

Ohio Agricultural Experiment Station.

CIRCULAR No. 91.

WOOSTER, OHIO, MARCH 20, 1909.

ALFALFA CULTURE.

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Alfalfa is being grown with more or less success in every county in this state; with greater success upon the rich and well drained limestone soils of the western half, than upon the shale clay and sandy loams of eastern Ohio, although under these much less favorable natural conditions success has been attained by many.

WHAT ALFALFA NEEDS.

A well drained soil. There are a number of conditions which are fatal to alfalfa. Among these, lack of drainage stands well to the front. Soils not having natural sub-surface drainage, i. e., a porous subsoil, should be tiled. While good surface drainage is helpful, trouble may be expected with a heavy, retentive subsoil, unless tile drainage is resorted to. Alfalfa will not thrive where the water level is permanently within three feet or less of the surface. It will stand flood water for a considerable time during the dormant season, unless the water freezes solid, but during the growing season two or more days' flooding is usually disastrous.

A sweet soil. No farm crop seems as sensitive to soil acidity as alfalfa. There is no use to seed alfalfa in Ohio where red clover fails to do well and sorrel is working in its place. Uplands usually become acid before bottom lands. As a general rule the first thing to do with all lands other than limestone, which have been in cultivation very many years, is to apply lime in some form. Not infrequently limestone soils which have been in cultivation for many years have had the lime pretty well leached out of the surface soil and will give better results if limed.

When in doubt as to whether lime is needed it is well to put out a small plot test to determine the needs of the soil.

Experiments conducted by this Station go to show that when soils are acid, no application of fertilizers or manures, nor any treatment of the soil in the way of inoculation is successful in growing alfalfa unless lime be first applied. Experiments to date indicate that fine ground limestone is effective in correcting soil acidity, but larger applications of the limestone are needed than of the caustic lime—practically double the amount. While soils vary as to the amount of lime needed, 2,000 lbs. of caustic lime, or 4,000 lbs. of ground limestone will care for most soils.

A rich soil. While alfalfa, like other legumes, may take care of its own nitrogen problem when once it gets well established with the proper nitrogen-gathering bacteria aiding it, yet a soil rich in all plant food constituents is an important factor in getting it established. For the purpose of enriching the soil for alfalfa there is nothing better than a liberal application of stable manure. This should not be applied to the surface soil just preceding the seeding of alfalfa for the weed seeds in the manure will make no end of trouble. If applied the same season the alfalfa is seeded it had better be plowed under. However, manure is best applied to a cultivated crop a year in advance of alfalfa seeding.

In the absence of manure it is well to make use of such leguminous catch crops as field peas, soybeans, cowpeas and the like, to fill the soil with humus-forming material. Then with an application of steamed bone and potash the fertility conditions should be well cared for.

Alfalfa is an unusually deep rooted plant and is thereby enabled to draw upon greater depths than most crops for phosphoric acid and potash, yet if good crops of alfalfa are to be grown year after year these constituents must be supplied at regular intervals.

A clean soil. In submitting a list of questions to alfalfa growers in Ohio some three years ago to ascertain as far as possible the reasons for success and failure with this crop it was found that by far more failures were ascribed to competition with weeds than to any other cause. To weeds and nurse crops (and they may not improperly be coupled together, for to an alfalfa plant they are indistinguishable) were ascribed 166 percent more failures than to all other causes mentioned.

Most soils are pretty well filled with weed seeds. It is a mistake to seed alfalfa in such soils until the weed problem has been solved. This may be accomplished in part, at least, by growing an inter-tilled crop as corn, potatoes, tobacco, etc., for one or two years previous to seeding alfalfa, and giving these crops very clean cultivation. It may be greatly helped by growing a cultivated crop like early potatoes the season of seeding, or a crop which will smother the weeds, as a thickly seeded crop or field peas. When the situation is critical enough to justify, the problem can be best solved perhaps by early plowing and giving clean fallow cultivation for 6 to 10 weeks previous to seeding. While this is expensive, it is pretty sure to result in a good, clean stand of alfalfa, and in the long run may prove economical.

