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ALFALFA ON SANDY LANDS

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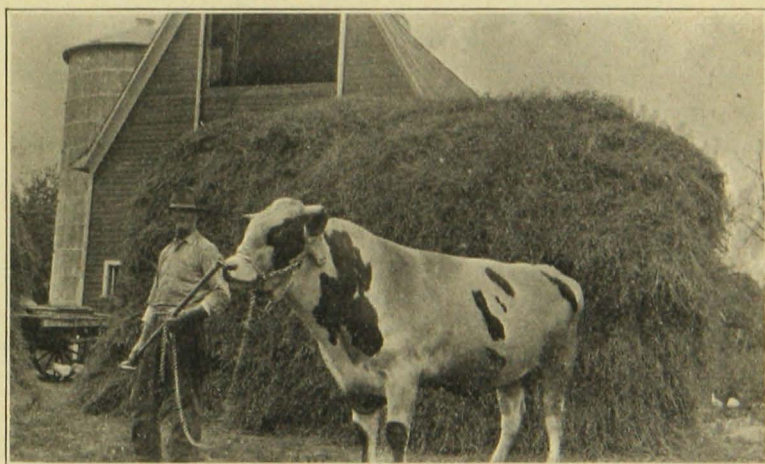


Fig. 1. Alfalfa Hay, Silage, and Good Livestock, a Winning Combination on Sandy Lands

On the very sandy lands of Anoka, Isanti, Chisago, Sherburne, and adjoining counties, on other lands of similar character, and on lands not so sandy elsewhere in the state, the production of profitable yields of crops is limited very largely by: (1) The lack of available water throughout the growing season; (2) A shortage of organic matter and plant foods, particularly of nitrogen in the form of nitrates; (3) Damage to small plants of the newly seeded crops by wind-blown sand.

This bulletin tells of the efforts of J. H. Craft, of Zimmerman, Sherburne County, Minn., in co-operation with the Division of Agronomy and Farm Management, to overcome the obstacles mentioned to the extent of making a real success of farming on this type of land.

Mr. Craft had no previous farm experience. The south eighty of his farm was purchased in 1901. He has lived on this since 1909. The north eighty was purchased in 1910 and the middle eighty in 1920.

LOCATION OF FARM

The farm is located in sections 24 and 25 of Range 35, Township 27, (Blue Hill), Sherburne County, Minn. This is two miles straight west of the only brick schoolhouse (District No. 50) on state trunk highway No. 18 (Scenic Highway) between Elk River and Princeton. The schoolhouse is located in the southeast corner of the cross roads four miles north of Zimmerman and approximately $4\frac{1}{2}$ miles south of Princeton. The farm is located on the west side of the first north and south road after leaving the main highway.

DESCRIPTION OF FARM

The soil surface is described as wind-blown fine sand. The subsoil is for the most part fine sand. The water table (the depth at which free water stands) is from 12 to 15 feet below the surface, varying on different parts of the farm, as the surface is rolling. Before they were brought under cultivation the fields were covered with low-growing red oak and underbrush.

While the lands on this farm now have the advantage of applications of manure, many of the stands of alfalfa were secured when the land was in the same condition as the majority of the farms in the sandy land areas. Even now the higher locations offer much the same obstacles to securing stands of alfalfa as are found on many of the farms in the sandy land areas.

PUTTING THE FARM BUSINESS ON MORE STABLE BASIS

By the spring of 1911, Mr. Craft had come to the conclusion that the keeping of livestock was essential in order to carry on farming operations successfully, but owing to the uncertain supply of leguminous hay that he had been able to produce, he could not see his way clear to follow out that type of farming. In the winter of 1911 he came to University Farm to learn whether there might be a crop that would help him solve his difficulties.

Alfalfa Recommended

Basing the recommendation on successful results in securing stands of alfalfa on the sandy lands underlaid by gravel on the prairie south of Monticello, Wright County, during the extremely dry summer of 1910, Mr. Craft was advised to sow Grimm alfalfa on his farm after properly inoculating the seed. Grimm alfalfa was recommended because it was hardy enough to live and produce crops under adverse conditions when common alfalfa failed.

