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Varietal Trials

of Farm Crops

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Agricultural Experiment Station
UNIVERSITY OF MINNESOTA

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MANY VARIETIES of farm crops are available from which the farmer can select the varieties which he will plant. These varieties differ widely in yielding ability, maturity, standing ability, quality, disease resistance, and other important characters. Successful crop production is dependent to a considerable extent upon how well the farmer selects varieties adapted to his farm.

To provide information as a basis for the selection of the most desirable varieties, the Minnesota Agricultural Experiment Station annually conducts comparative tests of varieties of each of the important farm crops. Studies of yield, plant height, maturity, lodging resistance, other important agronomic characters, disease resistance, and quality are carried out at the central station at St. Paul; at the six branch experiment stations located at Rosemount, Waseca, Morris, Crookston, Duluth, and Grand Rapids; in southwestern Minnesota; and in northern Minnesota. The trials in southwestern Minnesota are conducted in cooperation with an organization of the southwestern counties by R. G. Robinson and the project leaders from St. Paul. The trials in northern Minnesota are conducted in cooperation with the North Central Experiment Station at Grand Rapids or the Northwest Experiment Station at Crookston, and the county organizations.

Recommended varieties, more important old varieties, and promising new varieties are grown in replicated field plots at each location. These field plots are of size and shape appropriate for the particular crop. For example, in small grains and flax each plot is a drill strip wide and approximately 1/40 acre in size. These plots are handled so that the factors affecting yield and other characteristics are, insofar as possible, the same for all varieties at each location. In that way the extent of real differences among varieties can be measured with some precision.

Less important varieties and new experimental lines in early stages of testing are grown at some of these same locations in replicated row plots. In the case of small grains and flax, these row plots are each one rod long.

Reactions to important diseases are tested in specially conducted disease nurseries at the central station in cooperation with the Department of Plant Pathology and Agricultural Botany. Tests for quality are made by the Department of Agricultural Biochemistry, the United States Regional Soybean Laboratory, the Malt Research Institute at Madison, Wisconsin, the United States Department of Agriculture, or in cooperation with the Northwest Crop Improvement Association.

Included in the trials are improved varieties developed at other experiment stations in the United States and Can-

ada as well as those developed by the Minnesota Agricultural Experiment Station.

On the basis of results from these comparative trials, a list of varieties recommended for use in Minnesota is drawn up each year at the Experiment Station Crops Conference. Participating in that conference and helping to formulate the list of recommended varieties are staff members of the Departments of Agronomy and Plant Genetics, Plant Pathology and Agricultural Botany, Agricultural Biochemistry, Soils, and Entomology and Economic Zoology, Agricultural Extension, and of the six branch experiment stations. Extension Folder 22, *Improved Varieties of Farm Crops*,[1] presents the list of recommended varieties for each crop and in addition, lists of "varieties not adequately tested" and "varieties not recommended."

This report summarizes yield and other comparative agronomic data on varieties of barley, flax, oats, rye, spring wheat, winter wheat, soybeans, corn, alfalfa, bromegrass, red clover, sweetclover, field peas, and sunflowers grown in field plots in 1953. Average data rather than the results of individual tests or years are presented. The years during which each variety has been tested are given in the individual tables. Usually the number of years of trial varies among varieties within the same crop. For some such tests, adjustment of part of the yields has been made in such a manner that the differences among varieties are of the same magnitude as in the original data, yet so averages of varieties tested for different numbers of years can be compared directly. The method used is illustrated in detail in a previous isuse of *Varietal Trials of Farm Crops*,[2] and will not be described here.

Pertinent data on disease reaction of the varieties are taken largely from Folder 22.

Included also in this report are brief descriptions and histories of recommended varieties and of other varieties which have been or may be grown or offered for sale in Minnesota. Descriptions of varieties not included in field plots for 1953, and therefore not summarized in this report, are taken from data from previous field plot trials, rod row trials, or in a few cases from tests in adjacent states.

The individual crop summaries and varietal descriptions were prepared by the project leaders in the Department of Agronomy and Plant Genetics who are responsible for the varietal improvement studies with various crops. Cooperators from the Department of Plant Pathology include J. J. Christensen, M. B. Moore, and M. F. Kernkamp. Cooperators in the Department of Agricultural Biochemistry include W. F. Geddes, L. S. Cuendet, and C. G. Norris. Cooperators at the branch experiment stations include R. E. Hodgson and John Thompson at Waseca, A. W. Edson and R. O. Bridgford at Morris, T. M. McCall and O. C. Soine at Crookston, C. L. Cole and C. H. Griffith at Grand Rapids, and R. S. Grant and W. Nelson at Duluth.

In 1949, trials of small grains and flax were transferred from University Farm to Rosemount. Summaries in the tables for University Farm and Rosemount are presented under Rosemount and include data obtained at University Farm prior to 1949 and at Rosemount in later years.

Trials of field peas and sunflowers are conducted in cooperation with the branch station at Crookston. These crops are also tested in southwestern Minnesota and at Rosemount.

[1] *Improved Varieties of Farm Crops*, Minn. Agr. Ext. F. 22, 1954.

[2] W. M. Myers *et al. Varietal Trials of Farm Crops*, Minn. Agr. Expt. Sta., Misc. Rpt. 18, 1953.

BARLEY

J. W. Lambert

YIELD COMPARISONS

Average yields of several barley varieties as obtained at various locations in Minnesota during the period 1948-53 are given in table 1. Vantage was the highest yielding variety at Rosemount, Waseca, Morris, and in southwestern Minnesota. Montcalm equaled Vantage at Crookston. Trebi, Tregal, and Feebar were outstanding in the trials of northeastern Minnesota where Barbless and Mars gave the poorest yields.

OTHER AGRONOMIC CHARACTERS

Comparative data on date of heading, plant height, standing ability, kernel size, and weight per bushel are presented in table 2. For the first five varieties date of heading averaged about four days earlier, plant height one inch taller, and kernel weight one gram per thousand greater in the southern, central, and western locations than in the northeastern location. Lodging and bushel weight were much the same in the two general regions.

In the southern, central, and western locations Mars was the earliest variety, Kindred was only slightly later, and Barbless, Montcalm, and Vantage averaged several days later. Montcalm was tallest, Mars and Vantage being shortest. Mars and Vantage had good resistance to lodging whereas Kindred, Barbless, and Montcalm showed a marked tendency to lodge. Kernel weights were medium except for Mars, which was small. In bushel weight, Mars excelled and Barbless and Montcalm were lowest.

In regard to the northeastern locations, Plains averaged earliest in date of heading and Montcalm latest. Barbless, Peatland, and Moore were almost as late as Montcalm. Peatland was tallest followed closely by Montcalm, Barbless, Kindred, and Moore. Trebi, Tregal, Plains, and Mars were relatively short strawed. Mars and Feebar were the best in standing ability, though Vantage, Peatland, Tregal, Moore, and Plains were good in this respect. Kindred, Barbless, Montcalm, and Trebi were poor in standing ability. Trebi had the largest kernels. The kernels of Feebar were also large. Only Peatland and Mars were decidedly small in kernel size. Peatland and Mars were superior in bushel weight while Feebar was lowest.

MALTING QUALITY

Kindred is the variety most widely accepted by American maltsters at the present time. Also regarded with favor by many of the maltsters is the variety Montcalm. These two are now considered definitely superior to Barbless in malting quality. The rest of the varieties listed in tables 1 and 2 are classified strictly as feed barleys.

DISEASE REACTION

All of the varieties are susceptible to leaf rust. Those classified as resistant to stem rust in the following discussion have shown practical field resistance over a period of years. It is known, however, that they may be attacked by certain races.

Barbless is moderately resistant to barley stripe, moderately suceptible to spot blotch and net blotch, and susceptible to scab, loose smut, stem rust, and mildew.

Mars is resistant to stem rust, moderately resistant to net blotch, moderately susceptible to mildew, scab, and spot blotch, and susceptible to loose smut and stripe.

Table 1. Average Yields of Barley, 1948-53*

Variety	Southern, central, and western locations						Northeastern locations			
	Rosemount	Waseca	Morris	Crookston	Southwestern Minnesota	Average five locations	Grand Rapids	Duluth	Northern Minnesota	Average three locations
						bushels per acre				
Barbless	51.0	42.1	58.9	36.7	47.1	47.2	45.6	42.5	36.6	41.6
Mars	50.0	43.6	59.8	39.4	41.6	46.9	44.0	38.7	42.3	41.7
Kindred	50.8	47.6	57.6	38.7	46.3	48.2	48.3	41.2	46.6	45.4
Montcalm	46.8	45.9	59.8	43.8	44.8	48.2	47.1	43.1	48.4	46.2
Vantage	53.8	48.2	71.6	43.0	49.2	53.2	51.6	39.8	46.1	45.8
Feebar							48.3	46.5	47.0	47.3
Peatland							47.6	44.8	42.1	44.8
Trebi							58.1	43.0	48.0	49.7
Tregal							53.8	42.4	44.8	47.0
Moore							48.8	43.1	37.8	43.2
Plains							50.6	38.4	44.5	44.5
L.S.D. at 5 per cent point	3.3	3.7	4.0	5.0	3.7	1.8	4.7	3.5	6.1	2.8

*Data from northern Minnesota for 1950-53.

Table 2. Averages of Barley Varieties for Date of Heading, Plant Height, Lodging Score, Weight of 1,000 Kernels, and Weight per Bushel, 1948-53

Variety	Average southern, central, and western locations					Average northeastern locations				
	Date of heading	Plant height	Lodging score*	Weight of 1,000 kernels	Weight per bushel	Date of heading	Plant height	Lodging score*	Weight of 1,000 kernels	Weight per bushel
		inches		grams	pounds		inches		grams	pounds
Barbless	6-27	33	4	30.1	43.8	7- 1	32	4	29.1	43.0
Mars	6-23	29	1	26.8	46.5	6-27	28	1	26.9	46.4
Kindred	6-24	32	5	30.1	45.5	6-28	32	5	31.3	44.3
Montcalm	6-28	34	4	28.4	43.8	7- 2	33	4	29.8	43.7
Vantage	6-27	29	2	31.1	44.1	6-30	29	2	31.0	43.4
Feebar						6-29	28	1	35.1	40.9
Peatland						7- 1	34	2	27.2	47.4
Trebi						6-28	25	4	39.1	43.0
Tregal						6-29	27	2	32.2	43.1
Moore						7- 1	32	2	28.9	42.8
Plains						6-26	26	2	32.4	45.4

*1=excellent standing ability; 5=very poor standing ability.

Kindred is resistant to stem rust and moderately resistant to net blotch. It is moderately susceptible to mildew, loose smut, and scab and susceptible to stripe. It has, until recently, been considered moderately resistant to spot blotch. In 1953, however, fields of Kindred were observed which were heavily infected with spot blotch, indicating an increase in a new race or races of the causal organism.

Montcalm is moderately resistant to net blotch, moderately susceptible to spot blotch, and susceptible to stem rust, stripe, loose smut, and mildew.

Moore is resistant to mildew and stem rust but is moderately susceptible to barley stripe and loose smut. It is very susceptible to net blotch.

Feebar is resistant to stem rust and moderately resistant to net blotch, stripe, and mildew. It is moderately susceptible to loose smut and susceptible to spot blotch and scab.

Plains is resistant to stem rust and stripe, moderately resistant to net blotch, loose smut, and mildew, but susceptible to spot blotch.

Vantage is resistant to stem rust and moderately resistant to net blotch. It is moderately susceptible to stripe and susceptible to spot blotch, mildew, and loose smut.

Peatland is resistant to stem rust and mildew, moderately resistant to spot blotch, net blotch, loose smut, and scab, and susceptible to stripe.

Trebi and Tregal are resistant to a number of races of loose smut, moderately resistant to net blotch, moderately susceptible to spot blotch, and susceptible to stem rust.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Kindred (L) (C.I. 6969) is a six-rowed, rough-awned, white aleurone variety with good malting quality. It has yielded well and is medium early, but it is highly susceptible to lodging. It is resistant to stem rust and moderately resistant to net blotch and spot blotch. It is moderately susceptible to mildew, loose smut, and scab and is susceptible to stripe. Kindred was selected by a farmer, S. T. Lykken of Kindred, North Dakota. It is recommended as a malting variety in all parts of Minnesota.

Montcalm (C.I. 7149) is a six-rowed, smooth-awned variety with a blue aleurone. It has yielded well in Minnesota and in recent years has been readily accepted by a large part of the American malting industry. It is tall, matures rather late, and has mediocre to poor strength of straw. Montcalm is moderately resistant to net blotch, moderately susceptible to spot blotch, and susceptible to stem rust, stripe, loose smut, and mildew. Montcalm was selected at Macdonald College, Quebec, from the cross (Michigan 31604 x Common Six-rowed 4307 M.C.) x Mandscheuri 1807 M.C. It is recommended as a malting barley in the northwestern and cutover sections of Minnesota.

Peatland (C.I. 5267), a six-rowed, rough-awned variety with white aleurone, has yielded better on peat soils than most other varieties of barley, as shown by several years' trials. Peatland also has yielded well on mineral soils and thus is recommended as a feed barley in the northeastern section of Minnesota. It is resistant to stem rust and mildew; moderately resistant to spot blotch, net blotch, loose smut, and scab; and susceptible to stripe. Peatland has small seeds and is not generally acceptable for malting purposes. It is a Minnesota selection from the variety Switzerland.

Vantage (C.I. 7324) is a stiff-strawed, six-rowed, smooth-awned feed barley which has a white aleurone. Of the varieties tested in the principal barley-growing areas in Minnesota during the last six years Vantage has averaged

highest in yield by about five bushels per acre. It is only slightly later in maturity than Kindred. It is moderately resistant to net blotch and susceptible to mildew, scab, loose smut, and spot blotch. Vantage was developed at Brandon, Manitoba, from a cross (Newal x Peatland) x Plush and is recommended as a feed barley in all sections of Minnesota.

Varieties Not Recommended

Barbless (Wisconsin Ped. 38) is a six-rowed, smooth-awned, white-aleurone variety. It yields well under favorable conditions. Barbless is moderately resistant to barley stripe and net blotch, moderately susceptible to spot blotch, and susceptible to scab, loose smut, stem rust, and mildew. It has weak straw and lodges badly when seeded on heavy or fertile soils. It is late in maturity. Barbless was selected at the Wisconsin Agricultural Experiment Station from Oderbrucker x Lion.

Bay is a six-rowed, smooth-awned variety which is susceptible to stem rust and gives only fair yields. Its parentage involves Manchuria, Lion, and Spartan. It was selected at the Michigan Agricultural Experiment Station.

Compana is a two-rowed, smooth-awned, white-aleurone variety which was developed for the dry conditions of Montana. It is considered undesirable for Minnesota. It was selected from a composite cross by H. V. Harlan and released first by the Montana Experiment Station.

Feebar is a high yielding, stiff-strawed, six-rowed, stem rust-resistant feed barley developed for the dry conditions of central and western South Dakota. It was selected from the cross, Peatland x Vaughn.

Galore is a six-rowed, smooth-awned variety developed in Canada for certain localized conditions. It is unsuitable for malting and is of little value for Minnesota. Its parentage involves O.A.C. 21 and Lion, and the originating station was the Ontario Agricultural College at Guelph, Ontario.

Kemble is a six-rowed, rough-awned variety selected by a farmer. The seed is small, and the plants have a marked tendency to lodge. It has been low in yield in Minnesota trials.

Manchuria is a type rather than a single variety. Several selections have been made within the type, including Minnesota 184, North Dakota 2121, O.A.C. 21, and Oderbrucker. The type is six rowed, rough awned, medium early, and medium tall to tall. The kernels may have either blue or white aleurone. All the known selections from the type are susceptible to stem rust, but several selections from Manchuria have shown a measure of resistance to spot blotch. Nearly all Manchuria selections are acceptable for malting. Yields of Manchuria selections tested in Minnesota have been mediocre. As the name implies the type had its origin in Manchuria but arrived in the United States by several routes.

Mars is a six-rowed, smooth-awned, stiff strawed, white-aleurone variety that produces plump, well filled kernels. It is early in maturity and has high weight per bushel. Mars is resistant to stem rust, moderately resistant to net blotch, moderately susceptible to mildew, scab, and spot blotch, and susceptible to loose smut and stripe. The seeds of Mars are small and low in diastatic activity and are therefore considered undesirable for malting purposes. Its parentage includes Lion, Manchuria, and Peatland. Mars was selected at the Minnesota Agricultural Experiment Station.

