Alfalfa in Missouri

W. C. Etheridge and C. A. Helm

Bulletin 492 August 1945

University of Missouri College of Agriculture
Agricultural Experiment Station

M. F. MILLER, Director

COLUMBIA, MISSOURI

Fig 1.—Alfalfa is an excellent crop for both hog pasture and hay. The 12 acres shown in the pictures has carried 65 spring pigs all season. The first cutting of hay was 2½ tons per acre and the second cutting, now being made, is estimated at 1½ tons. This is a two-year-old stand.

Fig. 2.—The great capacity of the alfalfa plant to yield is shown by this heavy production.

Alfalfa in Missouri

W. C. ETHERIDGE AND C. A. HELM

Missouri acres of alfalfa have doubled in recent years, reaching by now a total of 320,000. The main causes of this increase are (1) the steady high estimate of alfalfa as fine feed, (2) government payments for alfalfa production, and (3) government aid in procuring lime and other soil treatments necessary in many places for good growth of the crop. The development of such equipment as dehydrating plants for the processing of alfalfa concentrate, driers for the safer and more efficient curing of alfalfa hay, the one-man baler, and the buck-rate attachment for the tractor, have also influenced the general tendency to grow more of this valuable legume.

But 320,000 acres is very small size for a hay crop that is in such great demand by reason of its nutritive excellence, especially since good stands of alfalfa on fertile soil are likely to reach a higher value per acre than that returned by any other forage. There is enough suitable land to multiply several times the area now sown to alfalfa without displacing some other equally useful crop or producing a surplus of alfalfa hay, a commodity that we now buy in great tonnage from other states. Actually we have not less than 2,500,000 acres that would require no soil treatments for alfalfa, and perhaps 4,000,000 additional acres needing only moderate treatments. Mainly these lands are the rich loess and alluvial soils in northwestern Missouri and in the counties bordering the Missouri and Mississippi Rivers. Outside of these areas alfalfa is grown in localities where dairying makes a strong demand for the hay and improves the soil with heavy applications of manure.

The main causes of the small acreage and limited position of Missouri alfalfa are (1) the conflict between alfalfa harvesting and other necessary farm work of the season, (2) the hazard of wet weather for the first cutting, and (3) the cost and difficulties of production. The first cause goes with the system of farming and cannot be reduced except by broad changes in the selection of other crops to be grown on the same farm with alfalfa. The second cause is being reduced by the development of mechanical

hay driers and dehydrating plants. The third cause can be partly reduced by the correct practices discussed in this circular.

Essential conditions for alfalfa are (1) fertile, deep, well drained land, (2) soil treatments, if needed, (3) thorough preparation of the seedbed, (4) good seed, (5) effective seeding, including inoculation, (6) cultivation of the established stand.

Selecting and Treating Alfalfa Land

The capacity of land for producing alfalfa may be judged by observing the growth of other crops. Well-drained land which makes good crops of corn and red clover can with little or no further aid also make alfalfa. Ground limestone at 2 or 3 tons per acre and 20% superphosphate at 250 to 400 pounds would usually be the highest treatment needed by soil in that state of fertility. But where the land is too low in fertility for the natural growth of at least average crops of corn and clover, a profitable growth of alfalfa can hardly be forced with lime and fertilizer.

Lespedeza and even soybeans, are far better suited to such land. Their production is simple and easy, their yields of highly nutritious hay are larger than those of any other legume known to be grown successfully on medium to poor soil, and their soil treatments—if needed at all—are not costly.

Alfalfa considered on a basis of comparative profit is almost strictly a crop for good land.

On all grades of land below the very best, lime is a primary need of the alfalfa crop. Unless the grower has learned by previous experience or by comparing his land with surrounding areas, that he can produce good alfalfa without lime treatments, one of his first thoughts in planning for this crop should be—how much lime is needed? This, and such other local questions as cost of lime and means of procurement, can be answered by his county agent or other technical advisers with whom he is in contact.

The time and method of getting lime into the ground are very important. Lime to be effective must be evenly distributed and mixed thoroughly with the surface soil, and well dissolved there by the time the young growth of alfalfa begins. But ground limestone dissolves very slowly, requiring months of soil contact to become useful to a young plant. All of this means that lime should be spread from six months to a year before sowing the alfalfa crop.

