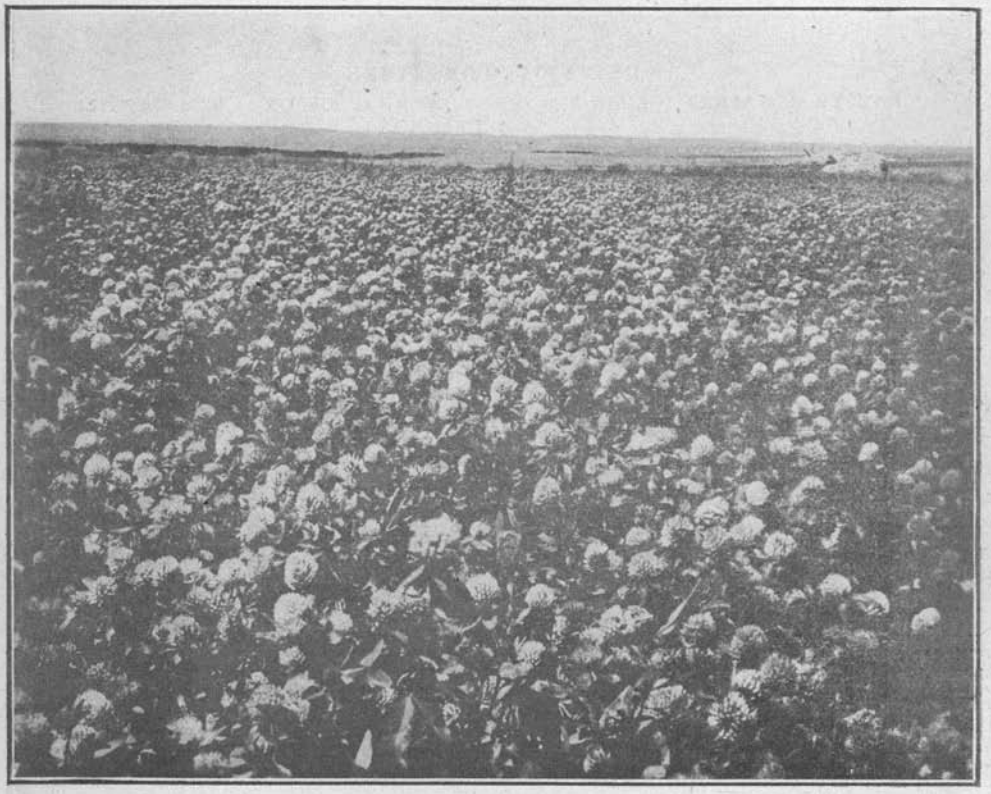
UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION

ABERDEEN SUB-STATION

The Production of Clover Seed Under Irrigation in Southern Idaho



A Field of Red Clover near Buhl.

By L. C. AICHER

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THE PRODUCTION OF CLOVER SEED UNDER IRRIGATION IN SOUTHERN IDAHO

INTRODUCTION

The clover-seed industry is of comparatively recent development in southern Idaho. A remarkable increase in the production of this crop has taken place within the past two years. Clover seed is now being produced in the Snake river valley from Washington county on the western border of the state, to Teton county, or practically the headwaters of the Snake, on the eastern border, with a range in elevation of from 2200 to 5500 feet.

Practically all the clover seed produced in southern Idaho is grown by surface irrigation. A small amount is grown by sub-irrigation. The practices in clover-seed production vary considerably with rise in elevation and the consequent shortening of the growing season.

The reputation of Idaho-grown clover seed is based on its high color, purity and vitality. Eastern seed-houses, the buyers of most of the Idaho-grown clover seed, use a large portion of this highly-colored seed to blend with eastern and foreign-grown seed to make it more readily marketable. Purity and color determine market values.

Climate and methods of handling the crop previous to hulling, largely determine the color of the seed. Clover-seed growers under humid conditions are at a disadvantage in the production of bright seed, for if the crop is not cured properly and promptly, sprouting and discoloration of the seed may take place. The southern Idaho seed grower has little difficulty in producing bright seed. The warm, bright sunshiny days which prevail during the seed-setting and harvesting period and the light rainfall insure the production of bright, highly-colored clover seed.

Temperature, moisture, and the activity of insects greatly influence the yield of clover seed. Pollination and fertilization are most successful when the blossoms are dry and when the atmosphere is both dry and warm. Insect activity, so essential to clover-seed production, is then most active. Bumblebees* and honey bees are very essential for the production of large crops of red clover seed. Honey bees, and many other bees of similar size, are valuable in cross fertilizing alsike and white clover.

In addition to having a favorable climate for seed production, the grower of seeds in southern Idaho is fortunately able to regulate by irrigation the moisture content of the soil and thereby the growth and vigor of the crop. Successful clover-seed production under irrigation depends in no small measure upon the judicious use of irrigation water. Over-irrigation is more often practiced in the production of the seed crop than is under-irrigation.

* Bulletin No. 289, U. S. Dept. of Agr., Red Clover Seed Production.

IMPORTANT FACTORS IN SEED PRODUCTION

The growing habits of the clovers, their irrigation requirements, the characteristics of the soil of the fields in which they are to be grown, the kinds of crops previously grown and troublesome weed pests are factors which should be taken into consideration in the selection of fields for seed production.

Alsike and white clover are perennials. Red clover is commonly called a biennial but frequently lives for three years.

The lay of the land should aid greatly in determining what variety of clover should be planted. Low, wet land or land subject to frequent overflow should be planted to alsike or white clover as these varieties require more water than red clover and are better able to withstand the over-irrigation which low-lying ground often receives. Higher ground or at least ground with good drainage should be selected for the production of red clover seed.

