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# CROP INVESTIGATIONS ON SANDY LANDS

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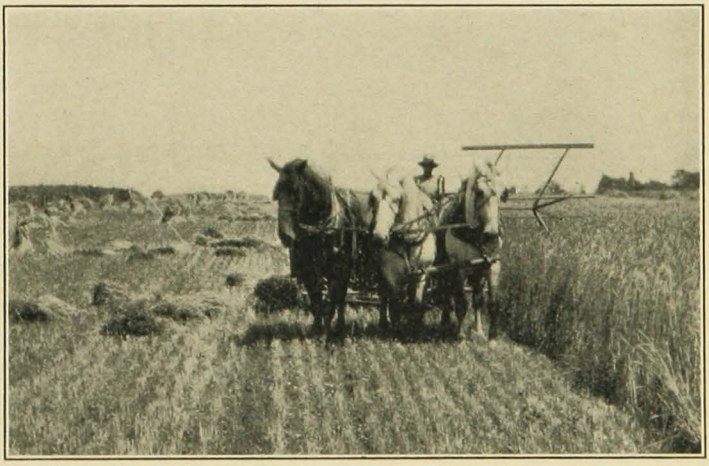
DIVISION OF AGRONOMY AND PLANT GENETICS



UNIVERSITY FARM, ST. PAUL

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# CROP INVESTIGATIONS ON SANDY LANDS

H. K. HAYES, A. C. ARNY, H. K. WILSON, AND LEROY POWERS[1]

## INTRODUCTION

Minnesota has several million acres of sandy land, on which the surface soil is sand or loamy sand and the subsoil is sand or, less commonly, gravel. The largest continuous area of such land lies north of the Twin Cities, extending from Minneapolis along the Mississippi River to St. Cloud and eastward from the river to occupy the greater part of Anoka, Sherburne, and Isanti Counties and some adjacent parts of Ramsey, Hennepin, and Chisago Counties. Many smaller areas of sandy land lie west and north of St. Cloud. In Anoka County alone are 143,600 acres of such sandy soil,[2] a little over half the area of the county; nearly four-fifths of the remainder is covered by peat.

In 1919 the University of Minnesota established experimental fields on typical sandy soil three miles southeast of Anoka, naming them the Coon Creek Sand Experimental Fields, to determine what methods of soil management and fertilization will give the most profitable returns as well as what crops and what varieties of crops will give the highest yields. This report summarizes the studies of small grains and cultivated seed crops from 1919 to 1932, inclusive.

The soil on the experimental field, mapped as Merrimac loamy sand, was originally forested by oaks. Before the University leased the fields they had been under cultivation about thirty years, being cropped chiefly to winter rye, corn, oats, and potatoes, with red clover often sown with the small grains but usually failing to make a stand. The soil is very poorly supplied with nitrogen, and non-leguminous crops show a marked response to nitrogen fertilizers; but little or none to phosphate and potash fertilizers or to lime. The texture and acidity of the soil and subsoil of the fields on which the grain trials have been conducted are indicated in Table 1.

[1] Acknowledgment is made to Dr. F. J. Alway, chief of the Division of Soils, for many helpful suggestions regarding the preparation of this manuscript and the interpretation of the data. G. H. Nesom also made helpful suggestions.

[2] Smith, W. G., Nesom, G. H., and Roth, E. G., Soil Survey of Anoka County, Minn., p. 16. 1918. Field Observations of the U. S. Dept. of Agr. Bur. of Soils in 1916. 30 pp. with map.

Table 1

**Texture and Acidity of Soil of Coon Creek Sand Experimental Fields***

| Depth | Moisture equivalent | | Hydrogen-ion concentration | |
|---|---|---|---|---|
| | North field | South field | North field | South field |
| | | | pH | pH |
| 1 to 6 inches | 5 | 6 | 5.3 | 5.2 |
| 7 to 12 inches | 4 | 4 | 5.7 | 5.2 |
| Second foot | 3 | 4 | 6.1 | 5.9 |
| Third foot | 3 | 3 | 6.2 | 6.1 |
| Fourth foot | 2 | 2 | 6.4 | 6.4 |
| Fifth foot | 2 | 2 | 6.4 | 6.4 |
| Sixth foot | 2 | 2 | 6.4 | 6.5 |

* Inoculation of Alfalfa on Lime-deficient Sandy Soils, by F. J. Alway and G. H. Nesom. Univ. of Minn. Agr. Expt. Sta. Tech. Bull. 46. 62 pp. (Out of print.)

## METHODS

The Division of Soils had entire charge of the preparation of the land, including fertilization and cultivation, as well as of the harvesting of the crops; the decision of the varieties to be tested and the computation of the yields was made by the Division of Agronomy and Plant Genetics.

The small grain crops, including spring and winter wheat, rye, oats, barley, and flax, were planted with a grain drill in plots 8 feet wide and either 66 feet or 82 feet long. The usual rates and times of seeding were followed and each variety was sown in two or three regularly distributed plots in order to eliminate, as far as possible, differences due to soil variability. Six square yards were harvested from each plot, the heads brought to University Farm, threshed, and the yields computed.

The plots each season were placed on an almost level uniform area on which the soil was in a state of productiveness comparable with that resulting from a regular three- or four-year rotation in which an application of 8 tons per acre of stable manure is made to a cultivated crop once in the rotation and this crop followed by small grain. In the experiment the corn may be assumed to have regularly received such an application of manure and the small grains to have been the first crop following the corn. This condition of productivity was in some seasons attained by the actual use of manure and in the others by the application of 200 pounds per acre of sodium nitrate or ammonium sulfate to either the corn, the small grain, or both, according to the previous treatment of the land. In some seasons an application of 100 pounds per acre of 45 per cent superphosphate and 200 pounds per acre of muriate of potash was made in preparing the seedbed, but later experiments showed that on this soil phosphate and potash fertilizers cause little or no increase in the yields of small grains. On the whole, it is safe to assume that the state of productivity of the plots was somewhat above that of the average of the better managed farms

of sandy land in Anoka and adjacent counties, where general farming is followed rather than truck growing, and the only manure used on the fields is that produced on the farm.

The corn plots were four rows wide and 23 hills long, planted in check rows in hills 3 feet 6 inches apart. The two middle rows were harvested, shocked, and husked after being field cured. The field weights of ear corn were determined and a 10-pound moisture sample was used for a dry-matter sample. Yields were computed on the air-dry basis.

The yields of corn, soybeans, field beans, and peas are directly comparable with the yields of small grains, in that they are grown on similar soil with very similar fertilization except that no nitrogenous fertilizer was applied to the legumes.

While the primary purpose of the studies was to determine the varieties best adapted to sandy soils, the data have been used also to compare the desirability of various crops on such soils.

## EXPERIMENTAL RESULTS

The studies carried out furnish information to answer the following questions: (1) What crops have succeeded best on sandy soils? (2) What varieties are best adapted to sand? and (3) Are the same varieties recommended for heavy soils?

### Comparative Value of Crops on Coon Creek Sandy Soil

Data from yield trials on Coon Creek sand are available from 1919 to 1932, inclusive, altho all crops were not grown for the entire period. Data for the small grain crops—oats, barley, spring wheat, winter wheat, and rye—are available from 1919 to 1932. Flax was grown from 1919 to 1923, soybeans from 1919 to 1925, and corn from 1919 to 1931. Field beans were grown from 1919 to 1924 and field peas from 1920 to 1925.

The yields given in Table 2 are in bushels per acre. The yields are the averages for all varieties of the crop for the season except for corn from 1926 to 1931, in which the yield of Minn. No. 13 corn was supplied by the Division of Soils from their plots. The averages given for midseason oats include all varieties except Gopher and Iowar, which comprise the early group. The differences in yield in bushels per acre are slightly in favor of the midseason group, the average yields for the two groups of oats being 26 bushels for midseason and 24.5 bushels for the early group. The midseason oats were grown each year from 1919 to 1932 and were used as a standard of comparison for other crops. The weighted yield given in Table 2 is an average for the years in which each crop was grown, corrected on the basis of the yield of midseason oats for the same period in relation to the yield for the

entire period. The proportion used in computing this average is illustrated as follows: Average yield of midseason oats 1919 to 1923: average yields 1919 to 1932 = Average yield of flax 1919 to 1923: weighted yield of flax 1919 to 1932.

There is some danger in making such a correction. Climatic conditions in a certain year may be favorable to one crop, as corn, but less favorable to the small grains, and vice versa. The corrections for the small grain crops make little relative difference in the average yields. With the flax crop grown from 1919 to 1923 the average yield was 3.5 bushels and the corrected yield was 4.3 bushels. The computed yields of soybeans, field beans, and field peas were also increased somewhat by correcting on the basis of the yield of midseason oats.

The yielding ability of the various crops in both bushels and pounds has been compared in Table 3 with midseason oats for the same periods. The range in yields furnishes one measure of the comparative desirability of the crop.

The lowest average yield of oats, 14.3 bushels, was obtained for early oats in 1923 and the highest yield was in 1928. The yield of barley ranged from 1.8 bushels in 1923 to 20.9 bushels in 1930. The average yields of oats and barley for a comparable period were 841.6 and 662.4 pounds, respectively.

