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The Alfalfa Seed-Crop and Seeding Alfalfa.

Saving Alfalfa For Seed.

I have had little actual experience in saving alfalfa for seed, and I do not find much information published on this subject. Many questions along this line come to me for answer, and in order to collect information on this subject—to learn the methods in practice, and profit by the experience of alfalfa growers—I have proposed a number of questions as follows, which were submitted for answer to several hundred prominent alfalfa growers throughout the West, mainly in Kansas:

1. What condition of soil, weather, etc., do you consider most favorable to the development of alfalfa seed? What conditions unfavorable?
2. What relation do bees and other insects have to the development of alfalfa seed?
3. Which crop of alfalfa is best to save for seed, and why?
4 Can you tell when alfalfa is likely to make a good crop of seed? How early in the growth of the crop can this be ascertained?
5. At what stage in the maturity of alfalfa should the crop be harvested for seed?
6. Describe the methods of harvesting and caring for the seed crop.
7. When is the best time to thresh, and what kind of a thresher is best to use, an ordinary threshing separator or an alfalfa huller?
8. How should the seed be stored, and when marketed?
9. Give any other general information bearing on this subject which you may consider essential for the successful growing and saving of alfalfa seed.

Some fifty replies to these questions have been received, and in preparing the present bulletin the writer has drawn freely from these replies.

THE SOIL.

Good crops of alfalfa seed may be produced on a variety of soils, ranging from "black gumbo" to "sandy loam," but the general experience is that the soil should be well drained and of average fertility. Very fertile land, and soil supplied with an abundance of moisture "produces plant not seed." On this account in central and eastern Kansas, "upland" or "second bottom" is usually considered superior to "bottom-land" for alfalfa seed production. A soil poor in fertility will produce only light crops of seed, while large yields of seed may be produced from fertile land in a favorable season, but with unfavorable weather conditions the seed crop is more apt to fail on the more fertile soil. "Rankness in growth of plant is not conducive to the production of seed." Alfalfa will not thrive on a shallow soil with hard-pan subsoil, or on low or poorly drained land.

THE WEATHER.

In the opinion of many alfalfa growers the weather is a more important factor than the soil, in determining the production of a good crop of alfalfa seed. On a given soil capable of growing alfalfa, "the weather is the determining factor in seed production," or it may be as truly said that the moisture supply, in time and amount, largely determines the alfalfa seed crop on any field. On this point a majority agree that the alfalfa should have a moderate supply of water in the early part of the season, and during the early growth of the seed crop—just sufficient moisture to produce a vigorous, healthy plant. To insure a good crop of seed no rain should fall after the alfalfa begins to blossom until most of the bloom has fallen, and then the weather should continue rather dry until the seed crop is harvested and threshed, or put into the stack. Wet weather in the latter stage of its growth causes a continuation of blooming and the starting of a second growth of alfalfa, which interferes with an even and proper maturing of the seed. Also, it has been observed that very hot, dry weather, with a deficiency of moisture in the soil during the seed-forming period, has resulted in light blasted seed and a low yield. It is said that under the conditions observed, alfalfa flowers fail to secrete nectar and are hence not fertilized because not visited by bees and other insects.

OTHER FACTORS.

A rather thin stand of alfalfa with vigorous plants of average growth favors the development of seed, while a thick stand and a rank growth of plant are considered unfavorable conditions for seed production. The seed fields should be comparatively free from weeds. By disking and harrowing the alfalfa, early in the

spring, or perhaps after the first or second hay crop is removed, the weeds may be held in check and the soil kept in good tilth, resulting in strong, well-developed plants, capable of producing large yields of sound, plump seed.

EFFECT OF BEES AND OTHER INSECTS.

The botanist informs us that alfalfa blossoms do not self-fertilize. In order that the blossoms become fertilized and produce seed it is necessary that pollen from a separate flower be brought in contact with the pistil of another flower. It is very improbable that the pollen can blow from one flower to the other, as is the case with corn and some other plants. Thus there is little question but that the pollen is transferred from flower to flower by insects, which accomplish this good work while they sip the nectar which each healthy flower secretes, apparently for the very purpose of attracting insects.

