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EC180 Crop Production Under Irrigation in Nebraska

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Contents

Photographs—courtesy of Soil Conservation Service.

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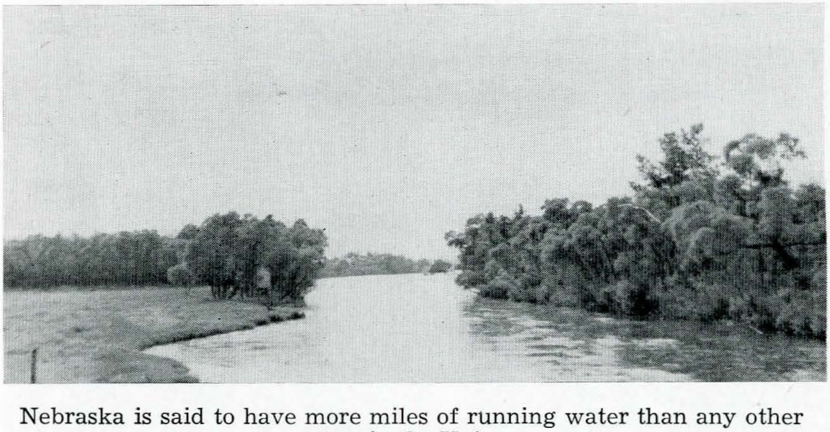
Crop Production Under Irrigation In Nebraska

D. L. Gross [1]

THE ACREAGE of irrigated land in Nebraska has increased greatly in recent years. Nearly one million acres are now receiving supplemental water. In addition to the older Platte and Republican Valley projects, recent public developments include the "Tri-County," "Mirage Flats," and "Loup Valley," and the more recent developments in the Republican Valley. In addition, private development has been extensive, involving the use of deep wells, and diversion or pumping from streams. There has also been limited irrigation from runoff water impounded by privately constructed dams, or diverted directly to the fields. Private development has taken place largely in south central and southwestern Nebraska. Some irrigation is now practiced in nearly all counties of the state.



Nebraska is said to have more miles of running water than any other state in the Union.

Although the need for irrigation in Nebraska was most clearly demonstrated in the dry 1930's, the real value of supplemental water became evident in the early 1940's when rainfall was above normal. In these years it became increasingly apparent that in

[1] Extension agronomist.

central Nebraska where most of the new irrigation development occurred, supplemental water could be expected to more than double the yields of corn and most other crops as compared with non-irrigated yields.

This field yielded 139 bushels per acre in 1946. Walter Maaske farm, Bertrand.

Each newly-irrigated acre tends to stabilize Nebraska's agriculture by reducing the effects of severe drouth, by making possible greater diversity of crop production, and more intensive use of soil building crops.

Greater use of irrigation water will likely tend to increase the number of people gainfully employed on the farms and in the towns and cities of Nebraska, and at the same time improve the general standard of living.

PROBLEMS OF THE NEW IRRIGATOR

THE CHANGE from dryland to irrigation farming creates many problems for the new irrigator. Often the beginner does not fully appreciate the importance of such factors as land preparation, water distribution methods, soil fertility, choice of crops and varieties, rates of planting, time of watering, rate of application, relative capacity of soils to hold water, and depths from which plants secure their water. The discussions which follow may help the new irrigator to learn more quickly the fundamentals of good irrigation, and thus reduce probable losses as the result of inexperience.

Resting—while a good water distribution system does the work.

LAND PREPARATION AND WATER DISTRIBUTION

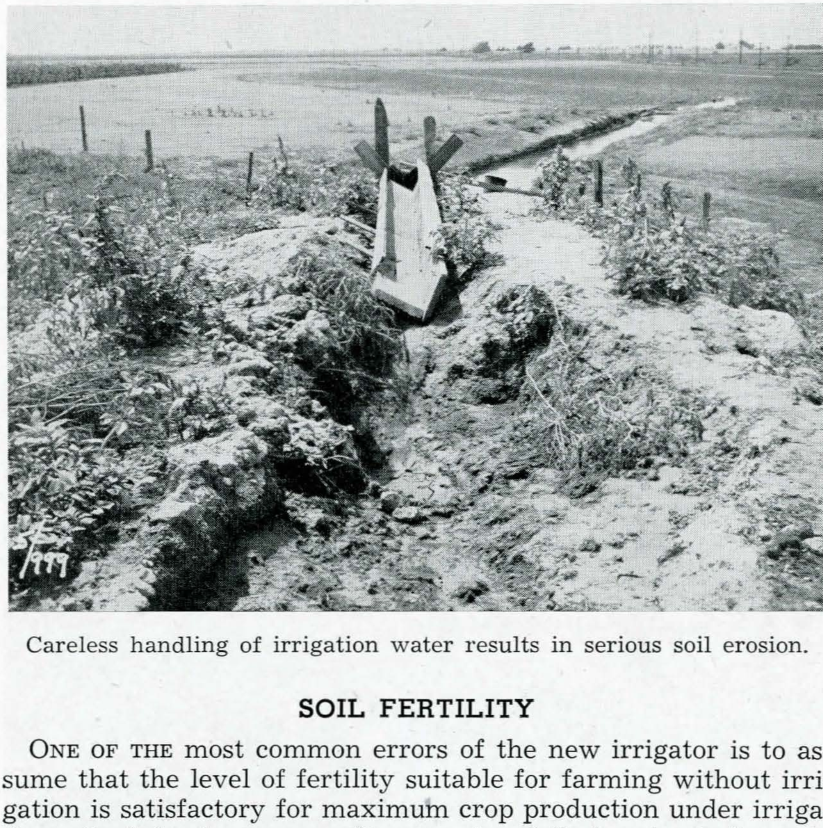
IT IS USUALLY important that the new irrigator obtain the services of an experienced irrigation engineer or other competent technician to make such surveys as are necessary to determine the feasibility of irrigation for each segment of the farm; the method of water distribution, whether by gravity or by a sprinkling system; the feasibility and economy of each of these; need