Wherever possible, land which has been already highly improved by the growth of an alfalfa or clover crop, should be avoided in clover-seed production. High fertility encourages a strong vegetative growth which is usually made at the expense of the seed crop. New land or land which has produced a crop of small grain, beets or potatoes, is good land for the seed field.

If noxious weeds, the seeds of which cannot be removed from the clover-seed crop, are known to be present in fields otherwise suited to the crop, planting should be delayed until danger from such pests is passed. Often, early spring fallow with thoro cultivation will destroy such weeds and planting of the clover-seed crop can be done after they have been destroyed. If weeds having seeds of the size of tumbling-mustard seed are known to be present in the soil the larger seeded red clover should be planted; if harvested with the clover seed, weed seed of that size can be removed from it by the proper adjustment of screens on the cleaning machine. It is almost impossible to free a field entirely from weeds. Seeds of many weeds can be taken out of the various clover-seed crops by running them over a good cleaning mill, but every effort should be made to free the seed fields of noxious weeds either before planting or while the crop is growing.

It is not advisable to keep one piece of land in clover for seed production for a long term of years. To maintain a well-balanced agriculture in southern Idaho, clovers for seed production should take their places in rotation with other crops. Clovers, because of their ability to add humus and nitrogen to the soil are invaluable in the production of small grains, potatoes, and root crops. Moreover, clover fields gradually become foul with weed pests regardless of strenuous efforts to keep them out. The markets demand pure seed, and that can best be insured by the adoption of a system of crop rotation which will put the clovers for seed production in rotation with small grains and cultivated crops.

PREPARING THE SEED BED

Fall-plowed land is best for clover-seed sowing because of the firm condition of the land brought about by freezing and thawing and length of time used in settling of the soil. If fall plowing is done comparatively

early, weed seeds germinate and grow before winter sets in. Weed seeds escaping germination in the fall will start growth early in the spring and will be largely destroyed by the spring cultivation required in putting the seed bed in final preparation for planting. It is good practice to disk stubble land a couple of weeks before the plowing is to be done in order to start weed growth which is later destroyed by plowing. Land preparation for clover-seed production is as much a problem of killing noxious weeds as it is of getting the seed bed in proper condition for planting. Clover requires a firm but not necessarily a deep seed bed. Fall-plowed land usually affords an excellent seed bed for clover seed. Where spring plowing is to be used for clover planting, comparatively shallow plowing should be practiced and the land firmed by rolling or by irrigation before planting. The corrugated roller is one of the best tools for use in firming soil. A disk with the disks set straight can also be made to do fairly good work. A firm, closely compacted, seed bed is absolutely necessary to insure an even and strong germination. Clover seeds are small and must be brought into close contact with the soil particles to insure their getting sufficient moisture for germination. If the seed bed is not sufficiently moist to germinate seed it cannot readily be firmed by the use of tools. Land in this condition should be given a good irrigation before planting. Further firming of the soil will not then be necessary but a good leveling and floating should be given as soon as the soil is sufficiently dry to work well.

Fig. II—Corrugated for irrigation; note shallow corrugations.

Planting in grain stubble is the surest way to obtain a good stand of clover on sandy land which is inclined to blow. Planting should be delayed however until weed growth has started and has been destroyed. A double disking or cultivation with a spring-tooth harrow can be made to kill all growing weeds. A drag harrow to better prepare the seed bed should follow the disk or spring-tooth harrow. Sowing and if necessary, irrigation, should immediately follow to give the clover a quick start thereby choking down any further weed growth. On sandy or wind-

blown soil frequent applications of water are necessary to insure a good stand and to keep the clover growing steadily.

VARIETIES

Growers of clover seed in southern Idaho are limited by market demands to comparatively few varieties. Red clover is more commonly grown in the United States than any other variety. The past few years however have witnessed a great increase in the use of alsike and white clover in the eastern and southern states. Sweet clover or Bokhara clover is being grown in sections of the United States east and south where unfavorable soil conditions for the most part discourage the growing of alfalfa or red clover. Sweet clover sets seed more readily under all conditions than the red, white or alsike clovers.

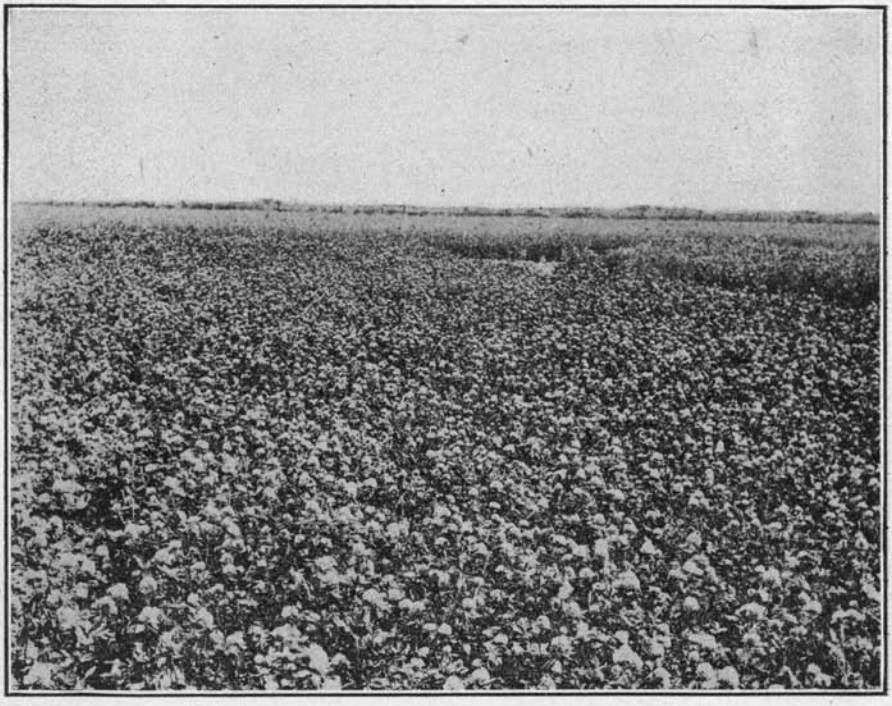

Fig. III—Red clover for seed production. Aberdeen Sub-Station.

