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APPROVED VARIETIES OF GRAIN AND CORN FOR MINNESOTA

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INTRODUCTION

The investigations in farm crops plant breeding and the variety trials carried on at University Farm and the substations have as their main aim the production of improved varieties of farm crops. After a new variety has proved its value by an experimental test, it is increased and is then distributed to farmers for further increase and trial.

The details of these experimental studies need not be given at this time. It is important, however, to point out that the various tests on which these recommendations are based are the result of cooperative effort on the part of central and substation men. The varieties grown for distribution are agreed upon in a general conference held each winter. All experiment station men who have any part in the production or distribution of varieties get together and decide which are the most promising. The final decision is in all cases based on carefully controlled experimental trials. New productions from other states are being constantly tried in Minnesota. When a pedigreed variety from another state shows desirable performance ability, it is as freely recommended as a variety produced at the Minnesota experiment station.

The purpose of this bulletin is to give a short history of recommended varieties and their distinguishing characteristics together with comparative data on yields. With this information at hand, growers should be better able to choose suitable varieties.

These recommendations are based on experimental studies. The final decision as to which variety to grow must be made by the farmer and based on the result of his own trial. By growing only standard recommended varieties the farmer can eliminate the partial failure which so often results from planting an over-exploited variety which may be totally unadapted to his conditions.

Unless some means is taken to keep these desirable varieties pure, they sooner or later become mixed with less desirable forms and their value is largely lost. Therefore, besides finding for growers the best possible varieties of farm crops and making first increases of them for distribution, the Minnesota Experiment Station is cooperating with the Minnesota Crop Improvement Association in registering and certifying seed of these varieties in the hands of the growers so that they may be maintained in a pure state and quantities of seed may be available for use each year.

RECOMMENDED VARIETIES OF FARM CROPS FOR MINNESOTA

The following varieties are recommended by a committee of men at University Farm and the substations. They have a record for favorable performance under experimental tests.

Wheat

Spring varieties: Common bread wheat, Marquis, accession No. 1239¹.

Durum wheat, Mindum, Minn. No. 470.

Winter varieties: Minturki, Minn. No. 1507.

Oats

Early maturing: Sixty Day, Minn. No. 675; Iowa 103, accession No. 531.

Medium maturing: Victory, accession No. 514; Minota, Minn. No. 512; Improved Ligowa, Minn. No. 281.

Barley

Six-rowed: Improved Manchuria, Minn. No. 184; Minsturdi, Minn. No. 439.

Two-rowed: Svansota, Minn. No. 440.

Rye

Swedish, Minn. No. 2, for general planting.

Rosen for southern Minnesota and other localities where winter-killing is not likely to be a factor.

Flax

Wilt-resistant varieties: Primost, Minn. No. 181, Blue Dutch, Minn. No. 182, North Dakota Resistant, No. 114.

¹ Accession number signifies that the particular variety referred to was originated at some other experiment station but has been tested in Minnesota and found desirable for use in the state.

Soybeans

Early maturing: Minsoy, Minn., No. 139.

Medium maturing: Chestnut, Minn. No. 110; Habaro, Minn. No. 109.

Field Peas

Golden Vine, Minn. No. 95.

Corn

Southern: Silver King, Murdock, Rustler, Minn. No. 13.

Central: Minn. No. 13, Rustler.

Northwestern and north central: Northwestern Dent, Early Minn. No. 13, Minn. No. 23, and flint varieties.

Northeastern: Earliest flints, such as Squaw, Gehu, and Dakota White.

METHOD OF COMPARING YIELDING ABILITY

The actual yields in bushels per acre of the different varieties at the central and substations are given. The yielding ability of each variety is compared with a standard, the yield of which is considered as 100. This makes a comparative consideration of the yields of the different varieties possible without doing any further figuring.

Spring Wheat

Marquis is a beardless, stiff-strawed, common spring wheat of the Fife group. This variety was produced in Canada from a cross between Hard Red Calcutta and Red Fife. Marquis ripens earlier than Bluestem, has stiff straw, produces good yields, and has proved of wide adaptability under various spring wheat conditions. Its chief defect is its susceptibility to black stem rust and its somewhat greater susceptibility to scab than some other spring wheats.

Mindum, Minn. No. 470, is a bearded, amber-seeded, durum wheat belonging to the Arnautka group. It resulted from the selection of a durum seed found in a common bread wheat. It was sent to the Crookston station in 1905 and proved a good yielder under Crookston conditions. In 1915 and 1916 it gave such high yields in the row tests made at University Farm and the substations that it was increased and placed in variety tests. As a result of these tests it has been increased for wider distribution. It is not quite so rust resistant as some North Dakota durums but more rust resistant than the Arnautka commonly grown. It has a high-yielding ability under Minnesota conditions.

