

PRODUCTIVE METHODS FOR OATS IN MISSOURI

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The acre yield of oats in Missouri is lower than in most neighboring States, due (1) to a climate which is comparatively unfavorable for this crop and (2) to the failure of the average Missouri farmer to produce oats as efficiently as he produces corn and wheat. Consequently the Missouri oats crop is generally unprofitable, on the basis of its market value; and even in the most productive sections of the State its cash returns per acre are much less than those from other important crops. But despite this condition the Missouri oats crop has in recent years covered nearly two million acres annually—a scale of production by no means consistent with unprofitable returns.

There are four reasons for the large acreage of this crop whose cash value alone offers but little inducement to production even under the most favorable conditions. First, the high feed value of the crop, especially for young stock. Second, the economy of labor in its production; since

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(a) no plowing in preparation for oats is necessary, (b) oats seeding comes early in the spring before labor must be utilized in starting the corn crop, and (c) when oats is included in the rotation a larger acreage can be farmed with a given force of labor. Third, oats fits between corn and wheat in the rotation and utilizes land and a certain force of labor, both of which might otherwise be unproductive between the harvesting of corn and the seeding of wheat. Fourth, oats often serve as a nurse crop for clover and spring sown alfalfa, although not generally so suitable as wheat for this purpose.

Therefore, in spite of low cash returns oats occupy a place in our general farming system, which cannot be completely filled by any other crop, although for some purposes barley or soybeans may be substituted with good results. It is the purpose of this circular to discuss better methods of oats production, whose use will result in larger yields and greater profits.

SEED BED PREPARATION

Oats are commonly grown after corn. One of three methods is usually followed in preparing the land: (1) Plowing during late winter or early spring, (2) double disking and harrowing, or (3) broadcasting the seed on corn stalk land and disking or harrowing it into the soil. Of the

TABLE 1.—EFFECT OF SEED-BED PREPARATION AND MANNER OF SEEDING ON THE YIELD OF OATS
(Warrensburg Experiment Field, Johnson County)

Method of Preparing seed bed	Manner of seeding	Yield in Bushels per acre		
		1915	1916	Average
Single disked	Broadcast	3.1	28.9	16.0
Double disked, harrowed	Drilled	11.5	28.3	19.9
Fall plowed 6 inches and harrowed	Drilled	18.8	40.6	29.7
Spring plowed 4 inches, double disked and harrowed	Drilled	19.4	28.7	24.1

(Shelbina Experiment Field, Shelby County)

Method of Preparing seed bed	Manner of seeding	Yield in Bushels per acre			
		1912	1913	1916	Ave.
Seed disked in	Broadcast	29.2	3.7	14.7	15.9
Double disked and harrowed	Drilled	32.0	4.5	19.1	18.5
Spring plowed and harrowed	Drilled	27.8	5.4	11.2	14.8
Fall plowed, double disked, harrowed	Drilled		5.6	19.9	

three methods the second is generally the most practical. After pasturing, the stalks should be dragged down and either cut up with a stalk cutter or by cross disking at the time the land is being prepared for seeding. Spring plowing will produce larger yields provided the act of plowing does not result in late seeding. But one of the advantages of oats in the cropping system is that the crop can be produced without plowing; and under average conditions it is questionable whether the larger yields which sometimes result from plowing will pay for the extra labor required.

The results of various methods of seed bed preparation from two experiment fields are reported in Table 1. The comparatively large yield which resulted from fall plowing at Warrensburg during 1916 was probably more the result of early seeding than of good seed bed preparation. The spring of that season was wet and late seeding on all spring-prepared land resulted. The fall-plowed land, being drier, was prepared and seeded ten days earlier than the other land. On the Warrensburg field spring plowing produced a better average yield than disking, but on the Shelbina field a lower yield, probably because it delayed the seeding. From the average yields obtained, disking or double disking, and harrowing seems the most practical method of preparation.