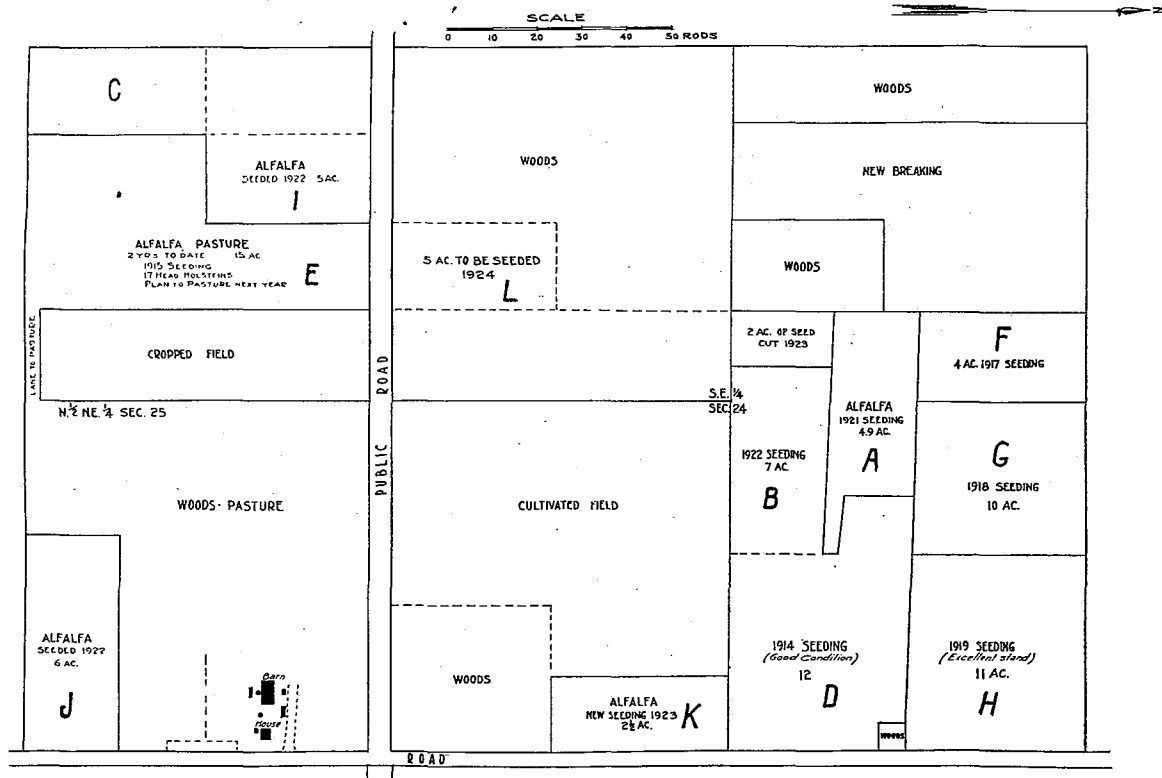


Fig. 2. Location of Alfalfa Fields on the Farm, with Size and Dates of Seeding

At that time the price of 40 cents per pound for pure Grimm alfalfa seed seemed very high to Mr. Craft, but he ordered 10 pounds from Henry Peterman, of Waconia, in May, 1911, and later purchased an additional amount.

Henry Peterman obtained seed for his original planting direct from Wendelin Grimm, which leaves no doubt as to its genuineness.

Clover Fails—Alfalfa Succeeds

Clover had been tried each year but was found not to be a dependable crop. Mr. Craft seeded clover with grain in the spring. This is the only practical way of seeding clover in Minnesota, for when sown without an accompanying grain crop the weeds frequently are thicker than the grain. The clover plants started all right and frequently made considerable growth during the early part of the summer, but in about four years out of five it disappeared during the summer because sandy lands planted to grains or other crops which are not cultivated dry out rapidly unless rains are frequent and moderately heavy. While young clover plants have taproots and grow down to a considerable depth in the soil, the root is almost always more or less branched and grows downward too slowly to keep the end in moist soil.

When prolonged drouths occur, the grain and clover plants use up the available moisture in the upper two or three feet of the sandy soil more rapidly than the young clover root can grow downward, with the result that the clover plants die out for lack of water. Even if light rains wet the ground to a depth of a few inches, this moisture frequently disappears rapidly again and therefore does not save the plants.

Young alfalfa plants, on the other hand, growing in a very compact seedbed are able to force their tap roots downward more rapidly than can the clover plants and therefore, using the needed water as they go, the lower part of the root is always in moist soil and the plants are able to withstand the prolonged drouths which usually prevail on these sandy lands in summer.

The roots of alfalfa plants from July, 1923, seeding in the north center eighty had roots from 3 feet 6 inches to 4 feet 6 inches deep when dug on October 6. The upper 2½ to 3 feet of sand at that time was dry. The young alfalfa roots had penetrated beyond the dry layer approximately one foot into the moist sand below. They were not suffering for moisture. Shallower rooted plants were dead.