Farmers themselves are divided upon this point, as to whether insects are necessary or useful in the pollenization of the flowers. Many maintain that as good crops of seeds were produced many years ago, before bees were introduced into a certain locality, as are produced now. Others state that in a locality where bees are kept there is no noticeable difference in seed yields near apiaries compared to yields from fields further away. Such data, however, do not disprove the facts as stated above. Doubtless other insects besides bees assist in fertilizing the alfalfa flowers. If you will observe an alfalfa field in full bloom you will usually find it swarming with insects of various kinds —bees, flies, butterflies, millers, ants, and sometimes grasshoppers — although it is doubtful whether the latter are of any benefit, and certain it is that they are often a pest when numerous. It is quite possible that ants are among the important insects concerned in fertilizing alfalfa blossoms; there is proof, however, that bees do assist in pollenating the flowers of alfalfa, as shown by the investigations of Prof. S. J. Hunter, of the University of Kansas, as published in the Twelfth Annual Report of the Kansas State Board of Agriculture. At the Experiment Station last season, 1905, part of the alfalfa plants in the breeding plot were covered with fine netting to keep out the insects, with the result that scarcely any seed formed on the covered plants, except in flowers which pushed through or against the netting, allowing fertilization by insects from the outside. On the other hand, adjacent plants not covered were well filled with seed pods.

There should be a double benefit to the alfalfa seed grower who keeps bees, for not only may he secure larger yields of a superior quality of seed by reason of the work of the bees, but the alfalfa

is one of the most valuable honey plants. In the alfalfa districts of the State the yield of honey per hive, according to Secretary F. D. Coburn's reports, is much larger than in the sections where alfalfa is but little grown; and not only may the bees in alfalfa districts make double or treble the usual amount of honey, but this honey is very superior in quality, unequaled even by the white clover honey of the eastern states. "In favorable seasons, 100 pounds of honey per hive is no uncommon yield in alfalfa regions."

WHICH CROP TO SAVE.

The region lying west of the Missouri river grows most of the alfalfa seed produced in the United States. A large part of this seed is grown by irrigation in the western part of the Great Plains region, in several of the mountain states, and in California. Much seed is also produced without irrigation in the eastern part of the Great Plains region. The dry climatic conditions of the West make this section of the country better adapted for the production of alfalfa seed than the more humid regions of the central and eastern states. The best quality of seed and the largest crops are produced in an arid climate by irrigation. The supply of water and the weather conditions during the growing period of the crop largely determine which crop to save for seed. Any one of a season's crops may produce good seed provided the soil and weather conditions are right for growing and maturing the seed. About the same time is required to produce a crop of seed as is required to produce two crops of hay. In the irrigated districts of Colorado and western Kansas the first crop is often saved for seed, the practice being not to irrigate this crop, thus causing a medium but thrifty growth of plant, which, with the favorable weather conditions prevailing in the arid regions, usually seeds well.

On the whole, especially in the more humid regions, the second or third crop is more often saved for seed than the first crop, mainly because more favorable weather conditions prevail in the late summer and early fall for maturing the seed. Also, the insects which may help to fertilize the blossoms are more numerous in the latter part of the season. Only in the southern states is it possible to use a later crop than the third for seed.

In those latitudes where the third crop may mature seed before cool weather and frost, the choice between the second and third crop for seed is decided mainly by weather conditions at and before the blossoming period. If the supply of moisture has been moderate and the alfalfa has made a proper growth and little or no rain falls during the blossoming period, the second crop will likely

seed well. However, if the second crop is rank in growth, or heavy rain falls just previous to or when the alfalfa is in bloom, it is best to cut for hay. In the non-irrigated area of the semi-arid portions of Kansas and other western states drouth is apt to prevail in the latter part of the season, by which the growth of the third crop is greatly reduced, causing only a slight development of seed. In such districts the second crop should be saved for seed, or perhaps the first crop, especially on dry uplands which may produce only one good crop (the first crop) in a season. In northwestern Kansas and Nebraska it is doubtless safest to use the second crop for seed as the third crop is apt to be caught immature by frost. In central northern Kansas a farmer must usually decide early whether to save the second or third crop; if the third crop is to be saved for seed it is best to cut the first and second crops a little early, giving as much time as possible for the third crop to mature. Also, the early cutting for hay gives not only an earlier but more vigorous growth to the third crop, insuring a large production of seed in favorable seasons.

Some growers state that the third crop should be preferred for seed because it blooms more evenly and matures more evenly and in a shorter period than the second crop. If this is a fact, it may be largely due to the favorable weather conditions which are more apt to prevail during the season of the year when the third crop is growing and maturing. When it can be successfully done, using the third crop for seed has an advantage over using the second crop in that it allows the harvest of two good hay crops, while if the second crop is harvested for seed only one crop of hay is usually secured that season, the growth after the seed crop being insufficient as a rule, in the sections of Kansas named, to produce hay. On the other hand, when the third crop is matured for seed sufficient growth of the alfalfa usually takes place after removing the crop to give a good winter cover, and it is the general report by those who practice this plan, that taking the third cutting for seed does not exhaust the alfalfa plants so much as taking the second crop for seed.

Insect pests, as the grasshopper and web-worm, are also a factor in determining whether the second crop, or any crop, may be safely saved for seed. The web-worm is more likely to attack the second crop, but in southern Kansas the third crop is also apt to be injured by this pest.

WHEN ALFALFA WILL MAKE A GOOD SEED CROP.

