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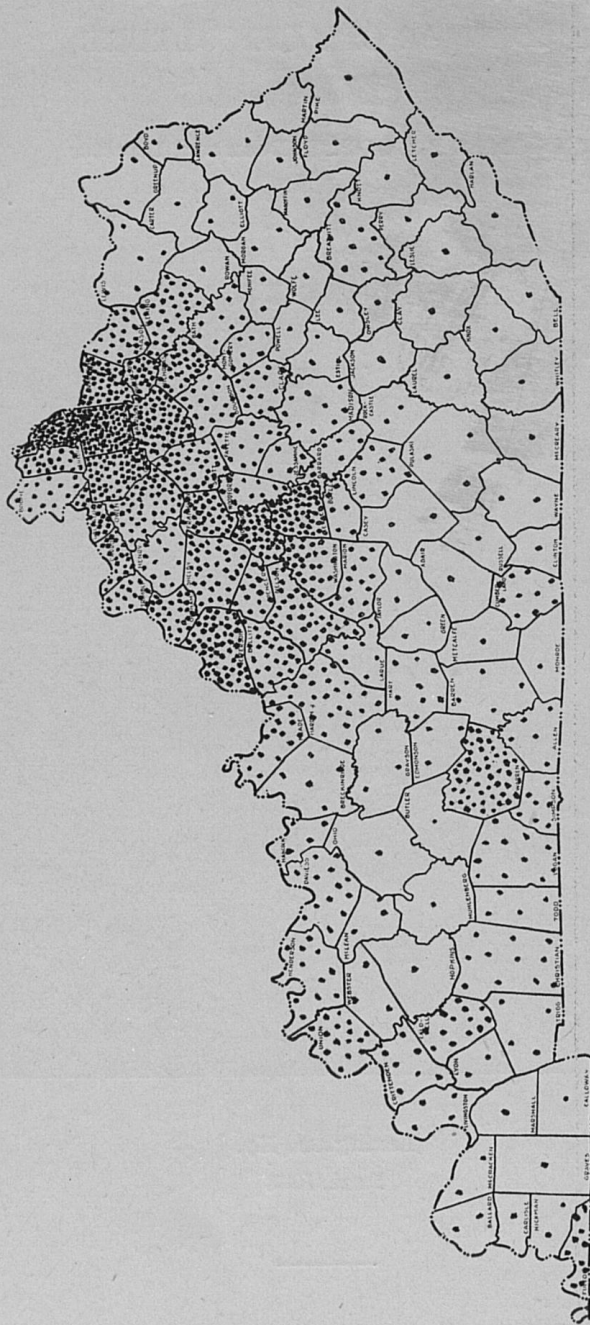
GROWING ALFALFA IN KENTUCKY



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There were 133,555 acres of alfalfa in Kentucky in 1934, distributed as shown above. One dot represents 100 acres. Based on United States census data.

Circular No. 312*

GROWING ALFALFA IN KENTUCKY

By **E. N. FERGUS, RALPH KENNEY, and W. C. JOHNSTONE****

Alfalfa is undoubtedly the most dependable hay crop for Kentucky. With proper care, it lasts for several years and produces three to five crops annually; consequently at least one good crop is almost certain, even in years of severe drouth or when rainy weather makes curing difficult. Its dependability together with its high acre yield, high nutritive value and outstanding palatability, justify the growing of alfalfa on many farms in Kentucky. The crop is not the easiest to grow of the meadow crops suited to Kentucky, tho there are large sections of the State where it thrives almost as well as any other hay crop. Perhaps it is best adapted to much of the outer Bluegrass region, especially of northern Kentucky, but it is well adapted to other areas and, with practicable soil treatment, can be grown satisfactorily on many farms of the State.

SOIL REQUIREMENTS

A well-drained, fertile, neutral or only very slightly acid soil is necessary for satisfactory alfalfa production. Tho most of the soil of Kentucky lacks one or more of these qualities, a considerable area is naturally suited for producing good yields of the crop. Much hill land of northern Kentucky and some of the red, limestone soil just outside the Western Coal Field, are of that kind. Apparently the former is suitable because of limestone fragments in the soil, and the latter because of leachings from marl beds on hillsides above. Most well-drained bottom land, also, produces good yields of alfalfa without soil treatment. There are other areas on which the crop makes good growth without soil treatment, yet more profitable yields are produced after the soil has been properly treated. The soil in the rest of the State must be properly treated before it will produce good yields.