An inoculated soil. Our various leguminous plants have the power, through the aid of microscopic organisms which live in nodules upon their roots, to make use of the uncombined nitrogen of the air. The presence of these organisms is very important in so far as the maintenance of the fertility of the soil is concerned and has much to do with the successful growing of some of the legumes. This is especially true regarding alfalfa. The early pages of the history of alfalfa growing in this country are filled with failure after failure until the ground *gradually became inoculated*. Experiments at this Station have shown that inoculation is very helpful in promoting the healthfulness and vigor of alfalfa and in increasing its yield. Plots growing side by side, with other conditions of growth identical save inoculation, have shown a gain of 1.26 tons of hay per acre in favor of soil inoculation for the three cuttings the year after seeding. It has been possible to distinguish between the inoculated and the uninoculated plots a half a mile away from them, simply by the difference in the color of the alfalfa—the inoculated plots being a very dark green, the uninoculated plots a pale, greenish yellow.

Alfalfa then, should not be seeded without first inoculating the soil with the proper nitrogen-gathering bacteria. The most effective way of accomplishing this is to take soil from an old alfalfa field where nodules are found upon the alfalfa roots, and apply it just before seeding, at the rate of 100 to 400 pounds per acre, depending upon the convenience and expense in securing the infected soil. This soil may be broadcasted by hand and harrowed in, or sifted and drilled in with a fertilizer drill. Care should be taken not to dry the infected soil in the sunlight, or let it lie in the sunlight after it is broadcasted before harrowing in, else most of the bacteria will be killed.

If it is more convenient to secure soil from a patch of sweet clover (*Melilotus alba*) it will prove as satisfactory, for the bacteria which work upon sweet clover work also upon alfalfa.

PREPARING FOR ALFALFA.

It should be remembered that alfalfa is no ordinary crop. That if successful it will last four or five years and perhaps longer. Accordingly mistakes made with this crop mean more than with our common annuals. As stated above, one should make his plans for alfalfa from one to three years in advance, filling the soil with organic matter and plant food and cleaning it of weeds. It is not possible to plow and prepare a good seed bed for alfalfa in a week's time, as is frequently done for other crops. Time is an important factor in

preparing a seed bed for alfalfa, and enough time should be taken to accomplish the desired result, viz., a firm, fine, moist and clean seed bed.

Preparatory crops. In the effort to avoid losing the use of the land the season alfalfa is seeded, a number of different crops have been grown in advance of seeding, among them early potatoes, oats, soybeans (cut for hay), field peas and wheat. Perhaps the safest crop to precede alfalfa is early potatoes. Potatoes may be gotten out of the way for late July or early August seeding and when they have been kept clean a good seed bed is speedily available. Next to potatoes, likely, stand field peas, as these come off early and leave a clean seed bed. Oats and soybeans are most too late for sure seedings of alfalfa. Wheat, while earlier, is more or less uncertain, much depending upon moisture conditions.

Nurse crop vs. seeding alone. This Station has tried a number of different nurse crops; among them wheat, oats, barley, corn and soybeans. Under our conditions none has proved successful. Wheat has seldom given success elsewhere. Under some conditions oats and barley have given success. Seeding with corn at last cultivation is uncertain. In soils well filled with humus, and with favorable conditions as regards moisture during August and September, good seedings may be secured.

When seeding early, i. e., April or May, it is usually more satisfactory to use a nurse crop than to seed alone. Barley is to be preferred, with oats second choice. Usually the latter had better be cut for hay.

When to seed. Mid summer seeding, without a nurse crop, upon land which has been thoroughly prepared, probably furnishes the most favorable conditions for securing a stand of alfalfa. This thorough preparation may consist of four to eight weeks of fallow cultivation, or of a preparatory crop, as early potatoes or peas, which is out of the way in good season.

Source and character of seed. Alfalfa varies widely in hardness. With few exceptions we have found the southern grown seed to be tender and unable to withstand our Ohio climate. Northern and northwestern grown seed have quite uniformly given good satisfaction. No one should purchase alfalfa seed without knowing its source and first examining a sample for adulteration and seed impurities. The greatly increasing demand for alfalfa may have encouraged adulteration; at any rate it is occasionally met with. The

seed most commonly used to adulterate alfalfa is yellow trefoil (*Medicago lupulina*). Other adulterants sometimes used are sweet clover and bur clover. The weed pests to be especially guarded against are dodder and narrow-leafed plantain. Purchasers of seed who are not familiar with these and other possible impurities should submit a sample to the Botanist of the Experiment Station before purchasing. Such examination is made free of charge for residents of this state.

