Winter Barley in Missouri

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Bulletin 508
September, 1947
COLUMBIA, MISSOURI

UNIVERSITY of MISSOURI
COLLEGE of AGRICULTURE

Agricultural Experiment Station
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Fig. 1.—A close view of winter barley sown in early September. Soil erosion could scarcely occur in such a thick spreading growth. This crop is ready for a long period of fall grazing.
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J. M. POEHLMAN and C. A. HELM

Winter barley is a valuable crop for the southern half of Missouri. The development of winter-hardy varieties will extend the crop northward. Tests of winter barley were begun by the Missouri Agricultural Experiment Station in 1921. They have been broadened and intensified. The information gained by these studies is reported herein.

Merits of Winter Barley

Winter barley gives an abundant and nutritious pasturage as well as good yields of excellent feed grain. Perhaps it is not equaled by any other crop for such a dual purpose.

It fits well in rotations with other crops and is a particularly favorable nurse for legumes and grasses. It makes thrifty use of soil fertility and is one of the most efficient cover crops for the control of soil erosion during the fall and winter. It can profitably take the place of corn on land medium in fertility, where winter-killing is not too severe.

Winter barley ripens much earlier than any other Missouri grain crop. The favorite varieties mature in late May to early June, about one week ahead of rye, two weeks ahead of wheat, and three to four weeks earlier than oats.

Thus winter barley escapes much of the damage by chinch bugs and spring drought that may be fully inflicted upon later grain crops. Because the barley crop is harvested so early, the growth of any legume or grass previously sown therein is greatly favored; or, if there is no intersown growth, the land is left free in time for sowing a full season crop of soybean hay or Sudan grass. Barley grain is available for feed in early summer when the supply of other grains, especially corn, is low and the price high.

Winter barley may be produced by nearly the same standard methods used in growing a crop of wheat. In central and south Missouri it may be considered as safe a crop as either wheat or oats, if it is correctly handled, and if its partial avoidance of chinch bugs and spring drought is taken into account over a long period.

Winter Barley Pasture

In Missouri winter barley is excellent for fall pasture. It exceeds wheat and equals rye in earliness and size of fall growth and vigorously renews itself under grazing. It, therefore, can furnish abundant pasturage in the fall and, if not severely damaged by winter, still
develop a spring growth for either pasturage or grain. Wheat sown very early for fall pasture and grazed as long and as heavily as barley sown at the same time, would be subject to injury from the Hessian fly. Wheat estimated wholly as a pasture crop is inferior to barley for fall pasture but generally superior for spring pasture. Rye is less productive than barley on good land if both crops are given an early start in a normal season; but rye is superior to barley on medium to poor land, particularly if the sowing is very late and the season dry.

In the fall and early spring stages of its growth winter barley has the high palatability and nutritive quality of good young grass. The average composition of barley pasturage through the period October 10 to November 7, is shown in comparison with representative analyses of young bluegrass and young alfalfa, in Table 1. A striking feature of the barley composition is a good content of protein in relation to such a high proportion of water. The water content, however, decreases as the plants advance in age. The abundant growth is eagerly eaten by grazing animals.

Table 1.--Chemical analysis of barley pasturage, bluegrass and alfalfa

<table>
<thead>
<tr>
<th></th>
<th>Water %</th>
<th>Ash %</th>
<th>Crude protein %</th>
<th>Fat %</th>
<th>Crude fiber %</th>
<th>Nitrogen-free extract %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley (6-10 weeks growth)</td>
<td>84.9</td>
<td>2.3</td>
<td>4.0</td>
<td>0.5</td>
<td>2.6</td>
<td>5.7</td>
</tr>
<tr>
<td>*Bluegrass (before heading)</td>
<td>76.2</td>
<td>2.7</td>
<td>5.3</td>
<td>1.3</td>
<td>5.2</td>
<td>9.3</td>
</tr>
<tr>
<td>*Alfalfa (before bloom)</td>
<td>80.1</td>
<td>2.3</td>
<td>4.7</td>
<td>0.8</td>
<td>4.2</td>
<td>7.9</td>
</tr>
</tbody>
</table>

*From Henry and Morrison.

