be about four percent light yellow to yellow kernels.

Spear possesses better resistance to yellow dwarf than Froker, Diana, or Chief. Seedling tests indicate that it is moderately resistant to crown rust race 264B but has some susceptible segregates. The postulated genotype for stem rust is B (seg.) Defh. About 62% of the plants contain the dominant B gene and are therefore resistant to race 61.

West Oats

P. A. Portmann

West is a new variety of oats being released to farmers in Western Australia for the 1975 season. Results from 80 trials over the last 3 years have indicated that West outyields Swan, the current commercial variety, by an average of 11% over the state and that quality wise it will be as good as Swan.

West is a selection, previously known as XBVT189, from the cross Radar 2/ML27. ML27 is a sister line to Swan. It has ingerited rust resistance from Radar 2 and is currently resistant to all races of oat stem rust in Western Australia.

The following tables suitably summarize West's yield and quality compared with Swan.

Table 1

West Oats - Summary of Yield Data 1970-73
Mean Yields as Percent of Swan

(Number of Comparisons in Brakets - Direct Comparison with Swan)

A. REGIONS X ZONES

	RainFall Regions			Means
	High (450 mm)	Medium (325-450 mm)	Low (325 mm)	
Zones:				
North	105 (3)	137 (7)	112 (3)	126(13)*
North Central	121 (5)	109 (6)	109 (4)	112(15)*
Central	101 (5)	113 (7)	108 (5)	108(17)*
South Central	106 (6)	112 (5)	120 (3)	110(14)*
South	107(16)	107 (9)	107 (5)	107(30)NS
Means	107(35)*	115(34)**	110(20)*	111(89)***

B. REGIONS X TIME OF SOWING

	Rainfall Regions			Means
	High (450 mm)	Medium (325-450 mm)	Low (325 mm)	
Sowing Times:				
May 16-31	99 (3)	97 (1)	107 (3)	102 (7)NS
June 1-15	116 (9)	107 (8)	109 (6)	111(23)**
June 16-30	106(17)	117(18)	110 (8)	111(43)***
After June	106 (6)	122 (7)	130 (3)	114(16)NS
Means	107(35)*	115(34)**	110(20)*	111(89)***

Significance:- *, **, *** - Significant at .05, .01, .001 levels of probability respectively (assessed on 't' test applied to percentages in individual trials).

Table 2

Quality Results - Oat Variety Trials (1971-1973)
Mean Quality Data of West Expressed as a Percentage of Swan

(Number of trials in brackets - direct comparison with Swan control)

	Agtron Reflectance %	N%, d.b.	Hectolitre Weight (kg)	Groat %	Groat Weight (mg)	% Grain Retained Above 2.0 mm sieve
1971 Stage 3 Trials						
High Rainfall Region		118 (4)**	98 (4)	103 (4)	96 (4)	100 (4)
Med. Rainfall Region		118 (3)*	101 (4)	103 (3)	90 (3)	99 (3)
Low Rainfall Region		118 (2)	95 (4)	100 (2)	81 (2)	90 (2)
All Trials		118 (9)***	98 (9)	102 (9)	91 (9)	97 (9)
1972 Stage 4 Trials						
High Rainfall Region	108 (6)**	108 (6)*	99(16)	101 (6)	83 (6)**	93(16)*
Med. Rainfall Region	103 (6)	104 (6)	99(15)	102 (6)	85 (6)**	88(15)
Low Rainfall Region	103 (4)	104 (4)	96 (8)**	100 (4)	88 (4)**	82 (8)*
All Trials	104(16)*	105(16)	98(39)**	101(16)*	85(16)***	89(39)***
1973 Stage 4 Trials						
High Rainfall Region	111 (6)	107 (6)	98 (6)	99 (6)	81 (6)	97 (6)
Med. Rainfall Region	111 (6)	104 (6)	98 (6)	99 (6)	78 (6)	96 (6)
Low Rainfall Region	111 (4)	103 (4)	99 (4)	104 (4)	83 (4)	89 (4)
All Trials	111(16)	105(16)	98 (16)	100(16)	80(16)	94(16)

Rainfall Regions - High (450 mm), Medium (325-450 mm), Low (325 mm)

Significance based on "t" test applied to individual trial percentages - *, **, *** significant at .05, .01, .001 levels of probability respectively. 1973 results not yet analysed.

The full pedigree of West is:

Kent/Ballidu (M127)//Radar 2.

West has a medium tillering habit, with strong erect equilateral panicles. It sets 2 to 3 grains per spikelet. The leaves are pubescent, non-glaucous and semi-erect. The straw is yellow in colour and coarse although not as coarse as Swan.

