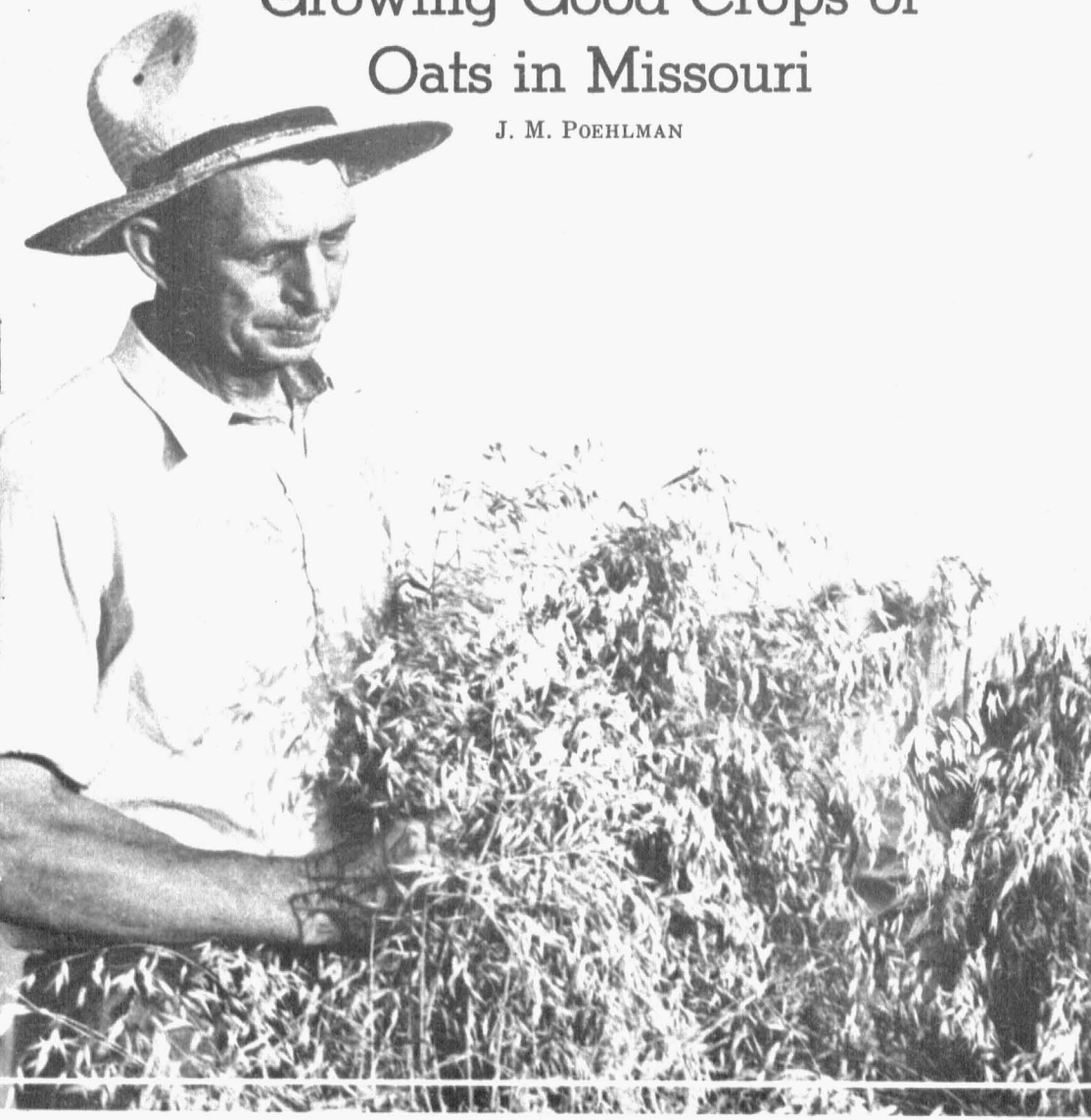
Growing Good Crops of Oats in Missouri

J. M. POEHLMAN



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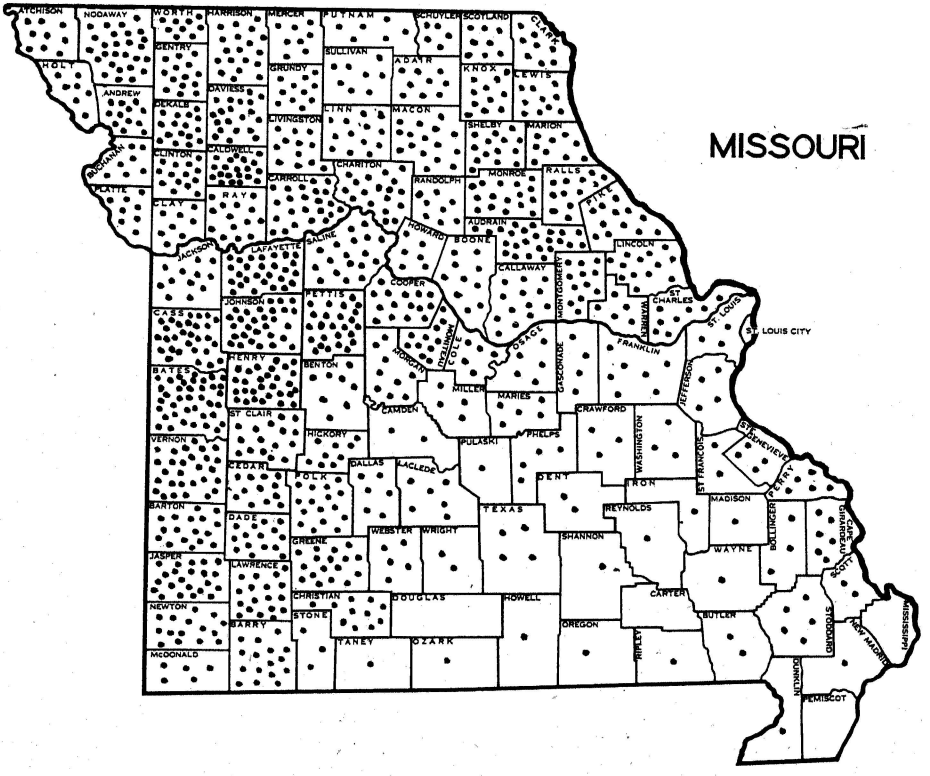