Land leveling pays good dividends on many fields by way of better water distribution.

Diverting flood waters to cultivated fields is a growing practice in Nebraska. Earl Bell farm, Franklin county.

for drainage; necessary land leveling and the costs thereof; location of laterals; determination of row directions and length of runs; placement and design of outlets, check dams and other structures; and the feasibility of use of movable gated pipes.

Devising an efficient water distribution system is one of the "musts" of successful gravity irrigation. A well planned system not only facilitates even water distribution, but also reduces time and labor requirements, assists in the control of erosion, and reduces leaching of the soil.



Careless handling of irrigation water results in serious soil erosion.

SOIL FERTILITY

ONE OF THE most common errors of the new irrigator is to assume that the level of fertility suitable for farming without irrigation is satisfactory for maximum crop production under irrigation. Such beginners are often convinced that water is the only major limiting factor in crop production. After a year or two of irrigation farming under this assumption, the irrigator discovers that soil fertility is also a primary factor, and that big yields remove much fertility which must be returned if yields are to be maintained at a satisfactory level. This applies principally to soil nitrogen which is usually the chief fertility element needing re-

placement. A 100-bushel crop of corn removes approximately 100 pounds of nitrogen. Under these conditions an additional 50 pounds of nitrogen are removed if the stalks also are harvested. Phosphorus may need replacement on some soils and for certain crops.

CROP ROTATIONS AND SOIL IMPROVEMENT

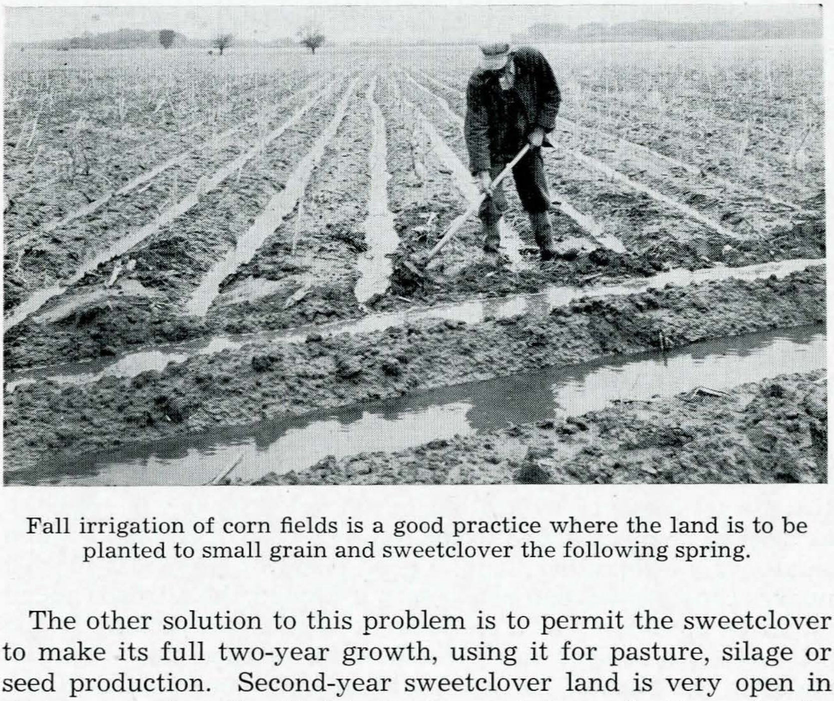
SOIL NITROGEN is replaced in the soil by the use of barnyard manure and commercial nitrogen fertilizers and by growing leguminous plants, chiefly biennial sweetclover, alfalfa, and red clover. If not clipped or grazed, one year's growth of these crops under good growing conditions may add 100 to 200 pounds of nitrogen to the soil per acre. These legumes are not all adapted to the same conditions or to the same cropping system and therefore must be discussed separately.

Biennial sweetclover.—This legume is used more widely than any other in short rotations. In the cornbelt section sweetclover is usually followed by corn and is commonly plowed under at the beginning of its second year's growth as soon as the crown buds of the clover are well started in their growth. Plowing prior to this stage of growing may not kill all the clover plants. The remaining ones act as weeds in the field, interfering with tillage operations.

Second-year sweetclover tends to make the soil more receptive to water, and more open in structure.

This problem is a more serious one when beets or early potatoes follow the first-year clover since the seedbed for these crops must be prepared very early in the spring. Under these conditions if the ordinary plow is used for seedbed preparation, a large number of the clover plants are likely to survive, interfering with planting, thinning, tillage, and probably with harvest.