Table 2

**Yields per Acre Obtained from 1/40-Acre Variety Trials on Coon Creek Sand**

| Crop | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 |
|---|---|---|---|---|---|---|---|---|
| | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. |
| Oats, midseason | 26.9 | 20.8 | 21.0 | 23.2 | 14.6 | 30.2 | 25.7 | 23.3 |
| Oats, early | ... | 21.9 | 26.9 | 27.2 | 14.3 | 20.0 | 15.7 | 19.8 |
| Barley | 13.3 | 4.8 | 15.5 | 7.7 | 1.8 | 18.4 | 16.7 | ... |
| Spring wheat | 10.0 | 6.0 | 10.9 | 13.6 | 3.9 | 14.1 | 12.2 | 10.3 |
| Durum wheat | 8.4 | 4.5 | 9.3 | 9.9 | 4.1 | 11.1 | 14.7 | 7.7 |
| Winter wheat | ... | 9.7 | 15.9 | 20.2 | 12.1 | 14.1 | 0.0 | 4.2 |
| Rye | ... | 11.1 | 25.9 | 22.5 | 14.2 | 20.5 | 15.8 | 11.3 |
| Flax | 2.4 | 7.4 | 2.6 | 2.9 | 2.4 | ... | ... | ... |
| Corn | 34.9 | 12.3 | 17.6 | 5.4 | 8.3 | 34.5 | 12.9 | 18.9 |
| Soybeans | 17.8 | 4.1 | 9.0 | 5.0 | 4.1 | 4.3 | 5.3 | ... |
| Field peas | ... | 2.8 | 0.6 | 3.9 | 2.5 | 5.3 | 7.4 | ... |
| Field beans | 14.0 | 14.4 | 5.2 | 7.3 | 6.4 | 4.7 | ... | ... |

| Crop | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | Av. yield | Weighted yield* |
|---|---|---|---|---|---|---|---|---|
| | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. |
| Oats, midseason | 32.1 | 38.5 | 35.9 | 31.5 | 17.3 | 23.8 | 26.0 | 26.0 |
| Oats, early | 27.0 | 34.5 | 26.5 | 33.5 | 30.9 | 20.0 | 24.5 | 24.5 |
| Barley | 20.4 | 13.0 | 17.5 | 20.9 | 19.1 | 10.7 | 13.8 | 13.6 |
| Spring wheat | 12.9 | 10.2 | 16.4 | 12.5 | 10.7 | 6.1 | 10.7 | 10.7 |
| Durum wheat | 17.3 | 8.4 | 13.6 | 9.7 | 10.2 | ... | 9.9 | 9.9 |
| Winter wheat | 4.5 | ... | 0.0 | 6.6 | 14.4 | 17.7 | 9.9 | 10.3 |
| Rye | 11.6 | 16.6 | 17.2 | 22.7 | 18.5 | 26.2 | 18.0 | 18.0 |
| Flax | ... | ... | ... | ... | ... | ... | 3.5 | 4.3 |
| Corn | 28.1 | 30.5 | 8.6 | 20.1 | 0.0 | ... | 17.9 | 17.9 |
| Soybeans | ... | ... | ... | ... | ... | ... | 7.1 | 8.0 |
| Field peas | ... | ... | ... | ... | ... | ... | 3.8 | 4.4 |
| Field beans | ... | ... | ... | ... | ... | ... | 8.7 | 10.0 |

* The yield of midseason oats for the same period each of the crops was grown was compared with the yield of oats from 1919 to 1932, inclusive, and a weighted yield was used for each crop. Data for rye in 1928 and for corn from 1925 to 1931 were supplied from the plots of the Division of Soils.

Average yields of oats and spring wheat for a comparable period were 832 and 642 pounds, respectively. Yields of spring bread wheat were low in 1920, 1923, and 1932, with an average of 6.0, 3.9, and 6.1 bushels, respectively. Durum wheat averaged about 50 pounds per acre lower than the bread wheats.

The yield of winter wheat averaged lower than that of spring wheat, largely because of crop failures in 1925 and 1929 and low yields in 1926 and 1927. Yields of winter wheat were higher in favorable seasons than those of spring wheat. In comparison with oats during a comparable period, winter wheat yielded 594 pounds and oats 800 pounds.

Rye was the only small grain crop that yielded more grain per acre than oats, the comparison for a thirteen-year period being oats 832 pounds and rye 1,008 pounds. Low yields of rye were obtained in 1920, 1926, and 1927, about 11 to 12 bushels per acre.

Flax yields were low in four of the five years it was tested and this crop is without doubt undesirable for sandy soils.

Corn gave variable yields and was a total failure in 1931 because of a lack of moisture. In general, corn is well adapted to sandy soils except in dry years.

Soybeans and field beans gave fair yields but the yield of field peas was low.

**Table 3**

**Yields of Other Crops in 1/40-Acre Plot Trials on Coon Creek Sand in Comparison with Midseason Oats as a Standard**

| Crop | Years grown | Range in yield | Average yields | |
|---|---|---|---|---|
| | | bu. | bu. | lb. |
| Oats | 1920-32 | 14.6–38.5 | 26.0 | 832.0 |
| Oats, early | " | 14.3–34.5 | 24.5 | 784.0 |
| Oats | 1919-25; 1927-32 | 14.6–38.5 | 26.3 | 841.6 |
| Barley | " " | 1.8–20.9 | 13.8 | 662.4 |
| Oats | 1919-32 | 14.6–38.5 | 26.0 | 832.0 |
| Spring wheat | " | 3.9–16.4 | 10.7 | 642.0 |
| Oats | 1919-31 | 14.6–38.5 | 26.2 | 838.4 |
| Durum wheat | " | 4.1–17.3 | 9.9 | 594.9 |
| Oats | 1919-27; 1929-32 | 14.6–35.9 | 25.0 | 800.0 |
| Winter wheat | " " | 0.0–20.2 | 9.9 | 594.0 |
| Oats | 1920-32 | 14.6–38.5 | 26.0 | 832.0 |
| Rye | " | 11.1–26.2 | 18.0 | 1,008.0 |
| Oats | 1919-23 | 14.6–26.9 | 21.3 | 681.6 |
| Flax | " | 2.4– 7.4 | 3.5 | 198.2 |
| Oats | 1919-25 | 14.6–30.2 | 23.2 | 742.4 |
| Soybeans | " | 4.1–17.8 | 7.1 | 425.1 |
| Oats | 1920-25 | 14.6–30.2 | 23.2 | 742.4 |
| Field peas | " | 0.6– 7.4 | 3.8 | 225.0 |
| Oats | 1919-24 | 14.6–30.2 | 22.8 | 729.0 |
| Field beans | " | 4.7–14.4 | 8.7 | 520.0 |
| Oats | 1919-31 | 14.6–38.5 | 26.2 | 838.4 |
| Corn | " | 0.0–34.9 | 17.9 | 1,002.4 |

Table 4

**Digestible Nutrients Produced per Acre by Different Crops on Coon Creek Sand Compared with Midseason Oats as a Standard***

| Crop | Years grown | Av. yield | Yield of nutrients | | | |
|---|---|---|---|---|---|---|
| | | | Crude protein | Carbo-hydrates | Fat | Total |
| | | lb. | lb. | lb. | lb. | lb. |
| Oats | 1920-32 | 832.0 | 80.7 | 433.5 | 31.6 | 585.7 |
| Oats, early | " | 784.0 | 76.0 | 408.5 | 29.8 | 551.9 |
| Oats | 1919-25; 1927-32 | 841.6 | 81.6 | 438.5 | 32.0 | 592.5 |
| Barley | " " | 662.4 | 59.6 | 442.5 | 10.6 | 525.9 |
| Oats | 1919-32 | 832.0 | 80.7 | 433.5 | 31.6 | 585.7 |
| Spring wheat | " | 642.0 | 64.2 | 425.6 | 9.6 | 511.7 |
| Oats | 1919-31 | 838.4 | 81.3 | 436.8 | 31.9 | 590.2 |
| Durum wheat | " | 594.9 | 59.5 | 394.4 | 8.9 | 474.1 |
| Oats | 1920-27; 1929-32 | 800.0 | 77.6 | 416.8 | 30.4 | 563.2 |
| Winter wheat | " " | 594.0 | 59.4 | 393.8 | 8.9 | 473.4 |
| Oats | 1919-32 | 832.0 | 80.7 | 433.5 | 31.6 | 585.7 |
| Rye | " | 1,008.0 | 99.8 | 689.5 | 12.0 | 816.5 |
| Oats | 1919-23 | 681.6 | 66.1 | 355.1 | 25.9 | 479.8 |
| Flax | " | 198.2 | 40.8 | 33.7 | 57.5 | 203.7 |
| Oats | 1919-25 | 742.4 | 72.0 | 386.8 | 28.2 | 522.6 |
| Soybeans | " | 425.1 | 141.1 | 105.0 | 68.4 | 400.0 |
| Oats | 1919-25 | 742.4 | 72.0 | 386.8 | 28.2 | 522.6 |
| Field peas | " | 225.0 | 42.8 | 125.6 | 1.4 | 171.5 |
| Oats | 1919-24 | 729.0 | 70.0 | 379.8 | 27.7 | 513.2 |
| Field beans | " | 520.0 | 97.8 | 266.8 | 4.2 | 373.9 |
| Oats | 1919-31 | 838.4 | 81.3 | 436.8 | 31.9 | 590.2 |
| Corn | " | 1,002.4 | 75.2 | 679.6 | 46.1 | 859.1 |

* Based on Henry and Morrison. See footnote 3, below.

### Yields of Digestible Nutrients

The yields of digestible nutrients per acre, given in Table 4, are based on the percentages of digestible crude protein, carbohydrates, and fats given by Henry and Morrison[3] for the various crops and computed for the average yields in pounds of seed for the year the crops were grown. In each case the particular crop is compared with midseason oats for the same period.