Fig. 1.—This map shows where oats are grown in Missouri. (Each dot represents 2000 acres.) Oats is an important crop for the Missouri farmer as it enables him to move easily in a rotation from a cultivated crop such as corn to small grains and legumes, and provides excellent grain feed for livestock.

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(Revision of Bulletin 439)

J. M. POEHLMAN

Oats are a low priced crop. Therefore oats must give a high yield per acre, whether the returns are figured for the crop as a separate unit or as a part of the year's production by an acre of land.

But in many seasons the yield of oats in Missouri is sharply checked by early hot dry weather. (See Fig. 2.) Our spring period is nearly always too short for the best development of the oats grain. That is the reason Missouri oats seldom if ever reach the large yields and heavy weight per bushel found in northern oats.

The limitation of growth by a short season may be partly avoided by an early crop. This favorable possibility is the basis of the more important methods for the production of good crops of oats here, whether they are grown after corn or soybeans in rotations or grown with Korean lespedeza to form a double-crop rotation in one year.

Methods for an Early Crop

The early sowing of a productive, early variety is the essential practice for a good yield of oats in Missouri. If this is supplemented by the suitable preparation of the land, the reasonable use of fertilizer, and the treatment of the seed oats for smut and blight, the resulting crop is likely to be satisfactory. Each of these measures for good production is discussed in this bulletin.

Effect of Early Sowing

The favorable influence on yield of sowing the oats crop early is generally known to progressive growers. It is clearly shown by the results of sowing the Columbia variety on advancing dates in three distinctly different seasons at Columbia, Missouri. The yields are summarized here:

(Excellent season, March to July) 1933		(Good season through May and June) 1931		(Extremely poor season through June) 1932	
Date sown	Yield per A. Bu	Date sown	Yield per A. Bu	Date sown	Yield per A. Bu.
Feb. 28	68.3	Mar. 26	51.9	Mar. 28	29.0
Mar. 28	60.6	Apr. 2	50.3	Apr. 7	28.2
Apr. 12	47.7	Apr. 11	35.2	Apr. 18	22.9

Heavy reduction in yield resulted from late planting in all three seasons—the excellent, the good, the poor. This fact indicates the necessity of starting the crop early enough to permit it to utilize the longest possible period of moist cool weather and thus reach advanced growth before it is damaged by drought and heat. If a late maturing variety had been used in this test instead of the early maturing Columbia, the losses from late sowing probably would have been much greater.

In southern Missouri oats should be sown in late February if conditions permit the good preparation of the land. In central Missouri early March would be a suitable period for best early seeding. In northern Missouri the crop should usually be sown by March 20.

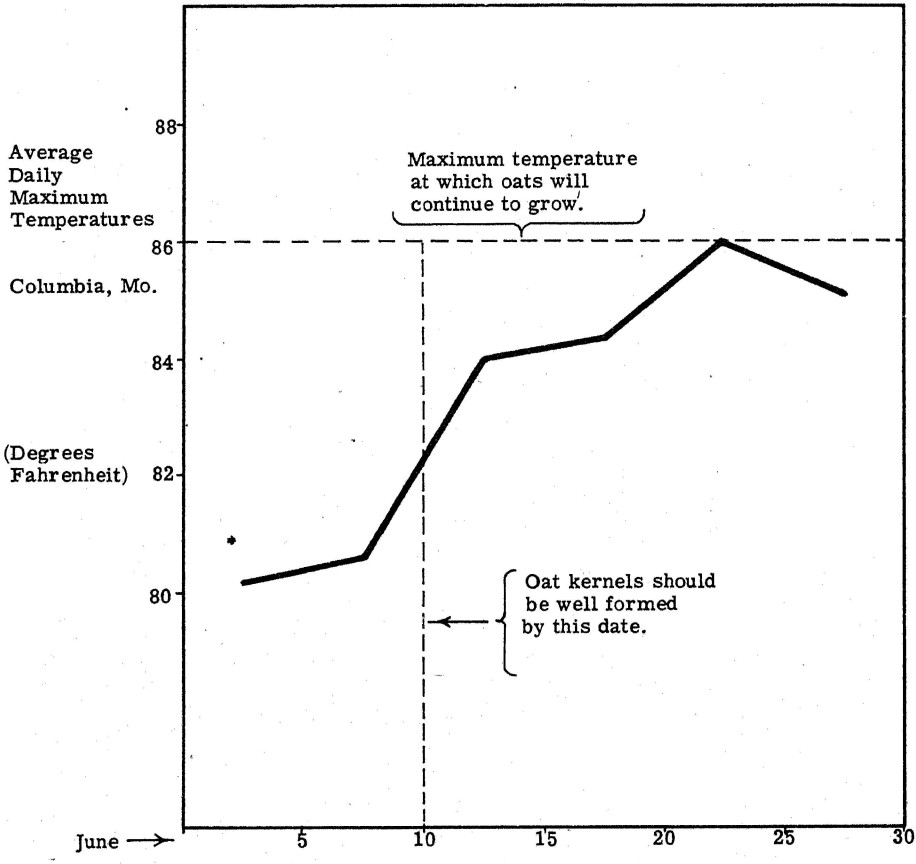


Fig. 2.—In Missouri, the temperatures of mid-June and late June often approach or even exceed the maximum (86 degrees), at which oats will continue to grow. Kernels formed under these conditions are light in weight. Early seeding of an early variety permits full development of the kernel before high temperatures are encountered.