Moore is a six-rowed, smooth-awned, white-aleurone feed variety that is late in maturity, has moderately stiff straw, and has yielded well at all locations except Crookston. It is resistant to mildew and stem rust, but it is moderately susceptible to scab and spot blotch and to

stripe and loose smut. It is very susceptible to net blotch. Moore was developed at the Wisconsin Agricultural Experiment Station from crosses involving Lion, Oderbrucker, Chevron, and Olli.

O.A.C. 21 is a blue-aleurone selection from the Manchuria type. It yields moderately well, has rough awns and weak straw, and is susceptible to stem rust. It has limited acceptance in the American malting trade. As the name implies it was selected at the Ontario Agricultural College.

Plains is a very early, six-rowed, smooth-awned variety developed by the South Dakota Agricultural Experiment Station for the plains country of that state. It has yielded well in Minnesota but is not acceptable for malting. It has short, stiff straw and is resistant to stem rust. Its parentage is Peatland x Dryland.

Trebi is a high yielding, six-rowed, rough-awned variety with very poor malting quality. It is resistant to certain common races of loose smut but is susceptible to stem rust, covered smut, and a number of other diseases. The kernels have blue aleurone and are very large.

Tregal is a six-rowed, smooth-awned variety which has yielded relatively well in Minesota, but it is unsuited for malting purposes. Its disease reaction is like that of one of its parents, Trebi. The other parent is Regal. Tregal was selected at the North Dakota Agricultural College.

OATS

W. M. Myers and K. S. Koo

YIELD COMPARISONS

Average yields of the varieties at six stations, southwestern Minnesota, and northern Minnesota are reported in table 3. Because of crop failure, no data are available for Waseca in 1953. Seven varieties—Bonda, Mindo, Clinton, Andrew, Ajax, Vicland, and Gopher—have been continuously in tests at five stations for nine years. Trials were initiated in southwestern Minnesota in 1947 and in northern Minnesota in 1950. No data are available for northern Minnesota for 1952.

Missouri O-205 has been in the tests for three years, Clintafe for two years, and Clintland, Sauk, and Fortune were included in these trials for the first time in 1953. Yields of James, a hullless variety, have been multiplied by 10/7 to make them comparable with yields of hulled varieties.

It can be seen from the adjusted average of all tests that among the recommended varieties, Branch and Ajax have been highest in yield, followed in declining order by Missouri O-205, Andrew, Shelby, James, Clinton, Clintafe, Mindo, and Bonda. Important factors affecting yield in 1953 were stem and crown rust, especially stem rust. Bonda, Mindo, Clinton, Clintafe, James, and Shelby were susceptible to the prevalent race of stem rust, and yield of these varieties was reduced as a result. This was especially true for Shelby which has, on the average of several years, been one of the high yielders but which was one of the lowest in 1953. Of the three varieties in test for the first time, Sauk was high in yield while Clintland and Fortune were intermediate. The lack of reliability of such single year tests must be stressed, however.

OTHER AGRONOMIC CHARACTERS

Comparative data on agronomic characters other than yield are sumarized in table 4. These data are for four lo-

Table 3. Average Adjusted Yields of Oats

Variety	Years of trial	Rosemount	Morris	Crookston	Grand Rapids	Duluth	Years of trial	Waseca	Years of trial	Southwestern Minnesota	Years of trial	Northern Minnesota	Grand* average
		bushels per acre						bushels per acre		bushels per acre		bushels per acre	
Gopher	1945-53	69.6	95.2	66.0	72.1	66.6	1945-52	73.1	1947-53	66.7	1950, 51, 53	67.6	72.0
Vicland	1945-53	70.6	87.3	63.1	69.9	63.0	1945-52	68.9	1947-53	64.9	1950, 51, 53	71.4	70.0
Bonda	1945-53	71.3	77.1	62.9	63.6	64.0	1945-52	72.4	1947-53	62.6	1950, 51, 53	61.5	66.1
Mindo	1945-53	71.1	81.2	65.4	65.0	67.9	1945-52	74.9	1947-53	57.6	1950, 51, 53	57.6	66.5
Clinton	1945-53	72.3	80.6	64.6	69.2	68.2	1045-52	77.8	1947-53	62.6	1950, 51, 53	59.0	68.1
Andrew	1945-53	74.7	86.2	65.4	70.6	69.1	1945-52	73.0	1947-53	64.8	1950, 51, 53	66.4	71.0
Ajax	1945-53	75.3	92.3	72.3	80.3	74.8	1945-52	79.2	1947-53	71.6	1950, 51, 53	69.0	76.5
Shelby	1948-53	69.3	87.7	71.1	69.6	71.0	1948-52	76.6	1948-53	65.2	1950, 51, 53	54.5	69.8
James†	1949-53	72.0	85.5	69.4	61.3	62.4	1949-52	73.4	1949-53	68.8	1950, 51, 53	65.3	69.2
Branch	1950-53	75.9	98.9	66.5	82.1	81.6	1950-52	70.4	1950-53	67.5	1950, 51, 53	65.6	76.9
Mo. O-205	1951-53	72.4	88.1	59.9	73.2	72.5	1951-52	78.9	1951-53	74.2	1951, 53	66.9	72.5
Clintafe	1952-53	74.4	88.7	60.9	67.6	67.0	1952	83.8	1952-53	55.7	1953	60.6	67.8
Clintland	1953	82.3	86.0	70.2	64.5	67.1		.....	1953	55.8	1953	66.0	70.3
Sauk	1953	68.0	96.6	77.8	92.8	81.7		.....	1953	73.8	1953	73.2	80.6
Fortune	1953	52.7	84.8	78.0	70.8	61.8		.....	1953	71.2	1953	65.5	69.3
L.S.D. at 5 per cent point‡		3.8	4.5	5.3	5.3	4.5		4.6		4.5		6.8	1.9

*Average does not include Waseca, from which data were not available in 1953.

† Yield adjusted to allow for absence of hull.

‡Applies only to comparisons among varieties grown for the entire period.

cations, namely University Farm-Rosemount, southwestern Minnesota, Morris, and Crookston. All data are for the years of test indicated for the respective locations in table 3, except that there were no data on lodging for Crookston for 1951 and the date of heading data from southwestern Minnesota were based only on 1950-53 data.

The earliest varieties in date of heading were Mindo and Andrew. Missouri O-205 was two days later and Bonda, Clinton, James, and Clintland were three days later than Mindo. Clintafe was four days later than Mindo; it headed at the same time as Vicland; and it was one day earlier than Gopher. Shelby and Sauk were six days, Ajax and Fortune seven days, and Branch eight days later than Mindo.

Mindo and Vicland are the shortest varieties while Ajax, Branch, and Fortune are the tallest. Shelby, Bonda, Missouri O-205, Clintafe, and Sauk are also relatively tall varieties.

In weight per bushel, James, the hulless variety, was outstanding. Among the hulled varieties, Bonda, Missouri O-205, Clintland, and Shelby were superior. Gopher, Vicland, Ajax, Sauk, and Clintafe were relatively low in weight per bushel, and Fortune was distinctly inferior. Other varieties were intermediate.

Missouri O-205, Andrew, and Clintland were the varieties lowest in per cent of hull, while Fortune and Branch were highest in this character. Vicland, Bonda, Ajax, and Clintafe were also relatively high in hull percentage.

In weight per 200 kernels, Bonda was highest, followed by Andrew, Sauk, and Shelby. Among the hulled varieties, Clintafe had the lowest weight of kernels.

In standing ability Branch, Ajax, and Shelby are weaker than other recommended varieties. Sauk and Fortune are also inferior in this character.

DISEASE REACTION

All tested varieties are susceptible to stem rust. Vicland, Andrew, Ajax, Branch, Missouri O-205, Sauk, and Fortune are resistant to race 7 but susceptible to race 8. Bonda, Mindo, Clinton, Shelby, James, Clintafe, and Clintland are resistant to race 8 but susceptible to race 7. Gopher is susceptible to both

Table 4. Average Date of Heading, Plant Height, Weight per Bushel, Hull Percentage, Weight of 200 Kernels, and Standing Ability for Oats at Four Locations*

Variety	Date of heading	Plant height	Weight	Hull	Weight of 200 kernels	Standing ability†
		inches	lbs. per bushel	per cent	grams	
Gopher	June 29	35	33.5	31.6	4.7	2
Vicland	June 28	32	33.5	32.7	4.9	2
Bonda	June 27	38	36.4	33.1	6.0	1
Mindo	June 24	33	34.2	31.2	5.0	1
Clinton	June 27	36	34.9	30.0	4.9	1
Andrew	June 24	36	34.6	27.6	5.5	1
Ajax	July 1	41	33.8	32.7	5.0	2
Shelby	June 30	38	35.4	32.0	5.3	2
James	June 27	36	41.6	0	3.5	1
Branch	July 2	40	34.5	34.2	5.1	2
Mo. O-205	June 26	38	35.6	26.4	4.6	1
Clintafe	June 28	37	32.8	33.1	4.1	1
Clintland	June 27	34	35.8	27.1	5.0	1
Sauk	June 30	37	33.3	30.2	5.8	2
Fortune	July 1	43	31.4	34.9	5.0	2

*Rosemount, Morris, Crookston, and southwestern Minnesota.

†1 = good, and 2 = medium.

races 7 and 8. Races 7 and 8 have been prevalent in Minnesota and race 7 was most prevalent in 1953.

All varieties except Clintafe and Clintland are susceptible to some races of crown rust. These two varieties have resistance to all races of crown rust known in North America. Vicland, Branch, and Ajax have moderate resistance to race 45, which has been prevalent in recent years. Missouri O-205 has had moderate resistance in the field to prevalent races.

All varieties in the trials except Vicland have been resistant to *Helminthosporium victoriae*. In some years, yields of Vicland have been seriously reduced by this fungus.

All of the recommended varieties except Ajax continued to prove resistant to prevalent races of smut.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Ajax (C.I. 4157) has white grain and is later in maturity than Bonda, Mindo, Clinton, and Andrew. Ajax has been outstanding in yielding ability on the average and is similar to Shelby in standing ability. It is less desirable than other recommended varieties in weight per bushel. It is susceptible to smut and resistant to race 7 of stem rust. It was developed in Canada from the cross Victory x Hajira.

Andrew (C.I. 4170) is an open-panicled, yellow-grained, very early maturing oat which has excelled in yielding ability in trials arranged by the United States Department of Agriculture throughout the corn belt. It has good weight per bushel, excellent standing ability, and a low hull percentage. It is similar to Clinton in plant height. It is resistant to smut and to race 7 of stem rust. It was selected at the Minnesota Agricultural Experiment Station from a cross of Bond x Rainbow.

Bonda (C.I. 4329) is a good-yielding, open-panicled, early maturing oat with a yellowish-white, large-sized grain of superior bushel weight. It is taller than Mindo or Clinton and is about equal to them in standing ability. It is resistant to smut and to race 8 of stem rust. Bonda was selected at the Minnesota Agricultural Experiment Station from a cross of Bond x Anthony.

Branch (C.I. 5013) is a yellow oat. It excels in height of plant and is late in maturity. It has given excellent yields but has lodged somewhat more than other recommended varieties. It also has a relatively high hull percentage. It is resistant to smut and to race 7 of stem rust. It was developed in Wisconsin from the cross (Forward x Victoria-Richland) x Forward.

Clintafe (C.I. 5869) is similar to Clinton in most characteristics but is about one to two days later in maturity and one to two inches taller. It also differs from Clinton in having resistance to all prevalent races of crown rust. It is the only recommended variety resistant to crown rust. It was developed at the Iowa Agricultural Experiment Station from a cross of Clinton x Santa Fe, backcrossed three times to Clinton.

Clinton (C.I. 3971) is a good-yielding, open-panicled, yellow-grained, early maturing oat with good weight per bushel. It is intermediate in height between Bonda and Mindo. Clinton has a relatively low hull percentage. It is resistant to smut and to race 8 of stem rust. It was selected at the Iowa Agricultural Experiment Station from a cross of D69 x Bond.

James (C.I. 5015) is a hull-less variety. It has excellent standing ability, is about like Bonda and Clinton in time of maturity, and has good yielding ability. It is resistant to smut and to race 8 of stem rust. It was selected in South Dakota from the cross (Bond-Double Cross B) x Nakota.

Mindo (C.I. 4328) is a good-yielding, very early, open-panicled, yellowish oat with good weight per bushel. The straw is short and the variety has good resistance to lodging. It is resistant to smut and to race 8 of stem rust. Mindo was selected at the Minnesota Agricultural Experiment Station from a cross of Bond x [(Minota x White Russian) x Black Mesdag].

Missouri O-205 (C.I. 4988) is a grayish-red oat. It is high in yield, has good straw strength, low hull per cent, and good test weight. It is about like Bonda in maturity. It is resistant to smut and to race 7 of stem rust. Missouri O-205 was developed in Missouri from the cross Columbia x (Victoria-Richland).

Shelby (C.I. 4372) has a yellowish-white grain and matures as late or slightly later than Ajax. It does not stand up as well as some other recommended varieties although it has a good straw type. Like Ajax, it has yielded somewhat higher on the average than the other recommended varieties. It is superior in weight per bushel, although not equal to Bonda, and has intermediate-size kernels. It is resistant to smut and to race 8 of stem rust. It was selected in Iowa from a cross of Anthony x Bond.

Varieties Not Adequately Tested

Abegweit is very late, rather good yielding, and low in test weight. It is resistant to race 7 of stem rust but susceptible to race 8 and is susceptible to smut. It was selected in Canada from Erban x Vanguard.

Clintland (C.I. 6701) is similar to Clinton in most characteristics but has resistance to all known North American races of crown rust. It was developed in Indiana from the cross Clinton x Landhafer, backcrossed three times to Clinton.

Clarion (C.I. 5647) is medium tall, medium maturing, and has large, yellow seed of high test weight. It is resistant to race 7 of stem rust, resistant to smuts, and susceptible to crown rust. It was selected in Iowa from the cross Clinton x Marion and was released in several New England states in 1953.

Craig is medium tall and late. It has large white seed of medium test weight. It is susceptible to both races 7 and 8 of stem rust and to crown rust but is resistant to smuts. It was developed in New York from a cross Ithacan x Victoria.

La Salle (C.I. 5628) is very early, medium in height. In preliminary tests in Minnesota it has been inferior in yield. It is resistant to smut and to race 8 of stem rust. It was selected in Illinois from the cross Clinton x Marion.

Rodney (C.I. 6661) is tall, very late, has large, plump seed, a high test weight, and is apparently high in yield. It has resistance, at moderate temperatures, to all stem rust races except 7A. It was developed in Canada from a cross [(Victoria x Hajira-Banner) x (Victory x Hajira)] x Roxton.

Sauk (C.I. 5946) is tall, late maturing, good yielding, and somewhat susceptible to lodging. It is resistant to race 7 of stem rust. It was developed in Wisconsin from the cross (Forward x Victoria-Richland) x Andrew.

Varieties Not Recommended

Tama, Vicland, Vikota, Control, Boone, and **Forvic** are varieties of oats that carry the Victoria type of crown rust resistance. All are susceptible to *Helminthosporium victoriae* and should not be grown because of possibility of losses from this disease.

Beaver has given good yields in rod-row trials but is not superior to the recommended varieties. It is late maturing, moderately susceptible to lodging, and low in test weight. It is susceptible to crown rust, smuts, and race 8 of stem

rust. It is a Canadian variety selected from a cross of Vanguard x Erban.

Benton is a tall-growing variety. It has the same resistance to diseases as Clinton but in three-year trials has yielded less in Minesota than the recommended varieties. It was produced from a cross of D69 x Bond at the Iowa Station and has been increased in Illinois and Indiana.

Bonham is earlier than Clinton, slightly taller, has good test weight, but has yielded less than the recommended varieties. It is resistant to race 8 of stem rust. It is a mass selection made in Michigan from C.I. 3664, a cross of Bond x D69. It has been increased and distributed by the Michigan Station.

