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9. ABSTRACT

A PROJECT: To find oat varieties resistant to rust and virus yet displaying satisfactory agronomic adaptation to the climates and soils of less developed countrie
DURATION: 1975 - Ongoing.
DEVELOPMENTS: Building on this project's first report, dated 1976, which indicated that certain cultivars had attractive possibilities for pasture, forage, or grain use in Brazil and Columbia, the second year of the project focused on efforts to increase oat production. Results show that improving oats through breeding programs could make that grain a competitive crop in developing countries. Breeding programs were continued through 1976 and this report includes nursery observations from 15 sites -- covering parts of the eastern and western hemispheres, and locations both north and south of the equator. Emphasis was placed on finding lines with crown rust resistance, preferably with satisfactory adaptive qualities.

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Breeding Oat Cultivars Suitable for Production in Developing Countries

Report of Research Findings - January 1, 1976 to December 1, 1976
Agency for International Development-Contract ta/C-1171. U.S. Department of State
U. S. Department of Agriculture, University of Wisconsin- Madison
College of Agricultural and Life Sciences, Agronomy Department Jan. 1977

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PN-AAD-127

ANNUAL REPORT

OF

RESEARCH FINDING

BREEDING OAT CULTIVARS SUITABLE FOR PRODUCTION IN DEVELOPING COUNTRIES

January 1, 1976 - December 31, 1976

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Contract No. AID/ta-C-1171

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BREEDING OAT CULTIVARS SUITABLE FOR PRODUCTION IN DEVELOPING COUNTRIES

Contract No. AID/ta-C-1171

INTRODUCTION

Contract No. AID/ta-C-1171 provided means for investigating feasibility of breeding oat cultivars suitable for production in developing countries. The first annual report, dated January 1976, covered the initial attempts to find suitable cultivars for production of grain or forage in sub-tropical and semi-arid areas. Prior information indicated that certain cultivars had attractive possibilities for pasture, forage, or grain use in Rio Grande do Sul of Brazil and in Colombia. There was limited work in progress in several other areas; but a reevaluation of varieties and conditions of production needed to be examined.

Oats offer the possibility of producing two crops of forage or grain a year in subtropical areas. The straw is useful for livestock feed or bedding and the grain is high in protein and vitamins. Caryopses are likewise high in proteins and vitamins and can be processed into highly nutritious human food products. Such products would be very useful for children in areas of known deficits of essential amino acids.

World production statistics of oats show this crop to be widely grown, ranking after wheat, rice, maize, and barley. Tonnage for 1973-1974 averaged 88.7% of that of soybean, and was more than that of sorghum, millet or rye. Oat production was 14.3% or about one-seventh as much as wheat, the most widely grown grain crop. See Table 9.

The areas grown to oats compared to wheat in the more prosperous food-producing countries are 20.4% for USA, 22.9% for Europe, and 26.0% for Canada. These countries have crop and livestock enterprises that use oats for feed as well as for human food. In some North African countries oats cover less than 3% as much area as wheat. In Chile and Uruguay the percentage of oats compared to wheat is relatively greater. However, oats are less used in Brazil and Argentina. Oats could be used more widely as fall-winter pasture in Brazil, Argentina, and other countries.

The oat plant is versatile in areas of moderate climate. This crop can serve as a substitute for other crops. In recent times production of other crops have been periodically threatened or reduced by disease or environment.

Very likely oat production could be increased if systematic and scientific effort were focused on the crop for an extended period of time.

This, the second report of the project, will cover the second year's investigation, and will relate to, and build on the first year's experience. The geographic areas of this study cover parts of the eastern and western hemispheres as well as locations both north and south of the equator. Since thousands of miles separate sites of investigation, no one cultivar would be expected to be best suited for all locations. Yet some of the cultivars useful in fall-sown areas of the United States give most promise in approaching homeostasis (adapted agronomically). There are deficiencies within this group of varieties that could be remedied by an adequate breeding and testing program. With a broad spectrum of plant characteristics available in various sources of germplasm, it appeared quite feasible to improve oats by breeding methods so that the crop could become more competitive with other crops, and therefore be more widely used.

PLAN

Breeding programs usually require constant effort over a long period of time before accomplishing objectives. The first step is to assess available germplasm. Since there is the likelihood that available cultivars do not possess all characteristics needed, hybridization of properly chosen types followed by intensive selection and progeny-testing are accepted steps in improving oats.

To find suitable parental breeding stocks, a search of the USDA World Collection of Oats at Beltsville, provided through the courtesy of J. C. Craddock, was planned by growing parts of the collection at each of four locations. The four locations chosen in 1974 were Bogota, Colombia; Porto Alegre, Santa Maria, and Passo Fundo, Brazil. Unfortunately, the seed shipment to Passo Fundo was delayed in transit and was planted in 1975, instead of 1974.

Additional breeding stocks were provided by twenty or more oat workers, most of whom were in the United States. This group of stocks is called "Wisconsin Assembled Lines." Appreciation is expressed to those people who provided seed. They are listed in Table 2 of the 1976-dated report.

At each of the test locations attempts were made to designate those lines with breeding promise and to retest them in 1975 and 1976. This was the route chosen for screening of better parental types. However, certain crosses were made in the summer of 1974, choosing better parental combinations based on

information available at that time.

For nursery observations in 1976, entries were from the "Wisconsin Assembled Group" including selections from the World Collection and 50 populations from the rising F_3 generation. Table 1 provides a list of cooperators who grew this material and gave their time and effort in furthering this project. The location of the test and the number of entries as well as planting time are also given in Table 1. All of the test nurseries were reviewed by the senior writer except for Texas, Kenya, Chile, and Peru. Nurseries at Temuco, Chile, and Puno, Peru, were in the juvenile plant growth stage. The ones at Cuzco, Peru and Bogota, Colombia were to be planted in December of 1976 or January 1977.

EXPERIMENTAL RESULTS

Table 2 provides rust readings available in spring (north of the equator) April-June of 1976. Although a nursery was grown at Puerto Rico, rust did not develop satisfactorily. Selections were made in the rising F_3 generation at Puerto Rico and were planted at Madison, May 1976. This will be mentioned later in this report.

Texas

Two crown rust readings were made in the Beeville, Texas nursery by Dr. M. E. McDaniel. The results are given by utilizing descriptive letters such as R, S, HR, MR, MS, tr, to mean (R) resistant, (S) susceptible, (HR) highly resistant, (MR) moderately resistant, (MS) moderately susceptible, (tr) trace, and (Imm) immune. The second reading, April 14, is given and the March reading is omitted. See Table 2.

The test appears to have been fairly severe since some (Ga 7199) were moderately resistant in 1975 but susceptible in 1976. Possibly crown rust race composition had changed, or the epiphytotic was more intense than in the prior year. The selection 73C1518 followed the same trend. On the other hand, X1913-3 gave "VR" readings each year. The readings at Beeville, Texas, may be more useful to North American workers than readings from other locations. Disappointingly, several from the retests of the World Collection showed susceptibility; although several remained resistant. The selections from Missouri showed crown rust susceptibility but remain hopeful because of probable red leaf (virus) resistance. A group with unmistakable crown rust susceptibility was winter-hardy (in USA).

Algeria

The oat nursery was planted at El Harrach Dec. 18 and 19, 1975 by Dr. George Varughese. Most of the oats pollinated near May 20; but some early selections were nearly ripe at this time. Plant height averaged near 87cm (35"). Though panicles appeared quite normal for kernel number, some had as many as 150 spikelets. All told, plants were growthy. Herbicide dosonex had been applied with some apparent injury. Crown rot was evident in some rows, but was not uniformly distributed. Markton's crown rust was variable in intensity among replications of this variety. This disease appeared to be gaining infection severity. Crown rust readings of Dr. Varughese are given in Table 2, where there was a range from 0 in several to 80 for Swan and Fla 70Q1093. In comparing readings with those of Texas, there appears some interaction of varieties, since Fla 70Q1093 was Imm (immune) at Texas. Perhaps the pathogenic race was different in Algeria from that in Texas. Mn 720183 was 0 in Algeria, 10 R in Kenya, and susceptible in Texas. Other examples of lack of agreement could be cited. This probably verifies existence of physiologic races of Puccinia coronata. Stem rust varied from 0 to 60 with mostly low readings, probably indicating lesser damage than crown rust.

Tunisia

Oat growth at the Beja nursery in Tunisia by Dr. A. Maamouri showed excellent development with height varying between 145 cm and 200 cm (nearly 7 feet). See Figure 2. Enormous yields of "green chop" were available--if the plants had been used in this manner. Grain yield estimates were well over 3600 kg/ha (100 bushels per acre). Lodging was generally low, although a very few were 60 per cent. Straw diameter was thick in some selections but thin in a few. Apparently growing conditions were excellent. Heading occurred between April 25 and May 10. On May 22 the moderately early group, Coker-Florida-Texas, were turning color toward ripening. The overall crown rust infection was light; but a few selections, Markton and the winter group, had infection of 10 to 60%.1/ Stem rust was not seen May 22, except for one pustule on X2503-1.

Nursery plants at Beja had an assortment of leaf spots, some parasitic and some nonparasitic, none of which materially damaged yield. Minor infection of Helminthosporium, Septoria, and mildew were present. Probably one third of the entries had limited mildew on leaves. Apparently rainfall had been above average at Beja.

1/ Table 2.

Kenya

Stem and crown rust readings were provided by Dr. Robert Mutuura for a nursery of 1974-prepared entries, when grown at Njoro, Kenya. The stem rust readings were outstanding, indicating high susceptibility for a large proportion of the lines and a very serious production problem. In contrast, many lines showed low crown rust infection as recorded in Table 2.

Table 3, provided by Dr. Mutuura, gives a list of the most promising selections for resisting both of the rusts. The ones labeled "P" were suggested as being promising for parents in hybrids. Fortunately, Mn 720183 has been included in recent crosses, even though its grain quality is mediocre to poor. CDA CI 9139 x Rodney O was the only A. sativa selection without stem and crown rust infection. However, this selection was intermediate to susceptible to crown rust in Puerto Rico and Santa Maria in 1975. Its grain quality is poor. Two other sativa entries, X2221-2 and X2300-4, were suggested by Dr. Mutuura as suitable parents; the former is A. sativa and the latter has A. sterilis in its ancestry. Five A. strigosa (2n=14) had low leaf and stem rust infection. Transferring their resistances to A. sativa is known to be a major task. X1922-4 had a low stem rust reading; but productivity problems arise for this selection. Mn 734470-2 with resistance to both rusts in Kenya has been used as a parent recently.

Jordan

The regular 300-entry test was grown at Amman by Dr. M. A. Duwayri and the "skim off" of 98 entries from the prior years' nursery was grown at Ramtha in North Jordan near the Syrian border. Each test was rain fed, both having less than normal precipitation. Rainfall at Ramtha was 16.8 cm or less than 7 inches, and at Amman was 34.6 cm or about 15 inches. Plant height at Ramtha varied from about 20 to 45 cm, some producing good kernels and some remaining vegetative without heads. Of the 98 entries, 36 were designated for continuation. Early heading types, Australian-Coker-Texas-Georgia, were in the continued group as listed below.

73C1518	Suregrain bc	X1656-4-1	X2484-1	X3005-1	R11048
Coronado	Swan	X2220-2	X2505-2	X3236-2	R11049-2
Dal	TAM 312	X2426-4	X2666-3	X3304-1	R11052-1
Elan	CDA 139	X2459-1	X2678-1	X3314-1	R11066-1
Irwin	CDA 186	X2470-1	X2851-2	X3351-1	70R11668-1
Jaycee	64C4194-2	X2471-2	X2909A-6	73R11010-1	CI 6995

The nursery at Amman had plants with heights of 55 cm to 75 cm. A few were as low as 38 cm and a few up to 85 cm. Grain yields of the better harvested rows ranged from 11 to 89 g per 1 meter of rows 30 cm apart, averaging near 42 g per row or about 1370 kg/ha (38 bu/acre). This nursery appeared to be under stress when plants were compared to some oat plants in a nearby, but different nursery. In the oat test nursery some lines showed purple stems, perhaps indicating anthocyanin content. The most serious deficiency was that of root rot in certain entries. Root rot readings of 0-10, were given in Table 2, 0 being free, and 10 being very high. See Figure 1. X2300-4 and X2300-5 had high root rot readings, but were not cited for crown rot in Algeria. A few other selections had intermediate root rot in Jordan and crown rot in Algeria. The cause of either rot is not yet defined. Average root rot reading for harvested rows at Amman was 2.47 and for nonharvested rows was 4.42. The F_3 populations averaged 3.40 indicating a lower infection than the average for the nonharvested rows.

The root rot of lines in Jordan probably had a different causal agent than the crown rot of Algeria, since there were some differential varietal responses between locations. Repeatability of such responses may be difficult, indicating a special set of conditions that might not recur, unless the same soil area was used.

Turkey

Two sets of seed were sent to Turkish cooperators M. N. Taysi, M. Tanriyakul, and F. Altay. One nursery was planted in October 2 at Eskisehir with the hope of finding genotypes that would be winter-hardy. Seed was thin-planted or spaced, with the end result of almost complete winter killing. However, a nearby replicated yield test of local winter types had moderate survival. These were 66A/84 and 66A/85, having been received from USA. These were included in the 1976 Madison nursery where limited crossing was done. Finding breeding types that will survive the winter at Eskisehir may be quite difficult.

Given below is the tabular list of those selections offering promise in 1976 at Eskisehir. These selections did not lodge and they were without rusts. When compared to those of promise listed on page 14 of the prior report, only one selection appears on both lists. This suggests inconsistencies in line performance (though not all selections were grown in both years), or variation in seasonal influence, or other undetermined reasons for lack of selections common to both lists.

