Alfalfa in Western Oregon

Young alfalfa plant, showing partial development of roots, crown, and stems

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS
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SUMMARY

Place for alfalfa in Western Oregon.

Alfalfa promises to become the most important legume for forage production in Western Oregon and helps materially in reducing the present deficiency of legume forage.

Alfalfa is not advanced to replace red clover or other legumes. All legumes have their specific places in culture and use and should be grown where advantageous production can be secured.

The Willamette Valley and Southern Oregon can and do grow alfalfa for forage successfully. Southern Oregon grows good seed. Successful alfalfa production in the Coast sections is still in the experimental stage.

Seed-bed and its preparation.

Deep, sweet, well drained, mellow soils are best suited to alfalfa. More than 550,000 acres in Western Oregon is potential alfalfa land.

The seed-bed should be fine, firm, moist, and quite free from weeds at seeding time.

Lime applied at one to two tons an acre is an important factor in the success of alfalfa on sour soils. This is especially true in the Willamette Valley and Coast sections.

Seed and seeding.

Grimm has been accepted as the standard variety. It is proving successful under the many varying conditions in Western Oregon.

Domestic seed of high purity and germination and true to variety, rather than foreign seed, should be used.

Spring seedings, made alone, in late April, May, or early June, at 12 to 15 pounds an acre are most successful.

Inoculation is absolutely necessary.

Sow alfalfa shallow—not more than three-fourths of an inch deep.

Treatment of crop.

The stand and growth the first season determine to a large extent the future success of alfalfa seedings. Keep weeds clipped. Do not harvest young alfalfa for forage unless the plants reach the blooming stage. Clip or pasture in the fall so that plants will go into the winter with but little top growth.

Cut alfalfa for hay when 1/10 to 1/4 in bloom or before new shoots start from the crown.

Cure alfalfa so as to preserve the leaves, retain bright green color, have a sweet odor, and be dry when put into the mow or stack.
Alfalfa uses.

Alfalfa produces large amounts of excellent pasture for long periods for all kinds of livestock. It often causes bloat in cattle and sheep.

Alfalfa can be used for silage when impossible to cure it as hay.

Land-plaster and sulfur for alfalfa.

Alfalfa yields are increased by the use of land-plaster and sulfur.

Land-plaster to be most effective should be applied early in March. One hundred to one hundred and twenty-five pounds an acre produces largest increases in forage. Thick stands where heavy yields are obtained will probably use heavier applications.

Sulfur applied at 75 pounds an acre gave the largest hay yields over a period of six years. Comparable applications of land-plaster were not tried. The use of phosphorus and potash resulted in increased hay yields but the increase was not so large or as cheaply produced as where land-plaster or sulfur was used. Fertilizing alfalfa with manure, lime, or any fertilizer containing sulfur lengthens the life of the stands and improves the quantity and yield of forage.

Moving overflow water does not injure alfalfa.

Irrigation of alfalfa.

Alfalfa responds to irrigation. In Southern Oregon irrigation is usually necessary. In the Willamette Valley where irrigation systems can be installed cheaply, larger yields of forage are obtained.

Cultivation of alfalfa results in cleaner, higher-grade hay. The spring-tooth harrow is a good implement to use where the sod is not too heavy. Use disk harrow on heavy sod. Follow either implement with spike-tooth harrow. Cultivate before growth begins.

Pests.

Rodents should be controlled by poison, trapping, or any other feasible method.

The most destructive diseases of alfalfa in Western Oregon are stem rot, leaf spot, and yellow leaf blotch. Use resistant varieties.

Insect damage at the present time is very light in Western Oregon.
Alfalfa in Western Oregon

By

HARRY A. SCHOTH and GEORGE R. HYSLOP

Recommendations in this bulletin are based on field, plot, and nursery plantings at the Oregon Agricultural Experiment Station and on observations in the alfalfa fields in Western Oregon.

The earlier plantings at the College were on upland now known as the Willamette and Amity soil types and were made approximately twenty years ago. The more recent work is on field and plot plantings on the Chehalis and Newberg series, beginning in 1914. The plot work began in 1921, has been continuous, and has been rapidly expanded. The disease nursery was established in 1922.

More legumes necessary. Western Oregon needs more acres of legume crop. Crop production statistics show a low proportion of legume to cereal and other crops. Shipments of legume hay into Western Oregon indicate a deficiency in legume production. Legumes are needed not only to balance our forage needs but to enrich our soils and build our rotations.

It is estimated that there are approximately 550,000 acres in Western Oregon that have suitable soil, fertility, drainage and moisture conditions for the successful production of alfalfa. There are now many successful stands of alfalfa in Western Oregon. With more knowledge of land selection and proper cultural methods many more productive fields will be obtained.

Clovers and vetches, at present our most important legumes, have a wide range of adaptability and are often considered as general utility legumes. They are suited to many conditions. Alfalfa is a more specialized legume requiring more care in starting but being quite persistent when once established.

Alfalfa valuable forage. Because of its forage quality, long period of productivity, and soil-improvement value, alfalfa should be grown wherever possible. No other legume grown competes with it in forage value and length of productive period.

Alfalfa has few rivals as a forage plant. It is one of the best soil improvers, leaving a soil rich in nitrogen and organic matter. Its very extensive rooting system penetrates and opens up the subsoil to considerable depth.

There have been many failures with alfalfa. These may usually be attributed to the wrong soil type, poor seed, or poor preparation for sowing. Soils that are distinctly of little or no value for alfalfa should be used for the other crops. It is better and more profitable to grow a good crop of clover or vetch on a piece of land suited to these crops than to try to grow alfalfa on this same land with chances of failure against it.

It is not recommended that alfalfa should generally replace red clover since both make excellent growth under many similar conditions. Each has a distinctive field. Red clover grows on some land not suited to

Note: Forage Crop work at the Oregon Agricultural Experiment Station is conducted in cooperation with the Office of Forage Crops, Bureau of Plant Industry, United States Department of Agriculture.
alfalfa. It is better in short rotations for forage and seed production. Alfalfa is better on the deep, sweet lands, for forage, and in long rotations. The introduction of Grimm alfalfa and the development of a source of agricultural lime have made alfalfa culture more generally successful.

The Willamette Valley and Southern Oregon can grow alfalfa for forage successfully. Southern Oregon grows good seed; this has been proved, both experimentally and in farm practice. The general successful production of alfalfa in most Coast sections is yet to be demonstrated, although several productive fields have been established.

**DISTRIBUTION AND ADAPTATION OF ALFALFA TO VARIOUS SECTIONS OF WESTERN OREGON**

As shown in Fig. 1, Western Oregon as an alfalfa area may be divided into three sections: (1) the Willamette Valley, (2) the Coast Section, and (3) Southern Oregon, including most of the Umpqua and Rogue River valleys in Douglas, Jackson, and Josephine counties. These sections differ in climate and soil conditions. Different agricultural practices are therefore necessary for success with alfalfa. The basic principles, however, are generally similar and are applicable to each section.

The Oregon Agricultural Experiment Station successfully produced alfalfa on a field basis at Corvallis as early as 1914. The more general production of alfalfa in the Willamette Valley has mostly been within the past seven years, although there were a few successful fields established before that. Interest is rapidly increasing as farmers appreciate the possibilities of the crop.

Along the coast of Western Oregon, the successful growing of alfalfa is still rare. Acid soils, poor drainage, summer rainfall and harvest conditions are such
that few varieties of alfalfa yet tested seem generally suited to the conditions there. Numerous seedings have been made. The most successful have been in the warmer Coast areas on mellow, well-drained bottomland. Often during the first season the growth is sometimes successful. During the second season, however, the stands are usually thin and plants are not thrifty and are so crowded by weeds and grass that little growth is made. An occasional seeding on well-drained, deep, mellow land which has had a heavy application of lime to reduce the acidity has made good growth and produced fair crops. Except in favored spots with mellow, warm, limed soils and less summer moisture the crop does not seem very promising. There are a few areas at considerable distance from the coast and resembling inland conditions where alfalfa has greatest possibilities at present. Any farmer in the Coast Section contemplating growing alfalfa should select only his best-drained, cleanest, deepest soil, apply lime enough to sweeten this soil, use branching-rooted varieties such as Grimm and make certain that inoculating bacteria are present.

Most of the alfalfa in Southern Oregon is grown with irrigation. Many of the soils in this section are suited to alfalfa. These range from the coarse sandy and granitic to heavy adobe types. The areas producing alfalfa are concentrated about irrigation development and the crop is particularly emphasized as it is the best producer of forage to supplement the immense areas of range land in these and adjacent counties. Seed is produced in this section every year. Length of life of stands varies from 8 to 15 years.