Fig. 3.—Machinery to save labor and time and to avoid losses from early wet weather is essential in large scale processing of alfalfa. The load of green material at the right will be taken immediately to a dehydrating plant.

Whether the lime is spread and plowed under or spread on plowed ground and disked in is not important. The important thing is to get it spread evenly and to work it thoroughly into the soil.

Late spreading, uneven distribution and deep covering will give poor results.

The application of commercial fertilizer is a comparatively simple procedure. The fertilizer is best applied when the seed is sown, with a regular fertilizer drill or the fertilizer distributor of a standard grain drill. In actual practice, however, much alfalfa fertilizer is broadcast.

Good Seed

Good seed is necessary for the success of alfalfa because only good seed will produce a clean stand of vigorous young plants. Poor seed may fail to germinate, may produce weak plants, and is likely to infest the ground with noxious weeds which so often ruin a crop before it has served a useful purpose.

The qualities of good alfalfa seed are (1) purity, or freedom from weed seeds and from the seeds of other crop plants and from all forms of trash, (2) viability, or the power to germinate and start growth, and (3) adaptability of the strain or variety to thrive under local conditions for growth. Seed in which these three qualities are combined in a high degree is in a practical sense *good seed.*

Purity and viability are the qualities on which the grades of commercial seed are usually based. Seed prices are usually fairly adjusted to seed grades. Therefore the relative money value of a given lot or grade of commercial seed can be closely estimated by a sample analysis for purity and power to germinate. Relative prices of different grades, however, tend to raise the cost of low-grade seed above its real value in crop production, in comparison with the cost and value of high-grade seed. Seed analyses and price quotations together almost invariably show that a dollar will buy more pounds of pure live seed in the higher grades than in the lower grades.

Do the various grades of alfalfa seed, as classified and sold by the commercial seedsman, yield according to their rank in grade? A thorough experimental study of this question was first reported in our bulletin 326 (1939). Excellent seed produced from 1500 to 3000 pounds more hay per acre for the season than did the lower grades of seed. Also the hay from the good seed was of better quality because it was cleaner. The increase in yield and quality was obtained at an additional seed cost of 90¢ to $1.35 per acre. All other production costs of yields from high-grade and low-grade seed were the same. This is a sharp lesson to the alfalfa grower who might spend time, labor, and money in preparing and treating his land, only to lose the whole thing by sowing poor seed.

Good seed is usually worth the quoted price; poor seed is always too costly at any price.

What Variety or Strain of Alfalfa for Missouri?

Most varieties and strains of alfalfa are not easily told apart at sight, for they are not so distinctive in appearance as are the varieties of most other common field crops. Nor is much known about their special fitness for growing in certain places. Their responses to local conditions of growth have not anywhere been so well studied as have the reactions of the very numerous and well identified varieties of such crops as wheat, oats, barley and soybeans. We do know, however, that some of the varieties

and strains of alfalfa are practically different in vigor and yield when growing in Missouri. This difference may be as wide as the margin between success and failure of the crop or it may amount to only a small variation in the total yield for the season. All strains of domestic origin tested by the Missouri Experiment Station yielded better than any available strains of foreign origin. Foreign alfalfa seed should be avoided.

Of all the different varieties or strains of alfalfa, the Missouri grower is more interested in Common and the northern hardy strains than in any others. The name Common is applied to most strains adapted and grown throughout the greater part of the United States. These strains are not very distinctive in appearance but they may differ in their natural fitness for growth in a particular locality, according to their origin. Thus we may buy alfalfa seed called Kansas Common or Nebraska Common, the origin of the seed being indicated by the name, and find that it grows well in our locality; but seed of a Common strain from another state might grow less vigorously in the local situation.

