

**STATE COLLEGE OF WASHINGTON**  
**PULLMAN, WASHINGTON**

---

**DEPARTMENT OF  
EXTENSION**

**J. A. TORMEY, Director**

---

**GROWING ALFALFA  
WITHOUT IRRIGATION**

**—By—**

**IRA D. CARDIFF**

**Director, Washington Experiment Station**

**GEORGE SEVERANCE**

**Head of the Department of Agriculture**

---

**Published by the State College of Washington**

**SEPTEMBER, 1913**

**Series I.**

**No. 1**

## GROWING ALFALFA WITHOUT IRRIGATION

---

A careful study of conditions throughout the wheat belt shows very strikingly several very undesirable conditions and corresponding needs. First, our system of continuous grain-growing is resulting in gradual depletion of the soil humus. This is seen in the greater tendency of our soil to run together and bake, and to wash during fall and winter rains; in its reduced capacity for absorbing moisture and in the yellowish, spindling growth of grain exhibited in striking contrast wherever an old fence-row has been thrown into cultivation, or animals have left their droppings. In the semi-arid belt this deterioration is evidenced in the greater tendency of the lighter soils to drift. When grain crops are removed from the soil, the humus that is produced from the decaying grain roots and stubble is not equivalent to the amount of humus used up in the soil in the production of the crop. The inevitable result, therefore, of continuous grain growing is the gradual depletion of soil humus.

Nearly half the acreage of our great wheat region is in summer fallow each year, representing idle capital. This is necessary over the driest parts of the wheat region; but quite a large area of our wheat belt receives sufficient rainfall to grow good crops every year when proper precautions are taken to conserve moisture. In this portion of the wheat belt, the idle summer fallow is unnecessary and means a great loss. A reasonable interest on the present valuation of the land amounts to rent for the summer fallow year that in many cases will almost, if not quite, cancel the supposed profit from the wheat crop. A more diversified system of farming, including soil improving and forage crops, is necessary that the soil may be maintained in sufficient fertility to insure a good crop each year, and sustain livestock to consume all the corn, peas, etc., that may be grown on the summer fallow.

The serious labor conditions that usually accompany a strictly one-crop system are growing worse each year. Congestion of labor at certain periods forces high wages for inefficient transient labor, with almost entire loss of time for large

portions of the year for the farmer himself, as well as his expensive farming equipment.

Unsatisfactory conditions of country life are largely due to increasingly large farms, with a correspondingly scattered and diminishing rural population.

In the driest portion of the wheat belt considerable land is being actually abandoned because it is getting so badly out of condition as to drift badly and can be safely farmed no longer by old methods.

All these points simply emphasize the dire necessity for introducing some crop that will put our soil back into condition and permit greater diversification of farming, as well as overcome in the greatest possible measure the undesirable economic conditions mentioned above. One of the most valuable plants available for such improvement is alfalfa. Gradually it has been introduced during the last fifteen or twenty years until now more or less alfalfa is grown in every community of the Inland Empire where rainfall exceeds twelve inches. Alfalfa possesses many valuable characteristics:

1. It produces large tap-roots which bore fifteen feet or more into well drained soil and produce by decay a large amount of humus which is distributed throughout every cubic inch of soil, to considerable depth, exactly where it will do the most good. Soil examinations indicate that water goes down much more rapidly in decayed alfalfa sod than in similar soil that has not grown alfalfa. This increase in humus not only increases the capacity of the soil to absorb moisture, but promotes better air circulation and hastens the chemical changes of the soil that are so necessary for the proper development of available plant food.