ALFALFA SOILS IN WESTERN OREGON

Deep, sweet soils needed. Alfalfa makes the best growth on deep, sweet, mellow, well-drained soils. Deep soils are desirable and necessary because of the deep rooting habits of the alfalfa plants. Alfalfa does not thrive on sour or acid soils. It is never a successful crop where the soils are sour. Mellow soils such as sandy or silty loams are considered the best. They warm readily, make plant food available quickly, promote rapid growth, and are generally well drained and well aerated. In many localities drainage is a limiting factor in growing alfalfa. The crop needs good drainage conditions. It does not do well with roots submerged in water during the growing season. Poor drainage limits the root development and consequently the feeding area of the plants. Wet soils are often cold and sour.

Gravelly, granitic, and rocky soils having good depth, enough fertility to grow alfalfa successfully, and sufficient moisture, either natural or artificial, often produce excellent crops of alfalfa over a period of several years. Such soils, frequently difficult to handle and unsuited to shallow-rooted crops, are increased in crop-producing value if alfalfa can be established on them. Better returns are obtained for less work and they are improved by increased organic matter and fertility.

So many soils of Southern Oregon meet the essential requirements for alfalfa culture that no attempt is made to list all the possible soil types. Alfalfa production in Southern Oregon is more frequently limited by moisture than by the other factors.
In the Coast Section the most likely areas are warm, mellow bottom soils in warm interior valleys.

In the Willamette Valley the soil types best suited to the growing of alfalfa are those of the Hillsboro, Willamette, Chehalis, Newberg, and the lighter types of the Amity series.

Large acreage possible. According to completed soil survey data of some of the counties in the Willamette Valley the number of acres of these types suited to alfalfa is estimated to be as follows:

<table>
<thead>
<tr>
<th>County</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multnomah</td>
<td>34,000</td>
</tr>
<tr>
<td>Clackamas</td>
<td>66,000</td>
</tr>
<tr>
<td>Washington</td>
<td>92,000</td>
</tr>
<tr>
<td>Yamhill</td>
<td>81,000</td>
</tr>
<tr>
<td>Benton</td>
<td>53,000</td>
</tr>
<tr>
<td>Polk</td>
<td>40,000</td>
</tr>
</tbody>
</table>

Soil surveys being incomplete for the other counties the estimated acreages are as follows:

<table>
<thead>
<tr>
<th>County</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbia</td>
<td>18,000</td>
</tr>
<tr>
<td>Marion</td>
<td>55,000</td>
</tr>
<tr>
<td>Linn</td>
<td>55,000</td>
</tr>
<tr>
<td>Lane</td>
<td>70,000</td>
</tr>
</tbody>
</table>

These figures indicate a potential area of more than 550,000 acres of land in the Willamette Valley suited to the growing of alfalfa. Not all this land is immediately available. Large areas are still uncleared. Some needs drainage. Much more will need liming before alfalfa will succeed. There is probably little more than 10 percent of the total cleared acreage suited to alfalfa that could be seeded at once. A large amount of it is, and for several years probably will be, occupied by other crops.

**PREPARATION OF THE SOIL**

Firm seed-bed needed. The seed-bed should be fine, firm, moist and quite free from weeds. It is poor practice to sow on a poorly prepared seed-bed. Such sowing produces a spotted and uneven stand and poor yields for the life of the stand. Land subject to overflow or land inclined to run together or land that has been in cultivated crop during the previous year should be plowed about six inches deep early in the spring, and worked down as soon as possible. The deep workings should be early.

It is often a good plan to drag a float over the land to level it by shearing off high points and back furrows and filling dead furrows and depressions. Leveling simplifies cutting and raking later on. Where the crop is to be irrigated, the land should be well leveled in accordance with the farm irrigation system. From then on until seeding time it should be harrowed at least once every two weeks or often enough to destroy weeds, hold moisture and get it into a fine, firm condition.

Rolling desirable. Just before sowing, the land should be harrowed lightly as a final weed-control measure and rolled if the soil is at all loose. This rolling after the final working is especially important if the surface soil is dry; it results in holding more moisture near the surface, which is important until the roots get down and established. Upland
not in a cultivated crop may often be fall plowed and left rough through the winter. In the early spring it may be worked down by deep diskin
g and handling as described above. In some cases spring replowing may be necessary because of weed growth and the running together of the
soil. Land not cultivated and not fall plowed should be plowed as early
in the spring as possible, to give stubble or sod a chance to decay before seeding time.

Manure applied to the proposed alfalfa fields is often good for the
crop. Since there is a slight tendency to more disease, the manure should
be well rotted and applied in the fall where possible or, if on overflow
lands, very early in the spring. The young alfalfa plants are not very
vigorou, and they do not compete well with weeds for moisture or plant
food. Weeds rob them of moisture and plant food and also tend to shade
them. A well-settled, moist, weed-free seed-bed is of great advantage to
young alfalfa plants. It provides moisture for prompt germination and
for getting the roots established deeply enough to withstand dry weather.

**Lime very important.** Lime is an important factor in the success of
alfalfa on the sour soils. Most Willamette Valley upland soils and Coast
areas need 1 to 2 tons of lime per acre. It should usually be spread on
the land shortly after plowing so that it may be worked into the soil with
the later workings.

Land-plaster is of considerable value in establishing stands of alfalfa.
Fifty to seventy-five pounds an acre applied after plowing and previous
to the last cultural operations before seeding increases rapidity of early
growth, produces larger rooting systems, and results in better stands.

**GRIMM THE STANDARD VARIETY**

There are many varieties and strains of alfalfa. Seed of a large num-
ber of them is on the market. Some varieties are particularly adapted
to warm sections, some to dry conditions, and others to cold and more or
less unfavorable soil or climatic conditions. The majority of Western
Oregon is not suited to most varieties of alfalfa. Three varieties have
stood out under test and shown themselves to be better suited to Western
Oregon conditions than others. These are Grimm, Baltic, and northern-
grown Common.

Of these three varieties Grimm is probably the best because a large
number of the plants have a rather free-branching root habit which
adapts them to the shallower soils. Fig. 2 shows alfalfa plants with dif-
ferent types of roots and crowns. Grimm is long lived, very winter-hardy,
stands large amounts of precipitation during the dormant period, and
makes good growth on land with rather high acidity. It is also very dis-
gease-resistant as shown in Table VIII.

Baltic is closely related to Grimm, differing somewhat in rooting
habits and usually starting growth earlier in the spring.

Common alfalfa as offered for sale is quite variable. Seed from old
stands produced in the colder northern sections often produces excellent
crops in Western Oregon, while that produced in warmer sections is of
much less value and should not be used. The difficulty in buying common
alfalfa is to know whether that particular lot is a good one. Even with
Grimm it is best to buy certified seed.
SEED

Use good seed. Only the best seed should be used. Purity should be high, not less than 99 percent, and the impurities or foreign material should contain no noxious weed seeds such as dodder, morning-glory, Canada thistle, Russian Knap weed or Hoary cress. Germination should be 80 percent or more. Alfalfa seed often contains as much as 50 percent hard seed. This hard seed is good or will be good in time, but the getting of a profitable stand cannot be expected from the ordinary rates of seeding when a large percentage of the seed is hard and will not germinate promptly. The seed should be new, not more than two years old at most. It is easy to distinguish old seed because of its brown dull color. New seed is bright yellow with a slightly greenish cast.

Fig. 2. Alfalfa plants showing different root types and crown development.

The seed should be true as to variety. There are numerous varieties of alfalfa and the seed of these varieties cannot be distinguished. Because of the large differences in value and characteristics of varieties only pure seed of the variety adapted to the conditions where it is to be seeded should be used. Unless purchased from a known grower, only certified seed should be used.

Foreign seed stained. Foreign seed should not be used unless definite knowledge is had of its origin.

Recent seed laws have made it possible to distinguish domestic alfalfa seed from foreign seed. The Federal Seed Act requires that all imported seed of alfalfa be stained. The provisions of this law as it concerns alfalfa are as follows:
(1) Alfalfa seed of known foreign origin, other than Canada, and not formally determined by the Secretary of Agriculture to be unadapted to general use in the United States, is colored approximately 1 percent green.

(2) Imported alfalfa seed, formally determined by the Secretary of Agriculture to be unadapted to general use in the United States, is colored 10 percent red. Alfalfa seed from Argentina and from South Africa comes in this class. The same coloring is required for imported alfalfa seed of unknown origin.

(3) Alfalfa seed from Canada is colored approximately 1 percent violet.

**SPRING SEEDING BEST**

The best and cleanest stands of alfalfa have usually been obtained when May or early June seedings have been made. There is ample time before this to cultivate the land several times, destroy large numbers of weeds, and have the seed-bed in the best possible condition. In the southern sections earlier seedings on weed-free seed-beds are preferable so that the stands will become better established before the hot, dry season. In the Willamette Valley seedings made from May 1 to June 15 are usually most successful. May 15 to June 1 are usually best in the northern part of the Valley. In Southern Oregon, April seedings are preferred. In the Coast sections best results have been obtained from early June seedings. Seeding should take place as soon as the seed-bed is quite free from weeds and conditions are favorable to prompt germination.