Alfalfa is a very uncertain seed crop, and it is a difficult matter to estimate with any degree of accuracy early in the growth of the

crop what the yield of seed will be. If the weather and soil conditions have been favorable and the alfalfa has made a proper growth (not too thick and rank, but rather the stems should be of medium height and stout, with many branches), and there is an even heavy bloom over the field in five or six days after the first bloom appears, and no rain falls, the prospect for seed is good. The blooms should be large and of a dark rich color. When the blossoms are small and light in color it is evidence of a light crop of seed. Again, if the blossoms fertilize properly the flowers dry and stick to the stem a few days, while if they are not fertilized they drop quickly and the stems stand bare. Even before the bloom falls the circular pods are visible. The pods should appear thickly set on the stems, two or more in a group, to insure a good seed crop. Finally, if by examination the pods are found to be well filled with seed, the crop is assured, barring accidents by which the seed may be lost in harvesting and threshing.

From the above suggestions it may seem to the novice that he would be able to judge fairly well when a crop of alfalfa should be left for seed; yet old growers do not find it easy to decide. A grower who has had twenty years' experience writes as follows: "I can not tell when a good crop will be made until near maturity, as the blossoms often fail to seed, and then too much rain may cause well-fruited alfalfa to take a second growth and continue to bloom and ripen seed irregularly. Also, during damp, rainy weather the ripe seed may sprout, or when the weather turns dry the ripe pods may burst, shattering their seed." It is even possible that after a crop is ready to harvest it may be lost or badly damaged by excessive rain, causing the seed to sprout or the pods to burst when they dry in the sun.

Relative to saving a crop of alfalfa for seed these suggestions may be given:

If the weather has been too wet and the alfalfa grows too rank, cut for hay. If heavy rains fall while the alfalfa is in bloom, or before the flowers are fertilized, cut for hay. If for any reason the flowers are not fertilized and the bloom falls quickly, leaving bare stems, cut at once for hay. Even after the seed is formed if excessive rains come and a second growth starts, cut the crop and remove it, because it will fail to ripen seed evenly and is almost certain to be an unprofitable crop, and the sooner it can be taken from the ground the sooner another crop may start and mature.

WHEN TO HARVEST.

The harvesting depends a little upon the evenness of blooming and the weather conditions during the period of maturing. In a

favorable season, with even blooming and even maturing of the seed, the rule is to harvest the alfalfa when a large proportion of the pods have turned brown. In the average season, as the alfalfa matures part of the seed will be ripe while some seed is overripe and shattering and some is yet immature. With such a crop it is necessary to strike an average and harvest when the largest amount of plump, sound seed may be saved.

The opinions of farmers vary widely regarding the proper stage of maturity at which to harvest alfalfa. While the majority prefer to harvest when most of the seed is ripe and when two-thirds to three-fourths of the pods are brown, others recommend to harvest when one-half of the pods are brown. One grower harvests the crop when one-third of the pods are black, one-third brown, and one-third green; others harvest at once as soon as the ripest seed begins to shatter, while still others maintain that the first seed that ripens is the best and prefer to cut a little early, claiming that the seed will be of as good a quality and that there is less loss from shattering in handling and less danger of damage by unfavorable weather.

Mature alfalfa seed has a clear, light golden color; immature seed has more of a greenish tinge and may be shrunken, but if the crop is not harvested until the seed is fully ripe the pods drop off, the seed shells easily, and the crop is hard to handle without great loss, even if it escapes unfavorable weather after harvest. On the whole, it seems to the writer safest to cut the crop a little green rather than to risk loss in ways mentioned. The greenish colored seed if not too shrunken is good vital seed and germinates well.

METHODS OF HARVESTING.

A crude method is to cut with a mower and rake into windrows the same as hay. Handled in this way, much seed may be wasted. If the alfalfa is mowed in the morning, when the dew is on, and raked immediately there is much less shattering of seed. If cut during the heat of the day, to prevent the shelling and waste of seed men should follow the machine with forks, moving the cut alfalfa out of the way of the team and the machine. When provided with a buncher or windrower attachment, the mower does better work and may be economically used. There is some objection to leaving the alfalfa in loose bunches or in open windrows, and unless the weather is very favorable and the purpose is to thresh at once, it is best to follow the mower closely, placing the alfalfa in larger piles or cocks, about what a man can lift at one forkful, thus avoiding pulling the bunches apart in loading, which would cause the pods to break off and the seed to shatter. Also, if the alfalfa is placed at once in the cock in this way, the seed is prevented from

bleaching so much and the straw settles and sheds rain and is preserved and cured better than when left in the loose bunch or windrow, and well-cured alfalfa straw is said to have one-half the feeding value of alfalfa hay.