Barley gave lower returns than oats, 22 pounds per acre less in digestible crude protein and fat, respectively, and approximately 4 pounds higher in carbohydrates. In comparison with spring bread wheat, durum, and winter wheat, the differences are in general about the same as for barley and oats.

In comparing rye and oats, however, rye is somewhat better adapted for sandy soils than most small grain crops. It exceeded oats by 19.1 pounds per acre of digestible crude protein, by 256 pounds of carbohydrates, but yielded 19.6 less pounds of fat. Flax yielded about twice as much digestible fat as oats, but much less protein and carbohydrates.

[3] Henry, W. A., and Morrison, F. B. Feeds and Feeding. 18th Ed. 770 pp. The Henry-Morrison Co. 1923.

Corn compared favorably with oats, yielding 6.1 less pounds of digestible crude protein per acre, 242.8 pounds more carbohydrates, and 14.2 pounds more fat. Soybeans produced an average of 141.1 pounds of digestible crude protein per acre when they were grown and yielded slightly more fat than flax, altho the yield of carbohydrates was low. Field beans also excelled in the production of crude protein.

### Market Value of Seed of Small Grains and Corn

The calculated value per acre of the marketable seed is given in Table 5. The results are based on the average price per bushel from 1921 to 1930, inclusive, using the average price for the three months that the greatest amount of each crop was sold; and the average yields for the period the crop was grown. The value per acre is given on two bases, the actual computed value compared with midseason oats for the same period and the average value for the period corrected on the basis of the yield and value of midseason oats for the same period. The correction is made in the same way, as explained for the results given in Table 2.

**Table 5**

**Value per Acre of Other Crops Grown on Coon Creek Sand Compared to Midseason Oats as a Standard***

| Crop | Years grown | Av. yield | Av. price 1921-30 | Value per acre | Av. value for period, corrected by oats |
|---|---|---|---|---|---|
| | | bu. | bu. | | |
| Oats | 1920-32 | 26.0 | $0.32 | $ 8.32 | $ 8.32 |
| Oats, early | " | 24.5 | 0.32 | 7.84 | 7.84 |
| Oats | 1919-25; 1927-32 | 26.3 | 0.32 | 8.42 | 8.32 |
| Barley | " " | 13.8 | 0.50 | 6.90 | 6.82 |
| Oats | 1919-32 | 26.0 | 0.32 | 8.32 | 8.32 |
| Spring wheat | " | 10.7 | 1.07 | 11.45 | 11.45 |
| Oats | 1919-31 | 26.2 | 0.32 | 8.38 | 8.38 |
| Durum wheat | " | 9.9 | 1.07 | 10.59 | 10.59 |
| Oats | 1920-27; 1929-32 | 25.0 | 0.32 | 8.00 | 8.32 |
| Winter wheat | " " | 9.9 | 1.07 | 10.59 | 11.01 |
| Oats | 1919-32 | 26.0 | 0.32 | 8.32 | 8.32 |
| Rye | " | 18.0 | 0.73 | 13.14 | 13.14 |
| Oats | 1919-23 | 21.3 | 0.32 | 6.82 | 8.38 |
| Flax | " | 3.5 | 2.08 | 7.28 | 8.95 |
| Oats | 1919-31 | 26.2 | 0.32 | 8.38 | 8.38 |
| Corn | " | 17.9 | 0.61 | 10.92 | 10.92 |

* Average prices for small grains, flax, and corn for 1921-28, inclusive, are from Minn. Tech. Bull. 72, Indexes of Prices, Quantities, and Cash Incomes, 1910-27, by A. G. Black and Dorothea Kittredge, 1930. Prices for 1929 and 1930 are from Minn. Annual Crop Report, Minn State Dept. of Agr. Bull. No. 6. Prices for soybeans and cowpeas are from U. S. Dept. of Agr. Yearbooks.

The corrected value per acre based on midseason oats placed the crops and their average value in the following order: rye $13.14, spring wheat $11.45, winter wheat $11.01, durum wheat $10.59, flax $8.95, oats $8.32, and barley $6.82. Corn gave a calculated value of $10.92 per acre, being lower than spring wheat and rye.

## Variety Trials

A study has been made to determine what varieties of each crop are best adapted to sandy soils. The methods of work consisted of comparative trials of many varieties in nursery plots sown by hand in rows one foot apart and 18 feet long. The results of these studies will not be given in detail. Varieties yielding best in these small-plot trials have been placed in 1/40-acre plot trials. The summarized data for single years are given in the appendix. A generalized probable error, in percentage, is included for the benefit of the scientific investigator. The yields are compared with a variety accepted as a standard and grown for all years that the trials have been conducted. The years that the variety has been grown, the average yield compared with the standard, and the percentage yield in comparison are given.

### Oats

A brief history of the varieties tested is given here.

**Minota, Minn. No. 512.** Selected by the Minnesota Agricultural Experiment Station from an unnamed commercial variety in 1906. Named Minota in 1919.

Common type; open panicle; awnless; yellowish white grain; midtall, stiff straw; susceptible to stem rust; midlate.

**Victory, Minn. Acc. No. 514.** Originated at Svalöf, Sweden. First introduced into the nursery at University Farm in 1908. A later introduction via the Department of Field Husbandry, University of Saskatchewan, was made in 1915. The latter introduction is the basis for results in this bulletin.

Common type; open panicle; awnless or few weak awns; large, white grain; tall; midstrong straw; susceptible to stem rust; midlate to late.

**Anthony, Minn. No. 686.** Developed by the Minnesota Agricultural Experiment Station. Progeny of a cross between White Russian and Victory. First seed was distributed to growers in 1929.

Common type; open panicle; awnless to weakly awned; white grain; midtall, midstrong straw; highly resistant to stem rust; midseason.

**Minrus, Minn. No. 693.** Developed by the Minnesota Agricultural Experiment Station.

Common type; open panicle; white, weakly awned grain; short, stiff straw; resistant to stem rust; midseason.

**Irish Victor, Minn. Acc. No. 533.** An Irish Victor pure line obtained from the Maine Agricultural Experiment Station in 1916 as Maine No. 340.

Common type; open panicle; awnless; white grain; tall, stiff straw; susceptible to stem rust; late.

**Lincoln, Minn. Acc. No. 505.** Introduced from the Cornell Agricultural Experiment Station in New York in 1914.

Common type; open panicle; awnless; white grain; tall, strong straw; susceptible to stem rust; midlate to late.

**Gold Rain, Minn. No. 669.** Introduced from Svalöf, Sweden, in 1915.

Table 6

**Average Yields per Acre of Oats, Years Grown, and Percentage Yield in Comparison with Minota as 100**

| Variety | Minn. No. | Years grown | Av. yield | Percentage yield |
|---|---|---|---|---|
| | | | bu. | |
| Minota | 512 | 1919-27; 1929-31 | 26.2 | 100.0 |
| Victory | Acc. 514 | " " | 25.4 | 96.9 |
| Minota | 512 | 1924-31 | 29.3 | 100.0 |
| Anthony | 685 | " | 28.6 | 97.6 |
| Minota | 512 | 1928-30 | 35.5 | 100.0 |
| Minrus | 693 | " | 32.8 | 92.4 |
| Minota | 512 | 1919-23 | 23.5 | 100.0 |
| Irish Victor | Acc. 533 | " | 22.8 | 97.0 |
| Lincoln | " 505 | " | 19.7 | 83.8 |
| Minota | 512 | 1919-22 | 24.2 | 100.0 |
| Gold Rain | Acc. 669 | " | 21.5 | 88.8 |
| Silvermine | " 506 | " | 25.6 | 105.8 |
| Improved Ligowa | 281 | " | 22.5 | 93.0 |
| White Russian | Acc. 339 | " | 18.9 | 78.1 |
| Minota | 512 | 1920-22 | 23.5 | 100.0 |
| Garton 784 | Acc. 576 | " | 20.8 | 88.5 |
| Garton 473 | " 578 | " | 20.3 | 86.4 |
| Minota | 512 | 1929-31 | 29.0 | 100.0 |
| N. D. 22005 | Acc. 709 | " | 29.2 | 100.7 |
| N. D. 20014 | " 708 | " | 27.6 | 95.2 |
| Rainbow | " 710 | " | 28.2 | 97.2 |
| Minota | 512 | 1920-24; 1930-31 | 24.1 | 100.0 |
| Iowar | Acc. 670 | " " | 23.8 | 98.8 |
| Minota | 512 | 1920-30 | 28.0 | 100.0 |
| Gopher | 674 | " | 25.0 | 89.3 |

Common type; open panicle; awnless; yellow grain; midtall; midstrong straw; susceptible to stem rust; midseason.

**Improved Ligowa, Minn. No. 281.** Originated through a head selection made at University Farm in 1895 from the Swedish Select group.

Common type; open panicle; heavy to light awned; white grain; midtall, midstrong straw; susceptible to stem rust; midlate.

**White Russian (White Tartar), Minn. Acc. No. 339.** Seed obtained from a local seed company in 1905.

Orientalis type; side panicle; awnless; white to yellowish white grain; midtall, strong straw; highly resistant to stem rust.

**Garton No. 784, Minn. Acc. No. 576.** Introduced in Minnesota in 1915.

Orientalis type; side panicle; awned; brown to black grain; short, stiff straw; susceptible to stem rust; midlate; yields less than Minota.