Fall seedings are not generally successful. Good stands are often obtained in the fall, but the plants usually go into winter in a weak, soft condition. The natural period of dormancy comes upon them before they are well established, and severe weather conditions together with weed competition usually result in poor, or weedy, weak stands. Often the young plants heave out during period of night freezing alternating with day-time thaws.

**INOCULATION**

Inoculation important. It is necessary that alfalfa plants be inoculated with nitrogen-fixing bacteria. When plants are inoculated nodules grow on the roots. Alfalfa plants without nodules on the roots usually grow but three to six inches high, live one year, gradually turn yellow, and die.

On Western Oregon lands where alfalfa has not been grown inoculation is very necessary. In these sections inoculation must be supplied before alfalfa is seeded. Land that has grown alfalfa or sweet clover successfully within the past two years is itself inoculated, and alfalfa seeded on it will become inoculated without further treatment.

The soil method. One of the surest ways of getting a new stand of alfalfa well inoculated is by scattering soil from a successful alfalfa field over the land to be seeded. From 200 to 500 pounds of inoculated soil per acre scattered evenly over the field and harrowed in shortly before
seeding will supply enough bacteria for good inoculation. The soil should be taken from the surface foot of a successful alfalfa field free from disease or dodder seed. The soil should be spread while still moist. It is best to do this on a cloudy day or toward evening. The soil should be harrowed in at once as drying and exposure to sunlight kill the bacteria. Successful inoculation has been accomplished by mixing with the seed soil obtained from the roots of well-inoculated alfalfa or sweet clover plants and sowing them together either through a drill or broadcast. The method is not very practical. If seeded broadcast the field should be harrowed immediately after seeding. In some cases inoculation by moistening the seed and stirring in a small quantity of inoculated soil with the seed has been successful. The soil sticks to the seeds.

**Inoculation culture.** The commonest, easiest, cheapest, and most generally successful method of inoculation used in Oregon at present is the use of cultures of the bacteria that are grown under laboratory conditions. The Oregon Agricultural Experiment Station has put out thousands of these cultures at cost to farmers in the state. Various commercial laboratories also offer them for sale. The important thing in the use of these cultures is that they be fresh when used, that they be used according to directions, and that the inoculated seed be planted as soon as dry enough to handle. Prompt covering to prevent drying and exposure does much to assure success.

A combination of artificial culture on the seed and the spreading of inoculated soil over the field gives increased assurance of inoculation and is practiced by some successful alfalfa growers; although it adds to the expense of establishing the stand.

**RATE AND METHOD OF SEEDING**

**Thick stands best.** The surest way to get continued high yields of alfalfa is to get and maintain a good stand.

The rate of seeding practiced in any section should be such that the land will be fully occupied with thrifty plants. One pound of alfalfa contains approximately 220,000 seeds. This number of seeds distributed evenly over an acre would average 5 seeds to each square foot. If all those seeds produced thrifty plants there would be less than a half stand. A good stand should average 12 to 14 plants to each square foot. This would require three pounds of seed evenly distributed and every seed guaranteeing a plant.

It has been demonstrated repeatedly that one method of crop insurance for alfalfa is the use of enough high-grade seed to guarantee a stand when properly seeded under good conditions. At least 10 pounds an acre should be used; in most cases 12 to 15 pounds give better stands. Saving money by using less seed usually produces a poorer stand which gets thinner as time goes on and produces lighter and less profitable yields through its whole life.
TABLE I. YIELDS OF ALFALFA WHEN SEEDED AT DIFFERENT RATES AND BY DIFFERENT METHODS

<table>
<thead>
<tr>
<th>Method of seeding</th>
<th>Rate of seeding per acre</th>
<th>Average yields of field-dry hay per acre three years (1926-1928)</th>
<th>1st cut</th>
<th>2d cut</th>
<th>3d cut</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>lbs.</td>
<td>tons</td>
<td>tons</td>
<td>tons</td>
<td>tons</td>
</tr>
<tr>
<td>Broadcast</td>
<td>10</td>
<td>2.94</td>
<td>1.80</td>
<td>.57</td>
<td>5.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>2.94</td>
<td>1.80</td>
<td>.57</td>
<td>5.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>3.21</td>
<td>1.79</td>
<td>.51</td>
<td>5.51</td>
<td></td>
</tr>
<tr>
<td>Drilled</td>
<td>8</td>
<td>2.93</td>
<td>1.80</td>
<td>.57</td>
<td>5.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2.98</td>
<td>1.75</td>
<td>.44</td>
<td>5.17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>3.21</td>
<td>1.79</td>
<td>.51</td>
<td>5.51</td>
<td></td>
</tr>
</tbody>
</table>

In Table I is shown the average yields of field-dry hay obtained from broadcast and drilled alfalfa seed at different rates. In each method of seeding the total yield for the medium rate of seeding was lowest. This may be partly owing to the fact that the plants were not as large as in the lighter seedings or not as numerous as in the heavier seedings. The sowings were made under ideal conditions.

Sowing alone generally best. Alfalfa in all sections of Western Oregon where irrigation is not practiced produces surer and better stands when seeded alone. Young alfalfa plants are weak and shallow rooted for the first few weeks and will not stand competition at that time. Competition from a companion crop is not desirable later because of the usual short-age of moisture in the soil.

Where irrigation is practiced and there is abundant moisture available, alfalfa is often seeded with a small grain as a companion crop and good stands are obtained. Seeding of both is usually done at the same time.

When nurse or companion crops can be used without possible interference with the securing of a stand of alfalfa they are desirable because they give some return from the land while the alfalfa is becoming established.

It is generally best to make the seedings alone unless abundant summer moisture is available.

Successful stands of alfalfa are often obtained in grain stubble where irrigation is possible. The land before being seeded to grain should be leveled so that it can be efficiently irrigated.

The best method is to irrigate the land thoroughly, disk lightly as soon as dry enough, and sow the seed. If this method is followed, drilling is almost necessary as it is practically impossible to cover broadcast seed successfully and even in disked stubble.

Another method is to sow the seed broadcast or with a drill in the stubble as soon as the grain is removed and to irrigate afterward.

Shallow sowing safe. Alfalfa is seeded either broadcast or with a drill. A clover and grass seed drill or the clover-seed attachment on a grain drill properly regulated gives a evener distribution and better covering of seed than broadcasting and is the preferable method of seeding.
When seed is broadcast it should be distributed as evenly as possible so that the stand will not be patchy, leaving bare spots to be occupied by weeds and other plants.

When seed is drilled there are usually no further cultural operations afterward, although if the soil is quite dry or loose at the time rolling will often be of value and help to bring on more rapid germination. When broadcast it is necessary to cover the seed with a harrow or brush drag and often advisable to roll after dragging, if the surface is dry.

Alfalfa seed should not be covered more than 3/4 of an inch. If covered too deep the seedlings will not reach the surface. This is especially true in land that is inclined to crust easily on the surface.

**CARE DURING THE FIRST SEASON**

Clip weeds. Care of alfalfa the first season often determines its future success. It should make steady growth during the summer and the plants should crown out well and produce several branches. If weeds crowd or shade the seedlings, clipping with a mower should be practiced. This may be necessary two or three times during the season. Where weeds are maturing seed they should be clipped before the seed is mature.

On some unirrigated land the growth of the alfalfa plants the first year is seldom large enough to cut for forage. Under these conditions, even if the crop does look large enough to cut, it is better to allow it to grow at least until it reaches full bloom. This results in the development of a better root system and crown for future growth.

On irrigated or rich land it is often possible to obtain a crop of forage the first season.

**Winter top growth dangerous.** In most sections of Western Oregon the new alfalfa should go into the winter with as little top growth as possible. A surplus of winter top growth in this mild, moist section results in loss from stem rot. Late fall clipping or pasturing when the land is not wet is good practice.

**ALFALFA GOOD ALL-ROUND FORAGE**

Alfalfa is used primarily as a forage crop in Western Oregon. Most of it is used for hay. Small areas are used for pasture, some is cut green and used as a soiling crop for poultry and livestock, and a small amount is used for silage. Some seed is being produced in Southern Oregon and alfalfa is used as a fertilizer. Occasionally a stand is used for green-manure and cover-crop purposes. Alfalfa is naturally a soil improver wherever its growth is successful. When used in short-time rotations its value as a soil improver is probably greater than when broken up only after the stand is no longer profitable.