2. Alfalfa is also a nitrogen-gathering plant. It has the power, through the aid of certain forms of bacteria, to take up free nitrogen from the air. Hence an alfalfa crop leaves the soil richer in nitrogen when it is plowed up than when it was seeded. Nitrogen is the element that gives vegetation a rank, dark green, healthy appearance, when present in abundance. A deficiency of nitrogen causes a paler, spindling growth. Hundreds of thousands of dollars have been spent in trying to harness the power of great waterfalls in order to convert free nitrogen of the air into some commercial form to be sold as fertilizer. By allying ourselves with alfalfa we have a power

that can bring the free nitrogen of the air into our soil and returns a profit while we are accumulating this essential element. **At the usual commercial value of nitrogen the free nitrogen of the air above one quarter section of land would be worth a billion dollars. Every farmer has it within his power to draw upon this bank account without giving a mortgage in return.**

3. The perennial character of alfalfa, its great ability to resist drouth, and its remarkable tendency to make a continuous growth whenever there is warmth and moisture enough to make anything grow at all, make it one of the best all-around forage plants for the Inland Empire. Its remarkable adaptability to irrigated sections of our state and the high development of alfalfa growing in those sections render a discussion of alfalfa under irrigation unnecessary in this bulletin.

Alfalfa fits into the general scheme of rural improvement in the wheat belt in several ways:

1. By growing alfalfa for two or three years in every decade the fertility of the soil is more satisfactorily maintained.

2. A reasonable area furnishes abundant spring pasture to maintain stock needed to consume the waste from grain fields, and such crops as corn, peas, etc., that may be grown on summer fallow. Nearly all young stock, including cattle, sheep, horses, swine and idle breeding stock, will keep in good, thrifty condition and make rapid growth on alfalfa alone.

3. Alfalfa makes a high class hay for all kinds of stock. Where alfalfa is abundant and proportionately cheap, steers have been finished satisfactorily on alfalfa alone, and cows have been maintained in good flow of milk with no other food. However, this merely shows the great merit of alfalfa, for it is seldom advisable to confine stock to any single feed when they are being fed heavily. Numerous carefully conducted experiments fully prove that a properly selected variety of feed will be digested more completely, hence fed more economically, than will any single feed. An increasing number of farmers are using alfalfa hay as the sole roughage for their work horses, even when doing heavy work; and many of them report better results than when they were using other kinds of hay. Those who are successful in feeding alfalfa hay to horses in heavy work usually let the hay become more mature before cutting than when it is intended for cows or young stock.

4. Alfalfa is just beginning to be used for silage and no doubt will ultimately come into general use for that purpose.
5. Alfalfa makes an excellent soiling crop.

## HOW TO GROW ALFALFA

### 1.—Varieties

Notwithstanding the fact that the cultivation of alfalfa dates back as far as written history, perhaps less is definitely known in regard to its varieties than almost any of our more important cultivated plants. The reasons for this are probably two-fold. First, the breeding of alfalfa presents rather unusual technical difficulties and, second, the practical growing of alfalfa for seed requires especial attention to details, such as the average farmer is not inclined to give. As a result, we find alfalfa seed more or less expensive and many farmers who naturally would grow the crop hesitate at the initial cost.

Investigations of the past few years by the U. S. Bureau of Plant Industry, and many of the experiment stations, reveal the existence of a large number of promising varieties of alfalfa. Last year several very promising varieties were discovered by plant explorers in the dry land regions of northern Africa, where they were being cultivated by Arabs. Some of these undoubtedly will prove of great promise to us in our semi-arid regions. A number of very promising varieties of the yellow alfalfa (*Medicago falcata*) have also been discovered in Turkestan and Siberia recently, some of them enduring extreme drouth and others extreme cold. One species was found growing as far north as the sixty-second degree of latitude, where the minimum temperature reaches as low as minus ninety degrees Fahrenheit. This is a region where the subsoil is frozen the year around.

Of course, in the State of Washington those species adapted to dry conditions are of more interest to us than those capable of enduring low temperatures; yet, inasmuch as cold and dryness have physiologically much the same effect upon plants, all of these varieties may prove valuable to us.

Probably one of the most drouth-resistant varieties cultivated in this country at the present time is the Grimm alfalfa. However, it is very difficult indeed to obtain seed of the Grimm variety at the present time. A cross between the Grimm and one of the other varieties produced in Ontario (there known as

the "Ontario Variegated") has proven a very excellent variety in that region.