Practical experience and experimental tests, however, have found that good seed of any strain of Common alfalfa originating in any part of the Middle West, North Central or Northwest, may prove satisfactory in Missouri, in so far as the quality of the seed and the adaptability of the strain affect the success of the crop. Generally the alfalfa seed produced westward of Mis-

Fig. 4.—A big crop of alfalfa hay must be cured quickly to preserve its quality against weather damage as well as to save labor and time. After the hay is partly cured in the swath it is windrowed by the side-delivery rake and curing is completed in windrows. The hay is then ready for the baler.

souri is more likely than eastern seed to be well matured, heavy, and vigorous, by reason of the favorable climatic conditions which contribute to its better development. Even in Missouri, alfalfa does not usually mature and ripen the seed so perfectly nor yield it so abundantly as in the bright dry seasons of states farther west. Consequently we sow in Missouri very little home grown alfalfa seed and almost none from eastern sources. The western seed is generally preferable in quality and in price. And the western Common strains themselves do not usually show important differences in Missouri, beyond variations in the purity and germination of the seed.

The northern hardy strains by reason of their greater resistance to cold are widely grown in the North and their seed is frequently sold in Missouri. Their reputation for hardiness attracts much interest in Missouri localities where the losses of newly established stands are often charged to heaving and winter killing. A frequent question from alfalfa growers is on the choice between a Common strain and a northern hardy strain, usually Grimm, for local conditions.

From our tests of these varieties comes the following summary:

(1) On the best alfalfa land Common alfalfa was superior to Grimm.

(2) On medium alfalfa land (40 to 50-bushel corn land) there was no practical difference between the yields of the two kinds.

(3) On land marginal in fertility for alfalfa (35 to 40-bushel corn land) the northern hardy alfalfa was slightly better than the Common but neither kind was really successful.

There is some suggestion in these results that hardy alfalfa might be found superior to Common on the less fertile or marginal alfalfa land. But that would only bring mediocre crops of alfalfa into comparison with lespedeza and soybean hay crops whose excellent fitness for medium or poor land has been thoroughly proved. Alfalfa, one variety or another, belongs almost exclusively on the more productive soils.

New strains of alfalfa are constantly attracting attention. Prominent among these at the present time are Ranger, Buffalo and Orestan, all notable for long life where bacterial wilt has infected the soil. Where other conditions than bacterial wilt reduce the life of the stand to a few years, there seems no reason for using these resistant strains unless they also are

known to grow high yields under local conditions. An attractive new strain such as Ladak, which gives at the first cutting the greater part of its total yield, would not be practical in Missouri's usually early wet season. An important question on a new strain is always to be raised by the prospective grower: Can a practical quantity of the seed be obtained at reasonable cost? Usually it cannot until years of multiplication have followed its introduction. In the case of a special-purpose strain, such as one for wilt resistance, the grower will do well to question his county agent on the general utility and seed supply of the new plant.

The most practical recommendation of alfalfa seed at the present time is for the purchase of high-grade seed of a Common strain grown westward and northward of Missouri.

Preparing the Seedbed

More than three-fourths of all Missouri alfalfa is sown in late summer or early fall on a specially prepared seedbed. The condition into which the ground is worked for seeding has a very important influence upon the future growth of the crop. A firm bottom and a pulverized surface are the necessary features of a good seedbed.

Land can be brought to this condition with the least labor by breaking it in the spring or early summer and disking or harrowing as needed to keep down weeds until the time of sowing. This treatment will turn out at less than the usual cost, a clean, compact seedbed, that will be comparatively free from weeds next season. Such a seedbed will contain more moisture and available nitrogen than might have been present had the land grown a crop just before alfalfa or lain idle through the summer to be plowed and prepared shortly ahead of the time of sowing alfalfa.

Another good way of putting the land in condition suitable for alfalfa, is by the production of soybean hay. Lime, if needed for the alfalfa, is applied at least 6 months before the beans are planted. The bean hay can be cut by the middle of August, and the mellow stubble ground will then need little preparation for sowing the alfalfa. Successive crops of soybeans and alfalfa will require more fertility than is necessary for alfalfa sown as the single crop of the season on land that was spring plowed and kept bare until late summer. But the beans will make no greater demand on the soil than the heavy growth of weeds that would have come up, grown to maturity, and filled the soil with troublesome seeds, had the bean crop not been produced nor the land been fallowed. So unless the land is to be especially pre-

Fig. 5.—Sweet clover plowed under helps land to grow alfalfa.

pared through the spring and summer, it is good economy to grow the soybeans as a means of preparing the seedbed for alfalfa and for their own value.

Perhaps less than one-fourth of Missouri alfalfa is sown in the spring, and the practice is declining because of the usual difficulty in getting a good seedbed ready for sowing before warm weather. April is the best time for sowing, and usually the alfalfa is sown alone, although it is sometimes put in with a grain nurse crop sown at a peck or two per acre.