SOILS AND FERTILIZERS FOR OATS

Oats yield best on deep, rich, moist soils, such as grow good crops of corn, and when the soil requirement of the crop is thus satisfied there is no profit in the use of commercial fertilizers. The low yields of oats on the level prairies of Southwest Missouri and in the Ozark and Ozark Border sections are due mainly to the warm, dry weather which early checks the growth of the crop, but in some degree they are due also to the comparatively thin soils of these sections. On such soils, where clover and timothy follow oats, an application of commercial phosphatic fertilizer to the oats crop often pays, partly because of its later effect on the grass and clover. The fertilizer must be applied moderately, let us say 150 pounds per acre, at the time of seeding oats.

TIME OF SEEDING

Early seeding is fully as important as seed bed preparation, and for the best yields the land must be handled to insure timely seeding in the spring. In the southern part of the State seeding in February is desirable. In central Missouri, seed during the last week in February or the first week in March. Through northern Missouri the average best seeding dates are during the last three weeks in March.

METHOD AND RATE OF SEEDING

Oats are generally seeded by broadcasting with an endgate seeder or by drilling. Drilling is better than broadcasting, provided late seeding does not result. By broadcasting the oats can be seeded more rapidly and the seed can be covered by disking or cultivating before the land is in condition for drilling. When the corn stalks have not been re-

moved some difficulty is often had in drilling oats, especially with a hoe type of drill. Drilled oats give more uniform stands, mature more evenly, usually earlier, and are less affected by freezing weather during early spring.

The data reported in Table 2 show variations in yields from rates of seeding ranging from 6 to 12 pecks per acre. The differences are not great and not entirely consistent. Seeding less than 1½ bushels per acre may result in a low yield due to a thin stand. On the other hand, seeding more than 2½ bushels per acre is unnecessary.

In general the heavier and cleaner the seed the less required per acre. Light, chaffy, or dirty seed should be seeded at a heavier rate. When oats are broadcast about 25 percent more seed is necessary for a uniform stand than when drilled.

TABLE 2.—EFFECT OF RATE OF SEEDING UPON THE YIELD OF OATS
(Warrensburg Experiment Field, Johnson County)

Pecks sown per acre	Yield In Bushels Per Acre			
	1914	1915	1916	Average
4	8.4	18.4	27.9	18.9
6	9.2	25.3	28.1	20.9
8	10.7	24.5	30.7	22.0
10	9.3	26.0	32.0	22.4
12	9.2	27.9	34.6	23.9

HARVESTING AND HANDLING

In harvesting as a grain crop oats are cut and shocked like wheat, except that they should be put up in long, narrow shocks, two to four bundles wide, rather than in round shocks. This form of shock will avoid damage from rotting or discoloration during damp, rainy weather while the crop is in the shock. Two weeks of normal weather after harvest is usually sufficient for oats to become dry enough to thresh. Oats do not shatter so badly as wheat, especially bearded wheat, and may be allowed with less loss to become over-ripe before harvest. In threshing oats the cylinder of the machine should be run at a lower speed than in threshing wheat, but the other parts of the machine should be run at the same speed.

Clipped oats results from threshing very dry oats through a machine running at a very high speed. Extreme clipping is objectionable, especially from the standpoint of seed for planting purposes. Clipped oats often germinate poorly, especially under adverse conditions after planting.

OATS FOR HAY

Oats are often grown as a hay or sheaf-hay crop. When cut for hay they are best harvested with a mower, when in the early milk stage. At this stage the crop is too green to be safely cut and bound in bundles, so

it is cured and handled the same as any other hay crop. When cut for sheaf-hay the grain should be in the dough stage at harvest. At this stage the crop is best cut, shocked, and allowed to cure thoroughly before stacking or storing in barns.

OATS AS A NURSE CROP FOR CLOVER AND GRASS

Except when the crop is removed early for hay, oats make a poor nurse crop for clover or grass. The crop has an extremely high moisture requirement and always leaves the soil much drier than does barley or wheat. It also shades the ground more than does barley or wheat, and when harvested, the clover or grass is not so well able to withstand the dry, hot periods that usually follow harvest.