Plants from the 1922 seeding on the north eighty had roots varying from 5 to 5½ feet long. The upper 3⅓ feet of sand was so dry that dust could be blown from it. The soil below that contained considerable moisture.

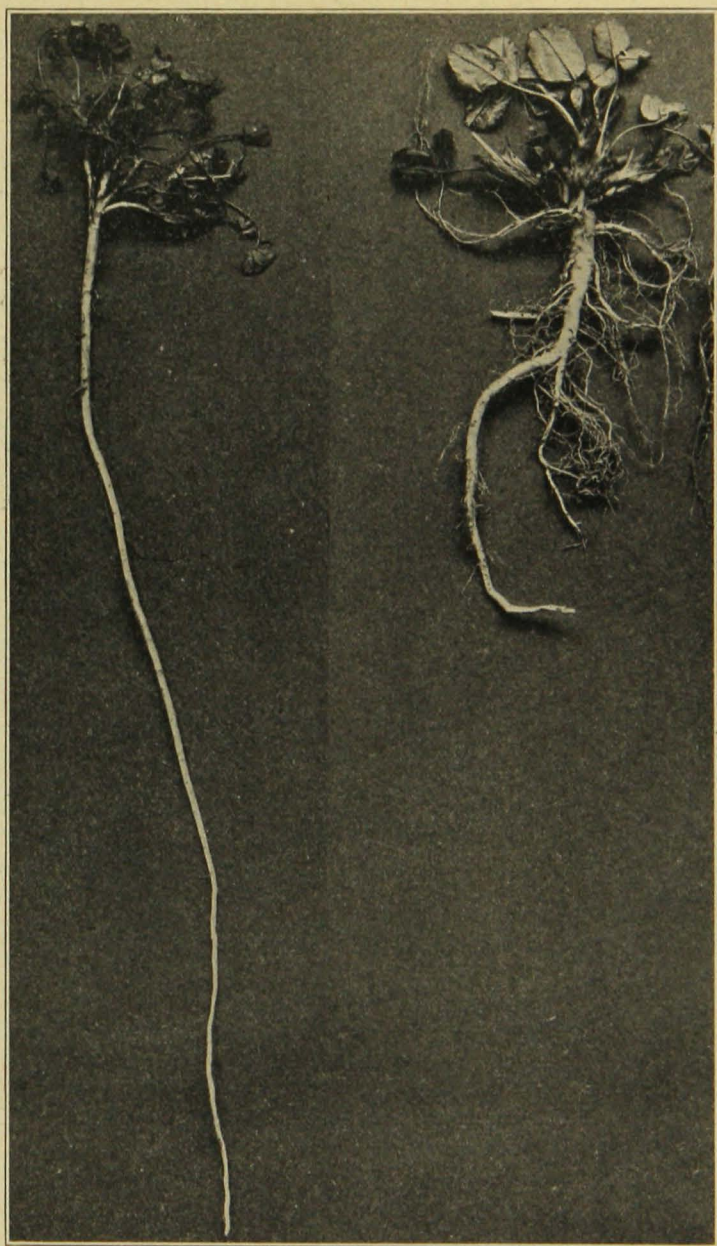


Fig. 3. Roots of Red Clover and Alfalfa Plants

This shows the tendency to branch and the shortness of root of a clover plant (right) as compared with the root of alfalfa plant (left). Seed of both were planted at the same time on adjoining plots. (Courtesy of Wisconsin Agricultural Experiment Station.)

No plants from the 1921 seeding were dug, but the roots of the plants in the 1919 seeding on the north eighty were down to the water table, 12 feet below the surface.