Sowing alfalfa after sweet clover is an excellent way of starting the crop. The land will have been limed and fertilized for the sweet clover, if it had needed these treatments. And the sweet clover will have left an abundant inoculation in the soil. Plowing under the second-year sweet clover in July for August seeding of alfalfa, or plowing it under in March or early April for the April seeding, will add large quantities of nitrogen and organic matter to the alfalfa seedbed. This is a very effective way of building up good medium land to a grade that can grow alfalfa with a better prospect of success.

Seeding Practices

The late summer sowing of alfalfa should be done near the beginning of the late summer rains. Usually this is about the middle of August. Late July or early August is suitable if the soil is moist, but there is no benefit to alfalfa from sowing early

on dry ground. For dry ground may contain enough moisture to sprout the seed but still not enough to sustain seedling growth, and so a good stand of small plants may perish. After the last of August, delay in sowing increases the danger that winter will kill the stand. Young alfalfa, to withstand hard freezes, must have been sown early enough to have grown strong roots.

The quantity of seed to sow to the acre will range from 12 to 20 pounds, depending on seed quality. Fifteen pounds of good seed (a bushel to four acres) will produce a satisfactory stand, if conditions of soil and weather are favorable and the date of sowing is timely. The quantity should be increased if the seed is poor, the natural conditions for growth unfavorable, or the date of sowing is late.

The seed should be evenly distributed. Broadcasting one-half the seed up and down the field and the other half across the field will insure a uniform spread. Half an inch is a suitable depth of covering. If a seed drill is used for sowing, the disks should be set to place the seed very shallow. An excellent way of covering alfalfa seed is to use the corrugated roller for the last fitting of the seedbed, then sow the seed, and then cover the seed by rolling again.

Where alfalfa is being sown for the first time, or where the land has not recently grown a successful crop of alfalfa or sweet clover, the seed should be inoculated with the nitrogen gathering bacteria, which enable the plant to obtain most of its nitrogen from the air. Inoculating material with instructions for its use may be obtained at very small cost from Department of Soils, Missouri College of Agriculture. Details of the resulting benefits may be read in Bulletin 322, which may be obtained free from the College.

Stage of Growth for Cutting

Several conditions bear upon the question, when to cut alfalfa? Yield of hay per acre; feed composition, palatability and digestibility of the hay; and life of the stand; all are deeply affected by the age of the cutting. Thus the hay cut young excels the hay cut old in every aspect of feed quality. The yield per cutting is smaller, though all cuttings add up to about the same total weight per season as do the less frequent larger cuttings. Younger cuttings will more frequently interrupt the growth of the plants and thus shorten the life of the stand.

It is concluded from judgment of all these factors that the best stage of cutting is when the new growth (growth from the

crowns below the top growth) is two or three inches long. This, in a bright dry season when the plants are blooming freely, will correspond to the stage of early bloom to one-third in full bloom.

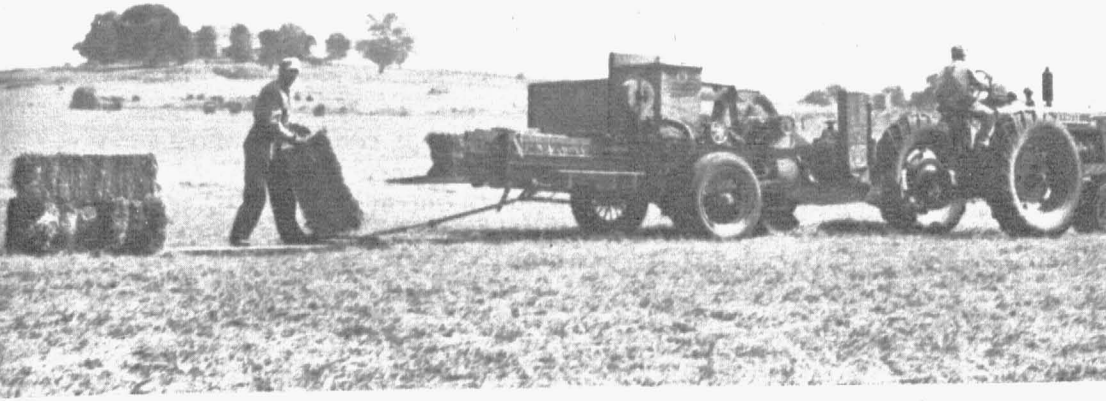
Such a rule applies only to the cutting of alfalfa for farm purposes. Dehydrating plants must harvest the stand according to their operational necessities and according to the fact that the younger growth gives more protein and less crude fiber in the processed concentrate.