* To supersede No. 70.

** H. H. Jewett, research entomologist of the Kentucky Experiment Station, collaborated in the preparation of the section on insects that attack alfalfa, and W. D. Valleau, plant pathologist in the Experiment Station, in the preparation of the section on alfalfa diseases.

Liming the soil is the treatment most generally needed for alfalfa production in Kentucky, and much of the land needs no other. For instance, two tons of limestone per acre on the Experiment Station farm at Lexington increased the average yield from



The upper picture shows alfalfa on limed land in the Central Bluegrass Region of Kentucky; the lower one is of alfalfa on the same kind of land not limed.

685 pounds to the acre, per cutting, to 1775 pounds; four tons increased it to 2,230 pounds, but six tons were no more effective than the 4 tons. Liming usually is necessary, also, in connection with fertilizer treatments.

Everything considered, 3 tons of limestone per acre appears to be the most satisfactory amount to apply for alfalfa production generally in the State. It should be applied two months or more, if possible, prior to seeding. Soil that has recently been limed may require no additional application. Liming materials such as marl and burned lime may be used instead of limestone, but the quantity to be applied should be regulated according to the neutralizing value. On the average $\frac{1}{2}$ ton of fresh, burned lime or $\frac{3}{4}$ ton of water-slaked lime is approximately equal to 1 ton of limestone in correcting soil acidity. The neutralizing value of marl should be ascertained by chemical analysis.

The hay removed each year from a good field of alfalfa contains as much phosphorus as 100 to 200 pounds of 20-percent superphosphate. Much of the soil of the State contains an insufficient amount of the element in available form to meet the needs of the crop. Perhaps the only soil that is naturally rich enough in phosphorus to produce good yields over a period of years is in the Bluegrass region, tho much river-bottom soil and some of the soil surrounding the Western Coal Field contain sufficient for producing good crops for a time. However, some soil even in the Bluegrass region does not contain enough for sustained good yields. It is apparent that much of the soil of the State must be treated with phosphate for the satisfactory production of alfalfa. The amount needed varies with soil deficiency but liberal applications are advisable because of the large amount removed by the crop. On the quite deficient soil, the application should be at least 100 pounds of 20-percent superphosphate an acre, or its equivalent in other carriers, for each year the crop is to be on the land. It should be put on at seeding time if possible, otherwise part should be applied then and the remainder broadcast later in early spring or after a hay crop has been removed.

On the whole, the soils of Kentucky are apparently well enough supplied with other nutrients to produce large yields of alfalfa, at least for the present, tho there is evidence that potassium is becoming somewhat deficient in soil that has produced large crop yields for several years. Perhaps the need for that fertilizer is not sufficient to warrant the recommendation that it be generally applied for alfalfa,

but it is good practice to treat a small area to test its effect. If it is beneficial, the whole field may then be top-dressed. Application



A meadow mixture containing alfalfa was sown on both the plots pictured above, at Mayfield. The plot in the upper picture was treated with limestone, superphosphate and potash. Alfalfa is very prominent in the vegetation. The plot in the lower picture was untreated. The vegetation is only weeds and some grass, but no alfalfa.

of 200 pounds of muriate or sulfate of potash per acre usually is sufficient for such a test. Despite the fact that the soil contains a large amount of total potassium it need occasion no surprise if potash fertilizer increases yield. Three tons of alfalfa hay contain about 80 pounds of potassium; consequently the amount of available potassium in the soil may well be insufficient to meet the considerable demand, especially after several crops of alfalfa have been harvested.

A well-drained soil is essential for good alfalfa. Many partial and some complete failures of stands are caused by too much free water in the upper two feet of soil. Care should be used, therefore, to select level land that is rarely "wet" or hillsides without extensive "seepy" areas.

VARIETIES

The varieties of alfalfa grown in the United States are of two major groups—common and variegated. Perhaps common alfalfa may be considered a variety with many strains known by state names, such as Kansas Common, Idaho Common, some of which are certified by seed or crop improvement associations. Turkistan, Hardistan and Kaw also apparently are common alfalfas. Variegated alfalfas of the United States include Grimm, Cossack, Baltic, Hardigan and Ladak varieties, and these, in turn, except Hardigan, perhaps, consist of strains designated by state names, such as North Dakota Grimm, Montana Cossack, etc.