**Garton No. 473, Minn. Acc. No. 578.** Introduced in 1915.

Common type; open panicle; white grain; midtall, midstrong straw; susceptible to stem rust; midseason.

**North Dakota No. 22005, Minn. Acc. No. 709.** A pure-line selection from Green Russian by the North Dakota Agricultural Experiment Station.

Common type; open panicle; nearly awnless; yellowish white grain; short to midtall, midstrong straw; resistant to stem rust; early to midseason.

**North Dakota No. 20014, Minn. Acc. No. 708.** A pure-line selection from Green Russian by the North Dakota Agricultural Experiment Station.

Common type; open panicle; awned, white grain; midtall, midstrong straw; highly resistant to stem rust; midseason.

**Rainbow, Minn. Acc. No. 710, North Dakota No. 22006.** Pure-line selection from Green Russian by the North Dakota Agricultural Experiment Station. Distributed in North Dakota in 1929.

Common type; open panicle; nearly awnless, yellowish white grain; midtall, midstrong straw; highly resistant to stem rust; early to midseason.

**Iowar, Minn. Acc. No. 670.** Selection from Kherson by the Iowa Agricultural Experiment Station.

Common type; open panicle; awnless, white grain; midtall; strong straw; susceptible to stem rust; early.

**Gopher, Minn. No. 674.** A pure-line selection from Sixty Day by the Minnesota Agricultural Experiment Station.

Common type; open panicle; awned, white grain; short, stiff straw; susceptible to stem rust, but earliness often enables it to escape damage; very early.

**Silvermine, Minn. Acc. No. 506.** Introduced from Cornell Agricultural Experiment Station, New York, in 1914.

Common type; open panicle; awnless; white to yellowish white grain; midtall to tall, midstrong straw; susceptible to stem rust; late.

The results of the yield trials are given in Table 6, the other varieties being compared with Minota as a standard. In trials on fertile soils in central and north central Minnesota, the new varieties Anthony, Minrus, and Rainbow have yielded on the average much better than Minota and Victory; in southern Minnesota Gopher has been outstanding. Gopher has proved much less satisfactory than Minota on sandy soils and is undesirable because of its short straw. In the early oat

group, Iowar, produced by the Iowa station, appears more desirable than Gopher. Midseason oats are probably more desirable on sandy soils in central Minnesota and in this group all of the standard varieties appear about equal in yielding ability. This includes Minota, Victory, Anthony, and Rainbow. Rainbow matures slightly earlier than the others.

### Spring Wheat

A brief history of the varieties tested is given here.

**Marquis, Minn. Acc. No. 1239.** A selection by Dr. C. E. Saunders, of Ottawa, Canada, from a cross between Hard Red Calcutta and Red Fife made by Dr. A. P. Saunders in 1892.

Awnless; white to yellowish, glabrous glumes; strong straw; susceptible to stem rust; midlate; desirable milling and baking qualities.

**Preston, Minn. No. 924.** A selection from Preston (Velvet Chaff), Minn. Acc. No. 188, by the Minnesota Agricultural Experiment Station in 1903. The original Preston resulted from a cross between Ladoga, a Siberian wheat, and Red Fife. The hybrid was made by Dr. William Saunders at the Dominion Experimental Farms, Ottawa, Canada, in 1888.

Spike awned; white, glabrous glumes; weak straw; susceptible to stem rust; midlate; produced flour of variable baking qualities.

**Kota, Minn. Acc. No. 2151.** Distributed by the North Dakota Agricultural Experiment Station from wheat introduced from Russia in 1903.

Awned; white, glabrous glumes; weak straw; resistant to stem rust; susceptible to smuts; not a good milling wheat.

**Marquillo, Minn. No. 2202.** Produced by the Minnesota Agricultural Experiment Station from a cross between Marquis and Iumillo, a rust-resistant durum variety.

Resembles Marquis; awnless; strong straw; resistant to stem rust; matures slightly earlier than Marquis; excels Marquis in yield when stem rust is a factor; not well adapted to dry conditions; milling and baking tests have shown the variety to be equal to Marquis in size and texture of loaf produced, altho yellow in color.

**Ceres, Minn. Acc. No. 2223.** Developed in 1918 from a cross between Kota and Marquis by the North Dakota Agricultural Experiment Station.

Awned; glabrous, white glumes; medium weak straw; resistant to stem rust; as early maturing as Marquis and about equal in milling and baking qualities; well adapted for dry conditions; outyields Marquis; susceptible to scab, bunt, and loose smut.

**Mindum, Minn. No. 470.** The result of the selection of a durum type from a common bread wheat by the Minnesota Agricultural Ex-

periment Station in 1896. Named Mindum, a contraction of Minnesota and durum, in 1918.

Yellowish, glabrous glumes; amber-colored kernels; midweak straw; fairly resistant to stem rust; high quality for macaroni.

**Kubanka, Minn. Acc. No. 2102.** Introduced from Russia in 1900 by M. A. Carleton, of the United States Department of Agriculture.

Yellowish, glabrous glumes; amber colored kernels; midstrong straw; moderately resistant to stem rust; good quality for macaroni.

**Table 7**

**Average Yields per Acre of Spring Wheat, Years Grown, and Percentage Yield in Comparison with Marquis as 100**

| Variety | Minn. No. | Years grown | Av yield | Percentage yield |
|---|---|---|---|---|
| | | | bu. | |
| Marquis | 1239 | 1919-31 | 11.1 | 100.0 |
| Mindum | 470 | " | 10.1 | 91.0 |
| Marquis | 1239 | 1919-23 | 8.6 | 100.0 |
| Preston | 924 | " | 9.3 | 108.1 |
| Marquis | 1239 | 1924-26 | 12.3 | 100.0 |
| Kota | 2151 | " | 12.0 | 97.6 |
| Marquis | 1239 | 1928-31 | 13.0 | 100.0 |
| Marquillo | 2202 | " | 12.2 | 93.8 |
| Marquis | 1239 | 1927, 1929-31 | 13.2 | 100.0 |
| Ceres | 2223 | " " | 13.8 | 104.5 |
| Marquis | 1239 | 1930-31 | 11.7 | 100.0 |
| H-44 | 2297 | " | 9.9 | 84.6 |
| Double Cross | 2303 | " | 12.2 | 104.3 |
| " " | 2305 | " | 11.3 | 96.6 |
| Marquis | 1239 | 1920-22 | 10.0 | 100.0 |
| Mindum | 470 | " | 8.9 | 89.0 |
| Kubanka | 2102 | " | 6.8 | 68.0 |
| Marquis | 1239 | 1919-23 | 8.6 | 100.0 |
| Emmer | 1165 | " | 10.9 | 126.7 |

**Emmer, Vernal, Minn. Acc. No. 1165.** A species often erroneously referred to as "speltz." Glumes are retained in threshing. Of little value as a crop but offers great possibilities as breeding material, as it is highly resistant to black stem rust and certain other important diseases menacing spring wheat in Minnesota.

**Double Crosses, Minn. 2303 and Minn. 2305.** Produced in Minnesota from crosses of (Marquis x Iumillo, durum) x (Marquis x Kanred).

Minn. 2303 is awnless; 2305 is bearded; both have glabrous glumes; Minn. 2303 excels in strength of straw.

**H-44, Minn. Acc. No. 2297.** A bearded variety resistant to stem and leaf rust but susceptible to black chaff. Produced by McFadden, in South Dakota, from a cross of emmer with Marquis. Of interest chiefly to the breeder.

Yields in comparison with Marquis are given in Table 7. Marquis yielded slightly more than Mindum for the 12-year period 1919-31 and Mindum yielded more than Kubanka for 1920-22. Marquillo yielded 6.2 per cent less than Marquis for 1928-31 and is not well adapted to sandy land. Ceres yielded 4.5 per cent better than Marquis and, according to Waldron, has considerable ability to resist drouth. Emmer, a hulled variety, yielded 26.7 per cent more than Marquis from 1919 to 1923 and may have some promise as a feed.

### Winter Wheat and Rye

Winter wheat and rye may be considered together. Trials of winter wheat were not extensive, only three varieties having been tested.

**Minturki, Minn. No. 1507.** Developed by the Minnesota Agricultural Experiment Station from a cross between Turkey and Odessa in 1902. The variety was named and distributed in 1919.

Awned; white, glabrous glumes; strong straw; red kernels; resistant to stem rust and covered smut; good milling and baking qualities; early maturing; winter hardy; high yielding.

**Minhardi, Minn. No. 1505.** Developed by the Minnesota Agricultural Experiment Station from a cross between Turkey and Odessa. Named Minhardi because of its great winter hardiness.

Awnless; white, glabrous glumes; stiff straw; red kernels; very susceptible to stem rust; matures at same time as Minturki; generally yields less than Minturki.

Fig. 1. Rye Is One of the Best Crops for the Sandy Soils of Minnesota

**Crimean, Minn. Acc. No. 845.** Introduced from Russia.

Awned; white, glabrous glumes; weak straw; red kernels; susceptible to stem rust; good milling and baking qualities; early maturing; winter hardy.

Yields in comparison with Minturki are given in Table 8.

**Table 8**

**Yields per Acre of Three Varieties of Winter Wheat, 1920-22, in Comparison with Minturki as 100**

| Variety | Minn. No. | Average yield, bu. | Percentage yield |
|---|---|---|---|
| Minturki | 1507 | 15.8 | 100.0 |
| Minhardi | 1505 | 14.6 | 93.4 |
| Crimean | Acc. 845 | 15.3 | 96.8 |

Minturki is of outstanding value and is grown widely in southern Minnesota, where it excels in winter hardiness and yield. It yielded well from 1920 to 1924, inclusive, and in 1931; but yields were low in 1926, 1927, and 1930 and failed in 1928 because of winter injury.

