UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

GOODING SUB-STATION

Experiments With Legume Crops Under Irrigation

Turning under red clover on the station farm for green manure

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BULLETIN No. 94 JANUARY, 1917

Published by the University of Idaho, Moscow, Idaho

Summary

The legume crops are among the most important for the irrigated lands of southern Idaho.

Under normal conditions twelve pounds per acre is a satisfactory rate of seeding for alfalfa. During its first season alfalfa should be irrigated by the corrugation method. Thereafter, flooding can be used with equally as good results. Comparatively deep applications of water should be made in the irrigation of alfalfa for hay. Under conditions similar to those which prevail at Gooding, alfalfa hay should receive about two and three-fourths acre feet of water per acre for a three-crop season. In the production of alfalfa seed the best results have been secured from seeding in rows, clipping the first growth about the last of May and thereafter applying light and comparatively frequent irrigations.

The Common is the most important strain of red clover. Red clover grown for hay requires practically the same treatment as alfalfa grown for hay. In growing it for seed, it is advisable to clip the first growth about the last of May and thereafter to apply light irrigations often enough to keep the crop in good growing condition. Red clover is a particularly valuable crop for use in building up the fertility of new lands.

Alsike and white clover are particularly valuable in pasture mixtures. When grown for seed the first growth should be allowed to mature the seed crop.

Crimson clover is not sufficiently hardy to be of any value on the irrigated farms of Idaho.

Conditions prevailing over most of the irrigated projects of south Idaho favor the production of field peas. The crop is a particularly valuable one. The best varieties are Amraoti, Blue Prussian, Kaiser, and Bangalia. Field peas should be sown with an ordinary grain drill at the rate of ninety to one hundred pounds per acre. Early sowing is advisable. Under normal conditions two irrigations give the best results. When mixed with oats, they make a satisfactory hay crop. They are being extensively and profitably used in pork production by the "hogging-off" method.

Vicia villosa or hairy vetch is the most productive of the vetches. When grown with oats it produces a heavy yield of excellent hay. The second growth can be used profitably as a green manure.

Of the several varieties of field beans tried out, the White Navy has proved to be the most desirable.

Horse beans are valuable as a "hogging-off" crop but for this purpose they are not the equal of field peas.

Climatic conditions which prevail over many irrigated sections of south Idaho do not favor the production of soy beans and cow peas.

EXPERIMENTS WITH LEGUME CROPS UNDER IRRIGATION*

Of all crops produced in irrigated Idaho the legumes are by far the most important. The state's advanced development in irrigation agriculture is directly traceable to a general recognition of the importance of leguminous plants. Its great hay crop upon which an extensive and growing livestock industry is based consists almost entirely of alfalfa and the clovers; the production of clover seed, peas, and beans constitutes a large and profitable industry; the importance of field peas in economic pork production is generally recognized; and the use of all of these crops in upbuilding and maintaining the fertility of raw sagebrush soils has become one of the first principles of our agricultural practice.

The work which has been conducted at the Gooding Sub-Station with the legume crops has consisted of the testing and comparison of varieties, experiments upon various phases of irrigation practice, and the seeding and cultural management of the most important of these crops. In all of the experiments every possible precaution was taken to eliminate variation in all of the factors of crop production except the one under study. In the irrigation experiments all water, both on-flow and run-off, was carefully measured over twelve-inch Cippoletti weirs. All waste water was deducted from the amount applied; the amounts reported in the experiments, therefore, represent water which was actually absorbed.

Alfalfa

Alfalfa has unquestionably played a more important part in the development of irrigation agriculture than has any other crop. Its natural characteristics and habits of growth make it particularly well adapted to irrigation. Its great value as a producer of enormous quantities of the best forage and as the prime factor in the up-building of the fertility of new lands is too well known to require discussion here.

Varieties: During the season of 1910, eleven varieties of alfalfa were planted on plats 1-40 of an acre in size. Very irregular stands were secured and, therefore, no data were obtained on the relative yields of the different varieties. They showed no variation in the time of starting growth in the spring and very little in the average height of the plants. The "common" alfalfa is by far the most extensively grown and under ordinary conditions it is very satisfactory. It usually consists of a mixture of several varieties or strains. Under adverse climatic conditions, Grimm alfalfa is to be preferred because of its greater hardiness.