Cherokee is slightly earlier and shorter than Clinton and has good test weight. It has been inferior to recommended varieties in yield and, contrary to previous reports, has not been resistant to crown rust. It is resistant to race 8 of stem rust. It is a selection from a cross of D69 x Bond which has been increased in Iowa and Kansas. Cherokee also is grown under the names Ames No. 2, McCarthy, or 3846.

Colo is a cross of Hancock x Morota-Bond. It yields well but in tests in Minnesota it has been inferior in yield to recommended varieties. It is taller and later than Clinton and Bonda and has been low in test weight. It is not resistant to crown rust but is resistant to race 8 of stem rust.

Eaton is a selection from a cross of Bond x Iogold increased in Michigan. It is resistant to the smuts and race 7 of stem rust. It is suceptible to crown rust.

Exeter is late in maturity. It has given good yields in rod-row trials though not superior to those of recommended varieties. It has weak straw and low test weight. It is susceptible to crown rust and resistant to race 7 of stem rust. It was selected in Canada from a cross of Victory x Rusota.

Fortune was selected at the University of Saskatchewan from the cross Victory x [(Victoria x Richland) x (Markton x Victory)]. It is resistant to race 7 of stem rust but susceptible to race 8 and is susceptible to crown rust. It is late in maturity, tall, has a tendency to lodge, and is low in test weight.

Gopher is an early oat with a white hull. It is susceptible to stem rust, crown rust, and the smuts.

Kent is an early maturing oat variety. It has not proved superior to recommended varieties in preliminary trials in Minnesota. It was selected from the cross Bond x D69 and increased at the Michigan Station.

Larain was selected from a cross between Gold Rain and Alaska made at the Central Experimental Farm, Ottawa. It has weak straw and low test weight. It is susceptible to the rusts and smuts and inferior in yield to the recommended varieties.

Marion is an early variety selected in Iowa several years ago from a cross of Markton x Rainbow. It was tested extensively in Minnesota several years ago. In these trials it yielded somewhat less than Vicland. It had slightly greater resistance to prevalent races of crown rust than recommended varieties selected from Bond crosses. It is resistant to race 7 of stem rust.

Nemaha is almost identical to Cherokee. It has been inferior in yield to the recommended varieties. It was developed at Iowa from the cross (Victoria-Richland) x (Morota x Bond).

Zepher is medium early, has a large grain that is gray in color, and has good bushel weight. It is inferior to Bonda, Clinton, Mindo, and Andrew in standing ability. It was selected at the Minnesota Agricultural Experiment Station from the cross Bond x Anthony.

RYE

R. G. Robinson, K. S. Koo, W. M. Myers

Average yields of rye for several years at five locations are reported in table 5. Emerald, Imperial, and Caribou are the recommended varieties. Emerald and Imperial have been reliable for many years; however, several varieties have surpassed them in yield in recent trials. Caribou, Antelope, Adams, Dakold 23, and Tetra Petkus (in tests only in 1953) have, on the average, been outstanding in yield. Yields of Tetra Petkus are adversely affected by pollen from other varieties and vice versa; therefore, Tetra Petkus must be isolated from other varieties to obtain maximum yields.

Winterhardiness is of major importance for fall-sown varieties, but data are limited because of the favorable winters in recent years. Observations indicate that Caribou, Antelope, Dakold 23, Pierre, and Emerald are superior to the other varieties in winterhardiness. Adams, Imperial, and German are sufficiently winterhardy for most conditions. Tetra Petkus showed more winter injury than the other varieties after the favorable winter of 1952-53, but more observations are needed before definitely rating it. Balbo is not sufficiently winterhardy to be reliable in Minnesota.

Lodging is a serious problem in rye production and Tetra Petkus was the only variety to show good lodging resistance. Balbo, Pierre, German, and the spring-sown varieties were fairly good. Emerald lodged more than any of the other varieties.

Balbo and Pierre matured early; Tetra Petkus and the spring-sown varieties matured about seven to ten days later. The other varieties were about two days later than Balbo and Pierre.

The spring-sown varieties were considerably shorter than the others; otherwise height differences were of no importance.

Bushel weight is an important market factor, and Caribou, Antelope, Pierre, and Dakold 23 were outstanding in this characteristic. Tetra Petkus and the spring-sown varieties were low in bushel weight.

Tetra Petkus had the largest seeds and German the second largest. Adams and Imperial had medium-sized seeds, and the other varieties had small seeds. Seeds of Tetra Petkus were nearly twice as large as those of the small-seeded varieties.

For fall pasture, Balbo appeared to make more growth than the other varieties, whereas Caribou, Antelope, Pierre, Dakold 23, and German appeared to make less.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Emerald is medium in yield, maturity, and bushel weight. It is slightly superior to Imperial in winterhardiness. It sometimes lodges badly. The seed is small and green. It was developed at the University of Minnesota by selecting green seed in self-pollinated lines and their combinations.

Imperial is medium in yield, maturity, bushel weight, and seed size. It is generally satisfactory in winterhardiness. The seed is light brown. The variety originated at the University of Wisconsin.

Caribou is high yielding, very winterhardy, medium in maturity, and high in bushel weight. The seed is small. It was selected from Crown rye by the University of Saskatchewan and increased and released by the University of Minnesota in 1953.

Table 5. Average Adjusted Yields of Rye

Variety	St. Paul		Morris		Grand Rapids		Southwestern Minnesota		Sandy soil*		Grand average yields
	Number of trials	Yields	Number of trials	Yields	Number of trials	Yields	Number of trials	Yields	Number of trials	Yields	
		bushels per acre		bushels per acre		bushels per acre		bushels per acre		bushels per acre	bushels per acre
FALL-SOWN VARIETIES											
Emerald	15	36.8	16	28.2	18	40.7	5	40.4	24	22.9	33.8
Imperial	15	38.6	16	29.2	18	41.0	5	40.3	24	21.8	34.2
Caribou	4	41.1	1	38.6	1	41.6	1	42.5	1	26.3	38.0
Antelope	4	39.6	1	35.8	1	35.1	1	41.2	1	26.7	35.7
Adams	3	39.8	1	34.4	1	41.6	1	44.1	1	26.2	37.2
Dakold 23	4	37.8	1	33.8	1	33.7	1	44.6	1	24.3	34.8
Dakold	13	36.7	14	27.1	16	36.1	3	37.0	22	20.3	31.4
Pierre	4	36.3	5	30.9	5	39.3	5	35.4	17	21.2	32.6
German	1	31.8	.....	.....	.....	.....	.....	.....	1	24.4	32.4
Balbo	2	34.2	.....	.....	.....	.....	1	25.6	5	20.1	27.4
Common rye			3	29.5	.....	.....	3	33.3	20	20.6	30.3
Tetra Petkus	1	12.7	1	15.8	1	30.2	1	26.8	1	5.0	18.1
Tetra Petkus isolated†	1	36.2	1	29.8	1	43.2	1	43.5	1	.....	35.4
SPRING-SOWN VARIETIES											
Canadian Spring	.....	.....	1	0.0	1	0.0	2	15.4	6	4.5	5.6
Florida Black	.....	.....	.....	.....	.....	.....	1	9.3	.....	.....	3.0
L.S.D. at 5 per cent point		1.9		1.4		2.2		3.8		0.9	1.0

* Fields in Anoka, Sherburne, Stearns, and Wright Counties.

† At least 100 feet from any other rye variety.

Varieties Not Adequately Tested

Adams appears identical to Imperial except it has yielded more. It is a combination of lines from Imperial which were selected for high fertility. The University of Wisconsin released it in 1953.

Dakold 23 is high yielding, very winterhardy, medium in maturity, and high in bushel weight. The seed is small. It was selected for improved winterhardiness from Dakold by the University of Saskatchewan.

German is medium in yield, winterhardy, medium in maturity, and good in lodging resistance. The seed is medium in size and bushel weight. The variety originated in Germany.

Tetra Petkus is high yielding, late maturing, and excellent in lodging resistance. Its winterhardiness is somewhat questionable for Minnesota, but more tests are required before it can finally be rated. The seed is very large but bushel weight is low. For maximum yield, this variety must be grown isolated from other rye varieties, because pollen from other rye will reduce the seed set of Tetra Petkus and vice versa. Tetra Petkus originated in Germany as a result of doubling the number of chromosomes in the Petkus variety.

Varieties Not Recommended

Antelope appears identical to Caribou except it has yielded less in Minnesota. It and Caribou are sister selections, and it was released by the University of Saskatchewan in 1952.

Balbo is low yielding, early maturing, good in lodging resistance, and poor in winterhardiness. The seed is small and medium in bushel weight. The variety was introduced from Italy and named by the Tennessee Agricultural Experiment Station about 1932.

Canadian Spring and **Prolific Spring** are spring-sown varieties, very low yielding, late maturing, and low in bushel weight. Prolific Spring was introduced from Germany by the University of Saskatchewan.

Dakold is low yielding but otherwise resembles Dakold 23. It originated at North Dakota Agricultural College.

Florida Black is a spring-sown variety, very low yielding, late maturing, and moderately resistant to leaf rust. The seed is very small and low in bushel weight.

Pierre is medium in yield, very winterhardy, early maturing, and fairly good in lodging resistance. The seed is small and of high bushel weight. It is a recombination of inbred lines from a population of Dakold and Swedish origin and was released by South Dakota State College in 1950.

White Soviet is low yielding, winterhardy, and medium in maturity. The seed is medium in size and bushel weight. It was developed by a seed company from an introduction from Canada.

SPRING WHEAT

E. R. Ausemus, D. W. Sunderman, K. J. Hsu

Comparative yield data are given in table 6 for the varieties grown at the six experiment stations during 1944-53 and in southwestern Minnesota during 1947-53. Willet was the highest yielding recommended bread wheat variety with Lee second and Rushmore third on the average of yield obtained at five locations. Mindum was the highest yielding durum wheat.

Comparative data on agronomic characters are given in table 7. All varieties except Selkirk and Willet are susceptible in the field to stem rust. Lee, Willet,

Table 6. Average Yields of Bread Wheats and Durums

Variety	Minn. no.	Years used in average	Rosemount	Waseca	Morris	Crookston	Years used	S.W. Minn.	Av. 5 locations	Years used	Grand Rapids	Duluth	Years used	Northern Minnesota
			bushels per acre					bushels per acre			bushels per acre			bushels per acre
BREAD WHEATS														
Thatcher	2303	1944-53	22.6	18.6	30.2	24.7	1947-53	22.2	23.7		.....	.....		.....
Rival	2670	1944-53	24.3	22.0	32.3	26.0	1946-53	23.1	25.5	1944-53	23.5	21.6	1950-53	20.6
Mida	2689	1944-53	25.4	21.0	31.7	27.2	1946-53	23.9	25.8	1944-53	24.0	19.4	1950-53	22.9
Henry	2753	1944-53	29.3	24.1	36.4	30.4	1946-53	27.6	29.6	1944-53	26.6	22.1	1950-53	29.7
Lee	2776	1946-53	29.3	22.7	35.4	28.8	1947-53	26.3	28.5	1946-53	27.6	21.1	1950-53	28.3
Redman	2777		.....	.....	.....	.....		.....	.....	1948-53	26.5	21.8	1950-53	28.5
Rushmore	2803	1949-53	27.5	23.3	33.8	27.5	1949-53	24.2	27.3	1950-53	27.0	23.4	1950-53	25.4
Willet	2855	1952-53	33.6*	28.9	39.9	26.8	1952	31.4*	32.1		.....	.....		.....
Selkirk	2859	1953	45.4	38.6	47.2	28.4	1953	37.7	39.9	1953	36.3	32.3	1953	43.6
Kentana	2860	1953	28.9	26.2	42.7	28.6	1953	38.0	32.9		.....	.....		.....
DURUMS†														
Mindum	470	1944-53	25.4	.....	33.2	28.5		.....	29.0		.....	.....		.....
Carleton	2707	1944-53	22.1	.....	29.2	26.7		.....	26.0		.....	.....		.....
Stewart	2708	1944-53	23.0	.....	33.0	28.3		.....	28.1		.....	.....		.....
Nugget	2825	1950-53	22.3	.....	27.2	26.4		.....	25.3		.....	.....		.....
Sentry	2866	1953	24.8	.....	38.0	27.6		.....	30.1		.....	.....		.....
L.S.D. 5 per cent point			1.5	1.4	1.5	2.6		1.3			2.2	1.9		3.6

* Grown at these stations in 1952 only.

† Average of Rosemount, Morris, and Crookston.

Table 7. Averages for Spring Wheat Varieties for Date of Heading, Plant Height, and Weight per Bushel

Variety	Minn. or acc. no.	Years used in average	Date headed	Height	Weight per bushel
				inches	pounds
BREAD WHEATS					
Thatcher	2303	1944-53	6-29	35	55.9
Rival	2670	1944-53	6-30	38	56.8
Mida	2689	1944-53	6-29	38	58.1
Henry	2753	1944-53	6-29	38	57.2
Lee	2776	1946-53	6-27	33	58.3
Rushmore	2803	1949-53	6-27	34	58.4
Willet	2855*	1952-53	6-30	37	60.2
Selkirk	2859	1953	6-30	35	62.8
Kentana	2860	1953	6-29	36	62.2
DURUMS†					
Mindum	470	1944-53	7-2	45	58.3
Carleton	2707	1944-53	7-3	46	56.8
Stewart	2708	1944-53	7-3	46	58.2
Nugget	2825	1950-53	6-29	37	54.7
Sentry	2866	1953	6-29	37	60.5

* Willet was not grown at Rosemount and Waseca in 1953.
† Not grown at Waseca.

and the three recommended durums are resistant to leaf rust. All recommended varieties have acceptable milling and baking quality, although Willet has a shorter dough mixing time than the other varieties, a characteristic considered undesirable by representatives of the milling industry because it is commonly related to low mixing tolerance.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Bread

West Central and Northwestern Sections

Mida (C.I. 12008) is a bearded variety with medium maturity date and strength of straw. It is moderately resistant to bunt, susceptible to loose smut, and susceptible to scab. It has a high test weight per bushel and appears about equal to Thatcher in milling and baking characters, except that Mida has given a lower loaf volume and has a shorter fermenting and mixing time. It is a selection from a cross of (Ceres-Double Cross) x (Ceres-Hope-Florence), made at the North Dakota Station.

For All Sections

Lee (C.I. 12488) is early, bearded, moderately resistant to bunt, resistant to leaf rust, and moderately susceptible to loose smut. It has short, medium-strength straw. It has a good test weight and appears about equal to Thatcher in milling and baking characters. Lee is a selection from a cross of Hope x Timstein made by the Minnesota Agricultural Experiment Station in cooperation with the United States Department of Agriculture.

Rushmore (C.I. 12273) is an early, awnless variety that has yielded less than Lee. It is susceptible to leaf rust but has good test weight and milling and baking qualities. It is a selection from a cross of Rival x Thatcher by the South Dakota Agricultural Experiment Station.

Willet (C.I. 13099) is a bearded, tall variety with medium strength of straw and maturity date. It is high yielding, has good test weight, and good milling

and baking quality except that it has a shorter mixing time than the other recommended varieties, a characteristic considered undesirable by representatives of the milling industry. It is moderately resistant to stem rust, resistant to leaf rust, and has more resistance to scab than other recommended varieties. It is a selection from the cross of Frontana x Thatcher made at the Minnesota Agricultural Experiment Station in cooperation with the United States Department of Agriculture.

Durum

West Central and Northwestern Sections

Carleton (C.I. 12064) is bearded, amber kerneled, and somewhat lower in yield than Mindum. It is moderately resistant to leaf rust and loose smut, moderately susceptible to bunt, and susceptible to scab. It has strong straw. It is about equal to Mindum in quality for semolina products. Carleton was selected from a Mindum x Vernal Emmer backcross made by the United States Department of Agriculture in cooperation with the North Dakota Agricultural Experiment Station.

Mindum (C.I. 5296) is bearded, amber kerneled, and high in yielding ability. It is moderately susceptible to bunt, susceptible to scab, but resistant to leaf rust. It has weaker straw than Carleton. It has excellent quality for semolina products. Mindum resulted from a durum type selected in a common bread wheat at the Minnesota Agricultural Experiment Station.

