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BULLETIN 234

Meadow and Pasture Management in the Ozark Region of Missouri



Good grass land is greatly reduced, as shown in the upper picture, by clearing and use for cultivated crops.. If tame grasses are sown immediately after the land is cleared, as in lower picture, the tame and native wild grasses together develop good pasture.

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Agricultural Experiment Station

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Meadow and Pasture Management in the Ozark Region of Missouri

C. A. HELM*

Abstract.—In this bulletin the results of grass investigations, during the year 1924, in the Ozark section of Missouri are reported. The region is divided into sections and the conditions and problems of each section are discussed. Recommendations are given for the most effective clearing methods, sprout control, and seeding practices. The grasses and legumes best adapted to the region together with their best use in mixtures are discussed.

The recommendations made in this bulletin are based on information obtained in a survey of the Ozark region made during the spring and summer of 1924. The greater part of the time from May to September was spent in interviewing those who were making a success in grass land development. Careful observations were made of the conditions that now exist, together with the factors involved.

Every county in the region was covered in this survey and the opinions and experiences of over 600 residents were obtained. The recommendations, therefore, represent a summary of the best methods prescribed by those who have been most successful in developing the region for pasture and meadow purposes.

The most important agricultural problem common to the Ozark region is that of the development and maintenance of grass land. The region is generally best suited to a livestock system of farming, with the major part of the land in grass.

The Ozark region has broad possibilities of development into a grazing region. The difficulties in its development are, however, very important. Sprout and underbrush control; the establishing of grass on new and old land; the reclaiming, as grass land, of old abandoned land formerly cultivated; and the maintenance of grass when once established are the primary Ozark grass problems. Their solution will best develop the farming possibilities of the region.

The region considered in this report comprises the rough, hilly area of Southern Missouri, excluding the Ozark border region adjacent to the Missouri and Mississippi Rivers. The Ozark border region is excluded since it has a comparatively large amount of more productive land and

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therefore a different grass problem. The recommendations for grass production may, however, apply to much of the poorer soils throughout the Ozark border. The region is shown in figure 2, and is divided into 6 sections or areas.

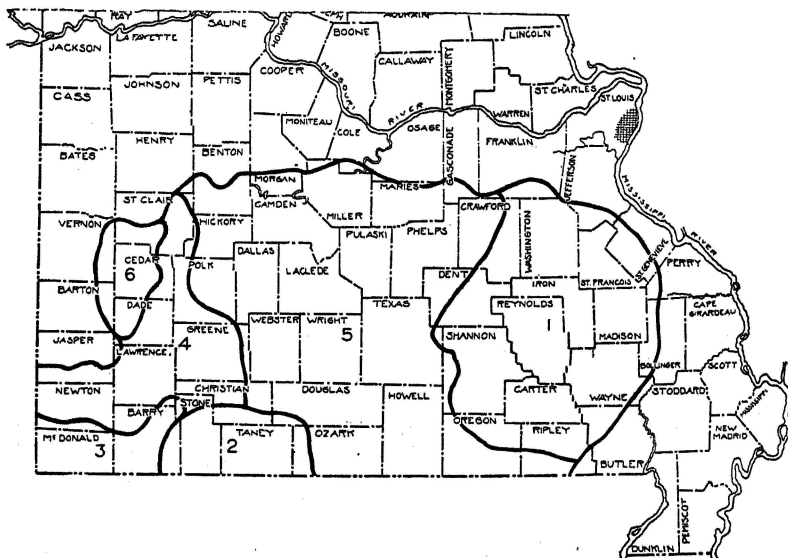


Fig. 2.—The several sections of the Ozark region considered in this bulletin are shown within the heavy, black lines on this map.

The Ozark region (see Sections 1 to 6 in figure 2) is characterized by its rough, hilly features with narrow ridges and steep slopes. The streams are bordered with narrow valleys affording a comparatively small proportion of bottom land. The region is similar throughout in possessing relatively large areas of rough undeveloped timbered land, and poor, light colored, droughty soils. It varies widely in the proportion of these areas, however, and is therefore divided into six sections. The land within each section is generally similar with respect to (1) surface features, (2) timbered land, (3) valley land, (4) tillable upland, (5) amount and size of surface rock, (6) soil fertility, (7) drought resistance, and (8) undeveloped land.

The boundaries of a section should not be assumed as definite divisions in all of the above features, but only as approximate lines.

Except on the river and creek bottom land, and comparatively small areas of the more productive upland, most cultivated crops are not grown profitably. The upland soils often are too rough to make cultivation possible. The upland in addition to being rough is usually very

stony, and cultivation leaves the stones on the surface in increasing numbers. The stony soils also are very droughty and on these soils dry weather invariably makes crop production very difficult.

The upland soils which are more level and comparatively stone-free are generally light colored, and shallow. These level soils are usually acid, low in organic matter and phosphates, and are not naturally adapted to the growing of clover. The land is wet and cold during the spring months, and usually becomes very dry during the summer, so that the yields of crops easily affected by drought are greatly reduced. The level upland in Section 5 is typical of this description while the exception is found in Section 4.

With the exception of Section 6 the majority of the Ozark region is of limestone foundation. The soil, being mainly residual from the impure limestone, contains fragments of chert varying greatly in percentage and size. On many steep slopes, especially those facing south and west, the soil is a mass of chert material. This condition is also especially noticeable on much of the land under cultivation from which the soil has washed.

In general the rocks are most abundant and most noticeable in Sections 1, 2, and 3, less abundant in Section 5 and least in Section 4. This is due partly to the chert content of the parent rock but also to the more hilly surface of the area resulting in greater erosion in some sections than in others, and accordingly a greater or less amount of rock residues left on the surface.

The amount and size of the rock is closely associated with the utilization of the land for crops. Where the stones are large and abundant the soil is invariably droughty, cultivation is impossible and deep rooting grasses are essential. Next to low fertility the stones are the most important difficulty in the utilization of the land for other purposes than forestry.

DESCRIPTIONS OF SECTIONS

Section 1 comprises the most extensive part of the Ozark region and has practically no level land. There are, however, limited areas of fertile and well improved land as found for example in a part of St. Francois County. This is a timbered area and very little of the land is under cultivation. The upland surface is a series of narrow ridges and steep slopes. Much of the upland soil of this area is classified as Clarksville stony loam. The abundance and size of the rock together with the hilly surface of the area makes the cultivation of such land impossible and accounts for its droughty condition.

The area is best adapted to timber and grass production. The soil except in a few favored areas is too stony and droughty for the best

development of grazing, and the development of forestry should predominate, while grazing should be of secondary importance.

In much of this area there may well be developed a combination of forestry and range pasture. More pasture can be obtained in this section where grown in open timber than where the land is completely cleared for grass. Grasses are very difficult to start and maintain on the upland that has been completely cleared of all timber.

Section 2 is very similar to Section 1 in surface features, but the soils in general are not as stony. The soils throughout this section therefore are not as droughty as the soils in Section 1. This section is more varied, however, and much of the area consists of hills that have a shallow soil covering with occasional outcrops of ledge or bed rock. Such soils, known as glade or bald areas, are too shallow to support tree growth.



Fig. 3.—Glade land in western Ozark counties. This soil is very shallow and has no value for cultivation. It is very poor grass land and produces practically no timber.

