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Progress in Variety Tests of Alfalfa

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BULLETIN NO. 120

APRIL 1910

AGRICULTURAL EXPERIMENT STATION

**SOUTH DAKOTA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS**

AGRONOMY DEPARTMENT

PROGRESS IN VARIETY TESTS OF ALFALFA

BROOKINGS, SOUTH DAKOTA

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ALFALFA

BY

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AND

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INTRODUCTION

The interest manifested in this forage plant shows its widespread and rapidly increasing popularity. Of seemingly unlimited productiveness, unhampered by many factors which affect the growth of corn, cereals and grasses, it keeps pushing its boundaries, north, east, south and west, to higher altitudes, until only few areas are not supplied. In these regions where it is unable to produce from four to six cuttings, it is content with one or two, and even then when given a chance by a favorable season, responds with a third.

Inquiries concerning the culture indicate a determined effort on the part of all farmers to produce this "queen" of nitrogen-gathering legumes. The organisms which live in the tubercles on the alfalfa roots are the poor man's friend. "They not only work for nothing and board themselves, but pay for the privilege."

The history of alfalfa has been written so many times in bulletins, various text books and the agricultural press, so that a resume of that phase of the subject seems unnecessary. Civilized man in his march of conquest and settlement has carried it with him into all countries. Its introduction into the United States has been both from the east and from the west; the greatest progress, however, has been from the west, because under these conditions it thrived more luxuriantly, proving its value more conclusively as a great forage plant.

Medicago sativa L. is the botanical name by which alfalfa is known. The different varieties or strains, if we might call them such, have been originated from this and are only distinct from it in so far as hardiness or productivity are concerned.

TYPE OF SOIL

Because alfalfa is so widely distributed in the United States it is so often taken for granted that it is able to make the best of any soil condition, and many failures can be attributed to just such conclusions. Its hardiness and deep feeding root system does not necessarily make it a crop which does not respond unfavorably to indifferent treatment. The selection of the field is of prime importance and must receive due consideration if alfalfa culture is successful.

Locality, altitude, soil type, position, do not have such dominating influence as the moisture conditions. The rather crude expression so commonly heard, "Alfalfa will not stand wet feet," is literally true, as many have found to their disappointment and expense. Choose a loamy surface with good drainage, which can be best obtained on a sloping hillside. The water table should be from two to three feet below the surface, and the subsoil should be porous enough to permit the roots to penetrate to the saturated soil beneath. If the soil is hard, impervious and water-logged, less than three feet beneath the surface, alfalfa is unable to utilize its deep feeding root system, and we lose the best results which recommends it to the farmer. A sloping hillside has the advantage in not having low, wet, flat spots in it where ice may form, which is as detrimental as standing water to a good stand. We have observed alfalfa which died on a well drained soil when covered with ice during the opening of spring.

When the plants are dormant the field will stand flooding, but not ice. So it is very essential that if a soil is low and subject to standing water, that complete drainage be inaugurated before the alfalfa is seeded.

A soil intended for alfalfa must not be acid, otherwise any attempt to grow alfalfa successfully will be a failure. Soils in humid regions are more likely to be in such condition, making it necessary to apply lime to correct acidity. We are safe in saying that there is a sufficient quantity of lime present in the soils of South Dakota for good growths of alfalfa.

The bacteria are likewise present in all our soils, so that inoculation is not necessary. Care should be taken when an examination is made for tubercles to dig out the plant carefully with a spade, because when a plant is pulled from the soil the nodules are apt to be stripped from the roots.

Only second to well drained soil should be one which is free from weeds. This can hardly be over emphasized, because many a field has been ruined by an early influx of weeds. The choosing of a field should have this in view, because more intensive cultivation can help to this end.

Unsubdued sod or any soils which have not yet been brought into good tilth should not be seeded to alfalfa. Many letters of inquiry are received and ask whether disking the native sod and seeding to alfalfa will insure a stand? To such we can only say, no; because no good results from such methods. The heavy soils west of the Missouri river, which have a deep weathered subsoil, are well adapted for alfalfa. This is especially true of soils lying adjacent to the hills, where surface wells are reached at depths of from fifty to one hundred feet.

