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Dollar Saving Systems

By Lou Ellen Ruesink, Editor, Texas Water Resources

Irrigated agriculture is the major consumer of water in Texas.

Indeed, the total irrigation water used in the state is well over 10 million acre-feet per year. This use compares with the 5.1 million acre-feet total surface water used annually in Texas.

This staggering total for irrigation use fosters increasing concern about the influence of irrigated agriculture on both the quantity and quality of the state's water resources. These concerns include:

- Seventy-nine percent of the water used for irrigation is from ground water reservoirs, many of which are diminishing at alarming rates.
- Texas cities and industries are demanding more and more of the limited water in the state.
- Water sources can be contaminated by fertilizers and pesticides carried by irrigation or rainfall runoff from agricultural lands or moved into underground reservoirs through the percolation of the water through the soil.

To alleviate these problems, the Texas Water Resources Institute for the past 10 years has researched the efficient use of water in food and fiber production. J. R. Runkles, Director of the Institute, explains that "since irrigation is a large part of the state's total water use, research to improve irrigation water efficiency and reduce return flow will benefit the entire state."

Scientists associated with the Institute determine water use efficiency by the ratio of total crop harvested to the total water used. They have compared water use efficiencies of different irrigation methods as related to energy consumption, economic feasibility, and soil and crop types.

Research projects have compared the most common types of irrigating row crops now used in Texas--furrow and sprinkler systems--and have studied new methods as well.

Furrow or flood irrigation systems involve running large amounts of water between rows and allowing as much as possible to be absorbed by the soil. This method requires a great deal of labor, moistens the entire field, and varies due to soil, slope, and location in field. It requires the least amount of capital, but is the most inefficient use of water and energy.

Sprinkler systems provide greater control over application rates, but uniform distribution is still a problem. Evaporation, especially during high winds, causes substantial losses of water. Modern sprinkler systems save on water and labor when compared to furrow irrigation, but they require more energy and more capital outlay. As a matter of fact, the sprinkler method costs almost as much energy to distribute the water as it does to pump the water from underground.

Agricultural engineers working on Institute projects have found that applying small amounts of water frequently is much more water efficient than soaking a field and waiting two or three weeks before soaking again.

Light, frequent irrigations are better for crop production and also leave soil moisture storage available for rain.

Drip or trickle systems are now recognized as excellent irrigation methods for high frequency, low volume applications of irrigation water. Trickle irrigation applies small amounts of water to the soil near the roots of the plant. Because there is practically no runoff and little evaporation, crops require as much as 50 percent less water.

Trickle irrigation as it is presently designed, however, requires a large capital investment and is labor intensive. It has been used successfully on high economic value orchard crops, but it is not economically feasible for row crops.

Current institute research emphasis is on designing and testing systems to adapt the trickle concept to row crops.

LEPA
Low Energy Precision Application System

With evangelical fervor irrigation researcher Bill Lyle encourages High Plains farmers to conserve three of their most precious natural resources: ground water, energy, and rain.

Listen to him they should . . . because their wells are "playing out" and their gas bills are soaring... and because there has to be a more efficient way to use the limited irrigation water than to spray it up into the wind or flood every inch of the field with little or no application control.

Perhaps Lyle's most important message is "Make use of all rainfall. Prepare fields so that rainfall can be retained and don't saturate fields to the point that they can't absorb rainfall."

Lyle, an agricultural engineer with the Texas Agricultural Experiment Station, has received funding from the Texas Water Resources Institute to design and develop an irrigation system which utilizes available rainfall and incorporates the basic concepts of drip irrigation. He is designing a completely mobile trickle irrigation which is adapted to large scale row crop production.

Lyle understands irrigated agriculture from growing up on an irrigated farm, actively farming irrigated lands in recent years, and studying irrigation technology at Texas Tech University and Texas A&M University. He also understands irrigators from serving as an irrigation specialist in the Texas Agricultural Extension Service. His responsibilities then included the irrigation educational and demonstration program for 82 counties encompassing over 10 million acres of irrigated land. He received his Ph.D. degree in agricultural engineering at Texas A&M and is now an associate professor with the Texas Agricultural Experiment Station at Halfway.