This problem may be overcome by using a subsurface tiller for the initial seedbed preparation operation. It is suggested that two operations be performed, first cutting the sweetclover just below the crowns with the subtiller, and next cutting the roots at a depth of about 6 inches with the plow or subtiller.



Fall irrigation of corn fields is a good practice where the land is to be planted to small grain and sweetclover the following spring.

The other solution to this problem is to permit the sweetclover to make its full two-year growth, using it for pasture, silage or seed production. Second-year sweetclover land is very open in structure and well suited to beet or potato production. At the Scottsbluff Experiment Station a rotation of "oats and sweetclover-sweetclover pasture-beets-beets," has been the most profitable one used over a twelve-year period. In parts of the state where corn is the principal crop, a somewhat shorter rotation, as sweetclover with oats, followed by two years of corn, would be more suitable. The second crop of corn might need a commercial nitrogen fertilizer for maximum yields.

In the management of biennial sweetclover it is well to keep in mind that 85 per cent or more of the nitrogen added to the soil by this crop accumulates in the first year, especially during the months of September and October. The actual amount of nitrogen added by sweetclover is apparently determined largely by the size and density of growth of the sweetclover plants the first year. Mowing or grazing the first-year growth of biennial sweetclover materially reduces the amount of nitrogen added to the soil.

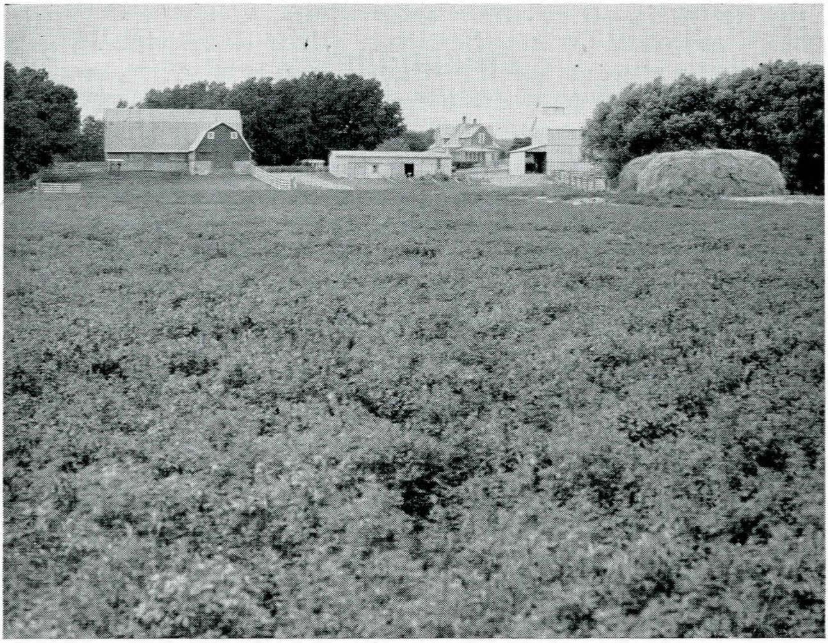
Inoculation of the sweetclover seed with the proper type of symbiotic bacteria is of course important in this respect if these bacteria are not already present in the soil. They are generally present in limy soil.

In establishing stands of biennial sweetclover it is often not expedient to irrigate the clover and its nurse crop in the spring of the year in order to assure a good stand of the clover. Under these circumstances it may be well to irrigate the land to a considerable depth in the previous fall. This would be especially feasible on soils of high water-holding capacity, but less so on very coarse soils. It is advisable to water the clover immediately after the companion crop is harvested.

Annual Hubam sweetclover.—The foregoing sweetclover discussion has dealt entirely with the biennial type. Hubam sweetclover, an annual type, is occasionally resorted to as a substitute for the biennial immediately preceding beets or early potatoes. This substitution is made to avoid the problem of handling the heavy roots and tops of the biennial.

Experiments have shown that a heavy, vigorous growth of Hubam accumulates about one-half as much nitrogen as does the biennial. Nearly all of the nitrogen in the Hubam is in the tops. If these are removed by grazing, or harvested for hay or seed, the amount of nitrogen added to the soil by a crop of Hubam is quite small. If, on the other hand, a good stand of Hubam is plowed under at full growth and before seed is formed, the nitrogen added might be considered as a supplement to nitrogen already in the soil before the clover was planted or to nitrogen that might be added in the form of barnyard manure or commercial fertilizer.

Alfalfa.—While biennial sweetclover is considered the most satisfactory legume for short rotations in the principal irrigated areas of Nebraska, alfalfa is best suited to longer type rotations. Good stands of alfalfa are very profitable in themselves as a source of high value roughage for livestock. Although alfalfa adds about as much nitrogen to the soil in one year's growth as does sweetclover, alfalfa stands are usually permitted to remain two, three or more years. The total amount of nitrogen added to the soil



Under irrigation, land broken from an old stand of alfalfa may produce as many as four successive corn crops of 100 bushels or more.

by alfalfa that is permitted to stand for several years, has not been clearly determined. It is known that grain and other crops following old stands of alfalfa show growth stimulation over a period of several years after the alfalfa is broken. While the second crop of non-fertilized corn following sweetclover can be expected to yield considerably less than the first crop, corn yield contest data indicate that on irrigated land three or more high yielding corn crops might be obtained following the breaking of old alfalfa stands. The following data are from the 1946 Nebraska corn yield contest:

	No. of fields	Av. yield of corn
1st crop after alfalfa	21	122 bu.
2nd crop after alfalfa	10	114 bu.
3rd crop after alfalfa	1	103 bu.
4th crop after alfalfa	5	104 bu.

