

Soil Treatment To Improve Permanent Pastures

ARNOLD W. KLEMME



A good grass-legume pasture requires a fertile soil.

Why Soil Treatments Are Necessary

For each acre of cropland used for crop production in Missouri, there is approximately another acre used for permanent pasture. Three-fourths of the permanent pasture is plowable. The livestock carrying capacity of many of these pastures is exceedingly low because of their depleted soil fertility, over-grazing and infestation with unpalatable vegetation such as tickle grass, broom sedge, poverty grass, red sorrel, wild aster and other weeds, all of which have low nutritive value.

The dominance of these unpalatable weeds and wild grasses

in poor pastures reduces the livestock carrying capacity and accelerates erosion. Some of the land used for permanent pasture is now so low in fertility and so badly eroded that it is better suited to timber; in fact the weeds and wild grasses are woody in composition and grow on soils too low in fertility to support nutritious grasses and legumes. Such areas should be reforested and used exclusively to grow timber. Only those areas best suited to pasture should continue to be used for that purpose and should be given the soil treatments necessary to grow nutritious pasture forage.

Nutrients Usually Needed

The plant nutrients usually lacking in soils of pasture lands are the same as those deficient on croplands; namely, lime, nitrogen, phosphorus, and frequently potash. Numerous experiments as well as observations by farmers show that soil treatments greatly increase the quantity and quality of forage. They increase the livestock carrying capacity and greatly reduce erosion on much of the pasture land in the state. Increasing the livestock carrying capacity of these pastures materially reduces the need for hay and grain and saves labor in livestock production.

Legumes Furnish Nitrogen for Grasses.—By using limestone and commercial fertilizer as needed, legumes such as white and sweet clover can be grown more regularly in permanent pastures. With these soil treatments, white and sweet clovers and lespedeza produce more forage and serve better to supply the grasses with nitrogen.

Farm Manure Supplies Nitrogen and Other Nutrients.—Since farm manure is available on every livestock farm and is an excellent source of nitrogen and other plant nutrients, it can be used to advantage on permanent pastures. Manure may be applied on pasture when other parts of the farm are not accessible. If there is not enough manure to cover both the crop and pasture lands, its application as a top dressing on thin eroded areas will help to reestablish grass and legumes on these spots. This also will check erosion.

Applications of 4 to 6 tons per acre will give greater response per ton of manure than heavier applications. A better balanced plant ration will be provided by scattering from 40 to 50 pounds of superphosphate evenly over the top of each load of manure. This will permit the covering of more acreage with the same amount of manure and double the returns per ton of manure. The feeding of animals on the thin spots in permanent pastures will also help to restore vegetation on these areas.

Lime Usually Necessary.—Lime or calcium is needed on most of the permanent pastures in order to establish legumes in the pastures

as well as to increase the growth and improve the quality of other forage plants. It also aids in making other plant nutrients available in the soil. The limestone should be applied in accordance with a soil test, which can be obtained by taking a sample of the pasture soil to the county extension agent. Limestone may be applied on permanent pasture at any time when conditions will permit the lime spreader to be driven over the field. On plowable pastures it can be worked into the soil later.

Other Fertilizers Also Necessary

After the lime needs of the pasture soils have been met, commercial fertilizers high in phosphate are needed on most soils to furnish a balanced supply of plant food throughout the growing season. On nearly all the pasture land in the state, phosphate or a phosphate-potash fertilizer is also necessary to keep legumes growing if they are to supply nitrogen for the grasses associated with them and to provide protein, and mineral-rich forage for the livestock. These mineral fertilizers also enable the grass to maintain a thicker sod and thus reduce weed infestation. On soils of average fertility, or less, it usually pays to use nitrogen in the fertilizer mixture.

The kind of fertilizer to use depends on the natural fertility level of the soil. This depends on its amount of organic matter, its ability to supply minerals, the amount of past legume growth in the pasture and the manure applications that have been recently made.

County agents can make soil tests of representative samples and if given the above information can make more definite recommendations as to the fertilizer grades to use.