Oats sown during the periods recommended may be damaged or killed by cold weather after sowing. But delay on account of this possibility will more frequently make certain the damage of the crop by drought in early summer.

Choosing a Variety

Improved varieties of oats are fast appearing. Sixteen, or more, named varieties have been developed in the five most recent years by agricultural experiment stations in the Midwest alone. Additional strains are being tested, increased, and distributed each year. This flow of superior varieties is the product of intensive and painstaking work by researchers engaged in breeding better oats.

From this succession of new and varied forms the farmer must choose a variety for his farm. Unless information is available that will permit the selection of adapted strains, the choice may not always be made wisely. The urge to try something new, combined with spectacular publicity about new varieties, sometimes results in discarding a good adapted variety for one unsuited to the locality. The only sound basis for choosing a variety is its record of performance as compared with that of varieties already accepted in the area where the variety is to be used. Also, careful consideration should be given to its important features—earliness, stiffness of straw, disease resistance, and kernel quality. Varieties favorable in all of these qualities will find wide and continued use, which is the final mark of a good variety.

Columbia Leads in Earliness

Real progress in growing better oats in Missouri was first made with the use of two early maturing, red-kerneled varieties. These varieties, Fulghum and Columbia, in the order named, successively filled the oat acreage of this State. Fulghum was first tested here in 1919, and its earliness and high yield were at once noted. Columbia was developed here from a single plant selected from Fulghum in 1920 and was distributed to farmers in 1932. Earliness, vigor, productiveness, and good seed quality have been its outstanding features. The use of Columbia spread rapidly and by the early "forties" it was grown on 90 per cent of the Missouri oat acreage. By that time, also, it had become one of the most widely grown spring oat varieties in the entire United States.[1]

Thus the special adaptation of extremely early maturing varieties of oats to Missouri conditions has long been established. And *earliness* remains the single quality most needed in our Missouri varieties.

[1] Coffman et al., Jour. Amer. Soc. Agron., 1945.

New Varieties are Resistant to Disease

Recently a group of new varieties has been brought into northern Missouri. Of these Boone has been most widely grown, but its sister selections—Tama, Control, Vicland, Cedar, and Vikota—are grown in lesser amounts. All of these are the product of a single cross between Richland, an Iowa variety, and Victoria, recently introduced from South America. These varieties have been characterized by short stiff straw, high yield of grain and resistance to rusts and smut. The stiff straw made these varieties more desirable for combine harvesting than Columbia and other varieties previously grown, and resistance to rusts protected them from ravages of these diseases in seasons when susceptible varieties were injured. In tests conducted prior to and including the 1945 season, comparative yields of Boone and Columbia were as follows:

Varieties	Northern[1] Missouri	Central[2] Missouri	Southern[3] Missouri
Boone	59.5 bu.	48.8 bu.	31.8 bu.
Columbia	45.9 bu.	50.2 bu.	34.5 bu.

[1]Tests conducted at Lathrop, 3 yrs.; Maryville, 3 yrs.; Bethany, 2 yrs.
[2]Tests conducted at Columbia, 7 yrs.; Elsberry, 2 yrs.
[3]Tests conducted at Sikeston, 3 yrs.

The superiority of Boone over Columbia in these tests in northern Missouri is easily observed. Here the Boone variety spread rapidly and soon led all others in acreage.

These data also show that in central and southern Missouri, the new Boone variety did not measure up to the older Columbia variety. Boone and its sister selections lack earliness—a feature essential for high yield in Missouri. Under our growing conditions Boone matures about five days later than Columbia. This difference, although small, in many seasons may mean the difference between a good yield of plump grain or yields reduced by grain light in weight. A variety such as Boone, well adapted to the seasonal conditions of central Iowa, may be moved into northern Missouri with little loss of adaptation, but moved farther southward it becomes progressively less and less adapted. For this reason Boone and its sister selections won acceptance only in northern Missouri.

In 1946, when planted alongside Columbia in nine plot tests in central and northern Missouri, Boone averaged 60.7 bushels as compared to 66.5 bushels for Columbia. These results for 1946 are given separately since they show a yield relation between these varieties in contrast to those already presented, and are significant since they mark the beginning of a decline in the use of Boone (and its sister varieties) in Missouri. Two factors contributed to the 1946 results. First, the season was early marked by high temperatures which more

Fig. 3.—Varieties of oats growing on the University South Farm, Columbia. From extreme left to right the varieties are Columbia, Osage, Neosho, Boone and Clinton. Columbia is the leading variety in Central and South Missouri, but has been largely replaced in northern Missouri by Boone. Clinton is expected to replace Boone in this area when seed becomes available.

nearly approached the average June temperature shown in Figure 2 than did the earlier seasons in which the high performance of Boone was noted. Second, and perhaps of greater importance, was the presence in Missouri of a new disease, currently called *Helminthosporium* blight. Boone and the sister varieties were greatly injured by this disease, while the older Columbia did not appear to be affected. This disease will be discussed in a later paragraph.