The Hardigan variety was superior to all others in tests conducted by the Kentucky Agricultural Experiment Station. Varieties from the southwestern part of the United States are least well adapted, tho seed from central and northern California has not been tested here. Turkistan, Hardistan, Kaw, and Ladak varieties are not well adapted. Yields produced by other varieties differed greatly but until more information is obtained regarding the adaptability of certified strains, no definite recommendations regarding them may be made. It appears, however, that the varieties best adapted to Kentucky are from Canada and the region of the United States north of the latitude of the southern boundary of Kansas. Northern Oklahoma seed seems to be as well adapted as at least some Kansas Common, and may be considered generally

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satisfactory for Kentucky. Differences in winter hardiness and resistance to diseases and insects appear to be the cause of the major differences in adaptation.

Some years ago it was difficult, if not impossible, to purchase alfalfa seed on the market with assurance as to its origin, and therefore as to its suitability for use in Kentucky. This situation has been remedied to a considerable extent by the Federal Seed Act, the Federal Verification Service, and by seed improvement associations in alfalfa seed-producing states. The provisions of the Federal Seed Act require that all imported alfalfa seed be stained in the following colors and proportions:

Canadian grown seed	1 percent violet
African grown seed and seed of unknown origin	10 percent red
Turkistan grown seed	10 percent purple red
South American grown seed	10 percent orange red
Seeds of foreign origin not specifically provided for in preceding groups	1 percent green

The Federal Seed Verification Service provides that bags containing seed produced in the United States may carry the United States verification tag indicating its origin. To each bag must also be attached a tag showing the percentages of germination and purity of the seed. Seed certification provides a purchaser with reliable information most helpful to him in purchasing intelligently. Bags of certified seed on the market carry the tag of the organization or agency certifying the kind of seed, its variety name, germination, purity, and kinds of weed seed present.

SEED INOCULATION

It is impossible to overemphasize the importance of seed inoculation for seedlings made on soil that does not contain the nodule-producing organism of alfalfa. Seedlings without root nodules may become yellow, weak, and generally so unthrifty that they cannot successfully compete with weeds or resist diseases. The stands rapidly thin out, tho some of the remaining plants may in some way become inoculated and survive. By that time the stand is so thin and weedy that it is not worth leaving. Therefore, all seed should be inoculated unless the field in which it is to be sown has recently

had a good stand of alfalfa or sweet clover. Even then inoculation may be beneficial.

Perhaps inoculation is most certainly attained by working fine soil from an old alfalfa or sweet clover field into the seed bed at the rate of about 200 pounds to the acre, shortly before or at the time of seeding. Another method is to sprinkle partially dried, pulverized soil from about the roots of old alfalfa or sweet clover plants over the slightly moistened alfalfa seed, and mix until soil adheres to all the seed. The common practice is to inoculate with commercial cultures, because of their convenience and general dependability. They should be used strictly according to directions printed on the container or results may be unsatisfactory.

RATE OF SEEDING

Obviously a uniform stand of good seedlings is essential for a satisfactory alfalfa meadow. Six or 7 pounds of good seed to the acre, if sown uniformly on a perfect seed bed when weather conditions are ideal, will produce a sufficient stand, but seldom are all conditions good enough to produce such a result; therefore it is safer, to sow 10 to 12 pounds to the acre. Higher rates are often used, but over 15 pounds to the acre is excessive if conditions are good enough to justify seeding.

SEEDING THE CROP

In Kentucky, alfalfa may be seeded during August or February or March. August seedings should be made between the 5th and 20th in northern Kentucky, between August 15 and September 1 in the southern part of the State, and at intervening dates in the middle part. Stands from somewhat later seedings often may be successful, depending upon the favorableness of fall and winter weather. Spring seeding may be done between the middle of February and the first of May, but the most favorable time appears to be from about March 10 to April 10 in northern Kentucky, and from March 1 to April 1 in southern Kentucky.

