Kentucky Bluegrass
In Missouri

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There are approximately 8,000,000 acres of Kentucky bluegrass in Missouri from which an average annual return of about $24,000,000 is derived from grazing, and $500,000 from seed. The gross return from bluegrass to the farmers of the State is exceeded by that from only three crops, corn, wheat, and hay. Little attention, however, has been given to establishing new bluegrass pastures and to keeping old pastures in a thriving condition, due partly at least to the lack of a thorough knowledge of the methods that should be used. Unfortunately there is a lack of conclusive experimental evidence bearing on the establishment and management of bluegrass pastures under Missouri conditions. The recommendations contained in this circular are, therefore, necessarily based largely on observation and practical experience.
METHODS OF ESTABLISHING A STAND OF BLUEGRASS

The method that should be used in establishing a stand of bluegrass is determined by a number of factors. Among these are fertility of the land, adaptability of the land to bluegrass, amount of weeds present, topography of the land, whether or not the land is tillable, and the immediate needs for the pasturage. It is beyond the scope of this circular to include methods for establishing stands of bluegrass under all conditions that might be encountered by farmers desiring to grow bluegrass. Only those methods which are most commonly applicable under Missouri conditions will be submitted.

Establishing a Stand of Bluegrass on Tillable Land.—The most common method used and one which has given good results is to sow timothy and bluegrass with wheat in the fall, adding clover the following spring. After two years of clover and timothy for hay the land is pastured. Either alsike or red clover may be used, the choice of kind being governed by the soil. On medium fertile, well drained land that is well supplied with lime, red clover will give the better results; while on poorly drained soils or acid soils alsike clover is to be preferred. The acre rates of seeding should be 8 to 10 pounds of timothy, 6 pounds of bluegrass, and 6 to 8 pounds of red clover or 3 pounds of alsike.

Where it is desired to start a bluegrass pasture quickly on land a fall or spring seeding on wheat or rye or spring seeding with oats, omitting clover and timothy, has given good results. The nurse crop may be grazed off or cut as a hay or grain crop, the method used being governed by a number of factors. But it will generally be found most profitable to cut the oats and rye as a hay crop and the wheat as a grain crop. If the nurse crop is grazed only enough stock should be used as would be required to keep it eaten down to a height of 4 to 6 inches. Extremely close grazing or grazing when the land is wet and boggy will destroy most of the young grass.

Satisfactory results have been obtained in parts of Northwest Missouri from the use of “dry rough” seed (taken from stripper and cured, but not threshed and cleaned) for seeding down pastures. The method is economical and compares favorably with methods which involve the use of cleaned seed. During the late winter or early spring the seed is hauled to a field of fall sown grain and sown from the wagon by hand. The seeding should be done on a dry windy day when the seed is dry and light and will be carried long distances by the wind, for under such conditions a more rapid and even distribution of the seed can be made.

Establishing a Stand of Bluegrass on Rough, Untillable Land.—Spring seeding of bluegrass on rough un tillable land is preferable to fall seeding, except on foul, weedy land where it may be necessary to give the grass a start in the fall so that it can compete successfully with spring weed growth. The acre rate of seeding should be 8 to 10 pounds of good seed per acre. No seed bed preparation is necessary, other than burning off leaves and other dead plant matter.

THE USE OF BLUEGRASS IN MIXTURES

There are at least three distinct advantages to be derived from seeding other kinds of grasses and also legumes with bluegrass. (1) The quicker growing kinds will furnish either a hay crop or good pasturage while the bluegrass is getting started. (2) In case the bluegrass fails the other grasses and also the
legumes might prove themselves well adapted to the land and produce a good pasture, and (3) a mixed seeding will give a greater total yield and a more uniform supply of feed than bluegrass seeded alone, and if the mixture includes a legume the food value of the mixture will be greater, pound for pound, than bluegrass or a combination of bluegrass and other grasses.

The kinds and amounts of the various grasses and legumes that should be included in a mixture with bluegrass are determined largely by the soil, but the future use of the land will determine to some extent the kinds to be included. If a hay crop is desired before the land is turned into pasturage, a mixture such as bluegrass, timothy and red clover might prove the most profitable, whereas if it is desired to begin pasturing the land as soon as possible, a mixture with a different composition might give the best results.

Mixtures and the acre rates of seeding which have been recommended* and found satisfactory for Missouri conditions are as follows:

1. "Kentucky bluegrass 8 pounds, timothy 8 pounds, red clover 5 pounds;
2. "Kentucky bluegrass 8 pounds, timothy 6 pounds, red clover 2 pounds, white clover 2 pounds;
3. "Kentucky bluegrass 8 pounds, orchard grass 5 pounds, red top 4 pounds, alsike clover 2 pounds;
4. "Kentucky bluegrass 8 pounds, orchard grass 5 pounds, timothy 5 pounds, red top 3 pounds, red clover 2 pounds, alsike and white clover 1 pound each.