The difficulty experienced in the dry climate of southern Idaho in harvesting the sweet clover-seed crop without loss and the low price usually paid for the seed has limited the production of this crop to a very small acreage. The competition of eastern-grown seed and the consequent low price paid for the seed in Idaho hardly warrants the production of sweet clover in southern Idaho when other clover-seed crops which yield a greater return with less labor in handling, can be grown.

There is not yet sufficient market demand for Crimson, Mammoth,

Hungarian, Ladino, and other less prominent varieties to warrant their being grown extensively for seed in the southern part of the state.

In buying red, white, or alsike clover seed to plant for seed production, only seed free from weed seeds and mixtures of other clovers should

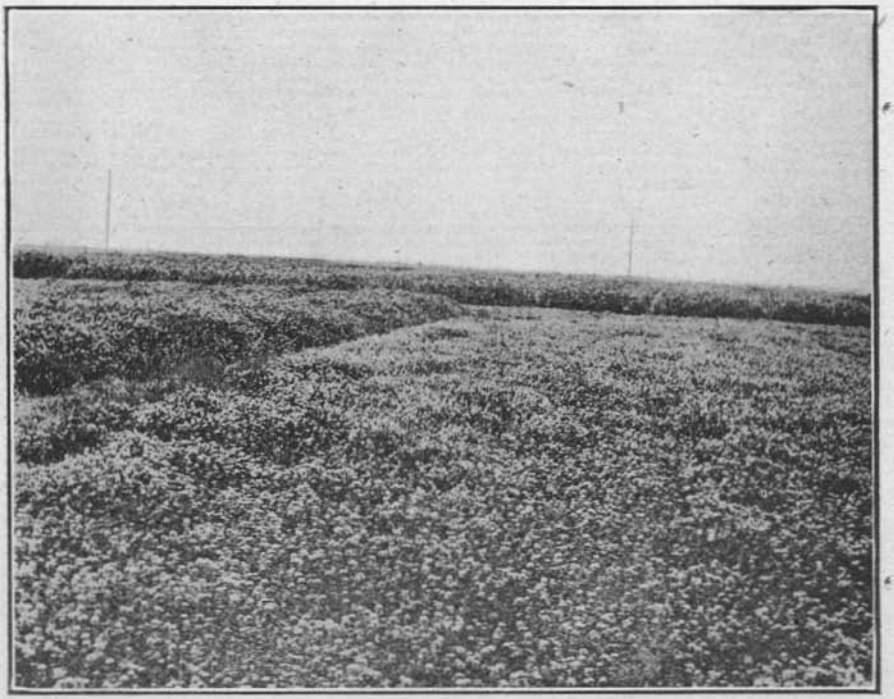

Fig. IV—White clover in foreground, alsike on the left. Aberdeen Sub-Station.

be selected. The best seed the market affords should be secured when planting for the production of a seed crop. The few cents per pound additional which such seed will cost will be more than made up in the returns from the harvest of the crop.

SOWING THE SEED

Various methods of sowing clover seed are practiced in southern Idaho, due in part to variations of soil and amounts of irrigation water available. In the dry climate of southern Idaho, broadcasting is to be discouraged on new soils or on soils which bake readily. Drill-planting insures a more even and uniform stand than broadcasting as the depth of planting is closely regulated and an even distribution of seed is made. Broadcasting is practiced most frequently where irrigation water is plentiful. Drill-planting is particularly desirable where flooding is practiced as the seed is placed beneath the surface where moisture is available for a longer period. The roots then are not subject to the quick drying

which takes place when the seed is on top of the soil. Irrigation need not be as frequent when the seed is drilled. Most drills can be set to plant at any desired depth. In using the drill care should be taken to see that every drill hole is sowing and that the shanks are set uniformly with reference to pressure of spring and depth of disks or shoes.

Clover seed should not be covered to a greater depth than one inch. Plenty of seed should be sown. The cost of an extra pound or two of seed is a small matter in comparison with the advantage to be gained by securing a thick, even stand. The stands on the Aberdeen Station shown in figures III and IV were secured by drilling the seed.

The whirling spray seeder, wheel-barrow broadcast seeder and the grain drill adapted to plant small seed, are machines used in broadcasting clover seed. The drill can be made to broadcast seed as well as to drill seed, if desired. The wheel-barrow seeder and drill are preferred because of their greater practicability in windy weather. Broadcast seeding requires from one-fourth to one-third more seed than drilling. Frequent irrigation is particularly necessary on soils on which seed has been broadcasted until the plants have reached a height of two or three inches. After the plants have made that growth the frequency of irrigation may be lessened.

Over the greater portion of southern Idaho, clover seed should not be planted in the fall because of danger from winter-killing. Some times in years of heavy snowfall and mild temperatures a fall-planting of clover seed will survive at the lower elevations.

If a nurse crop is to be used the clover should be sown immediately following the planting of the nurse crop. If the clover is to be grown without a nurse crop, planting may be done any time during the spring and summer. Early spring planting however is advisable because of the value of spring and early summer rains. In the earlier part of the summer the soil does not bake or dry out so quickly and the small clover plants have a better chance to make good. Elevation largely determines time of early spring planting. In the Boise valley as a rule plantings can be made by the first of April or even earlier. In the upper Snake river valley above St. Anthony planting is seldom done before the first of May; it is usually done later. Early spring planting is particularly advisable at the higher elevations because of the shortness of the growing season.

