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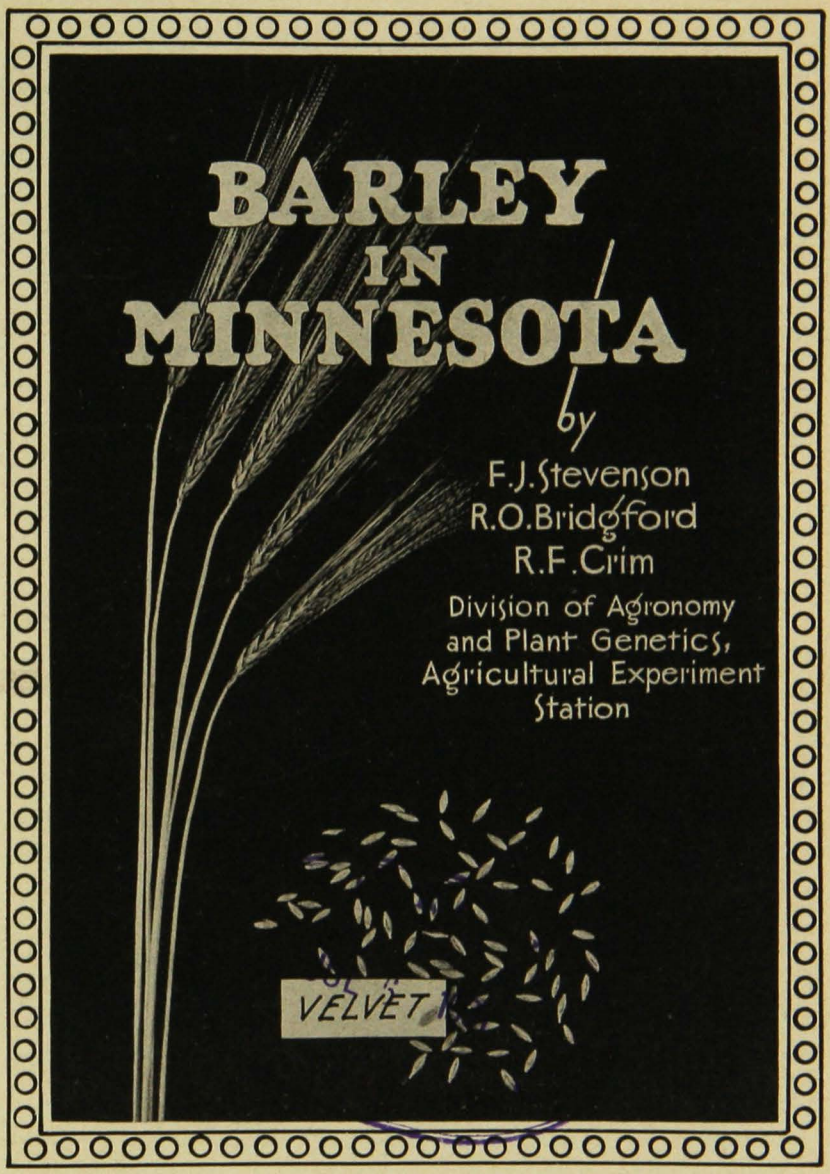


UNIVERSITY OF MINNESOTA
AGRICULTURAL EXTENSION DIVISION

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BARLEY production in Minnesota has increased greatly within the last few years. In 1926, the year that Velvet, a smooth-awn variety, was introduced, 1,307,000 acres of barley were harvested with a total production of 32,675,000 bushels. In 1929, 2,200,000 acres were harvested with a total production of 59,400,000 bushels. This is more than one sixth of the total for the United States and places Minnesota far ahead of any of the other states in barley production.

A growing appreciation of the value of barley as a feed crop and the introduction of adapted smooth-awned varieties have been the chief causes for the increase in barley acreage. Barley, corn, and oats are important feed crops in Minnesota. The importance of barley compared with corn and oats will be found in Table 1. The figures are taken from the Yearbooks of the United States Department of Agriculture.