A choice of these mixtures would be determined by the fertility of the soil. On the more fertile soils, timothy and red clover or white clover should accompany the bluegrass; but on the less productive soil orchard grass, red top and alsike clover should be added.

"For the drier, more gravelly lands one of the following mixtures, seeded at the recommended rates per acre, will usually be found satisfactory:

1. Orchard grass 8 pounds, Kentucky bluegrass 5 pounds, red clover 3 pounds;
2. Orchard grass 8 pounds, Kentucky bluegrass 5 pounds, red top 4 pounds, red clover 2 pounds, white clover 1 pound;
3. Orchard grass 8 pounds, Kentucky bluegrass 5 pounds, red top 4 pounds, red, alsike and white clover 1 pound each."

Since the above mixtures contain clovers that are normally spring sown they should be sown in early spring, March 1 to 20, rather than in the fall. Or the grasses may be sown in the fall and the clovers added in the spring. In the northern half of the State orchard grass also should be spring sown.

**MANAGEMENT OF BLUEGRASS PASTURES**

After a stand of bluegrass is established the chief consideration is keeping it productive. This can best be accomplished through proper grazing practices, and weed control.

**Grazing.**—Either over-grazing or under-grazing will injure the bluegrass sod. However, damage from under-grazing is most likely to occur in Missouri, especially in case of a succession of unfavorable seasons. Heavy grazing in time of drought may greatly reduce the stand of grass. Certain weeds will

*Missouri Agricultural Extension Service Circular 66.
thrive under heavy grazing and adverse weather conditions that are unfavorable to the grass and will establish themselves in the weakened sod. Here the weeds continue to multiply and grow in competition with the grass, unless eradicated by mowing or the cultivation of the land.

Injury from under-grazing is most likely to occur in seasons of plentiful rainfall and on very fertile soil. Under such conditions under-grazed pastures form a thick mat on the sod, which has a tendency to smother out the grass roots. In the following season weeds can easily establish themselves in the bare spots.

The practice of dividing pasture land into smaller tracts and grazing these in rotation is followed by a few farmers as a means of realizing the highest possible acre returns. Supposedly the practice will reduce the evils of overstocking and will give a greater amount of a better quality of grass. Under skillful grazing management such results can no doubt be obtained, but the practice may result in over-grazing of a part of the pasture land while the grass in the other areas is left under-grazed. The expenses involved in cross-fencing and in providing watering places for stock are important considerations in connection with a rotation system of grazing.

The growth habits of bluegrass and the purpose for which the crop is intended are important factors to consider in connection with grazing management. The grass makes some growth from about the first of March until December. The growth is luxurious from about April 15 to July 1 and from September 1 to November 15. During the hot weather of July and August the grass passes through a semi-dormant stage and makes only a comparatively small growth.

There is little danger of over-grazing during the periods of luxurious fall and spring growth. But at no time should the grass be eaten into the ground. To reduce the danger of over-grazing during summer and to insure plenty of good pasturage, a bluegrass pasture should be supplemented if possible with other pasture crops such as sudan grass and sweet clover.

In Northwest Missouri bluegrass is utilized either for pasturage alone or for pasturage and a seed crop. If a maximum seed crop is desired the grass should be pastured but lightly, or not at all, before stripping. If the pasture is used the stock should be removed by the time the grass heads begin to appear.

Under favorable soil and moisture conditions a pasture will furnish considerable grazing before stripping and afterwards give a fair yield of seed. In fact most of the bluegrass stripped in Missouri is grazed before stripping. Good bluegrass pastured moderately before stripping usually yields from one-half to two-thirds as much seed per acre as ungrazed pastures and in addition gives the extra return from pasturage. A choice between the practices of grazing or not grazing before stripping should depend chiefly on the season, price outlook for seed, kinds and amount of weeds present in the grass and the needs of the farmer for the spring pasturage.

After stripping, the land should be pastured heavily until about the first of July as a means of getting rid of the excessive top growth. It should then be pastured lightly through the hot weather of July and August and then moderately heavy during the fall. If bluegrass is desired for pasturage only,
it should be pastured heavily from about May 1 until the hot summer season. It should then be pastured the remainder of the year as indicated above.