Some of the ridge land in this section is fairly productive and develops excellent Ozark pasture. If put under cultivation, however, the soil is washed away within a few years, leaving a mass of rocks which will not permit further cultivation. In this condition the land is greatly reduced in its capacity to produce grass.

The ridge land in Section 2 has been cleared of its timber to a much greater extent than has Section 1. Unfortunately much of this ridge land has been or is now under cultivation, and only a comparatively small area is being developed into good pastures.

Section 3 is probably the most varied of all the sections, being very irregular in its percentage of land suitable for cultivation. Small areas of rolling land with wide divides are to be found over the section. Such land is generally more free from rocks and the rocks present are much smaller in size than in Sections 1 and 2. Spots of level land are small in proportion to the entire area, however, and the section in general is quite rough and stony and closely similar to Section 2, having narrow ridges with steep stony slopes.



Fig. 4.—A large area of the ridge land in Section 3 has been cleared. This land is fairly productive for grass and clover, provided that it is not first cultivated.

The relative area of level, more productive upland and the greater number and width of the valleys allow greater possibilities of mixed farming than are found in Sections 1 and 2. In Section 3 the development of the hill, ridge and steep slopes into timber and grass together with a careful system of soil management on the more level cultivated land will essentially solve the problems of the section.

Section 4 is generally uniform and over its greatest area might well be classed as rolling, with extensive areas of prairie land. In this section

the broad inter-stream uplands are level or slope gently toward the streams. The valleys are wider than those generally found elsewhere in the Ozark region. Prairie and level plateau areas exist in Sections 3 and 5, very similar in contour, but in much smaller, and less productive tracts, and are generally bordered with strips of rough hill and ridge land.



Fig. 5.—These pictures show the effect of continuous cropping of Ozark land which in its virgin condition was best adapted for grazing.

Section 4, unlike all other sections, is generally well adapted to mixed farming and the major part of the land is improved. The soils are more productive and less droughty. While most of the land is more or less stony, the rocks are much smaller in size and are not present in such quantities as elsewhere in the more rugged parts of the Ozark region.

A relatively large area of this section is adapted to cultivation but requires careful methods of soil management to maintain its fertility. Corn, oats, wheat, sorghums, soybeans, cowpeas, and clover can be

grown successfully on much of the land. The rough hill land areas which wash badly should be developed into pastures and meadows exclusively.

Section 5 in its surface features is intermediate between Sections 1 and 4 in having large tracts of rolling land together with a considerable area of rough stony land. The rough land predominates in the southern and northern margins and this rough land closely resembles Sections 1 and 2. The more level areas are generally found throughout the central part which is in fact the plateau, or divide, of the Ozark region. The level areas while possible to cultivate are not well adapted to the production of cultivated crops. The soil is very shallow, light colored, and often acid. Corn growing, except for forage or silage, is not profitable. Forage crops for winter feed with a well developed system of pasture and meadow land will give the best returns from land in this section.

Section 6 is varied both in contour and in soil. It is generally not as rough as are Sections 1 and 2. A large part is suitable for cultivation but most of the soils, because of their sandy and shallow character, are very droughty. A part of the tillable land is flat and poorly drained, and is accordingly cold and wet in the spring and early summer and subject to severe drought during dry seasons.

The rough areas are generally sandy, still less adapted to cultivation and not as good for grass as the soil on the more level areas. The rough land is generally timbered and should be handled exclusively for grass and timber.

This section unlike Section 4 is very irregular in both the soil and nature of the upland features. A smaller area of its land is improved and relatively less is suitable for cultivation.

LAND UTILIZATION

The Ozark region is extremely varied in its adaptation to farming. The extreme variation for the entire region may be found within any of the counties in the region. In some sections the land is generally too rough and broken for tillage. Again the surface is often covered with rocks so large and numerous as to make cultivation impossible and the soil very droughty. The character and depth of the surface soil and the character of the sub-soil is an important factor determining the value of the land for either cultivated or grass crops.

The upland of the Ozark region is therefore best adapted to livestock and forestry purposes. The amount of tillable areas and character of the land is such as to make grain production generally non-profitable.

Table 1 shows the yield of corn, oats, wheat and tame hay by sections over a ten-year period, 1914-1923. While the grain yields are fairly

similar the table indicates the superiority of Sections 3 and 4 for cultivated crops. By comparing the data in Table 1 with that in Fig. 6 the general character of land utilization may be clearly interpreted. The yields of corn, oats, and wheat for Sections 1 and 2 compare favorably with those of Section 4. However, Sections 1 and 2 have approximately one-fourth of the land under cultivation with 40 to 50 per cent undeveloped, while in Section 4, 50 per cent of the land is cultivated with only 7 per cent undeveloped land. Section 4 also has more than twice as much land cleared and providing good pasture.

The explanation for the comparatively high grain yields in Sections 1 and 2 is that the major part of the land is too rough and stony for cultivation and that crop production is limited mainly to the better land along the creek bottoms while in Section 4 the major part of the upland is either in cultivated crops or in pasture.

TABLE 1.—AVERAGE YIELD OF CORN, OATS, WHEAT AND TAME HAY DURING THE PERIOD 1914-1923.

(Compiled from Missouri Year Book of Agriculture, 1924)

Section	Bushels of Grain per Acre			Tons per Acre
	Corn	Oats	Wheat	Tame Hay
1	22.3	22.9	11.0	1.6
2	21.1	24.1	10.2	1.14
3	22.7	28.0	10.9	1.17
4	23.0	26.0	15.1	1.13
5	21.8	23.3	10.1	0.96
6	20.3	22.8	11.7	1.11

In Section 3, as shown in Fig. 6, a large part of the hill and ridge land has been cleared of its timber. Much of this land is unfit for cultivation and a large proportion is in grass. The same is true for Section 6, the major part of the land being either in cultivated crops or used for pasture. In this section the land under cultivation lies mostly along the eastern half, while the western section is used for grass land.

The situation in Section 5 is peculiar in that approximately $\frac{1}{3}$ of the land is under cultivation, $\frac{1}{3}$ in pasture and $\frac{1}{3}$ is still undeveloped. The undeveloped land in this section lies mainly along the streams and rivers. The upland is generally rolling enough to make cultivation possible and such land is mostly cleared and is either under cultivation or in pasture.

The upland in this section is generally thin, flat, poorly drained and often sour. This land is very deceptive, being poorly adapted to cultivated crops other than forage, meadow or pasture crops. It is generally

Percentage by Sections of
CULTIVATED, PASTURE^a and UNDEVELOPED LAND
 During the Year 1923

SECTION 1

	%	
CULTIVATED LAND	28.02	
PASTURE	15.14	
UNDEVELOPED LAND	51.07	

SECTION 2

	%	
CULTIVATED LAND	21.91	
PASTURE	15.14	
UNDEVELOPED LAND	41.28	

SECTION 3

	%	
CULTIVATED LAND	28.00	
PASTURE	36.76	
UNDEVELOPED LAND	28.18	

SECTION 4

	%	
CULTIVATED LAND	49.29	
PASTURE	36.09	
UNDEVELOPED LAND	7.45	

SECTION 5

	%	
CULTIVATED LAND	28.22	
PASTURE	33.35	
UNDEVELOPED LAND	32.95	

SECTION 6

	%	
CULTIVATED LAND	41.73	
PASTURE	47.35	
UNDEVELOPED LAND	5.22	

^aINCLUDES MEADOW CROPS

Fig. 6.—Percentage of cultivated pasture and undeveloped land in the Ozark region of Missouri, by sections, during the year 1923. (Compiled from data supplied by the Missouri Crop Reporting Service.)

