

UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

GOODING SUB-STATION

The Management of Irrigated Grass
Pastures



Ewes and lambs on pasture. Gooding Sub-Station, 1916

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SUMMARY

The irrigated grass pasture is an essential crop in southern Idaho agriculture.

Conditions are well adapted to grass production.

Of all the grasses tested at the Gooding Station, Orchard grass, Smooth Brome grass, Kentucky Blue grass, Meadow Fescue, and Timothy have proved the best.

Alsike or white clover is desirable in a very small proportion. More than two or three pounds per acre may cause bloat in sheep and cattle.

Mixtures give better results than any variety seeded alone.

Different conditions require different mixtures.

A total of 20 to 24 pounds of seed per acre is necessary.

Seed should never be bought in mixtures.

Thoro preparation of the seed bed is absolutely essential.

Grasses can be seeded any time from early spring to the latter part of July. Fall seeding is not advisable.

Broad-casting the different varieties separately is the most satisfactory method of seeding.

The seed should be covered lightly with a spike tooth harrow or good brush drag.

Under average conditions a nurse crop should not be used.

From planting until the grass comes up the seed bed must be kept moist.

The corrugation method is the best for the first season's irrigation. Thereafter flooding is very satisfactory.

Under conditions prevailing at Gooding established pastures require irrigation about every twelve days, with a total application for the season of about two and one-fourth acre-feet per acre.

Pastures can be grazed lightly the latter part of the first season.

The pasture should be divided into two or three parts and should not be grazed too closely.

Barnyard manure can be used on the pasture with good results.

Grazing tests on the Gooding Station indicate that one acre of good grass pasture will properly maintain two good dairy cows or three beef steers without any outside feed, from the last of April to the latter part of September. The number of sheep that can be kept on one acre depends to quite an extent on the breed. About seven or eight large ewes of the mutton breeds with their lambs can be properly maintained.

Such maintenance as this will warrant the use of grass pastures even on comparatively high-priced land.

INTRODUCTION

During the past few years the interest in irrigated grass pastures has steadily increased thruout southern Idaho and in the irrigated sections of other states. The best farmers have reached the conclusion that some system of livestock production forms the basis of success in irrigation agriculture, and there can be no doubt that successful livestock production necessarily involves the growing of grass pastures.

In most irrigated sections alfalfa is the great forage plant and for the production of both quality and quantity of cured hay it is unexcelled. But because of its tendency to cause bloat in sheep and cattle it is very unsatisfactory for pasture purposes for these animals. During the summer months cured hay furnishes only a small part of the average livestock ration and hence most farmers will have to look to some source other than alfalfa for their summer feeds.

The growing and feeding of soiling crops or the use of the summer silo is occasionally practiced to very good advantage in dairy farming. These systems, however, find their greatest use only where dairying is the farmer's sole business. On most irrigated farms time and labor must be divided between a diversity of interests. Many good farmers desire to keep in addition to their horses and dairy cows a small flock of sheep or possibly some beef steers. In such cases a good irrigated grass pasture will undoubtedly prove very profitable.

The irrigated lands of southern Idaho are particularly adapted to the growing of pasture grasses. Ample water which can be applied whenever needed keeps the grass green and succulent during the entire season. The comparatively high lime content of our soils fits them well for grass production. These conditions with almost continuous sunshine insure a rapid, vigorous growth.

Pastures fit well into a system of crop rotation and are very effective in building up and conserving soil fertility. The humus that is so necessary in soil maintenance is furnished in abundance by a decaying grass sod. A good pasture will, of course, be maintained for a number of years but when finally plowed up its beneficial effects upon sagebrush soils are remarkable.

Since the beginning of the season of 1911, the Gooding Experiment Station has paid considerable attention to grass pastures. Our work

NOTE: This bulletin is based upon the results of a series of experiments which have been conducted by the writer at the Gooding Experiment Station during the years 1911-1916, inclusive. For a description of the conditions under which this work was done see introduction to Idaho Experiment Station Bulletin No. 93—Experiments With Small Grains Under Irrigation.

along this line has included a comparison of different varieties and mixtures, experiments on the time of seeding, and grazing tests with dairy cows, beef steers, and sheep. In all of this work the various phases of pasture management under irrigation have been studied closely.

