FARM Assistance Focus

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

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

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 multifaceted 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 the 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 cotton 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 cotton crop may be watered four different occasions at a price of $7 per watering. In this example, a producer would pay approximately $28 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 cotton comparing furrow and surge irrigation methods. For the purpose of presenting comparative costs, two water price levels ($1 and $5) were assumed for the 38.5-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 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 a cost of $1 and $5 per acre inch of irrigation water. Scenarios 1 and 2 represent 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.

Table 1: Irrigation Application and Cost Information for Cotton, 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	19.53	$1.00	$19.53	$6.00	$12.00	$37.53	
2	Surge	13.48	$1.00	$13.48	$6.00	$12.00	$31.48	$1,800.00
3	Furrow	19.53	$5.00	$97.65	$6.00	$12.00	$115.65	
4	Surge	13.48	$5.00	$67.40	$6.00	$12.00	$85.40	$1,800.00

At low water prices, the economic incentive to switch to surge technology is minimal as the costs of the surge valve will offset some of the potential savings.

Table 2: 10-year Average Financial Indicators for Cotton, 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	29.94	21.66	8.28	1.00	0.74
2	Surge	29.94	21.60	8.35	1.00	0.74
3	Furrow	29.94	24.85	5.09	8.30	0.85
4	Surge	29.94	23.79	6.15	3.90	0.81

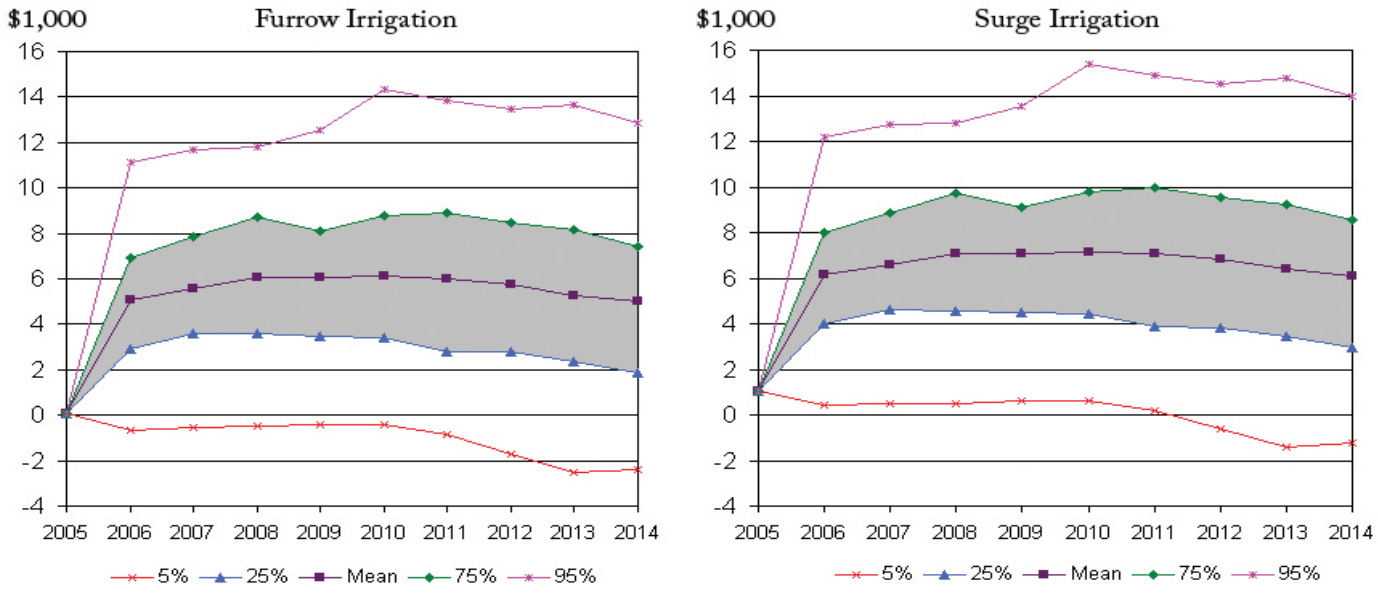
The 2nd and 4th surge scenarios assume a cost of the surge valve of $1,800. The surge valve expense is evenly distributed over the 10-year period with the assumption of no financing costs. For the analysis, no other differences were assumed for the surge valve scenario.

For each 10-year outlook, commodity price trends and inflation-adjusted costs follow the projections provided by the Food and Agricultural Policy Research Institute (FAPRI, at the University of Missouri). The demonstration site's 2005 results indicated below normal irrigated cotton yields due to the fact that 2005 was the first year of production for the site following a number of years of sugarcane production. Subsequent years are expected to generate a more normal yield of 980 lbs/acre, a 197 lb/acre increase from 2005. 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 Figure 1. Table 2 presents the average outcomes for selected financial metrics, while the graphical presentation illustrates the full range of possibilities for net cash farm income at the cost of $5 per acre inch.

Figure 1: Projected Variability in Net Cash Farm Income for Cotton ($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.

Cash receipts average $29,940 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 $21,600 for Scenario 2 to $24,850 for Scenario 3. Surge irrigation saves approximately 6 inches of water, resulting in a $6/acre variable cost savings at a price of $1/acre inch or a $30/acre savings assuming a $5/acre inch price of water.

Average annual Net Cash Farm Income (NCFI) is the highest under Scenario 2 (surge) at $8,350, followed closely by Scenario 1 (furrow) at $8,280, almost 1% less (Table 2). The $180/year additional cost for the surge valve partly offset the savings from lower water usage. At the $5 per acre inch water price, the average NCFI for surge was $6,150 or 21% higher than furrow at $5,090 (Figure 1). NCFI rises slightly in all scenarios from 2005 to 2010 before declining in the later years due to cost inflation outpacing the increases in prices and yield. Risk projections also indicate a 1% or less chance of a negative NCFI for Scenarios 1 and 2 (Table 2). At the high water price rates in Scenarios 3 and 4, the chance of negative NCFI averages 8.30% for furrow and 3.90% for surge.

In all four scenarios, liquidity improves as positive NCFI perpetuates a growth in ending cash reserves. With $1/acre inch water price, ending cash reserves are expected to grow to $83,460 in Scenario 1 and $84,130 in Scenario 2 during the projection period. Assuming a $5 per acre inch water price, projections reflected a slower growth in cash reserves for both furrow and surge irrigation (Table 3).

Summary

The case study results of furrow vs. surge irrigation methods for cotton 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 cotton production could be affected and the economic incentives to switch to surge irrigation systems will increase.

Table 3: Ending Cash Reserves in Year 2014 for Cotton, Volumetric Pricing

Scenario	Irrigation Method	Cost per Acre Inch	Ending Cash Reserves ($1,000)
1	Furrow	$1.00	83.46
2	Surge	$1.00	84.13
3	Furrow	$5.00	51.28
4	Surge	$5.00	61.93

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