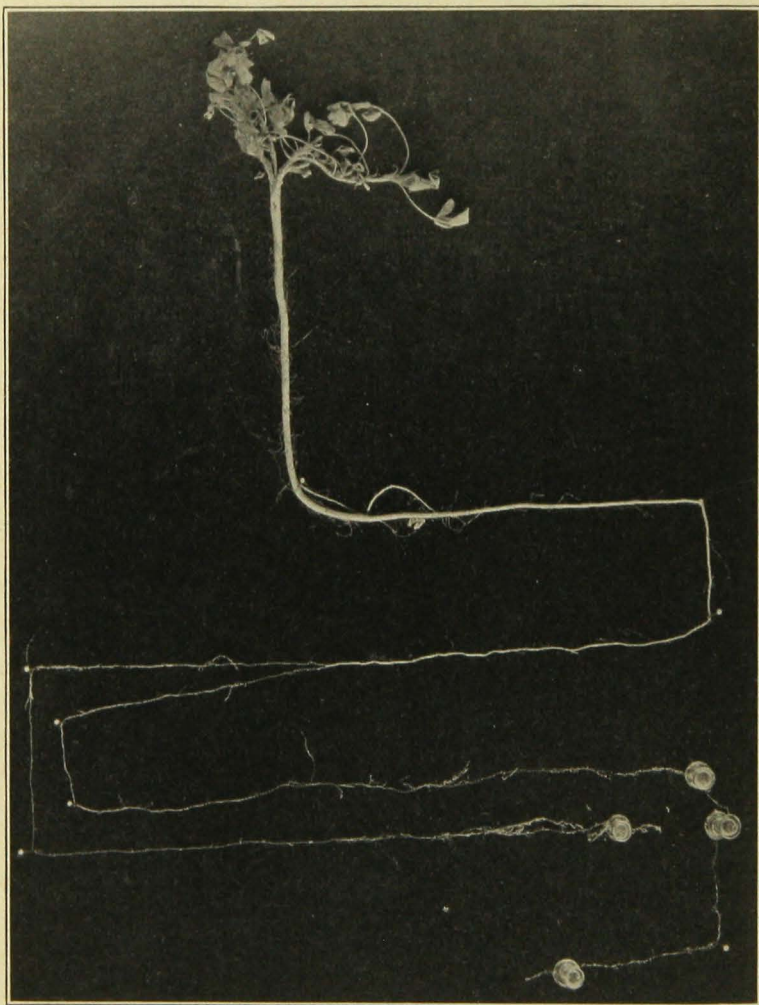


Fig. 4. Alfalfa Plant from July, 1923, Seeding on Center Eighty, Craft Farm, Dug on October 6, 1923.

The root had penetrated soil to a depth of 3 feet 6 inches.

Alfalfa roots grow downward rapidly in the first season and continue downward to the water table as the plants grow older, thus making it possible for alfalfa to make a stand when clover fails and to make some growth on these sandy lands even when drouths are so severe as seriously to injure or kill well established red clover plants. This habit

of growth, together with the fact that the plants are perennial, adapts alfalfa to sandy lands, particularly where the water table is not too far beneath the surface.

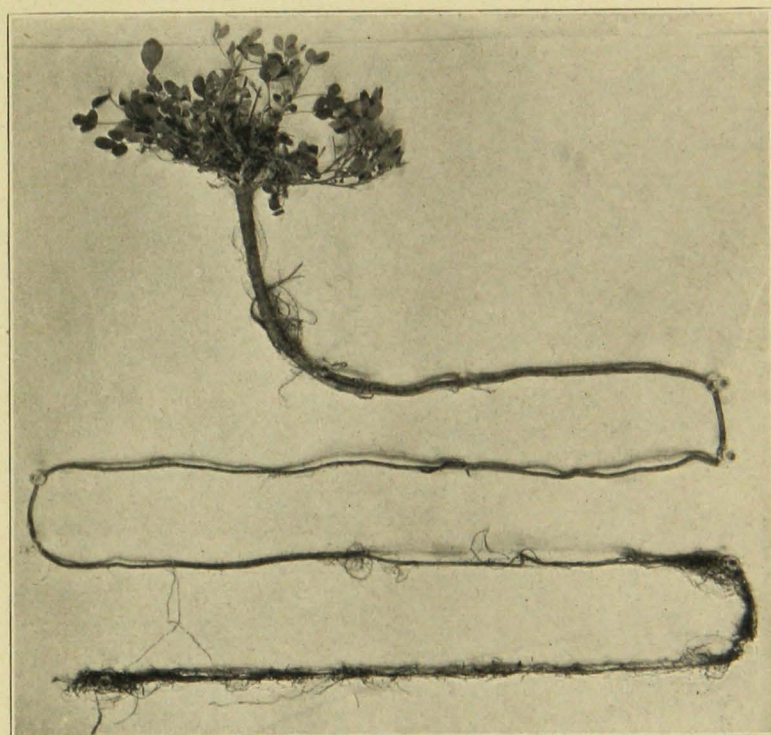


Fig. 5. Alfalfa Plant from 1922 Seeding on North Eighty Dug on October 6, 1923, at a Depth of 5 Feet 6 Inches

Alfalfa May Increase Organic Matter and Nitrogen Supply

The shortage of organic matter, which improves the physical condition of sandy land and in decaying releases nitrogen particularly which is needed to produce good yields of such crops as rye, oats, corn, and potatoes, has been mentioned as one of the obstacles to success.