The self-rake reaper is in common use, and is an excellent machine with which to harvest the alfalfa seed-crop. The gavels are dropped from the platform out of the way of the horses and the machine. Usually men follow with forks and lay three or four gavels in a pile. These bunches shed rain and preserve the seed and straw in better condition than the single gavels, and the seed does not shatter so badly in handling the larger compact bunches as in handling the smaller ones.

Some few growers cut the crop with a header, leaving the alfalfa in windrows across the field. This method is only satisfactory in a dry season, when the alfalfa is threshed or stacked at once, as soon after harvest as possible. Many western growers harvest alfalfa with a binder. The usual practice has been to remove the binder part, but leave the packers on and throw the bundles out loose, dropping in bunches by use of the bundle carrier or bunching with the fork, as already described in the use of the self-rake reaper. In recent years, however, many prefer to bind the alfalfa in bundles and shock the same as wheat or other grain. The advantage claimed for this method is that it requires less help, since one man may do the harvesting and put the crop into the shock if help is scarce; the alfalfa may be cut a little greener, the seed does not shatter so readily, and the straw may cure and keep better than when put up loose.

When bound and shocked the alfalfa should stand a couple of weeks, until dry enough to thresh. If put into the stack, threshermen prefer to have it loose, as bundles are more apt to be damp and tough, but if fully dried when stacked alfalfa should keep well in the bundle. It is suggested to stack with layers of straw between layers of alfalfa, in order to take up the moisture.

STACKING AND THRESHING.

The common practice, when it can be done, is to thresh from the field as soon after harvest as the seed is dry and the straw fully cured. If a machine can not be secured and weather conditions are favorable for stacking, better put into the stack at once when the crop is cured than to run the risk of damage by wet weather. A single rain will not injure the alfalfa much if it is well bunched or cocked, but continued wet weather causes the seeds to swell and perhaps sprout, and when the pods dry they burst, scattering the seed. Some growers estimate that half of the seed

is lost in this way by a few days of unfavorable weather, Also, if the crop is allowed to lie in the field for a long time there is more or less loss of seed from the effects of heavy dew and damage from mice and insects, and the longer the alfalfa lies the easier the pods break off and the seed shatters when it is finally handled and stacked or threshed. The largest amount and best quality of seed may be secured by stacking or threshing the crop as soon after cutting as it is in fit condition.

Care should be taken not to stack or thresh when the straw is too green or tough and the seed not fully dry. It requires even more time to properly cure the seed crop of alfalfa than it does to cure the hay crop; the stems are largely stripped of leaves and cure slowly and pack closely in the stack. If stacked green, the alfalfa is sure to heat and thus injure or destroy the vitality of the seed. Also, if threshed green or damp, much seed will be lost, since it will not hull properly, and if damp seed is stored in bulk it will heat and spoil. To cure the alfalfa fit to stack, from three to seven days of favorable weather are required, and a longer period if it is threshed from the field. When bound and shocked the crop should have a couple of weeks of drying weather to cure before stacking or threshing. It is safest to put into narrow stacks, and it is also a good plan to mix with layers of dry straw, especially if the alfalfa is bound and there is any indication that the straw is damp or green in the middle of the bundles. The straw improves the ventilation of the stack and absorbs the excessive moisture. The practice of using straw in this way, however, is seldom practicable — better stack only when fully cured.

To prevent loss of seed in stacking or threshing, racks are sometimes covered with canvas and canvas is spread under the machine or along the stack in order to catch the shattered seed and the bolls which break off; also, care must be taken to handle the alfalfa carefully in pitching and loading. Large growers of alfalfa often stack the seed crop in the field with the sweep-rake and hay stacker. Those who practice this method usually cut with the mower and leave in bunches or windrows, drying the alfalfa quickly and stacking as soon as possible. This is a rough way to handle the crop and occasions more or less loss of the seed, but where a large area is handled it may be more profitable to handle the crop in this way than to handle it by a slower method and run the risk of damage from wet weather. When the alfalfa is left in gavels or bundles, as thrown off by the harvester, it should be taken up with a barley fork. There will be less shattering of seed, however, if the alfalfa is in small, compact bunches, not too heavy to be lifted in one forkful.

When the alfalfa is stacked, unless threshed at once, within two or three days after stacking, it should be allowed to pass through the sweat before being threshed, which requires several weeks or months. The best plan is to cover the stacks well to prevent damage by rain, and thresh late in the fall when the weather is dry and cool. In order to secure seed for fall sowing it is often desirable to thresh from the field, and in a favorable climate or season, if a machine can be secured, this is the safest and most economical method of handling the crop.