Seeding: The best results have been secured by seeding in the late spring or early summer and irrigating by the corrugation method to be discussed later. An experiment on the rate of seeding was conducted during the years 1910 to 1912, inclusive. Five one-fifth acre plats were used; all were seeded at the same time and by the same method on well prepared seed beds. All were irrigated up by the corrugation method.

* This bulletin is based upon experiments which have been conducted at the Gooding Sub-Station during the years 1910 to 1916 inclusive. For a discussion of the conditions under which this work was done see introduction to Idaho Experiment Station Bulletin No. 93, Experiments with Small Grains Under Irrigation. In all tables averages only are given for the years mentioned in the text.

After the first season all were irrigated by flooding and were given as nearly as possible the same amounts of water. Results of the experiment are indicated in Table I.

Table I.—Yields from different rates of seeding

Rate of seeding	Average height of plants in inches	Cured hay in tons per acre
20 lbs. per acre.....	23	4.021
16 lbs. per acre.....	24	3.726
12 lbs. per acre.....	26	4.364
8 lbs. per acre.....	26	3.855
4 lbs. per acre.....	26	3.702

The heavier seedings of course produced the thicker stands. The plants of the heavier seedings were shorter too and less coarse and came into bloom on the average three days later than those grown from the lighter seedings. Only two cuttings were taken from each plat each season. A better quality of hay was produced by the twelve, sixteen, and twenty-pound seedings than by the four and eight-pound seedings. While some of the variations in yield of hay might have been due to slight differences in soil conditions, it is apparent that the best results came from the twelve-pound seeding. Under ordinary conditions with a properly prepared seed bed and a sufficient moisture supply, it is a waste of seed to use more than twelve pounds per acre. The best results have been secured by seeding alfalfa with a drill.

Irrigation: In the development of a crop of alfalfa hay, there are no marked stages thru which the plants go. The main object to be obtained is the production of a large amount of vegetative growth and this requires a relatively high content of soil moisture thruout the entire season. The first irrigation in the spring should be applied sufficiently early to prevent the soil from becoming dry. It is advisable to irrigate shortly before cutting. This practice will start the new crop growing as soon as the old one has been cut. Excellent results have been secured by planting alfalfa in comparatively dry soil and irrigating to germinate the seed. With grain crops there is considerable objection to irrigating after seeding and before the crop comes up but in the case of alfalfa, clovers, and grasses this plan of procedure has proved very satisfactory.

When irrigation is practiced to germinate the seed, the method of applying the water becomes a matter of great importance. During the seasons of 1910 and 1912, comparisons were made of the relative value of the corrugation method and the flooding method for this early irrigation.

On the plats which were irrigated by the corrugation method, the furrows were thirty inches apart. A small stream was allowed to run in each until the water had soaked across from one to the other. (See Figure I.) On the plats which were irrigated by the flooding method the water was applied by merely flushing a stream over the surface. On these plats the soil baked hard and, because of the large stream, washed considerably, an occurrence which caused an uneven stand and an indifferent growth of the young alfalfa. On plats irrigated by the corrugation method there was no soil-baking except in the small furrows and because of the small streams of water used no washing of soil, a condition which resulted in an even, thrifty stand.

Observations made on this test indicate clearly the superiority of the

corrugation method for *starting* alfalfa under conditions similar to those which prevail on the Gooding Sub-Station. The continuation of these tests has failed to show any advantage of corrugations after the first season, for the shade offered by the plants prevents soil-baking and the roots