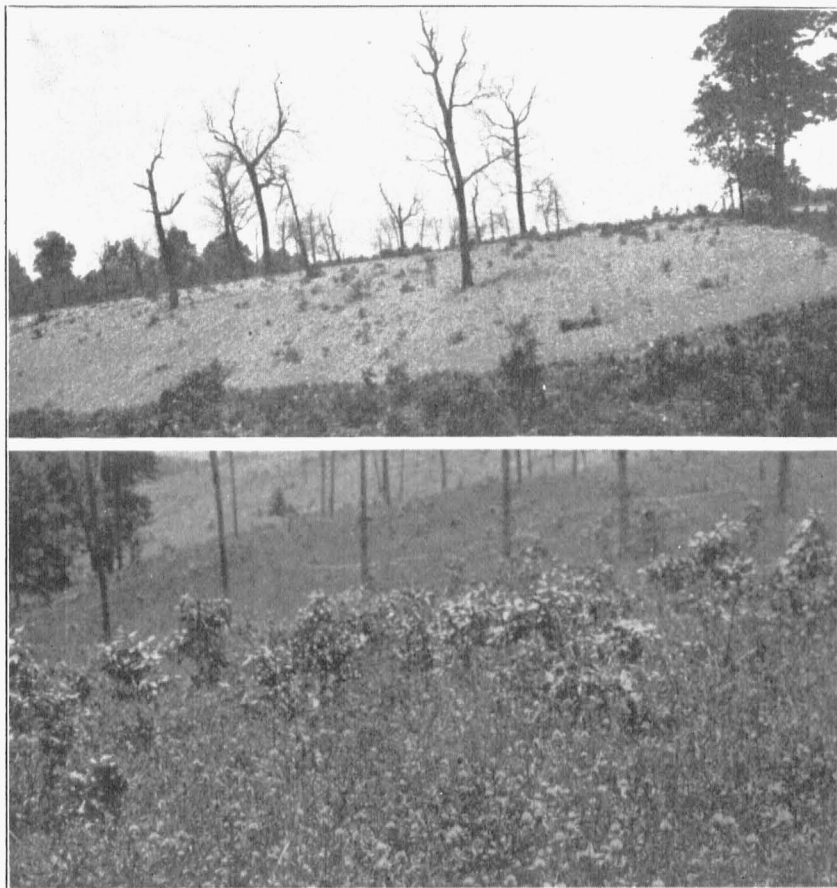


Fig. 7.—When newly cleared hill land is cultivated the soil is soon washed away, leaving a heavy layer of rocks. If sown to grass and clover immediately after clearing the soil is maintained and supplies good pasture. Both the above photographs were taken on the same hillside.

very wet during spring and droughty during summer. The comparatively low yields of cultivated crops in this section are indicated in Table 1.

Land in the Ozark region may easily be classified into one of two groups; (a) land adapted for cultivation, and (b) land adapted only for grazing or timber, or both.

Cultivated Areas.—Areas suitable for cultivation are best determined by the contour of the land which is related to the amount of rock in the soil. The amount of soil erosion or washing that will occur under cultivation is the most important factor to be considered. With soil erosion as a basis the (a) valley land, (b) gentle slopes or “slip-off”

slopes, and (c) wide divides which are level or only moderately sloping comprise the areas suitable for tillage.

This area of "cultivated land" becomes suitable for cultivation only so long as intelligent systems of soil and crop management are followed. To maintain the upland soil in cultivated land the cropping system employed must be first of all one which has in effect (a) the maintenance or improvement of soil productivity and (b) the prevention of excess soil washing.

The general practice of continuous cultivation now being followed is most destructive and is the chief contributing factor to unprofitable farming. Thousands of acres of land which were once productive grass land are now materially reduced in value for any crop.

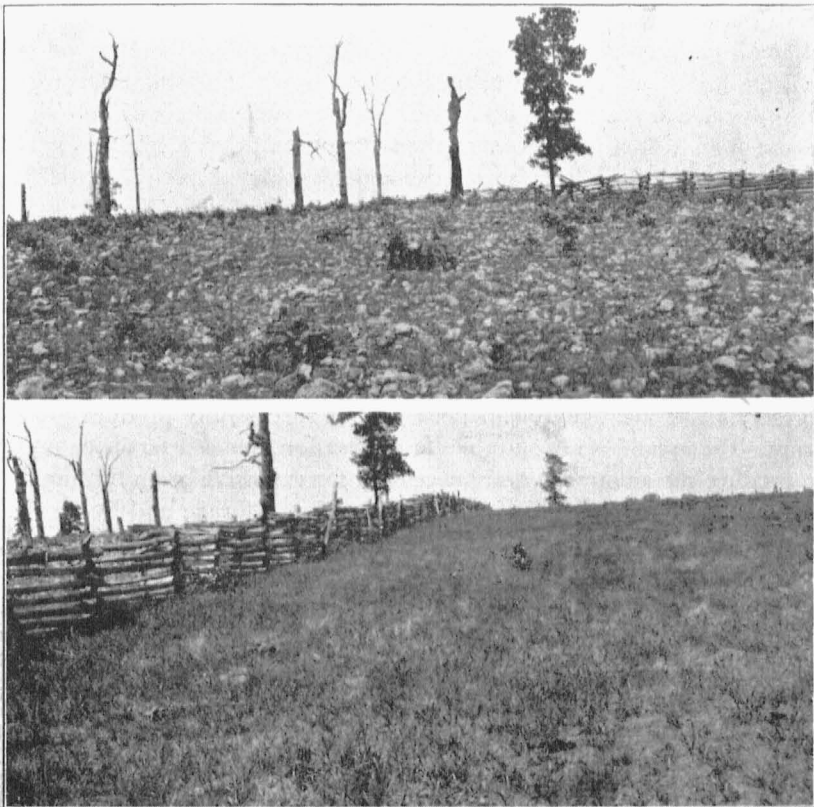


Fig. 8.—Here are shown two adjoining fields on neighboring farms in Texas County. The one at the top was under cultivation four years then left idle. The lower one was never cultivated, the land being seeded to orchard grass and redtop.

The common practice is to clear new ground and plant to cultivated crops like corn, kafir, oats and wheat, with little regard to its adaptation to such crops or to its slope in regard to soil washing. The result is that within a few years the soil is reduced to a mass of chert rocks and boulders, the soil having been washed into the valleys or their adjoining slopes. In proof of this condition large acreages are annually being abandoned as too poor to produce profitable crops. Such land is reduced in value for grass, is generally abandoned and within a few years becomes a mass of sprout growth.

Grass and Forestry Land.—By far the greater part of the upland including much of the reported improved land in the Ozark region is best adapted for grass and timber. Large areas especially of cut-over land are most economically handled in pasture.

A large part of the region, especially in Section 1, is best suited to timber with grazing of minor importance. Under a system of clearing of small underbrush, the deadening of old trees of no forestry value, and the use of goats to control new undergrowth, this land will return its best value in pasture timber. Under such management it will provide as much and often more pasture than were it to be cleared entirely of timber growth. Such land is usually rugged, with steep rocky slopes. It is easily affected by drought and if cleared will wash badly. It will, therefore, provide more pasture with the timber than if the timber were to be completely removed or if left to grow up in brush.