**Weed Control.**—On land level enough to permit the use of machinery, weeds are best controlled by mowing before seeds are produced. Land badly infested with weeds will require two mowings each year for two or three years. Thereafter one mowing each year is usually sufficient to keep the weeds in check. As a rule the best time to mow is during July and August. The kind, amount and stage of maturity of the weeds should, however, be taken as a criterion of the proper time to mow rather than a specified time. Mowing should be done when the greatest possible number of weeds can be destroyed before they produce seed.

On land too rough to permit the use of a mowing machine the weeds can be cut with a scythe. Although this practice requires considerable labor it is justifiable on good grass land where there is a shortage of pasturage for work animals and dairy cows.

Weed control is more important on bluegrass pastures that are to be stripped for seed than on pastures used for grazing only. Weeds not only reduce the yield but lower the quality of seed and increase the difficulty of stripping and selling the crop.

**HOW TO IMPROVE AN UNPRODUCTIVE BLUEGRASS PASTURE**

Frequently the care of pastures is neglected for other farm work. As a result pastures that once thrived grow foul with weeds, the stand of grass being reduced and becoming bare in spots. Such pastures can usually be brought back to a thrifty condition if the proper practices, including weed control, use of phosphates and manure, reseeding of bare spots and cultural treatments are carefully followed.

**Weed Control.**—No one of the above practices is likely to prove completely effective if used alone, but weed control should be the first step toward pasture improvement. Methods for the control of weeds have been indicated.

**Use of Manure and Phosphates.**—As the grass is given a more favorable condition to grow and spread by the destruction of weeds, its growth can be further helped by the use of manure and phosphate fertilizers. Whatever manure is available may be used, and acid phosphate should be applied at the rate of 150 to 200 pounds per acre. If manure and acid phosphate are combined the above rates for the fertilizer should be reduced about one-third. A choice between manure or phosphates for pasture improvement should be governed largely by the needs for the manure in connection with the growing of other crops. During certain seasons of the year, however, manure cannot be hauled on the cultivated land and it should be placed on a pasture if needed, rather than left exposed to washing and leaching by rain.

The scanty or bare spots should be the first treated and the treatments gradually extended over the entire pasture if possible. These spots should then be disked and harrowed as early in the spring as weather and soil conditions will permit so as to prevent the loss of fertilizer materials and to prepare the land for reseeding.

**Reseeding the Scanty Spots.**—After the land has been put in a favorable condition for the growth of grass through the destruction of weeds and the use of manure or phosphate, grass will naturally come in and gradually fill the sod. A good stand, however, may be secured much more quickly by reseeding where
the grass is thin or the ground bare. Seed should be sown at the rate of 8 to 10 pounds per acre either in the fall or early spring and harrowed in. Two to four pounds each of other kinds of adapted grasses or clovers may also be seeded along with the bluegrass.

**Cultural Treatments.**—Cultural treatments used to improve the stand and growth of bluegrass may include disking and harrowing. Doubtless some long established bluegrass pastures reach an unproductive stage that can be partially corrected through such treatments. The condition and its cause, however, is difficult to determine in a great many cases. The terms “sod-bound” and “root-bound” are commonly used to describe the condition, thus implying that it is due to the presence of an excessive root growth. Possibly a “root-bound” sod is sometimes the primary cause of an impoverished pasture. By breaking up the sod with a disk and harrow in such cases the plant food and moisture relations of the grass might be so improved that grass would again grow vigorously. In giving this treatment the land should be double disked as early in the spring as soil and weather conditions will permit, the disk being run at a slight angle and to a depth of about three inches. If the land is too rough to permit the use of a disk, a heavy wooden A-harrow with vertical teeth will be effective in tearing the sod apart.

Finally it should be emphasized in this connection that the process of rejuvenating an unproductive bluegrass pasture is long and expensive, and not always assured of satisfactory results. On tillable land the improvement is more certain, and probably more permanent, if the land is plowed and planted to clean cultivated crops for two or more years and then is seeded to grass. Thereafter the productivity of the pasture will be determined largely by the practices of weed control and grazing which are followed.

**EFFECT OF STRIPPING BLUEGRASS SEED ON THE FUTURE CONDITION OF THE PASTURE**

No harm to the pasture is likely to result from stripping the standing plants of their seed. In fact the practice is probably beneficial since some weeds are destroyed by the machine before their seed is produced. An ample supply of grass seed for reseeding remains on the pasture after the passage of the machine. In observations made in Northwest Missouri excellent stands of thriving grass were found in practically every case, even on pastures that had been stripped annually for a period of years. Few competitive plants were found. In fact if taken as a whole, the pastures which had been stripped of their seed showed a smaller percentage of foreign plants than other pasture lands in the same locality. The thriving condition of the stripped areas, however, cannot be attributed except in a small way to the stripping process; it is commonly the result of better practices in pasture management followed on most of the observed farms as a means of producing a good seed crop.