In general, rotations involving two to four years of alfalfa appear to be more suitable than longer or shorter ones. Where alfalfa is to stand more than three years it is important that a wilt-resistant strain be used.

Red clover.—This legume is adapted best to eastern Nebraska. Since it apparently is not superior to alfalfa or sweetclover as a soil building crop, its use on irrigated land is likely to be quite limited and confined chiefly to the eastern counties of the state.

Barnyard manure.—Barnyard manure has a twofold value for soil improvement. It not only returns essential plant food elements to the soil, but at the same time tends to improve soil structure. Good structure facilitates aeration, water intake and tillage operations. Fresh manure plowed under immediately after it is spread, returns nearly all of its original plant food elements to the soil. When manure is spread and left exposed over a period of several weeks, it may lose much of its nitrogen.

The growing and fattening of livestock on irrigated farms is favorable to long-time successful irrigation farming. This enterprise not only provides manure for soil improvement but at the same time provides a profitable outlet for hay and other roughages produced incidentally as a part of the soil improvement program, or as by-products from the principal crops. It also permits efficient use of labor throughout the year.

Crop residues.—The return of all unused crop residues to the soil is also important in maintaining soil structure and fertility. The use of crop residues in the feed yard where they may absorb liquid manures is a frugal practice.

Commercial fertilizers.—On a well-managed irrigated farm, commercial fertilizers are used as a supplement rather than a replacement of good crop rotations and barnyard manure. Nitrogen fertilizers are used more extensively than other types. Phosphorous and phosphorous-nitrogen combinations have given profitable returns in some instances. More detailed information on the use of commercial fertilizers appears in Extension Circular 175, a copy of which may be obtained from county agricultural agents or from the Agricultural Extension Service, College of Agriculture, Lincoln.

Some Suggested Rotations

1. Biennial sweetclover with oats-corn-corn plus nitrogen.
2. Biennial sweetclover with oats-sweetclover pasture-potatoes-beets, or beets-beets.
3. Biennial sweetclover with oats-potatoes-beets manured.
4. Alfalfa three to four years-corn three to four years.
5. Alfalfa two years-potatoes-beets manured.
6. Brome-alfalfa pasture three years-corn-corn or potatoes-beets manured.

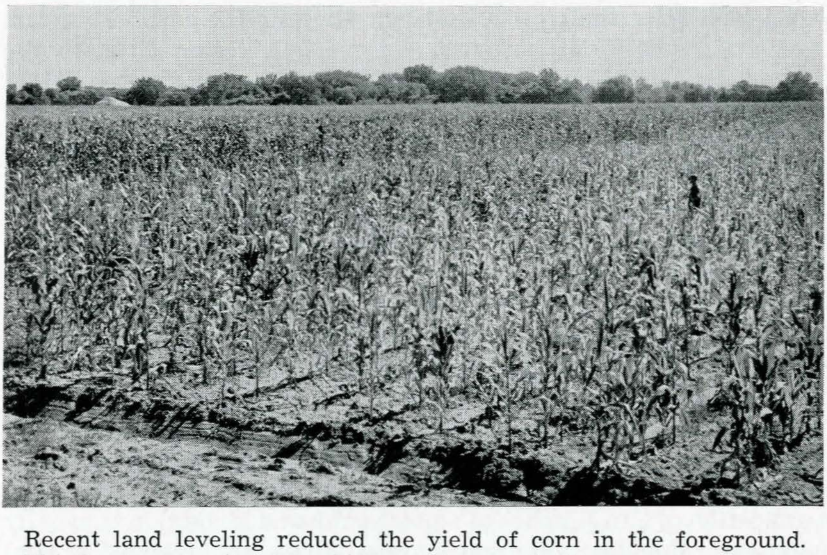
CROP MANAGEMENT

Corn Production

RECENT NEBRASKA corn yield contests have shown that under irrigation many yields in excess of 100 bushels per acre are being produced each year and that yields of 150 bushels or more are quite probable. A study of the contest records reveals the factors which most commonly determine whether yields are to be in the upper or lower levels. These are: soil fertility, timeliness and adequacy of irrigation, stand of corn, and weed control.

Other factors which are less crucial but nevertheless important are seedbed preparation, method of planting, time of planting, tillage methods, and choice of hybrids. Each of these will bear discussion.

Soil fertility.—This factor has been discussed. It may be added that commercial nitrogen fertilizers, chiefly in the form of ammonium nitrate, are being used on an increasing scale in corn production. It is commonly applied at the last cultivation in single bands about 6 to 8 inches from each row. Application at this time does not materially affect the size of the corn plant, the benefits being expressed chiefly in the size of the ears.



Recent land leveling reduced the yield of corn in the foreground. This land needs nitrogen which may be supplied by manure, legumes or commercial fertilizers.

Planting.—Preparing the seedbed early tends to favor early warming of the soil, early sprouting of weed seeds, nitrate development, and better stands of corn.