Clover and grass can be started earlier with wheat as a nurse crop than with oats, for in the latter case the seeding of the clover and grass must be delayed until conditions are favorable for oats seeding. Either wheat or barley is therefore preferable to oats as a nurse crop, if it may be included in the cropping system. When oats are used as a nurse crop the rate of seeding should not exceed 5 pecks per acre.

OATS IN MIXTURES WITH OTHER CROPS

For hog or dairy pasture oats and rape make a practical mixture. Both crops are early-seeded, cool-season plants. The land should be prepared in the ordinary way for oats. The oats should be sown at from 1 to 2½ bushels per acre, and the rape (Dwarf Essex) at 4 to 6 pounds per acre. When the oats are drilled the rape should be broadcast ahead of the drill by hand, or seeded through the grass seeder attachment. When the oats are broadcast and disked in, the rape should be seeded after disking and covered by light harrowing. Care should be taken not to cover the rape too deep.

Oats and Canada field peas make an excellent cured forage. The oats in addition to holding the peas off the ground make the crop more easily cut, cured and handled, and provide a better balanced feed. One bushel of oats and 40 to 60 pounds of Canada field peas per acre is the average rate of seeding. A late maturing variety of oats should be used to ripen with the peas. The two must never be mixed and seeded at the same time. The machine adjustments for seeding are entirely different for each kind of seed; each must be drilled separately or broadcasted separately and disked in. The stage of cutting for hay is determined by the condition of the oats, which should be cut when in the late milk, or early dough stage. Curing requires a longer period than when oats alone are harvested for hay.

SUBSTITUTE CROPS FOR OATS

Soybeans, barley, spring rye and spring wheat are spring-sown crops which can be substituted for oats in any cropping system. But the use of spring rye and wheat as substitute crops is not practical because of their extremely uncertain and very low yields. The comparative yields of spring wheat and oats are indicated in Table 3.

TABLE 3.—COMPARATIVE YIELDS OF SPRING WHEAT AND OATS ON FOUR EXPERIMENT FIELDS
(In Bushels per Acre)

Location of Test	Section	Years tested	Bu. Wheat (Marquis)	Bu. Oats (Kherston)
Maryville	Northwest	1919-20	19.1	53.0
Kirksville	North-central	1920	16.2	44.6
Warrensburg	West-central	1920	1.2	18.9
Columbia	Central	1918-20	9.7	40.0

Under certain conditions barley is a practical substitute crop for oats. On many farms labor conditions or soil fertility will not permit the production of as much corn as is actually needed for feed. Feeding tests have shown that barley, when soaked or ground, is practically as good as corn, pound for pound, for fattening hogs. When barley can be used in this way it is a practical substitute for oats, to supplement a short crop of corn. The comparative yields of barley and oats are reported from seven experiment fields in Table 4. (See page 7.) On a basis of pounds per acre the yields in some sections indicate a favorable comparison for barley.

When raised as a cash crop soybeans is the most practical substitute crop for oats. Being a spring-planted crop soybeans can easily take the place of oats in the rotation, and can always be harvested in the fall in time to seed the land to wheat. However, this substitution adds to the labor of cultivation during the summer months, although it does not increase the number of times the land must be plowed during the course of the rotation. Where oats are used the land is plowed before corn and after oats. Where soybeans are substituted the ground is plowed before both corn and soybeans but not after soybeans in preparation for wheat.

The comparative yields of soybeans and oats are reported from three experiment fields in Table 5. No practical comparison as to feeding value can be made between these crops, the soybeans being a protein concentrate. But if the two are compared as cash crops the value of soybeans will be found much greater due to the high price of the seed.