Wright

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

'Wright' spring oats (Avena sativa L.), Wisconsin X1641-2, C.I. 9218, was developed primarily by workers at the Wisconsin Agricultural Experiment Station and will be released to Wisconsin growers of certified seed in 1975.

The pedigree of Wright is: Trispernia x Belar 2x Beedee 3x Beedee 4x Beedee. Yield testing of Wright began in 1969 at Madison, Wisconsin. It has been tested at several Wisconsin Experimental Farms since 1971 and was in the USDA Midseason Uniform Performance Nursery in 1972-1974.

Wright is high yielding, with yield averages equalling those of Dal, and has higher test weight per bushel than any other variety. Grain color is light tan. Although it is 5-7 cm taller than Beedee, Wright has stiffer straw and lodges less than Beedee. It is 3-5 cm shorter than Lodi. It is intermediate in maturity, heading about 1 day later than Holden and ripening about 2 days earlier than Lodi.

Wright is resistant to races of leaf rust, stem rust, and smut now prevalent in Wisconsin. It is intermediate in response to Septoria, and in special tests has shown tolerance to the red leaf virus. Groat protein percentages are above average, with mean values over 1% above Froker but 1-2% below Dal. It is not as stiff-strawed as Goodland but Wright is expected to have a wide area of adaptation, especially on soils of medium and good fertility in Wisconsin.

VI. PUBLICATIONS

1. Anon. 1974. TAM O-301 and TAM O-312 Oats. Texas Agricultural Experiment Station L-1325 (Variety release leaflet).

2. Boland, P. and D. A. Lawes. 1973. The inheritance of the naked grain character in oats studied in a cross between the naked variety Caesar and the husked variety Bo 1/11. Euphytica 22:582-591.

3. Brakke, M. K., and W. F. Rochow. 1974. Ribonucleic acid of barley yellow dwarf virus. Virology 61:240-248.

4. Brinkman, M. A. 1974. Physiological and morphological explanations for yield differential existing among isolines and recurrent parents of oats (Avena spp.). Ph.D. Thesis, Iowa State University Library, Ames, Iowa.

5. Campbell, A. R. and K. J. Frey. 1974. Inheritance of straw-protein content and its association with other traits in interspecific oat crosses. Euphytica 23:369-376.

6. Chae, Y. A., and R. A. Forsberg. 1974. Inheritance of node, branch, and spikelet number in oat panicles. Generation mean analysis. Agron. Abstr.:50. (Abstract of a paper presented at the American Society of Agronomy annual meeting, Chicago, Ill., Nov. 10-15, 1974.)

7. Chae, Y. A. 1974. The inheritance of node, branch, and spikelet number in oat panicles. Ph.D. thesis, Department of Agronomy, University of Wisconsin, Madison.

8. Cisar, G. L. 1974. Panicle initiation and development in Avena sativa L. M.S. thesis, Department of Agronomy, University of Wisconsin, Madison.

9. Collins, F. C., J. P. Jones, and W. T. McGraw. 1974. 1973-74 Arkansas Oat Variety Tests. Arkansas Farm Research. Vol. XXIII (4) 4.

10. Collins, F. C., J. P. Jones, and W. T. McGraw. 1974. 1973-74 Wheat Variety Trials. Arkansas Farm Research. Vol. XXIII (4) 5.

11. Day, K. M., F. L. Patterson, O. W. Luetkemeier, H. W. Ohm, J. J. Roberts, M. L. Swearingin, G. E. Shaner, D. M. Huber, R. E. Finney, and R. L. Gallun. 1974. Performance and adaptation of small grains in Indiana. Sta. Bull. 32.

12. Day, K. M., F. L. Patterson, O. W. Luetkemeier, H. W. Ohm, J. J. Roberts, M. L. Swearingin, G. E. Shaner, D. M. Huber, R. E. Finney, and R. L. Gallun. 1974. Performance and adaptation of small grains in Indiana. Sta. Bull. 56.

13. Duffus, J. E., and W. F. Rochow. 1973. Positive infectivity neutralization reactions between isolates of beet western yellows virus and antisera against barley yellow dwarf virus. (Abstr.) No. 0895, Abstracts of Papers, Second International Congress of Plant Pathology.

14. Eagles, H. A. 1974. The heritability and environmental specificity of adaptation parameters for grain and straw yields of oats. Ph.D. Thesis, Iowa State University Library, Ames, Iowa.