The rate of seeding should vary with the kind and character of soil. Old land in good tilth will not require as much seed as land newly broken from sagebrush, to insure satisfactory stands. Red clover should be sown at the rate of from eight to twelve pounds per acre, alsike at the rate of from six to nine pounds and white clover at the rate of from five to eight pounds per acre.

A quart of clover seed weighs approximately two pounds. A bushel weighs from sixty to sixty-four pounds. The red, white and alsike clover seed vary greatly in size and the number of seeds per quart or per bushel varies accordingly. Piper in "Forage Crops" states that the number of red, white, and alsike clover seeds per pound is approximately 297,000, 800,000 and 718,000 respectively. Most grass-seeding attachments of drills are calibrated to sow on the quart-per-acre basis, but care-

ful calibration is not made for the various clover varieties. Hence if the drill is set to sow two quarts of clover, and red clover is used, it might sow two quarts, but if white clover is used the drill might actually sow four quarts. Every grower should calibrate his own drill to determine how much seed is actually planted when the indicator is set for a certain rate. The proper setting of the indicator on a Superior drill to insure the sowing of the right amount of seed per acre of the various clovers is indicated below.

Kind of Clover	Pounds per Acre	Rate on Drill
Red Clover	8 to 12	3 to 4 quarts
Alsike Clover	6 to 9	2 to 2½ quarts
White Clover	5 to 8	1½ to 2 quarts

The above rates of seeding have been practiced with satisfactory results at the Aberdeen Station.

Unless the land which is being sown for clover-seed production has previously grown a thoroly inoculated crop it is advisable to inoculate the seed or the soil with nitrogen-gathering bacteria at planting time. A thicker stand and a more vigorous growth results from thoro inoculation because it provides an additional source of plant food. Cultures for the inoculation of clover seeds can be obtained from the Department of Bacteriology of the Idaho Experiment Station, Moscow, Idaho, from the Bureau of Plant Industry of the U. S. Dept. of Agriculture, Washington, and from various commercial firms that manufacture them. Full directions for the use of the cultures are sent with them. Soils from thoroly inoculated fields of the same varieties may also be used to inoculate seed just previous to sowing. If advantage is taken of this fact, surface soils to a depth of two or three inches should be taken from a thoroly inoculated field, pulverized and sifted thru a very fine screen. This procedure reduces the soil to a correspondingly fine condition and will remove many weed seeds should they be present. A pound of glue, or as much thereof as may be required, is then dissolved in a tub of boiling water, which after cooling is sprinkled over the seed to be inoculated. The seed is then dusted with the pulverized soil and after drying for a short time, away from direct sunlight, may be sown in the usual manner.

The nurse crop, often justly called the robber crop, has some good features to recommend it and some bad ones which should discourage its wide use. Under certain conditions the use of the nurse crop is highly desirable. Too often however the nurse crop is grown for the commercial or feeding value of the crop rather than for the helpful effect it will have on the clover which has been planted with it. Reasons advanced for the use of a nurse crop are: (1) Its prevention or lessening of the destructive action of wind, sun, and irrigation water on the young clover plants; (2) its prevention of overly vigorous growth of the clover plants; (3) its commercial or feeding value.

When a nurse crop is planted with a clover crop there usually comes a time when the interests of one must be sacrificed for the best interests of the other. When that time comes the clover crop is usually the one to suffer. The Aberdeen Station has found that the best stands of clover for seed production are obtained by planting without a nurse crop, there-

by insuring a thick, vigorous growth free from weeds. If clover is to be grown without a nurse crop, sowing may be withheld until the seedbed has been thoroly prepared and weed growth destroyed.

If conditions demand that a nurse crop be grown with the clover, the character of the land and the previous crops grown will aid in determining the crop to be used. The nurse crop should always be planted first and to a depth of from two to two and one-half inches. The drilling of the clover seed should follow the planting of the nurse crop within a day or two.

Peas make a very excellent nurse crop wherever they can be successfully grown. The pea weevil may limit the successful use of peas to the upper Snake river section of southern Idaho. An early or medium early variety of pea should be chosen because of the early harvest necessary and the treatment of the clover field which should immediately follow. Peas should be planted reasonably early and the rate of seeding should vary with the kind and variety used. Field peas may be planted at the rate of from 90 to 120 pounds per acre, and garden peas, particularly the wrinkled varieties, at the rate of from 120 to 180 pounds.

Barley, wheat or oats may be used for the nurse crop. The rate of seeding of cereals should be reduced to about one-half or two-thirds of the normal. Barley and wheat are preferred to oats.

CARE OF THE NEWLY PLANTED FIELD

The first few weeks after planting is probably the most critical period in securing a good stand of clover. The clovers require a compact and moist seed bed to insure quick germination and vigorous growth. During this period drying out of the soil is to be prevented. Frequent irrigations are necessary after planting until the small plants become firmly rooted. When the plants have rooted sufficiently deep to secure a part of their moisture from the deeper layers of soil, irrigations may be less frequent. Light and frequent applications of irrigation water in the early stages of growth is a better practice than heavier applications at longer intervals. It is much better practice to apply an abundance of water at the earlier periods of growth of the clover crop than to apply water abundantly the following season when the seeding period is on. During the early growth of the clover the wellfare of the nurse crop must be temporarily neglected. Liberal use of water insures a good stand of clover and usually a rank-growing nurse crop. The reseeding of spots which for one reason or another failed to catch should be done as quickly as they are discovered.