There are a few instances where the soils are too alkali to get a good growth of alfalfa. Localized depressions seem to be characterized by failures from such causes; however, the plants may have been injured by excess of water rather than from an accumulation of mineral salts. The relation of alfalfa to alkali soil has been investigated by the California Experiment Station, and it was found that the tolerance of salt solutions in the soil by young alfalfa plants is about as follows, which represents the amount of alkali in an acre of soil for the upper two feet: Sodium carbonate, twelve hun-

dred pounds; sodium chloride, seven hundred and fifty pounds; sodium sulphate, twelve hundred pounds. When alfalfa has once become well established it is able to withstand a much larger proportion of mineral salts. For this reason a heavy flooding, so as to wash the alkali into lower strata, may be practicable; for this will enable the plants to secure a good root development before the alkali becomes too strong.

PREPARATION OF THE SEED BED

The grower who has his crop of alfalfa well started is more than half way on the road to success. While the selection of the field bears such an important part in successful alfalfa culture, the preparation of the seed bed is only of secondary importance. The successful farmer plans months, even years, ahead, in getting his field into shape for this crop; for the crop is to remain from five to ten years, so he cannot well afford to neglect any of the initiatory details. Money and time spent in the preparation of the seed bed, instead of in the purchase of a larger quantity of seed, will insure better stands, and this would be instrumental in extending the crop in this state.

This phase of alfalfa growing has been discussed much, yet it seems to be not entirely understood by the average farmer. Until we are made to fully realize and appreciate the need of a good seed bed we will be indifferent and put the seed into poorly prepared ground. The field should have been plowed long enough to enable the soil to be worked down and settle and fill with water. A loose, open, porous soil may be all right for potatoes, root crops or corn, which contain a large amount of food in the seed and which comes in contact with it, but is entirely unfit for alfalfa seed. He who sows his seed on freshly plowed ground with slight pulverization, can hope for nothing but fail in securing a stand. The first consideration in handling a field should be to get rid of the weeds. Nothing will be of greater service in this respect than

to begin early and persist in combatting them before the crop is sown.

The first choice of a previous crop is a well cultivated potato field. This puts the soil in good condition by conserving moisture and making the soil mellow. Weed and grass seeds are made to germinate and are then killed. Second to a potato field comes one which has been cropped to field peas. The peas should be seeded thickly enough to smother most of the weeds, and then after the crop is harvested the field should be plowed from five to six inches deep. Then leave the field in this uneven plowed condition during the winter until early spring. As soon as the soil is dry enough to work, disc well and harrow. This hastens the physical improvement, compacts the soil, loosens the surface to prevent evaporation, and induces the soil to warm up more rapidly, thus starting the germination of grass and weed seeds. If the ground becomes weedy, the disking and harrowing should be continued as often as required to kill them, because they are easily kept in check while young. This treatment should be continued until seeding time.

When it is desirable to put a stubble field in shape for alfalfa, it should be plowed early, or if this cannot be done, it should be disked at once. A disked field should be plowed later without much trouble, while the disking foul seeds are made to germinate.

When the seeding is done soon after the plowing, the proper seed bed may only be made by disking and harrowing or even the use of a sub-surface packer. When such is the case, disking before plowing is essential, because a seed bed is then prepared which is turned under by plowing. Under such treatment a six inch bed will be assured, while with a single plowing the bottom of the soil will be loose, cloddy, filled with trash and not connected with the soil below the plow line. A firm connection with the subsoil is preferred, so as to permit the capillary rise of water, a mellow covering

aerates the soil, and takes up heat, so that rapid germination and growth results.

Great care should be taken in disking in the spring, so that ridges are not thrown up. These must be harrowed down and the surface made perfectly level, otherwise the stand will not be uniform. In disking an advantage may be gained by lapping half, so that the uneven soil is thrown back again, then by harrowing the uneven surface is smoothed down. The plunger can be well utilized both before and after planting to leave the surface compact with still a loose covering of soil.

When a sod is deficient in available plant food and where the organic matter has been worked out, an application of manure is beneficial. This induces a vigorous growth while the plants are young and tender, so that they become more hardy. Alfalfa is a deep feeder, it is classed as a soil restorer, and while it gathers nitrogen from the air, it feeds heavily on the phosphorus and potassium in the soil. Plant food supplied to growing alfalfa will give quick returns and profit to the grower. Worn out soils should be first improved physically by incorporating manure and organic matter in the soil; however it should not be seeded to alfalfa until this material is well rotted.