Although more corn is listed than is surface-planted, much of the corn on irrigated land is planted with the loose ground lister on early plowed land. This method seems superior to others because it favors rapid plant development and earlier maturity. Loose ground listing facilitates cultivation and weed control with tractor equipment. Deep listing on unplowed land tends to retard the early growth of corn.

On irrigated land planting in the first half of May appears to be more favorable to high yields than later planting. The rate of planting must be governed by the amount of soil moisture and fertility likely to be available. High soil fertility and adequate irrigation whenever needed will permit planting at the rate of one plant every 10 to 12 inches in rows 38 to 40 inches apart. A lesser stand under these conditions will likely result in reduced yields. Thinner stands are advisable under conditions of limited fertility and soil moisture, or on weedy land.

Cultivation.—Control of weeds is of extreme importance if the best yields are to be obtained. Weeds use much soil moisture and soil fertility. As stated above, early spring tillage promotes early weed growth and thus reduces the likelihood of serious weed infestation after the corn is laid by. Ridging the corn at the last cultivation facilitates irrigation. Deep cultivation close to the corn plants should be avoided after the corn has attained a height of about 2 feet.

Irrigation.—The most common mistake of the new irrigator is to apply water too late, or after the plants have begun to show drouth symptoms. Once corn begins to show signs of soil moisture shortage it is likely that yield possibilities have been reduced. No amount of water applied later will correct the damage done. Delay in making the first irrigation is the most common error. Unless the soil contains an abundance of water, irrigation as soon as the corn is laid by is a wise precaution. In very dry seasons earlier irrigation may be necessary.

The use of an auger or spade to determine soil moisture conditions is essential. The use of a probe while irrigating, to determine the depth of water penetration, is also a good procedure. Application of 2 to 3 inches of water at the first irrigation is usually sufficient. Heavier irrigation may be advisable, however, if subsoils are quite dry.

A heavy stand of corn at near maximum growth may transpire as much as an inch of water in a single hot, windy day.

Delayed irrigation at later stages may be even more serious than delayed early irrigation. Although on cool cloudy days corn may transpire very little water, a heavy stand of corn at near maximum growth may transpire as much as an inch of water in a single hot, windy day. With this in mind, the wise irrigator will store a reserve of water in the soil, wetting it to a depth of 3 to 4 feet depending upon the soil type. Clay soils may hold about 3 inches of available water per foot of depth, a silt loam soil about 2 inches, and a sandy soil about 1 inch. When irrigating row crops, even distribution of water is important for adequate watering, avoidance of leaching of plant nutrients, and prevention of waste.

Long runs on light sandy soil result in over-watering at the upper end of the row and possible inadequate watering at the lower end. Another result may be the loss of much water to the deeper subsoils beneath the root zone. Under this condition, therefore, the length of run might need to be reduced to as little as 20 rods on relatively flat fields. When water is first turned into such rows a big head should be used to get the water to the lower end as soon as possible. The head may then need to be reduced to prevent loss of water at the lower end. The same procedure may be advisable on the heavier soils, although in these, water

penetrates more slowly and a more even distribution can be made even though the length of run is much greater. By using a probe and ascertaining the depth of water penetration at both ends of the row, the irrigator can determine whether an even distribution is being made, and what action to take with respect to length of run or the size of head to use.

Corn uses water until it is well dented and the soil should not be permitted to become dry before that time. Some corn growers believe that watering delays maturity. Actually adequate moisture at all times may hasten maturity. The later maturing hybrids can be used more safely on irrigated land than on comparable non-irrigated land.

The furrow method of irrigation is used almost universally for corn and other row crops. The use of siphons, lath boxes or other types of tubes facilitates even water application, and greatly reduce erosion losses.

Small Grains

SMALL GRAINS are not grown extensively on irrigated land in Nebraska since they are usually less profitable than other crops. Oats and barley are used principally as companion crops for legumes, being seeded at about one-half the normal rate. In central Nebraska these crops are usually planted on cornstalk land and may not be irrigated, especially if the preceding corn crop was watered late in the previous season, permitting a substantial carry-over of soil moisture into the spring months. Where small grains are irrigated, the flooding method from shallow, temporary field laterals is commonly used. The border method of water distribution is more satisfactory, however, wherever it is adapted. Except on light soils, a satisfactory growth of small grain and its companion crop usually can be obtained without irrigation other than that carried over from fall watering and that from spring rains. Early maturing and lodge-resistant varieties of oats or barley are most satisfactory as nurse crops under irrigation. When the small grain is planted without a legume, somewhat later maturing and possibly higher yielding varieties may be used.

Sorghums

SORGHUMS grown under irrigation are handled in nearly the same manner as corn. In south central Nebraska and in seasons of normal temperatures or above, grain sorghums can be expected to yield as well as or better than corn under the same conditions of soil moisture and soil fertility. This crop withstands delayed irrigation better than corn. The combine types of grain sorghums

are the most satisfactory. Lodge-resistant strains should be used. Very limited experimental trials indicate that on fertile soil, with adequate soil moisture, the short growing grain sorghums may give their best yields when planted in 20-inch rows with a stand of one plant every 4 to 6 inches in the row.

Alfalfa

ALFALFA is one of the most important crops on irrigated land. Its use for hay and soil improvement is almost indispensable in successful irrigation farming. Its use as hay in a livestock program tends to balance rations and provides much high-value barnyard manure.