Management of Winter Barley Pasture

To give its largest and best distributed yield of pasturage, winter barley should be sown at the rate of two bushels per acre right after the August or early September rains. In normal seasons it may be used from late September or early October until early December. Spring grazing, beginning April 1, may run well into May.

The length of the pasture period as well as the intensity of grazing winter barley requires regulation for the best yields of either pasturage or grain. Begin grazing long before the plants have begun to joint, for the jointed plants will neither renew growth if eaten down nor live through the winter if left ungrazed. Also there may be some smothering in a tall rank growth which goes ungrazed into winter, even though it has not reached the jointing stage. On the other hand, the stand should not be grazed to the ground, for this
treatment will weaken the plants and cause many to die during the winter. Therefore, the fall grazing of barley should be well balanced between under-grazing and over-grazing. The growth must be kept down to prevent either jointing or smothering, but not so low as to starve the plants. Probably the maximum pasturage for both fall and spring will be obtained if fall grazing begins when the stand is 4 or 5 inches tall and proceeds until winter at a rate that will evenly consume the growth and finally leave enough (about 4 inches) to stand cold weather.

Fall grazing, if not carried to the point of destruction, will allow a spring yield of grain; it may even increase the grain by keeping down a rank early fall growth that might otherwise reach the jointing stage or become infected with disease. Spring grazing, however, should be regulated according to the immediate need for pasturage

Fig. 2.—Winter barley (left) sown in early September made many times the fall growth of wheat (right) sown on the fly-free date in early October. The picture was taken in late October. Because of frequent heavy Hessian fly damage wheat cannot safely be sown as early as barley for pasture. This puts wheat under a disadvantage as a fall pasture crop. But even though the two crops are sown at the same time, barley far outgrows wheat in the fall.
and the future need for threshed grain. If the greater necessity is for pasturage the crop may be grazed out completely; if grain is the main requirement the spring growth must be spared from heavy grazing, or in a dry season not grazed at all, in order that it may develop a grain yield. Certainly the grower cannot have heavy spring pasturage and a good yield of grain from the same crop. In normal spring seasons even light grazing will reduce the grain yield.

The profits from (1) grazing out the spring growth of winter barley or (2) saving it to mature a crop of grain, cannot be accurately compared. Their net difference will fluctuate with the nature of the season, the need of the grower for pasture or grain, the cost of harvesting and threshing the grain, and the prices of other feeds that could be substituted for the barley pasturage in early spring or for the barley grain in early summer. In case the feed requirements of a farm demand heavy grain pasturage in both fall and spring, and a supply of threshed barley in early summer, the necessity can be met by (1) the usual heavy fall grazing of barley, and (2) the spring grazing of wheat. Thus the barley would be relieved from any spring use and allowed to produce its maximum yield of grain.

**Winter Barley an Excellent Nurse Crop**

Winter barley with its short straw and early maturity is much the best of all the grain crops as a nurse for new seedings of legumes and grasses. The growth of barley straw, especially if the crop is fall pastured, probably will not exceed two-thirds of the straw growth in wheat or oats. The grain normally ripens in late May or early June. Thus the barley crop makes a lighter and shorter draft than the other grains upon soil moisture and available fertility and, at an early stage relieves the inter-sown legume or grass from the retarding effect of competition by the larger plants for moisture, soil nutrients and light. The result is a comparatively quick and strong development of the legume or grass.

In winter-barley stubble early superior growth of red clover, sweet clover, alfalfa, lespedeza or timothy is commonly seen when compared to these plants grown in wheat or oats stubble. A similar advantage is given the young intersown plants by the very early varieties of wheat and oats, though it is not so great as that which results from the earlier maturity and smaller production of straw by winter barley. This favorable effect of winter barley upon the success of the legume or grass sown in it, is one of the important features of the crop.