**Table 1**

**Average Farm Value per Acre of Barley, Corn, and Oats in Minnesota**

| Year | Barley | Corn | Oats |
|---|---|---|---|
| 1915 to 1919 | $21.88 | $33.29 | $18.66 |
| 1920 to 1924 | 13.57 | 19.21 | 12.29 |
| 1925 to 1929 | 15.16 | 20.63 | 12.01 |
| 1915 to 1929 | 16.87 | 24.38 | 14.32 |

It will be noted that the value of barley per acre for the period 1915 to 1929, inclusive, averaged $2.55 more than oats; corn, an average of $7.50 more than barley. In many sections of the state barley can be grown to greater advantage than corn and even in Southern Minnesota it is of advantage to grow a small-grain crop in the rotation.

## IT FITS INTO THE ROTATION

A good ration should consist of a cultivated crop, a small-grain crop, and a hay or pasture crop. Barley may be seeded so as to distribute or balance the acreage of other small grains. Including barley among other small grains aids in the distribution of labor at seeding and harvest time. The barley harvest usually precedes oats. The practice of seeding sweet clover or alfalfa with barley is becoming common. Barley is a much better companion crop than oats as it does not shade the ground so completely.

In years when the supply of corn is limited, barley comes at an opportune time and may save the purchase of high-priced feed for pigs before the new corn is ready for use.

## USES AND PRODUCTS

Most of the barley grown in the United States is used as feed for livestock. A small amount is used for malting purposes and breakfast foods and about 1,500,000 bushels are pearled. A large proportion of the barley crop is fed to hogs and for this reason growers are interested particularly in its comparative feeding value. Plump, full-weight barley when ground is on the average about 5 per cent less valuable than shelled corn for raising pigs for pork production. Barley is higher in both protein and ash content than corn but lower by about 6 per cent in energy value. There is considerably more fiber in barley than in corn and more fiber in lightweight shrunken barley than in heavy, plump grain. When possible, plump barley should be used for hog feed, since fibrous feeds are not desirable.

Hog feeding tests conducted by E. E. Ferrin and Mark McCarty, of the Division of Animal Husbandry, University of Minnesota, showed that shelled corn gave a greater daily gain than ground barley, but, with current feed prices, the cost of the gain was practically the same.

Barley has proved to be a very valuable feed for fattening sheep and lambs. P. S. Jordan and W. H. Peters, of the Division of Animal Husbandry, University of Minnesota, report the results of feeding trials conducted at the West Central Experiment Station, Morris. In the fall of 1928, they found whole barley approximately equal to ear corn, bushel for bushel. The lambs fed whole barley made practically the same daily gains as those fed ear corn and were appraised at the same figure. The cost of the barley was higher than that of corn, so the net profit was slightly in favor of the corn. In the fall of 1929, a comparison was made between the efficiency of barley and that of oats as feed for fattening lambs. In a ration of alfalfa hay and a protein supplement of linseed meal, oats failed to make as good a showing as barley. The lambs fed whole oats failed to gain as rapidly as those fed whole barley; required more feed per hundred pounds of gain; had a higher cost of gain, and were appraised at 50 cents more per hundredweight. In several experiments reported in "Feeds and Feeding," by Henry and Morrison, lambs fed whole barley made slightly less gain than those fed corn, and consumed 5 per cent more grain and 10 per cent more hay for each 100 pounds gained.

Barley does not compare so well with corn as a feed for fattening baby beeves, as was proved by tests reported by Vaughan in University of Minnesota Experiment Station Bulletin No. 237. The margin per calf over feed cost was $6.91 for those fed barley and $16.15 for those fed corn. The animals fed barley returned 63 cents per bushel of

## Table 2

**Average Yields of the Recommended Varieties of Barley in One-Fortieth-Acre Plots Grown at University Farm, Waseca, Morris, Crookston, Grand Rapids, and Duluth, 1923-1930**