It is almost useless in the present stage of our knowledge of alfalfa varieties to recommend definite varieties in a state where agricultural conditions are so diverse as those in Washington. About all that can be said of the matter at the present time is that seed produced in a region similar to that in which it is to be grown will, on the whole, do better than seed imported from another locality where conditions may be radically different. That is, seed produced in the semi-arid region of Adams county, for instance, will probably do better in that region than seed imported from Illinois, Ontario or Germany. Fortunately, most varieties which appear upon our Washington markets will produce a paying crop if properly handled.

## 2—Seed

The great problem with the farmer at present is not what variety of seed to purchase, but whether the seed is pure and of good vitality. Tests of numerous samples of alfalfa seed by the Department of Botany of the State College of Washington reveal the fact that much of the seed is of low vitality, more than a third of it being below the legal standard of eighty per cent germination test and many of the samples running below seventy per cent. This, of course, is serious. One variety said to have been imported, and sold extensively in Eastern Washington the past spring, had a very low percentage of viable seeds, some samples of it running as low as fifty-seven per cent. On account of the fact that this seed was bright in color and gave an unusually high purity test, the dealers were able to dispose of large quantities of it. It is quite probable that this seed was two or three years old.

These tests carried on by the Department of Botany at the State College also reveal the presence of an enormous number of noxious weeds. For instance, of all the samples of alfalfa examined—

13 per cent contained one kind only of noxious weed seed.

17½ per cent contained two kinds of noxious weed seed.

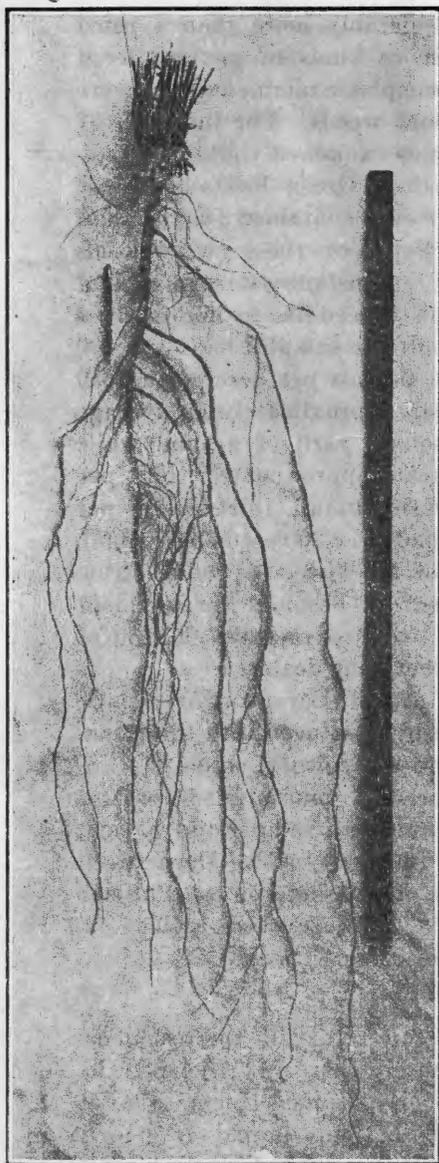
30½ per cent contained three kinds.

13 per cent contained four kinds.

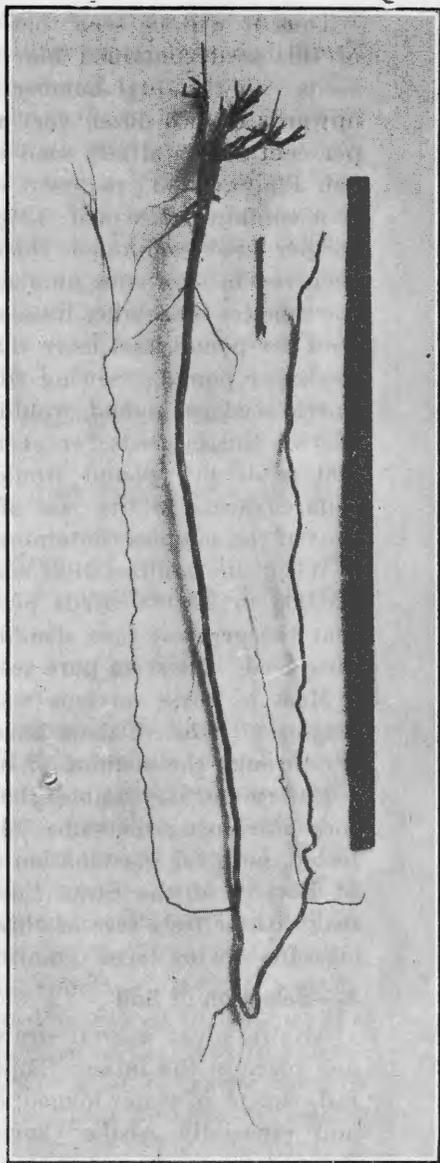
13 per cent contained five kinds.