**Winter Barley as a Feed Grain**

Winter barley is an excellent grain crop in Missouri by reason of its good yields, early maturity, high nutritive value, ability to grow
well on medium land, and easy rotation with other crops. The nutritive quality of barley grain is illustrated by the following analyses:

Table 2.--Nutritive quality of barley grain

<table>
<thead>
<tr>
<th></th>
<th>Digestible protein</th>
<th>Total Digestible nutrients</th>
<th>Calcium</th>
<th>Phosphorus</th>
<th>Potassium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Barley</td>
<td>9.3</td>
<td>78.7</td>
<td>.05</td>
<td>.38</td>
<td>.52</td>
</tr>
<tr>
<td>Corn</td>
<td>7.4</td>
<td>83.7</td>
<td>.01</td>
<td>.28</td>
<td>.33</td>
</tr>
<tr>
<td>Oats</td>
<td>9.4</td>
<td>71.5</td>
<td>.09</td>
<td>.33</td>
<td>.40</td>
</tr>
<tr>
<td>Rye</td>
<td>10.3</td>
<td>80.1</td>
<td>.04</td>
<td>.37</td>
<td>.54</td>
</tr>
<tr>
<td>Wheat</td>
<td>11.3</td>
<td>83.6</td>
<td>.03</td>
<td>.43</td>
<td>.44</td>
</tr>
</tbody>
</table>


These data indicate barley to be higher in protein than corn but lower in total digestible nutrients since barley carries a hull which reduces its total feed value. Barley may replace corn in the rations of swine, dairy cows, fattening cattle and fattening lambs or sheep. It may be used to replace oats for horses or as a part of the grain feed for chicks or laying hens. For all classes of livestock except sheep and poultry, the barley should be ground, crushed, or rolled. Barley light in test weight may have a higher percentage of protein than heavy barley, but in total digestible nutrients the light grain will be lower than the heavy grain.

Results of feeding trials at the Missouri Experiment Station† in which barley was fed to fattening pigs, indicate that pound for pound ground barley is worth about 95 per cent as much as corn. Being higher in protein than corn, less protein-rich supplement is needed to balance the ration. If the barley contains an excessive proportion of scabby kernels it should not be fed to swine.

**Soils That Suit Barley**

Fertile, well drained soil is best for barley. Rapid, vigorous growth, necessary for fall pasture and spring grain, cannot be reached on soils low in nutritive elements. On the other hand, barley grown on soils high in nitrogen may often lodge and produce low yields of grain. The most profitable results will be obtained with this crop on our rolling upland soils, medium to good in fertility.

**Growing the Crop**

Barley should be planted on a firm, well prepared seedbed. Plowing is usually desirable but not always necessary. If barley follows

†Missouri Agricultural Experiment Station Circular No. 321.
soybeans, lespedeza or similar crops which have been removed as hay or pastured off, leaving the soil clean and free of excessive trash, a thorough disk ing and harrowing may be sufficient. But if barley follows another grain crop, and there is a heavy covering of stubble or weeds, these should be plowed under in time for the seedbed to become settled and firm. At planting time the surface should be well pulverized to permit the covering of the seed behind the drill.

The date of seeding winter barley will be determined by the intended use of the crop—whether as fall pasture or for grain only.

Barley that is to be pastured long and heavily in the fall should be seeded in late August or as early in September as moisture conditions permit. Barley that is to be planted for grain only should be seeded about mid-September in central Missouri, or in the extreme southern part of the State the first week in October.

Whether used for fall pasture, or only as a grain crop, barley should go into the winter with at least four inches of top growth and a fully developed root system to reduce losses from winter killing.

The best way to seed barley is with a grain drill, which permits planting at a uniform depth and rate. A fertilizer attachment is an essential part of the seeding equipment. Rates of seeding commonly vary from 8 to 10 pecks per acre. The heavier rate is preferred if the seeding date is delayed, since late-seeded barley does not stool as heavily and is more easily winter killed than early-seeded barley.

**Fertilizers Increase Barley Yields**

Winter barley is best adapted to moderately fertile soils. Because the plant straw is weak, barley may lodge seriously on soils exceptionally rich in nitrogen. On medium, well-drained land, barley responds profitably to liberal amounts of commercial fertilizer. In fact, failure to fertilize the crop may materially affect the winter survival and otherwise cause low yields.