Two of the newer varieties are Clinton and Benton. These varieties, differing mostly in height of straw, were developed by crossing Bond, a variety introduced from Australia, with a stem-rust-resistant Iowa strain known as D-69. Clinton and Benton were jointly distributed by the Iowa, Illinois, and Indiana Agricultural Experiment Stations. Their outstanding qualities are high yield, stiff straw, and resistance to rusts, smut, and the new blight disease. Both are later in maturity than is generally desirable for Missouri, being even later than the Boone variety. But from information now available, it appears that Clinton, and perhaps to a less extent Benton, will find acceptance in northern Missouri, filling in the gap left by the decline in the acreage of Boone.

Other recent varieties will be discussed more briefly.

Marion is grown to a limited extent in Missouri. It has stiff straw, moderate resistance to rusts, and good resistance to smut and the new blight disease, but is even later in maturity than Boone or Clinton.

Mindo, Osage, and Neosho are all early maturing, but are short strawed, and the two latter are very susceptible to the new blight disease.

Bonda, Eaton, Forvic, and Mohawk are of varied origin and all are too late to warrant consideration in Missouri.

Combination of Earliness and Disease Resistance is Needed

Columbia thus remains the only variety currently grown in Missouri which has the essential quality of earliness. Boone and Clinton have combined resistance to rusts and smut, stiff straw, and good production, but they lack earliness. If all of these qualities could be fashioned into a single early strain, it appears that we would then have a variety suited to Missouri conditions. This is the goal of the Missouri oat improvement project. Crosses were made as early as 1936 between Columbia and selected stiff-strawed and disease-resistant strains. Selections from these crosses now under test show promise of approaching the measurements desired.

Columbia Marketed as "Special Red Oats"

The two principal market classifications of oats based on the color of the kernel are, in the order of their importance, white and red. In the northern corn belt area varieties are almost exclusively of the white-kerneled sort. Some of the newer varieties such as Boone and Clinton have yellow kernels, but these are marketed in the white classification. In Missouri and other southern corn belt states, the early red-kerneled varieties have led in acreage. For many years red oats were discriminated against because they had heavy hulls and produced feed poor in color. As the red Columbia variety appeared on the market in increasing quantities, it was found to have kernels that were large and plump with thin hulls. These were qualities earlier found only in the white varieties. In order that Columbia oats might be marketed on an equal basis with white oats, a separate grade classification was provided. Known as "Special Red Oats," it includes only oats of the Columbia variety or those oats having similar kernel characteristics.

Diseases of Oats

The smuts and rusts have, in the past, been the most serious diseases of oats in Missouri. But the appearance of the new blight disease, earlier mentioned, makes it necessary to add a third major disease to our list. These will be briefly described.

The oat smuts have long been common in Missouri. The oat head is destroyed by this disease and black masses of spores are formed instead of kernels. By harvest time these spores have been spread

Fig. 4.—Smut in oats may be controlled by simple seed treatments and by breeding resistant varieties. Columbia is susceptible to smut; Boone and Clinton are resistant.

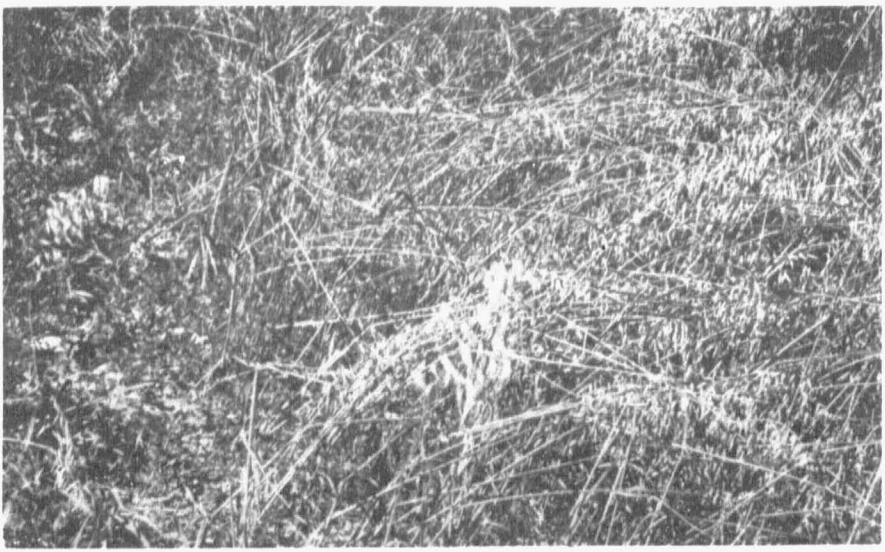


Fig. 5.—Lodging and low yield will result from a heavy infection with rust. If oats in Missouri are early, rust epidemics seldom reach the proportions illustrated here. But development of adapted, resistant varieties would protect the crop from the hazard of this disease in those years in which rust is present.