Stewart (C.I. 12066) is bearded, amber kerneled, and yields as well as Mindum. It is moderately resistant to leaf rust and loose smut, moderately susceptible to bunt, and susceptible to scab. It has weaker straw than Carleton. It is equal to Mindum in quality for semolina products. Stewart is a selection from a Mindum x Vernal Emmer backcross made by the United States Department of Agriculture in cooperation with the North Dakota Agricultural Experiment Station.

Varieties Not Adequately Tested

Bread

Selkirk is an awnless variety of medium height, maturity, and straw strength. It has been tested only one year, under severe rust conditions. In these tests it was moderately resistant to stem rust and leaf rust, high in yield, and had good bushel weight. Its milling and baking qualities appear to be satisfactory.

Kentana is a bearded semihard wheat produced by the Mexican breeding program. It is moderately resistant to stem rust and leaf rust. It has been tested for one year only and yielded well with high test weight. This variety was not very good in milling and baking quality in 1953, and has a shorter mixing time than the commonly accepted bread wheats.

Durum

Sentry is a selection from Ld 308 x Nugget made at the North Dakota Experiment Station. This variety was first tested in 1953 and was the highest yielding durum. It develops considerable rust but appears to have tolerance to stem rust which allows it to produce a very good yield and quality of grain. Preliminary tests show it to be satisfactory for use in making semolina products.

Varieties Not Recommended

Bread

All varieties are susceptible to stem rust race 15B, but many of them are resistant to other races.

Apex is low in yield and susceptible to leaf rust. It is not as satisfactory in milling and baking characters as Thatcher. It was develped from a cross of (Double Cross x H-44) x Marquis.

Cadet, an awnless variety, has been lower in yield than the best yielding wheats. It is satisfactory in milling and baking characters except that it has a low test weight, similar to Newthatch. It was developed cooperatively by the United States Department of Agriculture and the North Dakota Experiment Station.

Ceres, a bearded variety, has somewhat weaker straw than Thatcher and is equal to it in milling and baking qualities. It is moderately susceptible to fusarial head blight and susceptible to stem rust, leaf rust, bunt, and loose smut.

Henry, a bearded variety developed by the Wisconsin Station, is good yielding, moderately susceptible to bunt, and susceptible to scab. It is unsatisfactry in milling and baking characters.

Newthatch has high quality but is not satisfactory in yield or leaf rust resistance. It is susceptible to scab. It is a combination of a series of selections from a cross of Hope x Thatcher backcrossed to Thatcher. It was developed at the Minnesota Agricultural Experiment Station.

Pilot is a bearded variety that is susceptible to leaf rust and has weak straw. It is lower in yield and bushel weight than the best yielding wheats, but it is satisfactory in milling and baking characters. It is a selection from a cross of Hope x Ceres developed by the United States Department of Agriculture and the North Dakota Station.

Premier is moderately resistant to bunt, but it is susceptible to loose smut, scab, and black chaff. It is unsatisfactory in milling and baking characters. This variety is a selection from a cross of Ceres-Hope-Florence x Double Cross R.L. 625 developed by the North Dakota Station.

Regent is a beardless variety which has been lower in yield than the recommended varieties. It is susceptible to leaf rust and scab. This variety is equal to Thatcher in milling and baking qualities. Regent is a selection from a cross of H-44 x Reward, made at the Dominion Laboratory of Cereal Breeding, Winnipeg, Canada.

Rescue is a beardless, low yielding variety which has been developed for the area where sawfly is present. Rescue shatters easily and is weak strawed, rust susceptible, and of poor quality. It should be grown only in sawfly-infested areas. It is a selection from a cross of Apex x S615 (a solid stem line of common wheat) developed by the Dominion Department of Agriculture at Swift Current, Canada.

Redman is an awnless variety which appears slightly superior to Regent but not equal to the recommended varieties. It was selected from the cross of Canus x Regent made at the Dominion Laboratory of Cereal Breeding at Winnipeg, Canada.

Spinkota is a bearded variety which is susceptible to stem rust and bunt and of inferior milling and baking quality. It is a selection of Velvet Chaff or Preston developed by a farmer in South Dakota.

Thatcher is a beardless, strong-strawed wheat. It is very susceptible to leaf rust and scab. It is high in milling and baking qualities.

Durum

Vernum is a bearded variety resistant to leaf rust. It is lower yielding than are Mindum, Carleton, or Stewart. Its quality for semolina products is not equal to Carleton and Stewart. It is a selection from Mindum x Vernal Emmer backcrossed to Mindum, developed cooperatively by the United States Department of Agriculture and the North Dakota Agricultural Experiment Station.

Nugget is a very early maturing variety resistant to leaf rust. It is lower

in yield than the recommended varieties but is excellent in quality. This variety is very susceptible to stem rust race 15B. It was developed at the North Dakota Agricultural Experiment Station.

WINTER WHEAT

E. R. Ausemus, K. J. Hsu, D. W. Sunderman

The comparative data on yield and on agronomic characters for winter wheat grown at four stations during 1943-1953 are given in table 8 and table 9 respectively. Over the period of test, Minter was the best yielder, Minturki and Minter the most winterhardy, Iohardi the earliest in heading, and Blackhawk the most resistant to leaf rust as well as the tallest. The bushel weights of all varieties were good and the qualities satisfactory. None of these varieties, however, is resistant to the stem rust race 15B.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Winter wheat, where it can be grown successfully (as in southern Minnesota, an area in the vicinity of Grand Rapids, and in extreme north central Minnesota), is more profitable than spring wheat. The two recommended varieties have been developed at the Minnesota Agricultural Experiment Station. Both are susceptible to stem rust race 15B.

Minturki (C.I. 6155) is a bearded, white-chaffed, stiff-strawed variety of the Turkey type. It is early maturing and yields well. It is moderately resistant to bunt, loose smut, and fusarial head blight, but moderately susceptible to leaf rust. It is very winterhardy but not as reliable on sandy lands as winter rye. Minturki was selected from a cross of Turkey x Odessa.

Minter (C.I. 12138) is a bearded, white-chaffed winter wheat which is equal to Minturki in winterhardiness and slightly better in yielding ability. Minter has had a somewhat higher weight per bushel, whiter crumb color, and a lower pigment content than Minturki. It is a selection from a backcross of Hope x Minturki by Minturki.

Varieties Not Recommended

Iobred produces a high quality grain but is less winterhardy than Minturki and also yields less.

Iowin, developed by the Iowa Station, is not as winterhardy as Minturki.

Table 8. Average Yield of Winter Wheat*

Variety	Minn. no.	Years used	University Farm	Waseca	Grand Rapids	Average three locations	Years used	Southwest Minnesota
				bushels per acre				bushels per acre
Minturki	1507	1943-53	30.7	24.6	38.0	31.1	1950-53	22.2
Minter	2713	1943-53	32.6	26.2	39.6	32.8	1950-53	27.3
Blackhawk	2725	1943-53	31.6	25.0	34.9	30.5	1950-53	23.5
Iohardi	2800	1949-53	30.4	23.8	33.4	29.2	1950-53	21.7

* Crops failed at University Farm in 1943, 1944, and 1948; at Waseca in 1948; and at Grand Rapids in 1943, 1944, and 1946.

Table 9. Average Date of Heading, Plant Height, Winter Injury, and Weight per Bushel for Winter Wheat*

Variety	Years used	Date headed	Height	Winter injury	Bushel weight
		June	inches	per cent	pounds
Minturki	1943-53	20	39	34	58.4
Minter	1943-53	19	38	34	59.7
Blackhawk	1943-53	20	40	38	58.8
Iohardi	1949-53	18	39	40	59.7

* Crops failed at University Farm in 1943, 1944, and 1948; at Waseca in 1948; and at Grand Rapids in 1943, 1944, and 1946.

Kanred is not as winterhardy as Minturki and has weaker straw.

Minhardi is a beardless variety, more winterhardy and stiffer strawed than Minturki, but more susceptible to stem rust and bunt. It is less widely adapted than Minturki, and the grain is somewhat less desirable in quality than that of Minturki.

Blackhawk is a bearded variety of good quality. It is less winterhardy than Minturki, Marmin, or Minter, so yields less than these varieties when winter injury is severe. It is a selection of a Fultz x Minturki cross developed by the Wisconsin Agricultural Experiment Station.

Iohardi is an awned variety which was released to Iowa farmers in the fall of 1948. It is a selection from an Iobred x Minhardi cross developed at the Iowa Agricultural Experiment Station.

Marmin is a bearded winter wheat similar to Minturki but has been poorer in milling and baking characters. It was selected from a cross of Minturki x Marquis.

CORN

E. H. Rinke and E. L. Pinnell

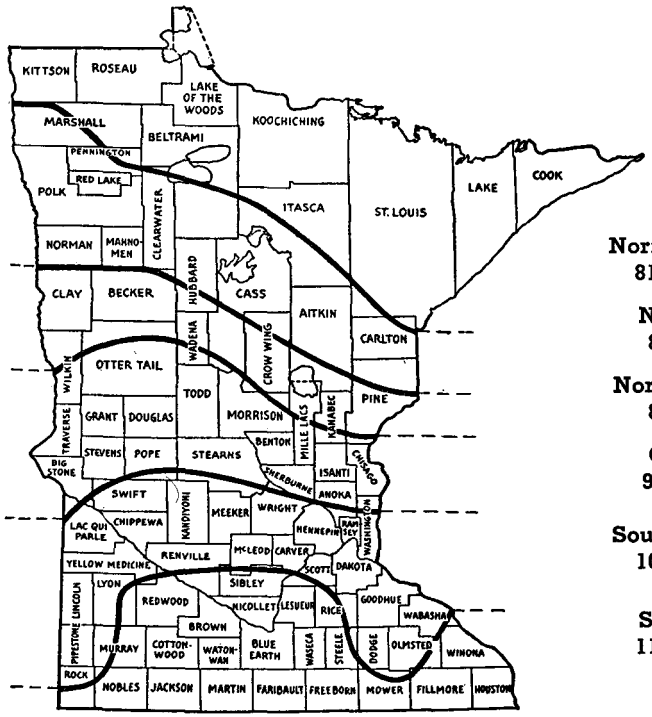
About 97 per cent of the corn acreage of Minnesota is planted to hybrid varieties. Over 675 hybrids are registered for sale in Minnesota. These include open-pedigree hybrids developed by state experiment stations and closed-pedigree hybrids developed by commercial seed companies. Only open-pedigree hybrids that have been adequately tested are included on the recommended list. It has not been possible to make extensive trials of closed-pedigree hybrids.

At the present time the recommended list of hybrids includes nineteen Minhybrids, five Wisconsin hybrids, one North Dakota (Nodak) hybrid, one Manitoba hybrid, and one A.E.S. (Agricultural Experiment Station) hybrid. The latter, A.E.S. 610, was developed through the cooperative efforts of breeders in several states in the North Central Region.

The corn-growing area of Minnesota has been divided into maturity zones (see map). Relative days to maturity for corn refers to the approximate number of days of growing season that may be expected, on the average, from emergence of the seedlings to the stage when the moisture in the ears on standing plants is about 40 per cent. Table 10 gives the pedigrees and maturity ratings for the recommended hybrids.

Tables 11 through 16 present long-time data on the performance of recommended hybrids and a few widely

Corn Maturity Zones in Minnesota



Northern Minnesota
81 Days or Less

Northern Zone
82 to 88 Days

North Central Zone
89 to 95 Days

Central Zone
96 to 102 Days

South Central Zone
103 to 109 Days

Southern Zone
110 to 116 Days

Zones indicate the approximate number of days growing season that may be expected from emergence after planting to maturity, the stage of being well dented before a killing frost.

grown open-pedigree hybrids. Accurate comparisons of hybrids can be made only when the data on the hybrids are presented in the same table.

In some tables data on hybrids recommended for an adjacent zone are presented for the information of those who prefer to grow hybrids somewhat earlier or later than those recommended for the zone.

Information is given for several charactors in addition to ear moisture and yield. The data are largely self-explanatory except for those on corn borer resistance and ear appearance. Corn borer resistance ratings are taken on hand infested plots in classes of 1 to 5, where class 1 indicates resistance (little feeding) and class 5 denotes susceptibility to corn borers (much plant damage).

The ear appearance rating is taken in classes of 1 to 5 on piles of husked ears from each plot. Class 1 ears have a "show type" appearance while those in class 5 have poor eye appeal.

Table 10. Pedigrees and Maturity Ratings of Hybrids Recommended for Minnesota

Hybrid	Pedigree	Maturity zone	Maturity rating in days
Minhybrid 408	(Oh51A x Os420) (A73 x A375)	Southern Zone	113-117
A.E.S. 610	(A73 x M14) (Oh43 x Oh51A)	Southern Zone	112-116*
Minhybrid 412	(Oh5 x Oh51A) (A73 x W22)	Southern Zone	112-116*
Minhybrid 411	(Oh5 x A73) (Oh43 x Oh51A)	Southern Zone	112-116*
Minhybrid 406	(A25 x A334) (A73 x A375)	Southern Zone	111-115
Minhybrid 405	(A311 x A334) (A374 x A375)	Southern Zone	110-114
Minhybrid 404	(A322 x A334) (A374 x A375)	Southern Zone	108-112
Minhybrid 409	(A73 x A334) (Oh5 x Oh51A)	Southern Zone	108-112*
Minhybrid 508	(Oh51A x A334) (A73 x A223)	South Central Zone	107-111*
Minhybrid 504	(A73 x A334) (Oh51A x A395)	South Central Zone	107-111
Minhybrid 503	(A73 x A334) (Oh51A x A375)	South Central Zone	107-111
Minhybrid 505	(A334 x Ill.4226) (Oh51A x A375)	South Central Zone	105-109
Minhybrid 507	(W10 x A334) (B9 x Oh51A)	South Central Zone	105-109*
Wisconsin 464A	(WM13R x R3) (W153R x W374)	South Central Zone	103-107
Minhybrid 608	(A334 x A340) (A357 x A392)	Central Zone	99-103
Minhybrid 607	(A334 x A344) (A357 x A385)	Central Zone	97-101
Minhybrid 609	(A203 x A218) (A344 x A385)	Central Zone	97-101*
Minhybrid 711	(A116 x A208) (W9 x A96)	North Central Zone	93-97*
Minhybrid 706 (white)	(A166 x A188) (A34 x A171)	North Central Zone	90-94
Wisconsin 275	(W9 x M13) (W49 x WH)	North Central Zone	90-94
Minhybrid 707	(A116 x A204) (W9 x A96)	North Central Zone	89-93*
Wisconsin 279	(W9 x M13) (WD x C49)	Northern Zone	86-90
Minhybrid 802	(A96 x Mt42) (WD x A165)	Northern Zone	84-88
Nodak 301	(A90 x A111) (ND203 x ND230)	Northern Zone	84-88
Wisconsin 240	(WD x W9) (W85 x W15)	Northern Zone and Northern Minnesota	82-86
Wisconsin 255	(WD x W9) (WJ x WH)	Northern Zone and Northern Minnesota	82-86
Morden 77	(V3 x A116) (WD x ND255)	Northern Minnesota	78-82

* Tentative ratings on new hybrids.

FLAX

J. O. Culbertson

YIELD COMPARISONS

Table 17 gives the average yields in bushels per acre for the eight-year period 1946-54 at Rosemount, Morris, Grand Rapids, and southwestern Minnesota. No yield data were taken at Crookston in 1952 or Waseca in 1953. The yield trials in northern Minnesota have been grown only during the four-year period 1950-53. Yields of varieties grown less than the full time have been adjusted so that they are comparable with yields from varieties grown the full eight years.

An attempt is made to sow all flax yield trials at an early date at each station. This early sowing usually favors the late maturing varieties, and it is probable for this reason that such varieties as Redwood, B5128, and Minerva had an advantage over such earlier varieties as Redwing, Sheyenne, and Marine.