Applications of 150 pounds of 20% super-phosphate per acre of winter barley at Columbia gave a four-year average increase of 8.3 bushels to the acre. Near Bolivar, in Polk County, the average increase over two years amounted to five bushels per acre, while near Paris, in Monroe County, the average annual increase over three years was 16.5 bushels. In a seven-year test near Elk Creek in Texas County, conducted by the Department of Soils, the fertilized barley produced an average of 11.5 bushels more per acre than did the unfertilized crop.

At Columbia the winterkilling of barley is nearly always less severe where fertilizer is applied. For example, in the hard winter of 1941 the yield without fertilizer was only 1.9 bushels per acre; but
adjoining plots receiving 150 pounds per acre of 20% super-phosphate yielded 16.6 bushels. At Columbia a moderate treatment combining lime, super-phosphate and potash has produced a nine-year average yield of 35 bushels where barley was grown in annual rotation with lespedeza. This was an average increase of 5.5 bushels per acre from lime only; 7.1 bushels from super-phosphate only; and 13.4 bushels above the yield on land receiving no treatment.

Fig. 3.—Many varieties of winter barley are tested on the Experiment Station plots at Columbia. Reno (left) is extremely hardy and productive and is the leading variety in Missouri. Missouri Early Beardless (center) also is widely grown. At right is an experimental selection being compared with these standard varieties.

Barley in Crop Rotations

Early growth, winter survival and finally the yield of winter barley is greatly influenced by the kind of seedbed provided. The seedbed should be finely worked and firm. It should be fully as good as the seedbed normally prepared for wheat. The crops which occupy the land ahead of barley, the manner of utilizing such crops, and the condition of land following their removal, all have a definite effect on the success of the barley crop itself:

Barley is less suitable than wheat or rye as a fall-sown crop to follow corn or soybeans for grain. Barley would be sown too late
following lespedeza if the lespedeza is left to ripen seed before preparation of the seedbed for barley seeding.

Soybeans grown for hay and removed in August or early September leave the ground in excellent condition, with little or no extra seedbed preparation required for early fall barley seeding. Excessive erosion which might otherwise occur following removal of the soybean crop is quickly checked by the early growth of the barley and the thick coverage which it quickly develops.

Lespedeza cut for hay in late July or early August, or fully grazed out by the last of August, leaves ample time for preparing the ground for seasonal barley planting.

Sudan grass on spring-plowed ground may be used for hay or pasture by early September and thus permit thorough disking of the seedbed for the fall seeding of barley.

It is feasible to grow barley and soybeans or barley and lespedeza in one-year rotations, by handling the soybeans or the lespedeza as suggested above. The winter barley could be entirely pastured out in the spring or combined for grain. Shallow plowing or thorough disking would permit quick seeding of the soybeans and give enough time to harvest the soybeans for hay by mid-September. A 70 to 80-day growth period of normal weather is the maximum required by soybeans to mature for hay.

A barley-lespedeza one-year rotation with the lespedeza stubble worked in late August or early September, would require that the lespedeza stand be renewed each year by sowing on the winter barley during the late winter or early spring months.

Winter barley and red clover work exceptionally well in a two-year rotation. Two fields are required. One field would be in barley which would also serve as a nurse crop for first-year red clover; the other field would be in second-year, or full season red clover. The light straw production and the early harvesting of the barley grain under average conditions of soil and season, will usually give three-fourths a normal yield from first-year red clover following removal of the barley.

The field of second-year red clover, following two cuttings of hay or one cutting of hay and the second cutting for seed, would be plowed shallow or merely worked with a disk or field cultivator in preparation of the ground for reseeding the barley. If the red clover seed crop is harvested and threshed standing with a combine enough red clover seed usually will be left on the ground to produce a normal red clover stand in the barley. Otherwise the red clover would be re-established in the barley by mechanical seeding.

A two-year rotation of barley and sweet clover may be carried on by essentially the same procedure outlined for barley and red clover.
Varieties for Missouri

Only the most winter-hardy varieties of barley can be successfully grown in Missouri. *Reno*, *Michigan Winter*, *Ward*, and *Kentucky No. 1* are the varieties so far known to be superior in hardiness and in yield. All of these are bearded and are similar in appearance, hardiness, and yield. All are susceptible to the various forms of smut, and all except *Kentucky No. 1* are highly susceptible to mildew. These diseases are common in Missouri. *Kentucky No. 1* is slightly later in maturity than the other three varieties.