Table 1. Comparative Average Yields per Acre of Spring Wheat Varieties at University Farm and the Substations

Variety	No.	Univ. Farm	Waseca	Morris	Crook- ston	Grand Rapids	Duluth
		(Bu.)	(Bu.)	(Bu.)	(Bu.)	(Bu.)	(Bu.)
<i>Three-year average (1919-1921)</i>							
Marquis	1239	22.1	19.5	14.4	15.1	4.3	16.9
Preston	924	23.3	17.8	11.8	14.4	3.4	15.3
Kitchener	2153	22.2	...	...	...	...	...
Bluestem	169	19.0	...	...	...	...	...
Mindum	470	23.3	29.5	16.0	21.9	6.8	18.5
Arnautka	2103	20.8	23.8	12.7	14.7	...	17.8
Kubanka	2102	...	20.1	12.5	17.0	...	16.0
Acme	1967	18.3	...	11.8	13.2	...	...
<i>(1920-1921)</i>							
Marquis	1239	23.6	20.0	12.6	16.3	5.8	16.0
Preston	924	23.9	17.9	10.5	16.2	4.8	16.1
Kitchener	2153	23.8	...	...	10.8	...	...
Bluestem	169	19.9	...	...	...	...	...
Ruby	2155	18.0	17.0	10.5	11.1	5.8	...
Red Bobs.....	2157	23.9	...	...	6.4	...	...
Kota	2151	20.5	...	...	13.1	...	...
Mindum	470	26.8	32.7	12.9	20.7	7.5	14.5
Arnautka	2103	22.2	25.9	10.8	14.2	...	17.7
Kubanka	2102	...	21.8	11.4	16.9	...	13.8
Acme	1967	20.5	25.6	8.7	11.6	...	16.9
Monad	2156	21.7	...	...	...	...	...
<i>Yield for 1921</i>							
Marquis	1239	24.8	20.0	12.5	15.1	6.5	16.7
Preston	924	23.0	17.4	8.9	11.1	2.4	15.1
Kitchener	2153	22.0	14.6	8.8	10.3	4.6	13.2
Bluestem	169	19.2	13.4	6.3	...	2.5	11.8
Ruby	2155	21.6	14.6	12.1	9.9	6.1	11.8
Red Bobs.....	2157	24.2	18.9	10.6	10.3	5.6	8.8
Kota	2151	23.0	13.6	9.6	10.1	4.1	10.4
Mindum	470	29.1	28.6	13.8	15.9	6.1	20.5
Arnautka	2103	24.7	24.9	11.5	12.4	4.4	22.4
Kubanka (98).....	2192	20.1	18.2	10.6	12.6	5.0	16.6
Acme	1967	22.7	18.2	9.9	12.1	5.4	17.8
Monad	2156	23.2	21.2	11.0	13.7	5.1	19.8

With the yield of Marquis considered as 100, an examination of the data shows clearly that, on the average, it has been the highest yielding common spring bread wheat. The yielding ability of Marquis combined with its excellent milling qualities make it the most desirable common spring wheat variety. Tests have shown Mindum to be of good quality for the production of macaroni and other durum wheat products. The demand for durum wheat for the manufacture of macaroni products is comparatively limited. Therefore no large increase in the acreage planted to durum wheat is desirable.

Table 2. Comparative Average Yields of Spring Wheat Varieties at University Farm and the Substations
(Yield of Marquis considered as 100)

Variety	No.	Univ. Farm	Waseca	Morris	Cookston	Grand Rapids	Duluth
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<i>Three-year average (1919-1921)</i>							
Marquis	1239	100.0	100.0	100.0	100.0	100.0	100.0
Preston	924	105.4	91.2	81.9	95.4	79.1	90.5
Kitchener	2153	100.5	...	...	...	...	...
Bluestem	169	86.0	...	...	...	...	...
Mindum	470	105.4	151.3	111.1	145.0	158.1	109.5
Arnautka	2103	94.1	122.1	88.2	97.4	...	105.3
Kubanka	2102	...	103.1	86.8	112.5	...	94.5
Acme	1967	82.8	...	81.9	87.4	...	...
<i>Two-year average (1920-1921)</i>							
Marquis	1239	100.0	100.0	100.0	100.0	100.0	100.0
Preston	924	101.3	89.5	83.3	99.4	82.8	100.6
Kitchener	2153	100.9	...	...	66.3	...	...
Bluestem	169	84.3	...	...	...	...	...
Ruby	2155	76.3	85.0	83.3	68.1	100.0	...
Red Bobs	2157	101.3	...	...	39.3	...	...
Kota	2151	86.9	...	...	80.3	...	...
Mindum	470	113.6	163.5	102.4	126.9	129.3	90.6
Arnautka	2103	94.1	129.5	85.7	87.1	...	110.6
Kubanka	2102	...	109.0	90.5	103.7	...	86.3
Acme	1967	86.9	128.0	69.1	71.2	...	105.6
Monad	2156	92.0	...	...	...	...	...
<i>Yield for 1921</i>							
Marquis	1239	100.0	100.0	100.0	100.0	100.0	100.0
Preston	924	92.7	87.0	71.2	73.5	36.9	90.4
Kitchener	2153	88.7	73.0	70.4	68.2	70.7	79.0
Bluestem	169	77.4	67.0	50.4	...	38.5	70.7
Ruby	2155	87.1	73.0	96.8	65.5	93.8	70.7
Red Bobs	2157	97.6	94.5	84.8	68.2	86.2	52.7
Kota	2151	92.7	68.0	76.8	66.9	63.0	62.3
Mindum	470	117.3	143.0	110.4	105.3	93.8	122.8
Arnautka	2103	99.6	124.5	92.0	82.1	67.7	134.1
Kubanka (98)	2102	81.0	91.0	84.8	83.4	70.9	99.4
Acme	1967	91.5	91.0	79.2	80.1	83.1	106.6
Monad	2156	93.5	106.0	88.0	90.7	78.5	118.6