TYPES OF FARMING

The Ozark region is first of all best adapted to livestock farming and forestry. The average upland farm cannot successfully produce grain crops. The upland is not suitable for cultivation, nor is it fertile enough to produce the amount of grain necessary for extensive grain feeding of livestock. The type of farming should be one of forage and livestock. The forage crops should be primarily that of pasture and meadow and therefore a grazing system of livestock farming should prevail.

Under the accepted methods of economical forestry production, land that is devoted to the lumber industry has little value as grazing land. The timber is allowed to grow unmolested, resulting in timber growth too thick for grass to grow. However, on much of the land a selective clearing process may be followed with sprout control by the use of goats which will provide both a profitable combination of grazing and timber. By this practice the returns from the timber become secondary to that of grazing.

In certain parts of the Ozark region, primarily in Sections 2, 3 and 4, small fruits and certain vegetables are produced profitably. However,

when the actual area of land used for such crops is considered, the acreage of such crops is found to be relatively small.

Dairying on an extensive scale succeeds best on farms located along streams having a relatively large acreage of bottom and valley land where enough corn and legumes can be grown to furnish the feed needed. However, such farms usually must depend on the upland to provide the necessary grass land for pasture. Therefore the size of the dairy industry is closely related to the successful growing of grass on the upland.

On upland farms dairying on an extensive scale must necessarily be managed on a basis of importing much of the feed used other than forage. Under this plan the railroad and highway facilities must be taken into consideration.



Fig. 9.—Steep, rocky slopes should not be completely cleared of all timber. Enough timber growth to furnish moderate shade and to hold the soil is more effective in getting this droughty land in grass.

In Section 1 the major part of the land is best suited for grazing and for forestry purposes. Much of this area is too rough and stony to produce good grass land if completely cleared of all timber. Exceptions are to be found along the valleys. Farms so located as to have considerable bottom and valley land in conjunction with hill grazing land are in position to follow any system of grain or livestock farming desired. Such farms, however, constitute but a small portion of the section.

Average farms in Sections 3 and 4, especially in Section 4, are well suited for general or mixed farming. Under good methods of soil and crop management, corn, oats, wheat, clovers, and meadow and pasture grasses can be produced profitably on the greater portion of the land in these sections and crop yields can be maintained by rotated cultivation.

CLEARING PRACTICES

The greatest grass problem in the Ozark region is that of sprout and underbrush control. It is also the most expensive part of starting and maintaining grass land. Sassafras sprouts and post oak runners are probably the most aggressive of all timber growth.

The best practice in clearing land is generally determined by highway conditions and the location with respect to railroads. Virgin and cut-over timber can be removed at a profit only when its location is such as to make timber transportation practicable.

The use of goats to clear land.—The use of goats is without question the cheapest and most satisfactory method of controlling sprouts. However, with poor care or management the losses of the animals may in some cases be great enough to more than equal the original value of the land. Where goats are properly handled it is possible to clear land and at the same time return a profit on the animals themselves.

The number of animals required per acre depends upon (a) the amount of brush and (b) the time during which the sprouts are to be killed. The most effective results are obtained when the animals are confined to rather restricted areas. However, the practice of holding them closely confined for too long a period often causes a heavy loss of animals through disease and under-feeding.

Two to four years are required to destroy completely all sprout growth. To obtain prompt results in heavy brush the number of goats used varies from four to seven head per acre. After the first year one animal should control three to five acres.

Where large tracts are to be cleared the land should be cross-fenced. After the sprouts have been reduced on one tract the animals should be transferred during the latter part of each day to unworked pasture. Under this system more land can be controlled by a given number of animals and fewer of the goats will be lost.

Unless held to a restricted area goats will not eat the foliage of some sprout growths, as for example hickory. If forced to destroy such sprout growth they will at the same time destroy much of the grass. This condition may also result in heavy loss of animals. It is therefore, often best to use some hand sprouting in connection with the use of goats.

In cut-over timber or when the land has become over-grown with heavy sprouts the animals should be turned in during the winter or early spring. Enough animals should be used to destroy all undergrowth foliage by the latter part of June. During the months of July and August the small brush should be cut and the large timber deadened. A good rule to follow is to cut all timber that may be thrown more quickly



Fig. 10.—The use of goats to control sprouts. The field shown in the upper picture is kept free of sprouts by the use of goats. The area shown in the lower picture was "slashed" in August, burned over the following February and sown to grass. Since that time the sprouts have been kept down by goats.

than deadened. Where the tract is to be handled as a forestry-grass combination a careful and systematic selection of timber to be left, becomes necessary.

The following spring the tract should be burned over during a dry period in March or April. If the tract is being handled as a forestry-grass combination, burning, if done at all, should be done during mid-winter. Burning will often result in damage to much of the standing timber, especially if done during spring or summer. Standing timber may also be damaged by winter burning when a large quantity of plant residue has accumulated on the ground.

During March or April, after burning, grass seed should be sown. From this time on the number of goats used per acre should be reduced to just the number needed to keep new sprouts under control.

When land is handled in this manner it is strewn with dead stumps, brush and tree tops. When heavy timber or brush is cleared the surface often is a tangled mass of such forest residue. Any attempt to assemble and burn this material is a doubtful practice even though a number of years are required for its decay. The labor necessary to do this is too great in proportion to the sale or grazing value of the land itself.

This forest material left on the land serves a useful purpose. It provides some protection to new grass during both winter and summer, and prevents too close grazing for the first two or three years.

Even after all sprouts have been completely removed, it is necessary every few years to use some goats. This is especially true where some timber is left. But even when all timber is removed sprouts and seedlings are continuously being introduced from neighboring wood land. Again blackberries, buck brush, and similar growth must be kept under control. The number of animals required to maintain such pasture land is very small, often not more than one animal for every 8 to 10 acres.

HAND CLEARING

Where marketing conditions are favorable land may be profitably cleared by hand by working small and damaged timber into cord wood and mine props. Some land owners make clearing contracts but require that both large timber and underbrush be cut and piled ready to burn. In many cases after the wood is sold and delivered to railroad points a small profit at least is realized over and above the cost of clearing.

When the above clearing methods are practiced it is very desirable that all timber be cut close to the ground if the sprouts are to be kept under control by using a sprout cutter.

If the clearing is done in the winter the land should be sown to grass during early spring. When land is cleared during summer and fall, it is best to withhold the grass seedings until the following spring. When the ground is matted with a thick layer of leaves, burning before seeding is necessary.

The control of the sprout growth becomes the most important problem immediately after the land has been cleared. Unless given attention the land in two or three years will become heavily set with a mass of brush, too thick to allow grass to succeed. The sprouts may be controlled by one of the three methods; (a) use of goats, (b) use of a sprout cutter, and (c) cut by hand. The first two methods are explained elsewhere in this publication.