Well inoculated alfalfa plants obtain a very large part of the nitrogen needed for growth from the air, where the supply is inexhaustible. Uninoculated plants are entirely dependent on the nitrogen in the soil for their supply. In sandy lands this is so low that the plants make a very weak growth or die.

On black loam soil attention to this detail increased the amount of nitrogen in alfalfa hay in one cutting from 11.95 pounds per acre on uninoculated soil to 105.3 pounds per acre on inoculated soil. In the same test the increase in the pounds of nitrogen in the roots to a depth

of 12 inches was from 3.83 pounds in uninoculated soil to 32.6 pounds in inoculated soil. Still greater increases than these may be expected from thoro inoculation on sandy lands.

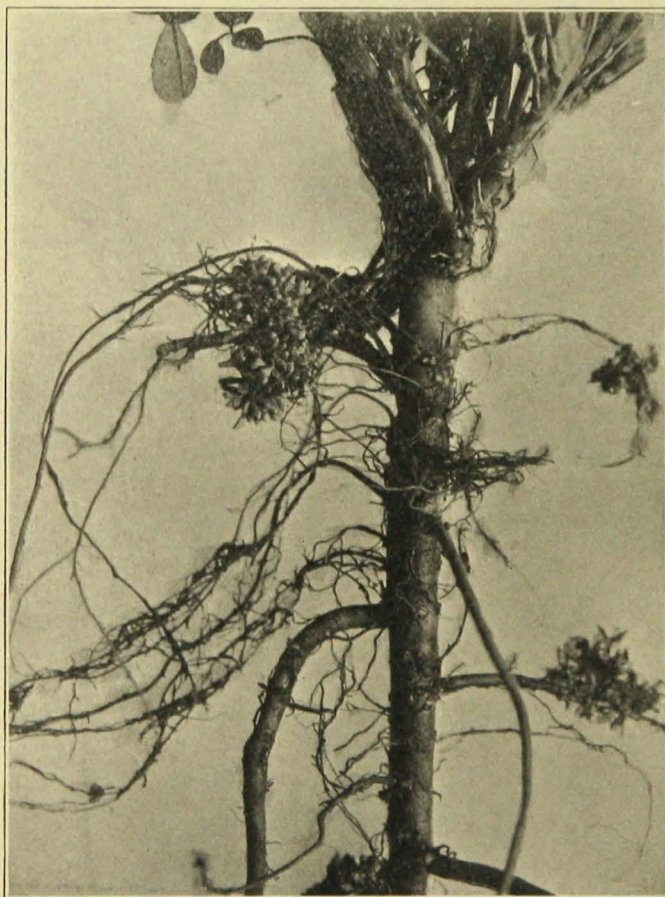


Fig. 6. A Well Inoculated Alfalfa Plant

Note the large bunches of nodules on the fleshy roots. The bacteria live in these nodules.

Inoculation is necessary in order that alfalfa may get a start, and it enables the plants to make a much more vigorous growth. On medium heavy black loam, the yield of dry hay at one cutting from inoculated alfalfa was 4143 pounds per acre as compared with 796.8 pounds from uninoculated alfalfa; the weight of the roots to a depth of 12 inches was 1510.6 pounds per acre for inoculated alfalfa and 541.3 pounds for uninoculated alfalfa.

Alfalfa from well inoculated fields, fed to livestock and the manure returned to the same field, may bring about material increases in both

the organic matter and the nitrogen. When the alfalfa plants are plowed under, the organic matter of the roots and stubble aids further in improving the fields for other crops, increasing the water-holding capacity and lessening the danger from blowing.

Methods of Securing Alfalfa Stands

The methods of securing stands have been changed gradually with experience. The high cost of the seed and the labor cost of preparing the seedbed make it important that all essential details be given proper attention so that good stands are secured as often as possible.

Lime

Water passing down through sandy soil carries the surface lime to lower depths, out of reach of young plants. Therefore the surface layers of sandy lands are very frequently acid. This condition makes it difficult or impossible for alfalfa seedlings to get a good start and maintain growth until the roots get down to the lime. For this reason the majority of sandy land fields need applications of lime for alfalfa.

Tests show that the fields on this farm are only slightly acid and therefore no lime has been used. However, marl and ground limestone will be applied at the rate of 2 tons per acre to both old and new seedings in 1924 in order to learn whether they will increase yields.¹

Grimm Alfalfa Used

None but genuine Grimm alfalfa has been used on this farm. There have been no serious losses of stands from winter-killing except in one instance, where the stand was pastured very close in the fall. From the standpoint of permanency of stand for hay production alone, it has been a paying proposition to use only the best Grimm seed available even at a higher price than for seed of doubtful origin.