Besides those of the recommended varieties, Marquis and Mindum, the comparative yields of a number of other spring wheats are given. **Haynes Bluestem, Minn. 169**, has been largely superseded by Marquis in the state. **Kitchener** and **Red Bobs** are selections made by Seeger Wheeler in Canada. They do not appear to be of value for Minnesota. **Ruby**, a variety of common wheat which was originated at Ottawa, Canada, produces grain of very high quality. It has yielded less than Marquis. **Kota** is a rust resistant common wheat originated at the North Dakota Experiment Station. In 1920, at University Farm, it showed weak straw and

only moderate yield. In 1921 it gave a better yield than in 1920, but its value is not yet known. **Arnautka** has not yielded as high as **Mindum** and is more susceptible to black stem rust. **Acme**, originated at the South Dakota Experiment Station, is rust resistant but has not proved a good yielder in Minnesota. **Monad**, originated at the North Dakota Experiment Station, is rust resistant but has not yielded as high as **Mindum** in the state. **Monad** is a more desirable wheat to grow than **D-5**, a red durum of low value for macaroni production, originated at the North Dakota Experiment Station. **D-5** should not be grown in Minnesota.

Black stem rust has reduced the yields of the spring wheats at Grand Rapids very materially. The varieties of spring wheat available at present can not be recommended for use in that part of the state.

Minturki, Minn. No. 1507, winter wheat, is a bearded, white-chaffed winter wheat which produces seeds of the well-known Turkey type. It is a result of a definite attempt made by the Minnesota station to produce a hardy winter wheat. Over 200 varieties from foreign countries and other sections of the United States have been tried without obtaining any variety which proved satisfactory for all characters. From testing these varieties it was found that Turkey winter wheat excelled in seed characters but was frequently injured under severe winter conditions. Under less severe conditions it produces good yields. **Odessa** is a red-chaffed, beardless winter wheat obtained from Russia. It matures later than Turkey, produces moderate yields, and is quite winter hardy. **Minturki** was produced by crossing Turkey and Odessa. The original cross was made in 1902 and the new variety, **Minturki**, was first increased in 1919. Registered seed of this variety will be available in quantity for seeding in the fall of 1922.

In addition to the yields of the recommended variety, **Minturki**, those of several other promising varieties are included. **Minhardi, Minn. No. 1505**, is a beardless, white, smooth chaffed wheat, resulting from a cross of **Odessa** and **Turkey**. It is stiffer strawed than **Minturki** and somewhat more resistant to winter injury. At University Farm, **Minhardi** has yielded about as well as **Minturki**. It does not seem as widely adapted to Minnesota conditions as **Minturki** and produces grain of somewhat less desirable quality. **Red Rock**, originated at the Michigan Experiment Station, has not proved as winter hardy as **Minturki** and **Minhardi**. It also shatters easily. The quality of the grain is high. **Crimean, accession No. 845**, has proved much more winter hardy than commercial Turkey varieties and produces grain of good quality.

Table 3. Comparative Average Yields per Acre of Winter Wheat at University Farm, Waseca, and Morris

Variety	No.	University Farm	Waseca	Morris
		Bu.	Bu.	Bu.
<i>Three-year average</i> (1919-1921)				
Minturki	1507	26.2	25.8	...
Minhardi	1505	24.5	20.3	...
Crimean	845	23.0	20.6	...
Red Rock.....	2154	19.7	...	...
<i>Two-year average</i> (1919-1921)				
Minturki	1507	23.4	27.2	...
Minhardi	1505	21.8	21.7	...
Crimean	845	20.9	20.5	...
Red Rock.....	2154	16.0	...	...
<i>Yield for 1921</i>				
Minturki	1507	14.0	14.3	17.7
Minhardi	1505	12.1	9.0	17.5
Crimean	845	13.9	9.4	16.6
Red Rock.....	2154	3.8	2.9	7.1

Table 4. Comparative Average Yields of Winter Wheat Varieties
(Yield of Minturki at University Farm, Waseca, and Morris Considered as 100)

Variety	No.	University Farm	Waseca	Morris
		Per cent	Per cent	Per cent
<i>Three-year average</i> (1919-1921)				
Minturki	1507	100.0	100.0	100.0
Minhardi	1505	93.5	78.7	...
Crimean	845	87.8	79.8	...
Red Rock.....	2154	75.2	...	...
<i>Two-year average</i> (1920-1921)				
Minturki	1507	100.0	100.0	...
Minhardi	1505	93.2	79.8	...
Crimean	845	89.3	75.4	...
Red Rock.....	2154	68.4	...	...
<i>Yield for 1921</i>				
Minturki	1507	100.0	100.0	100.0
Minhardi	1505	86.4	62.9	98.8
Crimean	845	99.3	65.7	93.8
Red Rock.....	2154	27.1	20.7	40.1

Oats

Sixty Day, Minn. No. 674, is an open paniced, white-seeded, early maturing oat. This variety resulted from a plant selection made in 1917 in a mixed commercial early oat. The purpose of this selection was to obtain a stiff-strawed, early white oat with high-yielding ability. Tests of this new selection made at both University Farm and the substations have shown that it has remarkably stiff or erect straw. It has yielded as well as Iowa No. 103 or slightly better. A very limited amount of this oat is available for distribution in the spring of 1922.