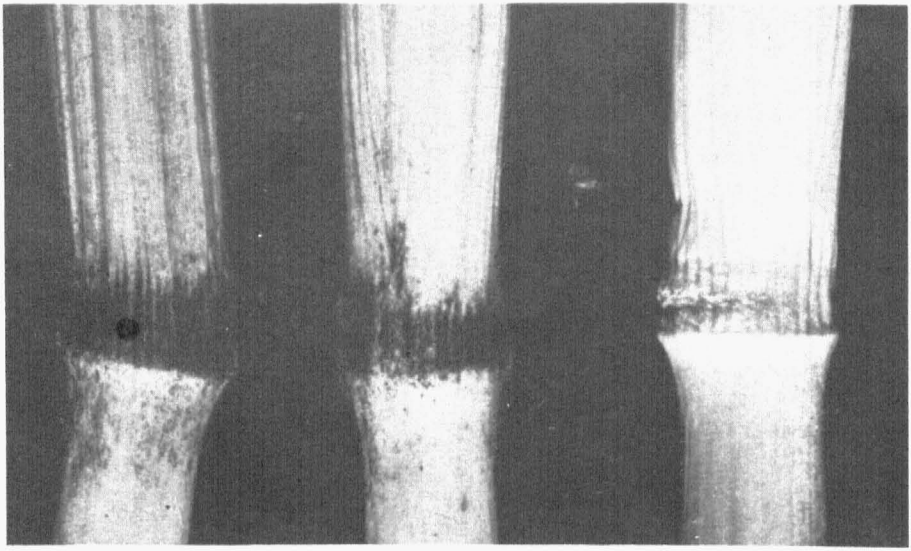


Fig. 6.—The discolored joints and stems of oats, as illustrated by the two stems on the left, are symptoms of the new Helminthosporium blight disease. Straw of Boone and similar susceptible varieties is weakened by this disease and breaks easily. Straw of resistant varieties, such as Columbia and Clinton, is clean and healthy as illustrated by the stem on the right.

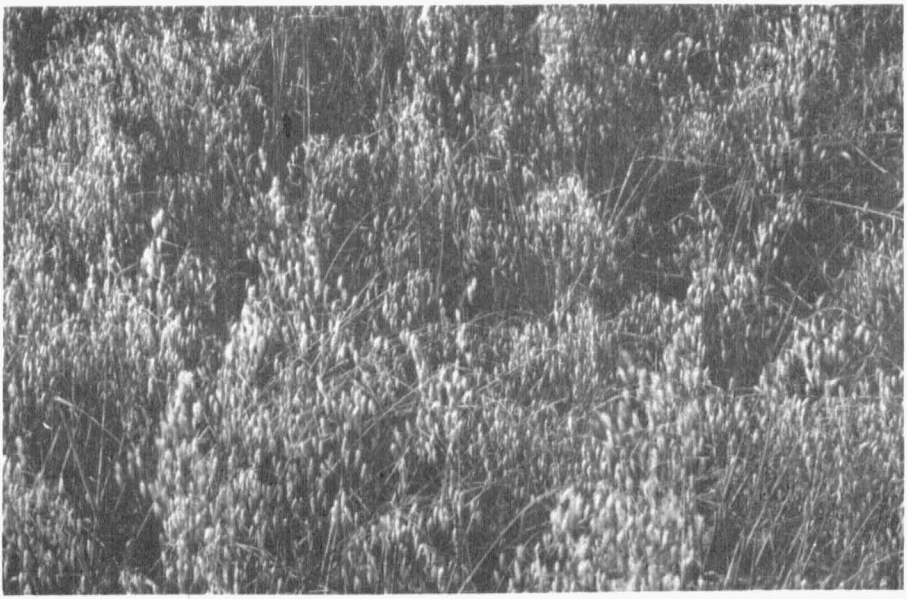


Fig. 7.—Lodging in Boone oats resulting from Helminthosporium blight. The important effects of this disease are reduction in stand, lodging, premature ripening, and loss in yield and test weight.

by the wind or washed to the ground, leaving only the naked stems on infected plants. The disease is propagated by the spores which fall on normally developing seeds and are thus carried into the next crop when those seeds are planted the following spring. Loss in yield is the important result of this disease. Control is effected by seed treatment killing the spores carried on the seed, and by breeding varieties resistant to this disease. Columbia, Fulghum, and older varieties are susceptible, but newer varieties, including Boone and Clinton, are resistant.

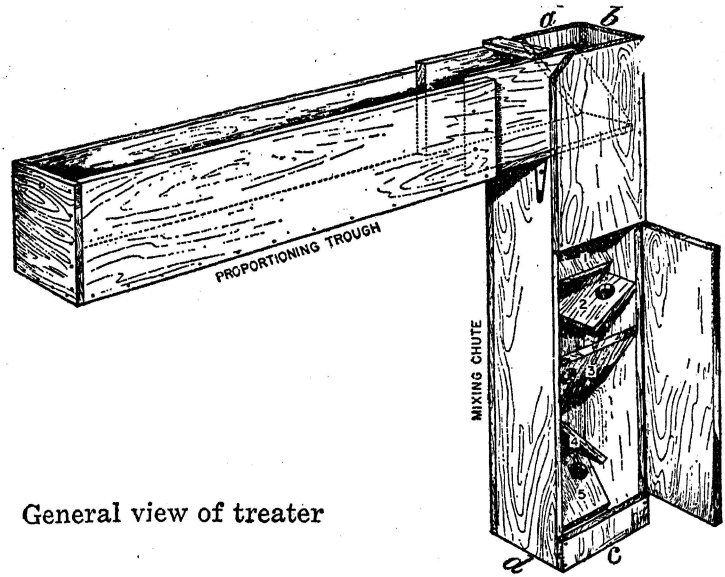
The oat rusts are of two kinds, crown or leaf rust, and stem rust. Crown rust appears as small orange-red pustules on the leaves and stem of the oat plant while stem rust produces brick-red, elongated pustules on the stems and to a lesser extent on the leaves. These pustules consist of masses of spores which are blown about by the wind and fall upon green, developing oats, there producing new infections. Wet weather at the heading stage favors the development of rust infections and also delays the maturity of the oats crop, thus prolonging the period of possible infection. An epidemic of this disease, occurring before the kernels are well formed, will result in low production of light kernels as well as severe lodging of the oat plant. Early seeding of an early variety will avoid rust damage in many years in Missouri. But the best control is by breeding resistant varieties. Boone and Clinton are examples of the latter.