8.7 per cent contained six kinds.

4.3 per cent contained seven or more kinds.



Alfalfa is a good subsoiler. Pencil at right shows relative size of roots. In decaying, these all form chambers for the entrance of air and water. No attempt was made to trace the roots to their full depth, or to save the mass of fibrous roots.



Mature root traced to a depth of eight feet. The root was doubled back for photographing. Note size of root at point of cutting off at eight feet deep.

Thus it will be seen that considerably more than a third of this seed contained four or more kinds of noxious weed seeds. In the total number of samples examined there were upwards of two dozen very noxious weeds. For instance, 57 per cent of the alfalfa seed samples examined contained English Plantain; 35 per cent contained Green Foxtail; 31 per cent contained Mustard; 13½ per cent contained Dodder, and 13 per cent contained Dock. Some of these weed seeds occurred in enormous numbers. For instance, 25 per cent of the samples containing Russian thistle seed had as high as 1650 seed per pound, and more than half the samples had over 800 seeds per pound. Sowing fifteen pounds per acre, with 1650 thistle seed per pound, would mean approximately an average of two thistle seeds for every square yard of ground while 800 seeds per pound would mean approximately one per square yard. In the case of Green Foxtail, thirty-seven per cent of the samples containing it had over 300 seeds per pound.

When one realizes that some of these weeds produce from 100,000 to 500,000 seeds per plant, it becomes very evident that the greatest care should be exercised in the selection of pure seed. **Insist on pure seed from your dealers!**

Most of these noxious weeds are of European or Asiatic origin and most of them have been introduced into this country through the medium of impure agricultural seeds.

Determine, if possible, the source of your alfalfa seed before purchasing the same; also procure a sample and have it tested, both for germination and for purity. The Department of Botany of the State College of Washington at Pullman makes these tests free of charge. Therefore, there is little excuse for sowing large quantities of impure seed.

### **3.—Selection of Soil**

Alfalfa loves a well drained soil. It will thrive almost any place in the Inland Empire where there is sufficient rainfall, except in water-logged, or poorly drained tracts. Clover, and especially Alsike Clover, is better adapted to poorly drained tracts, except where the soil is almost water-logged. Alfalfa is being produced successfully on all grades of soil from light sand to heavy clay.

### **4.—Preparation of the Soil**

Where the average rainfall is above twenty inches, fall

plow, leaving the furrows loose over winter to absorb as completely as possible the fall and winter rains. The soil should be harrowed in the spring as soon as it is fit to work. For three or four weeks it is best to keep the soil worked enough to preserve a mulch to hold the moisture without working deep. About the first of May the soil may be given a final fitting, aiming to form a firm seed-bed with a mellow but rather shallow, thoroughly worked mulch. Where the rainfall is less than twenty inches per annum, it is best to prepare good clean, well-tilled summer fallow, working the surface in the spring before seeding as in the case of fall plowing. The aim should be—

- a. To catch and retain all the moisture possible.
- b. To clean out the weeds.
- c. To develop available plant food to give the alfalfa a vigorous start; and
- d. To secure a physical condition of seed-bed that will make it possible to drill the seed into moist soil without seeding too deep.