Most alfalfa is seeded in the spring, in Kentucky, in a nurse crop because it is then more conveniently and cheaply done than in August. It also is generally easier to get a good stand from spring than from August seeding if care is taken to provide a light covering for the seed. Spring seeding has the disadvantage of subjecting

the crop to competition of a nurse crop, and apparently of somewhat unfavorable conditions for inoculation unless the soil already contains the nodule-forming organism.



Spring-sown alfalfa in the Central Bluegrass Region of Kentucky.

August seeding, if properly done, has the advantage of providing a uniform, weed-free seed bed, and apparently of being especially favorable for inoculation. It has the disadvantage of leaving the soil largely unprotected against erosion during the following winter—a serious objection on all but level land. As both August and spring seedings are sometimes attacked by diseases, there is little choice between them as regards obtaining healthy young stands.

Proper condition of the seed bed is very important. It should be firm, yet the surface should be in condition to provide a shallow covering of the seed. These conditions are almost always provided in the specially prepared seed bed but they are too often lacking when seed is sown in a winter nurse crop. Seed sown on a well-honeycombed soil will be satisfactorily covered, but there is danger that the seedlings may be injured or killed by late freezes. Seeding late enough to avoid that danger necessitates a light stirring of the soil to provide covering for the seed. This may be done at the time the seed is sown if a clover-seed drill or a grain drill with a grass-seed attachment is used. If these are not available, a disk or drag harrow or rotary hoe may be used. A cultipacker is satisfactory

also if the surface soil is dry. Excellent stands are usually obtained by seeding on a nurse crop which is being pastured, especially with sheep. The trampling of the soil produces the desired seed bed preparation. A heavy nurse crop is disadvantageous to alfalfa seedlings, consequently it should be pastured, if possible, to remove excessive leafage. Similar results can be achieved by clipping before the plants joint. On the average a nurse crop should not be pastured or clipped after about April 1 if it is to be cut for grain.

Tho the clover-seed drill and the grain drill with the grass-seeding attachment are very effective machines for proper seeding, they are not always available. Several kinds of hand-operated seeders are used. The wheelbarrow seeder does rapid and uniform sowing on level to gently sloping land. Horn and cyclone seeders are most generally used thruout the State because they are inexpensive and may be used satisfactorily under most conditions if one does not try to sow in too wide strips. Hand broadcasting is not recommended except for one skilled at it and even then perhaps it is advisable to sow half the seed in one direction and half at a right angle to the first.

CARE DURING THE FIRST YEAR

Perhaps more problems of management arise during an alfalfa field's first year than in all the rest of its life. If the nurse crop is heavy, should it be allowed to mature or should it be pastured closely or cut for hay? Not uncommonly, weeds become rather abundant; shall the field be clipped? Frequently the leaves become yellowish and the plants unthrifty in appearance; is it better to mow the crop or let it alone? Or the crop may make a large growth; shall it be cut for hay? If so, when? There are other questions which occasion much concern. Unfortunately, no unqualified answer can be given as an infallible guide for each situation; all decisions must be made according to the conditions, keeping in mind that generally the plants should have some good leaves on them at all times during the first year, and that they should make a good, undisturbed growth during the six weeks preceding the first heavy frost in the fall. It is obvious, therefore, that sometimes the stand may be moderately grazed; that sometimes it should be clipped, especially if weeds are smothering the crop. However, the

time to clip will have to be decided with some regard to the nature of the weeds. If clipping kills them, that produces a situation quite different from one that follows clipping if the weeds recover more vigorously and quickly than the alfalfa. For example, ragweed belongs to the former type, and crabgrass usually to the latter during midsummer. If ragweeds are clipped after they are large enough to smother alfalfa seriously, they usually will not make much recovery. Crabgrass, on the other hand, if cut during July and early August of any but a dry season, recovers quickly and soon produces a heavier growth than it would have produced had it not been cut, covering the new shoots of alfalfa. If clipped after it begins to mature, about August 25, however, it makes relatively little new growth, and the alfalfa shoots may have a chance to grow thru. In other words, in managing the alfalfa field during its first year of seeding, decisions have to be made with regard to all factors concerned.