Most of the flax varieties are immune to local races of rust, and little damage

SOUTHERN ZONE

Table 11. Average Corn Hybrid Performance in 12 Trials, 1951-53

Variety or pedigree	Maturity		Smut	Height		Shank	Husk*	Lodged	Ear		Plant* appear-	Ear* appear-	Corn borer	Ear	Yield
	Days	Zone		Plant	Ear		1-5	stalk	Length	No. rows	ance 1-5	ance 1-5	resistance	moisture	
			per cent	inches	inches	inches		per cent	inches					per cent	bushels per acre
Minn. 406	111-115	S	3	89	35	6	2.0	2	8.7	18	2.5	2.4	2.9	28.2	75.4
Minn. 408	113-117	S	3	91	38	6	2.3	2	9.2	18	1.9	2.3	.....	30.1	78.3
Minn. 411	112-116	S	3	92	35	6	2.7	1	9.4	17	2.3	2.3	2.0	28.7	79.9
Minn. 412	112-116	S	3	94	38	7	1.6	1	9.5	18	2.1	2.1	1.9	29.7	80.2
A.E.S. 610	112-116	S	3	90	33	6	3.0	2	9.3	18	2.9	2.3	2.5	29.0	78.4
L.S.D. at 5 per cent point														.97	2.96

* Class 1 rating is good; 5 is poor.

SOUTHERN ZONE

Table 12. Average Corn Hybrid Performance in 17 Trials, 1950-53

Variety or pedigree	Maturity		Smut	Height		Shank	Husk*	Lodged	Ear		Plant* appear-	Ear* appear-	Corn borer	Ear	Yield
	Days	Zone		Plant	Ear		1-5	stalk	Length	No. rows	ance 1-5	ance 1-5	resistance	moisture	
			per cent	inches	inches	inches		per cent	inches					per cent	bushels per acre
Minn. 404	108-112	S	2	90	28	6	2.2	4	8.4	18	2.8	2.6	2.4	28.3	67.7
Minn. 405†	110-114	S	1	93	39	6	3.0	4	8.5	18	2.9	2.7	.....	28.7	69.7
Minn. 406	111-115	S	3	91	36	6	2.0	3	8.4	18	2.4	2.5	2.8	28.6	71.0
Minn. 408	113-117	S	2	94	40	6	2.2	3	8.9	18	1.9	2.4	3.0	31.2	74.3
Minn. 409	108-112	S	5	92	38	6	2.6	4	8.6	18	2.4	2.3	2.9	27.2	72.7
A.E.S. 610	112-116	S	3	91	34	6	3.0	2	8.9	18	2.9	2.3	2.6	29.7	74.1
Minn. 503‡	107-111	S.C.	3	90	36	7	2.5	3	8.0	18	2.9	2.6	2.4	27.5	69.5
Minn. 507‡	105-109	S.C.	2	95	40	6	3.1	5	8.5	17	2.5	2.6	2.8	25.0	72.4
Minn. 508‡	107-111	S.C.	6	89	36	7	3.3	3	8.4	17	2.4	2.4	2.8	26.6	70.2
L.S.D. at 5 per cent point														0.8	2.3

* Class 1 rating is good; 5 is poor.

† Average for Minn. 405 adjusted from 1938-52 average.

‡ South Central Zone hybrid.

SOUTH CENTRAL ZONE

Table 13. Average Corn Hybrid Performance in 13 Trials, 1949-53

Variety or perigree	Maturity		Smut	Height		Shank	Husk* 1-5	Lodged		Ear		Plant* appear-ance 1-5	Ear* appear-ance 1-5	Ear mois-ture	Yield
	Days	Zone		Plant	Ear			Root	Stalk	Length	No. rows				
			per cent		inches			per cent		inches				per cent	bushels per acre
Minn. 503	107-111	S.C.	5	92	41	6	1.6	4	4	8.0	17	2.5	2.6	27.2	71.3
Minn. 504	107-111	S.C.	8	92	41	7	2.1	5	6	7.9	16	2.2	3.3	26.9	70.2
Minn. 505	105-109	S.C.	6	95	42	5	2.0	4	6	7.7	17	2.1	2.3	26.6	70.2
Minn. 507	105-109	S.C.	5	97	43	6	2.2	4	6	8.1	17	2.5	2.6	24.8	71.9
Minn. 508	107-111	S.C.	6	90	39	6	2.2	1	3	8.0	17	2.4	2.7	26.4	71.9
Wisc. 464A	103-107	S.C.	6	95	42	5	2.0	20	5	8.2	17	3.0	2.7	22.4	69.1
Minn. 406†	111-115	S.	4	96	41	5	2.2	2	5	7.9	18	2.6	2.7	27.9	73.6
L.S.D. at 5 per cent point														0.69	1.79

* Class 1 rating is good; 5 is poor.

† Southern Zone hybrid.

CENTRAL ZONE

Table 14. Average Corn Hybrid Performance in 10 Trials, 1949-53

Variety or perigree	Maturity		Smut	Height		Shank	Husk* 1-5	Lodged stalk	Ear		Ear* appear-ance 1-5	Ear mois-ture	Yield
	Days	Zone		Plant	Ear				Length	No. rows			
			per cent		inches			per cent	inches			per cent	bushels per acre
Minn. 607	97-101	C.	4	83	38	6	1.7	15	7.3	15	3.2	23.3	64.2
Minn. 608	99-103	C.	4	88	42	7	2.7	8	7.3	16	2.9	23.9	65.0
Minn. 609	97.101	C.	3	83	36	7	2.0	4	7.4	14	2.7	23.8	62.0
L.S.D. at 5 per cent point												1.2	2.5

* Class 1 rating is good; 5 is poor.

NORTH CENTRAL ZONE

Table 15. Average Corn Hybrid Performance in Five Trials, 1951-53

Variety or pedigree	Maturity		Smut	Height		Shank	Husk*	Lodged	Ear		Good	Plant*	Ear*	Ear	Yield
	Days	Zone		Plant	Ear		1-5	stalk	Length	Rows	ears	appear-ance 1-5	appear ance 1-5	mois-ture	
			per cent		inches			per cent	inches	number	per cent			per cent	bushels per acre
Minn. 706	90-94	N.C.	2	86	32	7	3.0	4	7.3	15	.89	2.0	1.9	32.3	56.7
Minn. 707	89-93	N.C.	3	82	35	7	3.0	4	6.0	15	.91	2.3	2.1	30.7	58.2
Minn. 711	93-97	N.C.	1	84	33	7	1.7	3	6.5	17	.92	2.0	1.9	32.3	55.9
Wisc. 275	90-94	N.C.	1	80	32	6	3.3	4	6.0	16	.89	2.3	2.5	31.4	53.6
Wisc. 355†	93-97	N.C.	0	88	35	5	2.7	2	6.8	14	.82	2.0	2.6	34.8	54.8
L.S.D. at 5 per cent point														1.7	3.2

* Class 1 rating is good; 5 is poor.

† Not a recommended hybrid.

NORTHERN ZONE

Table 16. Average Corn Hybrid Performance in 12 Trials, 1949-53

Variety or pedigree	Maturity		Smut	Height		Shank	Husk*	Lodged		Ear		Good	Plant*	Ear*	Ear	Yield
	Days	Zone		Plant	Ear		1-5	Root	Stalk	Length	Rows	ears	appear-ance 1-5	appear ance 1-5	mois-ture	
			per cent		inches			per cent		inches	number	per cent			per cent	bushels per acre
Minn. 802	82-86	N.	8	68	24	7	1.0	28	5	7.0	14	88	2.5	2.1	25.7	42.6
Wisc. 240†	82-86	N.	4	71	24	6	1.3	18	10	7.6	13	85	2.2	2.6	28.4	41.2
Wisc. 255	82-86	N.	6	71	26	6	1.0	13	3	6.8	14	80	3.5	3.5	25.1	40.5
Wisc. 279	86-90	N.	7	73	27	6	1.0	12	2	6.8	16	81	3.0	2.8	28.7	43.8
Nodak 301	84-88	N.	10	75	26	5	2.3	7	5	7.0	16	84	3.0	2.7	26.9	43.5
Morden 77	78-82	N.M.	11	70	24	5	1.0	14	5	6.5	16	80	2.5	3.0	21.8	39.7
L.S.D. at 5 per cent point															1.3	1.8

* Class 1 rating is good; 5 is poor.

† Flint dent hybrid.

Table 17. Average Yields of Flax

Variety	Rosemount		Waseca*		Morris		Crookston†		Grand Rapids		Northern Minnesota		Southwestern Minnesota	
	Years of trial	Yield	Years of trial	Yield	Years of trial	Yield	Years of trial	Yield	Years of trial	Yield	Years of trial	Yield	Years of trial	Yield
		bushels per acre		bushels per acre		bushels per acre		bushels per acre		bushels per acre		bushels per acre		bushels per acre
Bison	1946-53	15.3	1946-52	17.2	1946-53	20.7	1946-53	13.8	1946-53	12.8	1950-53	16.0	1946-53	17.0
Redwing	1946-53	17.6	1946-52	18.5	1946-53	20.6	1946-53	11.3	1946-53	14.9	1950-53	18.1	1946-53	17.2
Koto	1946-53	17.2	1946-52	19.8	1946-53	22.4	1946-53	14.0	1946-53	15.7	1950-53	20.9	1946-53	19.8
Minerva	1946-53	16.0	1946-52	17.8	1946-53	22.0	1946-53	13.0	1946-53	13.6	1950-53	19.3	1946-53	18.5
Redwood	1946-53	18.4	1947-52	21.2	1947-53	23.8	1947-53	14.9	1947-53	15.2	1950-53	21.1	1947-53	20.8
B5128	1950-53	16.3	1950-52	21.3	1947-53	22.4	1946-53	15.1	1948-53	14.1	1950-53	20.4	1947-53	21.9
Sheyenne	1948-53	15.9	1948-52	19.7	1948-53	21.3	1948-53	12.7	1949-53	14.4	1950-53	18.3	1948-53	18.4
Marine	1949-53	17.0	1949-52	20.8	1949-53	21.8	1949-53	12.4	1950-53	15.5	1950-53	19.8	1949-53	19.2
L.S.D. at 5 per cent point		1.1		1.5		1.1		1.6		1.3		2.8		1.1

* No yields taken at Waseca in 1953.
† No yields taken at Crookston in 1952.

resulted from this disease in 1953 although light infections of rust were reported from Rosemount and southwestern Minnesota on Bison, Redwing, and Koto. All the varieties are more or less susceptible to pasmo, and infections varied from light to heavy at Rosemount, Waseca, Morris, and southwestern Minnesota. Losses are difficult to estimate, but the more susceptible varieties such as Redwing, Redwood, and B5128 were undoubtedly injured more than the less susceptible varieties Marine, Minerva, and Sheyenne.

No single variety has been best for all locations or in all seasons. During the years of these trials, seasons generally have been favorable for late maturing varieties and these frequently have shown up best in the trials. It is likely that in very hot, dry years, a variety such as Marine would yield fully as well as Redwood or B5128.

Redwood has made the highest average yield at Rosemount, Morris, and northern Minnesota, although in some instances other varieties were nearly as high in yield. B5128 was the highest yielding variety at Waseca, Crookston, and southwestern Minnesota. At Grand Rapids, Koto has made the highest average yield. Marine has also made a good yield record, particulary at Waseca and Grand Rapids.

Bison has yielded less than the best recommended varieties at all stations, usually by a significant amount. Redwing has yielded somewhat better than Bison but has not been the equal of the recommended varieties. The average yield of Koto has been good, particularly at Morris, Grand Rapids, and northern Minnesota. However, this variety, like Bison and Redwing, is susceptible to rust, and if a serious epidemic should occur, it would suffer considerably. Minerva has been only fair in yield at most stations. At Morris, however, it has averaged nearly as high as B5128.

Of the two early rust-immune varieties, Marine has proved to be better than Sheyenne. In some trials the yield of Marine has been about equal to the yield of Redwood or B5128, although it has not been quite so high as an average.

OTHER AGRONOMIC AND QUALITY CHARACTERS

Data given in table 18 show the average date ripe, plant height, weight per 1,000 seeds, oil content, and iodine number of the oil.

Date of maturity is an important character in flax. In general, early maturity is preferable, since the crop escapes some of the effects of heat, drouth, and storms which may occur in late summer. Some of the early maturing varieties do not have the yielding ability of the later varieties, however, and frequently fail to yield as well except when conditions are unfavorable to late maturing varieties.

The range in average maturity was nearly two weeks between the earliest varieties, Redwing and Sheyenne, and the latest variety, B5128. Minerva, and Redwood are considered as mid-late in maturity while Marine, Koto, and Bison are mid-early.

There are no important differences in plant height of the varieties in these trials.

Redwing has small seeds. All the other varieties have medium-sized seeds, although seeds of B5128 and Bison are larger than seeds of Koto, Sheyenne, or Marine.

The oil content of Bison is considered good. Minerva was the only variety appreciably higher in oil than Bison, although Redwood was slightly higher. Redwing is definitely deficient in oil content.

Oil from the seed of Redwing, Minerva, and Marine has excellent drying quality, as is indicated by the relatively high iodine number. Koto, Redwood, and Sheyenne have satisfactory oil quality. Bison has oil of low drying quality.

DISEASE REACTION

Bison generally has been considered the variety most susceptible to rust. Heavily rusted fields of Koto have also been observed. Redwing is moderately susceptible while Minerva is moderately resistant to rust. Redwood, B5128, Sheyenne, and Marine are immune to races of rust found in Minnesota.

All of the flax varieties have some resistance to wilt. Koto is the most highly resistant, followed by Redwood, Sheyenne, Marine, and Bison; Minerva and Redwing are moderately resistant; B5128 is moderately susceptible.

None of the varieties is resistant to pasmo, although there are variations in the degree of susceptibility. Marine, Sheyenne, and Minerva are usually less severely injured; Redwing, B5128, and Redwood are susceptible. All other va-

Table 18. Average of Flax Varieties for Date Ripe, Plant Height, Weight per 1,000 Seeds, Oil Content and Iodine Number

Variety	Date ripe	Plant height	Weight of 1000 seeds	Oil content	Iodine number
	August	inches	grams	per cent	
Bison	11	23	6.1	38.2	175
Redwing	6	22	4.5	36.7	186
Koto	9	22	5.2	37.5	182
Minerva	15	22	5.9	40.4	184
Redwood	12	23	5.8	38.4	181
B5128	18	23	6.7	37.6	179
Sheyenne	7	22	5.2	37.2	181
Marine	8	22	5.1	37.7	187

rieties listed are intermediate in reaction.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

All Sections

Redwood (C.I. 1130) is a brown-seeded, blue-flowered variety originating from a cross of B5128 x Redson made at the Minnesota Agricultural Experiment Station in 1941. It is mid-late in maturity, immune to races of rust found in Minnesota, moderately wilt resistant, and moderately susceptible to pasmo. It has made excellent yields in field trials and has high oil content of good quality. The straw is of excellent fiber quality.

Marine (C.I. 1135) is a brown-seeded, blue-flowered, early maturing flax selected from a cross of C.I. 975 x Sheyenne made at the North Dakota Agricultural Experiment Station. It is immune to races of rust found in Minnesota, resistant to wilt, and moderately resistant to pasmo. Marine has not yielded as well as Redwood or B5128 when sown early, but in late sowings it seems superior to both these varieties. It has good oil content and the oil is of high quality. This variety is recommended for sowing wherever an early maturing, disease-resistant variety is desirable.

B5128 (C.I. 980) is a brown-seeded, blue-flowered variety resulting from a cross of Golden x Rio made at the North Dakota Agricultural Experiment Station. It is late maturing, immune to races of rust found in Minnesota, and moderately susceptible to both wilt and pasmo. It has produced excellent yields when planted early. The variety has good oil content of only fair quality. B5128 contains a mixture of types, including a small percentage of yellow-seeded plants and a small percentage of rust-susceptible plants.

Varieties Not Recommended

B. Golden is a yellow-seeded variety with pink flowers that fade to white on exposure to light. It is moderately susceptible to wilt. It is immune from races of rust common to the United States but is very susceptible to pasmo. The oil content of the seed is high and the oil is of good drying quality. It is not recommended because of its susceptibility to pasmo and because its short straw limits its ability to compete with weeds and causes some difficulty in harvesting. It was developed at the North Dakota Agricultural Experiment Station.

Bison is susceptible to rust but has yielded well in the Red River Valley except when rust is severe. It is resistant to wilt and moderately susceptible to pasmo. It is high in oil content but lower in oil quality than Redwing. It was developed at the North Dakota Station by plant selection. Bison has brown seeds and blue flowers.

Biwing is resistant to wilt but is moderately susceptible to rust and pasmo. It has fair oil content and quality, and only fair yielding ability. The flowers are blue, the seeds brown. It was developed by the Minnesota Agricultural Experiment Station.

