FARM Assistance Focus

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Impact of Volumetric Water Pricing for Sugarcane Comparing Furrow vs. Surge Irrigation in the Lower Rio Grande Valley

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Population growth, along with the demands of irrigated production agriculture, spur an interest in the potential for water shortages in the Lower Rio Grande Valley.

The Lower Rio Grande Valley has seen substantial population growth in recent years, leading to a dramatic increase in the region's demand for water. This additional consumption, coupled with the demands of irrigated production agriculture, has spurred an interest in evaluating the potential of water conserving practices in irrigated agriculture. Water use demonstrations on irrigated crops, such as surge irrigation in sugarcane, have been established to address this issue. Currently, agricultural irrigation water is sold on a "per event" basis rather than by volume as is the case for most residential and commercial users. A volumetric pricing structure could be in the future for irrigated agriculture in the Lower Valley region. Assessing the economic viability of the site demonstrations under various water rates allows for an accurate evaluation of the viability of surge irrigation.

The Agricultural Water Demonstration Initiative (ADI) project is a multi-faceted effort among the Texas Water Development Board, the Harlingen Irrigation District, South Texas agricultural producers, Texas Cooperative Extension and other agencies. It is designed to demonstrate a state-of-the-art water distribution network management program as well as cost-effective agricultural irrigation technologies that seek to maximize surface water use efficiency. The project includes maximizing the efficiency of irrigation water diverted from the Rio Grande River to water consumption by various field, vegetable and citrus crops.

The Texas Cooperative Extension (TCE) conducts economic analyses of demonstration results, evaluating the potential impact of adopting alternative water conserving technologies. TCE works individually with agricultural producers using the Financial And Risk Management (FARM) Assistance financial planning model to analyze the impact and cost-effectiveness of the alternative irrigation technologies.

A 2005 surge valve technology demonstration suggests potential water savings in sugarcane production (Table 1). Irrigation water in the Lower Rio Grande Valley is currently sold on a per-watering basis, regardless of amount used. For example, in a growing season a sugarcane crop may be watered eight different occasions at a price of $7 per watering. In this example, a producer would pay approximately $56 in total water costs. Under current water pricing structures, an initial financial analysis of the surge irrigation technology indicates no financial advantages when compared to traditional furrow irrigation. In fact, the surge valve scenario costs the producer approximately $1,800, on a net basis, thereby causing the producer to be worse off when compared to furrow irrigation. Surge technology and volumetric water pricing is a distinct possibility in the near future or in any time of water shortages. The following analysis evaluates the potential financial incentives for surge technology and water savings under hypothetical volumetric water pricing.

Assumptions

Table 1 provides the basic water use and irrigation cost assumptions for sugarcane comparing furrow and surge irrigation methods. For the purpose of presenting comparative costs, two water price levels ($1 and $5) were assumed for the 38-acre site. Non-irrigation production costs were derived from custom rates and estimates of per acre overhead charges typical for the region and were not changed for analysis purposes. The actual demonstration was conducted on an established field of sugarcane but the illustration projection was developed as though the establishment year was 2006 in order to present the full cycle of the typical multi-year crop. The assumptions are intended to make the illustration relevant to a wide range of producers in the Lower Rio Grande Valley area.

The analysis consists of four scenarios—furrow and surge irrigation at $1 and $5 per acre inch costs for irrigation water. Scenarios 1 and 2 represents irrigation at a price of $1/acre inch projected for a 10-year period for basic flood (furrow) and surge irrigation, respectively. The 3rd and 4th scenarios represent the pricing of water at $5/acre inch for furrow and surge irrigation, respectively. The 2nd and 4th surge scenarios assume a cost of the surge valve of $1,800. The surge valve expense is evenly distributed over

Table 1: Irrigation Application and Cost Information for Sugarcane, Volumetric Pricing

Scenario	Irrigation Method	Acre Inches Applied	Cost per Acre Inch	Water Cost Per Acre	Polypipe Per Acre	Irrigation Labor Per Acre	Irrigation Cost Per Acre	Surge Valve
1	Furrow	30.68	$1.00	$30.68	$10.00	$16.00	$56.68	
2	Surge	14.64	$1.00	$14.64	$10.00	$16.00	$40.64	$1,800.00
3	Furrow	30.68	$5.00	$153.40	$10.00	$16.00	$179.40	
4	Surge	14.64	$5.00	$73.20	$10.00	$16.00	$99.20	$1,800.00

A 2005 surge valve technology demonstration suggests potential water savings in sugarcane production.

Table 2: 10-year Average Financial Indicators for Sugarcane, Volumetric Pricing						
Scenario	Irrigation Method	Total Cash Receipts ($1,000)	Total Cash Costs ($1,000)	Net Cash Farm Income ($1,000)	Prob Net Cash Income <0 (%)	Avg Annual Operating Expense/Receipts
1	Furrow	22.74	17.75	4.99	23.60	0.67
2	Surge	22.74	17.38	5.36	22.40	0.65
3	Furrow	22.74	22.04	0.70	46.30	0.84
4	Surge	22.74	19.42	3.33	30.90	0.73

the 10-year period with the assumption of no financing costs. For the analysis, no other differences were assumed for the surge valve scenario. It is assumed the grinding rights ($750/acre) are purchased with 100% financing for 4 years. For each 10-year outlook projection, commodity price trends follow projections provided by the Food and Agricultural Policy Research Institute (FAPRI, at the University of Missouri) with costs adjusted for inflation over the planning horizon. Demonstration findings suggest no variance in yields between furrow and surge irrigation methods.