| Variety | Minn. No. | U. Farm | Waseca | Morris | Crookston* | Grand Rapids† | Duluth | Average, U. F., W., M., C., D. | Average, U. F., W., M., C., G. R., D. |
|---|---|---|---|---|---|---|---|---|---|
| | | bu. | bu. | bu. | bu. | bu. | bu. | bu. | bu. |
| Velvet | 447 | 38.3 | 52.2 | 35.2 | 35.2 | 23.3 | 37.5 | 39.7 | 37.0 |
| Glabron | 445 | 44.5 | 51.7 | 37.1 | 35.8 | 26.5 | 36.7 | 41.2 | 38.7 |
| Improved Manchuria | 184 | 39.2 | 52.7 | 33.9 | 34.4 | ... | 35.2 | 39.1 | ... |
| Svansota | 440 | 40.4 | 51.8 | 38.6 | 37.8 | ... | 33.1 | 40.3 | ... |
| Trebi | 448 | 45.3 | 62.5 | 37.3 | 39.9 | 27.5 | 41.6 | 45.3 | 42.4 |
| Peatland‡ | 452 | 39.9 | 53.5 | 33.8 | 39.5 | 28.0 | 35.3 | 40.4 | 38.3 |
| Minsturdi | 439 | 40.2 | | | | | | | |

* No data for 1928.

† Average, 1925-30.

‡ Comparable weighted average for Peatland, 1927-30, on the basis of yield of Manchuria for the same period.

grain while those fed corn returned 96 cents per bushel. Barley has less hull than oats and because of this is considered more valuable for growing pigs. Ferrin and McCarty concluded that oats, unless very low in price, is not desirable for raising pigs for pork.

Some barley is used for malting. Manchuria, previously grown in the state, is desirable for malting, and the new smooth-awned varieties, Velvet and Glabron, are equally satisfactory. Trebi, which has been

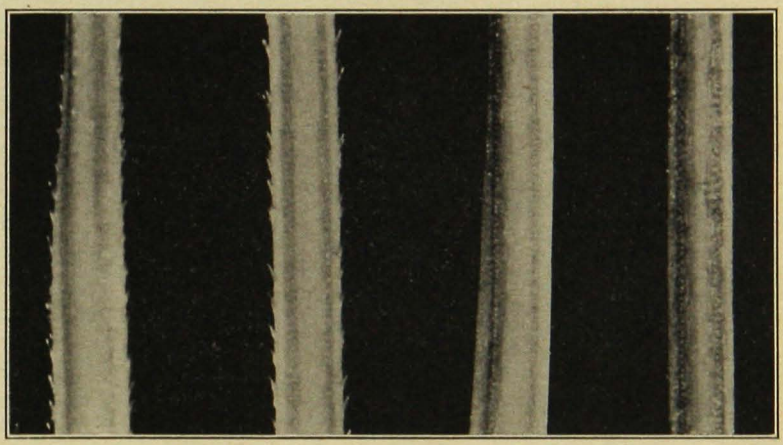

Fig. 1. Photograph of Portions of Rough and Smooth Awns
Rough awned, left; smooth awned, right

so popular in recent years in the Red River Valley, is considered undesirable for malting, and mixed with other varieties may cause a great reduction in price if purchased for malting.

Some sections of the state that grow barley in large quantities for sale might afford to grow only desirable malting varieties and thus obtain better prices than otherwise would be possible.

## RECOMMENDED VARIETIES

Extensive yield trials are made at the Central and Branch Experiment Stations, as are many demonstration trials in farmers' fields. The data obtained from these trials are compared and the more promising varieties are placed on the recommended list. Seven varieties of barley are on the recommended list: Velvet, Minn. No. 447; Glabron, Minn. No. 445; Improved Manchuria, Minn. No. 184; Minsturdi, Minn. No. 439; Peatland, Minn. No. 452; Trebi, Minn. No. 448; and Svansota, Minn. No. 440. Velvet is a smooth-awned variety of the Manchuria type. It has yielded about the same as Improved Manchuria (Table 2). The introduction of Velvet to farmers in 1926 has without doubt been an important factor in the rapid increase in barley

production in Minnesota. The different characteristics of the rough- and smooth-awned varieties are shown in Figure 1.

Glabron is very similar to Velvet in most of its characteristics but has a somewhat stiffer straw and has consistently yielded higher than Velvet in station trials as well as in farm trials in different parts of Minnesota (Table 2).

Improved Manchuria is well adapted to all parts of Minnesota, but like all other rough-awned varieties, it is very disagreeable to handle. It is somewhat inferior in yield to Glabron and has a weaker straw than either Glabron or Velvet. The comparative strength of straw of Velvet and Improved Manchuria is shown in Figure 2. For these reasons Improved Manchuria will probably be replaced by the smooth-awned varieties.