TABLE 5.—COMPARATIVE YIELDS OF OATS AND SOYBEANS ON THREE EXPERIMENT FIELDS

	Maryville (Nodaway Co.) 7 years		Columbia (Boone Co.) 4 years		Warrensburg (Johnson Co.) 4 years	
	Bu.	Lbs.	Bu.	Lbs.	Bu.	Lbs.
Kherston Oats	51.0	1632.0	35.4	1132.8	24.5	784.0
Medium Yellow Soybeans	15.1	906.0	20.9	1254.0	10.3	618.0

TABLE 4.—AVERAGE YIELDS OF OATS AND BARLEY TESTED ON SEVEN
EXPERIMENT FIELDS
(Yields in Bushels and Pounds per Acre)

Crop	Warrensburg (Johnson Co.)		Columbia (Boone Co.)		Maryville (Nodaway Co.)		Lewistown (Lewis Co.)		Shelbina (Shelby Co.)		Carthage (Jasper Co.)		Springfield (Greene Co.)	
	4 years 1914, 16-20		3 years 1918-20		5 years 1914, 16-20		2 years 1911-12		1 year		2 years		1 year	
	Bu.	Lbs.	Bu.	Lbs.	Bu.	Lbs.	Bu.	Lbs.	Bu.	Lbs.	Bu.	Lbs.	Bu.	Lbs.
Kherson Oats	31.0	992.0	39.9	1276.8	46.9	1500.8	13.2	422.4	35.0	1120.0	33.4	1068.8	32.7	1046.4
Oderbrucker Barley	10.6	508.8	19.1	916.8	30.8	1468.8	6.8	326.4	7.9	379.2	16.1	772.8	24.0	1152.0

TABLE 6.—YIELDS OF OATS VARIETIES AT COLUMBIA (BOONE COUNTY)

Variety	1911	1912	1913	1914	1915	1916	1917	1919	1920	Average Yields		
										9 years	8 years	8 years
										1911-17 1919-20	1911-17 1920.	1911-16 1919-20
Kherson	23.3	36.1	12.1	12.3	47.3	27.8	36.7	45.1	32.0	30.3	29.5	29.5
Red Rustproof	19.6	28.4	19.2	11.3	50.1	27.7	39.2	24.0	31.2	27.9	26.4	26.4
Silvermine	19.0	45.6	15.8	11.8	51.4	25.8	39.8		29.3		29.8	
American Banner..	17.0	50.1	7.7	7.9	39.0	21.9	41.6		25.2		26.3	
Swedish Select....	15.5	32.1	15.4	6.3	29.4	22.0		36.6	24.1			22.7

VARIETIES OF OATS

In oats as in all other widely grown field crops there are hundreds of differently named varieties. Many of these are probably the same except in name, and in some cases the same name is applied to several distinct forms. For example, in a collection of oats varieties obtained from a number of experiment stations and seedsmen, Etheridge* found that the Swedish Select variety occurred under 93 different names, many of which were applied also to other very different varieties. A similar condition is found among other varieties and the confusion is constantly being increased by the use of new and popular names for old varieties.

It is obviously desirable that variety names should be standardized so that the same name is always applied to the same variety. Many of the tests reported in this bulletin were conducted before standardized varietal descriptions were available, and consequently some of the varieties discussed are not named in accordance with the classification referred to. However, the varieties recommended are described in this bulletin, so that they may be recognized independently of name.

Groups of Oats Varieties.—Although many of the differently named varieties are probably identical, many others are clearly distinct, not only in their appearance but also in their adaptation and value.

The oats varieties grown in this country are of two distinct groups—common and Mediterranean. Common oats are probably descended from a species which includes the familiar wild oats of grain fields. They are thought to have originated in eastern Europe or western Asia. Most varieties of this group are grown as spring oats in the Northern States, though a few are grown as winter oats in the South. The Mediterranean oats are primarily southern oats, which probably originated in southern Europe or northern Africa. They are usually fall-sown, but some of the varieties have been found valuable as spring oats far north of the winter oats region. As a group they are more or less resistant to smut and leaf rust, but not especially resistant to stem rust. They have long heavy grains, with well-developed secondary grains.

The principal factor determining the adaptation of oats is the length of the growing season. In this respect the varieties fall into the following five groups, each of which is adapted to a more or less distinct region.

(1) *Winter Oats.*—In regions of moderate winter temperature winter oats ordinarily out-yield spring oats. In the cotton states they are usually preferred. The varieties grown include members of both the Mediterranean and the common oats group. They are characterized by their spreading habit in early growth. The principal varieties are Red Rust-proof, Winter Turf, and Culberson.