A word may be said in reference to putting the native prairie in fit condition for alfalfa. To those contemplating such a move, we would suggest to go rather slowly until you are familiar with the soil and the habits of the plant. The field should first have produced several crops of grain, as flax on breaking, followed by durum wheat, then oats or barley. The stubble field is then disked early, plowed in the fall and prepared in the spring as stated previously. Such would have received the following treatment: Native sod broken three inches deep, crop of flax; disked when crop has been removed and again in the spring, crop of wheat; disked early, then fall plowed five inches deep, crop of oats or barley; disked and plowed in fall in preparation for alfalfa the following spring.

PURE SEED

A prime requisite of the alfalfa grower should be that he demand good seed. It is not only necessary that it be strong, possessing vigorous germs, but it should be clean and free from foul weeds. Many a well prepared seed bed has been seeded to poor, foul seed, and after the failure the grower has given up the growing of alfalfa for all time; a failure at this time spells *failure*, quite likely to him, for all time. Nothing discourages the grower more than such a result, and an unsuccessful trial may indirectly influence his neighbor.

Good alfalfa seed possessing high germinating power has a bright golden color and when rubbed between the thumb and finger appears glossy. The experienced farmer can readily distinguish the poor seed by its rather brownish color and shrunken appearance. Some years olive green seeds are mixed in with good seed; this is caused by uneven ripening of the crop; however, such seed is good. The Turkestan variety has somewhat of a dull color even when well cared for. The grower should demand good seed, especially clean seed, for several very noxious weeds may be introduced into the field if due care is not exercised. Dodder is already in a few fields in the state, and this dangerous pest may be widely distributed. If the seed is not clean it should be run over a dodder screen. Foreign seeds are more dangerous than inert material, hence it behooves us to look to this very closely.

Any farmer can make a germination test for vitality, and this is the only safe and accurate way of knowing whether the seed will grow. Place some sand on a plate and cover it with a piece of blotting paper or cloth. Upon this place one hundred kernels of alfalfa seed which have been taken from the lot. Place another cloth or paper over this and moisten it, but use care not to get it too wet. Then cover with another inverted plate and set aside in the living room. At the end of a week the seeds may be counted and from those germinating the per cent calculated. Those which germinate within four or five days may be considered strong in vitality and

very good seed; while a weakly germ denotes poor seed which will perhaps only grow under the best of field conditions. Good seed should test better than eighty-five per cent and will require the minimum amount of seed per acre, while mixtures of strong and weak will require a heavier rate of seeding.

QUANTITY TO SOW

Growers are less agreed on the actual amount of seed required to secure a good stand than on any one point connected with alfalfa culture. The quantity varies from eight to twenty-five pounds per acre, and there are many instances where perfect stands have been obtained from seeding ten to twelve pounds. A larger quantity seems a waste. The Ohio Experiment Station has found that five, ten, fifteen, twenty and twenty-five pounds per acre gave yields respectively of seven thousand eight hundred sixty-two, eight thousand six hundred forty-eight, eight thousand five hundred fifty-seven, and seven thousand eight hundred and seventy-six pounds per acre. According to Farmers Bulletin No. 339, one pound of alfalfa seed contains over two hundred twenty thousand seeds, which give more than fifty plants for every square foot, if sown at the rate of ten pounds per acre and all seeds grew. This is quite sufficient for any soil, and a good seed bed with a uniform distribution would insure this result. The consensus of opinions, and the practice of most successful growers on both non-irrigated and irrigated land is, to sow about fifteen pounds to the acre.

TIME TO SOW

In the more humid sections, the middle of the season seems preferable to an earlier seeding, for this gives us an opportunity to combat weeds, which are ever a serious trouble. Earlier sowing is recommended in the semi-arid and arid regions, because under these conditions the available moisture supply is very important. A good rule to observe is to seed at such a time which will enable the young plants to have

made a vigorous growth when the critical time comes, whether it be an insufficient supply of moisture or an attack of weeds. Medium early seeding seems to give best results and is recommended.