Buda is resistant to wilt, moderately resistant to rust, and moderately susceptible to pasmo. It has fair yielding ability. The seeds are brown, the flowers blue. Buda was developed by the North Dakota Agricultural Experiment Station.

Crystal was developed by the Minnesota Agricultural Experiment Station. It has been difficult at times to obtain good stands of Crystal. The variety is immune to races of rust found in Minnesota, moderately resistant to pasmo, and susceptible to late wilt. The seeds are yellow, with high oil content of good quality. The flowers are white.

Dakota is not recommended for Minnesota because it is susceptible to races

of rust now prevalent in the state. Dakota is a selection from a cross of Renew x Bison that was first introduced in North Dakota. It has brown seeds and blue flowers.

Koto is brown seeded, high yielding, mid-late in maturity, resistant to wilt, and moderately susceptible to pasmo, but susceptible to races of rust common in Minnesota. It can be distinguished from Redwing by its characteristic dark-blue flowers. It has medium-size seed and satisfactory oil content and quality. It is a selection from a cross of (Russian x Argentine) x Bison, made at the Northern Great Plains Field Station, Mandan, North Dakota.

Minerva is yellow seeded, the flowers are very dark blue. Yields have been moderately good. While this variety has been moderately susceptible to late wilt at University Farm, it has been much more resistant at Fargo. It is moderately resistant to rust but moderately susceptible to pasmo. It has exceeded all varieties in percentage of oil content, and the oil quality is similar to that of Redwing. The straw is slightly less valuable for fiber for paper production than that of other varieties. It is a selection made in Minnesota from a backcross of C.I. 649 x Bison.

Redwing is well adapted for southern and central Minnesota but not for northwestern Minnesota. It has been satisfactory also in Koochiching and Lake of the Woods Counties and parts of Roseau County. It is early in maturity, moderately resistant to wilt, and susceptible to pasmo and rust. The seed is of medium size and produces an oil of high drying quality. It was selected at Minnesota from Acc. No. 91. Where an early variety is required, Marine has been superior to Redwing.

Royal is a mid-late maturing variety that is moderately susceptible to rust and wilt and susceptible to pasmo. The oil content and quality are similar to Bison. This variety has weak straw. It was developed at Saskatoon, Saskatchewan, Canada, as C.A.N. 1727. The seeds are brown and the flowers blue.

Rocket was developed in Canada. In trials in Minnesota it has yielded slightly less than Redwood. It is resistant to rust but moderately susceptible to wilt and pasmo. It has brown seeds with good oil content of good quality. The flowers are blue.

Sheyenne is early, immune to races of rust found in Minnesota, resistant to wilt, but moderately susceptible to pasmo. In trials in the state it has yielded less than have the recommended varieties when both were planted at an early date. It was developed at the North Dakota Agricultural Experiment Station. The seeds are brown, flowers blue.

Victory is high yielding, moderately susceptible to rust and wilt and very susceptible to pasmo. The variety lacks uniformity of type. It is easily distinguished by the characteristic large white flowers and large brown seed. It was developed at the North Dakota Station.

Viking is very similar to B. Golden.

Walsh is a blue-flowered variety with extra-large brown seeds. It has yielded less than the recommended varieties. It is moderately resistant to wilt, immune to races of rust common in the United States, and very susceptible to pasmo. It was developed at the North Dakota Station.

SOYBEANS

J. W. Lambert

Average yields for three locations in southern Minnesota and two locations in central Minnesota are given in table 19. At Waseca and Blue Earth the

medium early varieties, such as Capital and Renville, gave the highest yields while in the southwestern trials the later maturing varieties such as Harosoy and Hawkeye showed up best. As an average of the three southern locations Capital and Renville were highest in yield. The rest of the varieties except for Monroe gave very similar three-station averages. Monroe was significantly lower in yield than the others.

Of the varieties tested for several years at Rosemount and Morris, Capital was outstanding in yield. In one year of testing, however, Hardome compared very favorably with Capital. Flambeau, Ottawa Mandarin, Renville, and Blackhawk also gave creditable yields. Habaro was lowest in yield at these central locations.

OTHER AGRONOMIC CHARACTERS

In the southern locations Ottawa Mandarin was the earliest variety tested, Capital and Renville maturing two and four days later, respectively. The varieties Habaro, Monroe, and Blackhawk were medium in maturity. From data in many types of seasons it would seem that these three are about as late in maturity as it is safe to grow in the southern one-third of Minnesota with the possible exception of the southwestern counties where the later varieties such as Hawkeye and Korean have performed relatively well. It it apparent from the tables that the same varieties mature two to seven days later at the central locations than at the southern ones. This emphasizes the importance of proper consideration of maturity particularly in the central areas of the state. Here varieties of the maturity of Flambeau, Ottawa Mandarin, Capital, or Renville are satisfactory, while Blackhawk and Habaro occasionally mature too late.

The tallest varieties in the southern trials were Hawkeye, Harosoy, Harman, and Monroe, the shortest being Ottawa Mandarin and Renville. In the central locations Blackhawk was tallest, Ottawa Mandarin and Renville again being shortest. Hardome was rather tall, considering its early maturity.

Renville and Ottawa Mandarin were outstanding in resistance to lodging at all locations. Harosoy, Harman, and Hardome showed a decided tendency to lodge.

Seed size averaged larger in the southern than in the central locations. Korean had by far the largest seeds of any variety, Capital was clearly the smallest. The only commercial consideration of seed size is in respect to amount of seed required for planting.

OIL CONTENT

Because of costs and facilities required for chemical analyses the varieties in the regular yield trials have not been routinely analyzed for oil content in recent years, and comparative data for the periods and locations indicated in table 20 are not available. However, from determinations made in former years on the older varieties and in recent years on the newer ones the following general comments seem appropriate. Of the varieties shown in the table, Renville has the highest oil content. Capital and Blackhawk are very good in this respect. Fair to good in oil content are Ottawa Mandarin, Hawkeye, Monroe, Flambeau, and Harosoy. The oil percentage of Harman, Korean, and Habaro is, in general, low.

ORIGIN AND DESCRIPTION OF VARIETIES

Maturity before frost is an important consideration in soybean varieties used for seed production. The varieties must be earlier as the average growing season becomes shorter. For this reason the regions of adaptation for seed production are included in the description

Table 19. Average Yields of Soybeans

Name	Southern locations					Central locations			
	Years of trial*	Waseca	Blue Earth	South-western Minnesota	Average three locations	Years of trial	Rose-mount	Morris	Average two locations
		bushels per acre					bushels per acre		
Ottawa Mandarin	1948-53	30.7	36.3	21.4	29.5	1948-53	29.9	27.8	28.8
Habaro	1948-53	30.7	38.4	23.5	30.9	1948-53	25.0	25.9	25.4
Monroe	1948-53	29.0	31.5	21.1	27.2	.....	.....	.....	.....
Blackhawk	1948-53	30.3	35.9	25.0	30.4	1948-53	29.5	24.8	27.2
Hawkeye	1948-53	27.6	33.5	26.2	29.1	.....	.....	.....	.....
Capital	1949-53	32.4	35.9	25.2	31.2	1948-53	32.1	28.5	30.3
Korean	1949-53	29.8	36.4	26.2	30.8	.....	.....	.....	.....
Renville	1950-53	31.0	38.7	23.7	31.1	1950-53	26.5	28.3	27.4
Harosoy	1953	26.3	34.7	30.2	30.4	.....	.....	.....	.....
Harman	1953	25.7	32.8	29.6	29.4	.....	.....	.....	.....
Flambeau	.....	.....	.....	.....	.....	1948-53	27.0	29.2	28.1
Hardome	.....	.....	.....	.....	.....	1953	34.0	26.9	30.4
L.S.D. at 5 per cent point		1.7	2.2	1.7	1.1		1.7	1.6	1.2

* No data at Blue Earth in 1952.

Table 20. Averages of Soybean Varieties for Date of Maturity, Plant Height, Lodging Score, and Weight per 100 Seeds in Southern and Central Locations

Variety	Southern locations					Central locations				
	Years of trial*	Date mature	Plant height	Lodging score†	Weight per 100 seeds	Years of trial	Date mature	Plant height	Lodging score†	Weight per 100 seeds
			inches		grams			inches		grams
Ottawa Mandarin	1948-53	9-13	27	1.3	18.1	1948-53	9-15	27	1.4	17.2
Habaro	1948-53	9-21	30	2.3	18.1	1948-53	9-28	31	2.5	16.5
Monroe	1948-53	9-21	38	2.4	14.9	.....	.....	.....	.....	.....
Blackhawk	1948-53	9-23	36	2.1	15.6	1948-53	9-26	36	2.3	15.0
Hawkeye	1948-53	10-2	39	2.0	16.3	.....	.....	.....	.....	.....
Capital	1949-53	9-15	31	2.5	12.7	1948-53	9-18	32	2.4	11.7
Korean	1949-53	9-28	33	2.5	23.5	.....	.....	.....	.....	.....
Renville	1950-53	9-17	29	1.2	17.0	1950-53	9-19	28	1.3	15.8
Harosoy	1953	9-26	39	2.7	17.8	.....	.....	.....	.....	.....
Harman	1953	10-1	38	2.8	16.0	.....	.....	.....	.....	.....
Flambeau	.....	.....	.....	.....	.....	1948-53	9-8	30	2.4	15.0
Hardome	.....	.....	.....	.....	.....	1953	9-12	34	2.6	15.0

* No data at Blue Earth in 1952.

† Score of 1 = erect; 5 = completely lodged.

of varieties. Varieties used for hay can be somewhat later maturing than those used for seed. In general, a variety can be used about one maturity zone (see map, page 24) farther north for hay than for seed.

Recommended Varieties

Blackhawk gives high yields, grows 34 to 38 inches tall, and has considerable resistance to lodging. It tends to bear its lowest pods fairly well above the ground. The seeds are medium in size and yellow except for the light brown seed scars. The oil content of the seed is relatively high. This variety is a selection made at the Iowa Agricultural Experiment Station from a cross of Mukden x Richland. It is recommended for the Southern and South Central Corn Maturity Zones.

Capital is a high yielding variety that averages 30 to 32 inches in height and has a distinct tendency to lodge. The seeds are small and yellow with light brown seed scars, and they have a relatively high oil content. Capital was selected at the Central Experimental Farm, Ottawa, Canada, from a cross of 171 x A.K. (Harrow). It is recommended for areas of the state south of the Northern Corn Maturity Zone.

Flambeau grows 24 to 26 inches tall and has a considerable tendency to lodge. It has been a high yielder among the early varieties. The seeds are yellow with black seed scars and have a medium oil content. The variety is a selection made at the Wisconsin Agricultural Experiment Station from an introduction from Russia. It is recommended for planting in the Central, North Central, and Northern Corn Maturity Zones.

Ottawa Mandarin grows to height of 24 to 28 inches and is highly resistant to lodging. The seeds are fairly large, yellow with light buff seed scars, and have a medium oil content. This variety is a selection made at the Central Experimental Farm, Ottawa, Canada, from the variety Mandarin. It is recommended in areas of the state south of the Northern Corn Maturity Zone.

Renville grows from 26 to 31 inches tall and is highly resistant to lodging. The seeds are medium in size and are yellow with light brown seed scars. This variety has the highest oil content of any of the varieties tested in Minnesota in recent years. It was selected at the Minnesota Agricultural Experiment Station from a cross of Lincoln x (Lincoln x Richland) made at the United States Regional Soybean Laboratory at Urbana, Illinois. It averages a week earlier in maturity than Blackhawk and is recommended for the South Central and Southern Corn Maturity Zones and for the Central Zone. No seed will be available to the general public before 1955.

Varieties Not Adequately Tested

Hardome is an early selection from a cross of Mandarin x (Mandarin x A.K.). This variety was developed at the Dominion Experimental Farm at Harrow, Ontario. In preliminary testing it has given good yields, is slightly earlier than Ottawa Mandarin, and is of good height considering its maturity. It has a distinct tendency to lodge and is only fair in oil content.

Harosoy is a medium late selection made at the same station and from the same cross as Hardome. In only one year of testing in Minnesota it gave satisfactory yields, particularly in the trial in southwestern Minnesota. It matured about three to five days later than Blackhawk and grew relatively tall. It had a marked tendency to lodge and was medium in oil content.

Varieties Not Recommended

Adams was developed cooperatively by the Iowa Agricultural Experiment Station and the United States Regional

Soybean Laboratory from the cross Illini x Dunfield. It is too late for Minnesota.

Bavender Special was selected by an Iowa farmer. It is very late in maturity, lodges excessively, and is rather low in oil content.

Earlyana was selected from a natural hybrid at the Purdue Agricultural Experiment Station. It has given only fair yields in Minnesota and has lodged excessively. It matures two or three days later than Blackhawk.

Harbaro has been tested and used in Minnesota longer than any other variety. It has yielded well and is well adapted to southern Minnesota. However, it is low in oil content, tends to lodge, and in dry autumns often gives trouble from shattering. It is a selection made at the Minnesota Agricultural Experiment Station from an early introduction.

Harly was selected at the Central Experimental Farm, Ottawa, Canada, from a cross of Mandarin x A.K. (Harrow). It is medium early and grows rather tall. In three years of testing in Minnesota it has given relatively low yields.

Hawkeye was developed cooperatively by the Iowa Agricultural Experiment Station and the United States Department of Agriculture from a cross of Mukden x Richland. It matures a week to 10 days later than Blackhawk and has not outyielded Blackhawk in Minnesota.

Hokien, after three years of testing in Minnesota, appears to be identical with the variety Capital.

Korean was selected in Canada from an importation from the Orient; a Mr. Rickard of Champaign, Illinois, brought it to the United States. It gives relatively good yields in southern Minnesota. Oil content of this variety is only fair. It matures about four days later than Blackhawk, grows to medium height, and lodges rather badly. The seeds are very large.

Lincoln was selected at the United States Regional Soybean Laboratory from a cross of Mandarin x Manchu. It is too late in maturity for Minnesota.

Manchu Wis. 606, a selection made at the Wisconsin Agricultural Experiment Station from the older Manchu variety, has been grown rather extensively in Minnesota. It is similar to Habaro in yielding ability, maturity, and height. It lodges somewhat more than Habaro but has an appreciably higher oil content than Habaro.

Monroe is a tall growing variety that is about midway in maturity between Capital and Blackhawk. In several years of testing it has given lower yields than either of these varieties and has a marked tendency to lodge. Monroe was selected at the Ohio Agricultural Experiment Station from a cross of Mukden x Mandarin.

Pridesoy 57 is an early variety with good standing ability. The plants are slightly shorter than those of Ottawa Mandarin, and the oil content is lower than that of Ottawa Mandarin. It is a selection from the older variety Pridesoy.

SUNFLOWERS

R. G. Robinson and O. C. Soine

Short, combine-harvested sunflower varieties have been tested for six years on heavy soil in western Minnesota and have proved themselves to be an adapted crop. In comparison with soybeans at Crookston, Morris, and southwestern Minnesota, sunflowers produced much more oil per acre than did soybeans in every trial. Trials initiated in 1953 on sandy soil in Anoka

County also resulted in more oil production per acre from sunflowers than from soybeans.

In 1953, combine-harvested sunflowers occupied about 5,000 acres in northwestern Minnesota. Most of the crop was sold to bird feed dealers and to a Canadian cooperative which processes sunflower seed as an oilseed crop like soybeans.

Sunflower oil, like soybean oil, is edible and can be used in margarine, cooking oil, salad oil, and other food products. The meal or flour remaining after oil extraction is a valuable protein supplement for livestock, or it can be added to wheat flour to improve the quality and nutritional value of cakes and other bakery products.

SEED YIELD COMPARISONS

Average adjusted yields of sunflower varieties at Crookston, southwestern Minnesota, and Anoka County are shown in table 21.

Advance is recommended for either feed or oil in all parts of Minnesota. Arrowhead is recommended in central and northern Minnesota for feed only. Although Arrowhead yields as well or better than Advance in central and northern Minnesota, its seed contains less oil and will probably bring a lower price on the oil seed market. Mennonite seed contains less oil than does Arrowhead seed, and it is slightly later in maturity.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Advance is medium in maturity and stands well for combining. The seed is small, low in hull, and high in oil content and bushel weight. It grows about five feet tall and matures about the same time as the earliest soybean varieties. Advance is a topcross hybrid released about 1945 by the Dominion Experimental Farms in Canada and is produced by crossing the inbred, S-37-388, with the variety, Sunrise. Only seed harvested from the S-37-388 in the crossing field should be used for seed. Therefore, it is desirable for farmers to buy new, certified seed every year just as they do with hybrid corn.