Inoculation

When the first seed was purchased, in 1911, 300 pounds of inoculated soil was obtained with it. This was scattered broadcast and harrowed in immediately. Soil from the original seeding made on the south eighty and on Field A, in 1911, was broadcast on fields sown later. The alfalfa in all the fields except the west field on the south eighty, Field I, sown in 1922, is well inoculated. Thoro inoculation has been one of the most important factors leading to successful stands; and the necessity for always paying the strictest attention to this detail on sandy lands can not be over-emphasized.

¹ Information regarding the sources and amounts of lime to apply may be obtained from the Division of Soils, University Farm, St. Paul.

Successful inoculation may be had by mixing equal amounts of seed and finely sifted dry inoculated soil. The seed should be moistened with water before mixing it with the soil. So important is thoro inoculation that it often pays to use both commercial inoculants and soil.

On this farm where the fields to be sown to alfalfa have been near the old ones, several hundred pounds of soil have been taken from one of the old fields and spread at seeding time on each acre to be sown. This has been harrowed in as soon as spread.

Preparation of Seedbed and Seeding

Alfalfa has usually been sown following corn which has been manured. Any parts of the fields which have not produced good yields of corn were manured again before they were plowed for alfalfa.

Several of the stands now on the farm were secured by seeding the alfalfa with a light seeding of oats in spring, but this is too uncertain a practice to follow. When sown early in spring, the alfalfa plants grow slowly during the cool weather but the weeds grow rapidly. The weeds usually occupy the ground and poor stands of alfalfa are secured.

During the last few years the practice of seeding in late June or early July on a clean, well-packed seedbed was followed. The ground was plowed in late May or early June and kept clean until planting time. It was then packed hard, the harder the better. The corrugated packer is very essential in bringing about the desired results. When the soil was packed so hard that the heel made a mark in it with some difficulty, the seedbed was considered sufficiently hard.

The seed was then broadcasted evenly at the rate of from 10 to 12 pounds per acre. Most of it falls or rolls into the shallow furrows made by the packer. The ground is then harrowed lightly crosswise of the packer furrows and is again packed but in the opposite direction.

Injury to young alfalfa plants by blowing sand may be prevented by drilling from 15 to 20 pounds of buckwheat per acre across the direction of the winds that usually do the damage, before packing the land. Drilling the buckwheat in strips, leaving unsown strips of equal width between, will accomplish the same results. The roots of the alfalfa plants started in late June or July grow downward so rapidly that the lower parts are continually in damp sand and hence the plants grow well even when the buckwheat plants show very plainly the lack of moisture.

If there is sufficient moisture, the buckwheat will form seed and the crop may be harvested.

If there is trouble from blowing on only small areas on the higher parts of fields, light dressings of manure may be applied to these areas after the seed is sown.

Production of Alfalfa Hay

The main purpose in growing alfalfa was to obtain a dependable supply of good hay. With the exception of years of more than average rainfall, such as 1920, when three cuttings totaling five tons per acre of cured hay were harvested, the practice has been to make two cuttings of hay or one of hay and one of seed each year.

Cutting of the first growth, which was usually the most luxuriant, has been started about the time the new shoots show at the crown or when the plants are one-tenth or more in bloom. This is usually about June 15, but varies with the season. On account of the large acreage, the last fields were usually in full bloom before cutting.



Fig. 7. Corrugated Packer

A necessary implement on sandy lands in securing a hard seedbed for alfalfa.

The mower was started after the dew disappeared in the morning. The hay was raked as soon as well wilted, and hauled to the barn or stack before many of the leaves were dry enough to drop. The leaves are the most valuable part of the hay and every effort was made to save as many as possible.

At first the hay was raked, cocked, and loaded by hand. This gave the highest quality but the acreage soon became too large to handle the hay in this way. The side-delivery rake and hay loader are now used regularly.

The first cutting usually averaged from $1\frac{1}{2}$ to 2 tons of cured hay per acre and the second cutting from $\frac{1}{2}$ to 1 ton.

Hay either baled or in bulk has been sold for several years at from \$15 to \$20 per ton. Since alfalfa has been grown, more feed was sold each year from the farm than was purchased. Since alfalfa hay has been available, no bran has been purchased. Some oats have been purchased to grind for the cows and a little oilmeal has been fed.