Helminthosporium blight is a disease only recently found. It causes killing or blighting of seedling plants and premature ripening and lodging as the plants mature. The effects of this disease are reduction in stand, lodging, loss in yield, and production of kernels light in weight. It is severe on varieties derived from Victoria parentage; these include Boone, Tama, Vicland, Control, Osage, and others. Older varieties including Columbia and some of the newer ones such as Marion, Clinton and Benton have not been injured by this disease. Information on its control by seed treatment is, at this writing, scanty, but experimental results[1] point to control by use of New Improved Ceresan.

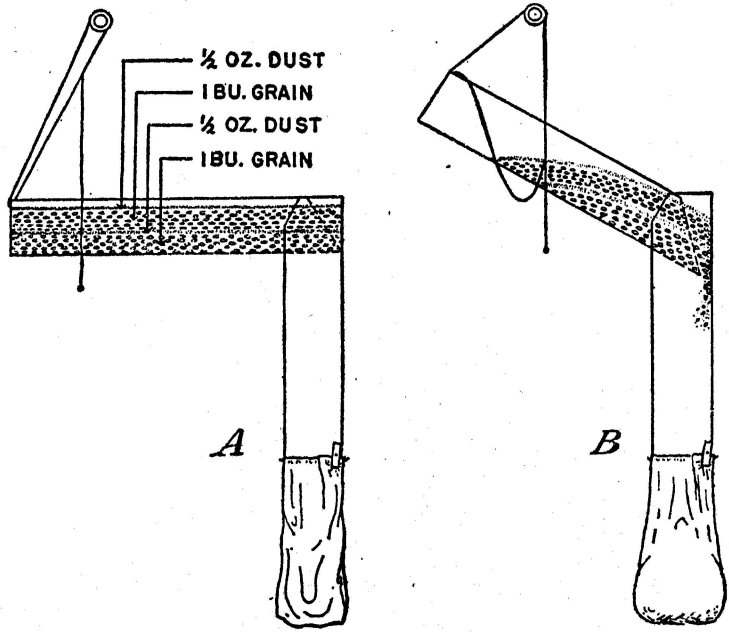
Seed Treatment

Seed oats are treated to control two diseases, smut and Helminthosporium blight. Both may be controlled easily and cheaply by a single treatment with New Improved Ceresan. This is a mercuric dust and is applied dry at the rate of one-half ounce per bushel of seed. Treatment is accomplished by mixing the Ceresan with the oats either in a tight drum or by the use of the simple seed treater

[1]Murphy, Iowa Farm Sci., 1946.



General view of treater



Using the treater: *A*, Manner of filling trough with seed and spreading the dust; *B*, dumping seed through mixing chute.

Fig. 8.—Plans for making and using a seed treater. (Courtesy of the Minnesota Agricultural Experiment tation.)

illustrated in this bulletin. If treatment is made for control of smut only, treatment with formalin is effective. Forty bushels of oats are sprayed with a mixture of one pint of 40 per cent formaldehyde and two pints of water, after which they are covered for a period of several hours. Seed treated with Ceresan is poisonous and should not be fed to livestock, but seed treated with formaldehyde may be safely used.

Hybrid Oats

New oat varieties are sometimes represented as 'hybrid" oats. It is usually meant that they are of hybrid origin. The term "hybrid" should not be applied to oat varieties with the same meaning in which it is applied to commercial types of hybrid corn, as the two crops differ in methods of pollination and breeding. "Hybrid" when applied to seed corn usually refers to first generation seed which must be replaced each year. But oat varieties of hybrid origin have been increased from a late generation selection from a cross between two varieties. Varieties developed in this manner are pure; and therefore the seed may be replanted year after year. Boone, Clinton, and other new varieties are of hybrid origin. But as varieties they should be judged on their performance—yield, earliness, stiffness of straw and disease resistance—not on their hybrid origin.

Preparing the Land for Seeding

The value of early seeding of an early variety for successful production of oats has been emphasized. But early seeding should not sacrifice entirely good preparation of the seedbed. The three factors (1) an early variety, (2) early seeding, and (3) a well prepared seedbed, are closely related in their effect on the success of the crop.

Plowing in winter or early spring will usually increase the yield of oats, provided the seedbed is not left too loose when the oats are sown. But the increase will seldom pay for the extra cost in labor if the plowing results in a delay in seeding the oats. Double disking and harrowing does not cause undue delay in seeding. A field cultivator may also be used in preparing a seedbed following the corn that has been cut and the stalks removed, or following Korean lespedeza sod, or following soybeans.

Seed Should be Drilled

Drilling oats has many advantages over broadcasting. Drilling controls the depth of seeding, putting the seed shallow or deep, depending upon the time of sowing and the moisture condition of the ground. In many seasons dry weather prevails during the early growing period. Oats sown broadcast in dry soil either germinate

slowly or, when they germinate, grow unevenly. This results in late and uneven maturity, which reduces the yield and quality of the crop. Also broadcast seeding covered by a harrow is likely to leave some of the grain exposed or covered so shallow that on sprouting it may be killed by freezing weather. Drilling requires less seed, 6 to 8 pecks per acre being as productive usually as the heavier rate of 8 to 12 pecks commonly used in broadcast seedings. Finally, use of a grain drill with fertilizer attachment makes possible the efficient use of fertilizer, placing it down in the furrow with the seed, which can not be accomplished in broadcast seedings.