Except on relatively small areas, controlling sprouts by hand cutting is not practicable unless cheap labor is employed. Sprouts are most easily killed if cut back during July and August. After two years of

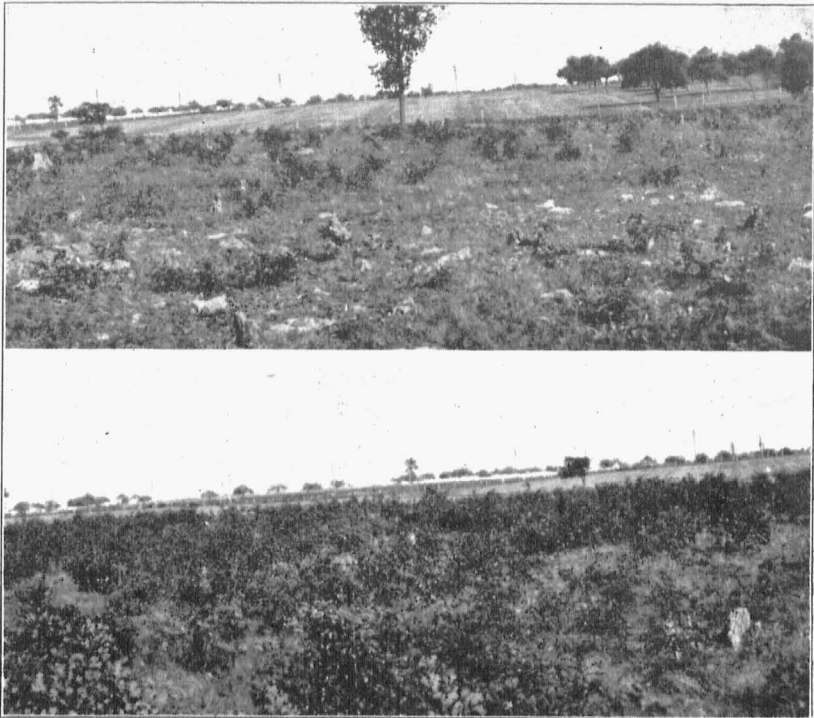


Fig. 11.—Hand sprouting is an expensive method of maintaining pasture land requiring several seasons to materially reduce their growth. These fields have been cleared three years. The upper field has had the sprouts cut back once each year during August. The sprouts shown in the lower picture were not cut back the last year.

brushing the sprouts generally are reduced to a point where they are easily kept under control. However, for several seasons thereafter, it is necessary that the scattered sprouts be kept cut back. Otherwise much time and labor will have been lost.

An effective start on sprout control may be had by burning late in May after the sprouts have leafed out. When there are not enough leaves to secure a good "burn over," it is best to allow the sprouts, wild grass, and weeds, to grow for one season after clearing, burning the following spring. This method is always equal to one season's hand sprouting and in many cases few sprouts start after fire has gone over the ground. For best results the material must be extremely dry and burning should be done when there is little wind. When this method is followed, grass seeding should always be done after burning and never before.

CLEARING WITH FIRE

The practice of burning over timber land yearly has in the past been a very common one. This has been especially common on open or so-

called "range" land. Its chief purposes have been to remove the heavy coating of dead leaves and to keep small sprouts and underbrush under control. In this it is effective, but at the same time it is very destructive to the native grasses. It is perhaps largely responsible for the practically complete disappearance of the native bluestem grass which was common all over this region years ago.

Another serious objection to burning is that its consistent practice damages or destroys much of the standing timber. On many tracts this timber is or will be more valuable than the pasture that might be obtained. Tame grasses sown on timber land are damaged materially by burning and in a few seasons are completely destroyed if the surface is burned every year.

Orchard grass is the most useful timber land grass. Being a bunch grass its crown grows above the level of the soil. The crown stands especially high when orchard grass grows in shaded conditions such as exists in open timber land. This grass will not survive yearly spring burning.

Japan clover also is reduced by burning. It is an annual legume and produces a heavy crop of seed each fall, even when under heavy pasture. Its heavy seed production alone keeps it from being killed out on burned over tracts.



Fig. 12.—Where all timber is to be removed, late spring burning is very effective in checking and killing sprouts. Vegetative growth should be allowed to accumulate for one season, burning late during the next spring after sprouts have leafed out or budded. Burning should be done by back firing during a calm, dry period. Grass seed may be sown at once after burning.

There is no denying the effectiveness of burning to control brush and sprouts. On cut-over land where all lumber and tie timber is removed and it is desired that the land be cleared completely, no method is more effective. The cut-over land should have reached one season's growth of wild grasses, weeds, etc., before burning. At least one season's

growth is necessary to accumulate enough plant residue for effective killing of sprout growth. The timber should be burned in late spring after it has completely leafed out.

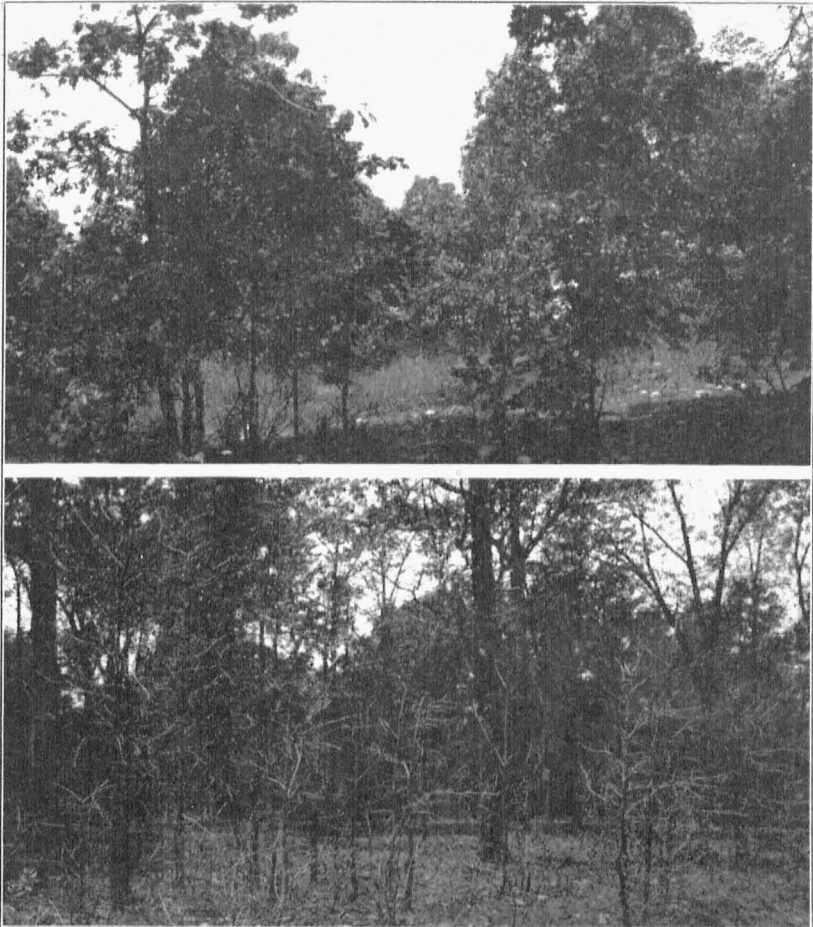


Fig. 13.—Adjoining tracts illustrating the use of fire in the spring to control underbrush growth in standing timber. This method though very effective damages valuable timber and when generally practiced will in time destroy practically all timber.