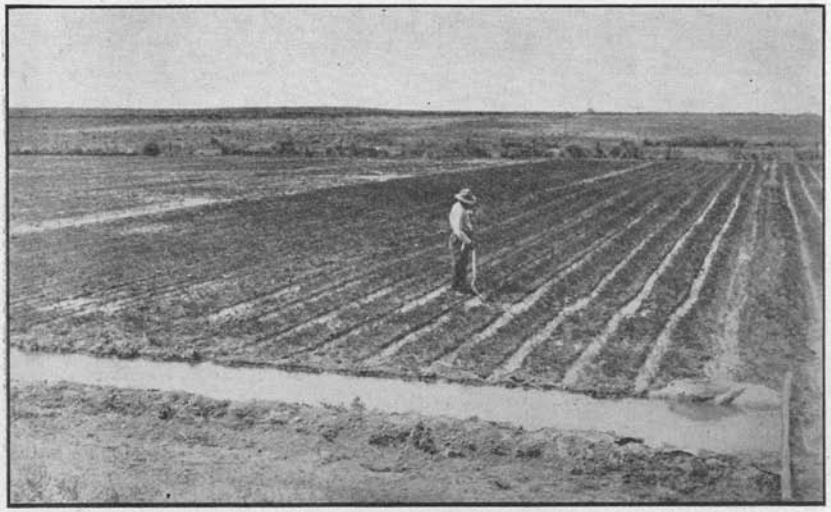

Fig. I—Irrigating young alfalfa by the Corrugation Method

keep the soil from washing. It is safe to say that on silt or clay loam soils with a gentle slope the corrugations will have no value after the alfalfa is well started. On sandy soils and steeper slopes, however, corrugations may still be valuable to prevent washing and to aid in an even distribution of the irrigation water.

On fields which have a uniform, gentle slope, flooding between borders is a very satisfactory method for the irrigation of old alfalfa. If the natural contour of the land is not adapted to the border method, free flooding can be practiced with excellent results.

During the years 1915 and 1916 an experiment was undertaken to determine the proper size of stream and the depth of application in the irrigation of alfalfa. One set of plats was irrigated by allowing the largest stream that could be obtained to flush quickly over the surface; it was shut off in time to prevent appreciable waste and resulted in a shallow application of water. Another set of plats was irrigated by the use of a stream one-half of the size of the first until the surface soil was wet; this procedure resulted in a somewhat deeper application. Still another set was irrigated by allowing a stream one-fourth the size of the first to run as long as was necessary to cover the ground; this procedure resulted in a heavy application of water. All of the plats in the experiment were irrigated on the same days and were given the same number of applications. Insofar as possible they were irrigated without waste but waste in some cases was unavoidable. Each irrigation, therefore, was calculated separately and the waste, if any, deducted.*

* It does not necessarily follow, therefore, that calculations based on the average head for the average time as given in Table II gives exactly the average application of water. All water was applied by flooding between borders.

Table II.—Results from variation in size of stream

Size of stream cu. ft. per sec.	Average time used	Average depth of application acre-feet per acre	Total water absorbed acre-feet per acre	Average height of plants inches	Tons of cured hay per acre	Tons of cured hay per acre-foot of water
.30	4 hrs., 40 min.	.373	1.863	26	4.246	2.279
.65	1 hr., 49 min.	.266	1.332	19	2.842	2.134
1.20	43 min.	.219	1.096	16	2.291	2.090

These tests were conducted in duplicate in 1915 and in quadruplicate in 1916. The plats had an average size of one-third of an acre. Five irrigations per season were given to each plat. Only two cuttings of hay were taken from each plat each season.

The results of this work indicate that comparatively deep irrigations should be used in the production of alfalfa hay. On loose porous soils deep irrigations are always given. In fact the irrigator is very likely to apply too much water in spite of efforts to prevent it and, hence, must flush the surface quickly with a large stream. Comparatively heavy soils with compact subsoils do not absorb water readily. On soils of this kind care must be taken to apply enough water at each application for the best growth of alfalfa. It would be possible of course to give a heavy application by running a large stream for a long time but that would entail a great amount of waste by surface run-off. On compact soils, therefore, it is the better practice in the irrigation of alfalfa for hay to divide a head of water into several small streams and permit them to run for a long time rather than to flush the surface with one large head for a short time only.

The water requirement of alfalfa hay is high in comparison with that for grain and root crops. The amount of irrigation that must be given to supply this requirement varies widely with different soil and climatic conditions. Therefore the results which have been secured in the work on the duty of water for alfalfa hay are applicable only to conditions which are quite similar to those which prevail around Gooding.

The experiments on the duty of water for alfalfa hay were conducted during the years 1911 to 1914 inclusive. During these years the several plats under experimentation received amounts of water ranging from one irrigation per cutting of hay to all that could be applied. In Table III the results of this work are indicated.

Table III.—Duty of water—Alfalfa

No. of Irrigations	Length of irrigation season in days	Total water absorbed in acre-feet per acre	Average height of plants in inches	Cured hay in tons per acre
3	63	1.020	18	3.206
5	102	1.794	19	3.862
8	107	2.122	26	4.955
11	98	2.697	30	6.394
11	114	3.621	30	6.502

The irrigation of these plats began during the first half of May. All water was applied by flooding between borders. An average precipitation of .218 feet occurred during the growing season indicated in the table.