(2) *Early Spring Oats.*—The early spring oats are adapted to regions too far north for the economical production of winter oats and not far enough north to have the long, cool, moist growing season necessary for

*Etheridge, W. C. A classification of the varieties of cultivated oats. Cornell Agric. Expt. Sta. Mem. 10. 1916.

the successful growth of later maturing spring-sown varieties. The principal varieties are Kherson and Sixty-day, of the common oats group, and Burt, of the Mediterranean group.

(3) *Medium-Early Spring Oats*.—Varieties somewhat later than those of the last named group, and somewhat higher in yield when seasonal conditions are favorable. An important member of this group is Silvermine, a variety of common oats.

(4) *Late Spring Oats*.—This group is the largest and most important for the country as a whole. It includes a considerable number of varieties which are still later in maturity than the last named group, and which are therefore adapted to still cooler and moister regions. In the States best adapted to oats production these are the leading varieties. In the greater part of Missouri the average season is far too short for their proper development, and their yields are frequently very low. Some important varieties are Swedish Select and Lincoln.

(5) *Side Oats*.—All varieties of this group are extremely late in maturing and are consequently not adapted to this State. They are easily distinguished by the one-sided appearance of their heads and the extremely coarse hull of their grains.

VARIETY TESTS.

Tests of Winter Oats.—Sometimes the winter is mild enough to permit the successful production of fall sown oats in the southern third of Missouri, and in such seasons they may exceed spring oats in yield. Frequently, however, they are completely winterkilled, even in that section, and their average yield through a long series of seasons is less than that of spring oats. For example, in a test of winter oats and spring oats at Carthage, Jasper County, during the four seasons 1910-1913 inclusive, the winter oats were killed out in three successive seasons, 1910, 1911 and 1912, while in 1913 the three varieties of winter oats grown yielded considerably more than the spring oats of the same season. Many tests of winter oats have been conducted by the Experiment Station on outlying experiment fields and in cooperation with farmers in southern Missouri. All of these tests have shown clearly that winter oats are not adapted to the State.

Variety Tests of Spring Oats.—To determine the relative value of varieties of spring oats in Missouri a large number of varieties were tested on the Experiment Station field at Columbia, and the most promising of these were then tested on five outlying experiment fields in various sections of the State.

The yields of five typical varieties of oats at Columbia during a nine-year period are shown in Table 6. (See page 7.) The leading varieties in this test were Kherson and Silvermine. It is to be noted that the yield of Swedish Select, a prominent variety of late spring oats, was conspicuously lower than that of any of the other varieties.

In northern Missouri variety tests of oats were conducted at Maryville, Nodaway County; Lewistown, Lewis County; and Shelbina, Shelby County. The results of the variety tests at Maryville are summarized in Table 7.

The leading variety in this test was Silvermine, followed by Burt, Swedish Select, Red Rustproof and Kherson. There was little difference in yield between the early, medium, and late varieties.

The variety tests at Shelbina and Lewistown were each carried on for a period of four seasons. In general the results of these tests substantiate those of the tests at Maryville. The leading varieties were Silvermine, Swedish Select and Kherson. There was little difference in yield between the early, medium early, and late varieties.

Variety tests of oats were conducted at two points in Central Missouri—Columbia and Warrensburg. The results of the test at Columbia have already been summarized. The yields of the principal varieties included in the test at Warrensburg are shown in Table 8. (See page 10).

In this test the early varieties, Kherson and Burt, were superior to all others during the season in which they were tested. The distinctly late varieties such as American Banner, Swedish Select and White Tartar gave decidedly low yields. Silvermine and Red Rustproof were intermediate in yield between the extremely early and extremely late varieties.

The only variety test conducted in southern Missouri was a four-year test at Carthage, Jasper County, in which Kherson was the leading variety.

Summary of Sectional Tests.—The general results of all tests indicate the probable superiority of medium early varieties in north Missouri, while in central and southern Missouri the extremely early varieties were decidedly the highest yielders. This is to be expected, since the season for oats is longer and consequently more favorable for later maturing types in northern Missouri than in the central and southern parts of the State. However, even in north Missouri little difference between the yields of good medium early varieties, such as Silvermine, and good extremely early varieties, such as Kherson and Burt, is to be expected.