Variety or selection	Height cm	Heading time	Yield g/2.5m row
Allen	45	June 5	140
Coolabah	50	May 22	120
Dal	90	June 7	140
Goodland	40	June 7	120
X1779-2	100	May 27	150
X2051-1	80	June 7	110
X2185-1	120	June 9	140
X2470-1	75	May 26	130
X2549-1	90	May 28	130
X2851-1	70	May 27	120
X2895-4	140	June 6	140
X3086-1	100	May 28	130
X3277-1	110	May 27	120
B579-1	95	June 6	90
5236 Zi	120	May 28	140
06378 Se	80	May 26	110
CI 1312	110	June 6	100
CI 5096	90	June 3	120
CI 5730	120	May 28	100
CI 6010	110	June 6	130

Lebanon

Civil unrest in Lebanon caused a discontinuation of the oat investigation in a dryland semi-arid area. Under irrigation at A.U.B. Farm, oats provided a large tonnage of greenchop in 1975. A group of 7 crosses was suggested by H. G. Nasr, as seen on page 16 of the prior report. The following crosses were made in the greenhouse early in 1976 and are now available as rising F_2's that might be used when stability returns to Lebanon and manpower is available for conducting agronomic tests, and utilizing breeding material.

X1273-4-1 x X2426-1-1	X2426-1-1 x X1273-4-1
X1273-4-1 x X2503-2	X2426-1-1 x X2666-3
X1273-4-1 x X2687-2	X2666-3 x X1273-4-1
X1273-4-1 x X2887-8	X2666-3 x X2426-1-1
X1273-4-1 x C1217	X2666-3 x X3443-1
Coolabah x C1217	X3443-1 x Rit A130

Brazil

Entre Rios

An arrangement between the Quaker Oats Company and the cooperative Agraria Mista Entre Rio near Guarapuava in the state of Parana provided a test using a small number of entries. Seed of Coker 234 and Coker 227 were supplied by H. F. Harrison of Coker Seed Company, Hartsville, S.C. Seed of TAM 301 and TAM 312 was supplied by M. E. McDaniel of Texas A&M University. Local seed of Coronado and Suregrain bc were included in a 4-replicate test where an area of about 4 x 6 m was single plot size. Two other entries were planned for testing; but seed did not become available. Production prospects were excellent and the test seemed to be very reliable at the Nov. 25 observation. Ranking of desirability by inspection only placed Coker 234 first, followed by Coker 227, Coronado, Suregrain bc, TAM 312, and TAM 301, respectively. TAM 301 had a leaf deficiency and was infected with Septoria. TAM 312 showed a lodging problem, while Suregrain bc had pinkish kernel (lemma) infection.

Porto Alegre

Dr. F. Carvalho has completed three seasons of investigation of oats at the University of Rio Grande do Sul of Porto Alegre at the Centro Agronomico farm at Guiaba. A complete summary of this oat program now in progress will not be attempted, but instead only portions of the nursery will be touched upon as indicated below.

1. Four-row plots of a preliminary yield trial of 81 entries with 3 replications.
2. Limited F_4 of a few hybrid populations provided earlier.
3. 300 entries sent in 1975, which included 50 rising F_3 populations; 250 were lines for testing.
4. F_3 of a few hybrids having CDA selections as parents.

The yield trial of (1) above was essentially completed. Some of the early selections ripened by mid-November or before. Some of the harvested bundles showed good straw types with panicle of good spikelets. The yield results probably will indicate progress in this recent oat improvement endeavor (1974-1976). Tandem cropping of oats and soybeans would necessitate the use of early maturing varieties which in turn may sacrifice grain yield of oats.

Of items 2 and 4 above, only little time was available for observation; therefore, a summary is not attempted here. The nursery was mature enough so

that the uredinial stage of crown rust had passed; therefore, readings for item 3 were made on telia appearance on leaf blades and sheaths. These readings given in Table 4 are subject to inaccuracies that arise when the uredinial stage has passed. Highest reading was 80 for Rodney 0; several were as low as a trace. No attempt is made to discuss all reading of Porto Alegre entries, except to indicate that adequate crown rust resistance seems evident. Limited stem rust was infecting a large number of lines while as much as 10% coverage was on some lines. Of the 250 Wisconsin assembled lines, red leaf or yellow dwarf was serious enough to prevent heading of some lines. This disease needs concentrated effort to reduce its effect through breeding procedures. However, complete resistance may not be attained easily. Wisconsin selection X2082-2 had considerable stem rotting attributed to Septoria.

The 50 hybrid populations in the rising F_3 generations were spaced in 6-row plots. Time permitted panicle selection in about one-half of the entries, the remainder to be selected later. The Porto Alegre program has been in progress longer than at other locations and is currently more advanced than others. However, the Colombia program is more advanced than that in Rio Grande do Sul; but this has been underway much longer through ICA efforts than that of R.G.S.

Passo Fundo

The Passo Fundo program was initiated in 1975. More than a hundred selections were harvested in 1975 by workers at Passo Fundo, and small seed lots were distributed to other workers in Brazil, Argentina, and Bolivia. Performance of these selections is not known. One shipment was delayed in transit and was not delivered in time for planting. A list follows of selections having leaf rust tolerance or resistance and grain quality considered "good" or "reasonable." Most of these occurred in the higher numbered CI group, evidencing more efficiency in breeding for crown rust resistance in the past dozen years. Coker-Florida-Georgia-Texas types seemed more promising than from other locations. Cutting treatments were given to those selections obtained from the prior year's harvest.

A list of World Oat Collection C.I. entries that appeared promising at Passo Fundo, Brazil, in 1975. Harvested by W. F. Kugler and J. C. Santiago.

3313 B[1/]	7560 R	8099 R	8235 R	8356 R
3314 R[2/]	7693 B	8110 R	8236 R	8357 R
3990 R	7912 R	8133 B	8254 R	8359 R
4078 R	7925 R	8134 B	8256 B	8366 R
4372 B	7926 B	8135 R	8257 R	8424 B
4452 R	7973 B	8142 R	8258 B	8425 R
4453 R	7974 R	8145 R	8259 R	8426 R
4541 R	7975 B	8146 R	8260 B	8429 R
4570 R	8019 R	8160 R	8261 R	8431 R
4640 R	8021 R	8164 R	8276 R	8443 R
4706 R	8023 B	8165 B	8278 R	8444 R
4707 R	8051 R	8226 R	8315 R	8446 R
4719 B	8057 R	8227 R	8316 B	8451 B
4833 R	8082 R	8228 R	8317 R	8453 R
4861 R	8093 R	8229 R	8353 B	8455 B
7546 R	8094 R	8234 R	8354 R	8456 R
				8458 R

1/ B means good (bom)

2/ R means reasonable (razoavel)

The 300 oat entry test was grown at Passo Fundo, Brazil, by Drs. J. C. Santiago and W. F. Kugler. Plants were essentially mature when observations were made November 27, 1976. Plant height often exceeded 110 cm. Red leaf (barley yellow dwarf) was severe, sometimes preventing seed production in susceptible lines. Yellow dwarf and crown rust notes were taken by the Passo Fundo workers and are included in Table 6; but would have been placed in Table 4 had they been received earlier in January. Only about a dozen selections had resistant "R" assigned in the yellow dwarf reading, while a much larger number was given some form of tolerance, and still others "not tolerant." Approximately one-half of the lines had sufficient crown rust resistance to be useful. The workers at Passo Fundo chose 35 selections for continued testing, and are noted "CP" in Table 6.

The following lines appeared more promising than others. These are Coker 227, Coker 234, 67 Ab 113 Fla, X2505-4, Ga 7199, C.I. 8234, and H555. The first, second, and fourth also showed promise at Castelar, as seen in Table 4.

Panicles were selected by Dr. Santiago and the senior writer in about half of the populations of the rising F_3 generation November 1976. Approximately one-half of the populations did not appear to have segregates that were worthy of testing further.

Other South American Countries

Uruguay

The 300 entry nursery was planted May 13 by I. de Leon and C. Perea in 2-row plots about 1 1/2 meters long at La Estanguela. The growth was generally good, often 122 cm to 173 cm (48"-68") tall, followed by partial lodging, thereby making note taking difficult. There were moderate amounts of red leaf and both leaf and stem rust. In fact, stem rust seemed more dominant than in late 1975 in the International Rust Nursery. Several increases of oats were in progress, some having less rust than others. One increase of local interest was selection 115 from original 1095a stock. The disposition of the 50 F_3 population was not fully determined December 1, 1976.

Argentina

Two planting dates, June 23 and July 20, were used by E. F. Antonelli to accommodate the 300 and 250 entry nurseries at Castelar. Growth of plants was generally very good. Plants varied in height from about 92 cm to 162 cm (37" to 65") in the first planting, and about 80 cm to 130 (32" to 52") in the second planting (not shown in Table 4) where only the 250 lines were included. Yellow dwarf was seen in the first planting; but was more severe in the second planting. This disease caused sterility, reducing seed set and plant height. Those most severely infected were Allen, X851-19, X1922-3, X2590-1, X2893-5, and X2895-4. See Table 4.

Crown and stem rust readings, sterility, and plant height at Castelar were provided by E. F. Antonelli. The crown and stem rust readings from 0 for both diseases to 100 for crown rust and 90 for stem rust. There were several selections that exhibited adequate resistance to the rusts.

Chile

Dr. E. Beratto planted the 300 entry nursery in August at Temuco, Chile, about 640 km south of Santiago. Temuco is relatively inaccessible by airplane, so Dr. Beratto brought representative leaf samples to La Platina for reviewing with Drs. I. Ramirez, Milam Gaglevic, and Ernesto Hacke. Some leaves were green and showed no disease infection. A partially "caramel" colored leaf sheath and leaf spot that resembled leaf spotting previously observed in the Dal variety was seen on specimens from Temuco. This spot has not been satisfactorily defined; but it may be related to mineral imbalance in leaf tissue; perhaps lesser amounts of assimilated manganese. This leaf and sheath spotting

at times seems to be a forerunner of Septoria. The greater part of the specimens were infected with halo (bacterial) blight in various stages of leaf development and deterioration. Yellow dwarf (red leaf) was seen in several samples.

La Platina, the main experimental farm in Chile, had outstanding nurseries of wheat and a small oat yield nursery. Several of the newer oat selections including the recently distributed variety, Nehuen, from Temuco as well as Putnam 61 were in a replicated yield trial. The newer selections had compact panicles and stiff straw resembling Stout and were standing well. There was one older selection that had many culms and was said to be adapted for livestock grazing.

Peru

Two sets of seed of 300 entries each were sent to Mr. Marino Romero at the College of Agriculture at La Molina, near Lima, Peru. One set was planted at Puno in October; and one set was scheduled to be planted in December at Cuzo. These seed lots had been delayed in transit. In order to avoid a repetition of the delay, a new and separate set of 300 entries produced at Madison in 1976 was delivered to Mr. Romero.

Colombia

The set of 300 entries mailed to Dr. R. Reyes at Bogota in March was not delivered, but was returned to the sender in November. The 1976 set of 300 was sent successfully by authorities in AID in Washington, D.C. However, the 1975 set was remailed from Washington, and is expected to arrive in time for the first semester seeding so there will be a double batch of seed for nurseries in 1977.

The "second semester" nursery at Bogota was concerned primarily with advancing several local selections and reselection from crosses using Bacatá and CI 7114 as parents. Of the most promising selections now available is one bred at Bogota and designated PM 25. Selection 1406 was crossed with Bacatá and provided about 500 reselections from this combination. Under their conditions PM 25 appears resistant to the "big three" diseases; i.e., crown rust, stem rust, and yellow dwarf (red leaf). Straw is medium in height, stands well, and the selection has relatively good kernel characteristics. Seed is near final increase prior to distribution to seed producers.

The 120 entry International Rust Nursery of Dr. Kilpatrick was reviewed. Even though stem and leaf rust were still developing, varieties were showing

differential responses. Some very early types were Diamante, Huamantla, Paramo, and Tarahumara. Emphasis on earliness probably reduced the number of their seeds per head.

Bayleton was being used as a spray to reduce ravages of rust; especially barley stripe rust. Chemical compounds of this type give mild hope that they might control some of the fungal diseases of oats.

Status of Madison Wisconsin Nursery 1976

Germplasm

Table 5 lists the contents of the 1976 Madison nursery. This represents a fledgling breeding nursery now in progress with implications of future develop ments. The raw material for improvement rests first with adequate germplasm having a wide spectrum of plant characters; that when combined or recombined will provide desirable types after hybridization and subsequent selection. The first three listings of Table 5 represent the assembled pool of germplasm: 250 Wisconsin-assembled selections, 65 additional lines of merit, and 228 entrie noted as promising in South America.

Table 5 indicates that 60 selections were in a crossing block planted especially for hybridization convenience. Other portions of the nursery primarily have segregating populations, F_2, F_3, and F_4.