As this work progressed a great many of the irrigation farmers of southern Idaho showed a very gratifying interest in it, and it was therefore deemed advisable at the close of 1914 to publish the results so far secured. This was done in Idaho Experiment Station Bulletin No. 80, under the title "Grass Pastures for Irrigated Lands," by the writer of this paper. The publication was very well received and early in 1916 the issue was practically exhausted.

The purpose of this bulletin is to re-issue the results which were published in Bulletin No. 80, together with the additional data secured from the experiments and observations during 1915-16, and to emphasize certain important phases of pasture management which are being somewhat neglected by many who own irrigated grass pastures.

LAND FOR THE PASTURE

It is a mistake to assume that the pasture should be located on land that is "good for nothing else." Grasses do fairly well on new soil but will respond as readily as any other crop to increased fertility. If maximum production is to be secured it will be necessary to locate the pasture on land that has previously grown alfalfa or clovers or has had applications of barnyard manure.

The farm sometimes contains a piece of ground that is rough or stony and on this account hard to work; or there may be a piece of wet, poorly drained land that fails to respond to ordinary cultivation. There are among the cultivated grasses, varieties that are fairly well adapted to such conditions. If properly seeded to the right grasses these pieces of land, which would otherwise be waste, can often be made to take their place in the farm economy to very good advantage. A question has arisen concerning the advisability of devoting our best and comparatively high-priced land to grass growing. In the light of the results that are being secured at the station and on many other farms, because of the small outlay of time and labor necessary to produce these results, and, in consideration of its lasting importance to our agriculture generally, we must conclude that the grass pasture deserves a foremost place in the list of very profitable farm crops and that very little if any of our land is too expensive to be used for pasture.

Since a grass pasture will be maintained for a considerable length of time it is essential that it be conveniently located. It should be borne in mind that the pasture will require frequent irrigation. On this account it should be located where the water can be applied easily and quickly at all times.

GRASSES TO USE

While a great many different grasses are used for pasture purposes, the list of really valuable and important ones is not very extensive. The following ten varieties have been tested during the past five years at the Gooding Experiment Station.

Orchard grass has proved to be one of the very best. It starts early and grows vigorously thruout the hot weather. It does not form a close, compact sod but grows in bunches. It is comparatively deep rooted.

Bromus Inermis or *Smooth Brome grass* is not as well known as some other varieties but is very valuable. It starts early in the spring and grows late forming a tough sod. It is one of the deepest rooting grasses and hence a good resister of drouth. It produces a large amount of very palatable feed.

Kentucky Blue grass is very extensively used and is one of the most valuable pasture grasses. It starts slowly and requires considerable time to form a sod, but when formed the sod is compact and tough. It is not a deep rooting grass and hence requires frequent irrigation. It grows best on well-drained soils. During the early and late parts of the season it is a good producer but does not grow vigorously during the hottest weather.

Meadow Fescue is sometimes called the English Blue grass. It forms a sod that is not as tough and close as blue grass nor as open as orchard grass. It is a fairly good producer and is well liked by the animals.

Timothy is usually grown for hay but is a fairly good pasture grass. It is a medium and late grower forming a sod much like meadow fescue. In pastures it is not quite so permanent as some other varieties.

Red Top is shallow rooted and forms a very tough, compact sod. Because of a smaller production it is not as valuable on good irrigated land as the grasses previously mentioned. It is particularly adapted to low, wet, poorly-drained soils and for such conditions is probably the best grass.

Tall Meadow Oat grass starts readily, early and late, and produces a large amount of feed. It is comparatively coarse, however, and is not as readily eaten as most other grasses.

English or *Perennial Rye grass* forms a medium sod and is a fairly good producer during the first season. It is easily choked out by other grasses and after the second or third season is of no value.

Italian Rye grass forms the same sort of sod as the English but is not as hardy nor as permanent and hence is of little value.

Canada Blue grass has proved the least valuable of all grasses tested. It produces only a scant, indifferent growth and furnishes very little feed.

CLOVERS

Most irrigated pastures contain a small amount of one or more varieties of clover in addition to the grasses. From the standpoint of increased feed production which it affords a small proportion of clover is very desirable. In some instances, however, where the proportion of clover has been too large it has caused bloat in cattle and sheep and hence has been considered very objectionable.

In all of our pasture mixtures at the station we have used a small amount of clover. We have conducted grazing tests on these mixtures for five years, using dairy and beef cattle and sheep and have had no difficulty because of bloat. From a great many observations we have concluded that bloat is caused only when the proportion of clover is too large and that a very small amount, two or three pounds per acre, is not only safe but very desirable, since it adds to both the quantity and quality of the feed produced.