Iowa 103, accession No. 531, is an open-paniced, early-maturing white-kerneled oat coming from an individual plant selection from Kherson made at the Iowa Experiment Station in 1906. It has proved a higher yielder than other early varieties with which it was compared prior to 1920 and it has been recommended to Minnesota growers as the best early oat of which seed is available in quantity.

Table 5. Comparative Average Yields per Acre of Oat Varieties at University Farm and the Substations

Variety	No.	Univ. Farm	Waseca	Morris	Crookston	Grand Rapids	Duluth
		Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
<i>Three-year average (1919-1921)</i>							
Victory	514	50.5	...	25.0	...	42.2	56.8
Minota	512	50.6	...	27.3	...	...	55.3
Silvermine	506	51.1	...	29.3	...	36.6	53.2
Swedish Select.....	513	47.2	...	24.3	...	36.1	...
Improved Ligowa....	281	48.2	...	...	...	33.1	54.8
Iowa 103.....	531	46.7	...	36.5	...	41.1	49.0
<i>Two-year average (1920-1921)</i>							
Victory	514	54.1	56.1	32.2	45.8	46.1	58.5
Minota	512	55.2	63.6	25.7	51.7	45.8	58.8
Silvermine	506	52.5	57.6	30.1	49.4	41.8	57.0
Swedish Select.....	513	51.3	51.9	24.3	38.6	41.2	...
Improved Ligowa....	281	48.8	...	...	42.2	34.0	59.1
Iowa 103.....	531	47.9	58.7	35.2	36.8	38.8	46.3
Iowar	670	47.4	68.0	39.3	36.1	40.3	57.6
Sixty Day.....	674	54.2	69.1	43.9	...	40.5	53.4
<i>Yield for 1921</i>							
Victory	514	44.1	37.9	32.8	27.8	33.4	41.6
Minota	512	47.3	45.8	30.7	46.9	34.9	47.0
Silvermine	506	44.3	42.7	35.4	36.5	29.2	45.8
Swedish Select.....	513	39.1	35.3	29.3	28.3	26.6	38.1
Improved Ligowa....	281	41.6	...	...	28.3	19.8	40.5
Iowa 103.....	531	43.1	54.4	33.1	38.3	31.1	41.6
Iowar	670	34.3	63.3	45.0	31.8	28.1	56.2
Sixty Day.....	674	50.7	66.5	48.7	40.7	20.7	49.7

Minota, Minn. No. 512, is an open-panicled, medium-maturing oat which has shown its ability to give good yields under various Minnesota conditions. It is the result of one of several plant selections made in 1906 from a commercial variety of oats grown on the farm of James A. Bull. It was first placed in variety trials in 1915 and was named Minota in 1919 after having shown its adaptability for Minnesota conditions.

Victory, accession No. 514, is an open-panicled, medium maturing, large, plump-kerneled, white oat with straw of good length. The kernels have weak awns or none. It was originated at Svalof, Sweden, and was first introduced into the nursery at University Farm in 1908. A later introduction came from the Department of Field Husbandry of the University of Saskatchewan in 1915. It has proved a reliable yielder in Minnesota.

Improved Ligowa, Minn. No. 281, is an open-panicled, medium maturing, plump, white oat with heavy to light awns. It has straw of medium length and stiffness. It originated through a head selection made in 1895 from the Swedish Select group. It is a good yielder and has been grown widely in the state.

Table 6. Comparative Average Yields of Oat Varieties
(Yields of Victory at University Farm and the Substations Considered as 100)

Variety	No.	Univ.	Waseca	Morris	Crook-	Grand	Duluth
		Farm			ston	Rapids	
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<i>Three-year average</i> (1919-1921)							
Victory	514	100.0	100.0	100.0	100.0	100.0	100.0
Minota	512	100.2	...	97.6	...	...	97.4
Silvermine	506	101.2	...	104.6	...	86.7	93.7
Swedish Select.....	513	93.5	...	86.8	...	85.5	...
Improved Ligowa....	281	95.4	...	...	...	78.4	96.5
Iowa 103.....	531	92.5	...	130.4	...	97.4	86.3
<i>Two-year average</i> (1920-1921)							
Victory	514	100.0	100.0	100.0	100.0	100.0	100.0
Minota	512	102.0	113.4	79.8	112.9	99.3	100.5
Silvermine	506	97.0	102.7	93.5	107.9	90.7	97.4
Swedish Select.....	513	94.8	92.5	75.5	84.3	89.4	...
Improved Ligowa....	281	90.2	...	...	92.1	73.8	101.0
Iowa 103.....	531	88.5	104.6	109.3	80.3	84.2	79.1
Iowar	670	87.6	121.2	122.0	78.8	87.4	98.5
Sixty Day.....	674	100.2	123.1	136.3	...	87.9	91.3
<i>Yield for 1921</i>							
Victory	514	100.0	100.0	100.0	100.0	100.0	100.0
Minota	512	107.3	120.8	93.6	102.4	104.5	113.0
Silvermine	506	100.5	112.7	107.9	79.7	97.4	110.1
Swedish Select.....	513	88.7	93.1	89.3	61.8	79.6	91.6
Improved Ligowa....	281	94.3	...	...	61.8	59.3	87.4
Iowa 103.....	531	97.7	143.5	100.9	83.6	93.1	100.0
Iowar	670	77.8	167.0	137.2	69.4	84.1	135.1
Sixty Day.....	674	115.0	175.5	148.5	88.9	91.9	118.0

The results given in the tables show that mid-season oats should be grown in central and northern Minnesota. Victory, Minota, and Silvermine seem about equally valuable. Improved Ligowa seems less desirable at all stations except Duluth, where it has given good yields. The early maturing varieties appear best suited to west central and southern Minnesota.