Results

A comprehensive projection including commodity price and yield risk for furrow and surge irrigation methods at the $1 and $5 per acre inch water prices are illustrated in Table 2 and Figures 1 and 2. Table 2 presents the average outcomes for selected financial metrics, while the graphical presentation of Figure 1 illustrates the full range of possibilities for net cash farm income at the cost of $5 per acre inch. Cash receipts average $22,740 over the 10-year period for all four scenarios as the case study yields were the same under both irrigation methods. Average cash costs range from $17,380 for Scenario 2 to $22,040 for Scenario 3. In the 2005 demonstration, surge irrigation saved approximately 16 inches of water, resulting in a $16/acre variable cost savings at a price of $1/acre inch or an $80/acre saving assuming a $5/acre inch price of water.

Average annual Net Cash Farm Income (NCFI) is the highest for surge irrigation under both water price assumptions. At $1/acre inch, surge irrigation generates an average $5,360 in NCFI, a 7% improvement over furrow irrigation (Table 2). At the $5 per acre inch water price, the average NCFI for surge was $3,330, substantially higher than the $700 for furrow irrigation. As is represented by Figure 1, NCFI rises and falls commensurate to the 5-year production cycle of sugar cane. All four scenarios reflect comparable levels of risk. Risk projections indicate similar probabilities for negative NCFI at $1/acre inch (23.6% chance for furrow and a 22.4% chance for surge). At the higher water price, the chance of negative NCFI averages 46.3% for furrow and 30.9% for surge.

Figure 1: Projected Variability in Net Cash Farm Income for Sugarcane ($5/acre inch)

Note: Percentages indicate the probability that Net Cash Farm Income is below the indicated level.
The shaded area contains 50% of the projected outcomes.

If water costs increase significantly, the economic incentives to switch to surge irrigation systems will increase.

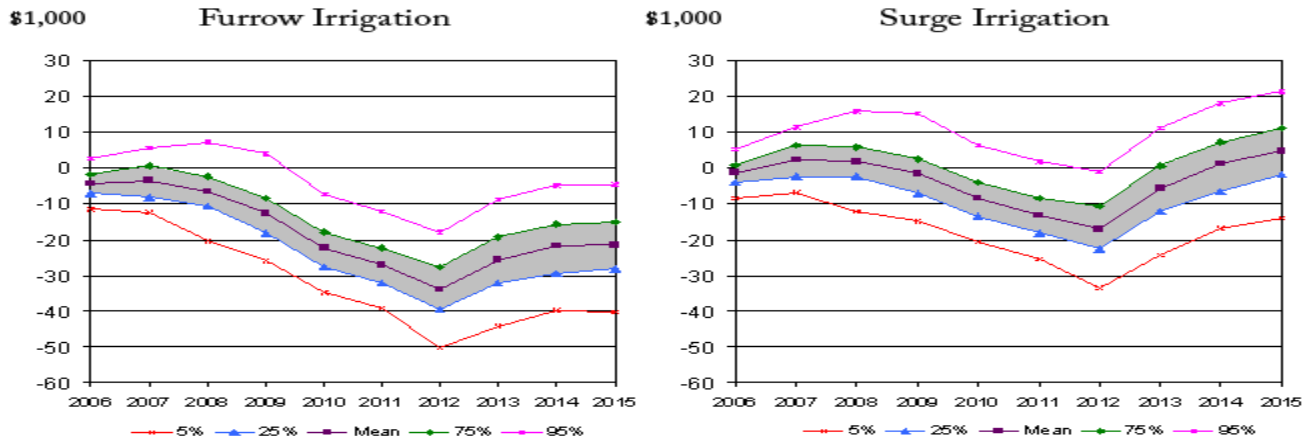
Table 3: Ending Cash Reserves in Year 2015 for Sugarcane, Volumetric Pricing			
Scenario	Irrigation Method	Cost per Acre Inch	Ending Cash Reserves ($1,000)
1	Furrow	$1.00	21.48
2	Surge	$1.00	25.22
3	Furrow	$5.00	-21.52
4	Surge	$5.00	4.78

A cumulative cash balance (Ending Cash Reserves) is presented to illustrate the nominal cash flow contribution or requirement that the 38-acre enterprise would create for a larger operation. Ending cash reserves in the last year of the projection are expected to generally grow to $25,220 under surge irrigation, 17.4% higher than the $21,480 for furrow irrigation with $1/acre inch water prices (Table 3). At a $5 per acre inch water price, projections reflect a negative growth in cash reserves for the furrow irrigation and only a marginal growth with surge irrigation (Table 3 and Figure 2).

Summary

The case study results of furrow vs. surge irrigation methods for sugar cane comparing water application rates and irrigation costs show significant implications at higher water prices. At low water prices, the economic incentive to switch the new surge technology is minimal as the cost of a surge valve offsets some of the potential water cost savings. However, if the current availability of low cost and plentiful irrigation water changes or if water districts switch to volumetric pricing, the profitability of sugar cane production could be significantly affected and the economic incentives to switch to surge irrigation systems will increase.

Figure 2: Projected Variability in Ending Cash Reserves before Borrowing for Sugarcane ($5/acre inch)



Note: Percentages indicate the probability that Net Cash Farm Income is below the indicated level.
The shaded area contains 50% of the projected outcomes.

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