The following clovers have been tested separately in pasture mixtures.

Alsike clover has given very good results. It fills in between the grasses and adds to the palatability of the feed. It is deep rooted, starts growth very early in the spring and grows vigorously thruout the season. It has proved the best variety under ordinary conditions and in addition is admirably adapted to low, poorly drained soils.

White clover has given nearly as good results as alsike. It starts growth later in the spring, however, is deep-rooted, and does not produce as much feed.

Red clover has been the least desirable of the three. It does not fill in among the grasses as well or start growth as quickly when eaten off as the others and it is more likely to cause bloat.

Alfalfa has not been used in any of the station pastures but we have observed it in a number of cases and have concluded that because of its tendency to cause bloat in sheep and cattle it is not advisable to sow in any proportion in the pasture.

MIXTURES

There seems to be no single variety of grass that has all of the characteristics that are desirable in an irrigated pasture. A mixture of several varieties is usually used and for a number of reasons is better than any variety seeded alone.

The various grasses show considerable difference in time of growth. Since with the aid of irrigation water the pasture can be kept in good growing condition thruout the entire season it is essential that it contain some early, some medium, and some late-growing varieties.

Loose, sandy soils or lands that have considerable slope will require a large proportion of those grasses which form a tough sod to insure protection against blowing or washing.

Pieces of high or rough land should have more of the more deeply rooting varieties since the moisture supply is likely to be deficient.

Low-lying, poorly drained lands should be seeded to those grasses whose natural characteristics adapt them to excessive moisture.

The results of our grass mixture tests indicate that under ordinary conditions such as usually exist on the irrigated lands of southern Idaho, orchard grass and smooth brome grass are the most important varieties. These grasses are hardy, vigorous and produce large amounts of excellent feed. Kentucky blue grass, meadow fescue, and timothy can be used to very good advantage in the mixture altho they are hardly as important as the first two.

The most satisfactory mixture for ordinary conditions such as exist at the station farm is as follows:

Orchard grass	5 pounds
Smooth Brome grass	5 pounds
Kentucky Blue grass	4 pounds
Meadow Fescue	4 pounds
Timothy	4 pounds
Alsike clover	2 pounds
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Total	24 pounds

The following mixture is simpler and has given very satisfactory results:

Orchard grass	8 pounds
Smooth Brome grass	8 pounds
Timothy	4 pounds
Alsike clover	2 pounds
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Total	22 pounds

For the low, poorly drained lands the following mixture is desirable:

Red Top	8 pounds
Timothy	6 pounds
Meadow Fescue	4 pounds
Alsike clover	2 pounds
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Total	20 pounds

For high lands that are apt to be dry this mixture is recommended:

Smooth Brome grass	12 pounds
Orchard grass	8 pounds
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Total	20 pounds

In suggesting the foregoing mixtures it is not intended that each of the grasses must be sown in exactly the amounts mentioned, but rather that these mixtures should furnish a guide that will enable the farmer to choose the best grasses and to sow them in somewhere near the best proportions. The essential thing is that several of the best grasses together with a small amount of clover be sown in sufficient quantity to secure a heavy stand.

In each of the foregoing mixtures the amounts suggested are for one acre and it may appear that more seed is called for than is necessary. If high grade seed is planted in a very well prepared seed bed with moisture and weather conditions exactly right a good stand can be secured with considerably less seed than is suggested above. There are many cases, however, where some of the conditions are not ideal. Grass seed sometimes contains considerable chaff and other inert matter and often is rather low in germinative power. A poorly prepared seed bed or a deficiency in the moisture supply might result in a low germination. Under the best conditions it requires practically all of one crop season to get the pasture started. A heavy stand is absolutely essential to maximum production and it would be poor economy to run the risk of having to use a thin, unprofitable stand in order to save a few pounds of seed.

The very best seed obtainable should be used. It should be possible to secure a good grade of seed of the varieties suggested for from fifteen to twenty-five cents per pound. Farmers will do well to avoid "seed house" mixtures. They often contain inferior grasses under fancy names. Even if the grasses are the best, as will be explained later, it is impossible to secure an even distribution if the seed is mixed before planting. Buy your grasses separately and insist that they conform to the State Pure Seed Law.