Importance of Early Maturity.—The relation of earliness of maturity to the yield of oats is more strikingly shown in Table, 9, which gives the

TABLE 9.—RELATION OF EARLINESS OF MATURITY TO YIELD OF OATS

Season	No. of Varieties	Average Yield			Late
		Early	Medium early	Medium late	
1919	40	61.60	53.20	47.30	24.40
1920	53	39.07	34.74	30.62	22.06
1921	32	42.79	31.00	26.05	22.39
Average		47.82	39.05	34.66	22.95

results of tests of a large number of varieties at Columbia during the three seasons 1919, 1920 and 1921. In each season a very close relation between time of maturity and yield is evident. In each case the earliest varieties

gave the highest yield, followed in order by medium-early, medium-late, and late varieties. On the average early varieties yielded more than twice as much as late varieties.

Varietal Recommendations.—The varieties recommended for northern Missouri are Silvermine, Burt, Kherson, and Sixty-Day. Of these Silvermine probably is the most productive. The varieties recommended for central and southern Missouri are the early varieties Kherson, Sixty-Day, and Burt. These are unquestionably superior to the late-maturing varieties, in this section.

The variety Fulghum has not received much attention as a spring-sown variety until very recently, although it has been grown in the South for many years. It is similar in some features to Red Rustproof, and probably has been grown to a considerable extent in this section under the names Red Rustproof and Texas Red. Indeed it is quite possible that the good reputation which Red Rustproof oats have in Missouri, Kansas and Nebraska is due in a considerable measure to the performance of Fulghum oats grown under their name. During the last three years both Fulghum and Red Rustproof oats have been grown by the Missouri Experiment Station in several sections of the State, and the former have been far superior to the latter in value. The superiority of Fulghum oats is due mainly to the fact that they are much earlier in maturity than the Red Rustproof. They are usually slightly later than Kherson, Sixty-Day and Burt, but earlier than Silvermine. Although they have not been grown by the Experiment Station for a long enough period to justify their recommendation, it seems probable that they will be found to be one of the most valuable varieties for Missouri.

VARIETAL DESCRIPTIONS.

Kherson and Sixty-Day.—Two varieties practically identical in appearance, and probably of the same origin. They were obtained about 25 years ago from a section in Russia in which climatic and soil conditions are similar to those of the Great Plains region of the United States. They are distinguished from other varieties of the common oats group by their short, slender stems; rather short, scanty heads; long slender awnless grains; and extremely early maturity. The color of the grains ranges from deep yellow to white, though pure strains with uniform white or yellow grains can easily be isolated. It has been suggested that the name Kherson be reserved for the yellow strains and Sixty-Day for the white strains. Most of the seed on the market consists of a mixture of yellow and white grains.

There has been some discrimination against these varieties because of their short stems, small heads and slender yellow grain. Certainly other varieties are more attractive in the field. The plump, white grain of some of the later-maturing varieties, particularly when grown under favorable conditions, also makes them seem better for seed. But on actual trial, the Kherson and Sixty-Day oats have shown their ability to outyield later-maturing types over a large area, including sections where the growing season for oats is considerably longer than in Missouri. In spite of the slenderness of the grain, the percentage of kernel is high—higher under Missouri conditions than that of any other variety of common oats.

Several pure-line selections of Kherson and Sixty-Day oats are on the market. These are strains presumably consisting of the progeny of a single exceptional plant selected years ago. Well known, pure-line selections of Kherson and Sixty-Day include Nebraska No. 21, Iowa No. 103, Iowar, and Wisconsin No. 5, which have white grains, and Iowa No. 105, which has yellow grains. Although these strains have not been found to differ greatly from the unselected Kherson and Sixty-Day in yield, under Missouri conditions, their use is to be encouraged, since they have all the advantages of Kherson and Sixty-Day and are usually pure and true to name.