15. Fatunla, T. and K. J. Frey. 1974. Changes in quantitatively inherited traits in radiated and nonradiated bulk oat (Avena sativa L.) populations. Egyptian J. Gen. & Cytology 3:259-276.

16. Fatunla, T. and K. J. Frey. 1974. Stability indexes of radiated and nonradiated oat genotypes propagated in bulk populations. Crop Sci. 14:719-725.

17. Forsberg, R. A., V. L. Youngs, and H. L. Shands. 1974. Correlation among chemical and agronomic characteristics in certain oat cultivars and selections. Crop Sci. 14:221-224.

18. Gough, F. J. and M. E. McDaniel. 1974. Occurrence of oat leaf blotch in Texas in 1973. Plant Dis. Reptr. 58:80-81.

19. King, J. W., F. C. Collins, and B. C. Troutman. 1974. Establishing a Bermudagrass lawn in a Cool Season Species Cover. Arkansas Farm Research. Vo. XXIII (4) 8.

20. Lawes, D. A. and P. Boland. 1974. Effect of temperature on the expression of the naked grain character in oats. Euphytica 23:101-104.

21. Lawrence, P. K. 1974. Introduction of exotic germplasm into oat breeding populations. Ph.D. Thesis, Iowa State University Library, Ames, Iowa.

22. Luke, H. H. and R. D. Barnett. 1974. Calcium nutrition and sensitivity of oat leaf tissue to victorin. Plant Disease Reporter 58(1):3-6.

23. Luke, H. H., R. D. Barnett, and W. H. Chapman. 1975. Variation in the horizontal resistance of oats to crown rust. Plant Disease Reporter 59: (in Press).

24. Luke, H. H., R. D. Barnett, and P. L. Pfahler. 1975. Inheritance of horizontal resistance to crown rust in oats. Phytopathology 65: (in Press).

25. Lyrene, P. M., and H. L. Shands. 1974. Groat protein percentage in Avena sativa L. fatuoids and in a fatuoid x A. sterilis L. cross. Crop Sci. 14:765-767.

26. Lyrene, P. L. 1974. Inheritance of groat protein percentage and other traits in Avena sativa L. x A. sterilis L. crosses. Ph.D. thesis, Department of Agronomy, University of Wisconsin, Madison.

27. Jones, J. P. 1974. Prolonged storage of Helminthosporium victoriae in soil. Phytopathology 64:1158.

28. Jones, J. P. and F. C. Collins. 1973. Oats-Smuts. Fungicide-Nematode tests, Results of 1973. Am. Phytopath. Soc. 29:130-131.

29. Maruyama, K., A. E. Harper, H. L. Shands, and M. L. Sunde. 1974. Improvements in protein quality and quantity of oat groats. Poultry Sci. Abstr. 53(5):1952.

30. McDaniel, M. E. 1974. Registration of TAM O-301 Oats (Reg. No. 256). Crop Sci. 14:127-128.

31. McDaniel, M. E. 1974. Registration of TAM O-312 Oats (Reg. No. 257). Crop Sci. 14:128.

32. Mislevy, P., P. E. Everett, and R. D. Barnett. 1974. Winter annual forage production at Ona and Immokalee, 1973-74. Florida Agricultural Experiment Station. Agricultural Research Center, Ona, Research Report RC-1974-5, 4 pp.

33. Murphy, Charles F. 1974. Identification of Diverse Polygenic Systems Affecting Certain Quantitative Expressions in Oats. North Carolina Agricultural Experiment Station Technical Bulletin No. 223. 43 pp.

34. Nelson, L. R., et al. 1974. Performance of Small Grain Varieties in Georgia 1973-74. Ga. Agr. Exp. Sta. Res. Rept. 192. 46 pp.

35. Ohm, H. W., F. L. Patterson, J. J. Roberts, and G. E. Shaner. 1974. Registration of Noble spring oats. Crop Sci. 14:906.

36. Ohm, H. W., F. L. Patterson, J. J. Roberts, and G. E. Shaner. 1974. Registration of Stout spring oats. Crop Sci. 14:906-907.

37. Ohm, H. W., F. L. Patterson, J. J. Roberts, and G. E. Shaner. 1974. Noble spring oat. Sta. Bull. 36.

38. Ohm, H. W., F. L. Patterson, J. J. Roberts, and G. E. Shaner. 1974. Stout spring oat. Sta. Bull. 37.

39. Peterson, D. M., Schrader, L. E., and V. L. Youngs. 1974. Elemental composition of developing oat plants. Crop Sci. 14:735-739.