The application of the larger amounts of water delayed the time of blooming, and, as may be noted from the table, increased the height of

the plants. It is also to be noted that the plats which received the greatest amounts of water returned the most hay per acre, a fact that indicates that the excessive water was not injurious to the crop. It should, however, be noted in this connection that in no case was the water allowed to pond up. Had it been allowed to do so and remain for any length of time considerable injury to the crop would have resulted. The run-off in all cases was carefully measured. Again it is to be noted that an increase of an acre-foot of water over 2.697 acre-feet per acre increased the yield of hay by only .108 tons or 216 pounds per acre. This increase in yield was insufficient to pay for the extra water used to secure it. During the season of 1912 only two cuttings of hay were harvested from these plats. During each of the other years three cuttings were secured. The plats which received the smallest amounts of water produced the poorest quality of hay.

In the light of results secured from these experiments on the irrigation of alfalfa, it is safe to conclude that under conditions similar to those which prevail at Gooding it will be profitable in securing three crops of hay to apply irrigation water to alfalfa up to about two and three-fourths acre-feet per acre. This amount of water can be applied best in seven or eight irrigations. More water than the amount indicated may produce a little more hay but the increased yield will not justify the extra expense involved.

Seed production: The production of alfalfa seed is an important industry in many parts of irrigated Idaho. Because of the exacting requirements of the plant upon climate and soil in seed production, certain sections of the state are far better adapted than others to alfalfa-seed production. Very little alfalfa seed is produced in the immediate vicinity of the Gooding Station and the work of the station in seed production from the standpoint of yield in bushels per acre has not been entirely satisfactory. Recommendations for procedure in seed production are based both upon the results of observation in the field and upon experimental data secured on the station farm.

It is a matter of common observation that satisfactory crops of seed are not usually produced on those fields which have the thick even stand so much desired in hay production. On the contrary the best yields of seed come from fields which have a thin irregular stand or from those which have been planted in rows. From plats on the station farm sown in rows 35 inches, 28 inches, and 21 inches apart, the heaviest yield of seed was obtained from the plats whose rows were 35 inches apart. The yield decreased regularly with decrease in width between rows but in all cases the rowed culture plats produced more seed than did the plats sown in the usual manner for hay production.

It is the practice of some growers to allow the first growth of alfalfa to make seed, of others to cut a full crop of hay and let the second crop go to seed, of still others to clip a very early crop of hay and secure their seed from an early second growth. These three plans of procedure in seed production have been tested out on the Gooding Station. The best results have been secured by cutting the first growth late in May and permitting the second growth to produce the seed.

The irrigation of alfalfa for seed production is unquestionably one of the most important factors to be reckoned with. During the years 1915 and 1916, an experiment was conducted to determine how best to

apply irrigation water for seed production. The experiment involved a comparison of the value of light, frequent irrigation with heavy applications at greater intervals. Each of the rowed plats mentioned above were divided into two parts. Both parts were given exactly the same treatment up to the time of clipping which was done May 31. Immediately after clipping all were irrigated alike. From this time until the seed was well formed, one-half of each plat was given four irrigations and the other half two, each half, however, receiving as nearly as possible the same total amount of water. The rows which received the light, frequent irrigations produced a greater quantity of seed than those which received the deeper irrigations at greater intervals. Figure II illustrates the appearance of the plats when all were in full bloom.

Fig II—Irrigation of alfalfa for seed production. Rows 35 inches apart. Those on the left received light, frequent irrigations. Those on the right received approximately the same total amount of water, but in fewer irrigations. The rows on the left produced far more seed than those on the right.

The amount of irrigation necessary for alfalfa seed varies widely with soil and climatic conditions but the light frequent applications of water will be found to give best results because they tend to maintain a uniform, yet not excessive, soil moisture content and that condition of soil appears to be highly desirable in seed production. In general it may be said that much less water is required to produce alfalfa seed than alfalfa hay.

Clovers

The Gooding Station has not conducted as many experiments with clovers as with alfalfa and some other crops. A part of the information given here with reference to this crop results from field studies and observations.

Of the different varieties of clover, red, alsike, and white are best adapted to conditions which prevail on the irrigated lands of Idaho. These varieties will be discussed in the order of their relative importance.