Farmers differ in their opinions as to whether it is preferable to thresh with a huller or with a common grain separator provided with a huller attachment. Some growers favor the use of the latter machine because the work can be done more rapidly. As a rule, however, when farmers have had a chance to use both kinds of machines, and have compared their work, the huller is preferred. Although it takes longer to thresh with a good huller, yet with a good crop enough more seed may be secured to amply pay for the extra time and expense required; in fact, the owner of a huller will often pay something for the privilege of threshing over again the straw-stacks left by the common thresher. Among the machines used, the Bidsell huller is well recommended; also, the Advance threshing separator with huller attachment received favorable mention. One farmer who has used both machines prefers the Advance thresher to the huller.

STORING AND MARKETING THE SEED.

A good method is to sack the seed and store in a dry place, which may be kept free from mice and rats. It is stated by some growers, however, that mice and rats will not touch alfalfa seed provided they have free access to other grain.

The seed should be cleaned with a good fanning-mill before selling, and all light seed, dirt and weed seed removed as far as possible. This extra work is usually well paid for in the better price received for clean seed. If the alfalfa is green or damp when threshed, the seed had best be spread twelve or eighteen inches deep on a tight floor in a dry place and shoveled over once or twice to dry it before it is cleaned and sacked. Prime alfalfa seed should have a bright, clear light golden or slightly greenish color. Seed which has been wet or bleached in the field will be darker in color, while heated seed will have a brownish dead color, indicating its lack of vitality.

From the grower's standpoint, the best time to sell the seed is when the price is highest. Prime seed usually sells at a high price early in the fall, when there is apt to be a shortage of seed

for fall sowing, and again early in the spring, about March 1, seed often brings the highest price, depending largely upon the supply and demand. Aside from its use for sowing, alfalfa seed has a standard market value in Europe for dyeing purposes, being used in the printing of cotton fabrics, and large quantities of seed have been exported from this country to supply the foreign demand. For different years and in different parts of the country the price ranges from seven to fifteen cents per pound. A bushel of alfalfa seed weighs sixty pounds. Three to four bushels of good seed per acre is a profitable crop. The average crop in the more favored alfalfa regions ranges from five to seven bushels per acre, while yields as high as twelve bushels per acre have been reported. A yield of less than two bushels per acre is an unprofitable crop.

On account of the uncertainty of the seed crop, several growers who replied to the questions stated that they have about decided to discontinue growing alfalfa for seed. It is a fact, however, that when a good seed crop can be secured it is a very profitable crop to the grower, and I hope that the information and suggestions contained in this Bulletin may be of aid in assisting farmers to grow and handle alfalfa for seed with a greater promise of success than has apparently been the general experience in the past.

Seeding Alfalfa.

With good seed, a proper seed-bed and land adapted for growing the crop, a careful farmer should be almost as sure of establishing a successful stand of alfalfa as the average farmer is of getting a stand of wheat or oats. This may seem like a strong statement, since failure to get a good stand of alfalfa has often been the experience of many farmers, especially those who were inexperienced in growing this crop. However, it is generally true that the longer alfalfa is raised on any farm the more readily it grows and the easier it becomes for the farmer to start the crop. Whether this is due largely to the fact that a farmer learns better how to seed and handle the crop, or whether the land becomes better adapted for growing alfalfa, is a question. Perhaps both are important factors in the successful production of the crop.

THE SOIL.

Alfalfa will succeed on a variety of soils, grading from sandy to heavy clay and "gumbo," although with unfavorable soil conditions it becomes more difficult to establish a good stand. The crop, however, does not thrive alike on all soils; perhaps a deep, fertile

loam or clayey loam well supplied with the mineral elements of plant food is the most favorable soil for growing alfalfa. The crop needs a deep, well-drained soil; on wet land with the water too near the surface, alfalfa will often produce poorly and the plants soon die. Alfalfa will not thrive on a soil deficient in lime, which shows an acid reaction. Some old lands in eastern and southeastern Kansas being originally rather deficient in lime, after years of cropping have become deficient in humus and organic matter and so deficient in lime that they will hardly produce alfalfa successfully until the soil is fertilized by manuring and the acid condition is corrected by applications of lime and land plaster.

In order that alfalfa may make a good stand and continue to produce large crops the land must be supplied with the nitrogen gathering bacteria which live on the roots of the alfalfa plants and supply a part of the plant's food. Lands which have never grown alfalfa may not contain these bacteria, and before alfalfa will grow well it is necessary to supply the bacteria by inoculating the new lands with soil from an old alfalfa field. From 200 to 500 pounds of infected soil, carefully spread and mixed with the soil by cultivation before the alfalfa is planted, is sufficient to inoculate the new land and infect most of the alfalfa plants within a year or so after seeding. The nitro-culture preparations for treating the seed before sowing, now manufactured and sold, also give good results when used carefully according to directions. The average farmer will secure better results by using the infected soil, when it can be secured at a reasonable cost, rather than to treat the seed with nitro-culture preparations.

THE SEED.