Silvermine.—A variety long grown in the United States and the standard variety of medium maturity. The plants are taller than those of Kherson and Sixty-Day, the stems coarser, and the heads larger. The grains are white, long and plump, and usually lack beards and basal hairs. Silvermine normally ripens about 10 days later than Kherson in Missouri. In the northern part of the corn belt, Silvermine and Kherson have been in general the leading varieties of those tested by experiment stations during the last fifteen years. Their relative value varies with the season, Silvermine usually yielding better in the more favorable seasons and Kherson in those less favorable.

Red Rustproof.—The leading variety of winter oats in the South, and widely grown as spring oats in Missouri, Kansas, and Nebraska. The names Red Texas and Texas Red Rustproof are also frequently applied to this variety. The plants are spreading in early growth and tiller heavily. They do not grow as tall as Kherson under Missouri conditions. The stems are rather coarse, and the heads short, with stiff, upstanding branches. The grains are long and well filled, with especially well developed upper grains, which frequently do not separate from the lower grains in threshing. They are reddish brown and bearded, and have many long bushy hairs at the base. Red Rustproof oats are always late in maturity in Missouri, ranging from 10 to 20 days later than Kherson. They are fairly resistant to leaf rust, though by no means immune. At the Missouri Station they have also been highly resistant to smut. On account of their late maturity Red Rustproof oats should not be grown in this state. Other varieties, notably Burt and Fulghum, possess all of their good qualities without their late maturity, and are therefore much better yielders.

Burt.—A very early maturing variety of the Mediterranean group. It is somewhat spreading in early growth, though not so spreading as Red Rustproof. Under Missouri conditions the plants are taller and the heads longer than those of Red Rustproof. The head stem is not so straight as that of Red Rustproof and Fulghum. The grains are similar in form to those of Red Rustproof, and are bearded, but have short bushy hairs at the base and are dull yellow in color. At this Station, Burt oats have been the earliest maturing variety grown, maturing 1 to 3 days earlier than Kherson and Sixty-Day. They are remarkably resistant to smut and fairly resistant to leaf rust. Their yields have been high, and it is probable that they will be found a leading variety in this State.

Fulghum.—A variety of the Mediterranean group, intermediate in some respects between Red Rustproof and Burt. The plants are taller than Red Rustproof though not usually so tall as Burt. The heads are stiffly erect but otherwise quite similar to those of Burt. The grains are similar in form to those of the two other Mediterranean varieties described though somewhat shorter, and usually free from awns or basal hairs. Three-grained spikelets are frequent, especially in the upper part of the head. The grains vary somewhat in color with growing conditions, but are typically buff or dun-colored, and are almost always of a lighter shade than those of Red Rustproof oats grown under the same conditions. Under Missouri conditions Fulghum oats are usually slightly later than Burt or Kherson. Like the other varieties of the Mediterranean group, Fulghum is resistant to smut and leaf rust. During the three seasons it has been grown in Missouri it has given extremely good yields. In Kansas, a selected strain of this variety has been very highly recommended under the name Kanota. On further trial Fulghum oats will probably be found to be a most valuable variety for the southern part of the corn belt.

THE QUALITY OF SEED.

The yield of the oats crop in Missouri can be materially increased by closer attention to the quality of seed. Farmers generally demand little more of their seed oats than that they will germinate and grow. In addition good seed should have these four qualities:

- (1) It should be of a variety known to be a good yielder in the region in which it is to be grown.
- (2) It should be adapted seed of the variety chosen, produced under conditions similar to those under which it is to be grown.
- (3) It should be practically free from impurities, including weed seed, seed of other grains, and seed of other varieties of oats, and
- (4) It should be free from seed borne diseases.

Recommendations of varieties for the State have already been made. Adaptation, purity and freedom from seed-borne diseases are briefly discussed below.

Adaptation.—It is commonly believed that oats “run out” when grown continuously under the rather unfavorable conditions of Missouri. This belief is probably based mainly on an actual decline in the yield caused by the increase in diseases or by the introduction of weed seed and mixtures of poorer varieties in the seed. It is not likely that the decline in yield is caused by actual degeneration of yielding capacity. Although the few experiments on this point do not prove unquestionably that oats seed do not degenerate, it is almost certain from evidence on related questions that degeneration does not occur. In fact, it is much more likely that a strain properly cared for will improve in adaptation. In practice it is worth while to change seed if the oats grown have become badly mixed or diseased, but this should not be allowed to occur. By proper seed treatment and by using ordinary precautions to prevent mixture, seed oats can be continuously grown under the same conditions without running out.