Minsturdi is a rough-awned, six-rowed barley. It has a dense head and stiff, short straw, which make it well adapted to rich soils where other varieties lodge badly. It is susceptible to the "stripe disease," which can be controlled by seed treatment.

Peatland is a rough-awned variety which, as its name indicates, is well adapted for growing on peat soils.

Trebi is a six-rowed, rough-awned variety that is grown quite extensively in northwestern Minnesota. In farm trials in 1929, it out-yielded Glabron and Velvet. It is losing favor among farmers as a feed barley, however, and is discounted on the market because of its poor malting quality. It is also susceptible to a disease which causes spot blotch, head blight, and root rot, and tho it yields well in spite of this handicap, it leaves the disease organisms in the soil to attack a following wheat crop.

Svansota is a rough-awned, two-rowed variety that has been recommended for northeastern Minnesota.

The yields of the recommended varieties at the various stations are given in Table 2.

**Table 3**

**Percentage of Hull for the Recommended Varieties of Barley Grown at University Farm, Crookston, and Grand Rapids**

| Variety | U. Farm | Crookston | Grand Rapids | Average |
|---|---|---|---|---|
| | per cent | per cent | per cent | per cent |
| Velvet | 11.5 | 12.2 | 13 2 | 12.3 |
| Glabron | 11.1 | 12.5 | 12.4 | 12.0 |
| Improved Manchuria | 10.3 | 12.0 | 11.6 | 11.3 |
| Svansota | 8.9 | 9.0 | 9.2 | 9.0 |
| Trebi | 11.2 | 11.5 | 12.2 | 11.6 |
| Peatland | 8.4 | 9.1 | 9.3 | 8.9 |

In addition to the trials at the experiment stations, many others have been made throughout the state in farmers' fields. A strip of the

recommended variety to be tested was seeded directly in the farmer's field at the same time that the farmer's variety was sown and comparable samples were harvested for the comparison of yields. In twelve trials made in the Red River Valley (Roseau to Traverse Counties), Trebi yielded 9.4 per cent more than Glabron. In twelve other trials in the same section, where the farm variety was unknown but which may have been Trebi, Glabron averaged 1.3

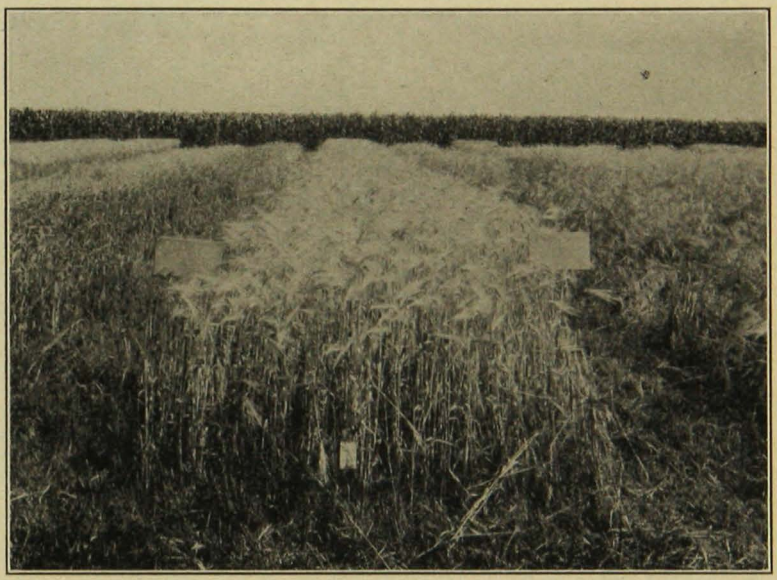

Fig. 2. Velvet Barley in Experimental Plots at University Farm with Improved Manchuria at the Right

per cent less than the other varieties. In thirteen trials in Faribault, Freeborn, Houston, and Steele Counties, Glabron averaged 8.1 per cent more than the farm variety, and in nineteen trials in these counties, Glabron yielded 7.1 per cent more than farm Velvet. In many of these trials, Glabron lodged less than the farm variety (Figure 3).

Velvet, Glabron, Trebi, and Manchuri have about the same percentage of hull. Peatland had the lowest percentage among the six-rowed varieties. Svansota, the two-rowed variety, has about the same percentage of hull as Peatland (Table 3).