TIME TO CUT ALFALFA

Cutting alfalfa for hay must be timed with regard to two considerations; one is the desire for high-quality hay, the other is the need of the plant to build up the food reserves in its root system necessary for the production of the early growth of the following crop. To make hay of the highest quality, the crop must be cut while all the leaves are green and the stems fine. These conditions more or less disappear by the time the plants have made their largest deposits of food materials in the roots. Nevertheless, it is possible to have high-quality hay and still allow the plants sufficient time to store food in their roots. Formerly it was the custom to determine the cutting stage by the stage of blooming or the length of the new shoots. Usually one or the other criterion is reliable but too often neither is very positive, and confusion may follow. It now appears that the better practice is to cut by dates rather than by apparent stage of growth, making the first cutting about May 20 in southern Kentucky, and June 1 in northern Kentucky, with subsequent cuttings at about six-week periods thereafter. The last cutting should not be made later than about six weeks before the normal time of first killing frost. It seems that alfalfa may be cut after it has been heavily frosted without injury to the stand; in fact,

the next year's crop sometimes is of better quality following late fall cutting.

CUTTING FOR HAY

The highest grades of alfalfa hay, according to Federal standards, are green, leafy, practically free of weeds and foreign material, and free of objectionable odor. To make such hay, the crop must not only be essentially weed-free and cut before it is mature, but also it must be cured in such manner that it retains most of its leaves and color. It is usually impossible to cure alfalfa hay perfectly in these respects, in Kentucky. Rapid curing is accomplished in the swath, but such hay is usually much bleached before it is cured. Curing wholly in the windrow or cock, so that the green color is largely retained, is uncertain because of the risk of rain before curing is completed. It is obvious, therefore, that, except during periods of most favorable weather, any method of curing must be a compromise between those that would produce the hay of natural green color on one hand, and one that would produce the most rapid field curing on the other. Usually, wilting the hay well in the swath and completing the curing in small windrows produces a high-grade hay in a reasonable time. During rainy weather, the problem is one of getting the hay cured at all, rather than of making a perfect cure. It is often necessary, therefore, to cure altogether in the swath or largely in the swath and finish in cocks covered with hay caps. Where considerable tobacco barn space is available, curing may be facilitated by spreading the partly cured hay in thin layers between the tiers. However, the problem of curing alfalfa hay in Kentucky is not so serious as might be inferred from these remarks. Tho the first cutting each year commonly may be poorly cured because of unfavorable weather, the second and third cuttings can usually be cured satisfactorily. Those two cuttings will supply the farm needs for highest quality hay, and the first cutting, if poorly cured, meets less exacting roughage requirements.

Hay that has an objectionable odor may have acquired it from heating or molding in the mow, stack, or bale, or from foreign material or weeds that were in the field. Again, it may have an odor acquired from the surroundings under which it is stored. It is important, therefore, that hay not only be well cured in the field,

but also that it be stored in a dry place where there are no objectionable odors, or in a properly built stack.

TOP-DRESSING OLD STANDS

Broadcasting fertilizers on old alfalfa fields which still have good stands is frequently profitable, as illustrated by an experiment conducted at the Western Kentucky Experiment Substation, Princeton. Plots in a four-year-old and a five-year-old alfalfa field which had received an initial application of 400 pounds of 16-percent superphosphate per acre were top-dressed with an additional 500 pounds per acre in the spring of 1931. The average annual yields per acre for 1931-1933 were 5004 pounds of hay from the plots that had not been rephosphated, and 7337 pounds from those that received additional phosphate. Observed effects of top-dressing with potash indicate that sometimes it too can be used profitably.

