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D. L. Gross

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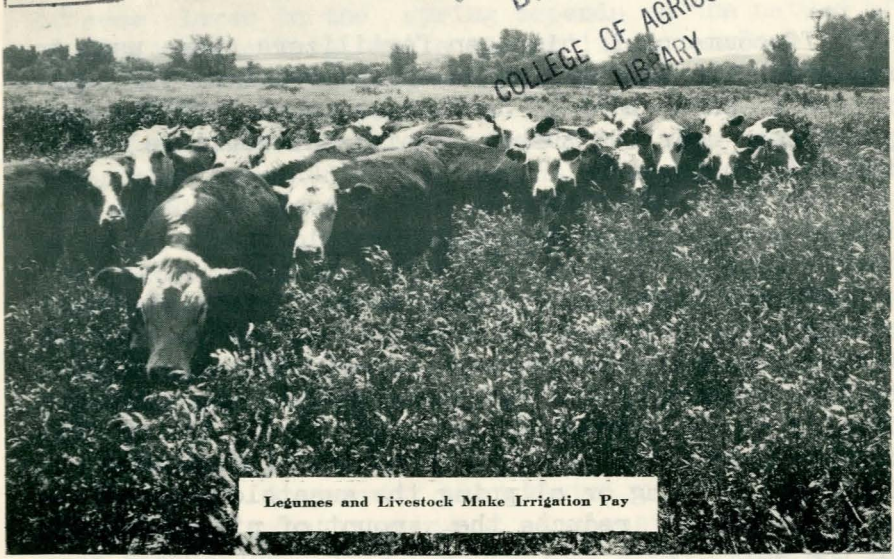

Legumes and Livestock Make Irrigation Pay

Cooperative Extensio... me Economics
University of Nebrask... e United States
Department of Agricul... Acting Director,
Lincoln.

CROP ROTATIONS UNDER IRRIGATION

D. L. Gross, Extension Agronomist

High yielding irrigated crops remove much nitrogen from the soil. As an example, it requires approximately a pound of nitrogen for each bushel of corn produced. In addition, about one-half pound of nitrogen per bushel of corn produced is required by the stalks. Most of the latter nitrogen is returned to the land if the stalks are incorporated with the soil.

If commercial nitrogen fertilizers were used to replenish the nitrogen actually removed from the soil, it would cost about 10 cents per pound. If the corn yield was near 100 bushels this cost would be about ten dollars per acre.

Use of Biennial Sweetclover

On the other hand, a good crop of biennial sweetclover sown with a nurse crop may add as much as 100 to 200 pounds of nitrogen per acre. The amount added by the sweetclover is in proportion to the size and density of the sweetclover growth. Nearly all of this nitrogen is added during the months of September and October. Grazing or clipping the sweetclover prior to or at that time reduces the amount of nitrogen fixed in the soil.

Plowing the sweetclover at the beginning of its second year growth, after the crown shoots are four to six inches long, is a recommended practice where the addition of nitrogen to the soil is the primary objective. No great amount of nitrogen is added to the soil by the second year growth. Most of this growth is at the expense of the roots, involving a transfer of much of the nitrogen from the roots to the tops.

Although delayed plowing in the spring does not result in a great amount of additional nitrogen fixation, such delay does permit the formation of much additional organic material, which, if plowed under as green manure, may tend to improve soil structure.

On the heavier soils, the matter of soil structure improvement is especially important. Good soil structure promotes rapid water absorption and ease of tillage, and has an important influence on crop yields.

The best time for plowing the second year growth of sweetclover in the spring depends on the nature of the following corn and soil conditions. Permitting the sweetclover to remove most of the soil moisture may result in poor seedbed conditions which is likely to have more influence on yields of the following crops than the additional amount of organic material that might be added by the extended growth period. In no case should such plowing be delayed to the extent that planting of the following crop is delayed beyond the normal date. Where irrigation water is not readily available for spring watering, delayed plowing and seedbed preparation may result in dry soils and serious yield reduction of the following crop.

Where soil structure is a special problem, it may be advisable to permit the sweetclover to make its full 2-year growth, using it for pasture, silage, or seed production. This second year growth has an unusual granulating effect on the soil. Although this is not a permanent effect, it is very helpful on the heavier soils by way of improved tilth and increased rate of water absorption.

Where beets and potatoes are grown, the practice of permitting the sweetclover to make its full growth in the second year may be desirable since good soil structure and rapidity of water intake on heavy soils is especially advantageous for these crops.

Over a 12-year period at the Scottsbluff Experiment Station, a rotation of oats and sweetclover followed by sweetclover pasture and finally by two years of beets has been the most profitable rotation used at that station.