Red clover: This type of clover is well adapted to growth under

irrigation. It is extensively grown both for hay and for seed and as a factor in building up and maintaining the fertility of sagebrush soils is second in importance only to alfalfa. There are a number of strains or varieties of this type. During the seasons 1912 and 1913 the following were grown on the station farm: Common, Mammoth, Italian, Perm, and Orel. Of these the Common proved to be the most satisfactory from the standpoint of hay and seed production. This strain is by far the most important and best known in the state.

In the *seeding* of red clover the best results have been secured by using the same methods that gave best results in the seeding of alfalfa.

In the *irrigation* of red clover for hay, it has been assumed that results secured with alfalfa with respect to time of irrigation, method of application, and amount of water, are applicable, an assumption which seems to be justified from the results secured in yields. In all cases, the yield of clover has been about the same in tons per acre as that obtained with alfalfa. The clover, however, has been harder to cure and is generally considered somewhat inferior to alfalfa in feeding value.

The production of red clover seed is an important industry on many of the irrigation projects of the state.

In growing red clover for seed the best results have been secured from stands sown as for hay production. It has been found advisable in nearly all cases to clip the first growth for hay and to allow the second growth to mature the seed crop. The second growth almost invariably produces more blossoms than the first and they show a much greater uniformity in their time of development, a condition that insures even ripening of the seed crop.

During the seasons of 1914 and 1915, an experiment was conducted to determine the most desirable time for clipping the first growth. The heaviest yield of seed was obtained from those plats which were clipped late in May. At this time the first growth had an average height of nineteen inches and had not yet shown any blossom buds. On these plats the second growth came into full bloom during the third week in July and the seed crop was matured by the first week of September. Plats which were clipped much later produced more hay but less seed. Moreover, the quality of the seed was impaired by frosts before it reached maturity. As in the case of alfalfa, less water should be used for the production of seed than for the production of hay. Moreover, the water should be applied in light irrigations in the manner suggested for the production of alfalfa seed.

In long-time crop rotations, alfalfa is the most desirable legume to be used because of its deep rooting system and the great value of the forage produced. For short rotations, however, those that are so necessary for the development of raw sagebrush lands, red clover is better adapted. It makes a quick vigorous growth, is easily plowed under, and when so treated its beneficial effects upon new lands are remarkable.

In the spring of 1911, three plats on the station farm were seeded to barley, oats, and wheat, respectively. Immediately after the grains were planted, one-half of each plat was seeded to red clover at the rate of six pounds per acre. A better stand was secured on the barley than on the wheat and oat plats. After harvest all plats were irrigated and fall-plowed, the growth of clover being turned under. The following spring all plats were seeded to grain as before and all were treated exactly

alike thruout the season. In Table IV the yields of grain and straw are recorded. It is perfectly apparent that even this light application of the clover crop as a green manure produced remarkable results.

Table IV.—Results from red clover turned under as green manure

	Barley		Wheat		Oats	
	Grain in bushels per acre	Straw in pounds per acre	Grain in bushels per acre	Straw in pounds per acre	Grain in bushels per acre	Straw in pounds per acre
Yield of clover plat...	58.04	2521	75.29	2768	39.27	3115
Yield of check plat....	40.47	2289	64.55	2188	29.80	2616
Increase due to clover	17.57	232	10.74	580	9.47	499

The cost of seed and sowing was less than two dollars per acre. It is perfectly evident that in all cases the investment was a good one. If the clover had been allowed to grow another year before plowing under, it is safe to assume that its beneficial effects would have been correspondingly greater. The most satisfactory method of procedure when clover is to be turned under as a green manure is to harvest two comparatively early crops of hay during the second season and to plow under the third crop.