40. Pomeranz, Y., and H. L. Shands. 1974. Gibberellic acid in malting of oats. J. Food Sci. 39:950-952.

41. Reeves, D. L. 1974. Registration of Chief Oats. Crop Sci. 14:127.

42. Reeves, D. L. 1974. Oats: your protein source? South Dakota Farm and Home Research, Summer, 11-13.

43. Rochow, W. F. 1973. Selective virus transmission by Rhopalosiphum padi exposed sequentially to two barley yellow dwarf viruses. Phytopathology 63:1317-1322.

44. Rochow, W. F. 1974. Vectors and Variations, p. 75-83. In R. H. Lawson and M. K. Corbett, (Eds.), Third International Symposium on Virus Diseases of Ornamental Plants. Technical Communication No. 36, International Society for Horticultural Science, The Hague, Netherlands.

45. Rochow, W. F., and J. E. Duffus. 1973. Specificity in reactions between isolates of barley yellow dwarf virus and antisera for isolates of beet western yellows virus. (Abstr.) No. 0898, Abstracts of Papers, Second International Congress of Plant Pathology.

46. Rochow, W. F., and Irmgard Muller. 1974. Mixed infections of barley yellow dwarf virus isolates in winter grains. Plant Disease Reporter 58:472-475.

47. Roelfs, A. P., and P. G. Rothman. 1974. Races of Puccinia graminis f. sp. avenae in the USA during 1973. Plant Dis. Reptr. 58:605-607.

48. Rothman, Paul G. 1974. Induction of early teliospore formation in oat rusts. Plant Dis. Reptr. 58:467-468.

49. Roylance, H. B., D. M. Wesenberg, J. A. Benson, R. M. Hayes, and D. Wattenbarger. 1974. Oat varieties for Idaho. Univ. of Idaho Current Information Series No. 217.

50. Schrader, L. E., D. A. Cataldo, and D. M. Peterson. 1974. Use of protein in extraction and stabilization of nitrate reductase. Plant Physiol. 53:688-690.

51. Sechler, Dale, J. M. Poehlman, et al. 1974. Performance of selected Small Grain Varieties in Missouri. UMC Agron. Report No. 74-8.

52. Shands, H. L., R. A. Forsberg, R. D. Duerst, and Z. M. Arawinko. 1974. Froker and Dal oats—performance and breeding. Wis. Agr. Exp. Sta. Bull. R2569. 5 pp.

53. Shands, H. L., R. D. Duerst, R. A. Forsberg, Z. M. Arawinko, G. L. Cisar, and P. L. Lyrene. 1974. Breeding oats for increased groat protein. Agron. Abstr.:67. (Abstract of a paper presented at the American Society of Agronomy annual meeting, Chicago, Ill., Nov. 10-15, 1974.)

54. Sharma, D. C. 1974. Spontaneous alien chromosome substitution and induced gene transfer in Avena. Ph.D. thesis, Department of Agronomy, University of Wisconsin, Madison.

55. Sharma, D. C., and R. A. Forsberg. 1974. Alien chronosome substitution—a cause of instability for leaf rust resistance in oats. Crop Sci. 14:533-536.

56. Spilde, L. A., R. S. Albrechtsen, and M. D. Rumbaugh. 1974. Relationship of Protein percent with other phenotypic characters in interspecific oat crosses. Crop Sci. 14:767-769.

57. Sraon, H. S. 1974. Quantitative Gene Action and Interrelationships of Protein Content With Some Metrical Traits of Oats. Unpublished Ph.D. thesis. South Dakota State University Library, Brookings, South Dakota.

58. Tantivit, A. and K. J. Frey. 1974. Inheritance of groat-protein percentage in reciprocal crosses among and within Avena species. Iowa State J. Res. 49:89-99.

59. Weerapat, P., Dale Sechler and J. M. Poehlman. 1974. Barley Yellow Dwarf Virus Resistance in Crosses with Pettis Oats. Crop Sci. 14:218-20.

60. Weerapat, P., Dale Sechler and J. M. Poehlman. 1972. Host Study and Symptom Expression of BYDV in Tall Fescue. Pl. Dis. Reptr. 56: 167-68.

61. Yokoo, Masao. 1974. Multiline cultivars for disease control. Japan. J. Breeding 24:104-111. (In Japanese).

62. Youngs, V. L. 1974. Extraction of a high protein fraction from oat groat bran and flour. J. of Food Sci. 39:1045-6.

63. Youngs, V. L., and H. L. Shands. 1974. Variation in oat kernel characteristics within the panicle. Crop Sci. 14:578-580.

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