The first requisite in getting a stand of any crop is good seed. Not only should alfalfa seed be of good quality and strong in vitality and germination, but it should be clean and free from foul weed seeds. It seems hardly necessary to enlarge on this point, yet many farmers are careless, much poor seed is sold and sown, and many costly failures result. Alfalfa seed costs so much, and the expense of a failure to get a stand is so great, that many farmers are discouraged by an unsuccessful trial, while others hesitate to make the venture. Those who are familiar with alfalfa seed can usually recognize seed of low vitality. New seed of good quality has a characteristic, bright, clear color, while old seed or seed which has received injury from wetting or heating has a dull, dead color, indicating its impaired vitality. Seed which is badly shrunken is also apt to contain a large percentage of seeds of low

vitality which will not germinate and grow under ordinary soil conditions.

The only reliable way to determine the vitality of seed is to test its germination. This can be done in several ways. A simple and handy method is to use a cigar box; place several folds of wet paper in the bottom of the box, over it sprinkle the seed and cover with several folds of wet paper; close the box and set it in a favorably warm place. Examine the seed in four or five days and count the germinations, remoistening the paper if necessary. At the end of eight or ten days the test may be discontinued and the percentage of germination calculated. A large percentage of germination the first three to five days indicates a strong, vigorous seed, while a slow, weak germination indicates seed low in vitality, which may not germinate when planted except under the most favorable soil conditions. For the best seed the percentage of germination should be 90 per cent or more. A low percentage of germination, and fairly quick and strong, indicates a mixture of good and poor seed, and such seed may be sown, but more seed will be required per acre to insure a stand.

Carefully examine the seed for impurities, and if weed seeds are present the alfalfa should be carefully cleaned before seeding. The parasite "dodder" is now appearing quite extensively in alfalfa fields in some parts of the West. This is a most dangerous pest, and it is usually unsafe to sow seed infected with dodder, even after thorough cleaning; but dodder seed is only about one-half as large as alfalfa seed and by careful cleaning, using a "dodder" sieve, which will also remove many of the smaller alfalfa seeds, the dodder may be removed, leaving only the choice, plump, clean alfalfa seed to sow.

AMOUNT TO SOW.

The amount of alfalfa seed to sow will depend to some extent upon the quality and vitality of the seed. The general practice has been, and perhaps still is, to sow from twenty to thirty pounds of seed per acre, but, many of the oldest and most successful alfalfa growers are now using much less seed. At the 1904 meeting of the Kansas Improved Live Stock Association, Mr. A. E. Sutton, of Russell county, stated during a discussion on this subject that he had secured a good stand of alfalfa by sowing only six pounds of seed per acre. Col. J. W. Robison, of Towanda, Kan., who grows thousands of acres of alfalfa on his large farms in Butler county, stated that he was then seeding fifteen pounds of alfalfa per acre, but that he intended to reduce this amount to not more than ten or twelve pounds of good seed per acre. Hon. C. B.

Daughters, of Manhattan, Kan., secured a splendid stand of alfalfa on his Blue Valley farm near Manhattan by sowing eight pounds of seed per acre in the spring of 1903; and so throughout the State I have found other farmers who now practice seeding twelve to fifteen pounds of alfalfa seed per acre, while formerly they used twenty to thirty pounds. At this Station a trial of seeding different amounts of alfalfa seed per acre was undertaken in the spring of 1904; alfalfa was seeded broadcast at different rates, varying from six to thirty-six pounds per acre. The soil was early spring plowing, which had been well settled by the use of the sub-surface packer, making a good seed-bed. The result of the trial was a fair stand of alfalfa, even on the most thinly seeded plot, while where the amount of seed was ten to twelve pounds per acre an excellent stand was secured. The heavier seeding gave a little thicker stand, but fewer healthy plants than the thinner seeding. Altogether these trials and the general experience of farmers prove that it is not necessary to use so large an amount of alfalfa seed per acre as has been the usual practice.

With alfalfa as with clover, doubtless the season has much to do with securing a successful catch. I well remember the remark of a good old Scotchman, a neighbor and relative who resides near my boyhood home in Wisconsin. When asked how much clover seed should be sown to get a good catch, he answered: "We'l, in a gude season a very leetle will do, and in a bad season it don't make much difference." With my personal knowledge and experience, however, I am sure that it often does make "much difference," and that even in an unfavorable season it is possible with an average amount of good seed sown at the right time, in a properly prepared seed-bed, to secure a successful stand of alfalfa or clover, or of almost any common domestic grass.

THE SEED-BED.

