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Advantages Claimed For New Irrigation System

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RECENT research indicates that light, frequent irrigations may improve yield and quality of some crops.

With new methods of water application, such as drip or trickle irrigation, excellent soil moisture control is possible and economically feasible on high-value crops, trials have shown. Soil moisture can be maintained at a high level with little loss of water and fertilizer by deep percolation, by applying water to the soil at essentially the same rate that it is used by the crop.

Evaporation from the soil surface is reduced and good aeration of the root zone also is maintained with this method of irrigation.

Engineers and scientists at the Snake River Conservation Research Center, Kimberly, Ida., are studying methods of adapting these concepts. Drip or trickle irrigation systems are expensive for use on row crops and require an elaborate and complicated filtering system to prevent clogging of the very small openings of the "drippers" or "tricklers." Filtering would be an even greater problem when irrigation water is taken from a canal.

One result of their study is an automated buried "multi-set" irrigation system now being developed and tested at the Research Center to reduce system costs and filtering problems.

With this system, the field irrigation run is divided into several subruns by buried pipe laterals placed at intervals down the field (note the figure). Water added at intervals along the furrow results in the same effect as if the field were divided into several shorter furrow segments. Since the water needs to advance only a short distance from each outlet, the entire length of each run, and hence the field, is wet more uniformly and in less time.

The experimental site where the system was tested last summer was divided into four subruns, each 165 feet long. Pipe laterals were buried below plow depth so that regular farming

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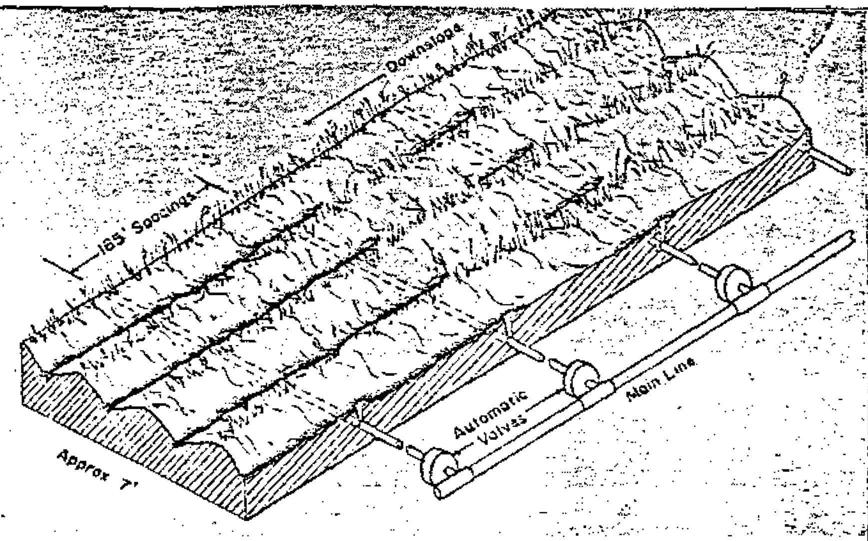

Diagramatic sketch to illustrate the experimental underground irrigation system when sequencing upslope. The length dimension has been distorted in this illustration. The lower two sets have just been irrigated as illustrated by the dark soil in the furrows. The automatic valve has just started water bubbling up from the buried lateral into the furrows of the next set.

operations could be carried on. Water was supplied to the individual furrows through open, uniformly spaced nozzles on the buried lateral.

When water was turned into the lateral, it jetted from the nozzles and washed a pathway up through the soil into the furrow. Nozzles in the test system were short ⅜-diameter tubes attached to the buried plastic pipe lateral. The nozzles were large enough so that when canal water was used, only a minimum amount of screening was necessary to prevent plugging.

Automatic valves developed at the Research Center were used to control the flow of water to each lateral. These valves turned the water on and off at the right time and in the selected order as the irrigation progressed across the field from one subrun to the next.

Such valves can be controlled by timeclocks, soil moisture sensors, programmed controllers, or a combination of these units. The valves are designed so that they can be opened and closed by a small stream of water taken from the irrigation pipeline just ahead of the valves. Each valve is closed as water flows through a small tube from the upstream side of the valve to fill a bladder inside the valve body. When the bladder is filled, the valve is closed; when the bladder is emptied, the valve is opened.

A small DC electric motor operated from two flashlight batteries controlled the opening and closing of the valve.

In the automated multi-set system tested, a tensiometer was used to determine when irrigation was needed.

When the soil water decreased to a predetermined level, the first automatic valve was activated to start irrigation in the first subrun. Water was distributed to each furrow in the set through the nozzles on the buried pipe. Irrigation water then flowed to the end of the subrun, where the next lateral was located, with some overlap onto the next set. The valve on the first lateral then closed, and the valve on the next lateral opened. Thus irrigation proceeded stepwise from one lateral to the next.

Laterals can be controlled in either a downslope or upslope direction. A commercial, programmed time, sequencing controller was used to control the valves in the experimental field test.

A crop of beans was irrigated about twice a week during the peak water use period in the test field. Water was in the furrows for about 1½ to 2 hours each time which was sufficient to infiltrate the moisture used between irrigations. With light, frequent irrigations, the furrows remained moist so that water advanced rapidly throughout the subrun length to give a relatively uniform application. Since the silt loam soil was kept moist, the added water was quickly distributed throughout the root zone and a very uniform, high soil water level was maintained throughout the season.

Some of the benefits of this new system would appear to be:

—Reduced soil erosion because smaller stream sizes are used in each furrow.

—Reduced runoff because of the short period of water application and infiltration into the subruns at the lower end of the field.

—Reduced deep percolation losses due to short runs and more accurate water distribution.

—Reduced labor requirements. Once the system is installed, very little labor is required except for maintenance and periodic observations.

—Less water is required, because with reduced runoff and deep percolation there is less waste.

—Reduced energy requirements. Many systems could be operated as gravity systems where land slope is adequate, or where a low pressure pipeline supplies the water. Other systems might require a pump to supply water at 3 to 5 pounds per square inch pressure, but this would require much less energy than the 50 to 100 psi required for a sprinkler system.

This system was designed to apply water very accurately and yet overcome most of the filtering and plugging problems that are encountered with drip or trickle irrigation systems. It is competitive in convenience and in first cost with solid-set sprinkler irrigation systems and operating costs are lower. This design will be tested on larger areas during the coming irrigating season.