METHOD OF SEEDING

The average farmer does not have a special grass drill, neither does he look favorably towards the suggestion of purchasing one. Consequently the alfalfa must be seeded with the machinery already on hand. An investment in a special seeder would more than pay for itself if any considerable acreage is to be sown to alfalfa. Alfalfa can be sown with any good wheat drill if it is mixed with finely ground corn or with some dried boiled millet seed. The Oklahoma Experiment Station recommends that a mixture be made of two-thirds ground meal and one-third alfalfa. With such a mixture from three and one-half to four and one-half pecks will be required to supply from twelve to fifteen pounds of seed. With grass seeder attachment or a drill the feed can be properly adjusted to the proper quantity. We must bear in mind to run the shoes shallow, for the seed should be covered with only a thin layer of soil unless it is sandy, when deeper seeding is necessary. The uniform depth of seeding, which is so essential, cannot be obtained if the ground is more or less ridged. When the spouts from the grain seeder attachment conduct the seed into the shoes, too deep covering is apt to be had on heavy soils. When drilled soil may be washed on the grain, even if it is placed at the proper depth.

Alfalfa can be, and is, often sown broadcast and then harrowed. When broadcasted, heavier seeding is necessary and care must be exercised to harrow at once. Just at the time when the young plumule is pushing its way through the surface, hot weather has a tendency to injure it. This has also been reported under broadcast seeding, when rain prevented harrowing them into the ground. The general practice among our best farmers is to sow alfalfa without a nurse

crop, although it may be deemed advisable, whenever the soil is sandy, to use a light seeding of small grain. The purpose of this is to prevent the sand from blowing. Four pecks of barley or oats per acre will be sufficient, because a heavier rate of seeding may grow so rank as to choke out the alfalfa. The grower should watch the crop closely, and when in his opinion the alfalfa is suffering, indicated by turning yellow, he should cut the crop at once. In the eastern part of the state, where there is an abundant supply of moisture and where noxious weeds are apt to cause trouble, a nurse crop may give good results; in fact some very successful farmers use a nurse crop whenever they seed, and have not had a failure. The crop of grain is part compensation for the year, while the alfalfa is making a start, and even though it must be harvested early, it can be cured for hay. The nurse crop method cannot be recommended for the western section of the state, because the young plants should be given all opportunity to avail themselves of the moisture supply.

MANAGEMENT OF THE FIELD

Ordinarily no treatment is required the first year after seeding, beyond clipping the growth of weeds. It is sometimes a good practice to harrow a newly seeded field after the plants have attained a height of three or four inches, in order to loosen the surface and aerate the soil, because young alfalfa plants are easily affected by a compact surface soil. The loose covering of soil on the surface covers the capillary tubes, which will be instrumental in conserving soil moisture. When harrowing, the levers should be set so that the teeth are inclined at quite an angle and then weighted down so that it will penetrate the soil. Such treatment will pull out some of the small weeds, cover up others, and will not pull out many alfalfa plants because of their long tap root.

When practicing clipping, judgment must be exercised so as not to set the mower too close to the ground, because

the plant should not be cut off below the lowest branch. Early mowing is therefore better, because the tips will then be removed, which will cause a branching of the plants and a more vigorous growth. We must remember that the young growing alfalfa plants require quite a top growth to balance the root development. Too close mowing will disturb this balance and many plants will die outright or be so decreased in vigor as to be unable to survive the summer. Harrowing after clipping is beneficial, and recommended. The field should be allowed to go into the winter with from eight to ten inches of growth as protection.

Cultivation is as beneficial to an alfalfa field as to a cultivated crop. Continuous mowing and travel compacts the soil to such an extent as to interfere with proper ventilation. Often it is necessary to drive and work on the ground when it is not in fit condition, and this continued for a few years has a very compacting effect on the soil. The disk harrow is used very widely and recommended for cultivating after the first year. The disking should be shallow the first years and the angles of the pitch should be such as not to turn the soil. It may, therefore, be necessary to weigh it down so that it will penetrate the soil to a depth of two inches. Good results have been obtained by disking the second and third years early in the spring or after the removal of the first crop. As long as the plants are under three years a single disking is sufficient every year; however, following this, two cultivations are preferred. The smoothing harrow should follow the disc in order to level the field again.

On the irrigated soils, in the western part of the state, the waters are often heavily laden with silt and clay, which settles on the surface soil, packing and baking, thus excluding air from the roots. Stirring and loosening this soil is therefore very beneficial. In many fields there is quite often a mulch of leaves, weeds and stalks left lying loosely on the surface, which can be incorporated with the surface soil by disking and harrowing. Such treatment will leave the soil more open

and porous. Various insects which harbor among the alfalfa crowns and eggs which have been deposited in the soil and among the roots and refuse will be exposed to detrimental conditions. The extent of controlling weeds and insects is hard to estimate, since no exact experimental data is at hand.