Alfalfa has few rivals among legume or other forage plants as a feed for livestock. Its name means the best fodder. Alfalfa hay properly cured contains from 1,025 to 1,050 pounds of digestible nutrients per ton.
This is about twice that contained in good grain hay such as oats, and is slightly higher than red clover and vetch. Its palatability is high and as forage it is readily consumed by horses, cattle, sheep, hogs, and chickens.

TABLE II. COMPARATIVE FERTILIZING VALUE OF ALFALFA HAY AND GRAIN STRAWS*

<table>
<thead>
<tr>
<th>Material</th>
<th>Yield per acre</th>
<th>Amount of primary elements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tons</td>
<td>lbs.</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>4.0</td>
<td>190.40</td>
</tr>
<tr>
<td>Barley straw</td>
<td>1.25</td>
<td>14.00</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>1.50</td>
<td>16.00</td>
</tr>
<tr>
<td>Oat straw</td>
<td>1.50</td>
<td>17.40</td>
</tr>
<tr>
<td>Rye straw</td>
<td>1.75</td>
<td>21.70</td>
</tr>
</tbody>
</table>

*Henry & Morrison, "Feeds and Feeding."

In Table II is shown the comparative fertilizing value of alfalfa hay and various grain straws. For many crops alfalfa hay can be used profitably as a fertilizer.

**ALFALFA FOR HAY**

When to cut. In the Willamette Valley three cuttings of hay are usually made. The first cutting usually is made from May 25 to June 10, the second from July 12 to 20, and the third from September 15 to 25.

In Southern Oregon where most of the alfalfa is grown under irrigation four cuttings are often made, the first late in May, the second early in July, the third about August 15, and the fourth late in September. Alfalfa is at its best for hay when cut in the medium-early bloom stage—when 1/10 to 1/4 in bloom. Other factors, however, partly determine when to cut the first crop. In warm, moist springs new buds or shoots often start from the crowns before blooming has begun. In that event the crop should be got out of the way of the new growth if the weather permits.

If those new shoots are allowed to grow up and are cut off with the first crop, the second crop is set back, thrown later into the dry season, and the yield is reduced.

Cutting is of course usually delayed until there is some assurance of dry weather in which to cure the hay. Even if the alfalfa reaches full bloom before cutting, the quality is still good. First-crop alfalfa, however, never reaches full bloom in the Willamette Valley until the second growth is too high, except in the rare, dry, hot, early spring.

Fig. 3 shows alfalfa in almost full bloom. Earlier cutting would make better dairy hay and there would be less danger of injury to new buds or shoots.

Study weather forecast. A good guide to haymaking weather may be had by studying the barometer and the daily weather map. This service of the Weather Bureau is now much more valuable since barometric readings by radio are received from ships at sea.
Fig. 4 shows a series of weather maps indicating when to cut and when not to cut hay.

When the barometer is rising and the weather map shows a "high" (high-pressure) area coming to the north of us, that means a north wind and several dry days of haymaking weather. If the equipment is ready, haymaking should be rushed as five or six-day periods of dry weather in late May or early June are precious.

If the barometer rises and the map shows the high going south of us, there is likely to be several days of drizzly weather not fit for haymaking.

Fig. 3. Alfalfa in almost full bloom. Better dairy hay is made by cutting at an earlier stage.

A lowering barometer with a "low" area north of us or through the Valley means rain. A low well to the south of us may mean north winds and some good weather.

Usually there is enough good weather to harvest the heavy first crop. Rarely is there lack of suitable weather for the harvest of second and third crops.

Save alfalfa leaves. Alfalfa hay to be of highest quality must be cured to preserve the leaves, retain a bright green color, have a sweet odor, and be dry when put into the mow or stack. The leaves of alfalfa dry very quickly and break off if not handled properly. It is necessary to rake the cut material into windrows as soon as well wilted. On hot, dry days the rake should follow the mower within an hour or two to avoid leaf loss. The hay should remain there until the stems have no free moisture as determined by twisting a wisp in the hands. Where drying is very rapid it is best to bunch or shock the hay and allow it to remain in this condition until dry enough to take out of the field. Where drying is not so rapid, hay may be cured in the windrow; the work of shocking is thus saved.
It is poor haymaking practice to allow the cut material to get brittle in the windrow. If this occurs, the loss of the valuable leaves is heavy. A ton of alfalfa hay properly cured and handled contains from 35 to 45 percent of leaves in the first cutting, 40 to 50 percent in the second cutting, and 40 to 60 percent in the third cutting.

**Fig. 4.** Weather maps showing positions of high and low pressure barometric readings. *Left:* “High” pressure area going to north, indicating good haymaking time. *Right:* “High” pressure area going to south and “Low” to the north, indicating rain and poor time to cut hay.

**Leaves high in feed value.** Since the feeding value of the leaves of alfalfa is from 55 to 60 percent of the total value of the hay, a maximum of leaves should be saved.

In Western Oregon it is sometimes rather difficult to cure the heavy first crop because of wet weather. The farmer often has to be governed more by the conditions of the weather and his ability to handle hay than...
by the conditions of the crop at the time of first cutting. Rain on new-
cut or partly cured alfalfa very seriously injures it. It causes loss of
color, palatability, and leaves.

**Hay caps valuable.** The use of hay caps as shown in Fig. 5 is good
practice in wet springs. The hay can be shocked reasonably green, cov-
ered with hay caps, and allowed to cure, with reasonable certainty that
the crop will be saved. The saving of one crop will pay for many hay
caps and the caps can be used for years if taken care of. Yard-square
pieces of light canvas or unbleached muslin weighted at the corners
are satisfactory on small shocks. Shocks for hay caps should be well

![Fig. 5. Hay caps in use to cover shocks during rainy period.](image)

made and high enough to shed water after settling and solid enough not
to blow over. Large burlap bags cut at the seams make fair hay caps and
are not expensive.

There is usually little difficulty in curing the remainder of the cut-
tings as weather conditions at these times are practically always good for
making hay.

**Brown hay making.** When climatic conditions interfere with the
curing or bright hay the crop may be preserved as brown hay. In this
process the hay is cured largely by the heat caused by fermentation.
After cutting and preferably after it is partly dried, the alfalfa is put
into stacks, each layer being tramped to make it as dense as possible. A
stack should consist of from five to ten loads of half-dried hay. The
second or third day after stacking the piles are opened to permit the
escape of vapor, after which the product may be safely housed. It takes
from thirty to sixty days for complete curing.

A more common practice is to dry the hay as much as possible in the
air and then pile into compact stacks where it is permitted to remain until
fed. It should not be put into the mow. The final product varies from
dark brown to nearly black.

**First cutting heaviest.** The first cutting of hay is usually the largest,
and each succeeding cutting gets smaller. In the Willamette Valley, when
fertilized, the first cutting averages about 2.5 tons, the second 1.25 tons, and the third .5 ton an acre. Where no fertilizer is used the yield usually is lower, the total for the three cuttings being from 3 to 4 tons an acre. Where land-plaster, lime, or sulfur is used on a good stand the total yield may be as high as 6 tons an acre. The proportion for different cuttings, however, is practically the same.

In Southern Oregon, under irrigation, where four cuttings are sometimes harvested, the first is usually the largest, the second and third about equal, and the fourth smaller. The total yield depends considerably on the water supply, but an average total yield of 5 tons an acre is to be expected under good conditions with a good stand.

![Fig. 6. Using side-delivery rake. A valuable implement for rapid handling of alfalfa hay.](image)

The first crop is usually considered by stockmen to be of highest feeding value. It is the coarsest and weediest of all the cuttings. Later cuttings are usually cleaner, finer, and leafier and are generally eaten with less waste.

In feeding value good alfalfa hay is equal to the best of clover or vetch and oats. It is the highest priced of the legume hays on the market.

The market value per ton and farm value per acre of alfalfa hay exceeds that of any other kind of hay.

**Baling for market.** As the acreage of alfalfa increases more will be baled and put on the market. Baled alfalfa hay should clean fine and have practically all the leaves, be bright green in color, and be neither moldy nor dusty. Hay is best when baled out of a stack or mow after having been there for from 30 to 60 days. Baling from the windrow often results in heavy loss of leaves and poor color if the hay is dry enough to keep in the bale. When green enough to save leaves, the bales with too high moisture content will heat and cake and often spoil. When hay is baled from the shock the loss of leaves is usually not so great. If left in the shock until thoroughly dry, good-quality bales are often obtained, although the color is not so good as when the hay is baled from the stack.
Piling bales. When baling from the stack for market off-colored or low-quality hay from tops and bottoms should be baled separately. Baled hay if piled in the field should be put on straw to keep the lower bales from becoming musty. The “bottom” of the bales with the fine compact surface should be placed on the outside of the pile to prevent moisture penetration, color loss and lower grades. The bale pile should be protected by a covering of straw or other material.