At the lower elevations in the Snake river valley, as from Twin Falls westward into the Boise valley, clover sown early in the spring can be made to produce a seed crop the same season. At the higher elevations in the Snake river valley, as from American Falls east and north, clover cannot be planted and a seed crop removed the same season. Some growers question the wisdom of permitting the production of seed the first year, even where climatic conditions favor it, in the belief that production of seed the first year injures the productive capacity of the plants for the second and successive years. It appears however that this belief

is not well founded for many instances of yields of seed varying from two to four bushels the first season with normal yields from the same fields the second season, can be cited. If the stand is sufficiently thick for a good seed yield and no weeds are present it would seem that the crop might be safely permitted to go to seed; otherwise it should be cut for hay.

Fields which are not permitted to ripen seed the first year should be clipped before seeds ripen, and the clipping removed from the field. Hence if a nurse crop is used the value of an early maturing one becomes readily apparent. The fields should be irrigated before clipping to insure a sufficient growth for a winter cover crop.

LATER CARE OF THE SEED FIELD

Cultivation: After weed growth has started in the spring of the second year from sowing, the field should be gone over with a spring-tooth harrow or similar cultivating tool. The amount and the severity of the cultivation to be given should be determined by the thickness of the stand, vigor of plants, and the variety of clover to be cultivated. Cultivation at this time can be overdone. Red clover will stand more cultivation than white or alsike. A thick stand will require little cultivation. It is advisable to cultivate alsike and white clover fields in the fall, after the seed crop has been harvested, in order to cover seed lost in harvesting thereby permitting early germination and growth the following spring. White and alsike clover fields are more or less permanent and should be given cultivation to rid them of weeds or the seed will not be marketable.

Control of the blooming period: As previously stated, pollination and fertilization take place most readily when the blossoms are dry and when the atmosphere is both dry and warm. The seed grower should therefore endeavor to bring his clover crop into full bloom during the hottest and dryest part of the season. That period varies with elevation. At lower elevations it begins about the first of July; at higher elevations it comes on about the last week in July and is of much shorter duration.

In the Twin Falls section, and in the sections to the west of Twin Falls, including the Boise valley, the first growth of red clover can be taken off for hay and the seed produced from the second growth. In the upper Snake river country a cutting of hay cannot be obtained because the season is not sufficiently long for seed formed from the second growth to mature. A light clipping of immature hay can be obtained or the first growth may be pastured until about the middle of June. One of three practices should be adopted in the upper Snake river country to hold red clover in check in order to bring about full bloom for the seed crop at the right time of the season: (1) Pasturing to the middle of May or first of June; (2)clipping not later than the first of June; (3) holding back early growth by withholding early irrigation. There is some danger in withholding early irrigation for if water is held off too long the bloom is likely to be hastened rather than held back. Light irrigation at the proper time will main-

tain the vegetative growth thereby overcoming the tendency towards early blooming.

The second growth of alsike is of little value for seed-producing purposes. The first growth therefore should be made to produce the seed crop even at lower elevations. It is necessary to hold back the blooming period of alsike; pasturing and the judicious use of irrigation water are the only means available to accomplish it. The best yield of alsike in the Aberdeen country last year was from a field pastured until about the first of June. The field was then given a good irrigation.

White clover seeds so readily that the crop can be pastured down until the first of June in the upper Snake river country and will then make a crop of seed. In the lower Snake river country from Twin Falls to the western boundary of the state, white clover can be made to produce two crops of seed in one season. In producing two seed crops in one season the early growth is not pastured. The prolonged seeding habit of the white clover accounts in a great measure for the enormous yields of seed reported from this crop in southern Idaho.

Irrigations: The careful use of irrigation water goes a long way toward insuring high yields of seed. Water must be made available to bring on the right kind of growth at the right time. A dwarfed growth is highly desirable for seed production. A strong vegetative growth is made at the expense of the seed crop. To a certain extent each seed field is a problem in itself. No set rule as to the amount of irrigation water advisable in the growth of a clover-seed crop and the time to apply it can be given as both vary with character of soil and climate. Plant growth must be the guide. Vigor of growth is an important factor in seed production which the irrigation farmer can largely control. It is within his power to crowd along or to hold back the crop growth in order to secure the benefits of the hot, dry season during blossoming

At the lower elevations where a hay and a seed crop can be secured from red clover, the hay crop should be crowded along as rapidly as possible. Two or more irrigations, depending on the type of soil, are usually required. A uniform irrigation before cutting the hay crop should be given to insure a good start for the second growth. A slow and dwarfed vegetative growth is desired for seed production. Careful use of water will bring about that kind of growth. The crop should be made to suffer somewhat for water a little before the first buds appear to hasten blooming. When in full bloom and setting of seed is taking place, a light application of water to fill the seeds is advisable. A short, thick growth is preferable to a strongly vegetative growth because the blooming and seed-setting periods are shortened and the ripening period hastened and made more uniform. Over-irrigation in clover-seed production during the seed-setting period should be carefully guarded against. At high elevations, where only a clipping of hay at the most can be obtained, the blooming period should be held back and made to coincide with the hottest weather of the season. As already indicated this can be accomplished by pasturing, clipping, or regulating the application of irrigation water to cause a slow growth. Pasturing or clipping is perhaps the safest practice in holding back the early growth.