Alfalfa does not spread nor cover the ground after the stand becomes thinner, as grasses or clovers. Whenever a plant dies, such a place is left vacant, and either weeds make their appearance or the surrounding plants grow with increased strength and vigor to utilize the empty space. In such instances disking has good effects in cutting out the weeds and splitting the alfalfa crowns. One root stalk with only a few branches can be made to throw out many more, and the hay crop will not be appreciably decreased.

The common disc harrow is widely used for cutting up an alfalfa field; however, another implement seems to be more beneficial and satisfactory. This new tool, instead of having continuous edge discs, has strong sharp teeth from the axle of the disc, which do not cut, but dig and tear loose the soil. There is no danger of cutting off any alfalfa plants, but on the other hand, it is not so apt to split the crowns.

It seems best to cultivate as soon as moisture conditions in the spring will permit, or after the first cutting of hay. If a single cultivation does not loosen up the soil sufficiently, a second treatment should be given. The cultivation may be both lengthwise, with the disc lapping one-half, or the second disking may be done crosswise. The latter treatment, if not well harrowed, has a tendency to leave the soil thrown in little blocks, yet a good harrowing or dragging will level the field. It is important that the harrowing should be thorough with either method of soil treatment. A single stirring of the surface may be sufficient during one year, although another can be given with profit, depending of course upon the condition of the field. Ofttimes it may be found that a good harrowing after the second crop is removed will be all that is required.

HARVESTING

There are a few localities where it is almost impossible to harvest alfalfa unless some of it is injured by rains. In fact, some good farmers say they will not grow it because of this. However, another grower has said that he never lost a crop in eight years' experience of alfalfa growing. These men are both living in the eastern part of South Dakota. The grower must plan his spring and summer work with reference to taking care of the hay crop.

The best time to cut alfalfa is when about one-tenth of the blooms are out, or if an examination is made at the base of the stalk new shoots are seen to make their appearance. Many times it is even practical to cut the first crop a few days earlier, especially if a large acreage is to be harvested. Time is one of the controlling factors in taking care of the hay. So that it is necessary for the grower to exercise judicious planning so as to utilize his time to better advantage.

It is a good plan to start the mower as soon as the dew is off in the morning and the prospects seem good for two or three days continued good weather. This hay should be tedded in the swath in the afternoon, so that it will dry out underneath. The side delivery rake is good, in fact the ideal machine to turn the hay. Beginning on the outside of the field, the hay is carried further out, leaving an open space which will be heated by the sun before the next round is made. On turning the next swath the dry hot stubble and soil will quickly draw the moisture from it, therefore the hay is curing from below as well as from above. The following morning the same rake is used as soon as the hay is sufficiently dry, and two swaths put in one, and in the afternoon it is ready to be stacked or hauled into the mow. Ofttimes when the crop is very heavy, it is best first to put into small cocks and left to cure for a few days.

The following method is practiced, and lends itself admirably to taking care of a hay crop if it is not too heavy.

The mower is run late in the afternoon, when not much wilting will take place and when the undergrowth is perfectly dry. The advantage of this over the early morning is that the soil is warm and dry, and that less surface is exposed to become wet by dew than when alfalfa is standing. The hay is turned in the following morning just before noon, and will be ready to rake and stack in the middle of the afternoon. Another plan is to rake in the afternoon and put it up in small cocks, turning these over the following day, replacing these two into one, and letting them cure for a few days before stacking. It is of the greatest importance that the hay be absolutely dry from dew before putting it into the barn or stack. Alfalfa is more difficult to cure properly than the grasses, because the leaves fall off so readily, and when we consider that these make up from forty-eight per cent of the crop by weight, their true value is very significant.

Whenever a late frost catches a crop and the tops turn yellow, it should be mowed at once, because the stalks will make a more rapid growth. The frozen parts of the plants will also discolor the hay, reducing its market value. The second and third cuttings are more easily taken care of, because the weather is more settled at that time. Hay cut late in the afternoon may be put up without hesitation whatever, as far as its feeding value or market value is concerned.

SEED

Many sections of South Dakota seem ideal from all view points of producing good alfalfa seed. The preliminary attempts in this direction seem to justify that it will prove an industry worthy of the most careful thought of our farmers. One factor of prime importance is that the available moisture supply be somewhat limited at the time when alfalfa is in bloom and seed is forming. Such conditions are apt to prevail during the growth of the second crop, as this is usually left for seed. Good indications for a heavy seed crop are strong, vigorous branching plants, not too rank growth, and

a uniform blossoming period. The experienced grower may think that he can tell fairly well what the seed crop will be even with the first growth, casting his predictions and conclusions on the blooming and the bees. However true that may be, the best seed producers say one is never absolutely sure what the crop will yield until it is well set in.