The real reason for the preference shown by most farmers for northern grown seed oats is the attractive appearance of such seed. The same varieties grown in a region with a long, cool, moist growing season and in a less favorable region like Missouri will produce grain of very different appearance. That produced under the favorable conditions will be bright and plump and will seem much superior to that produced under the unfavorable conditions. The actual seed value of the latter, however, for growing in the same unfavorable region, is probably greater than that of the former.

Purity.—Most of the seed oats available on the market are badly mixed. The common impurities include weed seed, seed of other grains, and seed of other varieties of oats. Mixtures of weed seed and of seed of other grains are obviously undesirable for their effect in reducing the yield of oats and in lowering the quality of the product. A mixture of other varieties of oats does not necessarily lower the commercial grade, but is undesirable nevertheless. The principal objections to a mixture of varieties are:

(1) The time of ripening of the different varieties included is likely to be variable. If the crop is cut when the earliest of these varieties mature, much of the grain will be immature when harvested; and if the harvest is delayed until the later varieties have ripened, much grain of the earlier types will have been lost by shattering.

(2) In ordinary field mixtures, relatively unproductive varieties are generally included, and the yield is therefore reduced to some extent. Pure seed of the best adapted variety will exceed such a mixture in yield by a considerable margin. Most of this mixture is caused by the traveling threshing machine, which carries seed from one farm to the next. If seed oats are taken only from the grain threshed after the machine has been running some time, the mixture of seed may be avoided to a considerable extent.

The Fanning Mill.—The original purpose of the fanning mill as a seed treating device, was to separate the large, heavy seed from the smaller and lighter seed which were considered inferior. There is probably little difference in the comparative value of large and small seed sown in equal volume, when sound, mature seed are included in each case. The use of the fanning mill simply for separating large from small seed therefore is inadvisable. However, the fanning mill has considerable value in removing weed seeds and light, shriveled and diseased oats. Whenever the seed to be used contains impurities of this sort, it should be thoroughly fanned to remove them. It is not worth while to fan clean, healthy seed to remove the smaller grains.

Seed-Borne Diseases in Oats.—The principal seed-borne disease of oats is smut. This disease causes much loss to Missouri oats growers every year. Susceptibility to smut varies, with different varieties, such varieties as Burt and Red Rustproof being practically immune, while other varieties, Early Champion for example, are highly susceptible. Oats smut can be eliminated by a simple seed treatment which can be applied under farm conditions with very little expense.

The essential feature of the treatment to control smut is the application of a disinfectant solution in concentration sufficient to kill the spores of the smut on the outside of the seed, but not sufficient to injure the germination of the seed itself. The best disinfectant for this purpose under Missouri conditions is a formalin solution. Formalin can be obtained at any drug store and will cost about 75 cents a pint. Various modifications of the formalin treatment have been suggested. The best method for farmers, from the standpoint of complete control of the disease and safety and simplicity of application, is probably the well-known method briefly described below.

1. Thoroughly fan and screen the oats, to remove as much of the smut as possible.
2. Mix one pint of formalin with 40 gallons of water for each 40 bushels of seed to be treated. Keep this solution covered, to prevent the formaldehyde gas from escaping.
3. Sprinkle the solution over the oats, using one gallon to each bushel, and mix until all the seed are thoroughly wet.
4. Pile the oats up and cover with blankets, canvas, or sacks.
5. After four or five hours uncover the seed and dry it as rapidly as possible.
6. Sow the seed at once to prevent re-infection.
7. All sacks, bins and machinery with which the oats may come in contact before seeding should also be thoroughly disinfected with the formalin solution so that the seed may not be re-infected with smut spores after the treatment. It is well to increase the rate of seeding slightly, because of the swelling of the seed during treatment.