Next to good seed (let the weather conditions be what they may), the seed-bed is the most important factor in establishing a successful stand of alfalfa. Although this idea of a "proper" seed-bed has been studied and discussed much in the last few years, yet I find that the principles involved in the preparation of a seed-bed and its condition at seeding time, as related to a favorable environment for germinating the seed and starting the young plants, are not yet fully understood by many farmers. A deep, loose seed-bed is not a favorable one in which to seed alfalfa, clover, or grasses. Such a seed-bed may be in a favorable condition for planting potatoes, or perhaps corn may sprout and grow well under the conditions named, since the seed is large and

strong in vitality and contains much nutriment to nourish and start the young plants, but with clover, alfalfa, grasses, and other small seeds, the ideal seed-bed should be mellow, but finely pulverized only about as deep as the seed is planted. Beneath the point at which the seed is placed and covered in the earth the soil should be rather firm but not too hard or compact; such a condition as may be secured by cultivating the surface of well-settled fall plowing, or by discing and harrowing unplowed corn land in in the spring. A proper seed-bed for fall seeding may often be prepared on early summer plowing or by discing unplowed land from which an early cultivated crop has been removed. When the seeding follows closely upon the plowing of the land, either in the fall or spring, a proper seed-bed may only be prepared by using such a tool as the sub-surface packer, by which the bottom of the furrow slice is pulverized and firmed, thus reestablishing the capillary connection of the soil with the subsoil, by which the moisture may be drawn upward into the surface soil to supply the germinating seed and the roots of the young plants.

The firm condition of the soil beneath the seed and a good connection with the subsoil not only offers favorable conditions for supplying the seed with moisture, but the mellow covering over the seed allows the air and heat to reach the seed from above, and these three — moisture, heat, and air--are the essential factors in seed germination; but if any of these are lacking the seed will not germinate. Moreover, the mellow surface above the seed allows the young plantlet to readily push its way up into the sunlight, when it throws out its green leaves, and through the action of heat and light the work of assimilation begins and the plant grows and soon establishes its roots deep in the soil and becomes able to withstand drouth and unfavorable weather conditions.

TIME TO SEED.

Alfalfa may be successfully seeded throughout the eastern half of Kansas either early in the spring or early in the fall. As to just how early it may be safely seeded in the spring will be determined by the date when the last severe frost may be expected. The young alfalfa plants may be destroyed by a hard frost just after the plantlets have appeared, showing their first pair of leaves. When the young plants have thrown out two or three pairs of leaves and have made some growth they are not likely to be destroyed by frost. Thus very early seedings are sometimes more apt to be successful than medium early seedings, while late seedings are most apt to suffer from heavy rain packing the soil and from the effects of hot, dry weather. As to how late it is safe

to sow alfalfa in the fall is also determined to some extent by the season. During a favorably moist, warm fall, seedings up to the last of September have succeeded at this Station, but on the whole the later seedings are much less apt to prove successful than the earlier seedings. Again, if the seeding is done too early in the fall, as in August, a period of dry weather may cause a poor germination of the seed or destroy many of the tender plants before they have established a root growth. This is a general rule which one may practice with success: Prepare the seed-bed early, either in the fall or spring, and seed when the soil is in a fit condition to germinate the seed. There is little use of sowing alfalfa unless the soil conditions are favorable to germinate the seed at once, because the seed will not germinate and grow until the conditions are favorable, and the seeds are much more apt to be injured and lost if they must lie for any considerable time in a seed-bed which is not in fit condition to germinate seed.

METHODS OF SEEDING.

A large amount of alfalfa has been seeded with the ordinary grain drill. At present the greatest objection to this method is that it requires too much seed. To sow in this way requires twenty to thirty pounds of seed per acre. The feed on the ordinary grain drill cannot be set up close enough to sow less than the amount named. A better plan than to sow with the grain drill is to have a grass seeder attachment to the drill, which will allow close adjustment, and with spouts emptying into the grain tubes, so that the seed may be dropped in the drill furrows and evenly covered. In many soils and seasons there is little doubt but that the method of seeding with the drill will give more favorable results than broadcasting. As a rule, however, alfalfa may be successfully started by seeding broadcast in a well-prepared seed-bed—care being taken to seed at the right time and when the soil is in favorable condition for sprouting the seed. Alfalfa is successfully sown by hand, but in recent years the little wheelbarrow seeder, several makes of which are sold on the market, has come into use for broadcasting grasses, clover, alfalfa, and small seeds.

The seed should not be covered deeper than one to two inches, or often less than one inch of soil covering is better in a wet season or on heavy, compact soil. The seed-bed should be fully prepared before seeding, and one brush with the harrow is usually sufficient to cover the seed on a well-prepared seed-bed having a mellow, even surface. If the seed is planted too deep, the young shoots will often be unable to reach the surface. The vitality of the small seed being quickly exhausted, the plant dies and the seed is lost.

As a rule I do not recommend rolling after seeding, preferring to do the firming of the soil before the seeding. In light soils or dry seasons, however, it may become desirable to roll to cover the seed and press the soil about the seed. It will always be well, however, to follow the roller with a light harrow, leaving the ground furrowed and with a surface mulch, and not smooth and hard as left by the roller.

