FARM Assistance Focus

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Furrow vs. Surge Irrigation in Cotton Assuming Restricted Water Availability in the Lower Rio Grande Valley

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Evaluating the economic viability of the site demonstrations allows for an assessment of furrow and surge irrigation as efficient water delivery systems, especially in times of limited water availability.

The Lower Rio Grande Valley has been the beneficiary of plentiful water from the Rio Grande River in normal rainfall years over many decades. However, a substantial population growth in recent years, coupled with the ongoing needs of irrigated production agriculture, has increased the overall demand for water in the area. In addition, periodic drought years, such as 2006 and 2009, have pressured water supplies and spurred an interest in evaluating water conservation practices. As a result, water use demonstrations on irrigated crops, such as furrow and surge irrigation, have been established. Evaluating the economic viability of the site demonstrations allows for an assessment of furrow and surge irrigation as efficient water delivery systems, especially in times of limited water availability.

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

Extension conducts the economic analyses of demonstration results to evaluate the potential impact of adopting alternative water conserving technologies. Extension 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.

In 2010, a furrow vs. surge valve technology demonstration associated with the ADI project was completed to analyze potential water application and irrigation costs scenarios 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 under furrow irrigation may be watered 3 different occasions (typically 6 inches applied per watering) at a price of $7 per watering. In this example, a producer would pay $21 in water costs. Labor and poly-pipe would add to the total irrigation costs per acre. Under surge irrigation, a producer potentially may apply less water, but a surge valve would be an added cost at about $1,800 and the cost for 3 watering events would still be $21. The following analysis

Table 1: Furrow and Surge Irrigation Cost Per Acre for Cotton

Water Pricing Scenario	Water Price ($/Ac In)	Water Applied (Ac In)	Furrow				
			Water Cost/Acre	Poly-Pipe & Labor Cost/ Acre	Variable Irrigation Cost/Acre	Surge Valve Costs/Ac/Yr (Over 10 Yrs)	Total Irrigation Costs/Acre
1	1.17	18	$21.06	$37.00	$58.06	N/A	$58.06
2	2.34	18	$42.12	$37.00	$79.12	N/A	$79.12
3	3.51	18	$63.18	$37.00	$100.18	N/A	$100.18
4	4.68	18	$84.24	$37.00	$121.24	N/A	$121.24
5	5.85	18	$105.30	$37.00	$142.30	N/A	$142.30
Water Pricing Scenario	Water Price ($/Ac In)	Water Applied (Ac In)	Surge				
			Water Cost/Acre	Poly-Pipe & Labor Cost/ Acre	Variable Irrigation Cost/Acre	Surge Valve Costs/Ac/Yr (Over 10 Yrs)	Total Irrigation Costs/Acre
1	1.17	14	$16.38	$37.00	$53.38	$9.23	$62.61
2	2.34	14	$32.76	$37.00	$69.76	$9.23	$78.99
3	3.51	14	$49.14	$37.00	$86.14	$9.23	$95.37
4	4.68	14	$65.52	$37.00	$102.52	$9.23	$111.75
5	5.85	14	$81.90	$37.00	$118.90	$9.23	$128.13

evaluates the potential financial incentives for using surge technology under volumetric water pricing and metered delivery scenarios.

Assumptions

Table 1 provides the basic water use and irrigation cost assumptions for cotton furrow and surge irrigation. For the purpose of evaluating these technologies, five water pricing scenarios were established. Increasing water pricing scenarios represent conditions of increasingly limited water availability, metered delivery, and volumetric pricing.

The number of acres under furrow & surge was the same (19.5 acres each). The average prices received in 2010 was $.74 per pound for cotton and $151 per ton for cottonseed. A five-year average yield of 1,000 pounds per acre was assumed. Production costs were derived from actual producer costs and estimates of per acre overhead charges. They are assumed to be typical for the region and were not changed for analysis purposes. The price of water in 2010 was $1.17/acre inch or $14/acre foot. These assumptions are intended to make the illustration relevant to a wide range of producers in the Lower Rio Grande Valley area.

The two demonstration sites were located adjacent to one another and considered a controlled experiment for comparison purposes. Differences in soil types, rainfall and management practices did not affect irrigation water application, production costs, and yields. The surge site assumes a surge valve cost of $1,800. The surge valve expense is evenly distributed over the 10-year period ($180) with the assumption of no financing costs. For the analysis, no other major differences were assumed for the furrow and surge sites.

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 reflect no significant differences in yields between furrow and surge.

Results

Comprehensive projections, including price and yield risk for surge irrigation, are illustrated in Table 2 and Figure 1. Table 2 presents the average outcomes for selected financial projections in all 5 scenarios. The graphical presentation in Figure 1 illustrates the full range of possibilities for net cash farm income in scenario 4 for both furrow and surge irrigation. Cash receipts average $1,020/acre over the 10-year period for the three sites. Average cash costs range from $888/acre to $1,024/acre for the various water pricing scenarios.

Using average net cash farm income (NCFI) as a barometer, surge becomes more profitable than furrow in scenario two--$2.34/acre inch or $28/acre foot—or about double the current water price (Table 2; Figure 1). At this water price level, the additional cost of a surge valve is covered by the water cost savings from using less water. The NCFI advantage under surge improves significantly as the price for irrigation water increases.