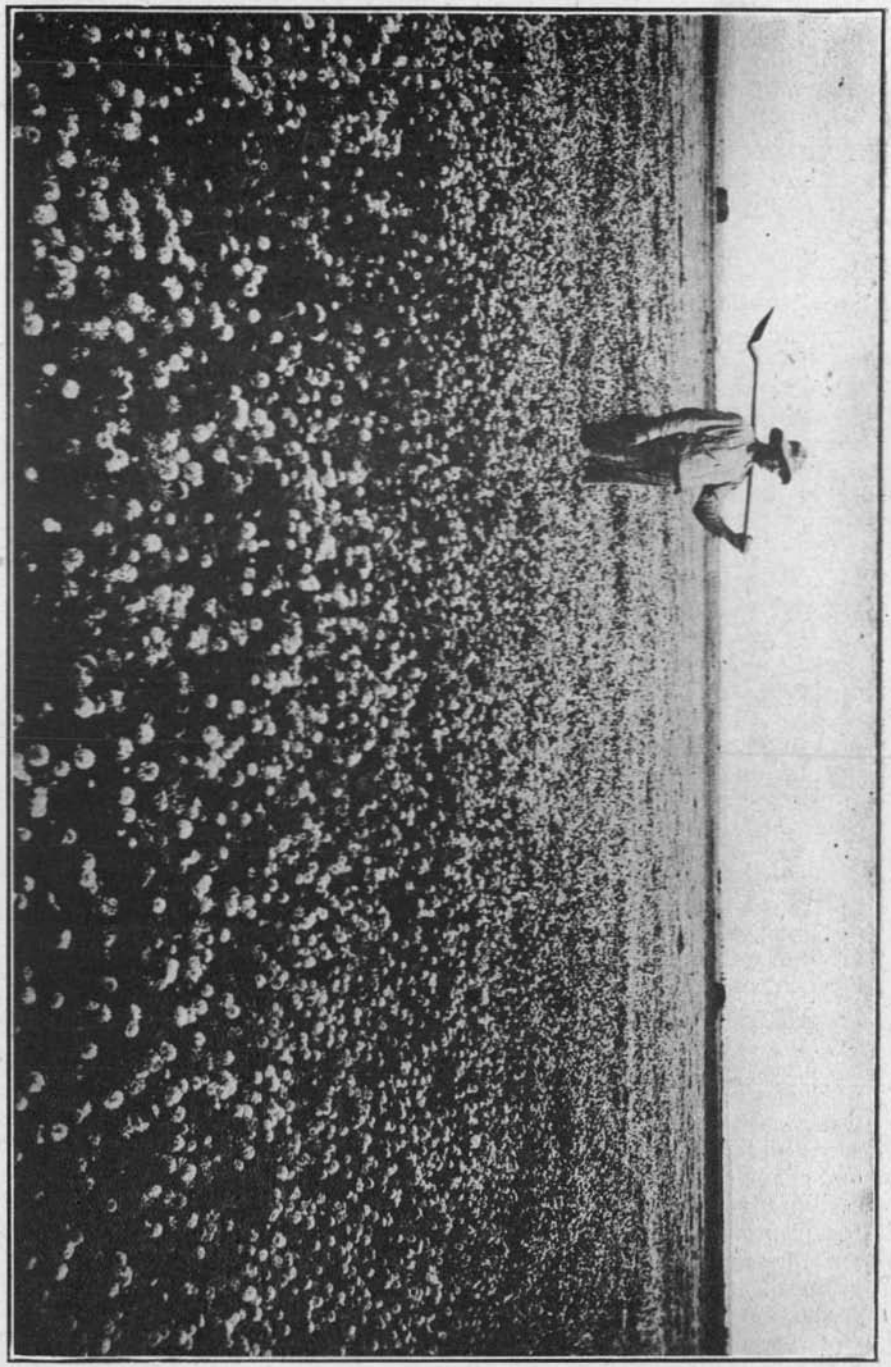

Fig. V—Irrigating alsike clover for seed production.

Alsike clover is a perennial. It differs also from red clover in that it will not yield a crop of hay and a crop of seed the same season. The early growth of alsike should not be forced too rapidly unless early pasture is desired in which case good irrigations may be given and the crop pastured until growth for the seed crop should be made. The time to permit this growth varies with the elevation. In the upper Snake river valley the fields can be pastured until the middle of May or the first of June and by the proper use of irrigation water from that time on, made to produce a good crop of seed. Care must be exercised in irrigating alsike clover. It will stand more water than red clover but if the water is applied at the wrong time a vigorous vegetative growth results and seed will not set. Water should be used to secure a steady but slow growth and withheld entirely for a short time before the appearance of the first bloom, until full bloom is reached. If then there is not sufficient moisture in the soil, a light application of irrigation water should be given. A slow, dwarfed growth will set more seed than a rank, heavy one and will be much easier to handle at harvest and hulling time. After the seed crop has been harvested, the fields should be irrigated and cultivated to start the growth of clover seed lost in harvesting.

White clover will use more water than either red or alsike clover and still produce a very good seed crop. It can be irrigated oftener and for a longer period than alsike. In habit of growth white clover differs greatly from alsike and red. The solid stems creep on the surface of the ground and take root, hence, when a stalk has matured, having produced flower and seed, the energy of the plant is given to the production of new stalks. White clover can be made to produce two seed crops in one season. After the first crop is made, the field should be irrigated and kept in a good growing condition for the second crop which will grow up thru the first one and may completely hide it. The irrigation of the second crop sometimes discolors the seed of the first crop but seldom injures its powers of germination.

WEED CONTROL

Weed control is the biggest problem connected with the production of clover seed in southern Idaho. When the land was new and irrigation projects were in their infancy, comparatively little attention was given to the control of weed growth. Weed pests became firmly established before the clover-seed industry had been established in southern Idaho. The best of clover seed has little commercial value if foul with weed seeds. Stringent weed laws are being enacted in many states of the Union to prevent the sale of impure seed and the further scattering of noxious weeds. Farmers generally are slowly realizing that pure seed is the best seed and the safest seed to plant. The pernicious practice of planting second-grade seed or screenings has caused much grief and trouble in the seed-producing industry. Seed foul with weeds should not be purchased for planting at any price. Thoro preparation of the soil to kill weeds and the selection of pure, clean seed are two practices absolutely necessary in the further development of the clover-seed business in southern Idaho. A day or two spent in cutting weeds out of the growing clover-seed crop will be found very profitable labor when the harvested seed crop is offered for sale. Certain sections of southern Idaho, spendid-

ly adapted to the production of seed crops, thru carelessness on the part of growers in protecting themselves against weed pests, have lost their reputations as producers of high-grade seed and are being passed up by the buyers. Many farmers fight weeds continually, but, owing to the reinfection of their soils with ripened weed seeds which fall into the irrigation water from ditchbanks, seem to be making a losing fight. Concerted action by all farmers in an irrigation country is the only means of solving the weed problem.