NURSE CROP.

It is safest, as a rule, to sow alfalfa without a nurse crop, and this is the method usually practiced, although it is possible to get good stands in the most favorable climate, soil and season by seeding with spring grain crops, If this method is practiced, lighter seedings of grain should be made than is the usual practice when the grain is seeded alone, and in a dry season it may become desirable to cut the grain crop for hay before it matures, in order to keep the alfalfa from being destroyed by drouth. The nurse crop method cannot be considered a safe one to establish a stand of alfalfa.

TREATMENT AFTER SEEDING.

Alfalfa seeded in the spring needs little care after the first season, more than to mow the weeds a few times during the summer to prevent the weeds from seeding and to keep them from smothering the young alfalfa plants. It is well to mow the field two or three times during the season, but the growth of weeds and alfalfa should not be cut too close to the ground. It seems to be true that when alfalfa has become well established, frequent close cutting seems to benefit the plant and cause it to grow more vigorously, but this is not true of the young, tender plants. It is true of alfalfa as with any other young plant, that it must form a top growth before or at the same time that it is producing roots. The leaves are the stomach and lungs of the plant, and before the roots can develop the leaves must manufacture the products which are built into the cells and tissue that constitute the roots. If this top growth of leaves is kept cut off before a sufficient root growth has been established to easily restore the top growth, the effect is to check the growth of the plant, weaken it, and perhaps destroy the plant. I have known of good stands of alfalfa which were destroyed by a single close mowing, not due wholly to the reasons assigned above, but to the fact also that the young, tender alfalfa plants which had been strongly shaded were suddenly exposed to the heat of the summer sun and a dry period of weather, which, together with the factors named, resulted in killing out the alfalfa almost completely. Clover seeded with a nurse

crop of grain is often destroyed by too sudden exposure to the hot sun and dry weather when the grain is harvested. (Others have ascribed this to the reflection of heat from the dry stubble, cooking the young clover, and advise mowing the stubble close to the ground as a preventive.)

The fall-seeded alfalfa needs no care in the fall—the full growth of plants and weeds should be left as a winter covering. The next season the alfalfa may be regularly cut for hay, and with a good catch will often produce three or four cuttings the first year, yielding three or more tons of good hay per acre, although on foul land the hay is apt to be a little weedy the first season. The fall seeding, however, has the advantage of the spring seeding in that the land returns a fair crop the first season after sowing, whereas with the spring seeding the alfalfa is not likely to make sufficient growth to produce a profitable crop of hay the first season; also, the weeds will usually be so abundant as to prevent the use of the first season's cuttings for hay, even should the alfalfa make sufficient growth. Fall seeding is also advantageous in order to get the start of the weeds, giving a comparatively clean crop of hay the first year after sowing.

Another method of seeding, adapted to weedy land or to land which is deficient in available plant-food, is to start the preparation of the seed-bed early in the spring, when the land may be either plowed shallow or cultivated with the disc harrow. Cultivation with the common harrow, disc, or Acme harrow, should be continued at intervals of a week or ten days, in order to destroy the weeds, conserve the soil moisture, and develop available plant-food. Late in the spring, during the last of May or first of June, seed the alfalfa, choosing a time to sow, if possible, soon after a good rain, so that the soil may be in good condition to germinate the alfalfa seed. Unless heavy rains fall immediately after sowing, alfalfa seeded by this method should start quickly and make a good stand; and the weeds will not be troublesome, since the weed seed in the surface soil has been germinated and the weeds destroyed by the early cultivation. The cultivation also causes some of the latent fertility of the soil to develop and become available to the young plants, and this, with the abundant moisture supply, should pratically insure a good start of alfalfa, provided weather conditions are not too unfavorable.

When alfalfa has become fully established the crop is benefited by occasional cultivation. The implement best adapted for this work is the disc harrow. Alfalfa may be disced in the spring before it starts much, and it may be disced after each or any

cutting during the season. At this Station the usual practice is to disc once a year, quite early in the spring, although discing several times during the season as described above has given favorable results in a single trial. In the experiments at this Station the least injury was done the alfalfa and the best work was accomplished by setting the discs rather straight and weighting the harrow so as to make it cut two or three inches deep, then the field was cross-disced and harrowed with a common harrow. As the soil is left by the discing, it does not form a perfect soil mulch to conserve the soil moisture, and also the clods thrown up by the disc interfere in mowing. The purpose of the discing is to loosen the surface soil so as to favor better aeration to the soil, kill the weeds, and form a mulch to conserve the soil moisture and at the same time present a surface more favorable to the absorption of the rains, and there is no doubt but that the discing of alfalfa favors the growth and development of the crop.