Table 6 lists 250 "Wisconsin Assembled Lines" and their several agronomic characteristics. The 1976 season was one of early planting, low rainfall after May 15, early heading, and early ripening. Heading date averaged near June 16 which is several days sooner than average heading dates of prior years. Earliest heading was June 10 for Irwin, the Australian variety, and as late as early July for Kentucky 63. Plant height had the wide range of 58 cm for Suregrain bc, to 108 cm for X2341-1. Only a few were more than 100 cm. Further, the taller ones usually had weaker straw as measured by snapback, a subjective test used for correlating with straw standability or lodging resistance. An exception is X851-19 that was tall, yet had high snapback. Snapback values ranged from 6.5 to 9.5. Some of the values were omitted for later heading types because soil moisture was so low that plant tissue was not turgid enough to make snapback tests reliable. Most of the better strawed types had readings of 9.0 or 9.5. Those with 8.0 or less are considered marginal for standability. Grain yields were obtained by cutting plants in 1 meter or 33 cm of row followed by threshing. These areas are too small to be reliable, yet extremes

for yields are learned. Those using one-third meter row length, are less reliable than 1 meter. X2186-1 had only 13 grams while two selections had 108 grams. Kernel weights of Wisconsin selections exhibited a wide range: 23.4 mg for X2638-1 to 39.9 for X2678-1, both being acceptable for plant types useful in Wisconsin. Irwin had a still higher kernel weight of 41.5 -- However, its yield was mediocre, while that of X2678-1 was high.

Hybrids

Thus far, emphasis has been placed on choices of parents; but hybridization is the next step in a breeding program. An active hybridization program was initiated in 1974, utilizing parents thought most able in hybrid combinations to give segregates superior to available lines or varieties. Fifty F_2 populations were sent to cooperators for selection or harvest purposes in 1976. Of the 50, 40 were listed in the first report. For convenience, the entire 50 are listed in Table 7, followed by the parentage of additional populations grown at Madison in 1976, totaling about 250.

Also recognized in Table 5 are F_1 hybrids grown in 1976; but are not listed in this report. The F_1 group will be planted in 1977 to produce additional F_2 populations. Hybrids made in the summer of 1976 were planted in the greenhouse November 1976 and are expected to provide more F_2 populations in 1977.

Approximately 250 segregating populations were available in the 1976 nursery. Fifty were from the rising F_3, and nearly 200 from an earlier generation. The latter 200 are being sent to various cooperators for selection purposes. A list of hybrids is provided in Table 7

DISCUSSION

Selection possibility

Will selections from this group, when progeny-tested, prove enough superior to warrant distribution for farmer production? Will there be need to intercross within hybrid selections? Answers must await selection and progeny testing in these populations.

The procedure of having selections made in the geographic area of future usage may be the quickest way of making improvement. This depends largely on parental choices and possible recombinations of characters. Persons best able to make the choices are those having local experience and insight as to

probable results following hybridization and selection. Otherwise choices made on already available parent performance have to suffice. There is likelihood that "second and third round" crossing will be needed to find genotypes most suitable.

Can one location serve as a test center for a desirable character? For example, "red leaf" or barley yellow dwarf? Very probably, yes. Can oat selections be interchanged to help other locations? Probably, but with delays because of postal services (already experienced) and quarantines that are designed to restrain introduction of pests.

Objectives

No attempt is made at this time to predict all procedures needed for successful implementation of a breeding program but to keep in mind objectives and needs as discussed on pages 19 and 20 of the first report. Good genotypes should include some of the following characteristics:

1. High grain yield and high test weight with good kernel and groat characteristics. Weathering resistance of straw, grain, and groats.
2. Early vegetative growth and maturity where double cropping is practiced.
3. Resistance to important diseases (pests), with their probable pathogenic races to include crown rust, stem rust, smuts, Helminthosporia, mildew, Septoria, root rots, aphids and other animal pests, viruses, red leaf (barley yellow dwarf), possible soil borne viruses, and several species of bacteria.
4. High nutritional qualities including high protein, high lysine, methionine and threonine, high vitamin content, and high digestibility.
5. Lodging resistance, including sturdy short straw with good feed value, taller straw where needed, and a good root system.
6. High forage yield, grazing adaptation (regrowth), high grazing yield (animal gains), followed by acceptable grain yields.
7. Adaptation to various environmental and stress conditions: poor and fertile soil, low temperature during flowering, low and high temperatures during growth period, sudden temperature changes, mineral imbalance, drought, existing photoperiods, and winter survival.
8. Adaptation to soil nitrogen-fixing organisms.

Intensive Testing

Two generations each year could speed progress. The greenhouse facilities are limited; but can two locations be used for two crops per year? This is being done for several crops. For sometime the senior writer has made limited selections in Puerto Rico-grown material in April and planted later at Madison. This was again attempted in early 1976 when F_3 and F_2 material grown at Isabela with the help of R. A. Kilpatrick and F. Jimenez was selected and then grown in panicle-rows at Madison as listed in Table 5.

For a breeding program to succeed, it must be broadly based with adequate support including funds and workers.

While progress in improvements can be made by utilizing limited workers, more success would likely result if a planned, coordinated and extensive program were activated. Some areas needing consideration are adaptation, plant and grain quality, and weed control. Breeding would need to be undergirded with intensive work in plant pathology, plant physiology, genetics (linkage), and cytogenetics. Considerable evidence indicates the existence of different pathogenic races to disease inducing fungi. This adds to the difficulty of obtaining and retaining adequate resistance.

Broad adaptation, agronomic, physiologic and mineral nutrition of plants would need investigation. Broad adaptation would benefit by participation by workers in foreign countries where oats may be grown. Plant structure, biochemical composition, and nutritional quality including live-weight gains of consuming animals would be desirable. A network of domestic and foreign workers with imagination and dedication would interchange breeding stocks and test lines, finally deriving superior cultivars (varieties). This would raise the production level of the oat crop and enhance food and feed availability over broad areas of the world.

Groat Protein

The groat protein content has been constantly monitored in this project, by courtesy of personnel of the National Oat Quality Laboratory under the leadership of Dr. V. L. Youngs and Keith Gilchrist. Some of the parents already used are high in groat protein percent, but some are not. However, it is fully expected that high protein type may be found by selecting within crosses already available.

Potential Chemical Male Gametocide

As a possible support in the breeding program for the purpose of making a large number of hybrids for genetic recombination, a potential male gametocide was examined preliminarily. The first report stated that five cultivars were sprayed with RH532 in 1975. Morphologic changes were noted. Those sprayed were interspersed with other nontreated cultivars, hopefully to cross-pollinate flowers in treated rows. Rust reaction was used, expecting to find resistant progeny from cross pollinated flowers. No rust developed in 1976, so the rust marker test was inconclusive. However, within these rows some plants appeared to be hybrid progenies, so individual plants were harvested and will be grown in 1977 to observe the extent, if any, of segregation.

Seed Needs

Assuming that satisfactory varieties are available or can be developed, there is need for a system of seed increase and distribution so that farmers could utilize the breeding advances. In some foreign countries there seems to be a deficiency in foundation seed production preparatory for certification of seed that could be used by farmers.

Oats for Forage

The first report indicated the usefulness of oats for forage. Oats can provide livestock with winter pasture when naturally occurring pasture is low in grazing material. The work of J. M. Scholl et al. in Rio Grande do Sul showed that oats could be used for either grain, pasture, or both. However, cutting treatment indicated that longer pasturing reduced grain yields proportional to length of pasturing time.

This work was extended in Rio Grande do Sul by comparing live weight gains of heifers when grazed on unimproved pastures and when pastures were sod-seeded with oats.[1/] The sod-seeded oats had 400 kg/ha of 10-30-10 fertilizer added and also 90 kg/ha of N applied in October or early spring. When oats were sod-seeded with arrowleaf clover, 400 kg/ha was added: but there was no spring application of nitrogen. The control utilized native pasture without the oat seeding or fertilization. Results are given in Table 8 where the improved pastures (oats + clover, or oats + nitrogen) gave cattle gains of 467 or more kg/ha compared to less than 91 kg/ha for non-improved, or native pastures. While grain production is one of the major objectives of this oat breeding effort, it seems probable that forage usage may become an even greater benefactor than grain production in areas of South America.

1/ Scholl, J. M., Jose F. J. Lobato, and Ismar Berreto. Improvement of pastures by direct seeding into native grass in Southern Brazil with oats, and with nitrogen supplied by fertilizer or arrowleaf clover. Turrialba 26:144-149. 1976.

SUMMARY

Feasibility of breeding improved oats for tropical or developing countries has been examined for a 2-year period. The World Collection of 7960 oat entries has been partitioned and grown at four locations in South America.

Emphasis was placed on finding lines with crown rust resistance, preferably with satisfactory agronomic adaptation. Agronomic adaptation was found in the Texas variety Coronado which is being grown commercially in southern Brazil. The Coronado variety has demonstrated its usefulness for forage, grazing and grain. Newer selections such as Coker 234 have better resistance to leaf rust, and probably tolerance to red leaf (barley yellow dwarf).

Crown and stem rust populations appear dynamic in South America and North Africa, thus indicating need of having several sources of resistance so that resistance could be retained should rust races change, thereby attacking hitherto resistant types.

Stem rust can attack Coronado and other types having acceptable adaptation. Stem rust is severe in Colombia and Kenya. Only limited sources of oats with resistance are available, and these have only mediocre grain quality.

PM·25 selection in Bogota appears to resist leaf rust, stem rust, and virus in Colombia. Its adaptation in other areas has not been tested.

Red leaf is widespread and sometimes severe. Aphids appear to be on the increase in South America.

Observations at Amman, Jordan, Lebanon, and Eskisehir, Turkey, suggested needs of drought resistance or perhaps drought escaping, since diseases were in low profile. Early maturing types may be useful in oat production in low rainfall areas. The need for winter survival of oats for Turkey has been expressed. Several diseases may be important in higher rainfall areas of Algeria and Tunisia.

Breeding lines assembled at Wisconsin exhibit individual characteristics of earliness, resistance to crown rust, and resistance to stem rust. Some with moderate tolerance to red leaf do not have adequate leaf rust resistance.

With characteristics available in various sources of germplasm it appears quite feasible to improve oats by breeding methods to become more competitive with other crops and therefore be more widely used.

A task force of workers is needed to enhance and maintain oat germplasm gains.

Table 1. Summary of oat nurseries, other than at Wisconsin, planned or grown for disease response, observations, and selection purposes for breeding oats for developing countries, 1976.

Location	No. of entries	Cooperator	Planting time	Plans
Puerto Rico	300	R.A. Kilpatrick F. Jimenez	Nov 1975	Crown rust, sel. in F_3
Texas	300	M.E. McDaniel	Nov 1975	
Brazil				
Porto Alegre	300 81	F. Carvalho	July 1976 June 1976	, sel. in F_3 F_4 Yield trial
Passo Fundo	300 250	J.C. Santiago W.F. Kugler A. Baier	June 1976	Crown rust, sel. in F_3 Cutting trial
Entre Rios	6	Mathias Leh O. Saenz	June 1976	Replicated yield trial
Colombia Bogota	300	R. Reyes-N	Delayed	Crown, stem rust, virus observation
Argentina Castelar	300 250	E. Antonelli	June 1976 July 1976	Rust readings, F_3 harvest " "
Chile Temuco Santiago	300	E. Berrato I. Ramirez	Aug. 1976	Crown rust, sel. in F_3
Peru La Molina	300 300 300 1/	M.J. Romero-L L. Gomez Pando	Oct. 1976 Dec. 1976	Plant at high elevations Puno Cuzco
Uruguay La Estanguela	300	I. de Leon C. Perea	May 1976	Crown, stem rust readings
Algeria El Harrach	300	G. Varughese L. Hachemi	Dec. 1975	Crown, stem rust readings, selection
Tunisia Beja	300	A. Maamouri A. Daaloul M. Deghais	Nov. 1975	Rust and mildew readings
Kenya Njoro	353 2/	R. Mutuura	June 1975	Crown and stem rust readings
Jordan Amman Ramtha	300 98	M.A. Duwayri and N. Hadad	Dec. 1975	67 continued for 1976-77 Root rot observations Adaptation study
Turkey Eskisehir	300 300	M.N. Taysi M. Ianriyakul F. Altay	Oct. 1975 Mar 1976	Observations Selection

1/ Seed lots prepared 1976.
2/ " " " 1974 delivered by D. C. Arny.

TABLE 2. DISEASE READINGS. Crown rust, stem rust, and root rot responses of oats grown at several foreign locations and U.S.A. in 1976. Readings at Algeria by G. Varughese; at Tunis, H. L. Shands, A. Daaloul and M. Deghais; at Texas, M. E. McDaniel, at Kenya, R. Mutuura; and at Jordan, H. L. Shands and M. A. Duwayri.

Variety or selection	Crown & stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S)						
	Algeria rust		Tunisia rust	Texas rust	Kenya rust		Jordan Root rot 3/
	Crown	Stem	Crown	Crown	Crown	Stem 2/	
Allen	20S	--	3 Int	MR-MS			4
Coker 227	10S	30S	10 Int	R	5 MS	50	2
Coker 234	10S	10S	3 MR	R	0	50	3
73C 1214	0	60S	0-R	tr R	0	50	1 4/
73C 1217	0	5S	0-Fl	R	0	50	0 CJ
73C 1518	40S	0	tr	S-	0	50	7
Coolabah	40S	40S	10 MS	S	0	50	6
Coronado	50S	0	5 MS	MS	0	50	4
Dal	0	0	tr	MR-MS	0	40	4
Elan	10MS	10S	tr	MS	0	40	8
Goodland	5S	0	tr	MS	10 S	40	3
Lang	20S	0	40 S	S			2 CJ
Irwin	30S	0	10 MS	S	0	90	2 CJ
Otee	60S	0	S MS	S			2
Portage	0	0	tr-	MS			4
Suregrain bc	30S	0	5 Int	S	0	30	3
Swan	80S	0	5 S	VS	20 S	90	2 CJ
TAM 301	0	0	0-R	MR-MS	0	50	4
TAM 312	0	0	0-R	VR	0	60	4
Fla 67Ab113	0	0	0-R	VR	0	40	5
Fla 70Q1153 1/	0	30S	0-R	MR	0	5MS	3
Fla 70Q1093	80S	0	0-R	IMM	0	40	3
CDA 28	-	-	0-R	MS	0	60	5
CDA 139	-	-	0-R	MR	0	40	4
CDA 286	0	0	0-R	R+S	0	40	3
Tx. 64C4194-2	10S	30S	tr	S	0	40	2 CJ
X851-19	20S	0	0-R	S			2 CJ
X1309-1-1-1	10S	10S	0-R	MR	5 MS	50	2 CJ
X1385-1	0	0	0-R	VR	0	60	3
X1552-1	0	0	0-R	MS	0	70	2
X1588-1	tr S	0	0-R	MS	5 MR	40	3
X1656-4-1	10 S	0	0-R	MR-MS	5 S	40	3
X1667-4	0	0	0-R	MR 5/	t MR	30	2 CJ
X1764-2	10 MS	tr S	0-R	tr R	0	70	3
X1772-2	0	10 S	0-R	tr R	0	60	3

1/ *A. strigosa.*
2/ Readings have S(sus.) omitted.
3/ 0 = little or no root rot, 10 = high root rot.
4/ CJ = continue 1976-77 test in Jordan.
5/ Early telia.