THE SPROUT CUTTER

Under conditions favorable for its use the sprout cutter is an effective means of sprout control. This machine consists of a series of chains attached at one end to an axle which through wheel traction is made to revolve at high speed. The result is that all foliage is stripped from the

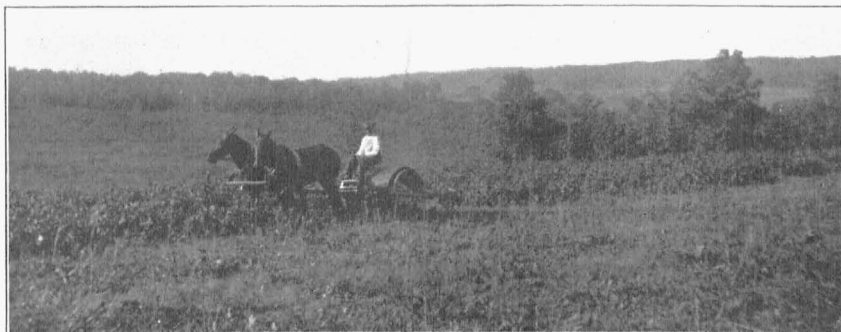


Fig. 14.—In the foreground a great improvement in pasture value has been made by the use of the sprout mower.

sprouts and where the sprouts are not too thick they are badly bruised and retarded in growth.

Most effective results are obtained with the sprout cutter, when the land has been cleared completely of all underbrush. Its use should start the first season after the ground has been cleared. It is not effective when used on land where sprouts have been allowed to grow unmolested for two or more years. Their height should not exceed two feet above the ground. Where this machine is used all stumps and other large growth should have been cut close to the ground. Its use is also limited to rolling and only moderately rough land since the work is done with horse power.

When sprouts have grown to a point where the main stem is woody and of good size it serves as a protection for new sprout growth that will form around the base, thus reducing the effectiveness of this machine.

Depending upon the smoothness of the land and the height of the sprouts one man and team can cover 3 to 6 acres per day. For best results sprouts should be clipped back twice each season, preferably once during June and again during the month of August. On large tracts it is a common practice to keep the machine at work continuously from late May to September. Where used on a large scale it is entirely practical to attach a motor to drive the beaters. This reduces materially the horse power required and makes possible the covering of more ground. The effect of this machine is identical with the use of goats. The more the leaves are removed during the season the more quickly are the sprouts completely destroyed.

Three season's use of this machine will reduce the average sprout growth to a point where it affects the pasture very slightly if at all. However, the machine must be used occasionally for several seasons

thereafter to prevent new sprouts from growing up. Otherwise, within a few seasons the land may again become overgrown with sprouts.

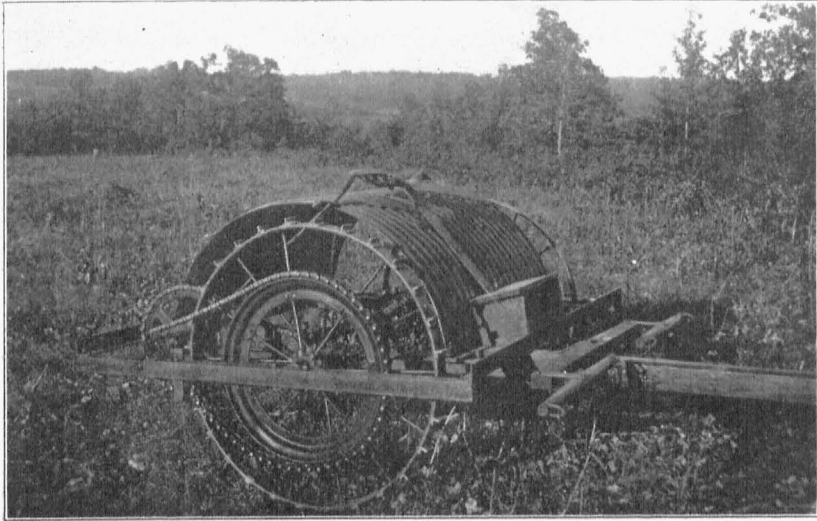


Fig. 15.—The sprout mower is an effective means of killing sprouts on land where the machine can be used satisfactorily.



Fig. 16.—This land was cleared in 1921 and seeded to grass.. The mower has been used once each year to keep sprouts under control.

GRASSES AND CLOVERS FOR OZARK PASTURES AND MEADOWS

Orchard grass, timothy, redtop, Kentucky bluegrass, Japan clover, alsike clover and red clover are best adapted for upland meadow and pasture. On other than bottom land sweet clover and alfalfa will seldom succeed without heavy applications of lime and phosphate. Red clover is rarely successful on old cultivated upland without phosphate and lime treatments.

In Sections 3 and 4, especially the latter, red clover does well on the better farms that have had good soil management. Red clover, sweet clover and even alfalfa succeed fairly well on virgin ridge land in the western part of Taney and the southern part of Stone Counties, in Section 2.



Fig. 17.—Orchard grass seed crop cut and shocked. This stand is two years old and practically all the red clover has disappeared. Note the leafy undergrowth left on the land.

Orchard grass* is the best of all tame grasses for the Ozark region. It is especially well adapted to Sections 3 and 4 and to the better areas in Sections 1, 2, 5, and 6. On land where general farming is practiced orchard grass alone or with clover can be grown in the rotation following oats or wheat. Sown in this way it provides a good meadow and pasture crop during the first two years of its growth, and makes one of the best of pastures thereafter. It is fairly permanent and can be left on a pasture for periods of three to ten years, depending on soil, stand and treatment.

*Write for Missouri Agricultural Experiment Station Circular 130, Growing Orchard Grass in South Missouri.

Orchard grass should be included in all pasture mixtures regardless of the soil type or fertility. It is especially well adapted to land that is only partly cleared and where the ground is shaded. It is well adapted to both wet and dry soils. Being a bunch grass, it is best sown in mixtures rather than alone. When sown alone the seeding must be heavy in order to produce a better sod.

Orchard grass starts its growth very early in the spring and affords the earliest pasture of all grasses. If not grazed too close it supplies good pasture during the entire summer, and the fall growth will give considerable winter pasture. Orchard grass will not survive continuous close grazing and is easily reduced in stand by the practice of yearly spring burning.

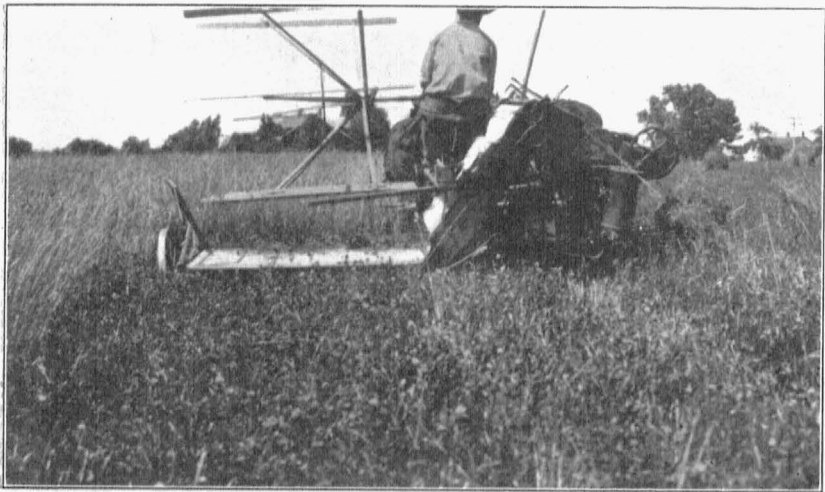


Fig. 18.—The seed crop of orchard grass is harvested with an ordinary grain binder.