Arrowhead is about five days earlier than Advance, is slightly taller, and is not quite as strong stalked. The seed is medium in size, low in hull, medium

Table 21. Average Adjusted Yields of Sunflowers

Variety	Crookston		Southwestern Minnesota		Anoka (two farms)	
	Years of trial	Yields	Years of trial	Yields	Years of trial	Yields
		pounds per acre		pounds per acre		pounds per acre
Advance	1948-53	1,010	1951-53	1,308	1953	379*
Arrowhead	1948-53	1,071	1951-53	986	1953	875
Mennonite	1953	1,110	1953	978	1953	595
Advance, second generation	1948-50	847	.....	.....	.....	.....
Sunrise	1948-50	325	.....	.....	.....	.....
S-37-388	1949-50	494	.....	.....	.....	.....
Girasol Klein	1948	718	.....	.....	.....	.....
Saratov Selection	1948	835	.....	.....	.....	.....
Manchurian	.....	.....	1953	980	1953	188
Greystripe	.....	.....	1953	739	1953	402

* Yield low because Advance was 35 per cent eaten by birds and Arrowhead only 4 per cent.

in oil content, and high in bushel weight. It has more seedling vigor and shows slightly less bird damage than Advance. It is an open-pollinated variety so seed for next year's planting can be saved from the commercial crop. Arrowhead was selected from Mammoth Russian by M. J. Thompson at the Northeast Experiment Station about 1920. It is recommended in central and northern Minnesota for feed only.

Varieties Not Adequately Tested

Girasol Klein is late maturing and tall. The seed is very high in oil. It was selected in Argentina from common sunflowers.

Saratov Selection is about the same maturity and height as Advance. The seed contains slightly less oil than seed of Advance. It is an Argentine selection from Saratov, a Russian variety.

Mennonite is slightly later maturing and taller than Arrowhead. The seed is large, high in hull, low in oil content, and medium in bushel weight. It originated in Russia many years ago.

Varieties Not Recommended

Commercial Advance or "Advance, second generation" yields considerably less than Advance and therefore should not be used for planting.

Greystripe is the latest maturing and tallest variety tested in Minnesota trials. The seed is large, high in hull, and low in oil content and bushel weight.

Manchurian is late maturing and is probably too tall for combine-harvesting. The seed is large, high in hull, and low in oil content and bushel weight.

Sunrise is used as the pollen parent of Advance hybrid. It is medium in maturity and low in yield. The seed is small, low in hull, and high in oil content and bushel weight. It originated from a selection made by the Dominion Forage Crops Laboratory in Saskatchewan and was released in 1942 after four generations of inbreeding.

S-37-388 is used as the female parent of Advance hybrid. It is early maturing and low yielding. It is an inbred line from Mennonite and was developed by the Dominion Experimental Farms.

ALFALFA

L. J. Elling

Alfalfa trials have been carried out at six locations in Minnesota during the past five years. These locations are Crookston, Grand Rapids, Morris, Rosemount, Waseca, and Winona. Trials before this time were made at Crookston, Grand Rapids, Morris, Waseca, and University Farm.

Because alfalfa is a perennial crop, seedings are made every three to five years rather than annually, as for the cereal crops. Stands are maintained and yields harvested twice annually until stands are uneven or until yields have been harvested for five years. Generally stands are rather uneven after three crop years. New and promising varieties are included in these trials along with standard and commercial varieties. Readings for per cent stand, winterkilling, and diseases are recorded as the opportunity is presented.

YIELD COMPARISONS

Table 22 gives forage yields and stand readings of Grimm, Ladak, and Ranger when grown on wilt-infested soil. Other trials have given similar results, but in these the presence of the wilt organism was not definitely established.

In all cases where wilt was a factor, Grimm was more severely thinned than

Table 22. Forage Yields and Stand Readings for Three Varieties of Alfalfa Grown on Wilt-Infested Soil

Variety	Morris, seeded 1940		Waseca			
			Seeded 1943		Seeded 1945	
	Five-year average forage yield	Stand 1946	Two-year average forage yield	Stand 1947	Four-year average forage yield	Stand 1949
	tons per acre	per cent	tons per acre	per cent	tons per acre	per cent
Grimm	3.91	17	2.7	10	2.1	5
Ladak	4.42	80	.....	.....	2.6	77
Ranger	4.32	90	2.8	51	3.0	87

Ladak or Ranger. The yields harvested during the third, fourth, and fifth crop years show that the loss of stand was reflected in the forage yields. Generally there were not significant differences among the three varieties for forage yields during the first and second crop years.

Table 23 gives the forage yields for 16 alfalfa varieties grown at six locations. Some varieties seemed to be superior for forage yield at most locations though the differences were not great. Narragansett and Ladak appeared consistently good with Narragansett yielding slightly better than Ladak.

Grimm and Ranger produced only average yields and were not outstanding at any location. In these trials bacterial wilt and winter injury have not been important factors. Therefore, such varieties as Atlantic and Buffalo appear much better than is observed normally in Minnesota. The yields obtained in 1953 show that Buffalo performed very well following the 1952-53 winter when there was no winter injury.

WINTERHARDINESS

The varieties listed in table 23 are, with three exceptions, considered sufficiently winterhardy for Minnesota. These exceptions are Atlantic, Buffalo, and Kansas Common. They are not reliable even when bacterial wilt is absent.

DISEASE REACTION

Ranger is the most wilt resistant of the Minnesota adapted alfalfa varieties in commercial production. Buffalo is

Table 23. Average Alfalfa Forage Yields

Variety	Crookston 1951-53	Grand Rapids 1951-52	Morris 1950-53	Rosemount 1950-53	Waseca 1951-52	Winona 1949-52
Ladak	1.41	3.44	2.85	4.07	2.71	2.36
Narragansett	1.36	3.54	2.95	4.14	3.05	.....
Ranger	1.29	2.90	2.85	3.70	2.72	2.40
Atlantic	1.25	3.11	2.84	3.96	2.75	2.08
A-224	1.28	3.14	2.93	3.85	.....	.....
A-225	.....	.....	2.98	4.14	.....	2.30
Buffalo	1.14	2.63	2.84	3.73	2.32	2.48
Canadian Variegated	.....	.....	.....	.....	.....	2.27
Cossack	1.22	3.24	.....	.....	2.84	2.39
Dakota Common	1.29	3.03	2.61	3.88	2.69	.....
Grimm	1.14	3.08	2.64	3.64	2.69	2.29
Kansas Common	1.23	2.80	2.70	3.76	2.68	2.34
Meeker Baltic	.....	.....	.....	.....	.....	2.01
Montana Common	.....	.....	.....	.....	.....	2.26
Rhizoma	1.22	3.56	.....	.....	2.75	.....
Turkestan	.....	.....	2.60	3.84	.....	.....

wilt resistant, but because it is susceptible to winterkilling is not adapted in Minnesota. Ladak is somewhat less resistant than Ranger, and A-224, A-225, and Turkestan are resistant to wilt. The remaining ten varieties that are listed in table 23 are susceptible to bacterial wilt.

None of the varieties in commercial production possesses resistance to the leaf spot diseases. Two of these diseases, common leaf spot, *Pseudopeziza medicaginis,* and blackstem, *Ascochyta imperfecta,* are the most common in Minnesota.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

For All Rotations

Ladak is a winterhardy variety introduced by the United States Department of Agriculture from northern India. It has averaged slightly higher than Ranger in forage yield. It recovers slowly after cutting, but the yield of the second cutting of Ladak has not been much lower than that of other varieties. It is recommended for seeding in both long and short rotations.

Ranger is a winterhardy variety developed by the United States Department of Agriculture and the Nebraska Agricultural Experiment Station. Slightly superior to Ladak for wilt resistance, Ranger is recommended for seeding in both long and short rotations.

For Short Rotations Only (Two Crop Years or Less)

Narragansett was developed by the Rhode Island Agricultural Experiment Station. In Minnesota trials it has produced definitely higher forage yields than Ranger and slightly higher yields than Ladak. Narragansett is winterhardy, it recovers rapidly after cutting, and its seedlings are vigorous. *This variety is susceptible to bacterial wilt and should be seeded only in short rotations (one or two years of hay production).* Until 1955 only limited quantities of seed of this variety will be available.

Varieties Not Adequately Tested

Vernal was developed by the Wisconsin Agricultural Experiment Station and was released in 1953. It has not been tested enough in Minnesota for a complete evaluation; however, it is wilt resistant, appears winterhardy, and in one limited trial gave satisfactory forage yields.

Dupuits is a variety of alfalfa introduced from France. It is susceptible to bacterial wilt and it may not be sufficiently winterhardy for Minnesota. In one limited trial it gave satisfactory forage yields.

Varieties Not Recommended

Uncertified southwestern-grown seed should never be planted for forage production in Minnesota. It lacks winterhardiness. This is in contrast to the certified seed of Ranger and Narragansett produced in the southwest, which are perfectly satisfactory in Minnesota.

Common alfalfas are named for the state or region in which they are grown. Seed of these strains is not designated as a variety and performance is not consistent from one lot to another. Generally, the common alfalfas are susceptible to bacterial wilt and yield somewhat less than improved varieties.

Atlantic is a synthetic variety developed by the New Jersey Agricultural Experiment Station. It yields about the same as Ranger but is susceptible to bacterial wilt and is not sufficiently winterhardy for Minnesota.

Buffalo is a wilt-resistant variety developed by selection from Kansas Common, which it resembles in most other characteristics. It is not sufficiently winterhardy for use in Minnesota.

Grimm is a winterhardy variety developed in Carver County by Wendelin Grimm. Where bacterial wilt is prevalent, the persistence of Grimm is decidedly less than that of Ranger or Ladak. Grimm is equal to Ranger and lower than Narragansett for forage yield where wilt is not a factor.

Nomad was developed in Oregon from plants of an old stand that spread by underground stems. Under conditions where adapted, Nomad is a spreading or creeping variety. It is not adapted to Minnesota.

Rhizoma was developed by the University of British Columbia. Under favorable conditions the plants spread by underground stems but the variety has not shown this characteristic in Minnesota. In trials in Minnesota, it has been about equal to Ranger in yield but is very susceptible to bacterial wilt.

Talent was selected from the French variety Provence. Talent is susceptible to bacterial wilt and is not sufficiently winterhardy for Minnesota.

Williamsburg was selected from Kansas Common for stem rot resistance. It, like Kansas Common, is not sufficiently winterhardy for Minnesota.

BROMEGRASS

H. L. Thomas

YIELD COMPARISONS

Because bromegrass is a perennial crop, data are collected from the same plots over a period of years. A series of plots was planted at all stations in 1950 and these plots are still in existence. All of the data presented in table 24 are from this series. All of the varieties were included in each test so that the averages reported are actual and not adjusted.

The southern brome varieties, with the exception of Fischer, are superior

Table 24. Forage Yield in Tons of Hay Per Acre at 15 Per Cent Moisture and Seed Yield in Pounds Per Acre*

	Forage						Seed				
	Rosemount 1951, 52, 53	Waseca 1952, 53	Morris 1952, 53	Crookston 1951, 52, 53	Grand Rapids 1951, 52	State average	Rosemount 1952, 53	Morris 1953	Crookston 1952, 53	Grand Rapids 1952	State average
Achenbach	2.84	2.59	1.92	2.61	1.51	2.37	118	232	82	76	127
Lancaster	2.89	2.47	1.99	2.38	1.70	2.35	119	385	98	118	180
Lincoln	2.71	2.56	1.90	2.59	1.36	2.30	120	301	99	102	150
Lyon	2.80	2.60	1.62	2.53	1.51	2.29	84	182	96	103	116
Manchar	2.70	2.19	1.75	2.68	1.68	2.28	192	336	191	150	217
Homestead	2.70	2.50	1.60	2.21	1.79	2.21	101	220	106	151	144
Elsberry	2.56	2.53	1.71	2.22	1.70	2.18	72	181	64	96	103
Fischer	2.58	2.32	2.22	1.89	1.66	2.15	89	468	74	125	189
B. in.-12	2.52	2.55	1.72	2.14	1.66	2.15	154	275	176	146	188
Canadian Commercial	2.10	2.23	1.39	1.78	1.67	1.85	166	161	114	179	155
L.S.D. 5 per cent point						.18					49

* There were three replications at each station. The yield of forage from second cuttings was included at Rosemount in 1952, Morris in 1952 and 1953, Crookston in 1952, and Grand Rapids in 1951 and 1952. In the remainder of the cases the season total is for one cutting only.

in these tests. Manchar looks desirable especially when both forage and seed production are considered. If it continues to perform in this fashion it will be considered for increase. Manchar was introduced from Manchuria by the U.S.D.A. and has been mass selected at Pullman, Washington. It is classified as intermediate between southern and northern type.

None of the varieties has ever suffered from winterkilling under Minnesota conditions. The diseases of importance in this crop are leaf spot and possibly seedling damping off. Disease resistance comparisons have not been made in the variety tests.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

The list of recommended varieties has been compiled from data collected during the period 1944 to 1950.

Lincoln, Achenbach, and **Fischer** are recommended varieties. These southern strains start growth earlier in the spring than Canadian brome and are somewhat more productive. Lincoln was selected in Nebraska, Achenbach in Kansas, and Fischer in Iowa. All of these are so-called farm strains. That is, they have been grown by one or two farmers, in the areas designated, for a long period of time and seem to have acquired a natural adaptation.

Varieties Not Recommended

B. in.-12 is a mass selection chiefly of nonspreading or restricted-spreading plants increased at the Utah Agricultural Experiment Station, Logan, Utah.

Elsberry is a southern early maturing type of bromegrass, the best of several accessions tested in the Soil Conservation Service Nursery at Elsberry, Missouri. It is believed to be derived from an old field of bromegrass located in northwestern Missouri or southeastern Iowa.

Homesteader is a composite of five strains originating from fields established in South Dakota 40 or 50 years ago. It has been increased at the South Dakota Agricultural Experiment Station, Brookings, South Dakota.

Manchar, a tall, leafy, semibunch type of bromegrass introduced from Manchuria under P.E.I. 109812 by the U. S. Department of Agriculture, was subjected to mass selection at Pullman, Washington. Its outstanding characteristics are seedling vigor and high seed production. It is intermediate in growth habit between the southern type, as exemplified by Achenbach, and the northern type of smooth bromegrass. It was increased at the Washington Agricultural Experiment Station, Pullman, Washington.

Martin is a mass selection developed from plants obtained from seed produced on an old bromegrass field in Martin County, Minnesota. It was increased at the Minnesota Agricultural Experiment Station, St. Paul, Minnesota.

Lyon (Nebr. 36), a selection similar to Lincoln, shows considerable refinement of plant characters over Lincoln bromegrass. It is outstanding in its production of high quality, relatively heavy seed. Preliminary testing shows it to be equal or superior to Lincoln bromegrass in forage and seed yields. Lyon was increased at the Nebraska Agricultural Experiment Station, Lincoln, Nebraska.

Lancaster (Nebr. 44) is a new strain developed at the Nebraska Agricultural Experiment Station, Lincoln, Nebraska. It is a synthetic variety produced by the hybridization of several unrelated outstanding plants. The variety has been superior in forage yield, quality, and seed yield in tests at the Nebraska Station.

RED CLOVER

H. L. Thomas

YIELD COMPARISONS

Tests conducted from 1923-27 by Prof. A. C. Arny showed that locally grown strains of medium red clover were markedly superior to introductions from foreign countries and southern United States. Average yields of forage collected from 32 experiments conducted from 1945 through 1952 (table 25) show the recommended varieties Wegener and Midland to be equal in yield and per cent stand to good commercial seed purchased in Minnesota. With this situation existing, it is still considered advisable to use named adapted varieties so that the seed is of known origin and performance. Seed of unknown origin may be inferior in performance.

Data on seed yield of the three varieties and of Minnesota commercial are given in table 26.

Dollard appears to be somewhat superior to the others in seed yield although the difference was not significant because of the high variability in the tests.