#### 5.—Seeding

Alfalfa has been seeded on a variety of dates with very good success. The Experiment Station prefers to seed during the first two weeks in May, this practice giving an opportunity for spring tillage, and allowing the warming up of the soil, which promotes a more rapid and vigorous growth. While many good stands of alfalfa have been secured by seeding broadcast, the most uniformly good results are secured by seeding with a grain-drill. If the drill is fitted with a grass seed-box, the hose or spouts should be detached from the grain-box and fastened to the grass seed-box so as to conduct the seed down into the hoes or discs, setting the drill to run as shallow as possible. The alfalfa seed will all be placed down in moist soil without being seeded too deep to come up, and a minimum of seed will suffice. Six pounds of high class seed is sufficient if the soil is prepared and the seeding done as indicated above. In Western Washington, broadcast seeding is more permissible than in Eastern Washington, because heavy dews and frequent showers usually keep the surface moist till the alfalfa becomes well rooted.

## 6.—Inoculation

Alfalfa's superiority over other crops is due to the fact that it is rich in protein (muscle-building food) and also to the fact that it enriches rather than depletes the soil upon which it grows. Both of these qualities are possible because of the presence of exceedingly small plants called "bacteria," which live upon the roots of the alfalfa, there forming the familiar nodules. In each nodule are millions of these bacteria which have the power of assimilating nitrogen from the air, said nitrogen being the basic element in protein food and a most important factor in soil fertility, as stated above. If these bacteria are not present in the soil, alfalfa does not do well. It then becomes necessary to inoculate the soil with the bacteria. This is accomplished in various ways. First, soil from an alfalfa field known to contain the bacteria may be scattered over the ground in question at the rate of two or three hundred pounds per acre, and harrowed or disked in. Second, a portion of soil may be treated with a pure culture obtained from a bacteriological laboratory and this disked into the ground in question; or, third, the seed which is to be sown may be inoculated with a pure culture obtained from a laboratory and these seeds sown in the inoculated ground. Whichever method is used, the inoculated soil or seed should not be exposed to strong sunlight; that is, the inoculation should take place on a cloudy day or in the evening. These nodule-forming bacteria seem to be present more or less in most of the soils of Eastern Washington. Therefore, most alfalfa growers are not obliged to inoculate their soil. Yet, in most regions inoculation proves beneficial because it hastens the time of nodule formation, thus aiding the growth of the alfalfa. On the Experiment Station farm it has frequently been noted that in fields which have not previously grown alfalfa it does not make as rank a growth at first as it does upon fields which are already infected with the nodule-forming bacteria.

In Western Washington inoculation seems to be quite essential, although the whole alfalfa problem is more or less in an experimental stage in that region at the present time.

In general it can be said that inoculation is necessary when it is observed that the alfalfa is devoid of nodules, or produces only a few of the same, or if the soil is low in organic matter,

or if the growth is irregular over the field, and it is found that some plants bear nodules while others do not. On the other hand, inoculation is not necessary when an average crop is being produced and nodules are abundant, or when the soil is already rich in nitrogen, as it is in some parts of the West. The most apparent indication of the need of inoculation is a yellowish, spindling growth of alfalfa.

The mistake should not be made of regarding the bacteria as fertilizer. They are not. They produce the fertilizer and the effect of inoculation must not be expected too early. It is also useless to inoculate upon acid or water-logged soil.

It has been the custom of the Experiment Station in the past to recommend inoculation by means of soil obtained from another alfalfa field. However, this method is attended with more or less danger, on account of the fact that a farmer may unconsciously introduce into his soil various fungous and bacterial diseases, Nematode worms, potato bugs, the potato tuber-moth, alfalfa weevil (which pupates in the soil) and also the seed of various and sundry noxious weeds. These are all real dangers. Inasmuch as some of these pests, like the bacterial leaf spot of the alfalfa, the alfalfa weevil, the potato tuber-moth, and the Colorado potato bug, are just commencing to enter the state, it becomes very important to exercise great care in inoculating by this method.

Inoculation by means of pure cultures is not attended with any of these dangers. However, there is one disadvantage in the pure culture and that is it is sometimes inert when obtained or so easily rendered inert by careless handling.

