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Water's Worth

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A farmer didn't need much help from economists a few years ago when water and energy were thought to be unlimited resources. Now he needs answers to some tough economic questions. He needs to know

- What he can afford to pay for water to irrigate his crop, assuming he can find a source of water.
- How energy prices affect his irrigation operation.
- How he can use diminishing supplies of water and energy more efficiently.

Economic research at the Texas Water Resources Institute has helped with irrigation decisions by looking at the dollars and cents reasons for irrigating--or not irrigating.

The farmer, in most areas of the state, could grow certain crops without paying anything for water. After all, rainfall a farmer can hold on his land is as free as the air and the sunshine. Unfortunately rainfall is not as dependable as these other gifts from nature--at least not in Texas. Low and variable annual rainfall has resulted in 60 percent of all crops in the state receiving irrigation water to supplement rainfall. These crops consume 76 percent of all the water used for all purposes--municipal, industrial, power generation--in Texas each year.

If rainfall runs off of the farmer's land into a stream or lake, it becomes the property of the state and can only be used with the state's permission. State laws and regulations determine who has the right to use the surface water and also which users have priority. Irrigation comes after municipal and industrial uses in priority. This means that as demands increase or droughts occur, surface water will be used for these higher priority uses instead of for irrigation.

Unless the farmer's land is adjacent to a river, he must pay the costs of water delivery. Since most surface water used for irrigation is first stored in large reservoirs, the cost of the water reflects the expense of development and storage as well as the cost of delivering the water.

A "free" source of water is stored underneath a large percentage of Texas farmland. Eighty-two percent of all irrigation in Texas, in fact, is now using water from underground sources. Water beneath a farmer's land is free because it is legally his property, but he must pay for the well, pump, and energy required to bring the water to the surface.

Water Value

No matter what the source of the water, the farmer must answer a basic economic question: can he afford it? Whether he is buying water from a supplier or pumping water from underground, the farmer must evaluate whether the value of his product will justify the cost of the water.

Agricultural economists associated with the Institute have developed several methods for determining what a farmer is able to pay for water. In one Institute-sponsored project, they estimated the value of water--or the farmer's ability to pay for water--for 20 different crops in 16 producing regions of the state. They based their estimates of what a farmer could afford to pay for water on (1) what he had to spend for other production costs, (2) what he could expect to receive for his crop, and (3) how much he could increase his crop yield.

As expected, the researchers found that the price a farmer is able to pay for water is greatly influenced by the price he can expect to receive for his product. The value of an acre-foot of water for cotton on the High Plains, for example, is estimated at $47 for cotton selling for $.40 per pound, but the same amount of water would be worth $121 if the farmer could sell his cotton for $.60 per pound.

Bruce Beattie, an agricultural economist at Texas A&M University, recently completed a project for the Institute looking at the value of irrigation water in 17 Western states including Texas. He found that under current pricing systems, an irrigator cannot possibly compete with other users when it comes to the value of water. Cities and industries are able to pay for water many times over what a farmer can pay. The farmer's real concern, therefore, is whether he will even be able to afford the water no other user wants to buy.

Energy Impact

The farmer on the Texas High Plains is caught in an even more difficult economic dilemma. He has suffered a dramatic increase in irrigation costs in the past decade due to a combination of declining water supply and rapidly rising energy costs. As the water table declines underneath his land, it takes more energy--which has tripled in cost during the 1970's--to bring the water to the surface.

All farmers are hard-hit by rising energy costs, but irrigators suffer the most, according to Ron Lacewell, a resource economist in the Texas A&M University Department of Agricultural Economics. He has directed 11 Institute projects evaluating impacts of increasing costs and possible curtailments of energy on agriculture.

Lacewell found that irrigation not only increases yields and removes much of the annual variation of crop production, but also increases the cost of production per unit. This last point is extremely important, he concluded, because it means irrigated agriculture is more vulnerable to energy price increases than nonirrigated agriculture. Irrigated crop production is also two to three times more energy intensive than dryland production because it requires energy for moving water as well as more fertilizers and pesticides. Lacewell estimates that irrigated cropland on the Texas High Plains requires the equivalent of well over 100 gallons of gasoline per acre and in some cases as high as 250 gallons of gasoline per acre per year.

Pumping costs alone, according to research directed by Lacewell, have risen to the point where continued irrigation activity at present levels is vulnerable on the Texas High Plains. Texas irrigators have experienced a 400 percent increase in natural gas prices in less than ten years. Lacewell reports that as pumping depths and energy prices continue to increase, the decline of Texas High Plains irrigation activity in its present form seems inevitable. He predicts serious negative impacts on regional land values, tax base, population, and employment in that part of Texas if farmers are forced to shift to dryland production.

Now, the Good News

Not all of the economic findings, however, are as grim as those just cited. Agricultural economists are optimistic for the future of the Texas irrigator. Two of the latest projects at the Institute offer real hope--and concrete help--for Texas farmers.

Ongoing research indicates that there are several ways a farmer may reduce energy usage and thereby cut irrigation costs. Energy saving methods presently available to High Plains irrigators, according to researchers, include more efficient pumps and more efficient application methods.

- Current average irrigation pump efficiency can be vastly improved, according to research results. The average farmer on the Texas High Plains can reduce his energy costs by as much as 41 percent by replacing or repairing pump equipment.
- New irrigation methods can mean savings in water and energy. One such method is an irrigation system designed by agricultural engineer Bill Lyle in an Institute project. Lyle's system, called Low Energy Precision Application (LEPA), is a mobile system for row crops which applies water more efficiently and requires less water pressure than existing systems.

It is estimated that a system such as Lyle's could increase irrigation efficiency 50 to 150 percent compared to furrow irrigation systems and 15 to 30 percent over existing

sprinkler systems. By reducing water application rates and sprinkler pressure, natural gas use per acre can be reduced by 60 percent. On the 1.74 million sprinkler acres of the High Plains, adoption of the Lyle system has a potential benefit of over one billion dollars over the next 25 years.

Economic studies at the Institute are also looking at the impact of using other water and energy saving methods for agriculture and using plants which demand less water than present varieties.

Even though many of the farmer's toughest irrigation questions remain unanswered, Institute research has given him a great deal of economically-sound information on which to base his decisions.

Economic Insights

Because many water supply and use questions must be answered in economic terms, the Texas Water Resources Institute has supported research for the past 15 years to solve agricultural water problems with economic expertise. Research has involved 22 researchers in the nationally-recognized Department of Agricultural Economics at Texas A&M University and has contributed significantly to state and federal policy formulation. Federal and state agencies and legislative committees studying agricultural production and energy impacts on agriculture have requested testimony from researchers involved in this program.

The Institute research program has focused primarily on economic issues involving supply, cost, and application methods of irrigation water. A few of the research highlights are summarized in this bulletin, and more information is available from the Institute.

One of the first studies ever funded by the Institute estimated the statewide impact of irrigated agriculture and the future demands for irrigation water. The report, which was requested by Governor John Connally in 1964 and used by the Texas Water Development Board in preparing the Texas Water Plan of 1968, emphasized the need for economic consideration in water resources planning. Texas A&M University scientists from several disciplines including agricultural economists worked on the study and concluded: "Each of the major natural resources--oil, soils, water, and climate--has had its effect on the growth and development of Texas; but of these, water will exert the dominant influence on our future growth. The final limit on Texas' economic expansion could be determined by how we use our water resources."

A common thread through all successive economic studies has been that wise development and efficient use of the state's water resources must be backed by economic research.