Fig. 7. Chart showing average yields of field-dry hay of various crops on the Oregon Agricultural Experiment Station, 1921-1926, inclusive.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>4.32 T.</td>
</tr>
<tr>
<td>Timothy and rye-grass</td>
<td>1.77 T.</td>
</tr>
<tr>
<td>Oats and vetch</td>
<td>2.28 T.</td>
</tr>
<tr>
<td>Red clover</td>
<td>2.45 T.</td>
</tr>
</tbody>
</table>

Alfalfa is also sold as cut alfalfa. It is possible to load cars to the minimum car-lot weight with the cut hay. Where cutting equipment is available, cutting is cheaper than baling, and the feed is generally consumed better by livestock.

The side-delivery rake. A farm machine of especial value for making hay of alfalfa is the side-delivery rake. This implement, shown in Fig. 6, handles large quantities of material quickly, windrows it with most of the leaves covered, and does clean work. It is also valuable for turning the hay after a rain or for the quick curing often necessary. At the turning
operation it shakes out considerable water and also aerates the hay. The side-delivery rake often takes the place of a tedder. Clean raking improves the grade of the next cutting as less dead material is left.

Hay-loaders have been used to some extent in handling alfalfa. For efficient use the hay must be cured in either the swath or small windrow. The action of the loader in picking up material somewhat too dry from either swath or windrow is such that many leaves are lost and the quality of the hay much reduced. Cylinder loaders taking the hay from windrows probably lose the least amount of leaves. Laborers object to cylinder loaders since the hay comes up too fast in many cases. These loaders are not suited to rough, uneven, or disked land.

The more general use of sweep rakes and slips will cheapen Western Oregon haymaking, especially for short hauls.

Alfalfa produces larger yields of hay than any of the other legumes or grasses commonly grown for that purpose in the Willamette Valley. Fig. 7 shows the comparative average yields of field-dry hay on the Oregon Agricultural Experiment Station for the years 1921-1926 inclusive.

Growing alfalfa hay to meet high market grades. The following cultural and production practices will help materially in producing alfalfa hay that will meet the requirements of high market grades:

1. Have full, pure stands. This reduces percentage of foreign material, and the forage is finer stemmed with more leaves.
2. Cut early. Alfalfa should be cut when 1/10 to 1/4 in bloom, or when new growth starts from the crowns, irrespective of bloom. Later cutting results in woody stems and loss of leaves as well as probable injury to the following crop.
3. Curing should be as rapid as possible to prevent discoloration and loss of leaves.
4. Cutting and raking should be clean so that no dead stubble or decayed material will be raked up with the next crop. The field should be kept free from trash at all times.
5. Only thoroughly cured hay should be stacked or baled.
6. Alfalfa hay should go through the sweat in the cock or stack before baling. It is difficult to produce high-grade hay when bailing is done from the windrow.
7. Stack and bale different cuttings of alfalfa separately.
8. Make stacks large so as to expose as little surface as possible.
9. Cultivation of alfalfa fields results in cleaner, better-grade hay. Alfalfa hay is graded downward quite heavily for weeds, stubble, dead grass, and trash.
10. Alfalfa hay should be stored under shelter. Outside stacking results in discoloration and actual loss of forage from weathering.
Figs. 8 and 9 show stands of clean alfalfa being harvested that if properly handled will produce No. 1 hay.

Fig. 8. Field of Grimm alfalfa. Second year after seeding.

Fig. 9. Mowing alfalfa. Second year after seeding.
 Alfalfa makes excellent pasture for cattle, sheep, and hogs. Its use for poultry pasture is increasing in sections suitable for its culture.

At present there are few fields used exclusively for pasture, most growers feeling that they can get more forage by harvesting the crop rather than pasturing it. Spring pasturing delays the time of cutting of the first crop for hay until good haymaking weather is reasonably certain. Pasturing often begins with the second crop and in other cases when it is harvested. Pasturing with cattle and sheep is usually done in the summer and fall. Farmers get more feed after the second hay crop by using the alfalfa in the form of pasture than they would get from the third crop as harvested forage.

When used as hog pasture the fields are usually divided into small sections and used in rotation throughout the growing season. Hogs should be ringed to prevent rooting.

For poultry, alfalfa is usually cut and chopped before being fed. Some poultrymen, however, divide the alfalfa field into pens and practice rotation pasturing.

Pasture yields high. The amount of pasture produced by alfalfa is probably larger than that produced by any other plant or combination of plants if grown on the right kind of land and properly handled. Cattle and sheep should not be allowed to tramp over the fields when the latter are wet and soft and should not be kept in a field until they damage the alfalfa crowns. Pasturing often is of value to the crop in that weeds and grass are held back or destroyed and cleaner crops of forage are harvested.

After pasturing alfalfa in the fall it is advisable, if the pasturing has been uneven, to go over the field with a mowing machine and clip the remaining stems. If accumulations of droppings are numerous they should be scattered with a drag or harrow.

Bloat. There is often danger of bloat with cattle and sheep when pastured on alfalfa. The actual risk varies greatly with individual animals, climate, and condition of the crop. The danger is always present in some degree and cattle and sheep should be watched rather closely when on alfalfa pasture. The second and third crops, making slower growth during the dry season, seem to produce less bloat. Sheep are more subject to bloat than cattle.

Bloating is avoided to a considerable extent by using grassy alfalfa fields for pasture, having a constant supply of fresh water for the stock, and by keeping cattle and sheep away from wet and frosted alfalfa. Before turning animals on alfalfa for the first time, allow them to fill up on grass or grass and grain, or other feed to which they have been accustomed. This practice may be followed for several days until the animals become thoroughly accustomed to the alfalfa. Watch the stock closely for the first few days and remove any animals permanently that show symptoms of bloat. There are great differences in the individual susceptibility. An occasional animal will sometimes bloat on cured alfalfa.
First crop may be siloed. Very little alfalfa has been used for silage in Oregon. It does not silo as readily as corn, vetch and oats, or peas and oats. Probably the only alfalfa silage made in Western Oregon is made from first crop that can not be cured into hay because of rain. The use of alfalfa for silage under these conditions saves the crop and produces good feed. Since alfalfa can be made into hay at less expense than into silage, it is only when it is impossible to cure the forage that it pays to put it into the silo. It is difficult to pack into the silo. It must be cut fine and packed evenly and continually or it may become moldy. Fresh, wet alfalfa usually needs no water added to it when being put into the silo. Half-cured alfalfa should have considerable water added to make it pack better. Alfalfa is high in protein and low in sugars.

The first cutting is the one usually used for silage. In Western Oregon a yield of about 10 to 12 tons an acre may be expected. Occasionally the third or fourth cuttings are put into the silo and can be mixed with corn. This combination makes excellent feed.

Carbohydrate needed for silage. The use of green alfalfa and grain hay combined in either about equal parts or three parts alfalfa to one part hay makes good silage. The addition of carbohydrate material such as corn-meal, blackstrap molasses, and green rye to alfalfa when put into the silo, according to Kansas Bulletin 217, resulted in preserving it for a longer time than when the alfalfa was siloed alone. In Western Oregon green barley may be used in place of the materials mentioned. Very often the large amount of grass in the first cutting is all the carbohydrate material necessary to make good silage.

Alfalfa silage ordinarily will not keep as long as corn silage unless very well packed. It is advisable to feed out alfalfa silage each year.

Alfalfa is an excellent soiling crop for poultry, dairy cows, and sheep. As a soiling crop the alfalfa should be cut fresh each day and hauled direct to the animals. It should not be piled in large heaps and allowed to remain there for several days as it heats quickly.

One precaution should be taken: Do not cut the same part of the field too often for soiling purposes. Frequent cutting weakens the plants and shortens the length of life of the stand.

There is little danger from bloat when alfalfa is cut and fed green if it is not wet with dew or rain or is not frozen.

Seed production does not appear to be practical in the Willamette Valley and Coast sections as the yield is too small.

In Southern Oregon, in the Umpqua and Rogue River valleys, some seed is being harvested. This region has promise of becoming a seed-
production area. Alfalfa sets seed better where it grows under a handi-
cap. Where growing on thin or gravelly soil, or with limited water or
with injured roots, it usually sets more seed than where the growing con-
ditions are favorable. When grown on good soil, and with irrigation,
usually seed production is stimulated by root injury or by limiting the
supply of water.

Second crop used for seed. Sometimes the first crop is saved for seed
where moisture is limited. Otherwise, in Western Oregon the second
cutting is preferred. There is less likelihood of insect loss when the sec-
ond crop is used. Where the chalcid infestation affects the first crop and
seed is to be grown, pasturing or clipping back to delay bloom is often
helpful.

When ripe the seed is cut with a mower with swather and bunching
attachment or with a self-rake reaper. When thoroughly dry it is hulled
either with a hulling machine or with an ordinary grain thresher equipped
with clover or alfalfa seed-hulling attachments. The combine may also
be used. Hulled seed usually contains less hard seed than thresher-
threshed seed.