Alfalfa has a relatively high water requirement, using as much as 7 to 9 inches of water per ton of hay produced. The higher amount applies particularly to south central Nebraska and especially in seasons when temperatures are high and humidity is low. Somewhat less water is required in the northern and western portions of the state. Where alfalfa is sub-irrigated by high water tables this high water requirement is not a problem. On farms where irrigation water is limited seasonally, however, careful water management must be exercised. Spring and fall watering of alfalfa will permit the use of all available summer water on other crops. If the alfalfa is on deep soil of a high water-holding capacity, much water may be stored in the spring and fall months for use by the alfalfa during the season when all available irrigation water is needed for other crops. Alfalfa is capable of drawing water from depths of 25 feet or more and thus may utilize deeply-stored water.

Pastures

GOOD PASTURES are a prime requirement on well-managed irrigated farms. If properly managed, such pastures can be as profitable as other crops, if not more so. Good management involves the proper choice of grasses and legumes, adequate irrigation, weed control and proper grazing methods.

Brome-alfalfa pastures have been highly productive in Nebraska under most conditions and under good management practices. The rate of planting is usually about 12 to 15 pounds of bromegrass seed and about 3 to 4 pounds of alfalfa seed. It is essential that a brome-alfalfa pasture be divided into three or more segments which are grazed alternately. Under continuous grazing the alfalfa is soon destroyed. When this occurs the bromegrass receives too little nitrogen for satisfactory growth. Nitrogen-starved bromegrass is low in palatability and nutritional value.

Brome-alfalfa pasture, properly bordered and frequently irrigated, can be expected to give as much net return as any crop.

Healthy stands of brome-alfalfa are highly nutritious. On phosphorus-deficient soils, the occasional application of phosphate fertilizer to brome-alfalfa pastures will stimulate growth of the alfalfa and thus increase nitrogen fixation. Any other treatment or condition which increases the growth of the sweetclover will also tend to increase nitrogen fixation.

Irrigated Sudan pastures are not surpassed by any other type of pasture in terms of grazing yield.

Pastures are watered in the same manner as alfalfa. The border system is most satisfactory where adapted. Frequent light applications of water are recommended.

A lush growth of any type of pasture may occasionally cause bloat in cattle and sheep. This seldom occurs, however, where the following precautions are taken: (1) Never turn the animals on such pasture when they are hungry. (2) Permit the animals to have access to dry feed and salt at all times. (3) Provide water in or near the pasture.

Over-grazing is the greatest menace to good pastures, occurring primarily in mid-summer when soil moisture is low and water is needed for other crops. The use of silage and supplemental temporary Sudan pastures in mid-summer will largely eliminate this problem.

Potatoes

THIS IS AN IMPORTANT crop in nearly all areas where irrigation water is available. Except for patches grown chiefly for home use, and limited production of certified seed potatoes grown on dryland in the western section of the state, commercial potatoes in Nebraska are grown principally on irrigated land. Extensive production is confined chiefly to the upper and middle Platte river valley, with limited production under the Tri-County and the Middle and North Loup irrigation projects. The growing of certified seed potatoes, chiefly for the southern states, is an important enterprise in western Nebraska.

The chief problems of potato production in Nebraska are disease control, soil fertility and management of irrigation water. These are the principal factors which govern yields and quality. The aim of the potato grower is to produce the highest yield of No. 1 quality potatoes.

Under irrigation, watering practices have much to do with potato quality and yield. Delayed watering in the late spring and early summer or at any later time when soil moisture is short, definitely reduces yields and quality. On the other hand excessive watering favors development of diseases, especially on heavier soils. On the lighter well-drained soils experiments indicate that frequent waterings may favor high yields. On such soils, however, excessive watering is likely to leach the nitrogen below the depth of the potato roots and thus reduce yields. An over-supply of soil moisture at digging time may cause some varieties of potatoes to crack easily, thus lowering the quality and grade. Potato tubers arrested in their growth as a result of soil moisture short-

age, may become very "knobby" when water is made available later.

The most successful potato growers are those who choose their seed stock carefully for freedom from disease, who maintain soil fertility with good legume rotations, and who use irrigation practices which keep the plants growing rapidly, but which avoid excessive watering, especially on the heavier soils.

Field Beans

THE GROWING of Great Northern navy, and Pinto beans, has been quite profitable under irrigation in the western, higher altitude section of Nebraska. Attempts to grow these beans in other parts of Nebraska, however, have usually resulted in unsatisfactory returns from the standpoint of both yield and quality. This has been due largely to damage from blight. Unless disease control methods are discovered or disease-resistant varieties developed, the acreage planted to this crop in central and eastern Nebraska will be of no economic significance.

Beans are sometimes referred to as a good crop for poor soil. Actually, however, this crop responds to fertile soil in the same way as any other crop. Like other crops, beans require a plentiful supply of nitrogen from the soil if they are to make their best yields.

It is important that blight-free seed be used. In the principal bean-growing areas of western Nebraska, the greater portion of the seed used is obtained from the western mountain states where serious blight is uncommon.

Cultural practices.—Early plowing followed by the use of the disk and harrow is recommended as a good method of seedbed preparation for beans. A number of harrowings prior to planting will aid in weed control.