While bumble and honey bees are capable of fertilizing alfalfa, their visits do not necessarily seem essential to pollination. It seems certain that other insects, especially those of nocturnal habits, play a very important point. The Kansas Experiment Station reports that where plants were screened so as to exclude insects, little or no seed was produced, while on adjoining plants it grew abundantly. This seems evidence in favor that insect pollination is needed and that alfalfa is not a self fertilizing plant.

The seed should be harvested when the pods are yet a little in the green stage. The greater portion of the pods should not be permitted to change to more than a yellowish or golden color, or else the seed will shatter. The field should be examined from day to day, and when some of the earliest pods are bursting open and most of them are yellow, it should be harvested at once. Alfalfa for seed can be handled with a mower and left to dry well in the windrow, but it should be raked during a cloudy day early in the morning or late in the afternoon. It can be put into cocks and threshed after drying out well, or threshed from the windrow. The binder may be used for harvesting alfalfa for seed, and then the sheaves can be shocked as flax. The later handling will be facilitated when the binder is used, whereby the expense of labor is saved. Until within a few years the threshing was done with the common threshing machine, which proved only a partial success. Recently clover hullers have been introduced which have given most satisfactory service, and will probably revolutionize the seed production. With a good self-feeder attachment, the expense and labor connected with threshing the alfalfa may be simplified in a great measure.

The straw is usually so stiff that it makes it extremely difficult to feed by hand. A yield of from four to six bushels is not uncommon, but rather seems a fair average; occasionally ten or twelve bushels per acre are harvested. The seed produced west of the Missouri river is of good quality and comparatively free from weeds. When the first crop is used for hay, the second meets the conditions best and is the crop harvested for seed.

VARIETIES TESTED

The following varieties mentioned in this test were seeded in 1906:

S. DAK. No. 1—From Utah, non-irrigated. Seed was received from the Bureau of Plant Industry as S. P. I. No. 12409.

1908—Gave two crops. The yield was 3,500 pounds, 1,500 and 2,000 pounds respectively.

1909—Only one crop was harvested.

S. DAK. No. 2—Turkestan. Seed received from the Bureau of Plant Industry as S. P. I. No. 11211.

1908—The total yield was 3,500 pounds; 1,350 and 2,150 pounds respectively.

1909—Only one crop was harvested; 4,100 pounds.

S. DAK. No. 5—From Poitu, France. Seed received from the Bureau of Plant Industry as S. P. I. No. 12695.

1908—The yield this year was 2,350 pounds; 1,200 and 1,150 pounds respectively in the two cuttings.

1909—Only one crop was harvested; 3,700 pounds.

S. DAK. No. 6—From Billings, Montana. Seed received from the Bureau of Plant Industry as S. P. I. No. 12747.

1908—Yield, 3,700 pounds. First cutting, 1,700 pounds; second cutting, 2,000 pounds.

1909—Only one crop was harvested; 3,450 pounds.

S. DAK. No. 7—From the Panhandle in Texas. Seed received as S. P. I. No. 12801, from the Bureau of Plant Industry.

1908—Two cuttings were made, yielding 3,500 pounds. First crop, 1,900 pounds; second crop, 1,600 pounds.

1909—One crop was cut; 3,750 pounds.

S. DAK. No. 23—From Northern Montana. Seed received as S. P. I. No. 12816 from the Bureau of Plant Industry.

1908—3,300 pounds was the yield from two cuttings; 1,850 and 1,450 pounds respectively.

1909—Only one crop was cut. The yield was 3,750 pounds.

S. DAK. No. 9—From Nebraska. Seed was received from the Bureau of Plant Industry as S. P. I. No. 12820.

1908—Two cuttings gave a yield of 3,850 pounds. First crop, 1,850 pounds; second crop, 2,000 pounds.

1909—Only one crop was cut, giving a yield of 3,450 pounds.

S. DAK. No. 10—From New York. Seed received as S. P. I. No. 13291 from the Bureau of Plant Industry.

1908—3,800 pounds was the yield from two cuttings; 2,200 and 1,600 pounds respectively.

1909—One cutting gave a yield of 3,000 pounds.