#### **7.—The Nurse Crop**

While in many instances farmers succeed with a nurse crop, the most uniformly good stands are secured by seeding alfalfa alone. Where rainfall exceeds twenty inches a fairly good crop of alfalfa hay may be secured the same season it is seeded, if no nurse crop is used. There are cases in which it is necessary to seed with some more rapid growing crop before seeding the alfalfa, in order to hold the soil from drifting, seeding the alfalfa after the quicker growing crop has made a good start. Rye has been used as a nurse crop quite frequently, with good success, on some of the drifting soils of the irrigated regions. It is questionable whether alfalfa can be grown with success where soils have begun to drift and no irrigation water is avail-

able. It should be attempted only in a very small way under such conditions until its merit is determined.

### **8.—Care During First Summer**

Contrary to the common belief that alfalfa will root better and give better results by clipping back, experiments have clearly shown that alfalfa will become better established, producing a better crop the ensuing year if it is not clipped back the first season until it has made a full growth. However, when weeds come in badly, it is best to cut the weeds, setting the mower bar to run high, to avoid cutting back the alfalfa plants as much as possible.

### **9.—Cultivation**

Alfalfa should be cultivated each spring as soon as the soil is fit to work and if possible after every cutting. The purpose is to conserve moisture, promote the necessary chemical changes in the soil for the preparation of available plant food, and to eradicate weeds. In light land the spring-tooth harrow is one of the best tools for this purpose. The results will be so much the better if the soil can be thoroughly worked up to the depth of four or five inches. The Alfalfa Renovator is one of the best tools in the heavier soils for this purpose and will do excellent work if weighted. In the absence of a special tool a disk harrow may be used satisfactorily. It is usually best to follow the renovator or the disk with a smoothing harrow to fine the soil and form a better mulch. The purpose of this cultivation is not to tear the plants to pieces as many imagine, but to secure the usual advantages of cultivation, the eradication of weeds, the pulverizing and ventilation of the soil causing more rapid development of plant food, and the conserving of moisture. With this viewpoint, one can appreciate that a mere musing up of the surface is of no great value.

### **10.—Pasturing**

To secure the largest returns from pasturing alfalfa it should be allowed to make a good start in the spring before turning on the stock and should be allowed to go into winter with a little top. Stock should be kept off the fields during the winter. At no time should it be pastured real close. The pasture should be divided into two or three parts and the parts pastured successively. This gives the alfalfa frequent opportunity to recuperate. Cultivation is just as beneficial to alfalfa

pasture as to alfalfa meadow. There is danger of bloating in pasturing cattle or sheep on alfalfa, but the danger is not great in the wheat belt if the stock is worked into it gradually and is kept off of luxuriant alfalfa when it is wet. Danger is also lessened by giving access to some other feed for part ration. Seeding orchard grass with alfalfa has helped to solve this problem in many cases.

### **11.—Making Hay**

A common rule is to cut alfalfa when one-tenth in bloom, but the proper time should be determined to some extent by the purpose for which the hay is made. If for horses or fattening animals it should be slightly more mature than if for dairy cattle. If left very long after the new shoots have started at the crown the succeeding growth will be materially lessened. If cut too green it will lack substance and be more apt to cause scouring, bloat, or other troubles. It should be handled much the same as clover, curing it principally in the cock, aiming to haul when no juice can be twisted from a wisp of stems. The leaves, the most valuable part, waste badly if cured much in the swath. The exact procedure and the time needed for curing must necessarily vary with the immediate weather conditions.

### **12.—Probable Yields**

The college has been raising from thirty to fifty acres of alfalfa per year for a good many years and the yield records show average yields for the entire area usually of from two to three and one-half tons per acre. In only a few instances has the yield of any considerable acreage fallen as low as two tons and in some instances it has reached nearly four tons per acre. The second crop has usually been pastured, otherwise the yields per annum of cured hay would have been slightly higher. Alfalfa tracts unbroken for years show no signs of deterioration, except when pastured very close continually or when not given cultivation. One small tract seeded in 1902 is as good as ever. The college does not aim, however, to establish permanent meadows, but to grow alfalfa or clover on all fields of the state farm in rotation with the other crops. While summer fallowing was practiced on the college farm ten years ago, the soil is being built up so that for several years summer fallowing has been discontinued and excellent crops are being

produced regularly, averaging fully as high as on good farms where grain is the sole crop, and summer fallowing is practised.