The horses have been fed alfalfa hay exclusively for the roughage part of their ration for the last eight years.

The alfalfa leaves that accumulate around the hay chute were fed to the hens with excellent results. Considerable quantities were sold to townspeople for feeding to their flocks. Calves eat these leaves with great relish and make excellent gains from them.

Alfalfa Hay and Cows Greatest Factors in Success

Before 1912 only two cows were kept on the farm. In 1913, after a hay supply was assured, a purebred sire was purchased and the herd was gradually increased to 14. In 1920, 5 purebred females were added to the herd.

Each cow fed alfalfa hay, corn silage, a mixture of ground corn-and-cob meal and ground oats, brings a cream check of from \$20 to \$30 per month.

Mr. Craft puts it in this way: "If it hadn't been for alfalfa I wouldn't have stayed on the farm. Alfalfa is the only crop I can depend on for hay every year. I could not afford to keep cows without a dependable feed supply."

Alfalfa Seed Production

All the seed sown on the different fields from 1914 to 1923 was produced on the farm.

The acreage of alfalfa on the farm and the dates of seeding each field are shown on the plan of the farm, Figure 1. Fields A and B were sown in 1911 and 1912, were plowed in 1917, and resown to alfalfa in 1921 and 1922. Field C was sown to alfalfa in 1913, plowed in 1920, and has not been resown. There are approximately 88.3 acres of alfalfa on the farm at present.

Until about 1918, nearby farmers were inclined to be skeptical of the value of alfalfa, particularly when seed was from 40 to 75 cents per pound. Therefore, practically all the seed sold before 1918 was sent outside the county. Since 1918, besides producing enough seed for increased acreages on the farm, seed has been sold to neighbors who have seen the fields and have been convinced that alfalfa has solved the hay problem on this farm.

At Zimmerman, Hartman Camp and Caster Fall have 17 and 3 acres of Grimm alfalfa, respectively; and at Princeton, Fred Hoehn, C. H. Newman, Carl Bender, Mrs. E. G. Griffith, Will Hecker, George Pooth, B. T. Hall, Loyd Boroyne, Rufus P. Morton, and C. E. Webster have from 2 to 40 acres from seed produced on the Craft farm.

Several of these purchased seed for only a small acreage and have increased the acreage from seed produced on their own farms. The

seed was purchased at the rate of 10 to 12 pounds for each acre to be sown.

In 1919, 1100 pounds of clean seed was sold to a seedhouse at 60 cents per pound. Every pound of this seed, instead of going to another part of the state, should have been planted in the sandy lands of Sherburne and adjoining counties.

The unqualified success of alfalfa and the large increase in the acreage on this farm from home-grown seed, and the spread to the farms of neighbors emphasizes the great importance of securing only genuine Grimm seed from the most reliable sources when a start is made in alfalfa growing in the sandy land areas of the state. Some farmers think that they are going to grow alfalfa for hay only and that registered Grimm seed is not necessary. Almost invariably, in the sandy land areas, as the acreage becomes greater seed both for home use and for sale is produced. Hence the importance of securing only genuine registered seed to start with in every instance.



Fig. 8. Mr. Craft in His Alfalfa Field Saved for Seed in 1923

The seed pods show black in the photograph. A few pods are shown natural size in the inset.

Harvesting and Threshing Seed

Some seed has been harvested each year since 1913 with the exception of 1920.

Seed has usually been obtained from the second crop. In very dry years such as 1923 seed was obtained from the first crop only. The seed from the second crop has usually been ready to cut early in September.

The practice has been to cut the seed crop when the majority of the pods have turned dark brown or black. The mower was used when

the growth was very short and the binder when the growth was taller. Cutting the seed crop with a binder is much more satisfactory than cutting it with a mower. The bundles were shocked in pairs, six or eight bundles per shock. The seed was threshed with the clover huller at a cost of \$4 per hundred weight, the thresher furnishing the crew.

Yields of seed have been as high as 2 bushels per acre and as low as 20 pounds.

Alfalfa Pasture

Alfalfa successfully solved the hay problem on this farm by providing a dependable supply in adequate amounts of a high protein roughage for all classes of livestock and a surplus for sale. Adequate and dependable pasture on these sandy lands is as acute a problem in summer as is the hay supply in winter.

Alfalfa has solved in a considerable measure the pasture problem on this farm, but much still remains to be learned regarding the best practices in the use of alfalfa for this purpose.

The practice followed so far was to use for pasture fields from which hay or seed crops were taken for several years and which are to be plowed in three or four years for other crops. An adequate acreage of alfalfa to meet all needs for hay and future pasture has been maintained constantly.