Table 2. Cont.

Variety or selection	Crown & stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S)						
	Algeria rust		Tunisia rust	Texas rust	Kenya rust		Jordan Root rot 3/
	Crown	Stem	Crown	Crown	Crown	Stem 2/	
X1779-2	40 S	tr S	10-S	S	0	60	4
X1913-3	-	-	0-R	VR	0	40	4
X1922-3	0	0	0 Fl	MS 5/			5
X2051-1	40 S	5 S	0-R	MR	0	30	5
X2051-6	0	0	0-R	R-MR	0	60	3
X2055-1	20 S	10 S	0-R	R	0	30	2 CJ
X2060-5	0	0	0-R	MS	0	30	2 CJ
X2082-2	30 S	0	tr MS	R	t MR	50	5
X2185-1	0	20 S	0-R	R	t MS	60	4
X2185-2	20 MS	20 S	0-R	R	5 S	50	4
X2186-1	0	5 S	0-R	R-MS	10 MS	30	4
X2219-3-1	10 S	0	0-R	S	t MS	50	5
X2222-3	10 MS	0	0-R	MS	5 MS	5 MS	4
X2223-1	40 S	0	tr MS	MR(?)	10 MS	40	5
Markton	60 S	10 S	10 S	VS	60	70	5
X2255-1	60 S	0	tr MR	VS	T MS	40	5
X2286-2	-	-	0-R	0	0	30	5
X2296-5	10 MS	0	0-R	MR-MS			5
X2299-3	40 S	0	0 Fl	R	0	30	5
X2300-2	30 S	0	0-R	0-VR	T MR	40	6
X2300-4	30 S	0	0-R	0-VR	0	30	6
X2300-5	20 S	0	0-R	R	20 S	50	9
X2317-1	0	0	tr MR	R	0	40	5
X2341-1	20 S	0	tr MR	R	40	70	4
X2341-2	10 S	0	1 MR	VR			3
X2357-1-1	20 S	0	3 MS	VR	5 MS	60	4
X2357-2	20 MS	0	5 MS	R	5 MS	70	4
X2357-3	20 S	0	15 S	R			3 CJ
X2379-8	30 S	0	40 S	R-MR	10 MS	70	2
X2379-9	40 S	5 S	10 S	VR	30 S	70	5
X2426-1-1	10 S	0	tr MR	MS 5/	10 MS	40	6
X2440-2	30 S	0	0-R	MS			1
X2456-2	10 S	0	0-R	S	40 S	60	4
X2459-2	30 S	0	0-R	R-MR	10 S	60	5
X2470-1	0	0	tr MS	MR-MS	T MR	70	4
X2471-2	60 S	0	3 S	MS	0	60	3
X2503-1	20 S	0	0-R	R	0	50	5
X2503-2	0	30 S	tr R	VR			3
X2503-3	0	30 S	0-R	VR			4
X2505-3	20 S	0	0 Fl	R-MR	0	50	4 CJ

Table 2. Cont.

Variety or selection	Crown & stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S) Algeria rust Crown	Algeria rust Stem	Tunisia rust Crown	Texas rust Crown	Kenya rust Crown	Kenya rust Stem 2/	Jordan Root rot 3/
X2505-4	0	0	0 tr	R-MR	0	50	6
X2506-3	20 S	0	0 tr	0-VR			5
X2508-1	20 S	30S	0 tr	0-VR	0	70	3 CJ
X2508-2	20 S	30S	0 tr	tr VR			3
X2509-1	10 S	0	0 Fl	R	0	60	5
X2529-2	0	20S	0 tr	0-VR	10 MS	60	3 CJ
X2549-1	0	0	0 tr	0-VR			3
X2590-1	40 S	0	10 MS	S	30 S	50	3
X2616-1	N	0	0-R	VR	0	50	5
X2616-2	N	0	0-R	VR			2 CJ
X2638-1	5 S	0	tr MR	VR	t MS	50	3
X2638-5	tr MS	0	tr MR	R-MR	0	50	2
X2638-6	5 S	0	1 MS	R-MR			3
X2642-1 6/	-	-	0-R	MR-MS	0	40	3
X2656-1	N	0	1 MR	MS			5
X2660-1	20 S	5 S	0-R	VS			6
X2670-1	10 S	20 S	tr R	S	t MS	70	2 CJ
X2670-2	20 S	10 S	15 S	MS	5 MS	60	2
X2675-2	30 S	0	tr R	VR			3
X2677A2	10 S	0	0-R	MS			5
X2678-1	30 S	0	2 Int	MS	10 MS	70	3 CJ
X2681-1	0	0	tr R	R	0	60	4
X2681-2 7/	10 S	0	tr R	R			3
X2682-1	0	0	0-R	R-S	0	70	5
Markton	80 S	30 S	25 S	V-S			3
X2682-2	0	0	0-R	R-S			4
X2682-3	0	0	0-R	R			4
X2738-1	20 S	0	0-R	MR			4
X2760-1	20 S	0	0-R	R	0	60	5
X2795-1	30 S	0	tr R	MS	5 MS	40	2- CJ
X2795-2	30 S	0	0-R	S	0	50	3
X2822-3	20 S	40 S	0-R	MS	30 S	60	3
X2832-1	40 S	0	tr MS	MR-MS	10 MS	60	3
X2848-2	0,60S	0	0-R	R-MR			3
X2851-1	10 S	0	0-R	MS	t MS	50	4
X2855-1	0	0	0-R	S			5
X2857-1	20S	10 S	0-R	VS			6
X2859-5	0	0	0-R	S			5
X2876-5	20S	0	0-R	MR 5/	0	50	4
X2876-7	10S	0	0-R	VR	0	50	5

6/ Promising at Beja.
7/ Large straw at Amman.

Table 2. Cont

Variety or selection	Crown & stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S)						
	Algeria rust		Tunisia rust	Texas rust	Kenya rust		Jordan root rot 3/
	Crown	Stem	Crown	Crown	Crown	Stem 2/	
X2882-4	20S	0	0-R	S	0	50	5
X2887-3	0	0	0-R	R-MR			7
X2887-10	20S	0	0-R	MS 5/	5MS	50	5
X2887-14	40S	0	0-R	MS 5/			6
X2887-18	60S	0	0-R	S			6
X2893-3	60S	0	0-R	S			5
X2893-5	60S	0	0-R	S			5
X2895-3	0	0	tr R	R,S			5
X2895-4	80S	0	1 MS	S			5
X2907-1	10MS	0	0-R	VR	0	50	6
X2908-1	20MS	0	tr MR	VR,S	5 MR	70	7
X2908-2	20S	0	0-R	VR			7
X2909A-2	40S	0	0-R	VR,S 5/	T MS	90	6
X2909A-6	40S	0	0-R	MR,	5 MS	80	6
X2914B-1	30S	0	tr R	MS	5 MS	70	5
X2947-1	60S	0	tr MR	S			6
X2977-1	30S	0	0-R	S	5 MS	50	4
X3056-1	0	20S	0-R	VR	T MS	60	5
X3056-2	10S	0	0-R	0 VR	5 MS	30	3 CJ
X3060-1	0	0	tr R	S	0	50	4
X3061-1	40S	0	2 MR-MS	VS			4
X3086-1	20MS	0	1 MR	S	20 S	70	3 CJ
X3086-1-1	20S	0	0-R	S			3 CJ
X3128-1	0	0	0-R	MR-MS	T MS	50	7
X3138-1	0	0	0-R	S	5 MS	60	8
X3158-1	10MS	0	0-R	S			4 CJ
X3159-1	20S	0	0-R	MS 5/			5
X3163-1	0	0	0-R	MR			5
X3183-2	10S	0	2 MS	R			4
X3183-3	20MS	0	2 I-R	R-MR	0	70	3
X3212-1	60S	0	4S	MR-MS	40 S	70	4
X3216-1	20S	0	10S	R-MR	10 MR	70	4
X3217-1	0	0	2 MR	0-VR	T MS	60	5
X3236-1	5S	0	2 MR	MR-MS	0	50	3 CJ
X3277-1	0,60S	0	2 MR	MR-MS	0	70	3
Wright					10 MS	70	
X3279-1	10S	0	tr F1	MS	0	70	3
X3320-1	-	-	4S	S	0	70	4
X3351-1	20S	0	0-R	R-MS 5/	0	80	4
X3352-1	0	0	0-R	MR			4
X3443-1	40S	0	3 Ms Int	S	5 MS	60	4

Table 2. Cont.

Variety or selection	Crown & Stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S)						
	Algeria rust		Tunisia rust	Texas rust	Kenya rust		Jordan root rot 3/
	Crown	Stem	Crown	Crown	Crown	Stem 2/	
X3444-1	30S	10S	2 MR	MS	0	60	3 CJ
B579-1	20S	0	0-R	VR			4
B583-1	10S	30S	3 MR	S			3
Kenya(631)	20S	0	4 MS	S			2 CJ
Dal	10S	0	tr R	MS	0	60	3 CJ
Ga7199 8/	20S	40S	6 MS	S	5 MS	50	4
CI 7171	40S	40S	0-R	MR-MS			3 CJ
CI 8234	30S	40S	MR	MS	10 S	60	3 CJ
CI 8235	4S	0	tr R	VR	0	60	4
CI 7172	N	40S	0-R	MR	0	40	5
CI 8360	0	0	0-R	MR 5/	0	40	5
H432 Si 9/	20MS	20S	tr R	MS	0	50	3
H549 Si	0	40S	2 MR	VS	20S	60	6
H555 Si	N	30S	tr R	VR	10S	80	4
H555 Si	10S	20S	1 MR	MR-MS 5/	40S	70	5
H556 Si	0	0	0-R	VR	0	70	4
H441 Si	0	20S	0-R	VR Fl	0	50	4
Mn 720183 10/	0	0	0 Fl R	S			4
Mn 721015	0	0	0-R	5S	t MS	10 MS	4 CJ
Mn 734470-2	0	0	0 Fl R	VR	tr	0	4
Mn 73503-1	0	0	tr R	VR	0	50	6
73Hn2211 11/	10S	0	2 S	S	10 MS	60	5
Hn615	40S	0	4 S	S	20 S	60	5
Can Rdy Pg 4	40S	0	25 MS	S	50 S	70	4
" Eg.2 4023 Pg 8	60S	tr S	30 S	S	70 S	70	3
Can. Ukraine Pg 9	10 MR	0	tr R	VS	30 S	40	3-
" Rdy 02	40S	0	6 MS	S	40S	90	7
366 Zi 12/	60S	40S	2 MS	VR			4
5236 Zi	0	40S	0-R	VR			4
5250 Zi	5S	0	tr MR	VR Fl			4
5326 Zi	N	60S	Prob R	R			2 CJ
5350 Zi	10S	0	0-R	S			3 CJ
5355 Zi	40S	0	0-R	R?			2 CJ
5528 Zi	0	0	0-R	VR			3 CJ
5534 Zi	0	0	0-R	0 VR			3 CJ

8/ D. D. Morey, Georgia.
9/ M. B. Simons, Iowa.
10/ P. Rothman, Minnesota.
11/ R. McKenzie, CDA, Winnipeg, Can.
12/ K. Ziegler and D. D. Stuthman, Minn.

Table 2. Cont.

Variety or selection	Crown & Stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S						
	Algeria rust		Tunisia rust	Texas rust	Kenya rust		Jordan root rot 3/
	Crown	Stem	Crown	Crown	Crown	Stem 2/	
06072 Se 13/	5S	0	F1 1MR	S			4
06035 Se	0	0	3 MR-MS	S			3
06204 Se	10S	0	tr R	MS			5
06361 Se	20S	10S	tr R	VS			2 CJ
06364 Se	40S	0	4 MS	VS			5
06080 Se	30S	0	3 MS	VS			3
06327 Se	-	-	1 MR	VS			2 CJ
06405 Se	60S	10S	5 MS	S			3
06378 Se	40S	0	4 MS	S			2
06430 Se	40S	0	10 S	VS			3- CJ
Pettis	30S	20S	4 MS	VS			Missing
CI 2332	60S	0	8 S				
CI 2678	40S	30S	10 S				
CI 2743	60S	20S	40 S				
CI 3031	20S	20S	30 S				
CI 3050	40S	20S	10 S				
CI 6632	40S	60S	8 S				
CI 6644	30S	10S	2 S				
CI 6978	30S	10S	6 S				
Markton	60S	10S	20 S				
CI 7125	30S	40S	8 S				4 CJ
CI 7143	40S	0	30 S		50S	70	3
CI 7337	20S	0	6 MS		50S		5
CI 7360	30S	0	6 MR-MS				2
CI 1312	30S	0	4 MS				4
CI 4990	40S	20S	5 S				4
CI 5015	10S	30S	2 MR				5
CI 5096	10S	40S	6 S				5
CI 5371	40S	0	3 MR-MS				3 CJ
CI 5398	40S	60S	3 MR-MS				3 CJ
CI 5399	40S	60S	4 S				4
CI 5419	40S	20S	4 S				4
CI 5428	0	0	3 S				4 CJ
CI 5506	20S	10S	2 MS	MR-MS			4
CI 5730	20S	0	20 S	VS			4
CI 5847	60S	60S	5 S				4 CJ
CI 5898	60S	60S	10 S				3 CJ
CI 5922	40S	30S	5 S				5
CI 6002	0	20S	10 S				5
CI 6003	5S	60S	4 S				6

13/ Dale Sechler, Mo.

