Irrigation of Sugar Beets

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Introduction

Irrigation as an art has been practiced for more than four thousand years in the old world and perhaps for nearly two thousand years in some parts of North America. Remains of ancient irrigation systems in Arizona indicate that a surprisingly large population in twenty communities was supported by irrigation water from the Salt River. Many of the ancient canals still remain and estimates of their age place the construction period about 700 A. D.

Slightly more than 100 years ago Mormon settlers in the Salt Lake Valley turned the water of City Creek onto a field of potatoes. This was possibly the first irrigation by white man in the United States.

Land Preparation

A certain amount of land preparation is always necessary if gravity methods of irrigation are to be practiced. Within recent years the science of land preparation has been greatly improved. At the present time the advent of large machinery has made possible extensive leveling operations which would not have been feasible at one time.

Space does not permit an extensive discussion of land preparation practices. It should be said, however, that the tendency at present is toward producing flat grades or entirely level fields. The idea of running the water downhill in furrows with considerable slope is no longer thought to be good practice. Swiftly running water produced erosion and is extremely wasteful of both soil and water.

Land preparation for irrigation does not consist entirely of the so-called leveling process. It embraces also surface and underdrainage. The fields to be irrigated must be protected from flood water arising in the surrounding higher areas. Excess irrigation water must be removed and underdrainage provided to prevent the water table from destroying crops.

Method of Water Application

There are four ways of applying water to land, namely:

1. Spreading it in thin sheets over the surface.
2. Running it in furrows.
3. Sprinkling it upon the surface, like rain.
4. Sub-irrigation.

Spreading water over the surface of the land in thin sheets was practiced by many early pioneers. They usually cut the ditch banks and allowed the water to run by a method called "wild flooding." This was **a** wasteful and inefficient method because so much of the land was unevenly irrigated and water was wasted. Fields were usually poorly prepared, high spots got no water, and low spots got too much.

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Modern flooding methods are efficient and economical of water. In some cases a flat area is diked and flooded to a predetermined depth. This is known as the basin method. The border dike method is more commonly used. A dike is built on either side of a strip of close-growing crop, such as pasture, hay or grain. Water is introduced at the high side of the strip and allowed to flood it *in* a thin sheet which passes over the surface in a predetermined period of time. This border dike method is practiced in almost all irrigated areas and is highly recommended when the work is properly designed and constructed. It is important that the flow of water be carefully adjusted to the width of the border strip and the slope of the ground.

When water is applied in furrows, it is also important to control the flow, dependent upon the slope of the ground. It seems that the soil to be irrigated makes very little difference as far as erosion effects are concerned. A rule of thumb which has been determined by more than 2,000 irrigation trials indicates that the size of the furrow stream in gallons per minute can be determined by dividing the ground slope in percent into the figure "10." In other words, if the slope of the furrow is 2 percent, the safe furrow stream is 10 / 2, or 5 gallons per minute.

The control of the furrow stream is accomplished in many ways, the commonest of which is the syphon tube. Syphon tubes are made in sizes from 1/2, inch in diameter to as large as 10 inches, for the irrigation of close growing crops. It is now common practice to use several syphon tubes to supply a single furrow until the water has reached the end of the row. Then one or more tubes can be removed so that waste water from the end of the furrow is minimized.

A second method of flow control for furrows is by means of gated surface pipe. Gated pipe is usually made *at* light metals and comes in sizes from 3 inches in diameter to as large as 12 inches. A sliding gate is provided for each. row. This permits careful regulation of the flow to each furrow. The pipe is easily portable and some farms of 160 acres are now irrigated without the use of any surface ditch.

For good rrigation practice, the water should reach the lower end of the row in one-fourth of the time required to irrigate the field. In other words, if it has been estimated that four hours are required to irrigate a field, then the water should reach the end of the rows in one hour. After this the stream should be reduced to minimize waste.

The sprinkler method of irrigation has been gaining greatly in popularity *in* late years. This is probably due to the invention and use of light portable pipe. Steel pipe was too heavy to be readily portable and too much work was required to move it. The pipe in modern sprinkler systems can be quickly moved from one location to another with a minimum of help.

There are on the market today several radically different types of sprinklers. The perforated pipe type consists of a pipe line in which a great number of small holes have been drilled. When water is applied

under low pressure, a large number of streams emerges to saturate the land area. The application rates of this type of sprinkler are rather high, the lowest being about 1/2 inch per hour while most of the systems apply about 1 inch per hour. It has met with favorable use for gardens and orchards.

The revolving head-type sprinkler is the most common in use today. Sprinkler heads have been developed to distribute water efficiently when the proper pressure is applied. Heads are usually spaced 40 feet apart on the line and the lines are moved in 60-foot intervals. This allows plenty of overlap and results in good distribution over the field surface.

The high-pressure-type sprinklers operate under pressures as high as 100 pounds per square inch. Some heads deliver as much as 450 gallons per minute each and cover a wide area. The latter type of sprinkler is used for tall crops, such as sugar cane or corn, where it is difficult to move pipe lines laterally.

The initial cost of sprinkler systems ordinarily ranges from $90 to S100 per acre. Operating costs vary, of course, with the type of system, the source of power, the availability of labor, and many other factors.

One of the greatest drawbacks of the sprinkler has to do with uneven distribution in windy weather. In some areas, labor costs are high and have retarded development.

The sprinkler system is particularly adapted to areas which cannot be irrigated by gravity, such as land which is sandy and has a high infiltration rate. Some areas have such rough topography and thin soils that land preparation is practically impossible. Such areas can better be irrigated by sprinkler than by other means.

Subirrigation requires specific surface and subsoil conditions to be successful. The areas whese it can be successfully applied are few in the United States. Where the subsoil consists of porous material underlaid with an imperivous strata, it is possible to fill the subsoil with water and cause the water level to rise to the roots of the plants. Many thousands of acres are irrigated by this means in the San Luis Valley of Colorado and in some areas along the Platte River in Nebraska.

Irrigation Potential in the United States

It is probable that every acre of land suitable for irrigation, and for which there is a water supply, will eventually be irrigated in this country. Irrigation practice is spreading very rapidly south and southeast. . The state of Arkansas has nearly three-fourths of a million acres of irrigated land and Florida more than one-half million.

A survey of irrigation potential for the United States shows a possible 48,000,000 acres, as compared to the 25,785,000 now being irrigated, according to the 1950 census. The potential survey shows that, of the 48,000,000 acres, approximately 6,700,000 will be irrigated by sprinkler methods. It is my opinion that gravity irrigation methods can be applied in the humid regions much more than is being done at present. Gravity irrigation systems,

when properly designed and operated, are usually much cheaper in initial cost and operating cost than sprinkler systems. It is not a tact that sprinkler systems are always more economical in water or easier to operate than gravity systems. When this statement is made it usually indicates that the speaker is thinking of gravity systems long since outmoded and that he is not familiar with new gravity irrigation methods. I have looked at thousands ot acres of land in Arkansas, Louisiana and other southeastern states which can be gravity-irrigated without difficulty.

It would seem to the author that good sense should be applied to irrigation practice, as in all other successful ventures. A careful appraisal should be made of the land to be irrigated, the water supply, crops to be grown, and even the man who is to do the irrigating. Then a system should be designed which will do the job most efficiently whether it be by sprinkler or gravity. It is unfortunate that in too many cases the designers of irrigation systems are not at all familiar with some of the new developments in land preparation in gravity methods of water application.