Rye is more winter hardy than winter wheat and has yielded somewhat better on sandy soil at Coon Creek than winter wheat. Several varieties have been tested.

**Swedish, Minn. No. 2.** Selected for its winter hardiness at the Minnesota station. Seed of variable color.

**Table 9**

**Average Yields per Acre of Rye Varieties on 1/40-Acre Plots on Coon Creek Sand in Comparison with Swedish as 100**

| Variety | Minn. No. | Years tested | Av. yield | Percentage yield |
|---|---|---|---|---|
| | | | bu. | |
| Swedish | 2 | 1920-23 | 18.4 | 100.0 |
| Wisconsin Pedigreed | Acc. 84 | " | 19.2 | 104.3 |
| Rosen | Acc. 82 | " | 18.1 | 98.4 |
| Swedish | 2 | 1929-31 | 19.8 | 100.0 |
| Dakold | Acc. 93 | " | 18.8 | 94.9 |
| Swedish | 2 | 1924-27 | 14.2 | 100.0 |
| Midsommerog | Acc. 87 | " | 14.3 | 100.7 |
| Swedish | 2 | 1923-27 | 14.6 | 100.0 |
| Colorless | 90 | " | 15.5 | 106.2 |
| Medium Green | 91 | " | 14.8 | 101.4 |
| Swedish | 2 | 1931 | 17.2 | 100.0 |
| Synthetic | 107 | " | 19.2 | 111.6 |

**Wisconsin Pedigreed, Minn. Acc. No. 84.** Obtained from Wisconsin; similar to Minn. No. 2.

**Rosen, Minn. Acc. No. 82.** Developed at the Michigan station but less winter hardy in Minnesota than Minn. No. 2.

**Dakold, Minn. Acc. No. 93.** A North Dakota selection that recently replaced Minn. No. 2 on the Minnesota station's recommended list. Excels in winter hardiness.

**Midsommerog, Minn. Acc. No. 87.** A Swedish variety, more susceptible to winter injury than Minnesota No. 2.

**Colorless, Minn. No. 90, Medium Green, Minn. No. 91, and Synthetic, Minn. No. 107.** Three Minnesota selections of uniform seed color.

Yields are given in Table 8 in comparison with Minnesota No. 2.

### Barley

**Improved Manchuria, Minn. No. 184.** Developed from an individual plant from the Manchuria group.

Six-rowed; hulled; white hull; rough-awned; average strength of straw.

**Svansota, Minn. No. 440.** Resulted from a cross between U. S. Dept. No. 456 and Svanhals.

Two-rowed; hulled; white hull; rough-awned; average strength of straw.

**Table 10**

**Average Yields per Acre of Barley Varieties, Years Grown, and Percentage Yield in Comparison with Manchuria as 100**

| Variety | Minn. No. | Years grown | Av. yield | Percentage yield |
|---|---|---|---|---|
| | | | bu. | |
| Manchuria | 184 | 1919-31, inclusive | 13.4 | 100.0 |
| Svansota | 440 | " " | 14.0 | 104.5 |
| Manchuria | 184 | 1924-25, 1927, 1929-31 | 17.3 | 100.0 |
| Velvet | 447 | " " " | 18.2 | 105.2 |
| Manchuria | 184 | 1924-28-31 | 16.4 | 100.0 |
| Trebi | 448 | " " " | 19.6 | 119.5 |
| Manchuria | 184 | 1928-31 | 16.2 | 100.0 |
| Glabron | 445 | " | 18.6 | 114.8 |
| Manchuria | 184 | 1930-31 | 17.0 | 100.0 |
| Minsturdi | 439 | " | 19.2 | 112.9 |
| Peatland | 452 | " | 21.4 | 125.9 |

**Velvet, Minn. No. 447.** Developed from a cross between a smooth-awned selection and Luth. Six-rowed; hulled; white hull; smooth-awned; midstrong straw.

**Trebi, Minn. No. 448.** Developed from a plant selection. Six-rowed; hulled; white hull; rough-awned; weak straw.

**Glabron, Minn. No. 445.** Developed from a cross between a smooth-awned selection and Manchuria. Distributed to Minnesota farmers in 1929. Six-rowed; hulled; white hull; smooth-awned; strong straw.

**Minsturdi, Minn. No. 439.** Produced from a cross between South African and Manchuria. Six-rowed; hulled; white hull; rough-awned; very stiff straw; susceptible to barley stripe disease; adapted to heavier soils on which most varieties lodge.

**Peatland, Minn. No. 452.** A plant selection from a variety called "Switzerland." Six-rowed; hulled; white hull; very rough awned; strong straw. Has been recommended primarily for peat soils.

Yield data given in Table 10 are expressed in percentage yield of Manchuria. Peatland gave the highest yield, followed by Trebi and Glabron. However, these tests with Peatland and Glabron are limited to two years, therefore are only indicative of what may be expected of the two varieties. Longer tests conducted on representative Minnesota soils at University Farm and the Waseca, Morris, and Crookston stations showed that Trebi and Glabron were consistently higher yielding than Manchuria and that Velvet and Peatland have yielded slightly more than Manchuria. It should be kept in mind that the buyers of market barley discriminate against Trebi and Glabron. For this reason they are recommended only for feed.

### Flax

The flax variety trials were made several years ago and are of little value, as the present varieties recommended for Minnesota—Bison, Buda, and Redwing—have not been tested on the Coon Creek sandy soils. The results given in the following summary demonstrate the fact that flax is not a desirable crop for sandy soils.

Table 11

**Average Yields per Acre of Flax**

| Variety | Minn. No. | Years grown | Average yield |
|---|---|---|---|
| | | | bu. |
| North Dakota 52 | Acc. 173 | 1919-21 | 4.3 |
| Minnesota | 19 | " | 4.1 |
| American Fiber | Acc. 165 | " | 4.0 |
| North Dakota 114 | Acc. 179 | 1922-23 | 2.9 |
| Blue Dutch | 98 | " | 2.5 |

### Corn

Corn variety trials have been carried for the last two years but the dry weather has caused very low yields, making the tests practically worthless. Results are given for several varieties grown from 1919 to 1925, inclusive. A short description of the varieties grown are given here.

**Minnesota No. 13.** Developed from seed obtained from a firm in St. Paul in 1893. Several strains have been developed through selection. Medium maturing strains, requiring 110 to 120 days to mature, such as those developed at University Farm and Morris, are adapted to central Minnesota. The Morris selection is several days earlier than the University Farm selection. The ears are 14- to 16-rowed, with yellow,

comparatively smooth kernels of medium depth. Cobs are red. Two early maturing strains of this variety, the Haney, developed by J. G. Haney, of East Grand Forks, and the Moccasin, by the station at Grand Rapids, mature in favorable years in northwestern and north central Minnesota.

**Rustler.** Similar to the medium maturing strains of Minnesota No. 13 in plant characters and maturity. Ears white, comparatively smooth, 12- to 16-rowed. Kernels of medium depth, cobs white. A high yielding strain has been developed at University Farm.

Fig. 2. Corn Is a Satisfactory Crop for Sandy Soil Except in Years of Drouth

**Northwestern Dent.** The Crookston strain, developed at the Crookston station, matures 7 to 10 days earlier than later strains of the variety. Recommended for the northwestern and north central parts of the state. Ears comparatively smooth, 12- to 14-rowed, kernels not deep, yellow capped red dent with considerable variation in shade of color.

**Minnesota No. 23.** An early-maturing, white-capped yellow dent developed from seed obtained from Mr. Berg of Mentor, Minnesota. Ears have 10 to 14 rows, kernels are smooth and short, cobs red.

**Longfellow.** An 8-rowed yellow flint with long ears. Matures at about the same time as Minnesota No. 13.

**Squaw Flint.** A variety with variegated kernels maturing as early as Minn. No. 23. It is a low-growing, vigorous variety.

Yields in these variety trials are given in Table 12.

**Table 12**
**Average Yields per Acre of Corn on Coon Creek Sand in Comparison with Minnesota No. 13 as 100**

| Variety | Years grown | Av. yield | Percentage yield |
|---|---|---|---|
| | | bu. | |
| Minn. No. 13 | 1919-25 | 17.7 | 100.0 |
| Rustler | " | 18.7 | 105.6 |
| Northwestern Dent | " | 13.9 | 78.5 |
| Minn. No. 23 | " | 13.2 | 74.6 |
| Longfellow | " | 16.5 | 93.2 |
| Minn. No. 13 | 1919-22 | 18.9 | 100.0 |
| Squaw Flint | " | 18.3 | 96.8 |

Rustler yielded 5.6 per cent more than Minn. No. 13, indicating that Rustler may be expected to yield somewhat better on light soils than Minn. No. 13. Northwestern Dent, and Minn. No. 23 gave much lower yields than either Minn. No. 13 or Rustler; Longfellow and Squaw flints were of intermediate yielding ability.

### Soybeans

Short descriptions of the soybean varieties tested are given.

**Minsoy, Minn. No. 139.** Developed from a selection made at University Farm. Low-growing plant, averaging 22 to 25 inches; fine stemmed, leafy, non-shattering variety; seeds small, light yellow with brown hilum. Recommended as a seed and hay crop in northern Minnesota and for early hogging-off in central and southern Minnesota.