Manner of seeding. It makes but little difference how alfalfa seed is sown so that it is done evenly and is well covered. The Station has secured very satisfactory results distributing alfalfa seed through the grass seeding attachment of an ordinary grain drill, dropping the seed in front of the hoes, the latter covering it. This has given decidedly better results than drilling the seed, i. e., distributing it *through* the drill hoes the same as wheat. It may be seeded quite satisfactorily with many of the common grass seeders in use, and by broadcasting by hand. Where there is a possibility of uneven seeding it is well to divide the seed and cross seed. Except when covered with the drill hoes the seed should be harrowed in.

Rate of seeding. This Station put out a thick and thin seeding test of alfalfa June 27, 1907, at the rates of 5, 10, 15, 20 and 25 pounds of seed per acre. The seed was distributed through the grass-seeding attachment of an ordinary wheat drill after repeated and careful testing. It was dropped in front of and covered by the drill hoes.

The results of this test thus far appear in the following table:

THICK AND THIN SEEDING OF ALFALFA.

Pounds of seed used per acre.	No. plants per sq. ft. July 31, '07	No. plants per sq. ft. May 2, '08	Total pounds hay per acre, 1908 (3 cuttings)
5.....	13	11	7,862
10.....	33	27	8,648
15.....	45	34	8,678
20.....	56	44	8,557
25.....	70	49	7,876

The number of plants per square foot was determined by counting three tracts 1.5 ft. square in different parts of each plot and the average taken. The plots are one-fifth acre each.

It will be noted that the maximum yield was harvested from the plot receiving 15 lbs. of seed per acre, but that 10 lbs. of seed gave within 30 lbs. of as large a yield of hay per acre. The yield from 20 lbs. of seed is somewhat lower than from 10 and 15 lbs., and the yield from 25 lbs. decidedly lower, exceeding the yield from 5 lbs. by an insignificant amount.

It should be stated that 5 lbs. of seed per acre proved a little light in so far as holding the weeds in check is concerned. If a few large weeds had not been removed from this plot it would have presented a somewhat ragged appearance. This being done the quality of the alfalfa was as satisfactory as on any plot.

This ground was in ideal condition for alfalfa when seeded, having been plowed some eight weeks previous and harrowed at intervals of 10 to 20 days until seeded. Under such conditions 10 to 15 lbs. of seed per acre would seem to be enough. It is to be doubted whether more than 15 lbs. of alfalfa seed per acre is needed in this state when a good seed bed is prepared, and it is surely cheaper to prepare such a seed bed than to buy alfalfa seed to waste among clods, or in a loose, dried out soil.

In consulting the above table it will be observed that nature is taking a hand in weeding out unnecessary plants. Comparing the stand of plants per square foot May 2, 1908, with the stand July 31, 1907, there is a shrinkage of 15.3 percent where 5 lbs. of seed per acre were used and 30 percent where 25 lbs. were used.

Clipping young alfalfa. Spring seedings of alfalfa will likely need one clipping. Mid summer seedings may or may not need clipping. Alfalfa should hardly be clipped much later than the first of September, else, of an unfavorable season, it is not likely to go into the winter with sufficient growth for protection.

In 1907, this Station conducted a clipping experiment upon alfalfa which was seeded June 27th. A portion of the field was clipped September 9th. At that time the alfalfa stood 12 to 18 inches in height, about 15 percent was in bloom and the new growth, or tillers were well started. Another portion of the field was clipped October 16th. There was little change in the alfalfa during the period from September 9th to October 10th save that the blossoms had dried up. The weather conditions were about normal the fall of 1907, the rainfall for September being 3.13 inches; for October, 2.34 inches; and for November 1.33 inches.

In the spring it was very noticeable that the new growth started off earlier and stronger where the alfalfa was not clipped. The total yield for the three cuttings was 1,376 lbs. per acre greater from the

plot not clipped than from the plot clipped in September, and 522 lbs. greater than from the plot clipped in October. The injury from the October clipping appears to be less because of the weed growth that took the place of the injured alfalfa.