The question of cutting the last growth of alfalfa in the fall must be decided according to the present need for more hay or the future benefit from prolonging the growth of the stand. Late growth by storing reserve material in the roots will strengthen the plant and probably increase its yield the next spring. Cutting the late growth will weaken the plant and probably shorten its life. But if the grower knows that his need for hay during the winter will be urgent, he may decide that late cutting is the more profitable course. For a favorable effect upon future growth, alfalfa should go into winter about six inches tall.

Cultivation of the Alfalfa Stand

The cultivation of alfalfa stubble with a spring-tooth harrow fitted with half-round teeth, immediately after the removal of a cutting of hay, is beneficial. It cleans out grass and weeds, thereby preventing these plants from crowding the next growth of alfalfa in its use of moisture and fertility. The effect on alfalfa of this treatment is much the same as the effect on corn of cultivating with plows. Substantial increases in the yield of clean alfalfa hay and in the life of the stand have readily been obtained in experimental studies of cultivation.

There is a marked tendency for Missouri alfalfa to become grassy-weedy in the third year and thereafter to decline rapidly in yield of clean hay. Cultivation can postpone this outcome. On the best alfalfa land, where a new stand can be made ready with little effort and small cost by the time the old one is run down, the practical returns from cultivation do not seem important. But on land that will produce alfalfa only by special preparation and costly treatment of the soil, a stand once established had best be kept productive for the longest time possible—and cultivation is one of the good means of doing it. Another effective means of keeping alfalfa productive is the application of fertilizer to the established stand. Such a treatment gives better results if cultivation has already loosened the surface or if it works the fertilizer directly into the surface. If the fertilizer is applied



Figs. 6, 7, 8.—The one-man pickup baler saves labor and time. This machinery working under favorable conditions can make at least 100 to 150 bales an hour. Note the slide for piling the bales. When the slide is loaded the pile of bales is pushed off. The piled bales are left in line for easy collection by the wagon.

in the spring it is more readily absorbed if cultivation during the previous season has left the ground clean.

It is well to say that the spring-tooth harrow, fitted with half round teeth that will scarcely damage the stubble, is the best implement for cultivating alfalfa. Implements that tear or split the stubble are likely to do much more harm than good.

Diseases of Alfalfa

Bacterial wilt, caused by bacteria in the roots and crown, occurs frequently in Northwest Missouri and occasionally in other parts of the State. Infected plants show pale stunted shoots with a tendency to curl. Brown or yellow discoloration is found under the bark of the root in contrast to the clear white wood of a healthy plant. In hot dry weather some of the infected plants wilt. The disease is spread by such means as drainage water, machinery, grazing animals, and contact between healthy and infected plants. It develops rapidly in fields that in recent years have grown alfalfa infected with the same virus. Bacterial wilt may cause the stand to become unproductive in two or three years, or it may continue to cause reduced yields until the stand is finally run out by other conditions.

No direct remedy for bacterial wilt is known. Where other crops replace alfalfa for a period of at least five years, probably the soil is cleansed of the infection. Strains of alfalfa resistant to this disease have been developed and they offer the most promising means for its control (page 8). Before such a strain is tried, advice on its probable adaptation should be sought from the county agent.

Crown rot is not a specific disease but is a general term often applied to any disease, known or unknown, or to any condition, causing decay in the crown of the alfalfa plant. Such decay accumulates with age. Late cutting or late heavy pasturing followed by winter killing, and rough treatment with harvesting or cultural implements, will increase the so-called crown rot.

Rust and leaf spot, each caused by fungi, are less important than bacterial wilt in Missouri. In wet seasons these diseases may show as spotting, yellowing and dropping of the leaves and in some places they are responsible for much damage. In young fields a brown girdling near the base of the stems may result in the loss of some plants, but in older fields the injury is less frequent. There is no known means of controlling these diseases except to sow the alfalfa in another field.

