FARM Assistance Focus

Texas A&M AgriLife Extension

Furrow vs. Surge Irrigation in Sugar Cane Under Restricted Water Availability in the Lower Rio Grande Valley

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Evaluating the economic viability of water conservation practices such as surge vs. furrow irrigation in field crops is necessary to identify cost-effective and efficient water delivery systems, especially in times of limited water availability.

The Lower Rio Grande Valley (LRGV) is facing water shortages and restrictions in 2013 across the four-county area for the first time since the 1999-2001 drought. The Amistad and Falcon reservoirs on the Rio Grande River have become dangerously low due to a prolonged 2011-13 drought in the U.S.-Mexico water shed. The outlook will continue to be bleak until a tropical storm in the Pacific or Gulf of Mexico changes the rainfall pattern and replenishes the reservoirs.

Agricultural producers have been notified of restrictions and/or irrigation curtailment. Many producers where possible have scrambled to buy higher-priced water to sustain field, vegetable and citrus crops. These acquisition efforts may be for naught as water supplies continue to decline and urban needs take precedence. Most producers have been informed of irrigation cut-off dates by the providing water districts.

Limited irrigation will have a significant and negative impact on area crop production and the area economy. Being perennial crops, citrus and sugar cane production will be especially affected, and possible loss of crops and trees could occur. The overall LRGV economy and population will feel the economic pinch.

Irrigation conservation and efficient use of available water supplies will likely be critical in the future, even after drought conditions are alleviated. Growing demands in Mexico and non-agricultural uses in the LRGV will pressure more efficient use of water and delivery systems. Evaluating the economic viability of water conservation practices such as surge vs. furrow irrigation in field crops is necessary to identify cost-effective and efficient water delivery systems, especially in times of limited water availability.

The Texas Project for Ag Water Efficiency (AWE) is a multi-faceted effort involving the Texas Water Development Board, the Harlingen Irrigation District, South Texas agricultural producers, Texas A&M AgriLife Extension (Extension), Texas A&M AgriLife Research, Texas A&M University-Kingsville, and others. 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 2012, a furrow vs. surge valve technology demonstration associated with the AWE project was completed to analyze potential water application and irrigation costs scenarios in sugar cane production (Table 1). Under surge irrigation, a producer potentially may apply less water, but a surge valve would be an added cost at about $2,000. The following analysis evaluates the potential financial incentives for using surge technology under restricted water supplies and volumetric water pricing. For this paper, it was assumed that water delivery was metered.

Assumptions

Table 1 provides the basic per acre water use and irrigation cost assumptions for sugar cane under furrow and surge irrigation. For the purpose of evaluating these technologies, two water pricing scenarios--in-district and out-of-district--were established. The water pricing scenarios represent actual 2013 conditions in the LRGV, where “in-district” pricing means the grower owns the water rights, and “out-of-district” means the grower must acquire and purchase water from another water right holder outside the district, thus leading to a higher water delivery cost.

The furrow and surge testing was conducted on the same 30.36-acre field. The average sugar cane price received in 2012 was $25 per ton. A 43 ton average yield per acre was assumed for both irrigation methods. 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 in-district price of water in scenarios 1 and

Table 1: Furrow and Surge Irrigation Cost Per Acre for Surge Cane								
Irrigation Scenario	Water Source	Water Price ($/Ac In)	Water Applied (Ac In)	Water Cost/Acre	Poly-Pipe & Labor Cost/Acre	Variable Irrigation Cost/Acre	Surge Valve Costs/Ac/Yr (Over 10 Years)	Total Irrigation Costs/Acre
1-Furrow	In-District	1.32	46.44	$61.30	$26.47	$87.77	N/A	$87.77
2-Surge	In-district	1.32	35.65	$47.06	$26.47	$73.53	$6.59	$80.12
3-Furrow	Out-of-District	5.40	46.44	$250.78	$26.47	$277.25	N/A	$277.25
4-Surge	Out-of-District	5.40	35.65	$192.57	$26.47	$219.04	$6.59	$225.63

2 was $1.32/acre inch or $16/acre foot in 2012 and $1.50/acre inch or $18/acre foot in 2013. The $5.40/acre inch price in scenarios 3 and 4 assumes out-of-district water at $37/acre foot with 15% water loss and a $18/acre foot pumping charge. Based on 10 irrigations, irrigation labor was $16.47/acre and poly-pipe $10/acre. These assumptions are meant to make the illustration relevant to a wide range of producers in the area.

The two irrigation scenarios were conducted on the same site 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 $2,000. The surge valve expense is evenly distributed over the 10-year period ($200/year or $6.59/acre per year) 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. Actual 2012 demonstration findings reflect no significant differences in yields between furrow and surge.