Many irrigators would like to plant beets and potatoes after first year sweetclover rather than after the second year crop. This would shorten the rotation without sacrificing any great amount of nitrogen. This practice is satisfactory where late planted potatoes are to follow the sweetclover, since, in this case, plowing can be delayed until the sweetclover crown buds are 4" to 6" long.

Earlier plowing does not kill the sweetclover and consequently it acts as a serious weed pest in the following crop. This growth often interferes with tillage operations. Recent experience indicates that this problem might be overcome by the use of the subtiller used in two successive operations, the first at a shallow depth to clip off the crowns, and the second at a depth of six inches. This method needs additional study to determine its effectiveness.

The frequency with which sweetclover must occur in the rotation depends upon the vigor of its growth, and upon the yield of the following crops. Data from the Nebraska corn yield contest have shown quite clearly that after a 100-bushel yield of corn is obtained following the clover, the second crop of corn can be expected to yield not more than 70 to 80 per cent of the first crop unless supplemental commercial nitrogen or manure is added to the soil. Without these amendments, the yield of the third and successive crops of corn is likely to be down to unprofitable levels, especially if the season has been such as to require a high usage of irrigation water.

One of the problems involved in sweetclover management is that of obtaining a good stand and a

heavy, vigorous growth, thus permitting maximum nitrogen fixation. Irrigation water is often not available for early spring use. If it is available, and the soil is dry, irrigation of the sweetclover and its companion crop of small grain is important. Where water is not available for spring use, it may be possible to fall irrigate the land intended for sweetclover. Watering the sweetclover immediately after the companion crop is harvested also tends to assure a vigorous growth. Inoculation of the seed is also important.

Use of Alfalfa

In this respect it is of interest to compare sweetclover with alfalfa. Again the corn yield contest has provided some interesting data. It has been determined that the amount of nitrogen added to the soil by alfalfa in one year is about the same as that added by sweetclover in its first year growth.

No data is available indicating the amount of nitrogen added by alfalfa in successive years. However, the corn yield contest data indicate that as many as four 100-bushel crops of corn may be obtained following old stands of alfalfa. This indicates that alfalfa may add as much nitrogen to soil the second, third, and successive years as in the first year. This has not been determined definitely, however.

Rotation Plans

In making rotation plans involving both alfalfa and sweetclover, the difference in the nature of these two crops must be recognized. Sweetclover, being a biennial crop, fits very well into a short time rotation, whereas alfalfa is more suitable for long time rotation. The following rotations are examples:

1. Sweetclover with oats, corn, corn with nitrogen fertilizer.

2. Sweetclover with oats, sweetclover pasture, 2 years of beets.
3. Sweetclover with oats, sweetclover pasture, potatoes, beets.
4. Alfalfa 3 years, potatoes, beets one or two years.
5. Alfalfa 4 or 5 years, corn 4 years. (In the absence of corn root worms).

Hubam Clover

In a few instances, growers of beets and early potatoes have experimented with Hubam sweetclover as a substitute for the biennial clover. Considering that a full stand and heavy growth of Hubam plowed under when in full bloom will add about one-half as much nitrogen to the soil as the biennial sweetclover in its first year, it is quite unlikely that this legume can be used economically.

If Hubam is mowed, grazed, or used for seed production, the amount of nitrogen added to the soil is greatly reduced. Most of the nitrogen in Hubam plants is in the tops.

Livestock-Crop Rotation

Since any successful, longtime irrigation program must include livestock as a means of economic disposal of legume crops and crop residues, and to provide barnyard manure for soil improvement, it is important that a third type of rotation be considered. Successful livestock production requires good pastures. Under irrigation no other pasture is superior to a brome-alfalfa mixture, seeded at the rate of about 12 pounds of brome and 3 or 4 pounds of alfalfa. Without the nitrogen supplied by the alfalfa, the bromegrass soon becomes stunted in growth, unpalatable, and low in nutritional value. With the alfalfa, the bromegrass is high in protein and very palatable.

Experience has shown that when brome-alfalfa pastures are grazed continuously throughout the growing season, the alfalfa is usually destroyed after a year or two of grazing. Soon thereafter the grass loses its vigor and high nutritional value. If such pastures are plowed at this stage and returned to other crops, the productive capacity of the soil is low due to nitrogen shortage.

A solution to this problem is found in a system of rotation grazing. Where the brome-alfalfa pasture is divided into three or more segments, and these grazed alternately, the alfalfa can be expected to remain indefinitely and the pastures to provide an abundance of highly nutritious grazing. This presupposes that a wilt-resistant strain of alfalfa is used as Ranger or Hardistan. Otherwise the alfalfa may be destroyed in the third and fourth years by this disease.

When such pastures are plowed and returned to grain production or to other crops, soil productivity can be expected to be very high, due partly to the nitrogen added to the soil by the alfalfa, and partly to the livestock droppings.

An additional benefit obtained by this type of rotation is the temporary improvement in soil structure due to the action of the grass roots.