Fertilizer for Oats

Fertilizing the oats crops is now an accepted practice by good farmers. If good production practices, such as early sowing of a productive variety, treatment of the seed, and thorough preparation of the seedbed are followed, use of commercial fertilizer will give excellent results in the yield and quality of the crop. Superphosphate, mixtures of phosphate and potash, or mixed fertilizers which also include nitrogen, applied in amounts up to 200 to 300 pounds per acre, may be expected to show profitable returns under these conditions. But if other production practices are poor the use of fertilizer may not be profitable. Where oats are used as a companion crop for legumes or grasses, the commercial fertilizer does double duty by increasing the grain yields and improving the stands of the legume or grass. With the use of newer stiff-strawed varieties of oats, losses from lodging under high applications of fertilizer, especially those containing nitrogen, will be diminished.

Oats as a Companion Crop for Legumes

An early variety of oats, sowed early on a well prepared seedbed makes a desirable companion (or nurse) crop in which to establish a legume or grass. This is important with the increasing use in Missouri of short rotations in which the oats crop is followed by sweet clover, lespedeza, or other legumes.

Oats in Crop Rotations

Oats may be seeded easily after a cultivated crop such as corn, soybeans, or sorghum. This is the essential reason for the large acreage of this crop seeded each year. Where the seedbed is prepared by double disking, as in the familiar practice of sowing oats after corn, production costs are low. This low production cost combined with the use of oats as a companion crop in which a legume is established, makes it an important crop to the farmer even though it may be low in bushel value. From the older long rotations in which corn was

followed by oats, wheat, and clover, have evolved the shorter and more efficient rotations in which corn is followed by oats and sweet clover, and the continuous 1-year rotation of oats-lespedeza.

Corn - Oats and Sweet Clover Rotation

The efficiency of the two-year rotation of corn-oats and sweet clover is making this a leading cropping system in Missouri. In this rotation corn is followed by oats in which sweet clover is established.

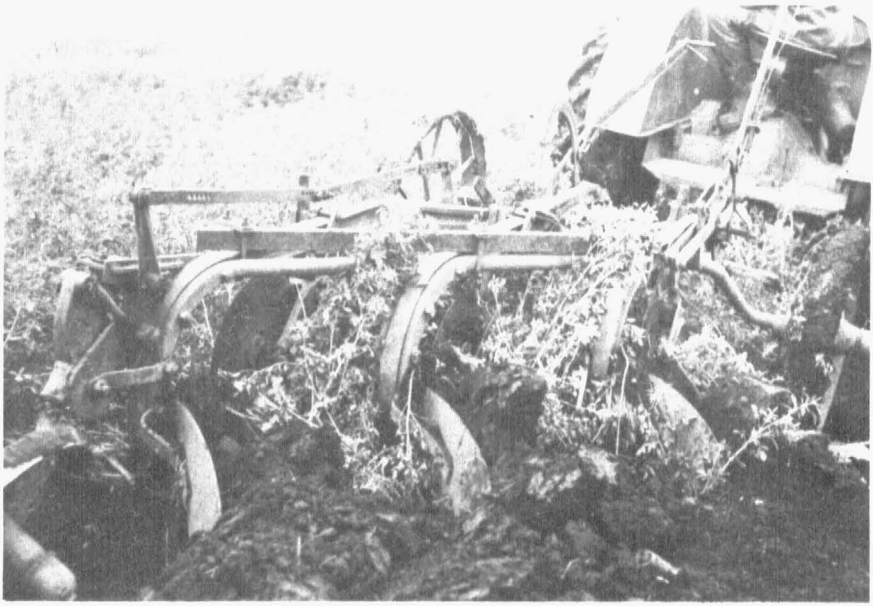


Fig. 9 —Plowing under sweet clover in early May before planting corn in the corn-oats and sweet clover rotation. In this rotation the oats crop makes it possible to move easily and quickly from a cultivated crop to a legume.

The sweet clover is plowed under the following spring in time again to plant corn. This rotation makes possible the growing of corn on fewer acres selected from those on which erosion will be least severe, furnishes a grain crop in oats which may be easily planted after corn and in which sweet clover may be established, and provides for the plowing under of a green leguminous crop immediately prior to planting of the corn. If practiced carefully, with the use of fertilizers on one or both crops, this rotation will result in rapidly increasing yields of both corn and oats.

Oats - Lespedeza Rotation

In this rotation oats is seeded on last year's Korean lespedeza sod. The seedbed is prepared by double disking or by use of the field

cultivator, followed by harrowing. These operations will put the lespedeza sod in good condition for seeding oats with a grain drill. In this way the 1-year rotation of lespedeza and oats may be carried on as long as desired, for under reasonable management the lespedeza will volunteer every year from seed produced and shattered to the ground the previous year.