Use Soil Tests to Determine Fertilizer Needs

As an aid in establishing legumes in pastures on soils well supplied with lime, it is usually advisable to use either phosphate or phosphate-potash fertilizers. If the soil test shows the soil low in available phosphorus and high in available potassium, then only phosphate fertilizer needs be applied. This may be either superphosphate or rock phosphate. On the other hand, if the soil is low in both phosphate and potash then a phosphate-potash fertilizer should be used. A grade such as an 0-20-20 or 0-12-12 would be a good one to use. If the soil is low in available phosphorus and medium in available potassium, a grade such as an 0-20-10 or 0-14-7 is suggested. If the soil is extremely low in organic matter, as well as low in available phosphorus and potassium, then a complete fertilizer such as a 5-10-5, 6-10-6 or 8-8-8 is recommended.

Should the soil be high in lime, available phosphorus and potassium, and have a good growth of clover growing with the grass, no

fertilizer will likely be needed. On the other hand, if no clover is growing in the pasture and the soil is low in organic matter, yet high in the above minerals, high nitrogen fertilizers such as a 10-6-4, ammonium nitrate, sulfate ammonia, urea or other nitrogen carriers can be used to increase the growth of the grass.

Some Suggestions on Pasture Fertilizers

For Light-Colored Soils.—Where soil tests are not used, the following suggestions may be taken as a guide for fertilizing pastures.

On limed light-colored soils where clovers or lespedeza are to be established with the pasture grasses, either phosphate or phosphate-potash fertilizers are suggested. Selection can be made from such grades as 0-45-0, 0-20-0, 0-20-10, 0-14-7, 0-20-20 or 0-12-12.

On soils which are deficient in lime, and where no legumes are in the pasture mixture, the growth of the grasses can be increased by drilling in a fertilizer high in nitrogen, such as an 8-8-8 or 10-6-4. The high nitrogen content of these fertilizers will supplement partially the nitrogen that would be obtained by growing legumes. Annual gains or production from pastures fertilized in this manner will not equal those from pastures well supplied with lime and able to furnish the plant a balanced ration, which in turn conveys its composition as feed to the animal.

For Dark-Colored Pasture Soils.—On dark-colored soils well supplied with lime, superphosphate is usually the main nutrient that is needed. However, when new pastures are being seeded on dark-colored soils severely depleted of organic matter and where no legumes have recently been grown or no manure applied, a complete fertilizer such as a 4-16-4 or 4-12-4 is preferable for the first fertilizer treatment. For later treatments after legumes have been well established in the pasture mixture, superphosphate alone is recommended.

Nitrogen Fertilizers That May Be Used.—When few or no legumes are in the pasture mixture and the grass fails to grow vigorously, even though the soil is well supplied with phosphorus and potash, additional high quality forage can be obtained by top dressing the pasture with nitrogen materials in the early spring (March) about the time growth starts or in the early fall about the time the fall rains start (September). Ammonium nitrate, urea, sulfate of ammonia, or other nitrogen materials can be used for this purpose. The rate per acre should be such as to supply 40 to 50 pounds of nitrogen per acre.

Rock Phosphate on Permanent Pastures.—Rock phosphate applied in liberal quantities on silt or clay loam soils can be used on permanent pastures to furnish phosphorus for clovers. The minimum