Barley

Manchuria, Minn. No. 184, is a 6-rowed barley which resulted from an individual plant selection made in 1901. It was increased for distribution in 1918. It is the best variety of the Manchuria group that has been tested in Minnesota up to the present time and gives good yields under various Minnesota conditions.

Minsturdi, Minn. No. 439, is a dense-headed, stiff, short-strawed, 6-rowed variety produced by a cross between the varieties South African and Manchuria. The Manchuria parent had high yielding ability and the South African parent excelled in stiffness of straw. The new variety has stiff straw and good yielding ability.

Svansota, Minn. No. 440, is a 2-rowed barley which resulted from a cross between Svanhals, a 2-rowed variety, and U. S. Dept. No. 456. It has quite stiff straw, and has proved somewhat better yielding than Chevalier. Both Svansota and Minsturdi are the result of coöperative investigations carried on between the United States Department of Agriculture and the Minnesota Experiment Station. The yields of the 2-rowed variety, Svansota, at the Duluth substation indicate that this variety can be used to good advantage in northeastern Minnesota.

Table 7. Comparative Average Yield per Acre of Barley Varieties at University Farm and the Substations

Variety	No.	Univ. Farm	Waseca	Morris	Crook- ston	Grand Rapids	Duluth
<i>Three-year average</i>		Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
Impr. Manchuria.....	184	30.1	38.7	30.1	...	28.7	39.2
Minsturdi	439	32.2	37.7	25.0	...	29.4	37.2
Svansota	440	28.6	32.4	27.2	...	24.3	45.8
Chevalier	230	28.2	33.8	...	...	25.1	33.0
<i>Two-year average</i>							
Impr. Manchuria.....	184	27.4	40.7	30.5	27.6	24.3	35.3
Minsturdi	439	36.2	37.9	20.4	29.8	24.0	34.6
Svansota	440	30.9	32.1	22.6	25.7	20.5	41.8
Chevalier	230	28.7	35.9	...	23.9	20.2	28.8
<i>Yield for 1921</i>							
Impr. Manchuria.....	184	26.9	47.8	28.8	24.4	14.5	25.5
Minsturdi	439	43.3	42.6	21.3	25.2	14.9	29.0
Svansota	440	32.5	29.0	21.5	23.1	9.4	33.5
Chevalier	230	29.5	34.3	21.0	17.0	9.9	24.1

Table 8. Comparative Average Yields of Barley Varieties

(Yields of Improved Manchuria at University Farm and the Substations Considered as 100)

Variety	No.	Univ. Farm	Waseca	Morris	Crookston	Grand Rapids	Duluth
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<i>Three-year average (1919-1921)</i>							
Impr. Manchuria.....	184	100.0	100.0	100.0	100.0	100.0	100.0
Minsturdi	439	107.0	97.4	83.1	...	102.4	94.9
Svansota	440	95.0	83.7	90.3	...	84.7	116.8
Chevalier	230	93.7	87.3	...	...	87.5	84.2
<i>Two-year average (1920-21)</i>							
Impr. Manchuria.....	184	100.0	100.0	100.0	100.0	100.0	100.0
Minsturdi	439	132.1	93.1	66.9	108.0	98.8	98.0
Svansota	440	112.8	78.9	74.1	93.1	84.4	118.4
Chevalier	230	104.7	88.2	...	86.6	83.1	81.6
<i>Yield in 1921</i>							
Impr. Manchuria.....	184	100.0	100.0	100.0	100.0	100.0	100.0
Minsturdi	439	161.0	89.1	74.0	103.3	102.8	113.7
Svansota	440	120.8	60.7	74.7	94.7	64.8	131.4
Chevalier	230	109.7	71.8	72.9	69.7	68.3	94.5

Besides the yields of the recommended varieties, that of French Chevalier, a 2-rowed variety developed at the Minnesota Experiment Station is included. It has not proved as satisfactory as Svansota.

Winter Rye

Minnesota No. 2 was produced by individual plant selections from a rye obtained in 1895 from John Brogard, Henning, Minnesota. It proved much superior to commercial varieties and was increased and distributed in 1908 as a commercial variety.