The principal means of keeping a seed producing area in a thriving condition is prompt grazing-off of the heavy top growth after stripping, light grazing during hot dry periods in July and August, mowing to kill weeds and properly regulated fall grazing.
BLUEGRASS SEED PRODUCTION

Bluegrass seed is produced mainly in the Kentucky and the Missouri districts. The Kentucky district is almost entirely within about eight counties of Central Kentucky. These constitute the famous Bluegrass Region of that State. Bluegrass seed is also produced in Ohio and Indiana, but as a rule not in large commercial quantities.

The following table shows the number of bushels of bluegrass seed produced in the Missouri and Kentucky districts from 1917 to 1926, and the average price paid to growers for rough cured seed.

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**Table 1.—Production of Bluegrass Seed in Missouri and Kentucky Districts; 1917-1926**

<table>
<thead>
<tr>
<th>Crop year</th>
<th>Missouri</th>
<th>Kentucky</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production rough cured seed (bus.)</td>
<td>Price paid grower per bushel</td>
<td>Production rough cured seed (bus.)</td>
</tr>
<tr>
<td>1917</td>
<td>55,000</td>
<td>1.60</td>
<td>200,000</td>
</tr>
<tr>
<td>1918</td>
<td>25,000</td>
<td>1.50</td>
<td>350,000</td>
</tr>
<tr>
<td>1919</td>
<td>325,000</td>
<td>1.65</td>
<td>350,000</td>
</tr>
<tr>
<td>1920</td>
<td>135,000</td>
<td>1.60</td>
<td>400,000</td>
</tr>
<tr>
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<td>185,000</td>
<td>2.00</td>
<td>175,000</td>
</tr>
<tr>
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<td>550,000</td>
<td>1.50</td>
<td>700,000</td>
</tr>
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<td>550,000</td>
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</tr>
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<td>325,000</td>
<td>1.75</td>
<td>275,000</td>
</tr>
<tr>
<td>1925</td>
<td>435,000</td>
<td>2.25</td>
<td>100,000</td>
</tr>
<tr>
<td>1926</td>
<td>650,000</td>
<td>1.25</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Average</td>
<td>323,500</td>
<td>1.64</td>
<td>420,000</td>
</tr>
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</table>

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The Missouri or western district includes sections of Missouri, Iowa, Nebraska and Kansas. Missouri produces 80 per cent or more of the total crop of the western district. The principal producing counties in Missouri are
Handing Bluegrass Seed

Stripping.—Bluegrass should be stripped as soon as the head has turned yellow and the seed firm. The stripping season is comparatively short, lasting not more than two or three weeks. The height of the season is usually reached during the second week of June, during which time a very large percentage of the total crop of the State is harvested. For any particular area of grass the stripping season will seldom extend over a period of more than eight or ten days. After the seeds have reached the stage of maturity that allows them to be easily stripped from the standing plant, a rather short period intervenes before the seeds begin to shatter. The amount of shattering is greatly increased by heavy rain and hail, and seed crops may even be lost completely through these unfavorable conditions.

Through fear of the loss of a crop, the farmer and “professional” or “contractor,” who have large acreages to strip, often make stripping too early. This results in a decreased yield due to shattering, and gives a poor quality of seed that sells at a discount under proper stage.

Stripping is done by means of hand strippers or by power-drawn machines. Hand stripping is practiced only in a very limited way, and is confined generally to the most productive spots of grass such as may be found in orchards, and on unmowed lawns.

There are several types of power strippers used in Missouri, but all are built on the same principle. They consist essentially of a large spike-studded drum which revolves at high speed. The seed and chaff are thrown beneath and behind the drum into a box and are emptied at frequent intervals and hauled to the curing beds. Several companies in Missouri manufacture stripping machines and sell them at approximately $75.00 each. Many farmers buy the castings from foundries and make their own machines at a saving of $5.00 to $20.00 on each machine. Old binders can be converted into strippers at a moderate cost. These are claimed by some to be superior to the regular stripper in that they can be easily adjusted to strip very short grass.

The acreage that may be stripped with a machine varies widely, but the average is approximately ten acres per day. Under normal conditions a machine is used about ten days each season, making a total of 100 acres for a machine in a single season. If properly cared for, a machine will last twenty years or more with a very small expenditure for repairs.