Table 2. Concluded.

Variety or selection	Crown & Stem rust 0-100 R(res.)-S(sus.), root rot 0-10(R-S)						
	Algeria rust		Tunisia rust	Texas rust	Kenya rust		Jordan root rot
	Crown	Stem	Crown	Crown	Crown	Stem 2/	
CI 6010	0	60S	2 MR-MS	20 MR-MS			5
CI 1821	40S	40S	4 MS	VS			6
OT 194	40S	0	3 MR				4
Aj 86/2/1	20S	10S	4 MS				6 CJ
Aj 113/19	40S	10S	60 S				5
Aj 126/126/39	60S	60S	50 S				5 CJ
Aj 130/163/125	80S	10S	40 S				5
Aj 140/35/75	40S	0	15 S				5
CI 9139 x Rdy 0	N	N	tr R		0	0	6
Markton	60S	30S	50 S				4
Norline 14/	80S	30S	60 VS				4 CJ
Pennlan	80S	10S	50 S				4 CJ
Pennwin	100S	0	25 S				4
Walken	60S	0	40 S				5
Compact	80S	10S	50 S				5
Ky 67 695	30S	20S	35 S				6
Ky 63 1935	80S	10S	40 S				7
Salem 15/	40S	10S	30 S				6
Checota 16/	60S	tr S	20 S				6
Chilocco	60S	10 S	40 S				5

14/ H. J. Marshall, Pennsylvania.
15/ C. H. Murphy, North Carolina.
16/ E. L. Smith, Oklahoma.

Table 3. Rust responses of more promising selections grown at Njoro, Kenya. Data from Robert Mutuura February 4, 1976. List Oct. 1974.

Selection	Rust response Crown (leaf)	Rust response Stem	Selection	Rust response Crown (leaf)	Rust response Stem
X1922-4	20 Ms	0	7001153 (A. strigosa)	0	5ms
X2221-2	10 ms	40s p 1/	C.I.7010 (A. strigosa)	0	5MR
X2221-3	10 ms	20s			
X2300-4	0	30s P			
X3025-1	0	20s			
Mn 720183	10R	0 P	CI 4639 (A. strigosa)	0	0
Mn 720226	20s	10Ms	CI 6954 (A. strigosa)	0	tmR
Mn 720968	0	10s	CI 6956 (A. strigosa)	0	tmR
Mn 720015	tms	10Ms			
Mn 730353	0	5s			
Mn 734470-2	TR	0 P			
CDA CI 9139xRod 0	0	0			

1/ P = most promising; continued in testing program. May be useful as parents.

Table 4. Crown rust readings of 250 oat entries in nurseries at Porto Alegre, Brazil, and Castelar, Argentina, and stem rust, sterility (BYD), and plant height of first planting date at Castelar, 1976. Castelar data by E. F. Antonelli.

Variety and selection	P.A. Crown rust	Castelar Crown rust	Castelar Stem rust	Castelar Sterility BYD a/	Castelar Plant ht. cm	Variety and selection	P.A. Crown rust	Castelar Crown rust	Castelar Stem rust	Castelar Sterility BYD a/	Castelar Plant ht. cm
Allen	10	t	40MR	5	105	Tx 64C4194-2	20	70	80	0	97
Coker 227	10	10MR	t	0	104	X851-19	35	10	10MR	4	148
Coker 234	5	5MR	t	0	102	X1309-1-1-1	5	5	5MR	0	132
73C1214	3	t	0	0	103	X1385-1	tr	0	5MR	2	126
73C1217	5	t	0	0	105	X1552-1	5	30	0	2	112
73C1518	5	t	50	0	102	X1588-1	10	t	0	2	148
Coolabah	40	80	10MR	t	112	X1656-4-1	50	10R	10MR	3	115
Coronado	25	60	60	0	112	X1667-4	60	t	0	2	139
Dal	15	5	tMR	0	130	X1764-2	5	0	80	1	132
Elan	5	20	tr	0	95	X1772-2	tr	t	40	t	148
Goodland	50	5	5R	2	120	X1779-2	60	90	40	1	130
Lang	30	90	0	1	125	X1913-3	40	20	tr	t	130
Irwin	40	90	20MS	0	115	X1922-3	20	t	0	4	155
Otee	50	30	tr	t	130	X2051-1	10	5	0	0	128
Portage	40	t	60	t	160	X2051-6	4	tr	5MR	t	128
Suregrain bc	10	80	70	0	105	X2055-1	3	tr	40	0	114
Swan	30	90	60	0	115	X2060-5	8	20	40	0	113
Tam 301	5	30	30MS	t	105	X2082-2	5	t	0	t	122
Tam 312	5	40	80	t	115	X2185-1	tr	0	60	t	131
67Ab113Fla	tr	0	40	0	108	X2185-2	tr	0	40	0	140
70Q1093	tr	t	10	0	110	X2186-1	10	t	tr	3	148
7001153Fla	4	0	20	0	142	X2219-3-1	15	80	0	t	130
CDA 28	10	10	30	0	108	X2222-3	15	5	0	t	148
CDA 139	15	5	10	0	92	X2223-1	30	70	0	t	128
CDA 286	10	5	t	0	105	Markton	15	90	10	2	138

a/ 0 = non-sterility; 5 = highest seed abortion.

Table 4. Cont.

Variety and selection	P.A. Crown rust	Castelar Crown rust	Castelar Stem rust	Castelar Sterility BYDa/	Castelar Plant ht.	Variety and selection	P.A. Crown rust	Castelar Crown rust	Castelar Stem rust	Castelar Sterility BYDa/	Castelar Plant ht. cm
X2255-1	25	80	tr	2	148	X2681-2	1	0	5	1	115
X2286-2	tr	0	t	0	158	X2682-3	1	0	20MS	1	125
X2296-5	15	t	0	0	130	~~X2638-1~~ X2738-1	2	0	20MS	1	120
X2299-3	5	20	t	0	129	X2760-1	1	5	50	t	135
X2300-2	5	0	0	-	128	X2795-1	20	t	tr	0	120
X2300-4	5	0	0	0	118	X2795-2	25	t	10MS	0	125
X2300-5	5	t	0	0	128	X2822-3	5	0	70	1	110
X2317-1	tr	5	tMR	0	135	X2832-1	10	60	20MR	t	120
X2341-1	10	40	t	0	148	X2848-2	10	t	10MR	1	127
X2341-2	5	50	0	t	162	X2851-1	5	0	5MR	t	123
X2357-1-1	10	30	0	1	145	X2855-1	10	t	0	0	125
X2357-2	20	30	0	t	143	X2857-1	15	60	5	0	130
X2357-3	3	40	0	t	137	X2859-5	15	40	t	0	120
X2379-8	15	40	tr	1	128	X2876-5	10	t	5MR	0	125
X2379-9	10	30	60	1	138	X2876-7	1	5	10MR	0	115
X2426-1-1	10	40	5	t	118	X2882-4	5	t	20	t	115
X2440-2	25	30	30	2	139	X2887-3	8	t	t	t	115
X2456-2	25	50	10MR	1	131	X2887-10	10	10	10MR	3	125
X2459-2	10	20	5MR	1	118	X2887-14	10	10	10MR	3	120
X2470-1	10	50	40	1	130	X2887-18	2	30	20	2	110
X2471-2	tr	60	0	1	145	X2893-3	20	40	t	3	120
X2503-1	25	5	30	0	147	X2893-5	25	40	10MR	4	115
X2503-2	20	10	40	0	145	X2895-3	15	30	0	0	140
X2503-3	10	10	30	t	150	X2895-4	10	70	t	4	120
X2505-3	5	30	t	t	120	X2907-1	15	60	5MS	0	125
X2505-4	tr	t	5	t	130	X2908-1	3	tr	10MR	2	130
X2506-3	tr	10	10	2	148	X2908-2	2	t	10	2	125
X2508-1	1	t	tr	t	133	X2909A-2	15	5	0	t	125
X2508-2	8	0	tr	t	135	X2909A-6	25	10	0	1	120
X2509-1	5	tr	5R	0	133	X2914B-1	20	20	t	2	125
X2529-2	8	t	20MR	2	135	X2947-1	15	90	0	2	130
X2549-1	1	0	60	3	145	X2977-1	5	5	0	1	135
X2590-1	5	40	60	4	140	X3056-1	3	t	40	0	140
X2616-1	1	tr	40	t	128	X3056-2	3	0	tMS	0	145
X2616-2	tr	0	5R	1	130	X3060-1	tr	0	0	t	160
X2638-1	20	t	80	1	130	X3061-1	15	50	0	3	137
X2638-5	10	0	70	1	130	X3086-1	30	t	0	1	115
X2638-6	5	0	70	1	123	X3086-1-1	30	5	0	t	115
X2642-1	5	0	60	1	142	X3128-1	20	40	0	t	115
X2656-1	15	5	0	t	122	X3138-1	15	t	0	t	135
X2660-1	15	30	50	0	112	X3158-1	10	5	0	2	110
X2670-1	25	30	70	2	128	X3159-1	55	5	0	2	115
X2670-2	40	30	70	2	128	X3163-1	20	0	0	2	122
X2675-1	10	10	5R	t	130	X3183-2	20	60	t	2	115
X2677A-2	10	5	tr	t	130	X3183-3	20	80	0	3	115
X2678-1	5	20	10MR	0	120	X3212-1	15	90	0	3	115
X2681-1	5	tr	20	1	128	X3216-1	25	90	0	2	110
X2682-1	5	0	20	t	128	X3217-1	5	0	0	1	125
X2682-2	1	0	5MR	t	115	X3236-1	15	50	0	0	120
Markton	10	90	20	t	136	X3277-1	25	50	0	0	125

Table 4. Concluded.

Variety and selection	P.A.: Crown rust	Castelar: Crown rust	Castelar: Stem rust	Castelar: Sterility BYD a/	Castelar: Plant ht. cm	Variety and selection	P.A. Crown rust	Castelar: Crown rust	Castelar: Stem rust	Castelar: Sterility BYD a/	Castelar: Plant ht. cm
X3279-1	20	20	0	0	125	Pettis	30	100	0	0	155
X3320-1	35	50	t	2	130	CI 2332	15	80	t	0	125
X3351-1	5	t	t	1	120	CI 2678	40	90	t	0	125
X3352-1	5	5	t	1	100	CI 2743	15	90	10	1	140
X3443-1	20	60	t	1	125	CI 3031 1/	5	80	t	0	125
X3444-1	20	70	0	2	125	CI 3050	15	90	20	0	155
B579-1	tr	0	0	t	125	CI 6632	10	90	0	0	125
B583-1	20	80	t	0	135	CI 6644	15	5	10	t	130
Kenya	10	60	30	0	100	CI 6978	20	80	10	0	130
Dal	35	0	t	0	120	Markton	40	100	5	0	135
GA7199	20	30MR	90	0	120	CI 7125	25	80	50	t	110
CI 7171	50	80	80	0	125	CI 7143	25	80	5	0	120
CI 7172	50	70	80	0	120	CI 7337	15	20	t	t	120
CI 8234	50	80	t	0	105	CI 7360	40	50	10	0	120
CI 8235	2	0	t	0	145	CI 1312	35	70	40	2	135
CI 8360	tr	0	t	0	135	CI 4990	10	80	5	0	150
H432 Si	30	10	40	0	125	CI 5015 1/	8	30	20	t	140
H549 Si	3	0	30	0	135	CI 5096	5	40	10	0	135
H555 Si	10	30	t	0	105	CI 5371	10	70	5	0	110
H555 Si	15	70	30	0	135	CI 5398	10	70	10	0	115
H556 Si	4	0	0	0	125	CI 5399	8	60	20	0	115
H441 Si	3	0	20	0	135	CI 5419	10	60	20	0	110
Mn 720183	1	0	0	0	135	CI 5428	8	10MS	80	0	115
Mn 721015	tr	0	0	0	120	CI 5506	8	40	70	t	150
Mn 734470-2	6	t	0	0	130	CI 5730	8	10	60	t	145
Mn 734503-1	tr	30	0	0	150	CI 5847	8	80	5	0	120
HN2211	5	t	t	0	135	CI 5898	10	80	10	0	115
HN 615	4	60	t	0	120	CI 5922	10	80	0	0	120
Can Rdy Pg 4	20	70	t	0	135	CI 6002	5	5	30	t	150
Can Eg^2-4023$_{Pg8}$	60	90	t	0	130	CI 6003	4	10	60	0	140
Can Ukr. Pg 9	4	30MS	5	0	150	CI 6010	5	10	40	0	140
Can Rdy 0^2	60	80	5	0	140	CI 1821	25	20	40	2	140
366 Zi	10	80	70	0	125	OT 194 1/	10	10	10MR	t	130
5236 Zi	2	0	70	0	135	Aj 86/2/1 1/	5	80	80	0	120
5250 Zi	1	0	5MR	0	140	Aj 113/19 1/	40	100	70	1	115
5326 Zi	1	60	0	0	125	Aj 126/126/39	20	90	40	t	125
5350 Zi	10	t	t	0	130	Aj 130/163/12	60	100	30	t	130
5355 Zi	15	t	0	0	135	Aj 140/35/75	50	100	70	3	115
5528 Zi	3	5	0	0	125	CI 9139 x Rdy	80	50	0	0	140
5534 Zi	2	0	0	0	120	Markton	20	90	20	0	130
06072 Se	25	60	t	0	115	Norline CI690	25	90	0	0	115
06035 Se	10	70	0	0	130	Pennlan CI788	50	100	0	0	115
06204 Se	35	80	5	0	110	Pennwin CI831	50	100	0	0	110
06361 Se	30	70	5	0	115	Walken CI8205	25	100	30	0	105
06364 Se	25	80	0	0	115	Compact CI828	50	90	0	0	90
06080 Se	30	80	t	0	120	Ky67 695 CI913	25	90	0	0	100
06327 Se	10	90	0	0	95	Ky63 1935 CI91	20	100	30	t	95
06405 Se	15	90	0	0	125	Salem	15	100	5	0	100
06378 Se	40	80	0	0	125	Checota	10	90	30	0	110
06430 Se	35	100	0	0	115	Chilocco	15	80	t	0	100

1/ Hulless.