HARROWING TO CONTROL WEEDS

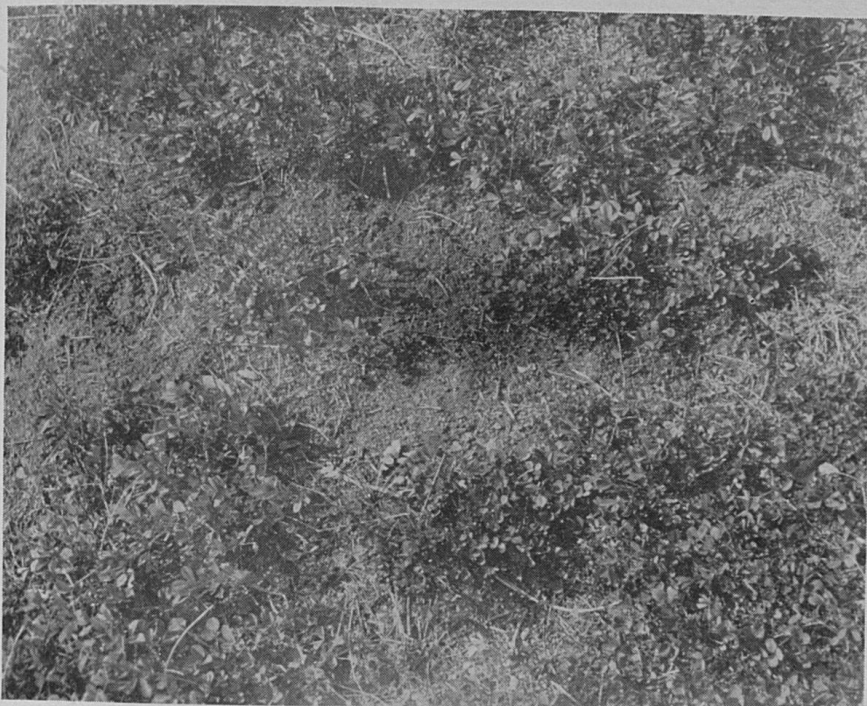
When the soil is quite dry, harrowing alfalfa immediately after a crop is cut is usually quite effective in controlling shallow-rooted weeds that are present, such as crab grass. If the soil is moist, however, little benefit will follow such cultivation.

ALFALFA IN ROTATION

Tho a stand of alfalfa lives for many years on soil adapted to it and the crop can therefore be grown under more or less continuous culture, it is a good crop for relatively short rotations on land well suited to it. Rotations such as corn, wheat, and two years of alfalfa are satisfactorily followed in Kentucky. However, a longer rotation is preferable in most parts of Kentucky, especially if grass is sown with the alfalfa. In this case the alfalfa mixture is used for hay for a few years, and then for permanent pasture until the field is put back to a cultivated crop. Experience indicates that it is undesirable to keep a pure stand of alfalfa for hay for more than four or five years. The withdrawal of a large amount of soil nutrients by the crop over many years may leave the soil so depleted in available mineral plant food that for a time it does not produce subsequent crops so well as it would had the alfalfa occupied the land a shorter time.

SOW A GRASS WITH ALFALFA

An alfalfa-grass mixture is so superior to alfalfa alone in Kentucky that alfalfa ought never be sown alone, tho perhaps there is no serious objection to it on level land. The outstanding advantage of the mixture is its distinct superiority over alfalfa alone in preventing erosion. Other advantages are better control of weeds,



A three-year-old stand of alfalfa, photographed November 3, 1937. Note the bare ground between the plants. This is on level land; consequently no erosion has occurred.

less danger of bloat when grazed, and generally better balance of nutrients. There are few valid objections to the alfalfa-grass mixture. One may be that the mixed hay which is always produced from the first cutting brings a somewhat lower price on the market than alfalfa alone. The second and third crops, also, may contain small amounts of grass, but that cannot be considered a real disadvantage because, had there been no grass, there most probably would have been weeds.

The alfalfa-Kentucky bluegrass mixture may be objectionable to the farmer who wishes to save bluegrass seed, because of the

tall alfalfa in the bluegrass. However, pasturing the mixture with sheep during the spring seems effectively to keep the first shoots of alfalfa out of the way at seed-stripping time.

All grasses commonly used in Kentucky are satisfactory for sowing with alfalfa and decision as to which to use may best be made upon the personal preference of the individual farmer. Until more is known of the suitability of less well known grasses, they should not be largely used with alfalfa in this State, tho small acreages on many farms are desirable so that one may become acquainted with their possibilities.

ALFALFA FOR SILAGE

Alfalfa put alone into the silo immediately after it is cut seldom, if ever, makes good silage, tho if dried in the field a few hours under good weather conditions it usually ensiles satisfactorily. However, in Kentucky the principal reason for putting alfalfa into the silo is that weather conditions are unfavorable for making it into hay; consequently it usually will be impossible to effect even partial drying in the field, of alfalfa that is to be ensiled. It is possible to preserve the silage by adding 40 to 50 pounds of molasses to each ton of green alfalfa as it goes into the silo. This makes a palatable and highly nutritious feed. To make a proper mixture of the molasses and alfalfa is somewhat of a problem. Measured amounts of molasses may be poured over known weights of alfalfa as it goes thru the silage cutter. Perhaps a more economical method is to distribute the molasses thru small holes in a piece of ordinary water pipe fastened to the silage cutter just in front of the rollers. Molasses can be fed into the pipe from a barrel by gravity or by a pressure setup which any good mechanic can construct. The needed number and size of holes in the pipe will have to be determined by trial and in relation to the rate of feeding the alfalfa into the cutter.