Curing the Seed.—The seed and chaff commonly termed “green rough” are hauled immediately to the curing bed after stripping. Curing may be done inside a building, provided it is well ventilated, or in the open. A small area of smooth ground, well sodded, with sufficient slope to insure good drainage, makes an excellent site for an out-door curing bed. The area should be mowed with a lawn mower and raked clean. The green seed is piled in small windrows running in the direction of the slope. The windrows should be about 15 or 18 inches high and should be dressed down on the sides with a pitchfork and made as narrow as possible so as to turn water and permit free circulation of air. These windrows should be turned frequently, usually four or more times daily.
to prevent overheating and to hasten drying. The curing process should be continued until the seed and chaff are thoroughly dry and show little or no tendency to heat or mold. Under favorable weather conditions and proper attention, only about two or three days are required to complete the curing in small windrows. Two or more of the windrows may then be thrown together in a large windrow (Fig. 4) and the seed allowed to stand undisturbed until ready to sack and store for sale. Frequent examinations should be made of the seed, however, to make sure that it is keeping properly.

The more frequently the seed is turned and exposed to the drying influence of the sunshine and air, the better the quality of seed produced. Green seed apparently of rather poor quality may be made to command a good price if properly handled; and green seed of excellent quality may be ruined by improper handling in the curing bed.

Fig. 3.—Stripping bluegrass seed with a hand stripper.

Care should also be exercised to avoid overheating of the green seed before it reaches the curing bed. The Kentucky Station* found that green seed left in sacks for three hours reached a temperature of 123 degrees F to 145 degrees F. Tests have shown that the germination of the seed is lowered greatly by a temperature of 140 degrees F. Probably under average Missouri conditions the green seed may remain in sacks for more than three hours without danger of serious injury. But the results obtained by the Kentucky Station emphasize fully the necessity of prompt delivery to the curing beds and of frequent stirring and turning of the green seed.

Marketing of Bluegrass Seed.—The seed is sold by the farmers in one of three conditions (1) freshly stripped seed commonly known as green rough; (2) cured seed or dry rough, and (3) the standing, unstripped crop. Those who make a practice of leasing land for stripping purposes often have several large crews employed and operate at different places during the stripping season. These “professional strippers” or contractors lease on the basis of a specified

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sum per acre or bushel; or they strip on shares. The price paid per acre for stripping privileges ranges from $1.00 to $10.00 and averages $2.00 to $4.00. If the field is stripped on shares, the farmer receives from one-third to two-thirds of the seed, either as cured or uncured, depending on the terms of the contract.

The practice of leasing fields is decreasing yearly, but 50 per cent or more of the crop is still handled in this way. When the low cost of equipment required for handling a bluegrass seed crop is taken in consideration, leasing seems questionable for the farmer who has 30 acres or more of good bluegrass seed. Selling the stripped and cured seed is usually more profitable.

Many of the contractors are buyers of cured and uncured seed, and often have one or more curing beds located at convenient places to handle the crop bought green. Also regular buyers are located in some of the larger towns in the bluegrass area. The price received by farmers varies widely, depending on the trend of the bluegrass markets and on the quality of seed. During the past ten years green rough seed has sold from 50 cents to $1.10 for a bushel of 14 pounds, while dry rough seed has sold for $1.25 to $2.25 for a bushel of 14 pounds. The average price received by growers in the Missouri district for cured seed from 1917 to 1926 was $1.64 per bushel of 14 pounds.

The yield of green rough seed per acre varies from 2 to 30 bushels, with an average of about 8 or 10 bushels. Five bushels is an approximate average yield of cured seed, but yields of 12 to 15 bushels are not uncommon. A few farmers and contractors have reported yields of 20 bushels or more per acre. On the basis of the average yields and prices, a gross return of $7.00 to $10.00 per acre may be reasonably expected from a crop of bluegrass seed. If the fields are handled in such a way as to give a maximum seed crop, and the seed is properly cured, a larger gross return can be secured from an acre.

Fig. 4.—A small area of smooth ground, well sodded, with sufficient slope to insure good drainage makes an excellent site for an out-of-door curing bed.
After the seed has been cured and stored it is marketed and sent to threshing and cleaning machines. Here the seed is carried through a series of processes that take out the chaff and other foreign material.

The loss in weight of curing and cleaning seed varies greatly with the condition of the crop at harvest, and the amount of foreign material present. The loss in weight during curing ranges from 35 to 75 per cent with an average between 45 and 50 per cent; the loss in weight from threshing ranges from about 20 per cent to 70 per cent with an approximate average loss of 50 per cent by weight. Hence a bushel of 14 pounds of green rough will thresh out about 3½ pounds of seed, or stated in other terms, 6 bushels of green seed will yield one bushel of 21 pounds of cleaned seed.