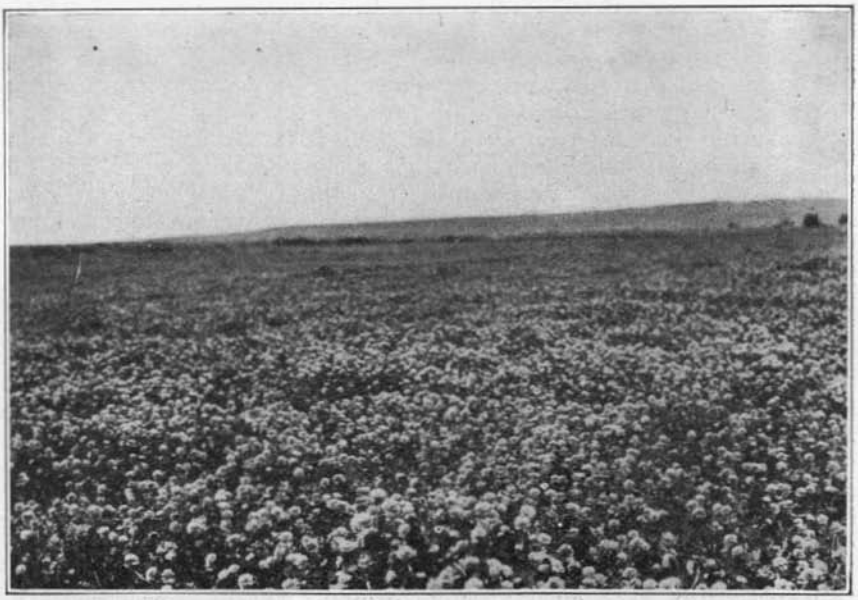

Fig. III—First growth of alsike clover in full bloom

Alsike and white clover: Of these varieties alsike is the most important. It is best adapted to wet lands. It is seldom grown alone but is being extensively used with timothy and red top as a mixture for hay production on lands that are too wet for alfalfa. Alsike is an excellent variety to use in this way. On average irrigated lands alsike too is particularly valuable in pasture grass mixtures.

White clover is extensively used in pastures and, altho not so desirable as alsike for pasture purposes, it gives very satisfactory results. Most of the work on the Gooding Station with these clovers has been in connection with pasture grass mixtures.* Some studies, however, have been made with them from the standpoint of seed production.

When sown for seed production it is essential that the seed be free from noxious weeds, the growth of which will detract from the value of the clover-seed crop. For both alsike and white clover-seed production. from five to eight pounds of seed per acre are usually sown. Suggestions already made with reference to methods and time of seeding alfalfa and red clover are applicable to alsike and white clover.

The results of several years' tests indicate that the first growth of these clovers should be allowed to mature the seed crop, that is, clipping the first growth should not be practiced. In these tests light irrigations have been applied as often as seemed necessary to keep the crop in good growing condition.

Crimson clover: In the summer of 1909 a plat was sown to crimson clover. This variety made a fairly good growth during the summer and fall but failed to live thru the winter.

Field Peas

Most of the irrigation projects of Idaho lie at comparatively high altitudes and possess soils and climatic conditions that particularly favor the growth of field peas. The field pea is rapidly assuming an important place among the best and most paying crops for irrigated lands in this state. Field peas furnish an excellent feed for certain classes of livestock; they have been used very successfully in economical pork production by the "hogging-off" method; they are valuable in short crop rotations; and when planted with oats they produce a heavy yield of first class forage.

The different varieties of field peas show wide variations in yields per acre. The selection of varieties from the standpoint of yield is, therefore, one of the very important considerations in the production of this crop. In Table V experimental results with a number of varieties are recorded.

Table V.—Variety tests of field peas

Name of variety	Time from seeding to maturity in days 1911-1916	Average height of plants at maturity in inches 1911-1916	Yield of grain in bushels per acre 1912-1915
Amraoti	133	39	39.01
Blue Prussian	136	39	30.17
Kaiser	137	41	28.68
Bangalia	127	36	27.73
White Canada	132	49	26.77
Scotch Blue	140	44	26.14
White Colorado	137	53	24.10
Carleton Brown	135	42	20.62

On June 7, 1914, a severe frost occurred resulting in a greatly reduced yield of all varieties for that year and causing a decrease in the average yield for the years 1912-1915 as shown in the above table. Of the varieties tested, the first four mentioned have proved very satisfactory

* See Idaho Experiment Station bulletin No. 95, Management of Irrigated Grass Pastures.

and are without a doubt the best varieties for the irrigated lands of southern Idaho.

Seeding: Field peas will germinate at comparatively low temperatures and should, therefore, be the first crop planted in the spring time. They should be seeded as early as the land can be properly worked so that the greatest development can take place before the period of hottest weather.

In 1913 an experiment was conducted to determine the relative value of different cultural methods in field-pea production. One-half of the land devoted to each variety was sown in rows twenty-one inches apart. The rows were cultivated with a garden cultivator. The other half of the land devoted to each variety was sown in rows seven inches apart with an ordinary grain drill. The plats so seeded were given the same irrigation. The average yield of all plats sown in rows twenty-one inches apart was 32.49 bushels per acre. The average yield of all plats sown with the grain drill was 38.98 bushels per acre. There was a yield of 6.49 bushels per acre in favor of the sowing in seven-inch drills. Field peas on irrigated lands should be sown at the rate of 90 to 100 pounds per acre.