Yellowing of alfalfa as a result of injury by leafhoppers is sometimes mistaken for a disease. In some years the damage is serious. An effective control is to cut the alfalfa when it shows extensive yellowing. The leafhoppers will migrate and the new growth will be normal.

Alfalfa-Grass Mixtures

The practice of mixing alfalfa with grass for hay and pasture is increasing. It calls for considerable judgment and accuracy in production and, if the mixed growth is to be pastured, for careful management in grazing. The possible gains are in yield, nutritive quality, facility of curing (by comparison with a pure growth of alfalfa), the length of the grazing period, the length of life where bacterial wilt is likely to infect the alfalfa, and the efficiency of alfalfa in the control of soil erosion.

It is important to decide first whether the grass or the alfalfa is to be the foundation crop for the other: whether some grass is to be sown on or with alfalfa, or some alfalfa is to be sown on grass. The nature of the soil will determine whether alfalfa should be sown at all. For while it is true that a scattered growth of alfalfa may live in grass on land that is no better than medium in productivity, a really useful mixture—anything like equal proportions of the two plants—will require natural alfalfa land or land that has been well limed and fertilized. There is no substitute for high fertility, natural or artificial, in the production of alfalfa, grass or no grass.

Smooth bromegrass and alfalfa make an excellent mixture for hay or pasture, where the soil is naturally suitable or can be made suitable for alfalfa. Even bromegrass is not likely to succeed profitably on soil below that grade of fertility. For less productive land a mixture of lespedeza with orchard grass or timothy or redtop would be much more practical. Seedbed preparation and soil treatment for alfalfa-brome will be the same as for alfalfa alone. Only adapted regional strains of both plants should be used. Sow 10 pounds per acre of each kind of seed, August 15 to September 15; or if the mixture must be seeded in the spring, sow in March rather than later.

Alfalfa mixed lightly with bluegrass is an excellent supplement to the pasture, increasing the present feed quality and benefiting the growth of the grass itself. It is practical only on high grade land or land that is well limed and fertilized. The soil treatments should be thoroughly disked into the pasture sod. Sow

4 or 5 pounds of alfalfa seed per acre, on the pasture sod, preferably at the usual time of sowing alfalfa in the fall. Careful regulation of grazing will be required to maintain alfalfa in bluegrass for a lengthy period, but the mixture is productive for as long as it can be held. Alfalfa, however, is more difficult to establish and maintain in bluegrass than is sweet clover.

Mixtures of alfalfa with orchard grass, Canada bluegrass, redtop and timothy are possible but not practical, with the single exception of adding a little timothy to alfalfa to make easier the sun-curing of the hay.

The Relation of Alfalfa to Soil Erosion

A thick vigorous growth of alfalfa and the mellow absorbent soil beneath it combine to afford excellent protection against surface runoff and erosion, what time the stand is thriving.

But there are other aspects of this question. First, the deep pulverized and compacted seedbed prepared for late summer sowing is also in almost perfect condition for severe erosion by late summer and fall rains coming before the young alfalfa is big enough to retard running water. Second, old alfalfa ground plowed up is extremely loose, and planted to corn or other rowed crop or even small grain, is certain to erode severely if there is enough slope to accelerate runoff. And so if instead of considering only the protective efficiency of the alfalfa *crop*, we think of the erodibility of alfalfa *ground* over the longer period, we must conclude that the whole effect of alfalfa production may increase rather than diminish soil erosion unless prevented by special management.

Therefore alfalfa ground on erodible slopes should be well terraced, and worked on the contour when establishing the crop and when the ground is plowed for subsequent cropping. The erosion hazard during the time of establishment is much reduced if large quantities of barnyard or green manure have been plowed under early, or a mulch of crop residues is worked into the soil.

If corn is to follow the alfalfa in order to use most profitably the large supply of available nitrogen left by the legume, spring plowing rather than fall plowing should be practiced. If fall grain instead of corn is to follow alfalfa, summer plowing of course will be necessary but the grain should be sown as early as may be permitted by other circumstances in order quickly to tie down the loose soil. Including a grass such as adapted brome will do much to reduce the erodibility of the soil.