Table 5. Summary of Madison nursery for purposes of breeding oats for developing countries.

No. of entries		Row Length cm	Row Length feet
250	Wisconsin assembled test lines	150	5
65	Additional selections with merit in prior tests	150	5
228	C.I. and P.I. of those selections with promise at Bogota and Passo Fundo in 1975 (Craddock)	150	5
50	Rising F_3 from bulked F_2 of 1975 nursery	300	10
107	Rising F_2 from bulked F_1 of 1975 nursery	300	10
107	Second planting in Rieder buckthorn area	150	5
90	Rising F_2 from bulked F_1 of 1975-76 greenhouse	300	10
90	Second planting in Rieder buckthorn area	150	5
150±	Rising F_1 from greenhouse 1975-76	Variable v.	
60	Parents in crossing block 1st planting date	300	10
60	2nd planting date	150	5
17	Head selections from 1975 nursery	150	5
139	Rising F_4 from F_3 and F_3 from F_2 (PR)	150	5
17	1 to 4-row increases	300	10
164	Progeny of plants treated with RH 532	300	10

Table 6. Agronomic and yellow dwarf responses of oat varieties and selections grown in 1.5 meter rows 30 cm apart at Madison, Wisconsin, 1976, and Passo Fundo, 1976.

Entry no.	Variety and selection	Heading date June	Plant ht. (cm)	Snap-back 0-10	Grain yield 1 m (g)	Grain yield .33m (g)	Kernel wt. (mg)	Yellow dwarf (red leaf)	Passo Fundo Brazil, 1976 1/ Crown rust	Passo Fundo Brazil, 1976 1/ Yellow dwarf
1	Allen	12	67	9.0	68		26.5	5	10 S	MS
2	Coker 227	17	61	8.5	52		38.3	5	t mS	ST CP
3	Coker 234	16	61	9.0	87		32.7	3	t mS	ST CP
4	73C1214	12	61	9.0	86		33.3	6	t mS	ST CP
5	73C1217	12	60	9.0	80		28.7	15	t mR	MST CP
6	73C1518	18	63	9.5	56		34.2	12	t R	MST CP
7	Coolabah	12	61	8.0	76		36.9	8	80 S	ST CP
8	Coronado	17	67	8.5	43		39.6	12	t mS	MRT CP
9	Dal	18	83	9.0	64		24.8	8	20MR	MST
10	Elan	16	59	8.5	29		36.0	2	30 S	S
11	Goodland	17	74	9.0	66		27.2	18	10MS	MST
12	Lang	12	70	9.0	89		33.3	9	80 S	T CP
13	Irwin	10	71	8.0	61		41.5	5	60 S	T
14	Otee	12	75	9.0	80		27.9	6	70MS	T
15	Portage	17	94	8.0		36	26.3	5	10 S	MST
16	Suregrain bc	15	58	8.5	44		35.7	2	80MS	SNT
17	Swan	11	64	8.5	70		41.1	8	80MS	ST
18	Tam 301	19	62	8.0	68		34.7	6	IS	MST
19	Tam 312	17	62	9.0	39		34.0	7	IR	MST
20	67Ab113Fla	16	69	9.0	38		32.4	8	MR	MST CP
21	70Q1093	12	55	9.0	52		29.1	4	R	ST CP
22	7001153Fla	19	106	6.5		19	18.7	6	R	MRT
23	CDA 28	17	59	9.0	49		34.5	10	t mR	ST
24	CDA 139	17	70	8.5	55		35.1	8	t mR	ST
25	CDA 286	17	67	8.5	71		36.4	12	-	MST
26	Tx 64C4194-2	17	66	9.0	44		36.7	6	80MS	MST CP
27	X851-19	18	92	9.0		37	29.7	10	t R	ST
28	X1309-1-1-1	12	70	9.0	75		32.2	10	30S	MS NT
29	X1385-1	17	82	6.0		31	32.6	12	tR	MS NT
30	X1552-1	16	65	9.0		36	27.0	8	20S	MS NT
31	X1588-1	17	88	6.5		28	24.4	18	t MR	mR
32	X1656-4-1	18	73	9.5		24	30.5	25	t R	MS NT
33	X1667-4	16	84	8.5	71		35.3	15	t R	S NT
34	X1764-2	18	80	8.5	69		31.4	15	t R	S NT
35	X1772-2	16	80	9.0	65		31.1	10	t R	S NT
36	X1779-2	17	80	9.5	85		23.6	6	80S	MS NT
37	X1913-3	18	86	8.0	68		33.7	12	t R	MS NT
38	X1922-3	27	102	-		21	24.8	12	30S	R
39	X2051-1	15	88	7.0	58		30.4	15	t R	MS T
40	X2051-6	15	82	8.5	80		33.8	12	t R	MST
41	X2055-1	15	80	8.5	66		29.5	10	t R	ST CP
42	X2060-5	12	76	8.0	62		29.2	8	t R	MS NT CP
43	X2082-2	17	73	8.5	71		33.3	12	t R	MS NT
44	X2185-1	16	84	9.0		29	29.9	10	t R	MS NT
45	X2185-2	12	82	9.0		30	31.4	10	t R	MS NT
46	X2186-1	17	85	8.0	13		29.7	12	t R	MS NT
47	X2219-3-1	18	82	9.0		33	31.2	8	30MS	mS
48	X2222-3	19	93	8.0		17	27.7	6	t R	MS NT
49	X2223-1	19	81	9.0	51		25.5	6	40S	MS NT
50	Markton	17	85	7.0	-		-	8	50S	MS NT

1/ R, resistant; M, very much; m, moderate; S, susceptible; T, tolerant; NT, not tolerant; and CP, continued testing at Passo Fundo.

Table 6. Cont.

Entry no.	Variety and selection	Heading date June	Plant ht. (cm)	Snap-back 0-10	Grain yield 1 m (g)	Grain yield 3 m (g)	Kernel wt. (mg)	Yellow dwarf (red leaf)	Passo Fundo[1/] Brazil, 1976 Crown rust		Yellow dwarf	
51	X2255-1	16	94	8.0		24	33.7	10	t R	S	NT	
52	X2286-2	11	95	7.5	50		25.6	12	30R	MS	T	
53	X2296-5	18	92	9.0	75		30.9	8	t R	S	T	
54	X2299-3	10	77	8.5		22	34.9	18	t R	MS	NT	
55	X2300-2	17	76	8.0	63		34.3	18	t R	MS	NT	
56	X2300-4	17	75	8.0		43	33.0	25	t R	MS	T	
57	X2300-5	16	74	8.0	75		31.1	15	t R	S	T	
58	X2317-1	10	80	7.5	71		27.8	8	t R	S	T	
59	X2341-1	17	108	7.5		33	28.8	8	t R	S	T	
60	X2341-2	17	106	6.5		26	25.4	10	t R	S	T	
61	X2357-1-1	12	80	9.5		28	29.9	12	t R	S	T	
62	X2357-2	12	84	9.5	47		20.6	8	20MS	S	T	
63	X2357-3	15	81	9.5	68		27.4	7	20MR	S	T	
64	X2379-8	12	75	9.5	58		28.5	7	10MR	MS	T	
65	X2379-9	12	80	9.5		22	33.9	10	tmR	MS	T	
66	X2426-1-1	16	66	9.7	68		29.3	8	t R	MS	NT	
67	X2440-2	21	85	9.0	104		30.9	8	10R	S	T	
68	X2456-2	16	80	9.0		26	27.4	10	10mS	MS	NT	
69	X2459-2	16	76	9.5		25	28.4	10	10R	S	T	
70	X2470-1	16	80	9.0		30	28.5	8	30mS	S	T	CP
71	X2471-2	11	68	8.5		24	43.0	10	40S	MS	NT	
72	X2503-1	12	83	8.0		26	31.0	10	t R	mS	T	CP
73	X2503-2	12	81	8.0		25	33.4	8	t R	ms	T	CP
74	X2503-3	15	83	8.0		7	32.5	10	30mR	S	T	CP
75	X2505-3	12	70	9.0		30	29.9	10	t R	S	T	CP
76	X2505-4	12	75	8.0	94		25.3	6	t R	MS	T	
77	X2506-3	17	91	8.5		21	32.5	6	30mR	MS	NT	
78	X2508-1	18	82	9.0		37	38.6	8	t R	mR	T	CP
79	X2508-2	17	82	9.0		28	39.8	8	t R	mS	T	
80	X2509-1	16	76	8.5	37		27.0	12	t R	S	T	
81	X2529-2	19	88	8.0	109		29.8	10	30MS	MS	NT	
82	X2549-1	16	91	7.0		25	25.0	8	t R	mS		
83	X2590-1	15	95	8.0		32	26.9	12	30mS	MS	NT	
84	X2616-1	16	69	9.0	55		26.5	10	t R	MS	NT	
85	X2616-2	16	71	9.0	41		29.0	10	t R	mS	T	
86	X2638-1	15	75	9.0	65		23.4	10	t R	MS	NT	
87	X2638-5	15	79	9.0	71		22.8	8	t R	MS	NT	
88	X2638-6	14	71	9.0	65		23.6	8	t R	mS	NT	
89	X2642-1	11	78	8.5		26	29.8	8	t R	MS	T	
90	X2656-1	16	80	8.0		24	28.2	10	t R	S	T	CP
91	X2660-1	16	66	9.0		30	32.4	7	t R	mR	T	CP
92	X2670-1	17	75	8.5		26	29.0	7	10MR	mS	T	
93	X2670-2	17	76	8.5	83		29.7	8	10mR	mS	T	
94	X2675-1	16	81	8.5	61		33.1	10	t R	MS	NT	
95	X2677A-2	15	80	9.0		24	33.3	7	t R	MS	NT	
96	X2678-1	16	69	9.0	91		39.9	8	t R	MS	NT	
97	X2681-1	24	83	8.5	59		27.2	12	t R	MS	NT	
98	X2682-1	18	81	9.0	86		30.5	20	t R	MS	NT	
99	X2682-2	17	78	9.0		31	30.2	10	t R	MS	NT	
100	Markton	17	92	7.5	-		-	8	t R	MS	NT	

Table 6. Cont.