Table 9. Comparative Average Yield per Acre of Rye Varieties at University Farm and the Substations

Variety	No.	Univ. Farm	Waseca	Morris	Duluth
		Bu.	Bu.	Bu.	Bu.
<i>Two-year average</i>					
Swedish	2	29.6	30.6	12.0	18.3
Rosen	82	31.7	37.7	...	16.9
Wis. Pedigree.....	84	30.0	24.5	...	17.4
Spring Rye.....	61	20.6	23.8	6.1	17.5
<i>Yield for 1921</i>					
Swedish	2	19.5	24.7	17.6	22.7
Rosen	82	18.1	28.6	16.3	23.2
Wis. Pedigree.....	84	19.1	24.8	19.7	21.7
Spring Rye.....	61	14.1	18.1	8.7	12.9

Table 10. Comparative Two-Year Average Yields of Rye Varieties
(Yields of Swedish at University Farm, Waseca, Morris, and Duluth Considered as 100)

Variety	No.	Univ.	Waseca	Morris	Duluth
		Farm			
		Per cent	Per cent	Per cent	Per cent
<i>Two-year average</i>					
<i>(1920-21)</i>					
Swedish	2	100.0	100.0	100.0	100.0
Rosen	82	107.1	127.4	...	92.3
Wis. Pedigree	84	101.4	82.8	...	95.1
Spring Rye	61	69.6	80.4	50.8	95.6
<i>Yield for 1921</i>					
Swedish	2	100.0	100.0	100.0	100.0
Rosen	82	92.8	115.8	92.6	102.2
Wis. Pedigree	84	97.9	100.4	111.9	95.6
Spring Rye	61	72.3	73.2	49.4	56.8

In addition to the yields of the recommended variety, Swedish, Minnesota No. 2, yield data for Rosen and Wisconsin Pedigree are given. **Rosen**, a variety developed at the Michigan Experiment Station, has proved a good yielder in Southern Minnesota. On sandy lands and on lands where surface water is likely to stand during fall or spring, it has shown more winter-killing than the Swedish. **Wisconsin Pedigree** was originated at the Wisconsin Experiment Station. It has yielded about as well as Minnesota No. 2.

Flax

One of the great difficulties in growing flax is the loss which results so frequently from flax wilt. While this disease may be controlled in part by crop rotation and seed disinfection, cases have been reported of serious wilt injury even tho no crop of flax had been grown on the land for many years. The best means of controlling this disease is the use of seed of wilt-resistant varieties. The first wilt-resistant varieties obtained were produced by selection at the North Dakota station. Two North Dakota varieties, **N. D. No. 52** and **N. D. No. 114**, have been distributed. These are the only varieties now available in quantity which are wilt-resistant, No. 114 being apparently somewhat more resistant than No. 52.

Selection experiments were started several years ago by the section of plant pathology of the Minnesota Experiment Station, with the view of solving the flax wilt problem through seed selection. This investigation has been carried on coöperatively in recent years with the Division of Agronomy and Farm Management, and two new wilt-resistant varieties have been produced. These have been obtained by selection from Minnesota accession Nos. 25 and 175,

respectively. They have been increased from plant pathology selection Nos. 25-7 and 175-1. An acre of selection No. 25-7 was grown at the Crookston station in 1921 and is being distributed under the name Primost, Minnesota No. 181. An increase plot of 175-1 was grown at University Farm in 1921 and is being distributed under the name Blue Dutch, Minnesota No. 182.

Professor Bolley, of the North Dakota station, believes that after being grown several years on clean soil a wilt-resistant variety loses its wilt-resistant character. To what extent this is commonly true or just how many years may elapse before a variety loses its resistance is not yet known. Using seed of wilt resistant varieties and avoiding very late planting are two important steps in the production of good yields of flax.

Table 11. Comparative Average Seed Yields per Acre of Soybean Varieties at University Farm, Waseca, and Morris

Variety	No.	University	Waseca	Morris
		Farm		
		Bu.	Bu.	Bu.
<i>Three-year average</i> (1919-21)				
Chestnut	110	20.6	...	23.9
Soysota	142	...	...	29.8
Minsoy	139	19.8	...	22.4
Wis. Pedigree I.....	164	20.6	...	22.9
Habaro	109	19.8	...	...
Elton	167	18.5	...	26.7
<i>Two-year average</i> (1920-21)				
Chestnut	110	14.5	22.9	23.2
Soysota	142	...	...	30.3
Minsoy	139	14.3	22.7	23.8
Wis. Pedigree I.....	164	14.7	24.9	23.4
Habaro	109	15.1	21.8	...
Elton	167	14.5	23.6	28.4
Mandarin	182	13.1	15.3	25.2
Manshuri	184	15.6	...	20.9
<i>Yield for 1921</i>				
Chestnut	110	32.8	32.2	23.0
Soysota	142	...	36.1	26.9
Minsoy	139	30.9	32.1	20.7
Wis. Pedigree I.....	164	32.4	37.1	24.1
Habaro	109	29.0	28.3	...
Elton	167	26.5	30.0	21.8
Mandarin	182	32.4	20.8	25.9
Manshuri	184	25.5	...	25.5

Soybeans

Chestnut, Minnesota No. 110, is a medium maturing variety requiring 110 to 120 days for complete development and is an upright growing variety averaging 34 to 35 inches in height. It is leafy and retains its leaves upon approaching maturity, which is desirable from the silage standpoint. The seed pods turn very dark

brown to black upon reaching maturity and the seeds are kidney-shaped and light brown in color. It was developed through selection of an individual plant in 1909 from seed obtained from the United States Department of Agriculture under the name of Chestnut. It has proved a good yielder of seed and a desirable variety for silage. It was distributed in 1918 as suitable for central and southern Minnesota.