Fig. 4.—Only the most hardy barley varieties should be grown in Missouri. In 1947 at Columbia, the Reno variety (left) survived with little killing; but the less hardy Wong variety (right) was severely injured.

*Missouri Early Beardless* is a hooded or beardless variety, and has been widely grown in southern Missouri. While one of the most hardy of the beardless types, it is less hardy than the bearded varieties listed above and is lower in total yields and test weight of grain. It produces an erect, leafy growth in the fall and spring, and these qualities have made it popular for pasture. It matures 3 to 5 days ahead of the bearded varieties, but is more inclined to shatter, and has a greater tendency to lodge. It is susceptible to the smuts and to mildew.
Comparisons in yield, test weight, and winter survival between these varieties follow:

Table 3.--Yield, test weight, and winter survival of barley varieties

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield¹ Bu. per A.</th>
<th>Test wt.² Lbs. per Bu.</th>
<th>Per Cent³ Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reno</td>
<td>34.5</td>
<td>46.5</td>
<td>91</td>
</tr>
<tr>
<td>Michigan Winter</td>
<td>33.5</td>
<td>46.7</td>
<td>90</td>
</tr>
<tr>
<td>Ward</td>
<td>34.9</td>
<td>46.0</td>
<td>89</td>
</tr>
<tr>
<td>Kentucky No. 1</td>
<td>35.9</td>
<td>49.5</td>
<td>91</td>
</tr>
<tr>
<td>Missouri Early Beardless</td>
<td>23.5</td>
<td>42.3</td>
<td>84</td>
</tr>
</tbody>
</table>

¹Fifteen comparisons at Columbia, Lathrop, Bethany, Elsberry, and Sikeston, (except Kentucky No. 1, 9 tests only).
²Two comparisons at Columbia and Lathrop.
³Five comparisons at Columbia (1943 through 1947).

The above data show little difference between the bearded varieties, but all of these kinds are superior in yield of grain and in hardiness to the Missouri Early Beardless variety. Numerous other commercial winter varieties have been tested in Missouri. The more important of these are Wong from New York, Nassau from New Jersey, Tucker from West Virginia, Iredell and Sunrise from North Carolina, Tennessee Beardless and Jackson 1 from Tennessee, and

Table 4.--Winter hardiness of barley varieties

<table>
<thead>
<tr>
<th>Year</th>
<th>Missouri Early Beardless</th>
<th>Michigan Winter</th>
<th>Reno</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yields in bushels per acre</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1935</td>
<td>25.8</td>
<td>47.5</td>
<td>---</td>
</tr>
<tr>
<td>1936</td>
<td>27.6</td>
<td>29.1</td>
<td>---</td>
</tr>
<tr>
<td>1937</td>
<td>26.0</td>
<td>46.8</td>
<td>---</td>
</tr>
<tr>
<td>1938</td>
<td>39.0</td>
<td>39.3</td>
<td>---</td>
</tr>
<tr>
<td>1939</td>
<td>32.9</td>
<td>34.6</td>
<td>---</td>
</tr>
<tr>
<td>1940</td>
<td>47.4</td>
<td>52.7</td>
<td>48.4</td>
</tr>
<tr>
<td>1941</td>
<td>19.5</td>
<td>42.7</td>
<td>49.8</td>
</tr>
<tr>
<td>1942</td>
<td>9.1</td>
<td>13.5</td>
<td>13.8</td>
</tr>
<tr>
<td>1943</td>
<td>28.7</td>
<td>36.0</td>
<td>35.4</td>
</tr>
<tr>
<td>1944</td>
<td>19.8</td>
<td>20.5</td>
<td>23.3</td>
</tr>
<tr>
<td>1945</td>
<td>28.2</td>
<td></td>
<td>35.5</td>
</tr>
<tr>
<td>1946</td>
<td>29.5</td>
<td>28.4</td>
<td>33.5</td>
</tr>
<tr>
<td>1947</td>
<td>29.0</td>
<td>36.1</td>
<td>37.6</td>
</tr>
</tbody>
</table>
Fayette from Arkansas. All of these are less hardy than the varieties listed in the summary above and are unsatisfactory for Missouri conditions.