Irrigation: If field peas are planted early in the spring time as suggested above on a well prepared seed bed, the winter and spring precipitation of a normal season generally furnishes sufficient moisture for their growth until just before blooming time. It has been shown conclusively in the station work that irrigation before this time tends to produce excessive vine growth at the expense of seed and that where excessive vine growth is induced the yield of seed is reduced. Irrigation water may be applied either by the corrugation method or by flooding. Field peas can easily be over-irrigated. The time of ripening can be controlled to a certain extent by the amount of irrigation water applied. Cases have been noted where the time of ripening has been delayed as much as two weeks by excessive applications of water. The irrigation requirement of this crop is considerably less than that of spring grains or potatoes. By far the best results have been secured on the station farm with an irrigation just before blooming followed with another when the peas were forming.

Forage production: In the development of a new farm from sagebrush land it is frequently necessary to produce a crop of hay the first year while the alfalfa and red clover are getting started. For hay production under these conditions a mixture of field peas and oats has been found very satisfactory.

During the years 1911 and 1912, an experiment was conducted to determine the proper mixtures and rates of seeding of oats and peas when grown for forage. From the experiment it was learned that a total of approximately 120 pounds of seed per acre was necessary. During the years 1913 and 1914 this amount of seed was sown in four different proportions with results indicated in Table VI.

Table VI.—Rates of seeding of peas and oats for forage

Peas lbs.	Oats lbs.	Total lbs.	Average height of crop in inches	Tons of cured hay per acre
80	40	120	41	2.626
70	50	120	41	3.223
60	60	120	42	3.109
50	70	120	42	3.171

The heaviest yield of forage was obtained with a mixture of seventy pounds of peas and fifty pounds of oats. The plats were cut when the peas were well formed and the oats were in the soft-dough stage. This period occurred during the third week of July. All hay so produced was of good quality and was eaten readily by all classes of livestock to which it was fed.

Hogging Off: On many irrigated farms field peas are being used to good advantage in pork production by the "hogging-off" method. Results secured on the station farm during the year 1916 indicate a very profitable return from this treatment of the crop. A somewhat limited experience on the station farm indicates that for "hogging-off" purposes a mixture of about three-fourths field peas and one-fourth wheat sown at the rate of ninety pounds per acre will give best results. The hogs should not be turned in until the peas are ripe. Peas alone in 1916 gave a net return of $39.68 per acre. Peas and wheat in the proportion and amount indicated above gave a net return of $45.20. The hogs were sold at $8.00 per hundred weight.

Vetch

Altho vetch is one of the minor legume crops, for certain purposes it has great value. It is especially valuable as a forage crop and for use

Fig. IV—Vetch and oat hay

as green manure on new lands. The first growth may be cut for hay and the second growth turned under for the benefit of a succeeding grain crop.

Varieties: Fifteen varieties of vetch have been grown at the Gooding Station. Of these *Vicia villosa,* commonly called hairy or winter vetch, has proved to be the most important and valuable. This variety is a winter type altho it may be planted in the spring or fall. It has a recumbent habit of growth. A grain crop is, therefore, usually planted with it to hold it up. It is a vigorous grower; the vines often reach a length of seventy-five inches.

Of the spring varieties *Vicia sativa,* or common vetch, is the best known altho *Vicia daisy carpa,* a new variety introduced by the United States Department of Agriculture, promises to be more valuable. The proper time and method of seeding spring vetch are practically the same as indicated for field peas.

Forage production: For forage production vetch is usually planted in a mixture with oats. A number of mixtures have been tried out. The best results have been secured by planting forty to fifty pounds of vetch and thirty to forty pounds of oats per acre. This mixture has produced an average of more than three tons of cured hay per acre. The hay was cut when the oats were in the solf-dough stage and the vetch in full bloom. This stage of growth was reached during the third week in July. While vetch and oats produce about the same yield of hay per acre as do peas and oats, vetch and oat hay is a much better feed. Whenever vetch was grown on the station farm, irrigation followed the removal of the hay crop. The heavy second growth of vetch resulting was then turned under as green manure. Its beneficial effects particularly upon raw sagebrush soils have been very noticeable. Most varieties of vetch seed abundantly but much of the seed is lost in the process of harvesting. If allowed to do so, hairy vetch will reseed itself year after year. The comparatively high price of its seed is largely responsible for the fact that this crop is not more generally grown. Vetch should be irrigated in practically the same manner as field peas.