Results

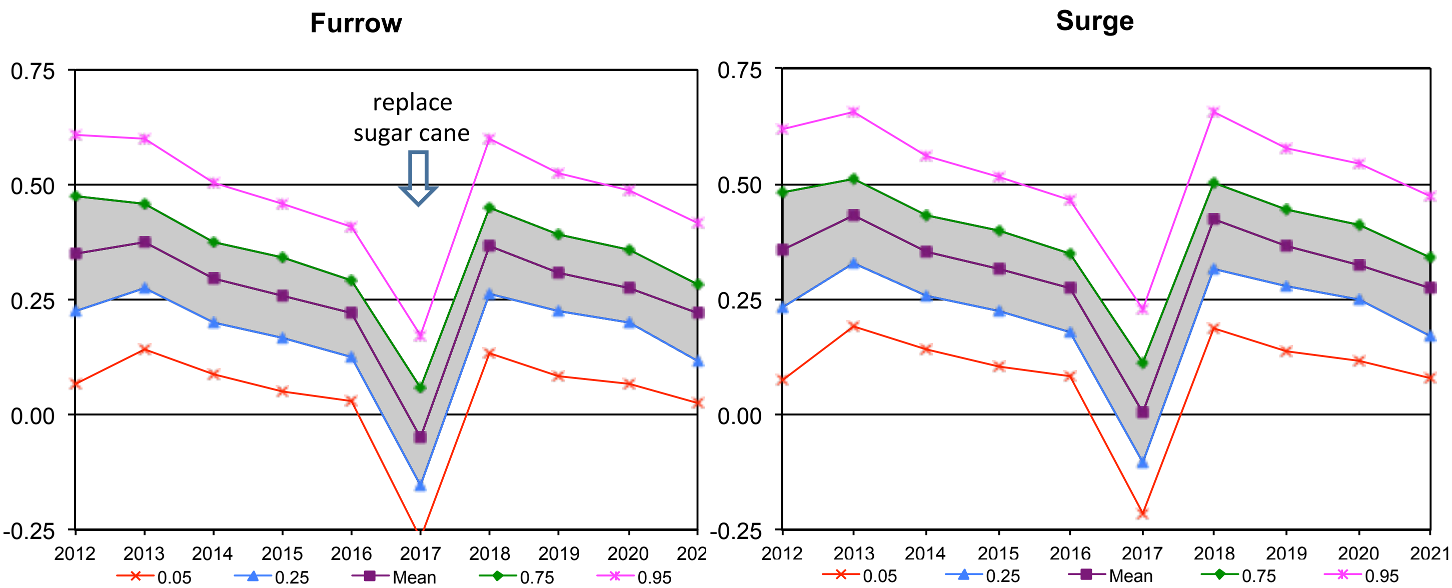
Comprehensive projections, including price and yield risk for surge irrigation, are illustrated in Table 2 and Figure 1. Table 2 presents the average outcomes for selected financial projections in all 4 scenarios. The graphical presentation in Figure 1 illustrates the full range of possibilities for net cash farm income in scenarios 3 (furrow) and 4 (surge) at the $5.40/acre inch out-of-district purchased water price. Cash receipts average $853/acre over the 10-year period for all four scenarios. Average cash costs were lower for surge under current in-district and out-of-district purchased water pricing scenarios.

Using average net cash farm income (NCFI) as a barometer, surge is more profitable than furrow (Table 2; Figure 1). In Figure 1, the dip in NCFI in 2017 for both furrow and surge reflect the costs of re-establishing the sugar cane. At both the $1.32 and $5.40 water price levels, the additional cost of a surge valve is covered by the water cost savings from using less water. The NCFI advantage under surge over furrow improves significantly as the price for irrigation water increases. The

Table 2: 10-Year Average Financial Indicators for Irrigated Sugar Cane							
			10-Year Average/Acres				
Irrigation Scenario	Water Source	Water Price ($/Ac In)	Total Cash Receipts ($1000)	Total Cash Costs ($1000)	Net Cash Farm Income ($1000)	Cumulative 10-Yr Cash Flow/ Acre ($1000)	Cumulative 10-Yr Cash Gain/Acre ($)
1-Furrow	In-District	1.32	0.853	0.420	0.433	4.575	--
2-Surge	In-district	1.32	0.853	0.407	0.446	4.710	135
3-Furrow	Out-of-District	5.40	0.853	0.590	0.263	2.767	--
4-Surge	Out-of-District	5.40	0.853	0.541	0.312	3.293	526

Results indicate that incentives to invest and adopt surge irrigation currently exist and improve as water prices increase.

Figure 1. Projected Variability in Net Cash Farm Income Per Acre for Furrow vs. Surge Irrigation in Sugar Cane at $5.40/Acre Inch Water Cost



advantage at $1.32/acre inch is 3% and the advantage at $5.40/acre inch is 18.6%.

Liquidity or cash flow also improves with surge irrigation at current in-district and out-of-district purchased water prices (Table 2). Ending cash reserves are expected to grow to $4,710/acre for surge, $135/acre more than furrow in the in-district water pricing scenario. In the higher out-of-district price scenario, the cash flow advantage of surge is more significant at $526/acre.

Summary

Surge offers the opportunity to conserve irrigation water in sugar cane and other field crops. The incentive for producers to switch to the new technology has been minimal under current water delivery methods and past water pricing levels. Under water restrictions and current water pricing, surge is emerging as a viable irrigation method assuming metered water. Demonstration results indicate that incentives to invest and adopt surge irrigation currently exist and improve as water prices increase.

The incentives for producers to switch to surge become 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. Scenarios 1 and 2 vs. 3 and 4 represent extremes of water availability situations. 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 longer-term expectations are for tighter water supplies and higher pricing, metering to manage water supplies and delivery by irrigation districts and surge technology will likely be more widely accepted by producers as viable alternatives for the LRGV. 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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