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Stretching into the '80s

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The challenge is loud and clear. Texas agriculture has no choice but to reduce its thirst for water. Producers in the future must "grow more crops with fewer drops."

Herb Grubb, Director of Planning and Development, Texas Department of Water Resources, issued the challenge to agricultural researchers attending the 1981 Texas Agricultural Experiment Station Conference. He explained that the water supply problems for Texas agriculture are urgent and critical. He urged the scientists to take a long hard look at water resources in the state and the competition for water in the years ahead.

There has never before been the urgency, according to Grubb, to develop more efficient irrigation systems and less thirsty plants. Grubb cited four reasons why Texas agricultural producers must improve the water efficiency of their methods and their crops:

- 1. Limited water resources
- 2. Increasing demand for water
- 3. World-wide market for Texas products
- 4. Water inefficiency of present production methods.

"Even with maximum surface water development and the most efficient management and use of all sources of water supply," according to Grubb, "the State's future economic opportunities may be limited from lack of sufficient quantities of water. The state must learn to live within its available water resources, however, for many years to come because there are many obstacles--institutional, political, and economic--to bringing water from outside the state.

Three-fourths of all the water used in Texas is used for irrigation. Cities use 11 percent; industries, 9 percent; and energy production, 2 percent of all the water now used in the state each year.

Even though present demand for irrigation water exceeds 13 million acre-feet, Grubb warns that by the year 2000 there will be less than 8 million acre-feet available for agriculture. Some of the reasons for this reduction are groundwater depletion and population and industrial growth, leading to increased competition for available water.

Texans are pumping 7.1 million acre-feet of groundwater MORE than nature replaces each year. The most critical groundwater depletion areas are (1) the High Plains, dependent upon the declining Ogallala Aquifer, (2) the Winter Garden area dependent upon the limited Carrizo Aquifer, and (3) the Gulf Coast region where urban populations and industries compete for the available water--and where the land surface sinks because of over--pumping of groundwater.

The population growth predicted for the state is sure to increase water consumption. Experts predict, in fact, that the demand for urban water will increase from the present 2.3 million acre-feet to over 4 million acre-feet by the year 2000. Industries attracted to this energy-rich sunbelt state are expected to continually require more water each year into the next century. Oil and gas activities are not only increasing, but using more water-demanding oil recovery methods than ever before.

Texas bays and estuaries need about 13 million acre-feet of fresh water annually to meet salinity bounds and marsh inundation needs. These needs will be considered in all future considerations of water rights.

Many water rights now held for agriculture may be shifted before the turn of the century to other users. Water developed in the future either as new reservoirs or new, deeper wells will be expensive and may be out of the economic reach of farmers.

Agriculture is the only major water user not expected to be able to increase its use. As a matter of fact, there is a very real possibility that agricultural producers will be forced by competition for water or by cost of water to reduce use of irrigation water. Not only is this reduction possible, but probable, according to Grubb.

He feels that state research agencies and universities should re-examine their research priorities and keep those dealing with increased water productivity and increased water conservation high on the list of projects to be funded.

Present food and fiber production in Texas is heavily dependent upon irrigation. Over 60 percent of all crops in Texas are produced on irrigated land.

Only one-third of all cropland in Texas, however, is irrigated.

One hundred percent of all Texas citrus and 87 percent of all vegetables produced in Texas come from irrigated lands. Fifty percent of all grain sorghum, 46 percent of the cotton, and 45 percent of the soybeans produced in the state are grown in irrigated fields.

Present agricultural production methods, in general, were developed when water was cheap and abundant. Most farmers today irrigate without measuring the amount of water applied to their fields because metering has traditionally cost more than farmers felt it was worth. Most farmers also still irrigate by the calendar or the clock rather than when the soil moisture or plants indicate a need for water.

Just as the energy crisis made motorists aware of their miles per gallon (MPG), the water crisis is forcing Texas irrigators to evaluate the amount of water their crops require. They will be much more aware in the future of "bushels (or bales) per gallon" (BPG).

Water saved by farmers can certainly mean dollars in their pockets. If just half an inch of water a year could be saved on the High Plains alone, it would save farmers there \$12.5 million dollars annually.

Decreasing water demand should not mean taking land out of production or settling for lower yields. Productivity should be held stable or increased, according to Grubb, because of growing world food and fiber needs and because of the economic impact of agricultural production in Texas.

His challenge to agricultural researchers emphasizes problems to be solved if Texas is to continue as a leader in food and fiber production. "It is imperative," Grubb feels, "that research to develop more efficient agricultural production technology be increased and pursued aggressively in the immediate future."

Grubb's challenge does not stop with research results, however. Once improved methods are developed, they must be marketed; and once drought tolerant plants are bred, they must be sold by seed companies. Individual farmers should be convinced of the need to conserve irrigation water. Government agencies and farm organizations, therefore, must also accept the challenge to encourage and assist farmers to increase water efficiency in Texas agriculture.