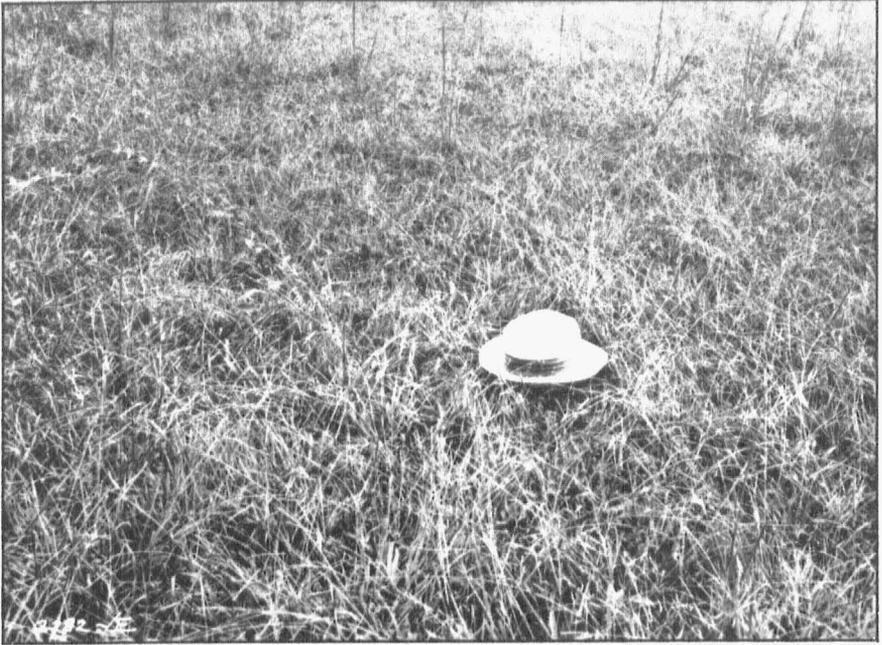


Fig. 2.—Liberal application of manure made the difference in the growth of this grass.

rate should be about 1000 pounds per acre every 4 to 8 years. Where potash or nitrogen is needed it should be applied in addition to the rock phosphate.

Rates Per Acre and Frequency of Applications

Tillage operations are essential to place fertilizer salts in the soil zone occupied by the feeder roots of the pasture plants. These operations require labor. Therefore, in order to eliminate as much labor as possible, heavy rates at a single application are better than numerous light applications. Somewhat better results can be expected at least in the beginning of a soil improvement program from rather liberal applications. The recommended rate is 60 to 100 pounds per acre of phosphate (P_2O_5). This would require an application of 300 to 500 pounds of 0-20-0 per acre. In case a phosphate-potash fertilizer, such as 0-14-7, was used the rate should be increased to 450 to 700 pounds per acre. Complete fertilizer, such as 4-16-4 should be used at rates of 350 to 600 pounds per acre. Such applications should be sufficient along with the fertility released by the soil itself to meet the needs of the pasture plants for 3 to 5 years. Full limestone applications usually meet the demands of the more exacting legumes for 10 to 15 years. When weeds begin to make their entrance into pastures, they indicate that some of the essential nutrients are lacking. Steps should be taken to supply the missing nutrients.

Applying Limestone and Fertilizers on Permanent Pasture

Limestone and fertilizers containing phosphate and potash give best results when they are placed well down into the soils. Phosphate becomes fixed in the soil almost where placed and since potash and limestone move downward very slowly, it is therefore desirable to place these materials deep enough so they will be close to the feeder roots of the plants, particularly of legumes which root deeply. When this is done, the lime and mineral fertilizer will react more rapidly with the soil. It is while in this condition that they supply most of the plant nutrients.

While limestone can be applied any time that the spreading machinery can be driven over the pasture, there are certain seasons of the year when it can be best worked into the soil; namely, late fall or early winter, and spring when the ground is soft. Thoroughly cutting the pasture with a sharp disk, a field cultivator, or spring-tooth harrow, during one of these periods will help get the lime into the feeding zone of the plant roots. On sloping land these tillage operations always should be on the contour.

Probably the most desirable time to apply fertilizers to permanent pastures is in the late fall or early winter, which will allow