### **13.—Alfalfa Versus Clover**

Clover as well as alfalfa has been grown in field quantities on the college farm for nearly twenty years, and the following conclusions seem to be justified:

- a. Where the annual rainfall exceeds twenty inches, red clover can be grown successfully and will yield about the same as alfalfa without irrigation.
- b. In the wheat regions with an annual rainfall of from twenty to twenty-five inches, the requirements noted for preparing the soil and seeding alfalfa, are even more imperative when seeding clover; but with strict adherence to methods outlined, an excellent stand may be relied upon with much certainty.
- c. Alfalfa produces a better crop than clover the season of seeding.
- d. Alfalfa is more apt than clover to produce a good second crop during dry summers.
- e. Alfalfa seems to endure pasturing better than clover.
- f. Clover deteriorates after three or four years, while alfalfa does not.
- g. Clover is better adapted to short rotation than alfalfa, and it is much less expensive to plow up and eradicate.
- h. Alfalfa is usually better adapted to permanent or semi-permanent meadows or pastures.
- i. They may be classed together as soil improvers, and are practically equal in feeding values.

---

Reports from a number of farmers show that alfalfa is being grown in a small way by a great many farmers in the Inland Empire; and that it is entirely past the experimental stage where the rainfall exceeds fifteen inches, with several reports of success in regions of twelve inches rainfall.

Estimates of yields by farmers about Pullman, who are growing from five acres to two hundred and fifty acres, run from two to four tons per acre, averaging about three tons from two cuttings.

R. S. Booth feeds alfalfa hay to his horses, as the only

roughage when at hard work, and reports no sickness since he began feeding it fourteen years ago. He says: "Alfalfa beats forty bushels of wheat per acre."

Max Hinrichs, with one hundred and fifty acres of seed alfalfa, and one hundred of hay and pasture, replies: "It is a decidedly paying crop; grain crops are much better after alfalfa."

R. S. Curtis replies: "A paying crop, even if soil improvement alone is considered."

Preston Morris: "A paying crop to the extent that it can be used up; would not advise growing it for market. Farmers should grow more alfalfa, but keep stock enough to consume it."

J. D. Carson reports: "Two tons of hay with good pasture afterwards; a good crop so far as it can be fed on place."

Nat Bryant has been growing alfalfa for eight years, and now has eighty-five acres.

Thomas Halpin has twenty-five acres of alfalfa, and feeds it to beef cattle. He says: "A paying crop to the extent that it can be fed out."

J. H. Weeks, who runs a dairy, has fifty acres in alfalfa.

B. Atherton reports ten acres of alfalfa, and will seed more next year. He has raised it for nine years, averaging about two and one-half tons, first cutting, with pasture afterwards. He has secured as high as four tons per acre, and says: "A good paying crop."

The State College does not advocate the wholesale introduction of alfalfa, or any other crop, by the inexperienced, but does urge the gradual introduction of alfalfa; also, clover, peas and corn, where the rainfall will justify it, to meet the needs mentioned at the outset of this article; and, also, urges the keeping of enough live stock for the consumption of such crops.

Farmers in the very dry wheat belt are advised to try alfalfa in a small way, exercising extreme care in every step. A few trials about Ritzville indicate that it may be grown there to good advantage.

Senator D. A. Scott of Ritzville has a small acreage, and considers it a success.

Thorough soil preparation, seeding with a drill, thin seeding, and vigorous cultivation become very important under such conditions.

In Western Washington, clover, peas and vetch all do so well and are so much better adapted to short rotations that alfalfa has been given very little trial. Wherever tried, it has made a sickly growth, and in every case seems to need inoculation. Owing to its superiority as a drouth-resistant plant, it may prove a superior crop for some of the lighter soils of Western Washington, but that point remains to be proven.

It must be borne in mind that the State of Washington is so varied in its soil and climatic conditions, that it is impossible to recommend without reserve, or to lay down an absolute set of rules to cover all conditions. Farmers are therefore advised to consider the points brought out in this bulletin and to work out the problems carefully to meet their local conditions.