## ADAPTATION OF VARIETIES

The smooth-awned varieties, Glabron and Velvet, and the rough-awned variety, Improved Manchuria, seem to be adapted to all sections of Minnesota. Trebi is best adapted to the northwestern terri-

tory. Its weak straw makes it undesirable for the conditions in southern Minnesota; Minsturdi, on the other hand, has a stiff straw and should be grown on the heavy soils where other varieties lodge badly.

Peatland is recommended for peat soils. In 1928 and 1929 some of the barley plots on the Page Low-Lime Peat Experimental Field were injured badly by disease. In 1928, Peatland and Velvet were compared. Velvet was injured severely by the disease, with the result that the average for 26 plots was only 6.6 bushels per acre; Peatland

Fig. 3. Glabron Barley in a Farm Demonstration Trial in Faribault County
Note the difference in the degree of lodging. Glabron, left; farm variety, right.

yielded 23.4 bushels per acre. In 1929. Peatland was compared with Glabron. On one field the plots were affected by the same disease, with the result that Glabron produced, as an average for six plots, 3 bushels per acre and Peatland 14.8. On another field there were 18 plots of each variety which were little, if at all, affected by the disease. On these plots Peatland yielded on the average 31.9 bushels per acre and Glabron 42.2. From these it is seen that Peatland is more resistant to the disease and consequently outyields Glabron and Velvet when the disease is prevalent. If Glabron escapes the disease, however, it may outyield Peatland on peat soils.

## ADEQUATE SEED SUPPLY

In addition to the use of high yielding adapted varieties, the maintenance of satisfactory soil conditions and good cultural practices, pure seed of high grade should be used. Seed of the recommended varieties is certified by the Minnesota Crop Improvement Association co-operating closely with the Minnesota Agricultural Experiment Station and Agricultural Extension Service. Liberal quantities of certified seed are produced annually by seed growers widely distributed through Minnesota. The fields of growers are inspected previous to harvest for purity, freedom from weeds and diseases, and general fitness for seed purposes. Purity of seed stocks is rapidly lost where no effort is made to keep them up. Seed certification is a very satisfactory means of maintaining a supply of good seed.

## DISEASES AND CONTROL METHODS

Barley is attacked by several diseases, the most important of which are loose and covered smuts, stripe disease, and late blight or spot blotch.

### Loose Smut

Loose smut of barley infects the flowers at flowering time. The spore clusters of infected plants develop in the heads the next year. These spore clusters are enclosed by a thin membrane which ruptures as the head emerges and sets free the loose spore-mass. The spores soon scatter, leaving the naked rachis and infecting neighboring plants.

If barley shows a very high degree of infection with loose smut, the seed should be discarded and new seed obtained. If this is impossible, sufficient seed for a seed plot may be treated by the hot water method. Place the seed in loose burlap bags until half full and soak in water at room temperature for about six hours. Then immerse in hot water at a temperature of 126 to 129 degrees F. for about 13 minutes. This treatment is rather difficult on the farm and if possible farmers should work co-operatively, treating their seed at a creamery where temperatures can be properly controlled.

### Covered Smut

The spores of the covered smut of barley are carried on the barley seed. If the grain is not treated, these spores germinate and infect the seedling plants. The fungus keeps pace with the growth of the plant and at ripening time, in place of a barley seed, a mass of spores is formed.

Treatment with a formaldehyde solution made with one pint of 40 per cent formaldehyde to 40 gallons of water is effective in the

control of covered smut of barley. Dip or sprinkle the seed with this solution or use a commercial seed-treating machine. Sow without allowing the seed to dry. Do not allow treated seed to freeze.

Ceresan is probably a better treatment for barley than formaldehyde, as it controls both covered smut and the stripe disease. Use 3 ounces of Ceresan to a bushel of seed. Be sure the chemical is well mixed with the seed. The mixing should be done in a closed container. An old barrel churn or something of this nature should be used. The dust is poisonous, so should not be breathed by the operator and the treated seed should not be eaten by livestock.