SEEDING

Thoro preparation of the seed bed is absolutely essential in starting a grass pasture. A great many failures to secure a satisfactory stand of grass are due directly to a poor seed bed. Grass seeds are very small and the tiny rootlet that is sent out at germination is not able to reach far. The new plant must be self-supporting at once because these seeds are not supplied with a great store of plant food as are some of the large seeds. If the soil is fine and firm and moist all will be well, but if it is loose and open, or rough and lumpy, the small plants will dry up and die and a thin stand will be the result.

Different types of soils require different methods of handling, so that no exact plan can be outlined for the preparation of a seed bed that will fit all conditions. In general, it is preferable to have the land fall-plowed and left rough thru the winter. As early as practicable in the

spring it should be double-disked, harrowed, and floated with an ordinary plank float. This should leave most soils in very good condition. On heavy clay, however, such an amount of tramping would probably result in too much packing and on very sandy soils less work would be just as efficient.

There are special cases that require special treatment. For example, in blow-sand the amount of work suggested above would be detrimental. Good results are often secured on this type of soil by seeding in an old grain stubble which will help to hold the sand particles down.

Under most southern Idaho conditions grasses can be seeded to advantage any time from early spring to the middle of July. Of course the later seedings have to be irrigated up as will be explained in the discussion on irrigation. If grasses are not to be irrigated up they should be planted as early in the spring as the land can be worked. A good moisture supply is absolutely necessary for vigorous plant growth, and, when such a moisture supply is maintained, the young plants will survive a light frost better than if the seed bed is dry.

Where the land can be irrigated readily the seeding can be done to best advantage in the late spring or early summer. This will allow weed seeds time to sprout and the young weeds can be killed easily by occasional harrowing. The warm weather with ample moisture which can be applied as explained later furnishes ideal conditions for rapid, vigorous growth. Grass varieties alone and in mixtures have been seeded on the station farm on May 4th, May 11th, June 22d, July 8th, July 14th and July 20th, and in each case have produced excellent, uniform stands; in fact, under our conditions late spring and early summer seeding with irrigation has proved by far the most satisfactory plan.

On October 3d, 1911, a pasture mixture containing Smooth Brome grass, Meadow Fescue, Italian Rye grass, and Red clover was seeded on a carefully prepared seed bed. The weather following this seeding was comparatively cool and none of the grasses came up before winter. In the spring of 1912 none of them appeared.

On September 17, 1912, a similar mixture was seeded on well prepared land. By October 10th, a fair stand of all grasses was secured and all grew well until the opening of winter. In the spring of 1913 the grasses failed to start growth and a close examination showed that they had almost entirely winter killed.

From these results we conclude that under our conditions fall seeding of pasture grasses is not advisable.

Grass seeding attachments can be secured for some grain drills but on ordinary soils their use is not recommended. Grass seed should be covered lightly and drilling will almost invariably put it in too deep.

In addition, drilling involves a great deal of time and labor, since it will be necessary to go over the ground as many times as there are varieties in the mixtures. It is evident, that if, for example, timothy and smooth brome grass seed were mixed the feeding mechanism of any drill would not be able to distribute them evenly. The smoother, heavier timothy would work to the bottom and run out on the first few rods while none of the light, coarser brome grass would be seeded until the last.

We have found broadcasting with a hand seeder of a good type to be the most satisfactory method. As with the drill, it will be necessary to go over the land a number of times because an even distribution of the grasses cannot be secured if the various kinds are mixed before planting. One man with a good broadcast seeder can go over an acre in a small fraction of the time that would be required for a man and a team with a drill.

The seed can be covered to good advantage with a spike-tooth harrow or a good brush drag, after which it should be corrugated for irrigation.

The foregoing suggestions are for average conditions and may have to be changed somewhat to suit special cases.

In many localities it is the common practice to seed alfalfa and clover with a grain crop. While there is a question as to the advisability of this plan there can be little doubt that grasses will do much better without the so-called nurse crop. The grain starts quicker and grows faster than the grass and is sure to rob it of most of the available moisture. If there is insufficient moisture the grass and not the grain will die. Even if there is plenty of water for both the grain will soon cover the grass completely. Instead of stooling out to form a sod it grows a long slender stalk in its attempt to get a share of the air and sunshine. In the hottest part of the summer when the already weakened grass plant requires plenty of moisture the land is left dry for the grain to ripen and gets no more water until after harvest. By this time a great deal of the grass is dead. Actual practice has shown that this is the case and that the use of a grain crop which is allowed to ripen almost invariably results in a poor stand of grass. There may be special conditions such as a blow-sand soil that will require the use of a grain crop during the early part of the season. In such cases a good deal of water should be applied and the grain should be cut for hay early in the summer.