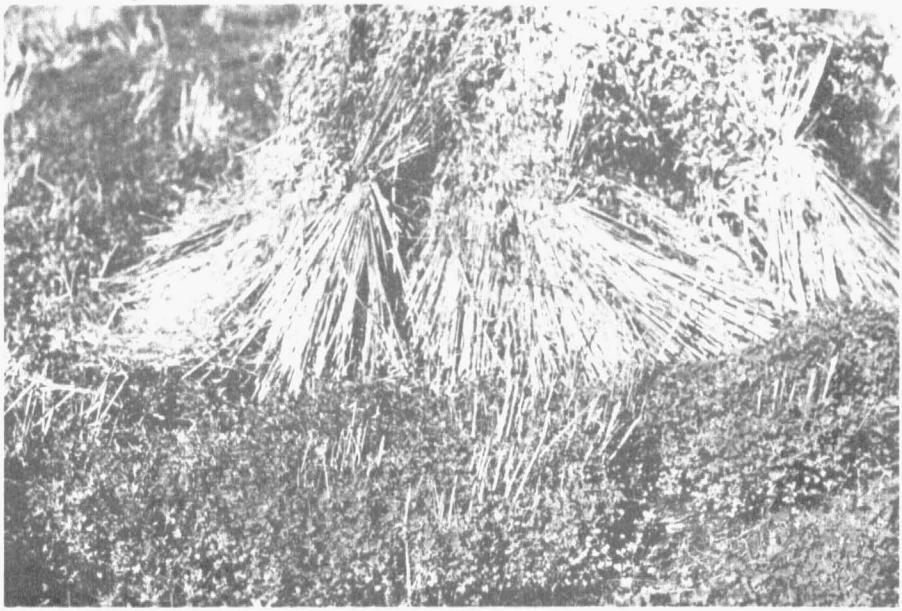


Fig. 10.—A thick stand of Korean lespedeza volunteers every spring in the 1-year rotation with oats and is ready for grazing soon after the oats are cut.

A large annual return per acre, produced at low cost, is the most conspicuous feature of the oats-lespedeza rotation. But that is not all. If the oats crop is kept fertilized, and the lespedeza pastured down adding nitrogen and organic matter to the soil, the fertility will be improved rather than reduced, notwithstanding the heavy production. The rotation is an easy and practical method of maintaining a continuous stand of lespedeza in Missouri, and is equally efficient for growing a good crop of oats.

Harvesting Oats

Oats for grain may be cut with a binder and threshed, or the two operations may be performed as one with the combine harvester. The change to combine harvesting of the oats crop is being made more slowly than with other small grains, such as wheat, for (1) lodging and shattering are more severe in oats when they are left standing

in the field until ready to combine, and (2) the value of the oats straw for feed tends to offset the additional cost of threshing. Varieties of oats grown earlier, such as Columbia, stand well for binder harvesting, but are usually severly lodged before the grain may be safely combined. Newer varieties, such as Boone, Clinton, and Benton have stiffer straw and stand for the combine with less lodging.

While lodging is the most apparent cause of the reduction of yield when ripe oats are left standing, it may not be the most serious as modern combines will pick up oats badly lodged with little loss. It is the grain left on the ground from shattering that constitutes the greatest reduction in yield. Observations made in the 1946 season at Columbia indicated that this loss may range from 15 to 25 per cent of the total production. The loss in yield from shattering may be high even if there is little or no lodging. In these observations, the Columbia variety with 95 per cent of the straw broken and lodged at the time of combining lost 17.6 bushels per acre from shattering, but a loss of 14.6 bushels was also measured in the stiff strawed

Fig. 11.—Combining oats from the windrow permits early harvest without the loss from shattering and weathering that occurs when standing grain is left for the combine.

Clinton variety where only 5 per cent of the plants were lodged. This represented yield reductions from that obtained by binder harvesting of 27.8 per cent and 20.5 per cent respectively. These data indicate that we are paying a high cost in yield loss for our economy in labor from combine harvesting.

In recent years a practice in harvesting oats, new to Missouri, has been increasing in use and favor. This is the windrowing of oats at the stage when they would normally be cut with a binder and, when dry, picking them up and threshing with the combine. The windrowing may be accomplished by cutting with a binder from which the bundle tying equipment has been removed. While this procedure requires one additional operation, as compared to combining of standing oats, it has these advantages: (1) early drying of the oats straw and grain, (2) preventing the loss in yield from shattering and the loss in quality from weathering that occurs when standing grain is left for the combine, and (3) leaving the straw clean and in a windrow so that it may be recovered easily if wanted for feed.

Winter Oats in Missouri

The production of fall-sown, or winter oats, in Missouri should be limited to the extreme southern part of the State if reasonable success is to be expected. Even in this area failures and low yields often result from damage by cold weather. In seasons with favorable weather conditions high yields exceeding those from spring seeding may be obtained. Fall seeded oats usually replace wheat, winter barley or rye in the rotation. The utility of the winter oats crop must therefore be compared with the utility of the wheat, barley, or rye crop that the oats replace.

Selection of the proper variety is extremely important in the production of winter oats. Many varieties are grown, but only the most hardy should be considered in Missouri. In tests of numerous varieties by the Missouri Experiment Station in Southeast Missouri at Sikeston, Winter Fulghum (C.I. 2498) has been the most consistent in production of high yields. Tennex and Fulwin, two varieties from Tennessee, appear to be outstanding in winter hardiness, as does Wintok, a new variety from Oklahoma, but they have been less productive than the winter Fulghum selection.

A good seedbed is important in the production of winter oats just as it is important for a good crop of winter barley or winter wheat. Good seedbed preparation and the use of fertilizer will reduce winter killing and contribute to the success of the winter oats crop. Early seeding is also important. Late seeding or seeding after Korean lespedeza has been removed for seed will usually result in severe winter injury to the oats crop and should not be permitted.