Minsoy proved to be much the most satisfactory variety in yield of seed, giving 25 per cent increase over Chestnut. On heavier soils Chestnut is one of the most desirable varieties for central Minnesota.

**Wisconsin Black, Minn. Acc. No. 164.** Matures in 90 to 100 days; height 28 to 30 inches; seeds medium size and black. Recommended for seed and hay production in northern Minnesota.

**Chestnut, Minn. No. 110.** Developed from a selection made at University Farm. Matures in 110 to 120 days, is leafy, fine-stemmed; average height 35 inches; seeds light brown, kidney-shaped. Desirable seed and hay variety in central and southern Minnesota.

**Mandarin, Minn. Acc. No. 182.** Matures in 100 to 110 days. Erect; height 29 to 30 inches; seeds yellow with yellow hilum. Leaves are not retained at maturity and seeds shatter readily.

**Soysota, Minn. No. 142.** Developed from a selection made at University Farm. Matures in 110 to 120 days; erect; height averages about 35 inches.

**Elton, Minn. No. 167.** Developed from a selection made at University Farm. Matures in 110 to 120 days, erect, height about 36 inches; seeds light yellow with yellow hilum. Leaves not retained at maturity.

**Manchu, Minn. Acc. No. 195.** Matures in 115 to 125 days, erect, leafy. Seeds round, yellow with black hilum. Desirable for southern Minnesota. Yields are given in Table 13.

Table 13

**Yields per Acre of Soybeans in Comparison with Chestnut as 100**

| Variety | Minn. No. | Years tested | Av. yield | Percentage yield |
|---|---|---|---|---|
| | | | bu. | |
| Chestnut | 110 | 1919-24 | 6.8 | 100.0 |
| Minsoy | 139 | " | 8.5 | 125.0 |
| Chestnut | 110 | 1920-25 | 5.3 | 100.0 |
| Wisconsin Black | Acc. 164 | " | 5.1 | 96.2 |
| Chestnut | 110 | 1921-24 | 5.1 | 100.0 |
| Manchu | Acc. 195 | " | 4.5 | 88.2 |
| Mandarin | Acc. 182 | " | 5.2 | 102.0 |
| Chestnut | 110 | 1922-25 | 4.6 | 100.0 |
| Soysota | 142 | " | 5.2 | 113.0 |
| Chestnut | 110 | 1920-23 | 5.5 | 100.0 |
| Elton | 167 | " | 5.2 | 94.5 |

## Field Beans

Yields of field beans are available for the period 1919-24, inclusive. A short description of each variety grown follows.

**Robust, Minn. Acc. No. 76.** Trailing habit of growth and resistant to anthracnose and blight. Medium early, maturing in about 100 days. Flowers white. Seeds white and medium in size.

**Brown Swedish, Minn. Acc. No. 74.** Bush habit of growth, susceptible to anthracnose and blight. Early, maturing in about 85 days. Flowers lilac color. Seeds rounded, ochre yellow in color.

**Arikara Yellow (Yellow Indian), Minn. Acc. No. 117.** Trailing habit of growth, resistant to anthracnose and blight. Flowers white. Seeds kidney shaped and yellow in color. Medium early, maturing in about 95 days.

**Snowflake, Minn. Acc. No. 75.** Plant short with trailing habit of growth, medium early, maturing in about 95 days. Flowers white. Seeds rounded, small, white.

Yields in bushels per acre are given in Table 14.

Table 14

**Yields per Acre of Varieties of Field Beans in 1/40-Acre Plots on Cook Creek Sand**

| Variety | Minn. No. | Years grown | Av. yield | Percentage yield |
|---|---|---|---|---|
| | | | bu. | |
| Robust | Acc. 76 | 1919-24 | 12.3 | 100.0 |
| Brown Swedish | Acc. 74 | " | 7.8 | 63.4 |
| Robust | Acc. 76 | 1920-24 | 7.7 | 100.0 |
| Arikara Yellow | Acc. 117 | " | 8.8 | 114.3 |
| Robust | Acc. 76 | 1920-23 | 8.1 | 100.0 |
| Snowflake | Acc. 75 | " | 7.1 | 87.7 |

For the period 1919-24, Brown Swedish yielded 36.6 per cent less than Robust. Arikara Yellow during the period 1920-24 yielded 14.3 per cent more than Robust; Snowflake yielded 12.3 per cent less than Robust during the period 1920-23.

### Field Peas

Yields of some of the varieties of field peas are available for the period 1919-25, inclusive, and of others for shorter periods. A short description of each variety grown follows.

**Golden Vine, Minn. No. 95.** Tall variety maturing in 95 to 100 days. Flowers white, pods short, narrow, and curved. Seeds light yellow and small.

**Wisconsin Blue, Minn. Acc. No. 118.** Tall variety maturing in 95 to 100 days. Flowers white, pods straight. Seeds blue, small in size.

**Marrowfat, Minn. No. 174.** Tall late variety maturing in 110 to 115 days. Flowers white, seeds light yellow in color and large.

**Meyer, Minn. Acc. No. 315.** Midtall variety maturing in about 90 days. Flowers white, pods short, seeds light yellow in color and small in size.

**Solo, Minn. Acc. No. 237.** Tall variety maturing in 95 to 100 days. Flowers purple, seeds gray speckled purple, medium size.

Yields of the field pea varieties are given in Table 15.

Table 15
Yields per Acre of Field Pea Varieties on Coon Creek Sand

| Variety | Years grown | Av. yield | Percentage yield |
|---|---|---|---|
| | | bu. | |
| Golden Vine | 1919-25 | 4.4 | 100.0 |
| Chang | " | 2.8 | 63.6 |
| Golden Vine | 1919-24 | 3.5 | 100.0 |
| Wisconsin Blue | " | 3.1 | 88.6 |
| Marrowfat | " | 3.3 | 94.3 |
| Golden Vine | 1920-23 | 2.9 | 100.0 |
| Meyer | " | 2.0 | 69.0 |
| Solo | " | 3.0 | 103.4 |

Golden Vine yielded at a higher rate than Chang, Wisconsin Blue, Marrowfat, and Meyer, and only slightly lower than Solo.

## SUMMARY AND CONCLUSIONS

1. Varietal experiments in 1/40-acre plot trials have been conducted on Coon Creek sand from 1919 to 1932, inclusive. Data for the small grain crops are available for the entire period, flax has been grown 1919-23, soybeans 1919-25, field beans 1919-24, field peas 1920-25, and corn for all years except 1932. In general, the yields for the various crops are comparable. The productivity of the plots was kept at a level somewhat above that of the average of the better managed farms of

sandy land in the county on which the only fertilizer used is the manure produced on the farm.

2. Yields of the various crops were compared with midseason oats for the same period and a weighted yield was obtained for each crop. The average production per acre of digestible nutrients, based on standards given by Henry and Morrison, was compared with midseason oats. Of the small grain crops, rye excelled in crude protein and carbohydrates. Oats was next, with spring wheat, barley, durum, and winter wheat giving about the same production of digestible crude protein and carbohydrates. Soybeans for the period grown yielded 141.1 pounds of crude protein to the acre and appear to be a satisfactory crop for growing on sand. Field beans also yielded well. Corn gave a computed production of 75.2 pounds of crude protein, 679.6 pounds of carbohydrates, and 46.1 pounds of fat per acre and is without doubt a satisfactory crop for sand in years of sufficient moisture.

3. The value per acre of the various crops was determined by the average price from 1921 to 1930 for the three months in which the largest amount of the crop was marketed and the average yield corrected on the basis of that of oats grown for the same period. On the basis of this computation the crops are placed in the following order for value per acre: rye, $13.14; spring wheat, $11.45; winter wheat, $11.01; durum wheat, $10.59; flax, $8.95; oats, $8.32; barley, $6.82. Corn gave a calculated value of $10.92 per acre. The cost of growing corn is somewhat greater than that for the other crops.

4. The primary purpose of the studies was to determine which varieties succeeded best on sand and whether these were the same as recommended for heavier soils.

(a) Gopher oats, which is recommended primarily for heavy lands, proved less satisfactory for sand than midseason varieties and not quite so desirable as Iowar, an early selection produced by the Iowa station. This variety grows somewhat taller than Gopher. A number of midseason varieties were compared with Minota. Anthony and Minrus, two varieties resistant to stem rust produced at the Minnesota station, yielded somewhat less than Minota, a midseason variety formerly on the station's recommended list. On the basis of these studies, it seems logical to conclude that Minota is perhaps the most desirable variety for sandy soils and should be placed on the recommended list. On heavier soils many data are available to prove that Anthony and Minrus are much more desirable varieties than Victory and Minota.

(b) It is of considerable interest to note that emmer, frequently called "speltz" by farmers, yielded an average of 26.7 per cent more than Marquis. Ceres, the North Dakota production generally recognized as somewhat resistant to drouth, proved more desirable on sandy lands than Marquis and is perhaps the most desirable variety for

use on sandy lands. Marquillo, a Minnesota production that has excelled in the Red River Valley, did not prove very satisfactory for sandy lands. This is also in agreement with the previous conclusion that Marquillo does not succeed particularly well in seasons in which moisture is deficient or in areas in North Dakota somewhat deficient in rainfall.

(c) Minturki winter wheat proved the most desirable of the three varieties tested on sandy soils. Winter wheat is a hazardous crop for sandy soils but gives good yields when not injured by winter-killing.

(d) Swedish, Minnesota No. 2 rye, yielded somewhat better than Dakold, the North Dakota selection now recommended for Minnesota. Several new productions gave good yields but no seed of these newer varieties is available.