S. DAK. No. 11—From Khartov, Russia. Seed received as S. P. I. No. 13858 from the Bureau of Plant Industry.

1908—Gave a yield of 4,250 pounds; 2,500 and 1,750 pounds respectively.

1909—3,450 pounds was the yield for one cutting.

S. DAK. No. 12—Home grown seed.

1908—3,850 pounds was the amount from two cuttings; 2,300 and 1,550 pounds respectively.

1909—Only one crop was cut, giving a yield of 3,100 pounds.

S. DAK. No. 13—From Simbrisk, Russia. Seed received from the Bureau of Plant Industry as S. P. I. No. 13,857.

1908—Two cuttings gave a yield of 2,800 pounds; 1,700 and 1,100 pounds respectively.

1909—One cutting, yield 2,800 pounds.

The longest period that any one plot of alfalfa has been growing at the Agricultural Experiment station is at the substation at Highmore.

Turkestan (*Medicago sativa* var. *turkestanica*) was sown in 1899 at the rate of 25 pounds to the acre; seed from Section of Seed and Plant Introduction, No. 991; sown May 21st; sprouted and up May 27th; made a fine growth up to July 4th; badly damaged by hot winds July 15th to 20th; six to ten inches tall July 1st. It did not grow any taller. It was still alive and fresh October 24th.

This is the original importation brought from Turkestan in 1898 and 1899 by Professor N. E. Hansen as agricultural explorer for the United States Department of Agriculture.

1900—Wintered in good shape, and by April 14th was one to two inches high. By May 15th it was eight to ten inches, and beginning to dry up. It did not grow after May 15th, and was mowed July 10th. It began to grow again in August, and by September it was twelve to sixteen inches high. It was mowed September 20th. The weight of forage was 1,100 pounds per acre.

1901—Started April 12th. May 1st, eight inches high; June 1st, the east side of the plot was twenty inches high; west side, which is on higher ground, eight to ten inches high. Badly damaged in May and July by dry weather, but started up again in August and September. The yield was 1,000 pounds.

1902—No record.

1903—The yield of hay was 3,060 pounds. The first crop was 2,080 pounds, and the second crop 980 pounds.

1904—The yield of hay this year was 1,672 pounds. Only one crop was harvested.

1905—The yield of hay was 3,560 pounds. Two crops were cut, yielding 2,148 and 1,412 pounds respectively.

1906—4,132 pounds was the yield of two crops. The first crop was 2,880 pounds, while the second one was 1,252 pounds.

1907—No record.

1908—This year gave the largest yields of any of the years since the test was started—5,320 pounds. The first crop was 2,624 pounds, and the second 2,696 pounds.

1909—Only one crop was cut, and the yield was about 2,000 pounds.

The forage work was extended last year, and now includes six thousand five hundred plants of alfalfas received from Professor N. E. Hansen of this Station. The seed of these plants was secured by Professor Hansen in his several trips into Siberia, Russia, and other countries as an explorer for the United States Department of Agriculture.*

The following is a brief history of the seeds and where obtained:

S. DAK. No. 35—*Medicago ruthenica*—S. P. I. No. 24451. Same source as S. P. I. No. 24456. This is a favorite wild forage for the stock kept by the Mongolian nomads of Eastern Siberia. It is a native of stony and sandy regions of Siberia, extending east to the region of Lake Baikal, and into China.

S. DAK. No. 36—*Medicago sativa* (*Turkestanica*)—S. P. I. No. 20711. Seed originally from Tashkent, the capital of Russian Turkestan. Professor Williams of the Moscow Agricultural College has found this strain very hardy and very productive.

S. DAK. No. 38—*Medicago media*—S. P. I. No. 20714. Originally from a single plant growing wild in the Voronezh province of the central Volga river region, Russia. It is a natural hybrid of *Medicago falcata* and *Medicago sativa*, and found wild in the dry steppes. Sometimes has blue flowers.

* His preliminary report of the "Wild Alfalfas and Clovers of Siberia, with a Perspective View of the Alfalfas of the World," was published May 28, 1909, as Bulletin 150, Bureau of Plant Industry, United States Department of Agriculture. A copy may be obtained by sending money order or cash, ten cents, to the Superintendent of Documents, Government Printing Office, Washington, D. C.

on one branch, yellow on another, and sometimes both colors on the same branch. This seed was secured from Professor Williams.