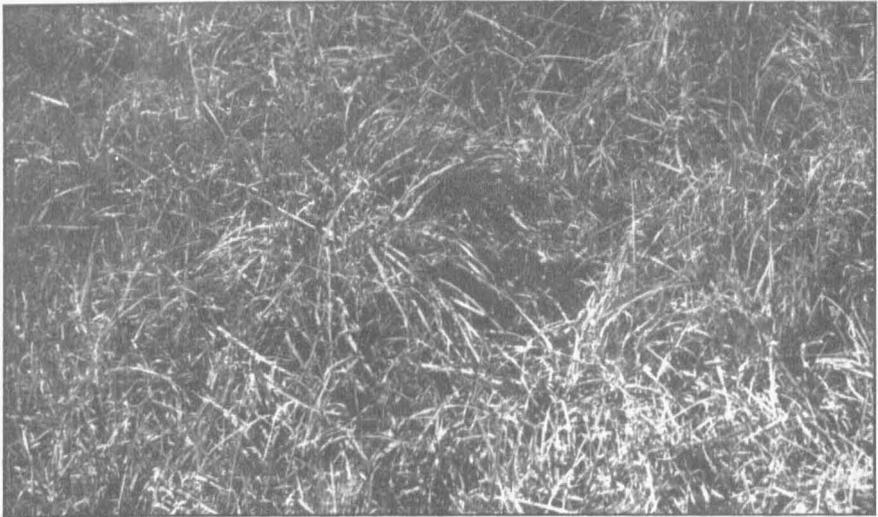


Fig. 3.—A complete fertilizer helped get this thick growth of orchard grass.

time for the fertilizer salts to react with the soil and be more available to the next season's growth. They may be applied, however, in the early spring by drilling the fertilizer as deeply as possible so that it will be in the zone of the feeder roots. When a drill is not available, the fertilizer may be broadcast on the surface with a lime sower or oat seeder and cut into the soil in the same manner and with the same equipment as used for limestone.

Soil Treatments Help Even When Left on Surface

Because of stones, stumps, and other hazards, there are some areas of permanent pasture which cannot be worked with a disk or harrow. On these areas the broadcasting of limestone, fertilizer, manure and seed on the surface in winter will help materially to improve the growth. It should, however, be worked into the soil wherever possible.

Reseeding Permanent Pastures

After the application of soil treatments, a thin sod of bluegrass or redbtop generally thickens naturally. It is only when there is little or none of these grasses that it is advisable to sow additional grass seed. After lime and fertilizer have been applied and the pasture has been thoroughly cut with a disk, spring-tooth harrow, or field cultivator, sweet clover and lespedeza may be seeded. One or both of these legumes should be in all permanent pastures to increase the production of forage and to supply the grass with nitrogen. If the

soil is deficient in lime, the sweet clover should be left out of the mixture.

Since the disking of lime or drilling of fertilizer into the soil on permanent pasture must usually be done in late fall, early winter or spring, the seedlings of legumes can well be made at that time. If made during the winter on pastures which have been thoroughly cut with a disk or field cultivator, the sweet clover and lespedeza mixture can be broadcast on the surface at the rate of 10 to 25 pounds per acre. When either is sown alone, the same amount of seed is suggested. The alternate freezing and thawing of the soil can be depended upon for ample covering of the seed. If seeding is delayed until spring, it may be done by placing the mixture in the grass seed attachment on the grain drill and drilling so the seed falls behind the disk or hoe of the drill. The seed may also be broadcast on the surface of the cultivated area. Spring rains usually will cover the seed to a sufficient depth to insure germination.

Fertilizing — Plowing — Reseeding

On the less fertile, plowable, and permanent pastures that are badly infested with perennial weeds, thicker sodded and more vigorous growing grasses and legumes frequently can be obtained in less time by plowing and reseeded. When this method is used approximately two-thirds of the fertilizer application can be plowed under and the remaining third placed on the surface at seeding. Plowing helps to eliminate the perennial weeds as well as affording opportunity of placing some plant food in the lower soil layers to feed the deeper rooted legumes.

Good Management of Pastures Helps to Keep Them Productive

Permanent pastures should be so managed as not to be overgrazed. This can best be done by using supplementary or rotation pastures in conjunction with permanent pasture. Bluegrass and other grasses become woody, unpalatable and low in feeding value during the hot summer months. At this period supplementary or rotation pastures should be used so as to have green succulent feed. Lespedeza is an excellent legume to use during this time.

Mowing as needed to control weeds and brush helps to conserve moisture and plant food for the more desirable grasses.

Additional information on pasture management is given in Missouri Experiment Station Circular 244.