Table 12. Comparative Average Seed Yields of Soybean Varieties
(Yield of Chestnut at University Farm, Waseca, and Morris Considered as 100)

Variety	No.	University Farm	Waseca	Morris
		Per cent	Per cent	Per cent
<i>Three-year average</i> (1919-21)				
Chestnut	110	100.0	...	100.0
Soysota	142	...	...	124.7
Minsoy	139	96.1	...	93.7
Wis. Pedigree I.....	164	100.0	...	95.8
Habaro	109	96.1	...	...
Elton	167	89.8	...	111.7
<i>Two-year average</i> (1920-21)				
Chestnut	110	100.0	100.0	100.0
Soysota	142	...	...	130.6
Minsoy	139	98.6	99.1	102.6
Wis. Pedigree I.....	164	101.4	108.7	100.9
Habaro	109	104.1	95.2	...
Elton	167	100.0	103.1	122.4
Mandarin	182	90.3	66.8	103.6
Manshuri	184	107.6	...	90.1
<i>Yield for 1921</i>				
Chestnut	110	100.0	100.0	100.0
Soysota	142	...	112.1	117.0
Minsoy	139	94.2	99.7	90.0
Wis. Pedigree I.....	164	98.8	115.2	104.8
Habaro	109	88.4	87.9	...
Elton	167	80.8	93.2	94.8
Mandarin	182	104.3	64.6	112.6
Manshuri	184	77.7	...	110.9

Table 13. Three-Year Comparative Average Yields of Silage and Hay per Acre from Soybean Varieties at University Farm
(Yield of Chestnut Considered as 100)

Variety	No.	Silage		Hay	
		Tons	Per cent	Tons	Per cent
Chestnut	110	7.8	100	2.68	100
Habaro	109	8.2	106	2.68	100
Elton	169	6.7	86	2.45	91
Wisconsin Black.....	118	6.1	78	2.31	86
Soysota	112	6.7	86	2.31	86
Wis. Pedigree I.....	164	5.5	71	2.19	82
Minsoy	139	4.0	51	1.80	67

Minsoy, Minn. No. 139, was derived from an individual plant selection made in 1912. It is a low growing variety averaging 22 to 25 inches in height and maturing in from 90 to 100 days and therefore is not suited to growing with corn for silage in central and southern Minnesota. It retains its leaves after maturity, has pods tawny yellow in color and rather small, round, light yellow seeds. This variety has averaged as high in seed yields as any other in the trials and is recommended for seed production throughout the state and particularly for northern Minnesota where early maturity is a necessity. Where soybeans are planted with early corn for hogging-off purposes, this variety may be used to advantage.

Wisconsin Pedigree I is a selection from Wisconsin Black made at the Spooner station, Wisconsin. It is uniform in plant habit and medium early in maturity. It is suited to the north central and northern part of the state for seed production.

Habaro, Minn. No. 109, was derived from an individual plant selected in 1909 from a commercial variety of this name. It is a very upright, leafy variety of approximately the same height as Chestnut but slightly later in time of maturity. The seeds are light yellow and considerably larger and rounder than those of Chestnut. This variety has proved a desirable seed yielder and a somewhat heavier yielder of forage than Chestnut. It was increased at the Waseca substation in 1920 and appears promising for southern Minnesota.

The yields of three varieties in addition to the ones recommended are given:

Soysota, developed from an individual plant at the Minnesota Experiment Station, is similar to Chestnut in maturity. It is as good a yielder as Chestnut but averages two or three inches less in height and has yielded somewhat less per acre of hay and silage.

Elton was also developed from an individual plant at the Minnesota Experiment Station. At University Farm it has not proved as satisfactory as Chestnut but appears well adapted to southern Minnesota and Iowa.

Field Peas

Golden Vine, Minn. No. 95, is a medium tall growing variety with small smooth, yellow seeds. It matures at about the same time as Victory or Silvermine oats and is therefore suitable for growing with these varieties for hay or seed.

VARIETIES OF CORN FOR MINNESOTA

Minnesota may be divided approximately according to the length of the growing season for corn, into three sections, the southern, central, and northern.

In addition to the local varieties being grown in these sections, several standard varieties are known to be adapted.

Varieties for Southern Minnesota

These varieties are comparatively tall, strong growers, requiring from 120 to 130 days to reach maturity. They are recommended for the most productive soils in the section. On the less productive soils, the earlier maturing varieties recommended for central Minnesota, should be used. For early hogging-off, the varieties recommended for northern Minnesota may be used.

Silver King is a more or less rough, creamy-white, dent corn averaging 16 rows to the ear with comparatively deep kernels. The stock from which the variety, as now grown, was developed was brought to Iowa from Indiana in 1862.

Murdock is a comparatively rough, yellow, dent corn averaging 16 rows to the ear. In kernel characteristics, other than color, it is similar to Silver King. The early history of the variety has not been traced.

Varieties for Central Minnesota

The varieties recommended for central Minnesota are earlier maturing than those recommended for southern Minnesota. They require from 110 to 120 days to reach maturity. For early hogging-off purposes, the early varieties recommended for northern Minnesota may be used.