S. DAK. No. 39—*Medicago media*—S. P. I. No. 20716. A sand lucern or hybrid alfalfa (*Medicago media*) descended originally from a single plant found wild on the steppes of the Voronezh province, southeastern Russia. The flowers are called black-green, but are really a very dark purple, changing to a rich green with dark purple veins; plant of strong, very upright growth; a heavy seeder here the past two years.

S. DAK. No. 40—*Medicago falcata*—S. P. I. No. 20718. Plants found wild at Omsk in western Siberia. Very green early in the spring; endures severe drought; does well upon soils underlain with hardpan; somewhat resistant to alkali.

S. DAK. No. 41—*Medicago falcata*—S. P. I. No. 20719. Same source as S. Dak. No. 40. Seed picked from wild plants late in the fall when there was a little snow on the ground. Latitude 55 degrees.

S. DAK. No. 42—*Medicago falcata*—S. P. I. No. 24452. Picked a few miles from Obb, Tomsk province, where the Obb river crosses the Siberian railway. One of the most characteristic and dominant plants of the open steppes in Tomsk province, western Siberia. Highly regarded by the peasants as a pasture plant and for hay.

S. DAK. No. 43—*Medicago falcata*—S. P. I. No. 20724. Seed gathered from plants growing wild at Tomsk, Siberia.

S. DAK. No. 44—*Medicago falcata*—S. P. I. No. 24452. Seed gathered from north of Irkutsk, near western shore of Lake Baikal, eastern Siberia, and extending to a hundred miles north, among the Buriates.

S. DAK. No. 45—*Medicago falcata*—S. P. I. No. 20720. Picked from a load of wild hay brought in by the Buriats, native Mongolians, to the hay market at Irkutsk, on Lake Baikal, eastern Siberia.

S. DAK. No. 46—*Medicago falcata*—S. P. I. No. 20725. Sample of the third generation under cultivation by Professor Williams. Seed obtained from wild plants in the Don province of the lower Volga river region of southeastern Russia.

S. DAK. No. 47—*Medicago falcata*—S. P. I. No. 20717. Found wild in the Khartov province of southeastern Russia.

S. DAK. No. 48—*Medicago falcata*—S. P. I. No. 20726. Seed obtained from wild plants in the province of Samara in the northern Volga river region of extreme east European Russia, on the edge of Siberia.

S. DAK. No. 49—*Medicago falcata*—S. P. I. No. 20721. Found wild in the Samara province of the northern Volga region of extreme east European Russia, on the edge of Siberia.

S. DAK. No. 50—*Medicago falcata*—S. P. I. No. 20722. Found wild in the Saratov province of central Volga river region of eastern Russia, adjoining Siberia.

S. DAK. No. 51—*Medicago falcata*—S. P. I. No. 24455. This seed was gathered on the east bank of the Irtysh river, about ten miles north of Semipalatinsk, western Siberia. Plants with stems five feet eight inches long were found. Of erect habit. Both as growing in the wild pasture and as hay, the plant is well liked by stock.

S. DAK. No. 52—*Medicago falcata*—S. P. I. No. 20719. This seed was found wild on the open steppes at Omsk, Akmo-linsk province, western Siberia.

S. DAK. No. 53—*Medicago falcata*—S. P. I. No. 24451. Seed gathered in almost pure sand at Station Charonte, in an arm of the desert Gobi, a few miles from Chinese territory, on the Siberian railway. This region is marked by extremes of heat and cold, and especially by the fact that often cold sufficient to freeze mercury is experienced with no snow on the ground.

S. DAK. No. 54—*Medicago media*—S. P. I. No. 20571. The native alfalfa taken from the twenty year old fields near Ultuma, near Upsala, Sweden, about sixty (60) degrees north latitude. Possibly there is some *Medicago falcata* mixed with it, as both are found in the same vicinity.

All varieties have stood the hard winter very well.

This is plant row work with the varieties described above, In addition to the plant row work, investigations are in progress along the following lines: Rate of seeding at different times and under different conditions as regards nurse crops; value of disking, harrowing, etc., of fields that are well set: test of seed from different sources.*

* In the spring of 1910 Professor Hansen suggested the following names: S. D. No. 35, Gobi Desert; S. D. No. 38, Cossack; S. D. No. 39, Chernoo; S. D. No. 41, Omsk; S. D. No. 42, Obb; S. D. No. 49, Samara; S. D. No. 54, North Sweden.