For the season of 1953 data are reported for 15 varieties. Table 27 shows forage yield at Rosemount, Waseca, Morris, and Grand Rapids and indicates seed yield at Rosemount, Waseca, and Morris. Blackstem resistance as rated on August 14 at Rosemount is shown in table 28.

Table 25. Average Yield of Forage in Tons per Acre at 15 Per Cent Moisture and Average Per Cent Stand Covering the Years 1945-52 Inclusive and Grouped by Locations

Locations	Number tests	Wegener		Midland		Dollard		Commercial	
		Stand	Yield	Stand	Yield	Stand	Yield	Stand	Yield
		per cent	bushels per acre	per cent	bushels per acre	per cent	bushels per acre	per cent	bushels per acre
Lewiston and Winona	2	90	3.31	93	3.32	88	3.51	95	3.14
Mantorville, Orrock, Elk River	5	79	2.38	74	2.34	75	2.16	66	2.18
University Farm, Rosemount	5	83	2.37	72	2.21	82	2.45	81	2.49
Breckenridge, Morris	9	95	2.81	95	3.01	94	2.60	94	2.75
Waseca	1	88	2.70	83	2.50	83	2.80	73	2.30
Crookston	4	97	1.65	97	1.62	97	1.96	97	2.04
Grand Rapids	5	90	3.12	90	3.19	91	2.96	92	3.19
Total	31								
Unweighted average		89	2.60	87	2.63	88	2.54	87	2.61

Table 26. Seed Production in Pounds Per Acre

	Year	Wegener	Midland	Dollard	Commercial
		pounds per acre			
Grand Rapids	1948	27	21	54	18
Crookston	1949	31	43	77	56
Rosemount	1950	96	93	80	109
Crookston	1950	11	17	39	23
Rosemount	1952	154	172	161	161
Morris	1952	194	154	236	171
Crookston	1952	139	98	93	109
Average		93	85	105	92

Table 27. Forage in Tons per Acre at 15 per Cent Moisture and Seed Yield in Pounds per Acre

Variety and source	Rosemount, cut June 25	Waseca, cut June 29	Morris, cut June 15	1st cut average	Morris, cut Aug. 5	Grand Rapids, cut Aug. 28	2nd cut average	Rosemount	Waseca	Morris	Seed average
F.S.N. Commercial Medium Red	2.30	1.56	1.49	1.78	2.64	.74	1.69	49	167	188	135
Wegener (Minn.)	2.08	1.63	1.37	1.69	2.29	.75	1.52	59	245	172	159
Midland (blend)	2.02	1.86	1.50	1.79	1.95	.74	1.34	59	206	144	136
Dollard (Quebec)	2.08	1.55	1.42	1.68	2.21	.74	1.47	81	264	225	190
Pennscott (Penn.)	2.06	1.86	1.24	1.72	2.38	.77	1.57	54	217	223	165
Rahn (Illinois)	2.25	1.79	1.57	1.87	2.21	.78	1.49	51	240	205	165
Ottawa (Ottawa)	2.23	1.88	1.35	1.82	2.38	.82	1.60	62	236	211	170
Van Atta (Ohio)	2.20	1.78	1.44	1.81	2.37	.78	1.57	52	250	140	147
Libel (Kansas)	2.12	1.73	1.25	1.70	2.20	.76	1.48	54	214	203	157
Purdue (Indiana)	2.07	1.78	1.53	1.79	2.10	.73	1.41	75	230	125	143
Van Fossen (Ohio)	2.04	1.64	1.31	1.66	2.33	.68	1.50	66	273	138	159
Kenland (Kentucky)	2.07	1.80	.98	1.62	2.04	.81	1.42	45	224	245	171
Wisconsin Mildew Resistant (Wisc.)	2.19	1.89	1.25	1.78	2.33	.77	1.55	55	242	228	175
Emerson (Iowa)	2.03	1.65	1.16	1.61	2.34	.73	1.53	44	201	204	150
L.S.D. at 5 per cent point	.08	.94	.37	.34	.25	.23	.17	17	101	91	46

Table 28. Reaction of Varieties of Red Clover to Black Stem at Rosemount, 1953

Variety and source	Blackstem resistance 1-5*
F.S.N. Commercial Medium Red	1.6
Wegener (Minn.)	3.4
Midland (blend)	3.2
Dollard (Quebec)	1.2
Pennscott (Penn.)	4.0
Rahn (Illinois)	3.6
Ottawa (Ottawa)	2.2
Van Atta (Ohio)	3.6
Libel (Kansas)	2.6
Purdue (Indiana)	1.8
Van Fossen (Ohio)	2.8
Kenland (Kentucky)	3.2
Wisconsin Mildew Resistant (Wisc.)	2.8
Emerson (Iowa)	4.0

* 1 most resistant; 5 least resistant.

Dollard looks relatively good throughout all the tests. It is the equal of any in forage yield and the highest in average seed yield (significantly so in 1953). Perhaps more important it was superior to all others in blackstem resistance at Rosemount in 1953. Dollard is distinguished by the fact that most of the leaves lack the light-colored leaf markings found on other red clover varieties. It is not recommended since there is as yet no seed of it available commercially.

Less extensive trials of Mammoth or single cut red clover have been conducted. In seven tests for the period 1945 to 1953, with all branch experiment stations represented, the forage yield of commercial Mammoth was compared with Altaswede. For the average, commercial Mammoth yielded 2.22 tons per acre and Altaswede significantly less, 2.01 tons. In the Rosemount test given above, commercial Mammoth was highly resistant to blackstem but Altaswede was not included.

Since Altaswede has been advertised as being long lived the data in table 29 are of particular interest. The stand percentages are from an experiment planted at Rosemount in 1949.

Table 29. Stand Percentages from an Experiment Planted at Rosemount in the Spring of 1950

	October 1950	May 1951	June 1952	May 1953
Wegener	43	58	100	8
Midland	42	55	83	15
Commercial Mammath	60	70	100	25
Altaswede	42	43	100	13

The stand of Altaswede did not persist as well as commercial Mammoth and persisted about the same as the double cut types, Wegener and Midland.

Altaswede has smooth (not hairy) leaves, which are reputed to make it susceptible to leafhopper attacks.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Wegener is a strain grown for a number of years by E. C. Wegener, Bertha, Minnesota. It is adapted to Minnesota conditions, is a good forage and seed yielder, and provides a good second cutting.

Midland is a blend of strains from Ohio, Indiana, Illinois, and Iowa, produced by cooperation of several midwest experiment stations and the United States Department of Agriculture. Under Minnesota conditions, it is equal to Wegener in forage yield for both first and second cuttings and is a good seed producer.

Varieties Not Recommended

The state of origin of all medium red varieties is shown in table 27. All of these are farm strains (i.e., a history in their own locality similar to Wegener) except Kenland and Wisconsin Mildew Resistant.

Kenland is the only variety of which large amounts of seed are commercially available. It is resistant to southern anthracnose and is adapted to approximately the southern half of the red clover belt. It is susceptible to northern anthracnose and is probably not sufficiently winterhardy for Minnesota. It was developed by the Kentucky Agricultural Experiment Station and the United States Department of Agriculture.

Wisconsin Mildew Resistant was developed by the Wisconsin Agricultural Experiment Station and the United States Department of Agriculture. As the name indicates, it is resistant to mildew. It has not been superior in yield and seed of it has never been produced in quantity.

Altaswede is a late, single-cut type developed by the Alberta, Canada, Agricultural Experiment Station. Despite claims that have been made for it, Altaswede has not proved to be perennial in tests in Minnesota, and it has yielded significantly less than commercial Mammoth.

BIENNIAL SWEETCLOVER

H. L. Thomas

YIELD COMPARISONS

The recommended varieties, Evergreen (white blossom) and Madrid (yellow blossom), are considerably better in forage yield in the fall of the seedling year than the commercial varieties. Evergreen has the added advantage of being two weeks later in flowering and a very rank-growing, heavy forage producer the second year.

Satisfactory seed yields have been obtained from both recommended varieties. See table 30 for a summary of data collected from experiment stations and other locations, 1945-52.

The recommended varieties of sweetclover are distinctly better than the

Table 30. Summary of Sweetclover Data

Variety	Forage yield of Commercial yellow*	Vigor rating†	Maturity rating
	per cent		
Evergreen	115	1.7	Very late
Madrid	102	2.0	Early
Commercial white	102	3.2	Medium
Commercial yellow	100	3.5	Early

* Taken second year, 15 per cent moisture.
† Class 1 rating is good, 5 is poor. Rating taken in fall of seedling year.

commercial strains which are being grown extensively.

ORIGIN AND DESCRIPTION OF VARIETIES

Recommended Varieties

Evergreen is a white-blossomed sweetclover introduction from Ohio. It produces a larger growth than common types the fall of the first year, is a heavy forage producer the second year, and comes to full bloom two to three weeks later than common types. Therefore, it has a longer grazing season.

Madrid is a yellow-blossomed, biennial type introduced into the United States from Madrid, Spain, in 1910. The first-year growth of Madrid is superior to common types and the forage and seed production the second year are satisfactory.

Varieties Not Recommended

Spanish, Reg. No. 1, is white blossomed. It was introduced from Madrid, Spain, in 1910 and was formerly called Madrid white.

Williamette is white blossomed. It was developed at Corvallis, Oregon, by growing successive generations in the same soil allowing disease organisms to eliminate the susceptible plants.

Nebraska Fine Stem is a selection made at the Nebraska Experiment Station.

Erector is a white-blossomed variety mass selected at Brandon, Manitoba. Its lower branches ascend at an acute angle.

No. 1 Arctic is derived from a Siberian importation. It has white blossoms.

Brandon Dwarf, a dwarf white, was developed at Brandon, Manitoba.

Alpha is a dwarf variety developed at the University of Saskatchewan.

DRY, EDIBLE PEAS AND FIELD PEAS

R. G. Robinson and O. C. Soine

Most of Minnesota's production of dry, edible peas is in the Red River Valley. The peas are sold to a processor for use in soup and pigeon feed, but pea seed can also be fed to sheep, hogs, and cattle. The seed is reported to contain over 20 per cent digestible protein. In other parts of the state, field peas are occasionally sown in a mixture with oats and harvested as a forage crop.

YIELD TRIAL DATA

Chancellor, Dashaway, and Multiplier are the recommended varieties, and their performance in comparison with that of other recently tested varieties at Crookston is shown in table 31. Rates of sowing of all varieties were adjusted for differences in seed size and germination so that equal numbers of viable seeds were sown on each plot. These adjustments were based on Chancellor of 90 per cent germination at two bushels per acre.

Forage trials of field pea-oat mixtures were conducted at Rosemount and in southwestern Minnesota, and the data are reported in table 32. In these trials peas and oats were mixed in the

Table 31. Averages of Pea Varieties for Seed Yield, Date of First Bloom, Date of Maturity, Weight per Bushel, and Weight of 100 Seeds at Crookston

Variety	Years of trial	Yield	Date of first bloom	Date of maturity	Bushel weight	Weight of 100 seeds
		bushels per acre			pounds	grams
Chancellor	1948-53	23.4	July 1	August 18	63.2	13.4
Dashaway	1948-53	23.6	June 30	August 18	63.4	12.9
Multiplier	1948-53	23.5	July 4	August 19	63.4	13.8
Guinevere	1952-53	18.9	July 11	August 13	63.7	21.0
Arthur	1952-53	17.7	July 5	August 10	62.6	23.7
Valley	1952-53	22.9	July 1	August 10	62.4	21.4
L.S.D. at 5 per cent point		2.1				

drill and sown at an acre rate equivalent to 1.5 bushels of Chancellor peas plus 1.5 bushels of oats. For forage purposes, pea variety did not seem to make much difference; however, observations indicate that the early blooming Dashaway or Chancellor are the preferable varieties for these pea-oat mixtures.

These trials have also indicated that rape, alfalfa, or vetch sown with the pea-oat mixtures made satisfactory stands, provided the pea-oat forage was not cut too low. The rape made sufficient growth to provide some pasture in the fall.

ORIGIN AND DESCRIPTION OF VARIETIES

Varieties Recommended

Chancellor is high yielding, medium in maturity, and long vined. The seed is small, cream colored, and high in bushel weight. The Dominion Experimental Farm at Ottawa, Canada, selected it in 1906 from an English variety also called Chancellor.

Dashaway is like Chancellor except it is one day earlier and has slightly smaller seeds. It was selected from Golden Vine by F. J. Dash, a Saskatchewan farmer, in 1914 and distributed by the University of Saskatchewan in 1922. It is grown on more acres in Minnesota than any other variety of dry, edible peas.

Multiplier is like Chancellor except it is somewhat later in flowering and maturing and has slightly larger seeds. It is thought to be of Canadian origin.

Varieties Not Adequately Tested

Valley is high yielding, early maturing, and long vined. The seed is large, cream colored, and high in bushel weight. It originated in 1924 at the Dominion Experimental Farm at Ottawa, Canada, from a cross of Chancellor x Early Raymond.

Varieties Not Recommended

Alaska is low yielding, very early maturing, and short vined. The seed is medium in size, green in color, and medium in bushel weight. It is also used as a canning variety. It was introduced as an American variety about 1884 but was probably the same as the English variety, Earliest of All. Many strains of this variety are available.

Arthur is medium in yield, early maturing, and long vined. The seed is large, cream colored, and high in bushel weight. It has many fasciated stems and bears its pods in a cluster at the top of the plant so is a good variety for combining. It is reported to be a good variety for splitting. It originated at the Dominion Experimental Farm at Ottawa, Canada, in 1892 from a cross of Mummy x Multiplier.

Table 32. Average Forage Yields, Protein Content, and Date of First Bloom of Pea-Oat Mixtures

Pea variety	Oat variety	Years of trial	Rosemount			Southwestern Minnesota		
			Forage*	Protein*	Date of first bloom	Forage*	Protein*	Date of first bloom
			pounds per acre	per cent		pounds per acre	per cent	
Chancellor	Branch	1951-53	5,457	12.3	June 24	5,657	12.2	June 27
Dashaway	Branch	1951-53	5,490	13.3	June 23	5,812	13.1	June 26
Multiplier	Branch	1951-52	4,840	12.9	July 2	5,867	12.8	June 29
Valley	Branch	1953	5,444	13.1	June 27	5,362	12.2	.....
Chancellor	Clinton	1953	5,716	12.9	June 24	.....	.....	.....
Dashaway	Clinton	1953	5,793	13.6	June 24	.....	.....	.....
Valley	Clinton	1953	5,906	13.0	June 27	.....	.....	.....
L.S.D. at 5 per cent point			2,714			859		

* 15 per cent moisture basis. Protein data not obtained in 1951.

Austrian is low yielding, late maturing, and medium in vine length. The seed is small, dark speckled in color, and high in bushel weight. It has pink flowers and is very fine stemmed. Large acreages are sown in the fall in the southern states and used for pasture, winter cover, and green manure. It originated in Austria.

Chang is high yielding, medium in maturity, and long vined. The seed is medium in size, high in bushel weight, and is cream colored with a black hilum. Processors do not like it because the black hilum spoils the appearance of whole pea soup. It has more seedling vigor than most other pea varieties. It is a University of Minnesota selection from seed introduced from China by the USDA.

Delwiche Early Scotch is low yielding, early maturing, and short vined. The seed is medium in size, mottled green in color, and medium in bushel weight. It originated from a cross of Alaska x Late Scotch and was released by the University of Wisconsin in 1949.

First and Best is medium in yield, is the earliest maturing, cream-colored variety, and is short vined. The seed is medium in size and bushel weight and seems to be desirable for splitting. It is of American origin and has sometimes been called Extra Early. It is grown on more acres in the United States than any other cream-colored pea.

Guinevere is like Arthur except it is somewhat later in maturity and higher yielding. It may be of lower quality than Arthur for edible purposes. A Canadian farmer selected it from Arthur in 1918, and it was increased in Saskatchewan.

Late Scotch is medium in yield, late in maturity, and long vined. The seed is medium in size, mottled green in color, and medium in bushel weight. It was selected from Scotch peas by the University of Wisconsin about 1910.

White Marrowfat is medium in yield, late maturing, and long vined. The seed is large, cream colored, and medium in bushel weight. It originated at the Dominium Experimental Farm at Ottawa, Canada, in 1891.