Timothy is of comparatively little value in the Ozark region, except for meadows. As a meadow grass it is well adapted to the heavy, wet soils in Sections 5 and 6. Even in these sections its growth during July, August and September is very light and in many years of excessive drought and heat it is materially reduced in stand and often dies out completely. For meadows it is fairly well adapted to Sections 3 and 4, but there it can not compare favorably with orchard grass for either pasture or hay.

Timothy may well be used in all pasture mixtures, however, its germinating power, low seed cost, and ability to start early in the spring



Fig. 19.—Timothy (upper picture) is a good Ozark meadow or seed crop on the flat heavy soils. Red top (lower picture) is the best pasture grass and makes a fair hay crop on soils that are flat and poorly drained. It is especially well adapted to Sections 5 and 6.

and make a rapid early growth, makes it highly desirable as a lead crop. When sown with orchard grass and redtop it is usually crowded out after the first two seasons.

Redtop is the best sod-forming grass that is adapted to the Ozark region. It is especially well adapted to the heavy wet soils of the whole region and particularly to Sections 5 and 6. It is valuable chiefly as a pasture. The yield and feeding value are generally too light to warrant its general use as a meadow crop. On wet clay soils it produces a heavy crop of leaves and only on such land is it adapted for meadow. Even on such land timothy or orchard grass is equally good if not better than redtop for meadows. Red or alsike clover cannot be used satisfactorily as a meadow in a redtop mixture, owing to the lateness of maturity of redtop hay. Redtop being very aggressive and with wide adaptation should be used in pasture mixtures. It is, however, not resistant to shade and will not succeed in heavy timber land. It is not well adapted to Section 1 except on the flat areas. It should be used liberally in all mixtures sown on flat, wet land.

Kentucky bluegrass under good pasture management will become at least one of the most valuable pasture grasses for the Ozark region. But under the present methods of spring burning and continuous and heavy grazing, or where the underbrush growth is heavy, bluegrass has little chance of establishing itself. Bluegrass rarely succeeds when broadcast in mixtures. Under poor pasture management it rarely survives the drough of the first season. The seed is also very expensive and generally of low vitality.

Bluegrass is best started after a pasture of other grasses has been established. Broadcasting the seed thinly over manured spots will practically guarantee a start. An effective method is to scatter bluegrass seed during early spring around the droppings of animals over an established pasture. When started in this way it will, under good pasture management, spread rapidly and establish itself over the most favorable if not all of the well drained areas.

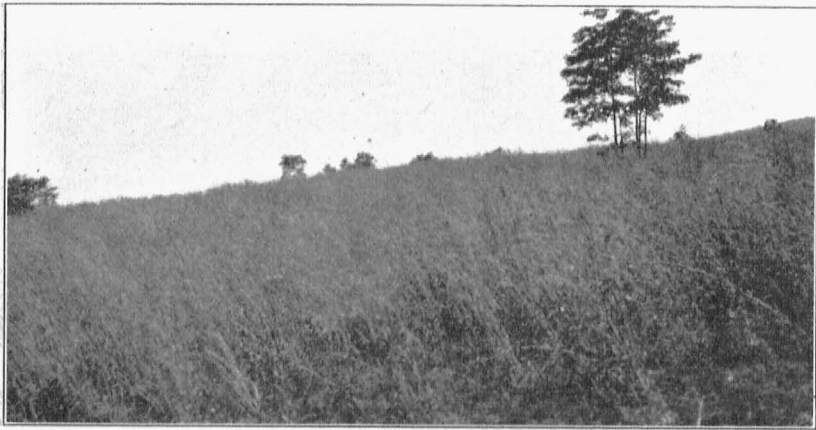


Fig. 20.—Broom sedge is very aggressive and quickly establishes itself in old meadows and abandoned cultivated land.

Brome or Smooth Brome grass gives little promise of value as an Ozark pasture or meadow grass. Though generally known for its drought resistance, it apparently cannot withstand the combination of drought and heat to which all grasses are subjected during June, July and August. It is not heat resistant enough to be superior to orchard grass even on the most favorable soil conditions.

Meadow fescue or English bluegrass is grown to a limited extent in the northern part of Section 6, but more commonly in the Ozark border and level prairie regions to the north and west of Section 6.

Meadow fescue is not as desirable as timothy or orchard grass for hay and is less valuable than orchard grass for pasture. It makes a comparatively poor meadow in that the stems are rather bare of upper leaves, though producing an abundance of basal leaves. It is therefore, more valuable for pasture than for meadow, and is especially well adapted on clay or wet land. It provides good early spring and late fall pasture furnishing comparatively little pasture during the dry, hot periods, of July and August. Meadow fescue is grown primarily as a seed crop to meet the commercial demand for seed for use primarily as a lawn grass.

Native prairie grasses thrive on a considerable area of the land used for meadow in Sections 4, 5 and 6. They are the primary meadow grasses on the level prairie land to the west of these sections. These grasses known collectively as "prairie grass" are, in reality, made up of several different grasses, namely Big Bluestem or Forked-beard grass (*Andropogon furcatus*), Little Bluestem or Broom grass (*Andropogon scoparius*), Indian or Wood grass (*Sorghastrum nutans*), and Tall Smooth Panicum (*Panicum virgatum*).



Fig. 21.—Over the greater part of the Ozark region the natural grass will come in immediately following the clearing of new land provided the land is not put under cultivation and is not burned over each year.

They are common only on virgin land and never occur on land which has been under cultivation. They grow more or less over the entire Ozark region, making up a considerable part of the natural pasture on partially or completely cleared land. Cultivation, close and continued grazing, and annual burning will reduce or completely eliminate them.

A grass known as Broom sedge (*Andropogon virginicus*) is similar in many respects to the Big and Little Bluestem grasses. This grass may

be identified by its habit of bunch growth and its presence in old meadows and abandoned fields. Since the plant is not grazed by stock it becomes very prominent in old abandoned fields and tame meadows, growing erect and reaching a height of 2 to 4 feet. Its growth period does not start until early summer, reaching full growth in late fall. This grass is non-palatable and is avoided by stock during its earlier growth. Later it becomes coarse and woody, resulting in an unmolested growth even on land where grazing is short. When present in old meadows, it produces seed in late summer after the hay crop has been removed. Broom sedge has comparatively little value for pasture during spring and summer and is utilized by stock mainly as a winter pasture, if at all. If cut early it produces a fair yield of hay which is low in feeding value.

Japan clover (*Lespedeza striata*) is the most valuable legume for pasturage in the Ozark region. It has a surprisingly wide adaptation, thriving well on the most droughty soils. It is least adapted to the flat, tight, poorly drained areas, but even there it makes some growth.