USE AS GREEN MANURE AND COVER CROP

In irrigated sections where fruit growing is practiced, alfalfa may
be used as a combination green manure and cover crop. Where ample
summer moisture is available and summer cultivation is not necessary,
alalfa can be left in orchards for some time. It may be used for forage
to some extent when needed.

Alfalfa has considerable value as a cover crop even though it is
dormant during the winter. The crowns protect the land from surface
washing and often help hold accumulations of leaves and other organic
materials.

ALFALFA AS A SOIL IMPROVER

Alfalfa with its strong rooting and nitrogen-gathering habits is a
soil improver of considerable value. The rooting system is large and
increases the organic-matter content of the soil. When the sod is broken
up the effect of the large rooting system is felt for several years, as
decay is rather slow. The nitrogen content of the soil is increased. The
total amount of other plant foods is probably decreased to some extent.

USE OF FERTILIZERS ON ALFALFA

In Western Oregon where soil conditions in many sections are
none too well adapted to the growth of alfalfa the use of fertilizers
often determines whether the crop can be grown, and if it can be grown
whether at a profit or loss. If good stands of alfalfa can be obtained
and the addition of a small amount of fertilizer at low cost will cause
it to produce several successive profitable crops, or if an already good-
producing stand can be made to increase its yield from 25 to 40 percent,
there can be no argument against the use of fertilizers. Certain fertilizers
applied at the right time in the proper amounts have given profitable increases in yields as shown by the work at the Experiment Stations at Corvallis and Talent.

Manure is a food fertilizer. Because alfalfa gathers much of its own nitrogen, manure rich in that element may often be better used on other crops. If manure is used for alfalfa it should preferably be applied to the land before plowing or used as a top dressing early in the spring. For this latter use it should be well rotted and fine.

**Lime.** Alfalfa is usually benefited by lime. There are many fields producing successful crops of alfalfa without its use and there are also many fields that fail without the use of lime.

On lands showing high acidity, lime is recommended as a direct aid toward getting stands and yields of alfalfa. Willamette Valley upland soils and most Coast soils respond profitably to its use. In some sections it is rather costly to use lime, but use of lime will usually insure a stand and increased yields.

Lime should be applied either in the fall or early spring. If applied in the fall there is no particular need to work it into the soil. If applied in the spring it will naturally be worked in during the soil-preparation operations. Some farmers do not apply the lime until just before the last operation before seeding. Others apply it either before or after plowing. It is preferable to apply after plowing; otherwise, part of it will be buried and be of little benefit to the upper soil layer. From one to two tons an acre should be used on most upland in the Willamette Valley that is otherwise adapted to alfalfa. Good results are often obtained by using half this amount. In the Coast Section from one to three tons an acre are advisable. In Southern Oregon and on many Willamette Valley sandy bottom-lands lime is not often needed, as the soils as a whole are not as acid as in other sections of Western Oregon.

Lime is often of prime value in helping to establish a stand. Data are not available to show how long an application will last.

**Land-plaster, sulfur, phosphorus, and potash.** For increased annual crop production the use of land-plaster and sulfur have proved valuable and profitable. Potassium and phosphorus have been of some value. Nitrogen generally is of little value with alfalfa.

Experiments have been carried on at the Oregon Agricultural Experiment Station during the past six years to note the effect of the use of land-plaster, sulfur, superphosphate, and potassium sulfate on alfalfa.

The results of experiments with land-plaster are shown in tables III, IV and V.

**TABLE III. EFFECT OF THE USE OF LAND-PLASTER APPLIED AT DIFFERENT DATES. YIELDS OF ALFALFA FOR HAY**

<table>
<thead>
<tr>
<th>Rate of application per acre</th>
<th>Date of application</th>
<th>6-year average yield per acre of field-dry hay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st cutting</td>
</tr>
<tr>
<td>lbs.</td>
<td>Date</td>
<td>tons</td>
</tr>
<tr>
<td>100</td>
<td>March 10</td>
<td>2.90</td>
</tr>
<tr>
<td>100</td>
<td>March 30</td>
<td>2.73</td>
</tr>
<tr>
<td>100</td>
<td>April 14</td>
<td>2.75</td>
</tr>
<tr>
<td>100</td>
<td>May 4</td>
<td>2.58</td>
</tr>
<tr>
<td>Check—No fertilizer</td>
<td></td>
<td>2.50</td>
</tr>
</tbody>
</table>
**Date of application of land-plaster.** Table III shows the yields of field-dry hay obtained from 100-pound applications of land-plaster at different dates on Willamette River bottom-land.

The earlier applications result in the largest increase in yields. As the date of application advances the effect of the land-plaster is reduced. Early applications are better distributed because of more general soil moisture conditions and the effects are felt throughout the growing season. Late applications are of least benefit and result in smallest crop increase because the first crop gets little benefit from the application. The growth of alfalfa is often so large when the land-plaster is applied, moreover, that considerable of it may not reach the soil; also, the land may be quite dry and rainfall low after the application so that there is little distribution or penetration into the soil.

Land-plaster applied even as late as May 4 resulted in an increase in yield, but the increase amounted to only .33 ton an acre whereas that from the March 10 application was .78 ton an acre.

**TABLE IV. EFFECT OF THE USE OF LAND-PLASTER APPLIED AT DIFFERENT RATES ON ALFALFA CUT FOR HAY**

<table>
<thead>
<tr>
<th>Date of application</th>
<th>Rate of application per acre</th>
<th>Sulfur present in each application of land-plaster</th>
<th>6-year average yield of field-dry hay per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs.</td>
<td>lbs.</td>
<td>tons</td>
</tr>
<tr>
<td>March 10</td>
<td>50</td>
<td>9.90</td>
<td>2.84</td>
</tr>
<tr>
<td>March 10</td>
<td>75</td>
<td>13.50</td>
<td>3.06</td>
</tr>
<tr>
<td>March 10</td>
<td>100</td>
<td>18.00</td>
<td>3.03</td>
</tr>
<tr>
<td>March 10</td>
<td>125</td>
<td>21.50</td>
<td>2.98</td>
</tr>
<tr>
<td>Check—No fertilizer</td>
<td></td>
<td>2.34</td>
<td>1.03</td>
</tr>
</tbody>
</table>

**Rate of application of land-plaster.** Table IV shows the effect of different rates of application of land-plaster on yields of field-dry hay.

Since experiments have shown that early applications of land-plaster result in largest increases in yield, all rate applications were made March 10.

There is a gradual increase in yield of hay as the amount of application of land-plaster per acre is increased. The largest increase is from the 125-pound application, amounting to 1.44 tons an acre over the unfertilized seedings. All applications produced substantial increases and resulted in profit for their use. Definite data are not yet available as to just how high the rates of application can be made and still obtain profitable increases, but indications are that the 125-pound rate is not enough for thick stands.

**Rate of application of sulfur.** Table V shows the results of the use of flowers of sulfur at different rates on hay production of alfalfa.

From the results of this work the indications are that the application of 75 pounds an acre results in the largest yield. Application of more than 75 pounds increases the yield over the checks and lightest application but does not increase them over the 75-pound rate, indicating that a 75-pound application is near the maximum necessary for largest increase. All rates showed large increases over checks.
Comparative yields of alfalfa fertilized with land-plaster and sulfur show that the sulfur, as such, and in land-plaster gives similar results. It is probable that since land-plaster is easier to spread and contains calcium it is the best to use. This is in general accord with the findings of the Soils department.

TABLE V. EFFECT OF THE USE OF SULFUR AT DIFFERENT RATES

<table>
<thead>
<tr>
<th>Date of application</th>
<th>Rate of application per acre</th>
<th>6-year average yields of field-dry hay per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs.</td>
<td>tons 1st cutting</td>
</tr>
<tr>
<td>March 10</td>
<td>25</td>
<td>2.89</td>
</tr>
<tr>
<td>March 10</td>
<td>50</td>
<td>3.07</td>
</tr>
<tr>
<td>March 10</td>
<td>75</td>
<td>3.11</td>
</tr>
<tr>
<td>March 10</td>
<td>100</td>
<td>2.97</td>
</tr>
<tr>
<td>Check—No fertilizer</td>
<td>2.47</td>
<td>1.13</td>
</tr>
</tbody>
</table>

Fig. 10. Showing effect of land-plaster on maintenance of alfalfa stand. *Left:* Land-plaster applied each year. *Right:* No land-plaster. Both seedings made under identical conditions.