Entry no.	Variety and selection	Heading date June	Plant ht. (cm)	Snap-back 0-10	Grain yield 1 m (g)	Grain yield 3 m (g)	Kernel wt. (mg)	Yellow dwarf (red leaf)	Passo Fundo[1/] Brazil, 1976 Crown rust	Yellow dwarf	
101	X2681-2	21	84	9.0	87		30.7	20	t R	MS	NT
102	X2682-3	18	80	9.0	65		29.3	12	t R	MS	NT
103	~~X2638-1~~ X2738-1	17	83	9.0	59		29.4	10	t R	S	T
104	X2760-1	16	83	9.0	60		35.1	12	t R	MS	NT
105	X2795-1	18	82	9.0		27	26.5	8	t R	mS	T
106	X2795-2	19	81	9.0		22	25.7	8	t R	mS	T
107	X2822-3	15	71	9.5	108		30.6	10	t R	MS	NT
108	X2832-1	16	82	9.0	63		28.3	12	t R	S	T
109	X2848-2	15	74	8.5	61		29.0	8	t R	S	T
110	X2851-1	16	75	8.0		25	23.2	8	t R	S	
111	X2855-1	15	78	8.0		41	34.7	10	t R	S	T
112	X2857-1	15	82	8.5		26	30.5	8	20S	MS	T
113	X2859-5	17	75	9.0	-		-	8	10mR	MS	T
114	X2876-5	12	70	9.0	78		28.5	10	t mR	MS	T
115	X2876-7	16	66	9.0	52		30.5	12	t R	MS	NT
116	X2882-4	17	82	9.0		18	27.4	7	t R	MS	NT
117	X2887-3	16	71	9.0		19	27.3	15	t R	mR	NT
118	X2887-10	17	81	9.0		31	30.3	12	t R	MS	NT
119	X2887-14	16	64	9.5		20	29.0	10	t R	ms	NT
120	X2887-18	15	65	9.5		21	31.1	12	t R	mS	NT
121	X2893-3	17	74	9.0		23	33.0	12	40mR	S	NT
122	X2893-5	17	76	9.0		26	29.9	14	50mS	S	NT
123	X2895-3	17	84	8.5		20	28.8	10	50mS	S	NT
124	X2895-4	16	75	8.5		38	24.8	12	60S	MS	NT
125	X2907-1	16	75	8.0	75		31.7	12	30mR	S	T
126	X2908-1	18	85	7.5		34	32.2	8	t R	MS	T
127	X2908-2	18	88	7.5	57		30.2	10	30mR	S	T
128	X2909A-2	15	80	9.5		27	27.8	8	50mS	mS	T
129	X2909A-6	15	75	9.5	49		32.8	5	80S	MS	NT
130	X2914B-1	18	81	8.0		26	26.3	10	t R	MS	NT
131	X2947-1	16	76	8.5		19	27.8	20	80S	S	NT
132	X2977-1	17	84	8.5		27	25.9	10	10mS	S	T
133	X3056-1	16	87	8.0	81		34.9	8	t R	S	T
134	X3056-2	17	85	8.0		25	30.5	12	t R	S	T
135	X3060-1	20	94	7.5		24	29.9	12	30mR	mS	T
136	X3061-1	16	84	8.0		20	31.8	10	60mS	mR	T
137	X3086-1	18	83	8.5		22	27.6	10	20MS	mS	T
138	X3086-1-1	19	81	8.5		29	24.8	10	t R	mS	T
139	X3128-1	18	78	8.0		18	31.1	8	30mR	S	T CP
140	X3138-1	19	75	8.0		20	23.9	15	t R	S	T
141	X3158-1	17	78	9.0		33	24.1	10	40mS	S	NT
142	X3159-1	17	69	9.5	41		29.0	15	t R	S	NT
143	X3163-1	18	85	9.0	82		27.5	6	TR	mS	T
144	X3183-2	16	64	8.5	62		28.0	8	30mR	MS	NT
145	X3183-3	16	65	8.5	73		30.1	12	30S	MS	NT
146	X3212-1	16	73	8.5		41	24.5	10	30mS	MS	NT
147	X3216-1	17	72	9.0	78		28.0	10	40mS	MS	NT
148	X3217-1	18	73	8.5		23	30.5	18	tmR	mS	T
149	X3236-1	12	71	8.5	79		27.7	10	40mS	S	T
150	X3277-1	16	76	8.5	108		29.5	10	40S	S	NT

Table 6. Cont.

Entry no.	Variety and selection	Heading date June	Plant ht. (cm)	Snap-back 0-10	Grain yield 1 m (g)	Grain yield 3 m (g)	Kernel wt. (mg)	Yellow dwarf (red leaf)	Passo Fundo[1/] Brazil, 1976 Crown rust	Passo Fundo[1/] Brazil, 1976 Yellow dwarf
151	X3279-1	17	71	8.0		11	30.2	10	30MR	S NT
152	X3320-1	17	85	8.5		40	27.9	15	30mS	S NT
153	X3351-1	16	76	9.0		23	36.0	10	t R	S T
154	X3352-1	17	61	8.0	91		33.0	8	t R	MS NT
155	X3443-1	16	81	8.5		29	29.4	15	30S	MS NT
156	X3444-1	18	78	7.5		24	24.7	10	40S	MS NT
157	B579-1	15	83	7.0		35	24.1	10	20mS	S NT
158	B583-1	16	84	8.0		42	21.6	12	60S	S NT
159	Kenya	17	64	9.0		15	31.5	10	70S	S T
160	Dal	19	81	9.0		32	24.2	8	30S	S T
161	GA7199	19	81	-		29	30.6	8	t R	S T CP
162	CI 7171	26	82	-		18	34.0	12	t R	MR T
163	CI 7172	25	82	-		22	34.4	12	t R	mR T
164	CI 8234	16	70	8.0		40	34.6	7	10S	mR T
165	CI 8235	20	83	8.0		30	32.3	12	t R	S T
166	CI 8360	19	86	8.5		32	32.0	12	t R	mS T
167	H432 Si	16	77	7.5		30	21.9	12	60S	S T CP
168	H549 Si	12	76	7.5	85		25.8	15	t R	S T
169	H555 Si	10	72	8.0	48		25.4	18	60S	S T CP
170	H555 Si	11	80	8.0		30	26.0	10	80S	S T CP
171	H556 Si	12	72	7.5	32		25.2	12	t R	mS T CP
172	H441 Si	11	93	7.0		31	23.8	15	t R	S T
173	Mn 720183	19	92	7.0	93		24.1	10	t R	mS T
174	Mn 721015	16	84	8.0		17	26.8	15	t R	mS T
175	Mn 734470-2	15	87	7.5		31	26.0	10	t R	S T
176	Mn 734503-1	20	97	7.5		37	28.1	8	t R	mR T CP
177	HN2211	20	83	8.0		36	31.0	12	t R	S T
178	HN 615	12	73	9.0	76		27.4	10	30S	S T
179	Can Rdy Pg 4	20	92	8.0		38	29.7	15	80S	S NT
180	Can Eg^2-4023 Pg 8	22	94	-		29	22.2	15	40mS	S NT
181	Can Ukraine Pg 9	30	97	-		52	23.0	10	20R	S T
182	Can Rdy 0^2	19	94	8.0		44	30.1	10	80S	S T
183	366 Zi	15	80	8.5	73		29.3	12	50mS	S T
184	5236 Zi	14-17	82	8.0		23	29.2	15	t R	MS T
185	5250 Zi	12	83	8.0		20	33.1	12	t R	S T
186	5326 Zi	11	83	7.8	71		23.5	15	t R	S T CP
187	5350 Zi	18	84	8.5	-		-	12	t R	M T
188	5355 Zi	9	81	7.5	-		-	12	t R	S T
189	5528 Zi	12	70	8.0	77		25.3	14	t R	S T CP
190	5534 Zi	12	81	8.0	79		31.5	10	t R	S T
191	06072 Se	16	70	8.0	64		28.5	10	80S	mS T
192	06035 Se	14	86	8.5		36	26.1	8	40mS	S T
193	06204 Se	16	72	8.0		33	26.1	8	80S	mS T
194	06361 Se	12	85	7.5		32	27.6	6	80S	mS T CP
195	06364 Se	15	80	7.5			30.7	10	70S	S T
196	06080 Se	12	73	8.5		37	34.6	15	80S	S T
197	06327 Se	12	63	8.5	71		27.2	12	40MR	S T CP
198	06405 Se	11	71	8.5	82		28.6	12	50S	S T
199	06378 Se	14	72	8.0		20	27.0	8	60S	S T
200	06430 Se	16	64	8.0	74		31.8	10	50S	S T

Table 6. Concluded.

Entry no.	Variety and selection	Heading date June	Plant ht. (cm)	Snap-back 0-10	Grain yield 1 m (g)	Grain yield 3 m (g)	Kernel wt. (mg)	Yellow dwarf (red leaf)	Passo Fundo 1/ Brazil, 1976 Crown rust	Yellow dwarf
201	Pettis	12	86	8.0		44	23.4	10	80S	S T
202	CI 2332	15-	82			22	31.5	20	20mS	MS NT
203	CI 2678	16-	94			31	36.6	12	50MR	S T
204	CI 2743	16-19	93	7.5		29	26.5	8	80S	S T
205	CI 3031 1/	14	70	8.0		25	19.3	15	20mS	S NT
206	CI 3050	23	103			26	27.8	12	t R	S NT
207	CI 6632	12	70	8.0	88		31.6	8	80mS	S T
208	CI 6644	15	81	8.5	86		28.7	12	50S	mS T
209	CI 6978	16	71	8.5		19	32.2	10	20S	S NT
210	Markton	17	91	7.5				10	40S	MS NT
211	CI 7125	16	77	8.0		27	35.4	10	20mS	S T
212	CI 7143	20	78	8.0		31	32.6	10	30mS	S T
213	CI 7337	12	82	9.5	80		32.1	8	40S	S T
214	CI 7360	16	82	7.5		25	27.0	8	t R	S T
215	CI 1312	18	92	7.0	58			12	50S	S T
216	CI 4990	15	86	7.5	77		25.3	10	80S	S T
217	CI 5015 1/	16	87	8.0		29	16.6	6	40S	S T
218	CI 5096	16	72	8.5		30	34.5	18	80S	S NT
219	CI 5371	17	75	8.5	77		28.8	6	60S	S T
220	CI 5398	18	74	9.0		29	27.0	8	50mS	S T CP
221	CI 5399	17	74	8.5	76		33.2	8	30S	S T CP
222	CI 5419	19	70	8.5		20	31.3	8	40S	S T CP
223	CI 5428	16	57	8.5	77		27.4	10	t R	S NT
224	CI 5506	15	93	7.5		28	29.0	10	t R	S T
225	CI 5730	15-17	85	8.5		24	27.6	15	t R	mST
226	CI 5847	18	86	8.0		31	32.9	10	t R	S T
227	CI 5898	18	73	7.5		10	21.7	8	t R	mT
228	CI 5922	15	81	8.5	69		32.9	10	10S	S T
229	CI 6002	12	98	7.5		21	30.5	12	t R	S NT
230	CI 6003	12	95	7.5		22	30.3	12	20S	S NT
231	CI 6010	12	80	8.0			30.2	10	t R	S T
232	CI 1821	17	87	8.5		33	26.1	10	40S	S T
233	OT 194 1/	16	85	8.5		29	21.9	6	10mS	S T
234	Aj 86/2/1 1/	17	78	9.0		35	29.2	10	t R	S NT
235	Aj 113/19 1/	22	74	8.5		28	17.0	20	20S	S NT
236	Aj 126/126/39	1/16	80	8.5		26	26.7	20	40S	S NT
237	Aj 130/163/125	1/22	82	8.5		29	20.3	8	40S	S NT
238	Aj 140/35/75 1/	26	75	-		19	18.8	10	t R	S NT
239	CI 9139 x Rdy 0	11	85-105	7.5		21	26.5	20	t R	S T
240	Markton	17	87	7.5				10	30S	S T
241	Norline CI6903	18-23	74	-	-	-	-	5	20S	S T
242	Pennlan CI7881	18-20	72	-	-	-	-	10	20S	S T
243	Pennwin CI8312	28	76	-	-	-	-	12	20S	S NT
244	Walken CI8205	7/1	70	-	-	-	-	10	30S	MSNT
245	Compact CI8280	28	61	-	-	-	-	6	30S	S NT
246	Ky67 695 CI9136	18-7/2	65	-	-	-	-	10	40S	S NT
247	Ky63 1935 CI9137	18-73	65	-	-	-	-	10	40S	S T
248	Salem	24	69	-	67		27.8	12	30S	S NT
249	Checota	17	74	-	-	-	-	8	40S	S T
250	Chilocco	18	76	-	-	-	-	10	80S	S T

1/ Hulless.

Table 7. Parents of segregating populations of oats available for selection: sequence numbers 1-50 in 1976 and 41 to 250 in 1977. Kernel weight of F_3 (1-50) and F_2 (51-250) at Madison, 1976.