IRRIGATION

As has been stated, our most satisfactory method of seeding grasses has been to plant them in a comparatively dry seed-bed in the early summer and to irrigate to bring them up. With many of our farm crops there is considerable objection to irrigation after seeding and before coming up. Pasture grasses, however, form an exception to this rule, because of the fact that the seed must be covered lightly. Even tho

the seed bed has plenty of moisture at planting time it is probable that the surface soil which contains the grass seed will dry out before germination is complete. Most of the failures to secure a good stand of grass are due to the fact that the seed is allowed to dry after germination has begun.

From planting until the grass is well started is the most critical time in the management of a grass pasture. The time between irrigations will depend upon the type of soil and the weather conditions. The applications need not be heavy but they should be frequent enough to keep the surface moist until the grass is up.

Experiments have shown that it is absolutely necessary that this early irrigation be applied by the corrugation method. In preparing land for this method small furrows are made either with a homemade corrugator or with an implement manufactured for the purpose.

On ordinary soils the furrows should be twenty-four to thirty inches apart. On the heavy clay soils they should be closer and on the sandy soils further apart. Their length will depend upon the type of soil and the slope of the land. It is necessary to make these corrugations immediately after seeding. A feed ditch is built along the upper end of the field and the water backed up in this ditch by means of a canvas dam. Tubes are used to convey a small stream through the ditch bank to each corrugation. The tubes are often made by nailing four laths

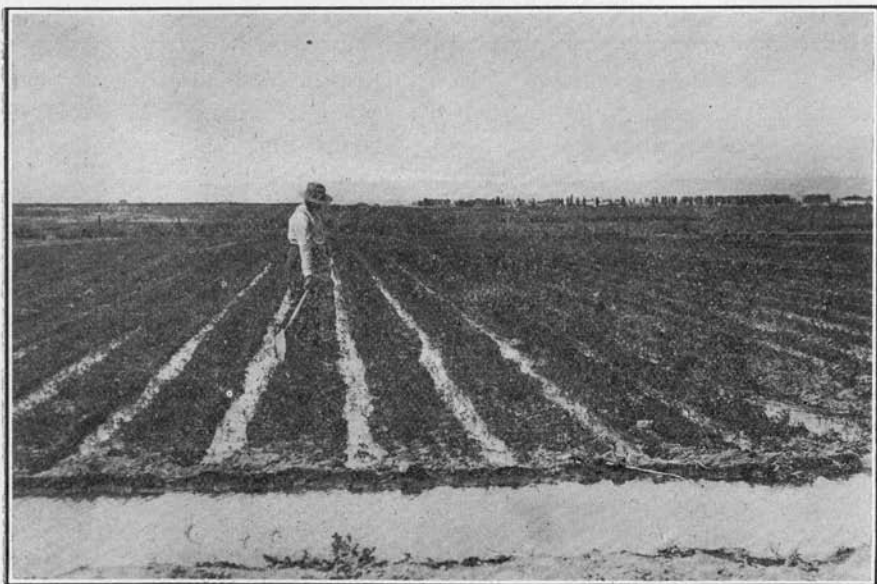


Fig. 1—Corrugation method used in irrigating young pasture grasses

together; cement tubes are being used to some extent and some are made of tin. In any case, they are imbedded firmly in the bank and carry the water thru without any danger of washing the bank away. In some cases the water from one tube is divided between two or even three corrugations. The small stream is allowed to run until it has soaked across from one furrow to the other as shown in the accompanying illustration. If flooded, most soils wash to some extent and also form a hard crust that the young plants cannot penetrate. Even if grasses are planted early enough in the spring to be germinated by the winter moisture the first season's irrigation can be profitably applied in corrugations because a baked surface will interfere seriously with the growth of the young plants.

After the first season it is not necessary to make fresh corrugations. The old ones will not be entirely filled and will help to lead the water. Since the grass sod will prevent washing or baking the pasture can be flooded with excellent results.