**Where Winter Barley May Be Safely Grown**

The best varieties of winter barley now available are reasonably safe from winterkilling in Missouri south of the Missouri River. With good cultural practices, they are reasonably safe also for the counties adjoining the Missouri River on the north. Farther north in Missouri severe winterkilling of barley may be frequently expected, even though the most hardy varieties now known, and good production practices, are used.

At Columbia no complete failure from winterkilling has occurred in 13 years ending with 1947, using the best production practices. During this period the Missouri Early Beardless variety has been grown every year, the Michigan Winter variety every year except 1945, and the Reno variety in each of the last seven years. Their annual yields are reported here to illustrate the relative safety of the barley crop in this area of Missouri. (Table 4).

The 1941 crop of Missouri Early Beardless was severely injured by winterkilling, the damage resulting from a sudden drop in temperature to near zero early in November, without previous hardening of the barley plants. Missouri Early Beardless is less hardy than Reno and Michigan Winter and, as illustrated by the comparative yields, was more severely injured. The low yields of all varieties in 1942 and 1944 did not result from winterkilling but from generally unfavorable growth conditions caused by excessive rainfall throughout the fall and spring.

At Lathrop in northwest Missouri, where winter conditions are more severe than at Columbia, winterkilling caused the abandonment
of the crop in two seasons during a seven-year period ending with 
1947. Winter wheat tests grown in adjacent plots were also aban­
donned in the same two seasons.

At Sikeston, in southeast Missouri, winter barley has not been 
appreciably injured by winterkilling in the 13-year period ending 
with 1947.

Winter barley is less hardy than winter wheat or rye, but is 
more resistant to killing than winter oats. Killing of the barley 
plants may occur by freezing or by the heaving of the plants out of 
the ground through the alternate freezing and thawing of wet soil. 
In the northern part of the winter barley area, the tops of the barley 
plants are usually killed by cold during the winter months, but if the 
crown remains green and the plant alive, the crop will recover and 
may still produce good yields. On wet, heavy soils much of the 
winter killing occurs during late winter or early spring from heaving 
or the lifting of the plants out of the ground. Winter killing by this 
method is less severe on well drained land.

Production practices which enable the barley plant to develop 
vigorous and healthy roots in the fall will decrease the winter injury. 
Such practices include early seeding of a hardy variety on a well­
prepared seedbed, liberal use of fertilizer, and disease treatment of 
the seed before planting.

**Barley Diseases**

The presence of disease in barley may increase winter killing, 
reduce yield, and lower the weight and quality of the grain. Diseases 
most destructive to the Missouri barley are the smuts, spot-blotch, 
stripe and scab. These will be briefly described and measures for 
their control discussed. Other diseases, such as mildew and scald, 
may be destructive in limited areas and in seasons favorable for 
their development but they are usually minor in importance.

**Smuts**—The smuts destroy the barley head, replacing the grains 
with a mass of black, powdery spores. Two kinds of smuts are easily 
recognized, *covered* and *loose*. In covered smut the masses of spores 
are inclosed in a white or grey membrane and often remain covered 
until after harvest. These smut masses are broken up in threshing 
and the spores scattered over the seed. Thus the disease is carried 
from one crop to the next on the *outside* of the seed. It may be easily 
controlled by dusting the seed with New Improved Ceresan at the rate 
of ½ ounce per bushel.

The loose smuts do not have a heavy membrane covering the spore 
masses and are soon washed off or blown away, leaving only the naked 
stems. Two forms of loose smut, indistinguishable in the field, are 
known to occur widely in Missouri. In one form called *black loose*
smut, the black spores are blown onto developing heads of adjacent plants, and are thus carried to the next crop on the outside of the seed as in the covered smut. This form of loose smut can be controlled by New Improved Ceresan, as described for covered smut.