HARVESTING

Clover seed should be harvested as soon as the seed has hardened and taken on a proper color. Cutting too early will result in shrunken seed and seed that is off-color. If the crop is allowed to stand after it has ripened, winds and the drying effects of the hot sun will cause a great deal of shattering. To prevent losses from shattering, some growers take advantage of the cool and moist night air and harvest entirely at night. This method reduces loss from shattering to a minimum.

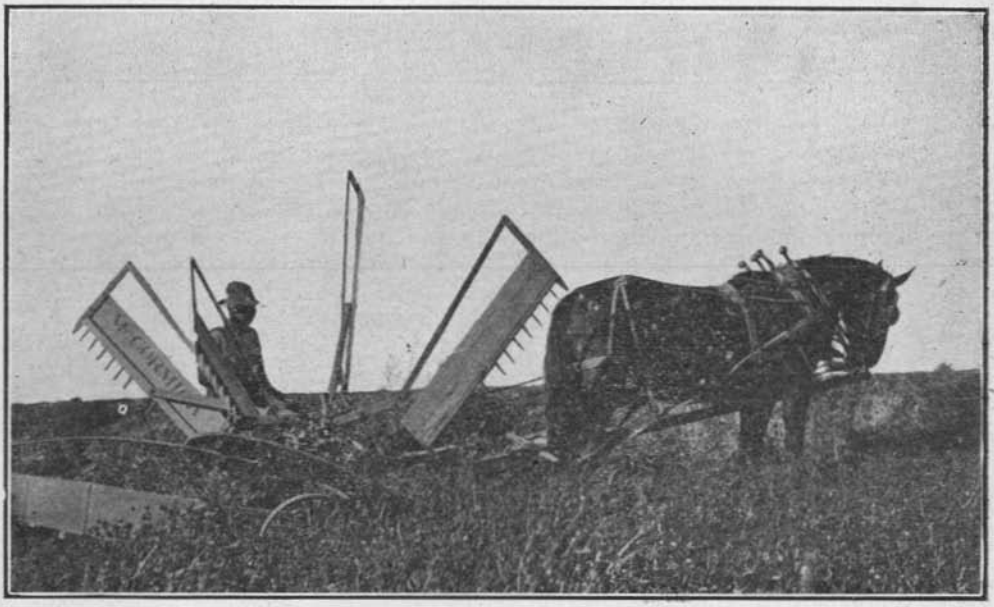

Fig. VI—The self-rake reaper in action in red clover.

The self-rake reaper is probably the best machine for harvesting red clover. This machine makes it possible in cutting to leave the crop neatly bunched with heads together out of the way of the team on the next round. Usually one man, but sometimes two, are required to follow up the reaper and bunch the clover for convenience in subsequent handling. Two of the bunches as left by the self-rake reaper are put together, heads in, as a protection against grasshoppers and the shattering effects of the

wind. The cocks thus made are just large enough for one handy forkful and that not only makes them easy to handle but reduces losses from shattering to a minimum, for tearing a cock into two or more forksful always causes loss of seed. All clovers cut for seed should be bunched immediately after cutting.

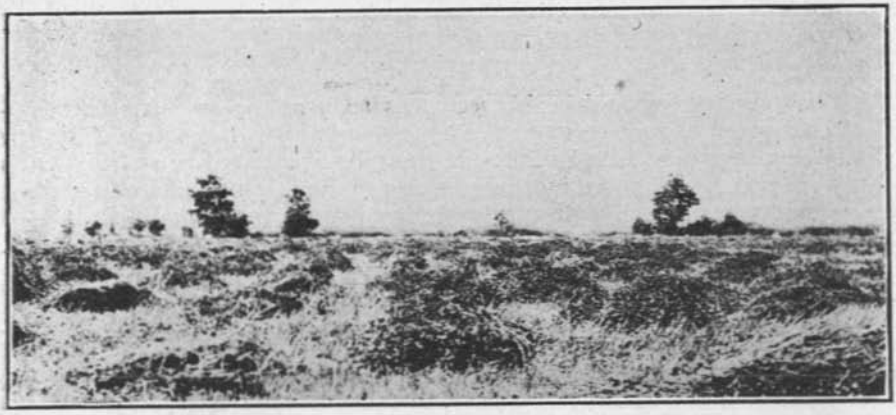

Fig. VII—Red clover bunched after being harvested with self-rake reaper.

Alsike clover is harvested with a mower, with or without the windrowing attachment. The advantage gained by the use of the windrower is prevention of trampling by the rolling of the cut swath out of the way of the team. The attachment also saves labor. This rolled swath should be torn apart and cocked as soon as possible after cutting. If permitted to dry out before cocking, or if left in the windrow and threshed from the field, there is a great loss from shattering when the crop is handled.

For cutting white clover the best machine in use is the ordinary mower fitted with a special cutter bar. This special cutter bar differs from the ordinary cutter bar in that it has smaller guards, more of them, and a smaller blade. The divider and the grass board are usually removed to prevent clogging and to permit of cutting closer to the ground. As a swath is cut one or more men follow closely behind the mower and cock it up out of the way of the team on the next round. White clover, particularly where the system of double seed cropping is practiced, is very thick, heavy, and hard to cut. Frequently a swath can be rolled up like a carpet, without breaking. Some growers in the clover sections of the state, practice rolling of the swath into rolls of convenient size for handling instead of cocking. Where the stand of white clover is thin, light, or short, or when the seed has been allowed to become over-ripe, a pan or canvas arrangement attached to the back side of the cutter bar will prevent loss of seed which might result from the handling of the crop by other means. This pan or canvas attachment can be operated by a man who follows closely behind the mower.