Use of phosphorus and potash. The use of both phosphorus and potash resulted in increased hay yields over the checks. Both are carriers of sulfur and it appears probable that this element in those fertilizers produces increased yield. The increased yield from the use of superphosphate is generally below that secured from the use of sulfur and land-plaster and is much more expensive. While alfalfa uses considerable phosphorus, the small increase in yield from its use, when compared to land-plaster and sulfur, does not justify its application except on those soils that are very low in that element. On some old upland grain soils alfalfa responds well to superphosphate.
The use of potassium sulfate gave an increase over the checks and corresponds favorably with the 75-pound applications of land-plaster. Again because of its expense it is best to use either land-plaster or sulfur.

Results vary. Because of the great variations in soil, moisture, and cultural conditions these results may not be applicable to all sections of Western Oregon. The alfalfa grower can soon ascertain by trial what fertilizer is best to use and how much to apply. It has been reasonably well established that land-plaster or sulfur are of most value in most sections of Western Oregon.

Fig. 11. Showing comparative growth of alfalfa at second hay cutting stage.  
Left: When fertilized with sulfur at 50 pounds an acre.  
Right: When no fertilizer was used.

It is necessary to apply most fertilizers, except lime, superphosphate, and manure, each year. Land-plaster and sulfur are easily soluble and the amount not made use of by plants the first year will probably be leached away to some extent during the dormant season.

Fertilizers may be spread by hand or with machinery. Hand spreading is often done on small areas. Fertilizer-spreading machines or end-gate spreaders are often used very successfully on large seedings. These can usually be regulated to spread quite accurately as little as fifty pounds an acre.

Sulfur is rather disagreeable to apply. By mixing sulfur with damp sand just before applying, dust is reduced and spreading made easier either by hand or machinery. About 15 percent sand is usually used.
Fertilizers, especially land-plaster and sulfur, have a pronounced effect on the maintenance of stands of alfalfa. Fields fertilized with either of these materials on the Oregon Agricultural Experiment Station have produced not only increased yields of forage but the forage contained a much higher percentage of alfalfa than that produced on fields not fertilized. It increases the length of life of the alfalfa and results in a decrease of growth of grasses and weeds, indicating that full stands of thrifty plants produce competition unfavorable to weed growth.

Figures 10 and 11 show effect on maintenance of stand and comparative growth of alfalfa when land-plaster and sulfur were used.

THE EFFECTS OF OVERFLOW ON ALFALFA

The effect of overflow on stands of alfalfa is constantly being referred to by persons who have or contemplate making seedings on land subject to overflow.

On land that has good depth and natural drainage and is subject to overflow for only short periods with moving water, there is little danger of injury. On land that is subject to overflow for long periods and on which the water gets stagnant there is danger of injury. Also, on land that is subject to long periods of excessive seeping and spots of overflow there will likely be injury. Use of excessive amounts of water over the plants for long periods smothers them and causes decay of crowns and roots.

There is little danger of overflow injury on most Western Oregon bottom-lands outside of the area covered by the Columbia River summer freshet, because the water is over the land for only a short time, is usually moving and as soon as the streams get within their banks the soils drain rapidly.

Where deposits of sediment accumulate on alfalfa fields it is advisable to distribute them with a harrow or scrapper, so that the plants covered will not die. Alfalfa plants can force their way through three or four inches of sediment but heavier deposits will cause injury.

ALFALFA UNDER IRRIGATION IN WESTERN OREGON

At present practically all the alfalfa grown under irrigation in Western Oregon is in the southern section. In this section irrigation is necessary on the majority of farms for successful production of more than one cutting of alfalfa. Alfalfa responds very well to irrigation and the methods used are similar to those in other irrigated districts.

In the Willamette Valley there is an occasional small field of alfalfa grown under irrigation. Irrigation is never necessary in this Valley for the production of the first or main crop. It makes substantial increases in the second and third cuttings, but more experimental data are necessary to establish the conditions under which the cost of furnishing water is justified by the results obtained.
ALFALFA IN ROTATIONS

Because alfalfa is a soil improver and produces profitable crops for several years, it fits in very well into the crop-rotation plans of practically all farms where it can be grown. It lengthens the cycle of rotation, reduces the number and cost of farm operations over a period of years and simplifies farming practices.

Corn or grain is a good crop to follow alfalfa. Because of roots that interfere with cultivation grain is generally used first. Potatoes may follow to best advantage the second season after plowing. These crops may be used for two or four years and then the field is resowed to alfalfa.

CULTIVATION OF ALFALFA

Make high-grade hay. Cultivation in some cases in this state and others has resulted in a slight reduction in the total yield, as it eliminates grass and weeds. On the other hand, when properly done it has improved the quality and grade of hay by reducing the percentage of grass and weeds and has also added to the length of profitable production of the stands.

In practically all alfalfa fields, after the second year, weeds and grasses increase rapidly and crowd the alfalfa. Cultivation holds these in check and helps retain moisture where irrigation is not practiced.

Spring-tooth good. The best implements to cultivate alfalfa with are the spring-tooth harrow, with the ends of the teeth narrowed, or the disk-harrow. The spring-tooth harrow does excellent work and is generally recommended where the soil is loose and the weeds and grass are not heavily sodded. The disk-harrow is used where the spring-tooth is not available. The disk-harrow was formerly considered to be a good implement to use for weed control, but recent investigations indicate there is frequently too much injury to alfalfa plants. It should be used only on heavy sod. After the field has been gone over thoroughly with one of these implements the grass roots should be shaken out to dry and the field smoothed down with a spike-tooth harrow.

Alfalfa is usually cultivated once each year. This cultivation should be in the early spring before growth begins. Cultivation is most effective at that time because weeds and grass are small and the least injury is done to the alfalfa crowns since they are practically dormant. Cultivation after growth begins destroys numerous buds and young shoots, retards early growth, and reduces the amount of the first cutting.

Some growers make a practice of cultivating immediately after each crop is taken off. If this is done the crop should be taken off quickly or the cultivation will probably destroy many new shoots and injure some buds, both of which will reduce the next crop. Such cultivation often makes dusty hay of the second and third crops.

Cultivation tests have been carried on at the Oregon Agricultural Experiment Station for three years. The results shown in Table VII indicate that cultivation reduced the yields. The first cuttings showed the largest differences in yields owing partly to difference in stand. One early spring cultivation was given each year.
There is no question that cultivation improves the quality of forage and perhaps lengthens the profitable life of the stand. In the past year the uncultivated first crop was so grassy that it was hard to recognize as alfalfa.

**TABLE VII. COMPARATIVE YIELDS OF ALFALFA HAY FROM CULTIVATED AND UNCULTIVATED FIELDS FOR THREE YEARS, 1923 TO 1925, INCLUSIVE**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1st cutting</th>
<th>2nd cutting</th>
<th>3rd cutting</th>
<th>Total yields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivated</td>
<td>2.90</td>
<td>1.24</td>
<td>.34</td>
<td>4.46</td>
</tr>
<tr>
<td>Uncultivated</td>
<td>3.28</td>
<td>1.27</td>
<td>.30</td>
<td>4.85</td>
</tr>
</tbody>
</table>

Note: 75 pounds of land-plaster were applied to both cultivated and uncultivated alfalfa March 10 each year.

*Weeds in alfalfa.* In Western Oregon where the winters are mild and moist and where the alfalfa is dormant for about four months there is excellent opportunity for weeds, especially grasses, to get started and make considerable growth without much competition.

Other weeds are avoided by using clean seed. Where impure seed has been used dodder and millet are often introduced and cause trouble. In practically all sections squirrel-tail and wild barley, both annual grasses, are increasing and becoming more difficult to control. Quack-grass and blue-grass are the most serious perennial grasses.

Different weeds have different control methods best adapted to them.

Patches of Canada thistle and morning-glory should be plowed up and consistently cultivated until eradicated before sowing the alfalfa. In very heavy stands of alfalfa, Canada thistle is sometimes smothered out to a considerable extent, but if not completely smothered out in two or three years, it will gradually come back as the stand of alfalfa gets thinner and competition less. The frequent mowing of the alfalfa also has a tendency to check the thistle.

When dodder is found the infested spots should immediately be mowed by hand, the plants allowed to dry and burned on the spot. Moving may scatter seeds or plants and cause the dodder to spread. After the first year if no patches have been missed there is likely to be no trouble from dodder unless seed is scattered on the land by irrigation water or otherwise.

*Cultivate out cheat.* Annual grasses such as wild cheat, millets, squirrel-tail, wild barley, and many others are best controlled by cultivation early in the spring before the alfalfa starts growth and by preventing the maturing of seed by cutting before the seed is ripe. Very often it is advisable to cultivate between the first and second cuttings. Cultivation at this time should be done immediately after the first crop is bunched or shocked so as to injure as little as possible the new buds and shoots of the second crop.
The perennial grasses such as quack-grass and blue-grass are best controlled by cultivation. These grasses should be controlled as soon as they appear, for if once they get started and set they are very difficult to handle.