Beans are commonly planted in early June in 20- to 24-inch rows at the rate of 50 to 60 pounds per acre. Dropping the beans 2 to 3 inches apart in the row is recommended.

Tillage methods for beans are about the same as for other crops. An exception is that the beans should not be cultivated when wet with dew or rain, since this tends to spread blight that may be present.

When beans are planted on light soils it is important that winter wheat or rye be planted on the land immediately before or following bean harvest to reduce soil blowing. A good covering of barnyard manure is also recommended.

Beans respond best to frequent light applications of irrigation water, depending on rainfall. Watering should be sufficient to

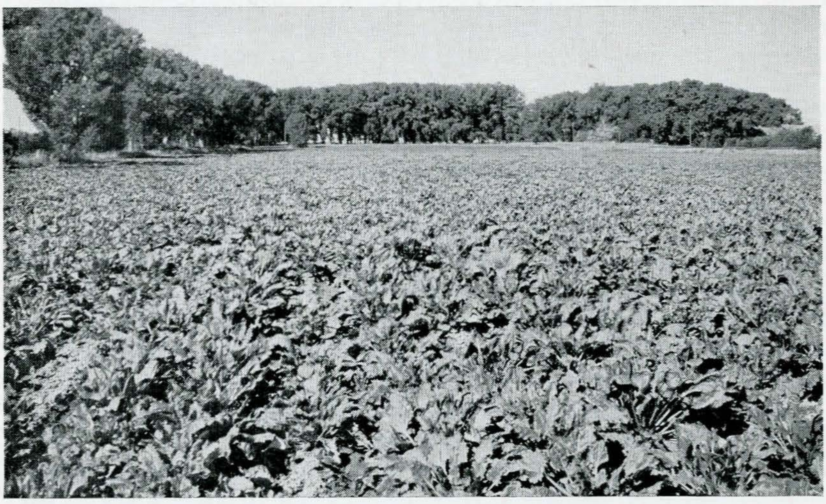
maintain a light green color in the beans. When beans show a dark green color it is an indication of soil moisture shortage.

Windrowing with the bean puller and harvesting with the pick-up combine is an accepted method of harvest. Commercial beans are delivered to bean plants where they are machine-sorted and bagged for market.

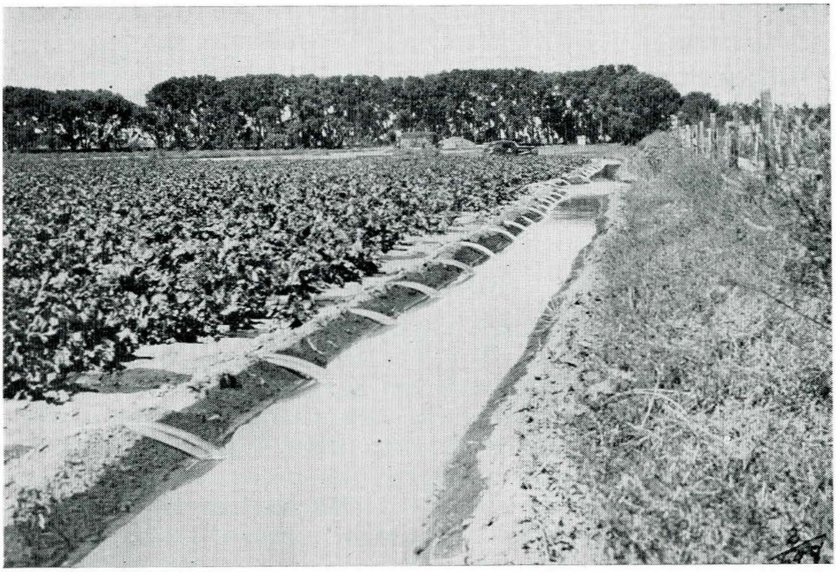
See Extension Circular 135 for more complete information on cultural practices.

Sugar Beets

THE GROWING of sugar beets has been one of the primary enterprises on irrigated land. This has been especially true in the higher altitudes where corn is not so well adapted. Whether or not sugar beet production will become important on newly-developed irrigated areas in the corn belt will be determined by relative returns, the development of mechanization in beet production methods, and the availability of irrigation water. In the Scottsbluff area sugar beets require more water than corn. In this area sugar beets are given from three to seven irrigations, using from 3 to 6 inches of water per irrigation. Careful water management reduces this requirement. Over-watering on very porous soils, and waste at the end of rows or through breaks in the laterals, account for much of this excessive use.



A heavy crop of beets may require as much as 200 pounds of nitrogen per acre.



Siphon tubes facilitate water distribution in row crops.

A good crop of sugar beets may yield as much as 20 tons or more per acre, requiring 175 to 200 pounds of nitrogen. Maintenance of such yields requires systematic crop rotations, including frequent use of legumes and application of barnyard manure and commercial fertilizers as a means of maintaining an adequate supply of nitrogen. On some soils phosphates may also need replenishment.

Rotations which have given good results over a period of years are:

Sweetclover with oats-sweetclover pasture-two years of beets.

Three years of alfalfa-potatoes-beets.