There seems little reason for clipping midsummer or later seedings of alfalfa the season of seeding, unless the alfalfa becomes diseased.

The old idea, that conflicts which weeds and alfalfa might be waging could be settled in favor of alfalfa by repeated clipping, is not well founded.

Making alfalfa hay. This is what one hopes to be doing, beginning the June following the year of seeding. When is alfalfa ready for harvest? There are several answers which may be given to this question, each of which should be taken into consideration. 1. When one-tenth to one-fourth of the bloom is out. 2. When the new growth is nicely started. 3. When it is at a stand-still as a result of one or many diseases to which alfalfa is subject. If one arbitrarily decides that alfalfa must not be cut until a certain percent of the bloom appears, he will sometimes wait in vain, waking up finally to find that his alfalfa is rapidly dropping its leaves and becoming less valuable every hour.

In order to make the best hay it is desirable to do as much of the curing as possible in the hay cock. Mowing in the middle part of the day when the weather promises fair, alfalfa should be ready to cock up in about 24 hours and should do the balance of its curing in the cock, save opening for a little while before hauling. In this way the leaves can be saved to best advantage, and they must be saved, for according to analyses made by this Station, 100 lbs. of leaves carry as much protein as 240 lbs. of stems.

Hay caps greatly simplify the matter of making good hay in bad weather. Good duck covers which will last a number of years can be purchased at from 25 to 50 cents each according to quality. Some farmers are using caps made from heavy unbleached muslin with good results.

ALFALFA DISCOURAGEMENTS.

Very many farmers have failed in their attempt to grow alfalfa. There is no disputing the fact that thousands of dollars have been lost upon unsuccessful alfalfa fields. Many of these losses might have been avoided. The reasons for some of these failures have already been enumerated in this circular. In brief they are: wet soil; acid soil; impoverished soil; weeds; lack of inoculation; poorly fitted seed bed; over nursing; ill-timed seeding; poor and weedy seed and excessive clipping.

Dodder. Dodder is a weed pest that has given much trouble. It is a "yellowish, thread-like, twining plant" which derives its sustenance from the host plant within its grasp, severing its connection with the soil and slowly carrying on its work of destruction. It gradually extends its domain and should be attended to when first discovered. If the infested spots are not numerous they may be dug out or burned over, using kerosene and any dry material as straw. If the area is very extensive the only recourse which is effective is plowing. The time for most efficient work, however, is when purchasing alfalfa seed. If only dodder-free seed be used there will be no infested fields.

Leaf spot. Leaf spot (*Pseudopeziza medicaginis*) is a fungous disease which is doing a great deal of damage in this state and seems to be present everywhere. It may be readily recognized by the small brown or black spots on the alfalfa leaves. The lower leaves are attacked first but it gradually extends over the whole plant. The badly diseased leaves usually turn yellow and drop, and fields that are allowed to stand until over ripe become quite bare of leaves in the lower half of the plant. There is no effective remedy for leaf spot. This disease may be held in check by cutting, and fields that are affected badly enough to stop growing should be harvested at once. Nothing is gained by letting such fields stand and frequently much is lost. The disease spreads rapidly and the dropping of the leaves reduces the food value of the crop. The new growth generally comes in much freer from leaf spot than the preceding crop. The second and third cuttings are more likely to be injured than the first crop.

Leaf spot is frequently called rust and blight.

SHOULD EVERY FARMER GROW ALFALFA?

Likely not. Some farmers will not find a convenient place for this long-time perennial in their farm rotations. They will be content with red clover, which, upon many soils, is a close second to alfalfa. At this Station the past season (1908) red clover gave a yield of 4.34 tons per acre at two cuttings, while under very similar conditions alfalfa yielded 4.66 tons at three cuttings. There is not very much difference between 4.34 and 4.66 tons, while there is some difference between two hayings and three hayings—but not enough to make up for the difference in the quality of the product in favor of alfalfa.

Upon some Ohio farms it is probable that red clover is, and for some time may be, a surer crop than alfalfa. The latter should be tried under conditions which have been made favorable, but in a small way, until its utility is demonstrated. A failure under more or less unfavorable conditions does not necessarily mean continued failure.