In cases where the land has a comparatively uniform slope flooding between borders is a very satisfactory method of irrigation. The borders or dikes are usually made from thirty-five to fifty feet apart and should run parallel with the slope. The land between should be carefully leveled, taking out any side fall, so that a head of water can be spread evenly between the dikes. The length of the run is dependent upon the type of soil. The open, porous soils require much shorter runs than the heavier soils with compact subsoils.

If the natural contour of the land is not adapted to the border method, free flooding can be used to excellent advantage. In any case a system of irrigation that will insure a quick and easy application of water should be properly and carefully installed.

Since grasses are comparatively shallow rooted, light, frequent irrigations will give better and more economic results than larger amounts at longer intervals.

If the pasture is to produce maximum returns it must be kept green and growing during the entire season. Some have objected to the growing of pastures because of their large water requirement. Under our conditions their water requirement is no greater than that of alfalfa hay. Grasses require more frequent irrigation since they are surface feeders but it is a waste of water to apply as much per irrigation as would be given to alfalfa.

During the past five years we have irrigated a total of 32 plats of mixed grass pasture that was being grazed. In all of this work as in our other irrigation investigations we have carefully measured all water supplied. The average results of all our pasture irrigation are as follows:

Length of irrigation season.....	122 days
Number of irrigations.....	10
Length of time between irrigations.....	12 days
Total water applied per season.....	2,242 acre-feet per acre

The soil upon which these experiments were conducted is a medium clay loam with a clay subsoil. With more open, porous soils, of course the water requirement would be greater.

MANAGEMENT OF THE PASTURE

Grasses seeded early in the spring should furnish a small amount of feed during the latter part of the first summer. If such is the case, light grazing will not only be profitable but will be beneficial to the pasture. Weeds will be eaten off and prevented from going to seed and the grasses will stool out more extensively than if they were allowed to head and produce seed. Care should be taken, however, that the young sod is not grazed too closely or tramped too severely. If seeded too late in the season to furnish any pasturage the first year it is advisable to clip with a mower to prevent any weeds from going to seed.

At the beginning of the second season and before any heavy grazing is begun the pasture should be divided into lots. While this is important in any pasture it is absolutely essential in an irrigated grass pasture. We have found in traveling over the state that failures to secure maximum production from established pastures were almost invariably due to the fact that the pasture was all in one field and was grazed continuously.

The number of divisions will depend upon the size of the pasture, the number of animals, and the system of irrigation. Many farmers are securing good results with two divisions and in many cases three seem to be more satisfactory. Under our conditions three lots seem to be more desirable and it is very evident that the cross fences are a good investment from the standpoint of increased feed production.

It should never be necessary to irrigate a pasture while the animals are on it, since they would cut up the sod and tramp the grass into the mud.

If two or three lots are used the grazing can begin earlier in the spring than would be possible if it were necessary to wait until the grass over the entire pasture has sufficient start to keep ahead of the animals.

The pasture should not be grazed too closely. Plenty of leaf surface is just as important for plant growth as an extensive root system. The grass that grows one day helps still more to grow the next, and a pasture that is grazed off and then allowed to grow unmolested for fourteen to twenty days will produce several times more feed than if it is kept close to the ground all the time. For many reasons alternating from one pasture to another insures fresher, better and far more abundant feed.

If any weeds appear or if some of the grass is left in clumps and begins to go to seed it is advisable to clip with a mower.

The pasture is possibly not as much in need of manure as some other parts of the farm because it receives a considerable amount during the summer. If barnyard manure can be obtained, however, it can be used to very good advantage on the grass. It should be spread evenly but not too heavily, in the fall after the close of the pasture season, and harrowed thoroly with a spike tooth harrow the following spring. Whether or not manure is applied, a good spike tooth harrowing in the early spring will be beneficial.

Since the animals spend the hottest part of the year on the pasture it is desirable that some shade be provided for them.

GRAZING TESTS

In order to furnish accurate information concerning the number of animals that a given area will maintain and to demonstrate the value of grass pasture we have conducted grazing tests with dairy cows, beef steers, and sheep.

Dairy Cow Grazing

During the summer of 1912 a one-half acre pasture was used for this test and during the seasons of 1913-14-15-16 an entire acre. The pasture was divided into three parts and grazed alternately as suggested above.