Japan clover will stand moderate shade, and is the first plant to appear in newly or partly cleared timber land. On dry stony hillsides it gains a foothold much more quickly if the land is only partly cleared. It is never necessary to seed Japan clover on new or virgin land. Its ability to spread to newly cleared areas is one of its important features. Through the gradual process of clearing, brushing, or sprouting of a tract, Japan clover quickly spreads and by the time the land is cleared has formed a heavy stand. Its rapid spread is partly explained by the fact that the germination of its seeds is not injured when they are eaten by stock. Japan clover, as found in the Ozarks, produces seed and dies out completely each fall. It is a heavy producer of seed, which accounts for its permanency. The seed produced in late fall becomes covered during the winter months by freezing and thawing and by the washing from rain or snow. Japan clover does not start in the spring until the danger of severe freezing weather has passed. It makes its best growth during mid-summer to early fall during the period when practically all other grasses or clovers supply the least amount of pasture. Generally it spreads in all permanent pasture and meadow land regardless of the other kinds of grasses or clovers sown. In timothy sod it makes up at least 90 per cent of the growth present after the timothy is cut for hay and it provides valuable pasturage in connection with orchard grass. However, where redtop is best adapted on wet, flat, heavy soils, Japan clover is generally absent or makes very little growth.

The stand of Japan clover is seriously affected by the practice of burning timber or pasture land. Accidental summer burning destroys the seed producing plants. Early fall burning destroys much of the seed

exposed on the surface. Through the common practice of spring burning much of the seed is destroyed and many of the newly sprouted seedlings are killed. Burning affects the growth of Japan clover far more than does close or continuous pasturing. Though it is not necessary, Japan clover may well be used in a mixture on worn or cultivated land which is being seeded down for pasture. One to two pounds of seed per acre is sufficient to guarantee a good stand. It will, however, spread to such land by natural means and in three to five years will become well set. Japan clover is always one of the first plants to appear when old cultivated fields are abandoned. Its appearance is due in part to the carrying of the seed by stock.

Japan clover is not suitable for meadows because of its dwarfed and prostrate habits of growth. On moist fertile bottom and low lands it is sometimes cut for hay. However, on such land red or alsike clover together with orchard grass or timothy would make more and better hay.

There are several varieties of Japan clover, some of which are common to the Ozark region. The exact difference in their adaptation and uses have not as yet been determined.

Alsike clover is especially adapted to the conditions under which redtop makes its best growth. It should also be included in all pasture mixtures sown on old cultivated land. Except on moist or heavy wet land, it has little value for hay, producing very little growth and maturing too early to be mixed with any grass except orchard grass. However, it should be used in all pasture mixtures sown on virgin or newly cleared land, especially those areas which are flat or poorly drained.

Red clover is, next to Japan clover, the most valuable pasture legume for the Ozark region. It is especially valuable on newly cleared land in Sections 1, 2, 3, and 4. When sown in a mixture it provides good pasture for at least two seasons and before the grasses used in the mixture have become well established. Red clover will grow equally as well on the stone covered ridge and slope land of Section 5, but on the flat, level areas will usually fail. It will not generally succeed in Section 6, except on the more fertile, well drained soils.

Native wild legumes are numerous throughout the Ozark region and as a whole have considerable pasture value. Two of these are especially valuable; Tick Trefoil and Wild Indigo.

Tick Trefoil (*Desmodium spp.*), known locally as "Beggar Weed", "Stick Tight," "Beggar Tick," and "Beggar Lice," is a coarse growing perennial legume and is found throughout the Ozark region associated especially with timber growth. In partly open timber growth it grows very tall and thick, especially on the low, moist areas. There are several types of this legume, all of which are very similar in grazing value. Tick

trefoils are similar to Florida beggar weed, but do not make as rank a growth. Stock generally avoid the plants during the summer months, but graze them during droughts and in late fall and winter.

Wild Indigo (*Baptisia tinctoria*) is a dwarfed, spreading legume, producing thick, fleshy stems and short, thick seed pods. It is found throughout the prairie sections and is always associated with the common prairie grass or small bluestem. It is of little use for hay but is valuable for pasture. During late fall it furnishes considerable pasture for range stock.

Wild Indigo should not be confused with an annual plant known as Rattle Box (*Crotalaria sagittalis*) which is also common to the Ozark region. Rattle Box grows much smaller in height, is not so spreading and matures during mid-summer. It is poisonous to stock, both in a green or dry condition. Its effect on stock is known as Crotalism by veterinarians and as "Missouri Bottom Disease" by farmers.

Common among the other wild forms are Hairy Bush Clover (*Lespedeza hirta*) a perennial legume, and Bush clover (*Lespedeza virginica*) both of which are commonly found on stony, dry areas.

Bermuda grass gives little promise of value in the more droughty parts of the Ozark region. Though it withstands heat it will not thrive under the prevailing droughty conditions. It is very difficult to establish, and provides pasture during a very short period and fails to survive on the dry, stony areas where most needed.

Johnson grass is of no value to the Ozark region. Only on the moist fertile bottom land will it make good yields and on such land it spreads rapidly and becomes difficult to eradicate. On thin or dry uplands its growth and permanency is very disappointing.

METHODS OF SEEDING

Seeding new land to grass is most effective when the seeding is done in early spring. Land that is freshly cleared should be burned over if covered with a heavy mat of leaves or grass. When at all possible the surface should first be scratched by using an A harrow or spring-tooth harrow. After seeding, a brush drag is as effective as any means for covering the seed.

Where the land is too rocky, rough or covered with stumps to permit the stirring of the surface, the seed should be broadcast in the ashes produced from burning. Little is to be gained from seeding before February 15 and all seedings should be made before the first of April.

Fall seeding is generally not advisable. There is the chance that the seed will germinate and be killed out by dry weather, or else that it will not reach sufficient growth to withstand winter freezes.

Seeding old cultivated land to grass is best done during the late winter or early spring. If the land has been in corn or some other cultivated crop the ridges should first be disked down, especially if the crop sown is to be used for meadow. If the surface is level and free of trash no seedbed preparation is necessary.

Manure should be spread thinly over the surface. If the manure is spread by hand, the grass seed should be sown ahead of it; but if a manure spreader is used, the seed may be scattered over the manure before it is spread. If manure produced from feeding redtop, timothy, or orchard grass hay which had become over-ripe before cutting is spread on the land, a stand of grass will almost certainly be established. The manure should be spread during January, February or March.

When sown without manure the land should be double disked before seeding. Oats sown at a peck to one-half bushel rate before disking will, if cut early, not materially retard the growth of the grass and will hold weeds in check. The oats should be disked in before sowing the grass seed. Cover the grass seed with a light harrow or brush drag. Cut the oats for hay as early as possible after they have jointed. If the oats are left to ripen they will often shade the grass and dry out the soil so much that the grass will be killed during July and August.

PASTURE AND MEADOW MIXTURES

(With rates per acre.)

Pasture Mixtures

WORN CULTIVATED LAND	NEWLY CLEARED LAND
Orchard grass.....10 lbs.	Orchard grass.....10 lbs.
Red top.....4 lbs.	Red top.....4 lbs.
Timothy.....4 lbs.	Kentucky Bluegrass.....2 lbs.
Japan clover.....2 lbs.	Red clover.....4 lbs.

DRY, STONY SOILS

Orchard grass.....10 lbs.
Red top.....6 lbs.
Timothy.....6 lbs.

Meadow Mixtures

NEWLY CLEARED OR FERTILE SOILS	WORN CULTIVATED LAND
Orchard grass.....10 lbs.	Orchard grass.....8 lbs.
Red clover.....6 lbs.	Timothy.....6 lbs.
	Alsike clover.....2 lbs.

WET OR POORLY DRAINED SOILS

Orchard grass.....4 lbs.
Red top.....6 lbs.
Alsike clover.....4 lbs.