In the other form, called brown loose smut, the spores are blown into the open flowers and grow inside of the developing seed. Brown loose smut cannot be controlled by surface seed treatments. Its control requires a hot water treatment in which the seed is immersed for 10 minutes in water, heated to a temperature of 129 degrees Fahrenheit. The seed should first be soaked for four hours and afterwards dried as rapidly as possible. This treatment may injure germination and should only be used with small lots of seed.

Fig. 6.—The covered smut of barley (left) is carried from one crop to the next on the seed. This disease can be controlled by treating the seed with New Improved Ceresan at the rate of ½ oz. per bushel. The loose smuts (right) are of two forms, indistinguishable in the field. Black loose smut can be controlled with Ceresan but treatment by the hot water method is required to control the brown loose smut.

Spot blotch—This disease affects the roots, leaves and head, resulting in reduced germination, winter killing, smaller yields and lighter grain. Since much of the damage is to the root system, its presence is not always observed and its importance has probably been
underestimated in Missouri. It is most severe in the fall when early planting is followed by warm, wet weather. Here it may be recognized by the presence of brown spots on the leaves, followed by a gradual yellowing and killing of affected parts. Plants severely injured winter kill more readily than healthy plants. The complex nature of this disease makes control difficult. Some benefits may be derived from seed treatment with New Improved Ceresan which kills surface

borne spores, but crop rotation in which barley does not follow barley or wheat is recommended. Use of fertilizer to keep the barley in a vigorous growing condition will reduce the amount of damage.

**Stripe**—This disease is characterized by the presence of dark stripes running lengthways of the leaf blade. Infected plants are usually stunted and often die before or soon after the heads emerge. Treatment of the seed with New Improved Ceresan will control this disease.

**Scab**—Scab may attack either the entire head or a portion of the head. Infected areas are killed, the hull becomes discolored, and the presence of a pink mold may often be observed. Diseased kernels are shriveled and light in color. It is more prevalent in wet than in dry

Fig. 7.—Spot-blotch affects the roots, leaves and head resulting in reduced germination, winterkilling, and smaller yields. It may be recognized in the fall by the presence of brown spots on the leaves, as on the plant at left. The affected parts gradually yellow and sometimes die. The plant at right has been stunted by this disease.
seasons. The organism causing the scab infection also produces root, stalk and ear rots in corn. Scab infection may be reduced by plowing under infected stubble, cornstalks, and trash, fanning the seed to remove light scabby kernels, and treatment of the seed with New Improved Ceresan to kill surface borne spores. Barley grain heavily infected with scab should not be fed to swine.

Winter Barley as Substitute for Corn

One of the larger problems of Missouri Agriculture is to find a better use for low-fertility land than growing on it the meagre corn crops that now occupy more than half our corn acreage. It is in filling this need that barley finds its greatest usefulness in Missouri agriculture.

Our corn crop in the past several years has covered approximately 5 million acres. It has been estimated that two-fifths of this acreage...
is on productive land where average yields will exceed 35 bushels per acre; the next two-fifths is on land that will produce an average of less than 35 bushels per acre; but the scanty output of the remaining one-fifth falls below even the 30 bushel mark.

There is little or no profit in growing corn on the less productive of these areas, unless the price of corn is very high. Furthermore, the continued cultivation of corn on land with a fertility level grading from 30 bushels downward, rapidly reduces the small store of remaining fertility, subjects the soil to destructive erosion, and year after year increases on the whole farm the difficulty of making a living.

Land below the productive grade of 30 bushels of corn to the acre, if it is to be used for staple crops, should not grow grain at all but should be turned to pastures and forages. On land capable of producing 30 to 35 bushels of corn, the small grains should be widely substituted for the corn crop, to supplement the grain feed supply from the large acreage of pastures and forages grown there.

Winter barley could well replace corn as a feed grain crop on much of the 30-35 bushel corn land in central and southern Missouri, where barley is a safe crop. Barley's special value for this purpose is found in (1) the high yield of grain per acre on soils of medium fertility, (2) the light draft on soil fertility, and the dense spreading growth which prevent soil loss through depletion and erosion, (3) the economy in production as compared to a cultivated crop such as corn, and (4) the high nutritive quality as a feed grain for all classes of livestock. If to these considerations is added the value of fall pasture, the utility of barley becomes even more significant.