The clover-seed crop should not be handled any more than is abso-

Fig. VIII—Harvesting red clover with windrowing attachment on mower. This equipment is particularly good for harvesting alsike clover.

lutely necessary. In sections of southern Idaho where clover hullers are plentiful, stacking is hardly necessary. If, however, hulling must be delayed, stacking will prevent losses from windstorms, attacks from insects, and damage from an occasional rain storm. In some sections of the state, stacking of the seed crop is becoming more and more a general practice. The stacks should be built narrow and relatively high to insure rapid and safe curing, and quick drying if rained on. Racks used to haul the clover to the stack or to the huller should be covered with canvas to insure catching of all shattered seeds.

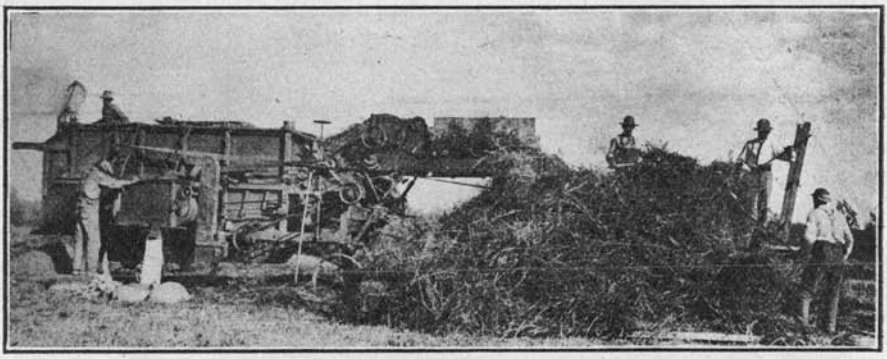

Fig. IX—Hulling clover in the field.

YIELDS

Yields of clover seed vary with methods employed in production and with other factors over which the grower has little or no control. Some enormous yields of seed from red, white and alsike clover have been obtained in various clover seed-growing sections of the southern part of the state. Some years climatic conditions and the activity of insect life, such as grasshoppers and aphids, and a short growing season may combine to reduce yields. However not all varieties are injuriously affected in any one season; a reduced yield in red clover may be coincident with maximum yields of white and alsike.

The following compilation of the average yields of the three varieties of clover for 1914, 1915 and 1916 was made from information received upon inquiry from seed growers and seed buyers from the various seed-growing sections of southern Idaho, and is fairly representative of what may be reasonably expected in the matter of yields:

Variety of Clover	Yield in Bushels per Acre		
	1914	1915	1916
Red	8	6	4*
Alsike	7	7	6
White	6	6	6

Exceptionally heavy yields reported from various points in southern Idaho range from nine to fifteen bushels per acre for red clover, from

* Yield greatly reduced by destructive action of aphids and grasshoppers.

eight to seventeen for white clover and from sixteen to twenty-three and one-half bushels for alsike clover. For the Aberdeen Station yields can be reported for 1916 only. They are: Red clover 4.1 bushels; white clover 6.6 bushels; and alsike 7 bushels per acre.

MARKETS AND MARKETING

Practically all the clover seed produced in southern Idaho is purchased by eastern seed houses. The Idaho product is in great demand for blending with and thereby making more readily marketable, eastern-grown and foreign-grown seed. Very little of Idaho-grown seed is sold on the eastern markets as such. Cooperative marketing of clover seed by farmers is not practiced extensively in southern Idaho. Clover seed is sold in the "dirt," on a recleaned basis, or after it has been recleaned. The acre-income whichever way the seed is sold is about the same. Convenience or necessity determine the basis of sale. Cleaning plants are maintained in the larger seed-growing centers by representatives of several large seed companies. A few privately-owned cleaning plants are in operation and a few of the more extensive growers are installing cleaning plants on their own farms. The price paid by buyers is based on purity and color. Color is given less weight than purity in determining prices to be paid. Prices for the most part are arbitrarily fixed by the eastern seed houses which buy the greater part of the seed crops. A uniform standard for clover seed is highly desirable in this state. Employment of standards worked out for clover seed in much the same manner as they have been worked out by the Office of Grain Standardization for corn and wheat and by the Bureau of Standards for cotton, would result in clover seed being sold more strictly on its merits and in putting the premium on high-grade seed. It is unfortunate for growers of clover seed in this state that all of Idaho's clover seed is not sold on eastern markets in competition with eastern and foreign-grown seed instead of being used to blend with and make them more readily marketable. Real competition in clover-seed markets would stimulate production in southern Idaho. The Aberdeen Station can report the purchase by eastern farmers' organizations of Idaho-grown seed and its highly satisfactory use by the membership of those organizations. Cooperative action on the part of Idaho seed growers in the various sections of southern Idaho could doubtless bring about the sale of straight Idaho-grown seed to consumers of the various clover seeds in the several parts of the United States. Clover seed produced in Idaho of course at this time constitutes only a small part of the total amount of seed annually used in the United States, but the acreage given over to the production of clover seed and the annual output can be greatly increased.

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.
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.
96. The Management of Farm Flocks in Idaho.
97. Commercial Onion Culture in Idaho.
98. Winter Versus Summer Pruning of Apple Trees.

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

*Ground Squirrel Control.
*Cost of Pumping for Irrigation.
*Oats in Washington.
*The Home Drying of Fruits and Vegetables.

*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.