The majority of weeds are most troublesome in the first cutting of hay. In old stands the first cutting is often more than half grass or weeds. The following cuttings are usually quite clean. As the first cutting usually represents half or more of the total year's crop, a large percentage of foreign plants in it reduces its value and the profits.

**Plow thin, weedy stands.** As a rule, when alfalfa gets so weedy that the first cutting is 50 percent or more foreign plants, it is a very good indicator that the stand of alfalfa is thin and that it will pay better to break it up and use the land for some other crop.

Some success has been had where alfalfa is grown for home use by cultivating early in the fall and seeding winter barley in it at the rate of a bushel to the acre. The barley used is usually of the beardless type so that it will make good hay. The continuous growth of the barley offers competition to the weeds and retards their growth. This barley is ready for hay at about the same time as the first cutting of alfalfa. The combination makes good hay or silage for farm use and gives a slight increase in yield.

Some farmers employ winter and spring pasturing as a dual purpose practice, to reduce the weeds and utilize all possible feed produced on the land. Conservative pasturing in the spring usually does little injury to established stands of alfalfa and usually reduces the weeds. Heavy pasturing in all kinds of weather may reduce the vitality of the alfalfa so that even if the weeds are reduced there will be no material benefit.

**RODENTS**

Animal pests when left uncontrolled become serious in alfalfa fields and cause considerable damage. Often the extent of the damage done is not realized because of the fact that the work of these pests is done largely during the dormant period and during the time when the alfalfa is tall enough to hide much of their activity. Rodents sometimes reduce the profitable life of seedings one or more years and when in sufficient numbers considerably reduce the yields of forage.

The worst rodent pests of alfalfa in Western Oregon are gophers, field-mice, moles, ground-squirrels, and rabbits. In irrigated sections rodents that live in the ground can be controlled to some extent by drowning as well as by poisoning and trapping. In other sections poisoning and trapping are the best means of holding the rodents in check. On land that overflows annually or biennially this trouble is usually cared for naturally to a large extent.

Systematic poisoning in fall and early spring and between cuttings will usually control rodents effectively.
DISEASES

Alfalfa is subject to various fungous diseases affecting roots, stems, and leaves. As a rule, no one of the diseases causes heavy loss, but occasionally seedings attacked by several of them in one season may be injured severely. Probably the most destructive diseases in Western Oregon are stem-rot, leaf-spot, and yellow leaf-blotch. Occasionally slight attacks of yellowing occur.

Up to the present time no heavy losses have occurred in Western Oregon.

Stem-rot losses. Stem-rot, Selerotinia trifoliorum, is a very common disease in Western Oregon on red, sweet, and alsike clover and vetches and peas. The disease attacks the plants near the surface of the ground, causing the stem to decay and the plant to wilt and usually die. This disease spreads rapidly and at times destroys most of the plants in large areas. Newly attacked plants have a white web-like material around the stems near the base. This is the disease in its most active stage. Later, numerous small black bodies are produced and may be seen surrounding the base or attached to the base of attacked plants. These resting bodies may remain alive for several years and under right conditions may produce structures bearing spores that may result in new attacks. There is seldom any injury done the first season. The most serious attack occurs beginning with the spring of the second year and is noticeable. Lighter attacks may continue year after year.

A field or part of a field of alfalfa attacked by this disease should be plowed up immediately and seeded to grains or grasses or used for cultivated crops for two or three years before reseeding to alfalfa or other legumes.

The use of disease-resistant varieties is promising in combating this disease. Grimm in the Experiment Station tests has proved to be the most resistant. See Table VIII.
Leaf-spot. Leaf-spot, *Pseudopeziza medicaginis*, is a common disease in Western Oregon, but seldom causes heavy injury. It causes small dark-brown spots on the leaves and when very abundant there is considerable shedding of the leaves. Heavy infection reduces the yield and feeding value of the forage. Heaviest attacks usually come during very moist seasons. There is no practical remedy. Pasturing the crop in the spring and fall usually results in some reduction of the disease. This makes the first crop come later when the season is dry and by pasturing off the crop ordinarily used for the third cutting, the trouble during the fall moist season is also removed. Different varieties show very little difference in amount of attack.

Yellow leaf-blotch. Yellow leaf-blotch is a fungous disease quite common in practically all alfalfa-growing districts and is found in most of the established fields in Western Oregon. It does very little damage. The disease attacks the leaves and is characterized by yellow spots with small brown dots on them. If infection is heavy the crop should be cut. Succeeding crops in the same year are seldom affected.

"Yellows" may affect the whole plant or only a few leaves. When serious large areas may be affected. Yellows seldom kills the plants. The trouble is often more serious than it may appear because of the reduction in yields it causes. Plants troubled with it are stunted and turn yellow. The exact cause of this trouble is not definitely known. Poor drainage, shortage of plant food, and high soil acidity may result in increased trouble from yellows.

The treatment advised is to cut the yellowed fields or heavily infected spots regardless of the stage of development. The new growth usually comes on normally and often is not infected. If this trouble occurs regularly it is advisable to plow up the field and before reseeding to alfalfa make sure that drainage is adequate and other soil conditions suitable for the crop.

Disease resistance. During the past seven years experimental work has been done at the Oregon Agricultural Experiment Station to determine the resistance of different varieties and strains of alfalfa to diseases. The particular data desired pertained to the resistance of various varieties to stem rot, *Sclerotinia trifoliorum*. This, at present, appears to be the most serious disease, possibly because plants attacked by it are often killed.

In this test, thirty-seven varieties and strains were used. These were seeded May 5, 1922, on land that was so heavily infested with stem-rot organisms that a stand of sweet clover was completely destroyed. All seedlings produced almost perfect stands, made very good growth the first year, and suffered no injury. Beginning with the spring of the second year, the work of the disease showed up and heavy losses were sustained by several varieties. During the second and third years the disease was very active and many plants died. During the fourth year, few plants died, and during the following three years there was no loss. Fig. 12 shows a view of the disease-resistance nursery during the fourth year.

Table VIII shows the percentage of plants remaining at the end of seven years and indicates quite conclusively the resistance to stem-rot
and other diseases of various alfalfa varieties and strains. In these seedings there was a small amount of leaf-spot and some yellow leaf-blotch and yellows, but not enough to destroy plants or cause serious injury.

TABLE VIII. PERCENTAGE OF PLANTS ALIVE AT COMPLETION OF SEVEN YEARS TEST FOR DISEASE RESISTANCE

Variety and percentage of plants alive after five years.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Percentage of Plants Alive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grimm—Idaho</td>
<td>98</td>
</tr>
<tr>
<td>Chile</td>
<td>98</td>
</tr>
<tr>
<td>Dakota</td>
<td>96</td>
</tr>
<tr>
<td>Baltic Idaho</td>
<td>95</td>
</tr>
<tr>
<td>Baltic</td>
<td>95</td>
</tr>
<tr>
<td>S. Africa</td>
<td>95</td>
</tr>
<tr>
<td>Baltic</td>
<td>15</td>
</tr>
<tr>
<td>Arizona Common</td>
<td>90</td>
</tr>
<tr>
<td>Cossack</td>
<td>90</td>
</tr>
<tr>
<td>Kansas Common</td>
<td>88</td>
</tr>
<tr>
<td>Canadian Variegated</td>
<td>85</td>
</tr>
<tr>
<td>Indian</td>
<td>85</td>
</tr>
<tr>
<td>Smooth Peruvian</td>
<td>80</td>
</tr>
<tr>
<td>Ladak</td>
<td>80</td>
</tr>
<tr>
<td>Argentine</td>
<td>65</td>
</tr>
<tr>
<td>Spanish</td>
<td>65</td>
</tr>
<tr>
<td>Argentine</td>
<td>65</td>
</tr>
<tr>
<td>New Zealand</td>
<td>55</td>
</tr>
</tbody>
</table>

Note: All seedings made May 5, 1922.

Stand the first year were practically equal and all near 100 percent.

INSECTS

Up to the present time insects have caused little injury to alfalfa in Western Oregon. Minor damage is occasionally caused by cutworms, grasshoppers, and leaf-hoppers, but it is so light that control measures would cost more than the value of the amount of crop saved.

The alfalfa weevil of the Rocky Mountain and Intermountain sections has not as yet been found in this section. It is well, however, to be constantly on the lookout for this insect and its presence reported as soon as suspected or found. Occasionally the clover weevil does minor damage to the leaves and stems, but its attacks are only at long intervals and the damage small.

The root-borer, which is destructive to red and alsike clover plants, occasionally attacks alfalfa plants near the crown and probably kills a few of them. Since, as the alfalfa acreage increases, insect troubles may also increase, it is advisable for the grower to keep on the lookout and take steps to control and outbreaks, for once insect depredations start to expand their control is rapidly made more difficult.