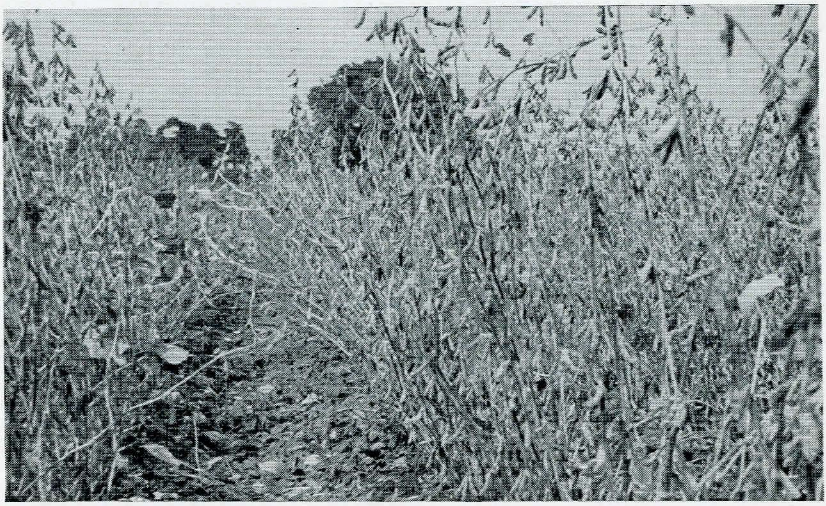
Two years of alfalfa-potatoes-beets.

Comparing sugar beet and potato yields in the last two rotations, it appears that over a period of years, two years of alfalfa was equal to three years of this crop in maintaining soil productivity.

Soybeans

THIS CROP has not proven very successful under irrigation. It does not seem to have as wide a yield range as corn. It appears to be adapted best to northeast Nebraska on non-irrigated land. Under irrigation, soybeans may be planted in 20-inch rows and cultivated with beet machinery. A rate of planting of 60 to 80 pounds per acre is recommended. There has been little experi-

ence with irrigated soybeans. It appears that the method of irrigation used for field beans would be satisfactory also for soybeans. It appears, also, that the method of harvest might be the same as for the field beans.



Soybeans do not seem to respond as much as some other crops to irrigation and high soil fertility.

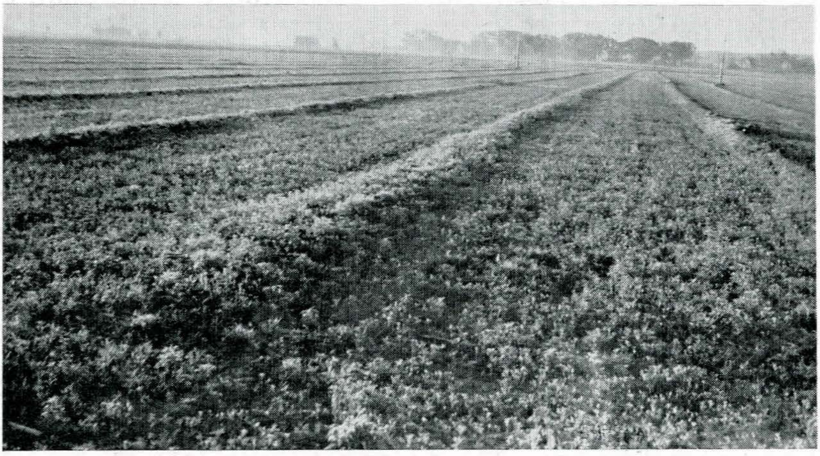
IRRIGATION METHODS

IN GENERAL there are six methods of water distribution commonly used. They are (1) the border system, (2) the corrugation method, (3) flooding from border ditches, (4) flooding from contour ditches, (5) use of furrows, and (6) wild flooding. The latter method is the least efficient and is not discussed in this circular.

Border irrigation.—Where adapted, the border system is considered the best method of water distribution for alfalfa, pastures and other non-cultivated land. This consists of a series of nearly parallel ridges leading directly down the slope, and between which large heads of water are introduced from the upper end. The head of water should be large enough to completely cover the interspaces. The available water at any one time, the degree of slope, and the soil type determine the correct distance between borders.

In order to facilitate hay-making, the border ridges on an alfalfa field are often made about 5 to 6 feet broad and about 6 inches high when settled. Narrower ridges are preferred by some where

these do not interfere with the operation of mowers, rakes, sweeps and other machinery used in hay-making.



Border irrigation of non-cultivated crops facilitates even water distribution.

Corrugation method.—The corrugation method of water distribution consists of a system of shallow parallel furrows 1 to 4 feet apart, depending upon soil type, and leading down the slope. By this means the water can be distributed quite evenly. This system is satisfactory providing erosion does not occur, and providing the furrows do not materially reduce the stand and the yield of hay. (See Farmers' Bulletin 1348.)

Border ditches.—The border ditch method of irrigation consists of the construction of a series of parallel ditches from which the water is diverted, and distributed by flooding. This method is less desirable than the other methods described since the ditches occupy a considerable portion of the land and a good job of water distribution requires much work with the shovel. Haying operations are complicated by this system, and weed and insect propagation is favored.

Flooding from contour ditches.—This method is considered superior to the border ditch method for even and efficient distribution.

Use of furrows.—This method is used almost universally for row crops. It involves the use of spiles in the form of "lath boxes," siphon tubes, car hose, or similar materials. Such tubes are essential to uniform regulation of flow.