The irrigation system Lyle has designed and is presently field testing looks much like other irrigation systems on the High Plains--a motor at the edge of the field moves a long metal frame which stretches halfway across the field. When the system is in operation, however, there are no long, high plumes of water spreading out from the frame. Not even a fine mist can be seen.

A closer look finds plastic pipe attached at regular intervals to the frame. Each piece of pipe, called a drop tube, ends with a special nozzle three to four inches above the ground. The nozzles are designed to apply the irrigation water at low pressure between the rows and below the crop canopy.

A motorized unit at the edge of the field moves the entire frame the full length of the field. It is equipped to unroll its supply pipe as it advances and is designed to follow a small trench for directional guidance.

Minimum alterations will be required to adapt Lyle's mobile trickle system to present farming methods and existing systems. It will use existing underground pipe installed on the majority of farms in the High Plains and in many other areas of the state.

The mobile trickle system is dependent upon another machine developed by Lyle--a basin tillage implement. According to him, basin tillage is an old concept, but one which has not been used much in modern times. Basin tillage uses mounds of soil placed across the furrow to form small basins. When rain falls or irrigation water is applied, the water is held in the basin long enough to soak in the land rather than run off carrying soil and chemicals with it.

Basin tillage has not been popular in the past because the small dams cause extremely rough rides for equipment operators. A front-end plow-out attachment has now been designed to remove dams in front of tractor tires.

Dikes or mounds are formed by a tripping-shovel basin-tillage unit designed by Lyle in 1977. It can be attached to any equipment currently used in crop production such as bedders, planters and cultivators, to avoid a separate operation. Lyle stresses that the unit can be built with readily available materials and with equipment found in most farm shops.

During the 1979 growing season Lyle will be making field evaluations to determine irrigation application and distribution efficiencies as well as energy requirements, rainfall utilization, and economic evaluation of the concept. The mobile trickle system is expected to increase water use efficiency 50-150 percent over furrow irrigation systems and 15-30 percent over existing sprinkler systems.

As soon as the Low Energy Precision Application (LEPA) System is perfected and the concept proven, Lyle hopes it will be adopted by some area farmers. Numerous irrigation manufacturers have shown interest in the concept.

If a system such as Lyle's could eliminate just one four-inch irrigation on the Texas High Plains, it would mean a savings to area farmers of 24 million dollars in fuel costs alone--not to mention the underground water and energy conserved.

Information Special

Back copies of most Texas Water Resources are available to those readers who are recent additions to the Institute mailing list--or to those readers who file everything, but can't find anything.

The following list of topics covered in the four years of publication indicates the diversity of water resources problems and issues facing Texans today. Copies will be sent free of charge to those who send their names, addresses, and desired topics to Texas Water Resources Institute, College Station, TX 77843.

1974
November, Ground Water Management (out of print)
December, Subsidence

1975
February, Subsidence
March, Ground Water Depletion
April, Artificial Recharge
May, Trickle Irrigation
June, San Antonio River Walk
August, Clearing Lakes before Inundation

September, Fresh Water into Estuaries
October, Water Reused for Irrigation
November, Water Reused for Aquaculture
December, Monitoring Aquatic Plant Growth

1976
February, River Authorities
March, Flood Plain Management
April, Water-based Recreation
May, Water for Food and Fiber
June, Mitigation
August, Gas Price Effects on Irrigation
September, Houston Ship Channel
October, Dallas Municipal Water
November, San Antonio Water Museum
December, Texas Water Resources Institute

1977
February, Rural Water Systems
March, Treatment of Wood Preserving Wastewater
April, Edwards Underground Reservoir
May, Water Rights
June, Range Runoff
August, Brazos River Basin
September, Weather Modification
October, Water for Energy
November, Residential Water Conservation
December, Industrial Water Conservation

1978
February, Lake Eutrophication
March, Interbasin Transfer
April, Dam Safety
May, Thermal Storage in Aquifers
June, Reservoir Land Use Regulations
August, Water Quality
September, Water Treatment
October, Underground Water Conservation Districts
November, Rural Water Systems Conference
December, Irrigation Efficiency