In one out of the four seasons in which the entire acre was used, two cows were able to eat all of the grass which the pasture afforded; in each of the other three seasons, however, it was necessary to use a third cow for part time since the acre produced more grass than the two cows could eat. In no case was the pasture able to keep the three cows the entire season.

The station owns a grade Jersey cow which has been used in all of the tests since the beginning of 1913. Each season it has been necessary to borrow other cows from neighbors and it has not always been possible to secure good producers. In all, seven different animals have been used, and they have been in all periods of lactation from fresh to nearly dry.

The average results of all of the grazing tests with dairy cows are as follows:

Length of test.....	138 days
Number of changes from one division to another..	15
Length of time between changes.....	9 days
Pounds of milk produced per acre.....	6330
Pounds of butter fat produced per acre.....	300.4

In all cases every cow gained in weight during the course of the experiment.

The tests were begun in the spring as soon as the grass was high enough to furnish all the feed the cows needed and were discontinued in the fall when the feed was no longer sufficient for the two cows. In all cases they were given no feed whatever, aside from what they obtained from the pasture. This was necessary in the experimental work but on the average farm some additional feed could be given in the fall when the grass is short and in this way the pasture could be used for a much longer period than 138 days.

BEEF CATTLE GRAZING

Grazing tests were conducted with good, grade Shorthorn steers in the seasons of 1914 and 1916.

In the spring of 1914 we purchased four two-year old Shorthorn steers and placed them on a one-acre pasture. This pasture was divided the same way as the cow pasture and was grazed in the same way. It was found that the one-acre pasture would not maintain four head and one was sold. The other three were kept easily and all made very good gains.

In the spring of 1916, two-year old steers were not obtainable and we purchased yearlings. Because of the fact that we had to use yearlings



Fig. II—Steers used in 1914 grazing test

we bought four head. These were placed on the same acre pasture which was grazed alternately as usual. The pasture would not keep the four head in good growing condition all the time, however, and it was

necessary to take them to other feed on two different occasions.

In all cases the steers were carefully weighed on and off the pasture so as to determine accurately the number of pounds of beef produced by the one acre of grass. The average of the two years' work shows a production of 732 pounds of beef per acre per pasture season.

In the season of 1915 steers were not obtainable and we used Short-horn heifers. It was not expected that the heifers would show such gains as the steers and this was a test of maintenance per acre rather than of beef production per acre.

Three two-year old heifers were maintained very well during the pasture season and they made very satisfactory growth, altho they did not get fat as steers would have.

Sheep Grazing

In the summer of 1912 a one-half acre pasture was used for a sheep-grazing test. Since we were not able to secure ewes and lambs the test was conducted with mature Lincoln rams.

Five rams were placed on the pasture but it was soon apparent that they could not eat all the grass and two more were added. The rams were full grown and very fat at the beginning of the test and hence made no gain in weight. The seven were maintained on the one-half acre very well and at all times had all the grass they could eat.

In the summer of 1913 another half-acre pasture was used for sheep grazing; this work was conducted with Lincoln ewes and their lambs.

The test was begun with six ewes and six lambs; they were unable to keep the grass down, however, and two more ewes were added. Even with this number it was necessary to clip the pasture and 705 pounds of cured hay were taken from the half acre. These were range sheep. They were not contented on the small pastures and did not make very satisfactory gains.

It did not appear advisable to continue this experiment with range sheep and the work was discontinued until the spring of 1916 when we secured good farm-raised sheep of the Hampshire breed.

Two acres were used for this work and the test was begun on April 25th with 18 ewes and their 24 lambs. All were pure-bred and of good type. The ewes were two, three, and four years old with an average weight of 110 pounds. The lambs were about two months old and had an average weight of 49 pounds. All were in good feeding condition.

Both ewes and lambs were very hearty feeders and it became apparent that the two-acre pasture would not maintain the herd of 42 head. Four ewes and six lambs were taken away.

Because of the fact that we had abnormally cold weather during

May and had started the pasture with too many animals it was necessary to put the sheep on other feed for 15 days.

At the close of this time they were brought back to the experimental pasture and the two acres maintained the 32 head satisfactorily until September 16th when the sheep had to be taken away for breeding. If this had not been necessary they could have been kept considerably longer.