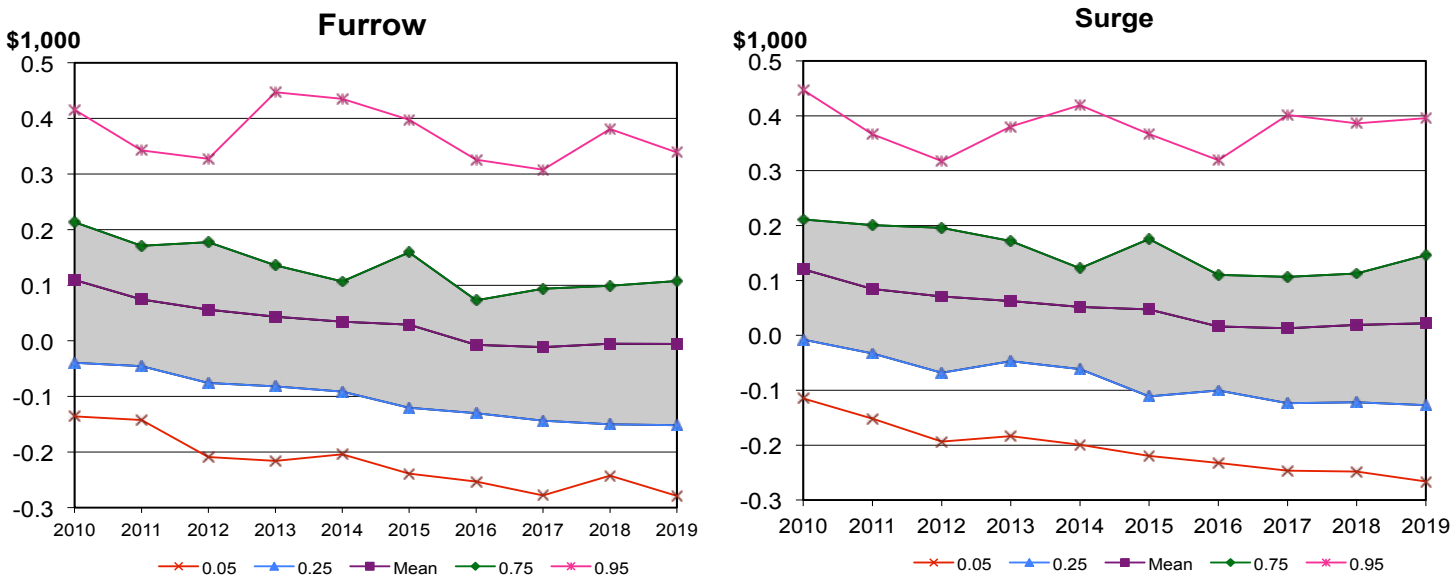
Liquidity or cash flow also improves with surge irrigation at higher water prices. Higher NCFI in scenarios 2-5 perpetuates a growth in ending

Table 2: 10-Year Average Financial Indicators for Irrigated Cotton

Water Pricing Scenario	Water Price ($/Ac In)	10-Year Averages/Acre					Cumulative 10-Yr Cash Flow/Acre	
		Total Cash Receipts ($1000)	Total Cash Costs		Net Cash Farm Income			
			Furrow ($1000)	Surge ($1000)	Furrow ($1000)	Surge ($1000)	Furrow ($1000)	Surge ($1000)
1	1.17	1.020	0.888	0.892	0.132	0.128	1.395	1.353
2	2.34	1.020	0.920	0.916	0.100	0.104	1.058	1.091
3	3.51	1.020	0.953	0.942	0.067	0.078	0.709	0.821
4	4.68	1.020	0.988	0.969	0.032	0.051	0.349	0.544
5	5.85	1.020	1.024	0.996	-0.004	0.024	-0.021	0.262

If long-term expectations are for higher pricing and/or metering to manage water supplies and delivery, surge technology will likely be viewed as a viable alternative for producers in the Lower Rio Grande Valley.

Figure 1. Projected Variability in Net Cash Farm Income Per Acre for Furrow vs. Surge Irrigation in Cotton.



cash reserves over the 10-year projection period (Table 2). Ending cash reserves are expected to grow to $1,091/acre for surge compared to $1,058 for furrow in water pricing scenario 2. In higher pricing scenarios, the cash flow advantage of surge is more significant.

Summary

Although surge offers the opportunity to conserve irrigation water in cotton and other field crops, the incentive for producers to switch to the new technology is minimal under current water delivery methods and water pricing levels. Demonstration results indicate that incentives to invest and adopt surge irrigation would begin with volumetric pricing and almost a doubling in water price to $2.34/acre inch.

The incentives for producers to switch to surge are more substantial at higher prices for irrigation water. In drought or other high water demand situations where the availability of water is restricted or limited, economic forces will ration supplies through higher prices and water will likely be metered. Water use efficiency will then become more crucial in controlling water cost.

This case study assumes higher water prices throughout the 10-year projection period. If water shortages and higher prices occur only in one year then return to previous levels, producers likely will have less incentive to change to the new surge technology. However, if long-term expectations are for higher pricing and/or metering to manage water supplies and delivery, surge technology will likely be viewed as a viable alternative for producers in the Lower Rio Grande Valley. In summary, the economic incentives for producers to switch to surge irrigation systems will likely be determined by the future availability and cost of water.

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