Agricultural forecasters predict that it is likely that the cost of food will become a major consumer issue early in the 1980's. . . and that the availability of food will become a dominant issue by the end of the decade. The worldwide demand for food and fiber dictates that producers in this important agricultural state make the most of every available drop of water for agriculture.

Meeting the Challenge

The challenge to use less water in agricultural production is not a new one for this water-short state.

Water conservation in agriculture, in fact, is a key research priority for the Texas Agricultural Experiment Station (TAES), a research agency in the Texas A&M University System.

Completed TAES research provides current producers with the know-how to improve the water efficiency in their farming operations. Many water saving management techniques and plants developed by TAES research, in fact, are already common procedures for Texas producers. Other water efficient methods identified by TAES researchers have not yet been developed to the point that they are ready for adoption by farmers.

The pressure is on, however, to provide more help to Texas agricultural producers caught in a water-short, high-energy-cost bind. "Research efforts must be expanded," according to Neville Clarke, director of the Texas Agricultural Experiment Station, "because the scarcity and expense of irrigation water could reduce the level of agricultural production in major agricultural areas of the state."

Irrigation Efficiency

Station researchers, headquartered in research centers throughout the state, study water use for many types of crops and in various types of climates. Research projects range from furrow irrigation in citrus orchards near Weslaco to sprinkler and drip irrigation in cotton fields near Lubbock; from flood and sprinkler irrigation in rice fields near Beaumont to irrigation using salt water on crops in the Pecos area.

A leader in new technology for water efficient irrigation is the low energy precision application (LEPA) system developed by the Station staff at Halfway, Texas. The LEPA system modifies a sprinkler system to apply water near ground level. It distributes water with little or no evaporation and little or no runoff and applies an exact amount of water precisely where and when a crop needs it. TAES researchers working with the LEPA system predict that when combined with micro-basins--basins formed by small dams across furrows to hold rain or irrigation water--the system will apply irrigation water with a 99 percent application efficiency.

The LEPA system is attractive, too, because its energy demands and labor requirements are low.

Capital investment for the system, however, is quite high. Station researchers are now in the process of adapting the LEPA system so that it can be used for other functions such as applying chemicals and planting crops. They feel that the energy saved by using the lightweight, low-energy system instead of traditional heavy equipment will more than justify the investment costs of LEPA.

Another TAES project underway brings the oldest and most common form of irrigation--furrow--into the computer age. Researchers are using micro-computers to adjust flow rates for each furrow so that the exact amount of water can be applied at the exact rate the soil can use it. TAES agricultural engineers working on the project predict a 75 percent

efficiency rate, compared to the present 45 percent average efficiency rate for furrow irrigation.

Since more than three-fourths of Texas' nine million irrigated acres are furrow irrigated, a change to computerized furrow application will mean large water savings in the state.

The research with the possibility for saving the greatest amount of water per acre, however, is that of replacing flood irrigation methods of rice production with sprinkler irrigation. TAES researchers estimate that over one million acre-feet per year could be saved by converting rice irrigation to sprinkler or LEPA systems.

Trickle irrigation, while used on a very small number of acres in the state, is important in water conservation because it is used on water intensive orchard crops. The current TAES research program includes trickle irrigation studies in citrus, pecan, and peach orchards.

Drought Tolerance

The challenge to use water more efficiently applies to dryland farming as well as to irrigated land. As water levels decline and energy costs soar--and as dryland production becomes more water efficient--many producers may find that they can "make ends meet" more easily with dryland farming rather than with irrigation.

Station scientists have developed several successful management techniques to help dryland producers. Drought resistant plants, for instance, are certainly important to those dependent solely on Texas rainfall. Micro-basin tillage--small dams formed across furrows to hold rain or irrigation water--and other methods of holding rainfall on fields can mean the difference between plowing under a scorched crop or marketing a harvest.

"Improving crop plants for drought tolerance through breeding," according to TAES Director Clarke, "is a necessary part of the total research program to improve water use efficiency."

Ongoing research by TAES researchers has shown that there are significant differences in drought tolerance in plants, but only a few strains can be investigated at a time using present research methods. There is a real need, however, to screen a large number of strains in a short time. For instance, at least 800 strains of cotton and 11,000 strains of grain sorghum need to be tested for potential drought tolerance. TAES scientists are working on ways to shorten the time necessary to identify and breed crops for resistance to water, heat, and salt.

The challenge for the Texas Agricultural Experiment Station is not only to find the most water efficient methods and plants, but also to make these alternatives attractive enough for producers to adopt them. Farmers--whether irrigation or dryland--who adopt water saving techniques such as micro-basins and who choose crops with drought tolerant tendencies will find themselves and their crops far ahead in the water-short years to come.