Field Beans

Conditions prevailing on many of the irrigated lands of Idaho seem to favor the production of field beans. In some sections this crop has attained considerable importance. The work with field beans at the Gooding Station has been limited to variety tests. White Navy, Mexican, Bales, Idaho, and Weiser have been tried out. Of these the White Navy and Weiser are the only ones that have matured fully before the occurrence of fall frosts.

Horse Beans

Horse beans, *Vicia faba,* or Broad Windsor beans are extensively grown in some parts of irrigated Idaho. They are grown almost exclusively for "hogging-off" purposes. During the season of 1915 a crop was grown on the station farm for the purpose of finding its relative value when compared with field peas used in the same way. The horse beans were sown a little too late to secure maximum growth. They are considered somewhat inferior to field peas when used for pork production. A net return of $31.52 per acre was secured from them.

Soy Beans and Cow Peas

In the spring of 1911 these crops were planted in rows two and one-half feet apart. Good stands were secured and the plants made a fairly good growth during the summer. Both were killed by frost on September 14 before any seed had matured. Since the first fall frosts never occur later, in the vicinity of Gooding, than the date mentioned, it is apparent that it is useless to attempt the production of these crops under conditions similar to those which prevail in this section.

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The following publications may be obtained without cost, by addressing the Agricultural Experiment Station, Moscow, Idaho.

Bulletins

60. Conditions Affecting the Production of Denatured Alcohol in the Northwest.
65. Alaska Wheat Investigations.
72. A Report on the Milling Properties of Idaho Wheat.
73. A Study of Idaho Butter with Suggestions for Improvement.
75. Composition of Irrigated and Non-Irrigated Fruits.
76. Tomato Culture in Idaho.
79. Potato Culture.
81. Soils of the Cut and Burned-Over Areas of North Idaho.
84. The Annual Report of the Experiment Station for the Year Ending June 30, 1915.
85. The Use of Lime-Sulfur as a Summer Spray for Apple Scab.
86. Some poisonous Plants of Idaho.
87. Insect Pests of the Orchards and Gardens of Idaho, and Their Control.
88. The Milling Values of Dry-Farmed and Irrigated Wheat.
89. Sheep and Lamb Feeding Experiments.
90. Creamery Records.
91. Methods of Clearing Logged-off Lands.
92. The Annual Report of the Experiment Station for the Year Ending June 30, 1916.
93. Experiments with Small Grains Under Irrigation.
94. Experiments with Legume Crops Under Irrigation.

Farmers' Bulletin 769. Growing Grain on Southern Idaho Dry Farms.

*Ground Squirrel Control.
*Cost of Pumping for Irrigation.
*Oats in Washington.

* Purchased of Washington State Experiment Station for distribution in Idaho.

Circulars

1. Spray Calendar.
2. Field Peas.
3. Feeding for Egg Production.
4. Forest and Shade Trees and Basket Willows Recommended for Planting in Idaho.

The list below may be obtained, also without cost, by addressing the Department of Agricultural Extension, Boise, Idaho.

Bulletins

3. Measurement of Irrigation Waters.
5. Hog Cholera in Idaho.
6. Rural School Lunches.
7. The Alfalfa Weevil.
8. Directory of Idaho Pure-bred Breeders.
9. The County Agriculturist Movement.
10. Batters and Doughs (Boys' and Girls' Club Work).
11. Third Year Sewing (Boys' and Girls' Club Work).
13. First Year Sewing (Boys' and Girls' Club Work).
14. First Year Cooking (Boys' and Girls' Club Work).
15. General Announcement (Boys' and Girls' Club Work).
16. Meat.
17. Second Year Sewing (Boys' and Girls' Club Work).
18. Biennial Report of Extension Division, 1915-16.

Biennial Report of the State Pure Seed Commissioner.

Circulars

10. Home Economics Schools.
11. Farmers' Schools.
14. How to Keep Fowls Healthy (Boys' and Girls' Club Work).
15. Fitting Fowls for Exhibition (Club Work).
16. Gardens (Club Work).
17. Butter (Club Work).

Farm Hints

20. Help Fight Hog Cholera.
21. Potato Diseases.
22. Grasshopper Control.