(e) Peatland barley, tested for only a two-year period, 1930-31, gave the highest yields of any variety, averaging 25.9 per cent more than Manchuria, Minn. No. 184. Trebi yielded 19.5 per cent more than Manchuria, Glabron 14.8 per cent more, and Velvet 5.2 per cent more. It should be remembered that Trebi and Glabron are not well liked by maltsters and consequently should be grown only as feed.

(f) The flax varietal trials were made several years ago and demonstrate the fact that flax is an undesirable crop for sandy lands.

(g) Minn. No. 13 corn, Rustler, Northwestern Dent, Minn. No. 23, Longfellow and Squaw flints were compared. Rustler gave an average yield of 5.6 per cent more than Minn. No. 13 and was much more satisfactory than the two dent varieties, Northwestern and Minn. No. 23. Longfellow and Squaw flints yielded well altho they were not quite equal to Minn. No. 13.

(h) Minsoy, an early maturing variety of soybeans, gave the highest yield of seed per acre. Chestnut, a midseason variety adapted for central Minnesota, also yielded well. Soysota, formerly on the recommended list, was tested for four years and yielded 13 per cent more than Chestnut. In general, the average yields were low and different results might have been obtained if the comparison had been made during a period more favorable for soybeans. The same recommendations hold on sandy lands as for heavier lands. Minsoy appears to be a very desirable early maturing variety for seed and Chestnut is perhaps the most desirable midseason variety available. Later maturing varieties, such as Manchu and Elton, are less desirable for seed purposes than the midseason varieties except in southern Minnesota.

(i) The variety trials with field beans and field peas were made several years ago. In general, field beans yielded well. Robust is one of the most desirable varieties. It is commonly recognized as one of the best varieties of field beans for heavy lands. Field peas gave low yields and appear unadapted for growing on sand if yields of seed are desired.

## Table 16

### Yields of Oats in Bushels per Acre and in Percentage of Minota as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand

| Variety | Minn. No. | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | Years | Per cent of Minota |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | | |
| Minota | 512 | 26.3 | 23.7 | 25.9 | 20.8 | 20.9 | 29.0 | 24.1 | 23.4 | 33.5 | 37.7 | 38.6 | 30.2 | 18.1 | 13 | 100.0 |
| Victory | Acc. 514 | 26.1 | 21.7 | 23.5 | 18.7 | 18.8 | 32.2 | 27.0 | 25.3 | 34.6 | ... | 31.1 | 32.7 | 13.6 | 12 | 97.1 |
| Anthony | 686 | | | | | | 29.5 | 26.0 | 21.2 | 30.3 | 36.8 | 36.0 | 32.7 | 16.5 | 8 | 97.6 |
| Minrus | 693 | | | | | | | | | | 37.1 | 35.3 | 26.1 | ... | 3 | 92.5 |
| Irish Victor | Acc. 533 | 26.2 | 20.3 | 22.6 | 28.3 | 16.7 | | | | | | | | | 5 | 97.0 |
| Lincoln | Acc. 505 | 24.4 | 19.3 | 19.5 | 27.2 | 8.2 | | | | | | | | | 5 | 83.8 |
| Gold Rain | Acc. 669 | 25.7 | 20.7 | 20.3 | 19.4 | | | | | | | | | | 4 | 89.0 |
| Silvermine | Acc. 506 | 25.2 | 25.5 | 25.2 | 26.5 | | | | | | | | | | 4 | 105.9 |
| Improved Ligowa | 281 | 24.4 | 22.6 | 20.2 | 22.6 | | | | | | | | | | 4 | 92.9 |
| Garton | Acc. 576 | | 23.8 | 19.3 | 19.3 | | | | | | | | | | 3 | 88.6 |
| Garton | Acc. 578 | | 17.9 | 18.5 | 24.5 | | | | | | | | | | 3 | 86.5 |
| White Russian (Tartar) | Acc. 339 | 19.2 | 18.6 | 13.1 | 24.7 | | | | | | | | | | 4 | 78.2 |
| White Russian x Victory | 696 | | | | | | | | | | 41.8 | 41.6 | 34.0 | 15.9 | 4 | 107.0 |
| White Russian x Victory | 694 | | | | | | | | | | 36.8 | 36.6 | 32.1 | | 3 | 99.1 |
| White Russian x Victory | 697 | | | | | | | | | | 38.0 | 38.1 | 32.6 | | 3 | 102.1 |
| White Russian x Victory | 699 | | | | | | | | | | 41.4 | 35.2 | 31.2 | | 3 | 101.2 |
| North Dakota 22005 | Acc. 709 | | | | | | | | | | | 32.7 | 32.5 | 22.3 | 3 | 100.7 |
| North Dakota 20014 | Acc. 708 | | | | | | | | | | | 36.3 | 32.9 | 13.6 | 3 | 95.3 |
| Rainbow | Acc. 710 | | | | | | | | | | | 33.7 | 29.9 | 20.9 | 3 | 97.2 |
| Fulghum | Acc. 537 | 24.7 | 15.3 | 23.4 | 23.2 | 8.5 | | | | | | | | | 5 | 80.9 |
| Average midseason oats | | 26.9 | 20.8 | 21.0 | 23.2 | 14.6 | 30.2 | 25.7 | 23.3 | 32.1 | 38.5 | 35.9 | 31.5 | 17.3 | | |
| Gopher | 674 | | 19.7 | 26.5 | 34.6 | 13.1 | 20.0 | 15.7 | 19.8 | 27.0 | 34.5 | 26.5 | 37.4 | ... | 11 | 89.3 |
| Iowar | Acc. 670 | | 24.0 | 27.2 | 19.8 | 15.5 | 20.0 | | | | | | 29.5 | 30.9 | 6 | 89.9* |
| Average early oats | | | 21.9 | 26.9 | 27.2 | 14.3 | 20.0 | 15.7 | 19.8 | 27.0 | 34.5 | 26.5 | 33.5 | 30.9 | | |

* Computed in percentage of Gopher.

Table 17

**Yields of Spring Wheat in Bushels per Acre and in Percentage of Marquis as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand**

| Variety | Minn. No. | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | Years | Per cent of Marquis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | | |
| Marquis | Acc. 1239 | 9.3 | 5.9 | 10.2 | 13.8 | 3.9 | 15.6 | 12.0 | 9.4 | 12.3 | 11.6 | 17.0 | 11.8 | 11.6 | 13 | 100.0 |
| Preston | 924 | 10.6 | 6.1 | 10.5 | 15.6 | 3.8 | | | | | | | | | 5 | 108.1 |
| Kota | Acc. 2151 | | | | | | 12.6 | 12.3 | 11.1 | | | | | | 3 | 97.3 |
| Marquillo | 2202 | | | | | | | | | | 8.8 | 15.5 | 12.9 | 11.4 | 4 | 93.4 |
| Ceres | Acc. 2223 | | | | | | | | | 13.4 | ... | 16.6 | 13.7 | 11.4 | 4 | 104.5 |
| Marquis x Emmer, H44 | 2301 | | | | | | | | | | | | 11.7 | 8.1 | 2 | 84.6 |
| Double Cross | 2303 | | | | | | | | | | | | 13.3 | 11.0 | 2 | 103.6 |
| Double Cross | 2305 | | | | | | | | | | | | 11.8 | 10.8 | 2 | 96.6 |
| Average | | 10.0 | 6.0 | 10.9 | 13.6 | 3.9 | 14.1 | 12.2 | 10.3 | 12.9 | 10.2 | 16.4 | 12.5 | 10.7 | | |
| Mindum | 470 | 8.4 | 5.5 | 9.8 | 11.4 | 4.1 | 11.1 | 14.7 | 7.7 | 17.3 | 8.4 | 13.6 | 9.7 | 10.2 | 13 | 91.3 |
| Kubanka | Acc. 2102 | | 3.4 | 8.7 | 8.4 | | | | | | | | | | 3 | 68.6 |
| Average | | 8.4 | 4.5 | 9.3 | 9.9 | 4.1 | 11.1 | 14.7 | 7.7 | 17.3 | 8.4 | 13.6 | 9.7 | 10.2 | | |
| Emmer* | Acc. 1165 | 15.3 | 9.5 | 7.7 | 11.3 | 10.9 | | | | | | | | | 5 | 126.9 |
| P.E. per cent | | 4.4 | 4.5 | 8.0 | 13.1 | 17.9 | 4.6 | 6.5 | 7.5 | 3.6 | 21.2 | ... | 5.1 | 4.8 | | |

* 20 per cent has been deducted for hull.