Minnesota No. 13 is a comparatively smooth, 16-rowed, yellow dent variety. The kernels are of medium depth. Early strains of this variety are grown in the western and central portions of the northern section. Seed from which this variety was developed at the Minnesota Experiment Station was secured in 1893 from a seed firm in St. Paul.

Rustler is a comparatively smooth, 16-rowed, white dent corn, similar to Minnesota No. 13 in kernel characteristics. This corn was brought to this state in 1895 by a Minneapolis seed firm. Earlier than this its history is not known. It has been improved at the Minnesota Experiment Station.

Varieties for Northern Minnesota

In northwestern and north central Minnesota early strains of Minn. No. 13 and Rustler may be grown successfully on the more productive soils. In northeastern Minnesota, particularly adjacent to Lake Superior, only the earliest flints are recommended for grain production.

Northwestern Dent is a 12-rowed, yellow-capped, red dent. The ears are comparatively smooth and the kernels are medium to shallow in depth. The plant is vigorous and of good size, making it suitable for both silage and grain production. Its early history is not known.

Minnesota No. 23 is a smooth 12-rowed, white-capped yellow dent corn. It is not as strong a grower as Northwestern Dent and is therefore not so well suited to both silage and grain production. It was secured from Jacob Berg, Mentor, Minnesota, in 1893, and was increased and distributed in the northern section.

Longfellow Flint grows to approximately the same height as Minnesota No. 13. It is an 8-rowed, yellow flint.

Triumph Flint gives a sturdier plant than Longfellow, and is usually somewhat later in maturity. The ears average 12 rows. It should be grown only on the more productive soils of this section.

Squaw (variously colored), **Gehu** (yellow), and **Dakota White** (white) are very low growing, early maturing flint varieties not suited to growing for silage purposes.

METHODS OF DISTRIBUTING AND CERTIFYING SEED

Each year increase plots of the recommended varieties are grown at University Farm and the substations. These plots are carefully rogued during the growing season. The crop is carefully harvested, threshed, and cleaned, particular attention being paid to the elimination of mixtures. This improved seed is then sold to certain farmers who will further grow and increase it.

The experiment station coöperates with the Minnesota Crop Improvement Association in keeping a record of the recommended varieties after they have been distributed to the farmer. A grower obtaining seed which is being increased, from any of the stations may apply through the association for a field and bin inspection of his field and threshed grain, respectively. If the field is in such condition that the inspector thinks the crop will produce good, un-mixed seed, and if it is relatively free from noxious weeds and diseases, the inspector reports favorably. Another inspection is made of the seed after it is cleaned and ready for use or sale by the

grower. If it then comes up to the standard qualifications for good, pure seed, as set by this association, a certificate of inspection is issued to the grower and a record is made of the seed. The grower is required to report to whom the seed is sold so that a complete history can be kept.

A crop produced from seed which was obtained from the station increase fields is recorded as second generation seed. Seed can be registered for two generations after being obtained from a station. It may be registered after that only if the grower maintains a special seed plot which is very carefully rogued. Plants from such a seed plot must be cut by hand and threshed by hand. Also he may register seed if a new supply is secured from the experiment station or from another grower who has maintained a seed plot and kept the seed pure. Hand selected grain which meets the requirements may be registered for three generations. A grower may have his seed recorded with the association after the third year as certified seed if he does not care to maintain a seed plot. Any variety may qualify as certified seed providing it meets certain standards of purity, freedom from disease and noxious weeds.

The method of inspecting and certifying may be summarized as follows:

1. The grower wanting to have his crop inspected writes to the secretary of the Minnesota Crop Improvement Association, University Farm, St. Paul, for an application blank.

2. The application blank is filled out by the grower and returned to the secretary. The application contains information as to crop, variety, number of acres, and where seed was obtained. It must be accompanied by a fee of \$3. One dollar of this is for membership in the association, and \$2 is the initial field inspection fee.

3. The secretary makes arrangements to have an inspector visit the farm some time before harvest to make the field inspection.

4. The inspector makes a report on the condition of the crop, its purity, freedom from weeds and diseases, and general condition of the farm. If everything is satisfactory, a final bin inspection is recommended. Otherwise the field is rejected for registered or certified seed.

5. After threshing, the grower sends in an application for bin inspection. This must be accompanied by a half-pint sample of grain cleaned as he expects to have it for sale, and a final inspection fee of \$2. A laboratory test is made as to purity and germination. If the sample is satisfactory, arrangements are made to inspect the seed in the bin. If this is found equal to the sample submitted

and up to all requirements, the inspector recommends that a certificate be issued for the seed. The inspector takes a 2-quart sample of the grain, 5 ears of corn, or 1 quart of grass seed to keep on file at the office.

6. The association sends the grower a certificate showing that the seed has been inspected both in the field and in the bin and is classified as either registered or certified seed. Tags are also provided to be used by the grower as his guarantee to the buyer of the seed.

7. The grower is furnished with cards for reporting sales of seed so that a record of the seed can be kept after it leaves his hands.

8. The association publishes an annual seed list of both fall- and spring-sown crops where all registered and certified seeds are given special notice. These seed lists are given a wide distribution throughout this and adjoining states.

No definite price is fixed by the association for the various classes of seeds. This is left to the individual. Usually a sufficiently large increase in price over common seeds is secured to repay the grower for his extra work and expense.