1976 F_3 from 1975 nursery F_2				1976 F_2 from 1975 nursery F_1			
Sequence number	Parents Female	Parents Male	Ker. wt. mg	Sequence number	Parents Female	Parents Male	Ker. wt. mg
	F_3 1976				F_2 1976		
1	PR76	x X2357-1-1	30.3	51	Coker 234	x TAM 301	33.1
2	PR76	x Suregrain bc	32.7	52	TAM 301	x Coolabah	32.3
3	X2309-2	x Coker 234	27.6	53	Fla 67Ab113	x Coolabah	32.6
4	X2503-1	x Coker 234	30.5	54	Coker 234	x CI 8235	32.2
5	X2185-1	x Coker 234	33.0	55	Coker 234	x X2379-9	35.9
6	X2185-2	x Suregrain bc	28.9	56	Coker 234	x X2426-1-1	31.6
7	X2638-1	x Coronado	28.4	57	Coolabah	x X2379-9	33.4
8	X2426-1-1	x Suregrain bc	30.3	58	Coolabah	x X2426-1-1	32.1
9	X2379-7	x Suregrain bc	33.8	59	Coolabah	x X2480-2	29.0
10	X3119-1	x TAM 312	30.1	60	Coolabah	x X3217-1	33.2
11	64C4194-2	x X2357-1-1	29.9	61	Coolabah	x X3217-1	31.0
12	64C4194-2	x X2379-9	34.7	62	Coolabah	x X3320-1	31.6
13	64C4194-2	x X2309-2	31.6	63	Coolabah	x X3320-1	31.1
14	X2185-1	x X3138-1	31.5	64	CI 8235	x Coolabah	34.5
15	X2185-1	x X3128-1	30.6	65	X2060-5	x Coolabah	32.1
16	X2185-1	x X2873-1	29.4	66	X2379-9	x Coolabah	34.4
17	X2185-2	x X2060-5	31.9	67	X2426-1-1	x Coolabah	32.9
18	X3212-1	x X2185-2	27.3	68	X2908-1	x Coolabah	29.9
19	X2185-2	x X2357-1-1	29.7	69	X2909A-6	x Coolabah	26.7
20	X2185-2	x X2908-1	30.6	70	X2909A-6	x Coolabah	32.5
21	X2286-2	x X2357-1-1	29.0	71	Coronado	x X1656-4-1	36.1
22	X2286-2	x Suregrain bc	27.6	72	Coronado	x X2379-9	34.4
23	X2287-1-1	x X2295-2-1	30.3	73	X2503-1	x Coronado	30.9
24	X2505-3	x X2185-2	34.8	74	Coronado	x X3217	34.8
25	X2505-3	x X2357-1-1	33.3	75	Suregrain bc	x X2908-1	34.3
26	X2505-3	x X2888-2	33.8	76	Irwin	x X2908-1	32.7
27	X2508-1	x X2887-12	37.9	77	Suregrain bc	x X3217-1	31.3
28	X2616-1	x X3236-1	24.9	78	Suregrain bc	x X2681-1	31.6
29	X2638-4	x X1309-1-1-1	29.2	79	Swan	x X2670-2	41.0
30	X2638-4	x X3119-1	26.2	80	Swan	x X2055-1	33.2
31	X2908-1	x X2309-2	29.2	81	X2305-3	x Swan	35.3
32	X2908-1	x X2876-7	28.8	82	TAM 301	x X2895-3	32.7
33	X3119-1	x X2078-1	32.7	83	X2895-3	x TAM 301	32.5
34	X3138-1	x X2379-9	30.9	84	TAM 301	x X3217-1	35.9
35	X3138-1	x 64C 4194-2	38.0	85	TAM 301	x H548	31.6
36	X3189-1	x X2379-9	31.7	86	X1309-1-1-1	x TAM 301	38.3
37	X3189-1	x X2638-1	28.7	87	X2357-1-1	x TAM 301	35.8
38	X3189-1	x X2687-1	30.9	88	X2503-2-1	x TAM 301	29.2
39	X3212-1	x X2426-1-1	27.7	89	X2590-1	x TAM 301	36.6
40	X3212-1	x X3056-2	28.5	90	X2908-1	x TAM 301	36.5
41	X3236-1	x X2357-1-1	26.0	91	X1309-1-1-1	x CI 8235	31.9
42	X3352-3	x X2851-2	29.2	92	X1309-1-1-1	x X2908-1	30.5
43	X3308-1	x X3352-3	35.9	93	X1309-1-1-1	x X2357-1-1	29.7
44	X2456-2	x Suregrain bc	31.9	94	X1656-4-1	x X2590-1	27.3
45	X2357-1-1	x Suregrain bc	31.8	95	X2379-9	x CI 8235	34.5
46	PR76	x HN 615	29.0	96	X2379-9	x X2503-2-1	33.4
47	X3308-1	x HN 615	34.5	97	X2379-9	x X2670-1	35.7
48	PR76	x X2888-1	29.7	98	CI 8235	x X2379-9	34.8
49	X2379-7	x X2888-2	39.2	99	X2185-1	x X2379-9	28.5
50	X2508-1	x X1309-1-1-1	34.4	100	Goodland		

Table 7. Cont.

Sequence number	1976 F_2 from 1975 nursery F_1 Parents Female		Male	Ker. wt. mg
101	X2503-2-1	x	X2379-9	31.2
102	X2503-2-1	x	X2379-9	34.0
103	X2379-9	x	X3217-1	32.5
104	X2379-9	x	X2908-1	28.7
105	X2379-9	x	X2426-1-1	32.1
106	X2670-1	x	X2379-9	33.6
107	X2185-1	x	X2638-1	26.0
108	X2185-1	x	X2670-2	29.2
109	X2440-2	x	X2185-1	27.4
110	X2440-2	x	X2185-1	28.9
111	X2440-2	x	X2908-1	29.1
112	X2480-2	x	X2908-1	31.8
113	X2503-2-1	x	CI 8235	36.9
114	X2503-2-1	x	X3217-1	35.7
115	X2638-1	x	X2908-1	28.3
116	X3217-1	x	X2638-1	27.6
117	X2681-1	x	X2426-1-1	31.2
118	X2681-1	x	X2426-1-1	27.9
119	X2681-1	x	X2426-1-1	31.6
120	X2681-1	x	X2590-1	25.4
121	X2895-3	x	X2638-1	28.0
122	X2908-1	x	X2426-1-1	34.6
123	X2909A-6	x	X2503-2-1	30.0
124	X2909A-6	x	CI 8235	35.2
125	X3061-1	x	X3320-1	30.8
126	X3279-1	x	CI 8235	35.8
127	X3279-1	x	X2426-1-1	30.7
128	X3320-1	x	X2670-2	30.4
129	X3320-1	x	X2638-1	25.5
130	X3320-1	x	X3217-1	30.2
131	CI 8235	x	X2426-1-1	33.9
132	H555	x	X2185-1	27.1
133	H555	x	X3217-1	31.1
134	X1385-1	x	X2055-1	29.5
135	X2317-1	x	X1385-1 1/	29.6
136	X2480-2	x	X2379-9	32.4
137	X2317-1	x	X2908-1	35.4
138	X2317-1	x	Suregrain bc	36.1
139	X2055-1	x	X2426-1-1	33.4
140	HN615	x	X1913-3	30.4
141	X1913-3	x	X2895-3	38.7
142	X1309-1-1-1	x	X1913-3	35.0
143	X1913-3	x	X2379-9	34.1
144	X2503-2-1	x	X1913-3	34.2
145	HN615	x	X2379-9	31.3
146	X2503-2-1	x	HN 615	27.9
147	X2859-5	x	TAM 301	31.1
148	X3217-1	x	X2859-5	30.6
149	CI 8235	x	HN 615	32.1
150	Markton			

Sequence number	1976 F_2 from 1975 nursery F_1 Parents Female		Male	Ker. wt. mg
151	X2503-2-1	x	HN 615	28.6
152	Coolabah	x	X1913-3	35.5
153	TAM 301	x	X1913-3	35.4
154	X2638-1	x	CI 8235	28.8
155	CI 2332	x	Coronado	37.0
156	CI 8235	x	CI 2332	33.5
157	X3217-1	x	CI 8235	29.4
	1976 F_2 from 1975-76 greenhouse F_1			
158	Coker 234	x	CI 2332	32.7
159	X2503-1	x	Dal	27.5
160	X2503-1	x	X3443-1	28.8
161	X2503-1	x	X2977-1	26.5
162	X2505-3	x	X2426-1-1	34.0
163	X2914B-1	x	CI 2332	27.7
164	CI 2332	x	X1779-2	26.4
165	CI 2332	x	Coker 1217	30.7
166	CI 1108	x	CI 2332	25.6
167	CI 6644	x	CI 5730	28.1
168	CI 4984	x	CI 7337	32.2
169	CI 6632	x	X2505-3	27.3
170	CI 6978	x	Zi 366	29.2
171	CI 6978	x	Coker 1217	33.2
172	Dal	x	Coolabah	32.8
173	Coolabah	x	Portage	28.9
174	Coolabah	x	X2357-101	31.5
175	Irwin	x	Portage	36.5
176	Irwin	x	X2357-1-1	38.7
177	X2505-4	x	Irwin	33.0
178	X2379-9	x	CI 5947	33.2
179	CI 1963	x	X2379-9	38.9
180	CI 5406	x	X2505-3	25.9
181	CI 5371	x	Suregrain bc	32.5
182	CI 5371	x	Elan	32.3
183	CI 5397	x	Coronado	34.5
184	CI 5397	x	Elan	31.8
185	CI 5398	x	64C4194-2	35.2
186	CI 5398	x	CI 7125	34.4
187	CI 5398	x	TAM 301	32.9
188	CI 5399	x	CI 2332	28.0
189	CI 5399	x	X2357-1-1	34.2
190	CI 5406	x	X2379-9	29.0
191	CI 6003	x	Swan	43.0
192	CI 6003	x	X2426-1-1	29.9
193	X2881-1	x	X2357-1-1	30.7
194	Dal	x	Coker 1217	29.5
195	Coker 1217	x	Dal	31.0
196	Goodland	x	Coker 1217	30.5
197	X2670-2	x	Coker 1217	29.8
198	X2881-1	x	Coker 234	28.1
199	Coker 1217	x	X2357-1-1	29.0
200	Coker 234	(Check var.)		

Table 7. Concluded.

Sequence number	Parents: Female	x	Male	Ker. wt. mg.	Sequence number	Parents: Female	x	Male	Ker. wt. mg.
	1976 F_2 from 1975-76 greenhouse F_1					1976 F_2 from 1975-76 greenhouse F_1			
	F_3 1976					F_2 1976			
201	Coker 1214	x	Swan	36.1	226	Kenya 631	x	X1913-3	32.7
202	Coker 1214	x	Se 06378	27.9	227	Kenya 631	x	Can 615	36.3
203	Coronado	x	X2078-1	30.2	228	Portage	x	Kenya 631	35.3
204	X2908-1	x	Coker 1217	29.4	229	Suregrain bc	x	X2895-3	33.3
205	X3443-1	x	Coronado	35.7	230	Ga 7199	x	X2895-3	32.0
206	Coronado	x	X1779-2	35.0	231	Coker 1217	x	X2895-3	33.2
207	GA7199	x	X1779-2	32.4	232	X2895-3	x	Coker 234	32.3
208	Coker 1214	x	Lang	31.5	233	X2859-5	x	Coker 227	36.1
209	TAM 312	x	X2078-1	34.6	234	X2859-5	x	Coker 227	40.0
210	X2185-2	x	OT 194	26.1	235	X1779-2	x	X1913-3	32.5
211	X2185-1	x	Se 06378	27.6	236	X1913-3	x	X2357-1-1	31.8
212	X2881-1	x	OT 195	28.1	237	X2051-6	x	X2895-3	29.8
213	X2977-1	x	Aj/2/1	30.9	238	X1913-3	x	X2859-5	31.2
214	X1656-4-1	x	X2051-6	31.3	239	X1588-1	x	X2859-5	30.4
215	X1779-2	x	X2051-6	33.8	240	X2185-1	x	Se 06378	30.3
216	H555	x	X2051-6	31.7	241	X2185-1	x	Lang	34.0
217	X2055-1	x	X2505-3	32.0	242	X2590-1	x	X2185-2	26.3
218	X3056-1	x	X2051-6	34.1	243	X2480-2	x	X2977-1	30.7
219	X2379-8	x	X2426-1-1	28.7	244	X2055-1	x	X2185-2	30.8
220	X2505-4	x	X2859-5	26.5	245	X2882-4	x	X2914B-1	255
221	X2881-1	x	X2185-2	31.2	246	X2185-1	x	X2078-1	32.4
222	Kenya 630	x	X1588-1	34.1	247	X3443-1	x	X2078-1	33.6
223	X2670-2	x	Kenya 630	33.3	248	X2456-2	x	CDA 283 2/	32.7
224	Suregrain bc	x	Kenya 630	32.2	249	X2501-1	x	CDA 286 2/	31.9
225	Kenya 631	x	X1913-3	36.2	250	Markton (Check var.)			

2/ F_3, 1.4 meters length.

Table 8. Performance (weight gain kg/ha) of beef heifers grazing unimproved and sod-seeded native pastures.1/ Guaiba, Rio Grande do Sul 1973-75. From Scholl et.

Performance		Native grass pastures		
			Sod-seeded oats - 400 kg/ha 10-30-10	
		No. treatment	plus arrowleaf clover	plus 90 kg nitrogen2/
Cattle Gains		kg/ha		
"Winter" 3/	July 17 - Oct. 4 '73	13	150	291
	July 4 -Sept. 18 '74	-4	19	51
"Spring"	Oct. 5 - Dec. 27 '73	0	188	72
	Sept.10 - Dec. 11 '74	41	241	189
"Summer"	Dec. 28 - Feb. 20 '74	55	121	148
	Dec. 12 - Feb. 2 '75	58	140	189
"Autumn"	Feb. 21 - Apr. 17 '74	12	57	-13
	Feb. 3 - Apr. 17 '75	6	18	10
Total for year-1973-74 (304 days)		80	516	498
1974-75 (315 days)		101	418	439
2 YEAR AVG.		90.5	467.0	468.5

1/ Grazed by yearling beef heifers with "put and take" system of stocking. All weights obtained after 14-16 hours of fasting without feed or water.
2/ On Oct. 25, 1973, an additional 15 kg/ha N was applied to the sod-seeded oat plots that did not have clover. This was to support summer native grass growth.
3/ These designations of seasons are approximations. Cattle were weighed at 28 day intervals after over night shrink.

Table 9. World production statistics of grain crops, and comparison of oats and wheat. FAO 1974 Yearbook Vol. 28.

Grain crop	World areas and production - 1973 and 1974				
	Hectares(1000)		Production, metric tons(1000		
	1973	1974	1973	1974	% whe 2 years
Oats	32,101	30,698	54,379	51,227	14.3
Barley	87,715	88,909	169,245	170,858	46.1
Maize	111,458	116,709	310,391	292,990	81.8
Millet	69,527	68,424	48,067	46,215	12.8
Rice	135,109	136,791	324,468	323,201	87.8
Rye	15,349	17,482	28,789	32,611	8.3
Sorghum	43,022	42,524	53,206	46,908	13.6
Soybeans	44,261	44,478	62,311	56,803	16.1
Wheat	224,480	224,712	377,272	360,231	100.0

Comparisons of oats and wheat crop areas (1000 ha) for certain countries in 1974.

	Algeria	Morocco	Tunisia	S. Africa	Canada	Mexico	USA
Oats	50	33	24	225	2471	55	5393
Wheat	2000	1917	1000	1450	9501	778	26490
Oats:Wheat %	2.5	1.7	2.4	15.5	26.0	7.1	20.4

	Argentina	Brazil	Chile	Uruguay	Turkey	Europe	Australia
Oats	253	30	97	61	300	6,266	900
Wheat	3902	2500	675	430	8,600	27,405	8800
Oats:Wheat %	6.5	1.2	14.4	14.2	3.5	22.9	10.2