## Table 18

**Yields of Winter Wheat and Rye in Bushels per Acre and in Percentage of Minturki Wheat and Swedish No. 2 Rye, Respectively, as Standards in 1/40-Acre Plot Trials on Coon Creek Sand**

| Variety | Minn. No. | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | Years | Per cent of Minturki |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | | |
| Minturki | 1507 | 10.1 | 19.1 | 18.1 | 12.1 | 14.1 | ... | 4.2 | 4.5 | ... | 0.0 | 6.6 | 14.4 | 10 | 100.0 |
| Minhardi | 1505 | 9.2 | 14.2 | 20.3 | | | | | | | | | | 3 | 92.4 |
| Crimean | Acc. 845 | 9.7 | 14.3 | 21.9 | | | | | | | | | | 3 | 97.0 |
| Average | | 9.7 | 15.9 | 20.2 | 12.1 | 14.1 | ... | 4.2 | 4.5 | ... | ... | 6.6 | 14.4 | 9 | |
| | | | | | | | | | | | | | | | Per cent of Swedish |
| Swedish | 2 | 10.2 | 24.8 | 22.7 | 16.0 | 20.2 | 13.8 | 11.3 | 11.6 | ... | 16.9 | 25.4 | 17.2 | 11 | 100.0 |
| Wisconsin Pedigree | Acc. 84 | 11.9 | 27.5 | 24.1 | 13.4 | ... | | | | | | | | 4 | 104.3 |
| Rosen | Acc. 82 | 11.3 | 25.3 | 20.8 | 15.0 | | | | | | | | | 4 | 98.2 |
| Midsommerog | Acc. 87 | | | | | 19.3 | 17.3 | 10.5 | 10.1 | | | | | 4 | 100.5 |
| Colorless Selection | 90 | | | | 13.3 | 22.6 | 17.5 | 10.9 | 13.4 | | | | | 5 | 106.6 |
| Medium Green Selection | 91 | | | | 13.3 | 19.6 | 14.7 | 12.4 | 13.8 | | | | | 5 | 101.2 |
| Emerald | 92 | | | | | 20.6 | ... | 11.8 | | | | | | 2 | 102.9 |
| Dakold | Acc. 93 | | | | | | | | | | 17.4 | 19.9 | 19.0 | 3 | 94.6 |
| Synthetic | 107 | | | | | | | | | | | | 19.2 | 1 | 111.6 |
| Average | | 11.1 | 25.9 | 22.5 | 14.2 | 20.5 | 15.8 | 11.3 | 11.6 | ... | 17.2 | 22.7 | 18.5 | | |
| Prolific Spring | Acc. 89 | | | | | | | | | | 26.3 | 13.9 | 6.7 | 3 | 78.8 |
| P.E. in per cent | | 22.0 | 2.7 | 8.1 | 9.0 | 5.3 | 6.7 | 4.4 | 5.3 | 0 | ... | 8.7 | 8.8 | | |

## Table 19

### Yields of Barley in Bushels per Acre and in Percentage of Manchuria as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand

| Variety | Minn. No. | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | 1927 | 1928 | 1929 | 1930 | 1931 | Years | Per cent of Manchuria |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. | | |
| Manchuria | 184 | 13.4 | 4.4 | 15.5 | 6.9 | 1.1 | 16.9 | 18.1 | 19.0 | 15.3 | 15.7 | 14.3 | 19.6 | 12 | 100.0 |
| Swansota | 440 | 13.2 | 5.1 | 15.5 | 8.5 | 2.4 | 16.5 | 16.5 | 20.6 | 12.8 | 17.2 | 20.3 | 19.2 | 12 | 104.7 |
| Velvet | 447 | | | | | | 21.0 | 15.4 | 21.7 | ... | 12.6 | 20.5 | 18.2 | 6 | 105.6 |
| Trebi | 448 | | | | | | 19.2 | ... | ... | 13.7 | 24.4 | 19.0 | 21.5 | 5 | 119.6 |
| Glabron | 445 | | | | | | | | | 10.1 | 17.6 | 24.7 | 21.9 | 4 | 114.5 |
| Minsturdi | 439 | | | | | | | | | | | 23.2 | 15.2 | 2 | 113.3 |
| Peatland | 452 | | | | | | | | | | | 24.4 | 18.4 | 2 | 126.3 |
| Average | | 13.3 | 4.8 | 15.5 | 7.7 | 1.8 | 18.4 | 16.7 | 20.4 | 13.0 | 17.5 | 20.9 | 19.1 | | |
| P.E. in per cent | | | | | | | | | 3.4 | 5.4 | 4.8 | 5.2 | 3.8 | | |

## Table 20

### Yields of Flax in Bushels per Acre and in Percentage of North Dakota No. 52 as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand

| Variety | Minn. No. | 1919 | 1920 | 1921 | 1922 | 1923 | Years | Per cent of North Dakota No. 52 |
|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | | |
| North Dakota No. 52 | Acc. 173 | 2.3 | 7.7 | 2.9 | 2.9 | 2.3 | 5 | 100.0 |
| Minnesota No. 19 | 19 | 2.4 | 7.5 | 2.4 | | | 3 | 95.3 |
| American Fiber | Acc. 165 | 2.5 | 7.1 | 2.5 | | | 3 | 93.8 |
| North Dakota 114 | Acc. 179 | | | | 3.1 | 2.7 | 2 | 111.5 |
| Blue Dutch | 98 | | | | 2.8 | 2.1 | 2 | 94.2 |
| Average | | 2.4 | 7.4 | 2.6 | 2.9 | 2.4 | | |

## Table 21

### Yields of Ear Corn in Bushels per Acre and in Percentage of Minn. No. 13 as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand

| Variety | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | Years | Per cent of Minn. No. 13 |
|---|---|---|---|---|---|---|---|---|---|
| | bu. | bu. | bu. | bu. | bu. | bu. | | | |
| Minn. No. 13 | 31.3 | 14.1 | 23.0 | 4.7 | 8.9 | 41.7 | 0 | 6 | 100.0 |
| Rustler | 38.2 | 14.7 | 20.1 | 6.2 | 11.0 | 40.5 | 0 | 6 | 105.7 |
| Northwestern Dent | 31.1 | 11.0 | 17.0 | 1.5 | 3.9 | 32.8 | 0 | 6 | 78.7 |
| Minn. No. 23 | 33.9 | 13.2 | 12.2 | 1.4 | 8.7 | 23.2 | 0 | 6 | 74.9 |
| Longfellow | 38.5 | 7.0 | 20.9 | 6.0 | 8.8 | 34.3 | 0 | 6 | 93.4 |
| Squaw Flint | 36.6 | 13.7 | 12.4 | 12.8 | | | | 4 | 103.3 |
| Average | 34.9 | 12.3 | 17.6 | 5.4 | 8.3 | 34.5 | | | |
| P.E. in per cent | 2.0 | 15.5 | 7.5 | 21.4 | 19.2 | 1.9 | | | |

## Table 22

### Yields of Soybeans in Bushels per Acre and in Percentage of Chestnut as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand

| Variety | Minn. No. | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | Years | Per cent of Chestnut |
|---|---|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | bu. | bu. | | |
| Chestnut | 110 | 16.1 | 4.4 | 9.1 | 4.5 | 3.9 | 2.9 | 7.2 | 7 | 100.0 |
| Minsoy | 139 | 19.4 | 4.9 | 12.8 | 3.7 | 4.6 | 5.8 | | 6 | 125.2 |
| Wisconsin Black | Acc. 164 | | 3.0 | 8.5 | 4.5 | 4.8 | 4.6 | 5.2 | 6 | 95.6 |
| Mandarin | Acc. 182 | | | 6.4 | 5.7 | 3.6 | 5.2 | | 4 | 102.5 |
| Soysota | 142 | | | | 5.9 | 5.9 | 5.7 | 3.4 | 4 | 113.0 |
| Elton | 167 | | 3.9 | 8.9 | 5.8 | 2.1 | | | 4 | 94.5 |
| Manchu | Acc. 195 | | | 8.1 | 4.9 | 3.5 | 1.6 | | 4 | 88.7 |
| Average | | 17.8 | 4.1 | 9.0 | 5.0 | 4.1 | 4.3 | 5.3 | | |

## Table 23

### Yields of Field Beans in Bushels per Acre and in Percentage of Robust as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand

| Varieties | Minn. No. | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 | Years | Per cent of Robust |
|---|---|---|---|---|---|---|---|---|---|
| Robust | Acc. 76 | 17.5 | 13.4 | 4.8 | 3.8 | 10.2 | 6.1 | 6 | 100.0 |
| Brown Swedish | Acc. 74 | 10.4 | 18.6 | 3.0 | 9.8 | 2.9 | 2.1 | 6 | 83.9 |
| Arikara Yellow | Acc. 117 | | 13.6 | 7.7 | 8.1 | 8.6 | 5.8 | 5 | 114.4 |
| Snowflake | Acc. 75 | | 12.1 | 5.2 | 7.4 | 3.8 | | 4 | 88.5 |
| Average | | 14.0 | 14.4 | 5.2 | 7.3 | 6.4 | 4.7 | | |

## Table 24

**Yields of Field Peas in Bushels per Acre and in Percentage of Golden Vine as a Standard in 1/40-Acre Plot Trials on Coon Creek Sand**

| Varieties | Minn. No. | 1920 | 1921 | 1922 | 1923 | 1924 | 1925 | Years | Per cent of Golden Vine |
|---|---|---|---|---|---|---|---|---|---|
| Golden Vine | 95 | 3.7 | 0.7 | 5.7 | 1.6 | 5.7 | 8.8 | 6 | 100.0 |
| Wisconsin Blue | Acc. 118 | 3.8 | 0.3 | 3.2 | 2.5 | 5.5 | | 5 | 87.9 |
| Marrowfat | 174 | 2.4 | 0.5 | 4.1 | 2.4 | 7.1 | | 5 | 94.8 |
| Chang | 234 | 1.7 | 0.6 | 2.1 | 3.4 | 2.7 | 6.0 | 6 | 63.0 |
| Meyer | Acc. 315 | 1.5 | 0.9 | 2.9 | 2.6 | | | 4 | 67.5 |
| Solo | Acc. 237 | 3.7 | 0.5 | 5.2 | 2.7 | | | 4 | 103.4 |
| Average | | 2.8 | 0.6 | 3.9 | 2.5 | 5.3 | 7.4 | | |