ALFALFA FOR PASTURE

A pure alfalfa pasture is highly productive and very palatable and nutritious. However, the plant, strictly speaking, does not have the habit of growth desired in pasture plants and alfalfa pasture usually becomes weedy rather quickly. A grass seeded with alfalfa produces better pasture than alfalfa alone.

INSECTS THAT ATTACK ALFALFA

There are few insect pests of alfalfa in Kentucky and these rarely attack the crop in sufficient numbers to seriously reduce the yield. The potato leaf hopper is the most common. It is a small, green insect that punctures the tender parts of the plant, thereby causing a yellowing of the leaves and, if the infestation is severe, of the stems also. There is no insecticide that can be used profitably for controlling the leaf hopper on alfalfa. The injury can be lessened and confined mainly to the second crop of hay by cutting for hay at certain times in relation to the development of the insect. The adults begin collecting on alfalfa about June 1, and immediately begin laying eggs. Therefore to ensure control the first crop of hay should be cut after about June 5 in southern Kentucky, and June 15 in northern Kentucky, in order to give the adults time to lay most of their eggs in this crop. These will be killed in the hay when it is cured. If the alfalfa is cut before those dates, the insect lays most of its eggs in the growth that produces the second crop of hay, which may be completely yellowed because of injury from the nymphs that hatch from the eggs. There is no practical way to prevent some yellowing of the second crop of hay, because the adults that appear on the first crop live for several weeks and will lay some eggs in the second crop, even tho the first crop be cut late. The second cutting should be made during the last week of July, at which time the hoppers are present in largest numbers and have passed their peak in egg laying. There will be very few insects on the third crop, so that it may be cut without regard to hopper control, but it should not be cut later than September 15 in northern Kentucky, and September 25 in southern Kentucky, so that the plants can make good growth before winter.

Ordinarily, hopper infestation is not serious in Kentucky, therefore alfalfa should usually be cut without regard to leaf-hoppers, unless the second crop becomes appreciably yellow. In that case, harvesting of the second crop should be delayed until the latter half of July, so that the eggs for the next brood of insects will be removed in the hay, and infestation of the third crop will be largely prevented. The third cutting should be made about six weeks after the second. Irrespective of whether one

is or is not cutting on schedule of dates that is unfavorable to the leaf hopper, the whole field should be cut within a day or two if hoppers are present; otherwise the new growth on the earlier cut portion becomes infested with insects from the later cut portion and may be very severely injured.

ALFALFA DISEASES

Alfalfa is seldom, if ever, free of disease in Kentucky. Usually diseases which attack the crop do not cause a rapid loss of stand, but mild attacks by several organisms sooner or later reduce a stand until it becomes unprofitable. Crown rot (*Sclerotinia trifoliorum*) frequently destroys fall-sown stands during late winter and spring following seeding. The presence of white to black more or less spherical masses of the fungus in the dead crowns is sufficient for diagnosis. Spring-sown stands and two-year stands are relatively free from this trouble, but some rotting of crowns can be found each year in older stands where the disease has become established.

Black stem (*Phoma trifolii*) is another common disease which causes blackening of the stems of the spring crop. Each year most of the new shoots arising from above-ground buds are killed, and in seasons when the disease is particularly severe plants may be killed, and the stand greatly reduced. It is probable that the yield and quality of the first cutting are reduced each year by this disease. The organism that causes the disease lives over winter on the dead stems produced the previous fall, from which the spores are washed onto the tender shoots in the spring. A reasonable degree of control is accomplished, therefore, by winter and spring grazing or by mowing the field in late winter.

Damping off may destroy seedlings of spring-sown alfalfa in a nurse crop and practically destroy the stand in a wet season. The disease is caused by a soil-inhabiting fungus which works at the surface of the ground. It thrives in a humid atmosphere. Perhaps thin seeding of the nurse crop and grazing it heavily might control the disease somewhat.