The first alfalfa used for pasture was the oldest seedings on Fields A and B sown in 1911, 1912, and 1913, respectively. This area was pastured in 1917 and the stand was injured by late and close pasturing and was plowed the next spring.

In 1918 and 1919 Field C, sown in 1913, was pastured. This field was plowed in 1920.

In 1920 clover growing on what is marked "cropped field" on the south eighty was used for pasture. A poor stand of clover was secured on one of the fields on the middle eighty in 1920. This field was used for pasture in 1921 but supplied very little feed after July 1. The cattle were fed alfalfa hay from July 1 to the end of the season.

As will be noted on the plan of the farm as given in Figure 1, the 15-acre field sown in 1915 on the south 80, Field E, pastured 17 cows beside the young stock, and horses when not working in 1922 and 1923, and will be used for his purpose again in 1924.

EARLY SPRING AND LATE FALL PASTURING INJURES STANDS

In pasturing the alfalfa it was never used early in spring. The alfalfa was usually 12 to 18 inches high before the cattle were turned in.

There is a silo on the farm and plenty of alfalfa hay. The cows are well fed at all times and do not go out to the alfalfa field the first

day ravenously hungry. For several days after being turned on the alfalfa they are fed well so that when they get into the alfalfa pasture they eat a little and then lie down for a time. The cows are observed closely for the first several days after they are turned on the pasture.

They have the free run of the pasture during the rest of the season. It has been found that cows on alfalfa pasture all day will eat with relish a limited amount of good alfalfa hay when they come to the yard in the evening.

Close pasturing in the fall has been found injurious to the stands and therefore should be avoided on all fields that are to be left to alfalfa the next year.

The growth of from 3 to 4 inches left on the alfalfa field in the fall acts as a protection, delaying alternate freezing and thawing, and holds the snow that falls. A blanket of snow is a very great aid in maintaining a comparatively even temperature both at and underneath the surface during winter and spring.

On other sandy land farms it is recommended that before any fields are used for pasture a sufficiently large acreage of alfalfa be well established to provide all the hay needed throughout the year and to provide pasture for the present and the following year. Then, if the field judiciously pastured this year is weakened or lost, there will still be enough for pasture next year and to provide hay as well.

CARE OF ALFALFA FIELDS

So far no cultivation has been given the alfalfa fields. Plans have been made to use the spring-toothed harrow immediately after the first cutting of hay in 1924, to the extent necessary to dispose of the Kentucky bluegrass that is in the alfalfa fields now.

Pocket gophers are fond of alfalfa roots, and alfalfa meadows and pastures are soon injured materially by these animals unless they are exterminated. There are no pocket gophers in the alfalfa fields of the Craft Farm. They have been exterminated by using a method very similar to that outlined in Minnesota Agricultural Extension Circular No. 14, except that powdered arsenic was used by putting a small amount into a small potato which had been plugged and afterwards the plug returned to place. Seventy-five cents worth of arsenic was enough for two years. From four to five hours each year has taken care of this detail successfully.

EXAMPLE FOR SANDY LAND FARMERS

This very successful farming venture carried on over 12 years on windblown sandy land is a shining example of what alfalfa will do for many families now living in comparative uncertainty and poverty on farms in this area. Actually seeing the prosperous appearance about the buildings on the farmstead and going over the alfalfa seedings made from 1914 to 1923 on a field scale, should convince every family living in the sandy land area that the growing of alfalfa and still more alfalfa is the way to wrest a comfortable living and prosperity out of this sand and still leave it as a desirable heritage to future generations.

Demonstration Days Planned

In order that as many as desire could go over this farm and profit by what may be learned, a series of demonstration days was arranged. The first of these was on October 6, 1923, when a large group of farmers from the county listened to a discussion of the alfalfa crop, observed the depth to which the roots had penetrated as shown in an open pit, and went over the various fields, including the pasture.

Beginning in May or June, 1924, several demonstration days will be arranged throughout the summer and in following summers as long as sandy land farmers can be benefited. The dates at which the demonstrations will be held will be given wide publicity. Arrangements may be made for large groups by addressing the writer at University Farm.

Mr. Craft is a busy farmer, all his time being taken up in caring for his crops and livestock. Therefore, he should in no case be asked to go over the fields with a few visitors. Wait until a demonstration day is announced and then go over the fields in the company of others. Likewise, he should not be expected to answer letters. Questions should be written down and asked on demonstration days so that others may also get the benefit of the information given in the replies.