### Barley Stripe

The stripe disease is very destructive. It causes yellowish stripes on barley leaves and stems. These stripes later enlarge and turn brown. Many of the stripes may run together, discoloring the entire barley plant. The heads also may be affected and the entire plant killed prematurely. The spores from these brown stripes are carried by the wind and settle in the blooms of the barley spike. The best procedure is to grow resistant varieties, such as Glabron, Velvet, and Manchuria. Minsturdi and Trebi are susceptible and if grown, it is strongly urged that the seed be treated with Ceresan as described above.

### "Spot Blotch"

The organism causing the late blight or spot blotch disease of barley may affect the roots, sheaths, glumes, and kernels. Somewhat elongated, dark, blotchy spots are formed on the leaves and stems. Foot and root rots follow and seeds do not develop. Primary infection results from wind-borne spores and from spores on the seed and in the soil. Numerous secondary infections may take place up to the time of ripening.

The best defense against this disease is to grow the resistant varieties, Glabron, Velvet, and Manchuria. Trebi is very susceptible altho it yields well in spite of this disease.

### Scab[1]

Scab of barley is caused by a microscopic plant that is responsible for seedling blight in corn, known as *Giberella saubinetti*. The fungus lives over winter in diseased cornstalks and also on diseased straw and stubble of small grains, and is most severe when diseased cornstalks or other crop refuse has been left on the field. It can be controlled in a large measure by clean plowing in the fall. It is important that all the stalks be turned under.

[1] This summary was taken from Farmers' Bull. 1599, U. S. Dept. of Agr.

Clean and well treated seed is recommended for controlling the disease. Proper crop rotation will also aid materially.

If it is necessary to use diseased grain for seed, the scabby kernels, which are light in weight, can be blown out with a fanning mill with a heavy wind blast. Three ounces of an efficient mercury dust per bushel are recommended for seed treatment. Ceresan will also control barley stripe.

Some varieties of barley are more resistant than others. In preliminary tests made in Minnesota, Peatland appears to be resistant.

## DATE OF SEEDING

Date-of-seeding tests at University Farm in 1920, 1921, and 1922 showed that the best yields were obtained when barley was sown as early in the spring as it was possible to make a good seedbed. The results with later dates varied with the season. In 1920, when planting was delayed 20 days, there was a reduction in yield of about 16 bushels per acre. In 1921, 10 days' delay in time of planting led to lower yields. Similar results were obtained in 1922, except that Manchuria yielded about the same for the earliest planting, 10 days later, and 20 days later. But when planting was delayed 30 days, the yield was 11.5 bushels less than that obtained by the earliest planting.

## RATE OF SEEDING

No very conclusive evidence has been obtained from the experiments on rate of seeding. General observations lead to the recommendation that two bushels of seed per acre is the right amount to be sown under ordinary circumstances. The amount depends, however, on the germination percentage. If this percentage is low, more than two bushels should be sown per acre.

## SUMMARY

Barley production has nearly doubled in Minnesota during the last four years.

Most of the barley grown in the state is used for feed. Plump, full-weight barley has been found to be very valuable for hogs, sheep, and lambs, comparing very favorably with corn for this purpose. It was shown, however, that barley did not compare so well with corn for fattening baby beeves.

Seven varieties of barley are on the recommended list: Glabron, Velvet, Improved Manchuria, Minsturdi, Peatland, Trebi, and Svansota. Glabron and Velvet are smooth-awned varieties adapted generally to all of the barley growing sections of the state. Improved Manchuria

is also well adapted, but is a rough-awned variety. Trebi is a high yielder but lodges badly on rich soil and is very susceptible to late blight or spot blotch disease. Minsturdi is a rough-awned, stiff-strawed variety well adapted for rich soils. It is susceptible to the stripe disease and should be treated with Ceresan. Peatland is recommended for peat soils. Svansota is recommended for the northeastern section of the state or where, for any reason, a two-rowed variety is desirable.

The percentage of hull is about equal for Glabron, Velvet, Trebi, and Manchuria. Peatland had a smaller percentage of hull than any of the other six-rowed varieties.

The most important barley diseases are covered smut, loose smut, stripe, scab, and spot blotch. Ceresan treatment, 3 ounces per bushel of seed, will control covered smut and stripe, and aid in the control of scab.

Seed for a seed plot may be treated with the hot water treatment to prevent loose smut.

There is no preventive for late blight or spot blotch. The remedy is to grow resistant varieties: Glabron, Velvet, or Manchuria.