Fig. III—Sheep grazing test, 1916. Note the abundance of forage

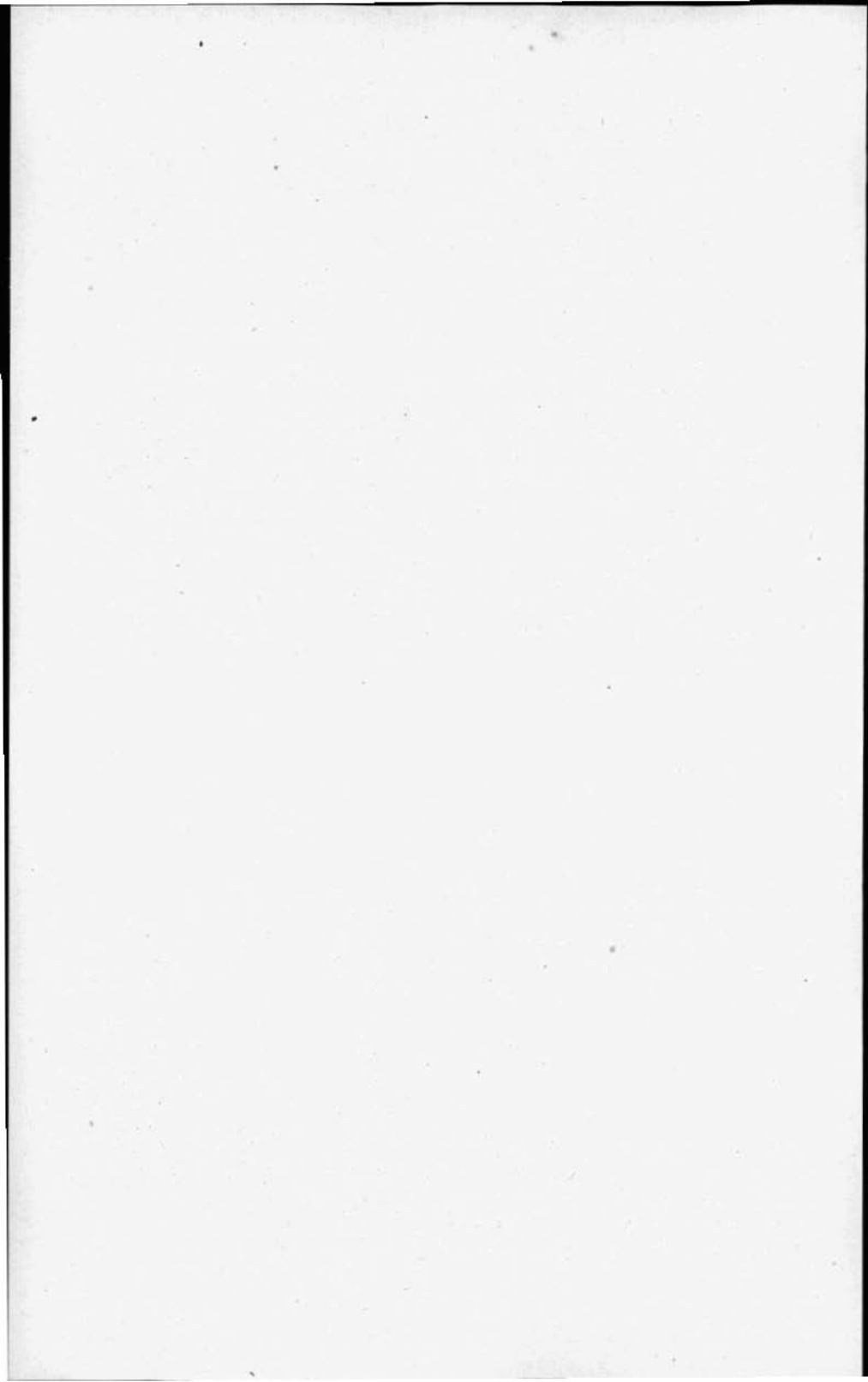
It is believed that if the test had been started with only 14 ewes and 18 lambs which were kept during the season that it would not have been necessary to seek any outside feed.

In every case the sheep were carefully weighed both to and from the pasture.

The net gain in pounds of mutton produced per acre of grass pasture was as follows:

Ewes	349 pounds
Lambs	558 pounds
Total	907 pounds

The pasture does not need reseeding each spring, is one of the easiest crops to irrigate, and the animals do all of the harvesting. These facts, together with the foregoing results certainly prove that the grass pasture is one of the most profitable crops for irrigated lands.



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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.
95. The Management of Irrigated Grass Pastures.

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.

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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.