FARM Assistance Focus

Texas Cooperative Extension
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Impact of Volumetric Water Pricing for Cotton Comparing Furrow vs. Drip Irrigation in the Lower Rio Grande Valley

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Water conservation is developing into an area-wide issue in the Lower Rio Grande Valley. Population growth in recent years has led to a significant increase in the region's overall demand for water. This increasing non-farm consumption, coupled with the demands of irrigated agriculture, has led to an interest in evaluating the potential of water saving practices in irrigated farming. Water use demonstrations on irrigated crops, such as cotton, have been initiated to address this issue. Historically, agricultural irrigation water has been sold on a "per event" basis rather than volume as is the case for most residential and commercial users. A volumetric pricing structure or water shortages could be in the future for irrigated agriculture in the Lower Rio Grande Valley region. Evaluating the economic viability of furrow vs. drip irrigation in cotton at various potential water rates allows for a more realistic look at the viability of drip irrigation.

The Agricultural Water Demonstration Initiative (ADI) project is a multi-faceted effort between the Texas Water Development Board, the Harlingen Irrigation District, South Texas agricultural producers, Texas Cooperative 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 irrigation water diverted from the Rio Grande River to water consumption by various field, vegetable and citrus crops.

Texas Cooperative Extension (TCE) is responsible for the economic analyses of demonstration results to evaluate 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.

In 2006, a drip technology demonstration associated with the ADI project 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 3 different occasions at a price of $7 per watering. In this example, a producer would pay approximately $21 in total water costs. Under current water pricing structures, an initial financial analysis of the drip irrigation technology indicates no financial advantages compared to the furrow irrigation. In fact, the drip scenario is worse off compared to the furrow irrigation due to the $142.60/acre/year average cost for the drip system. The following analysis evaluates the potential financial incentives for drip technology and water savings under hypothetical volumetric water pricing, which is a distinct possibility in the near future or in any time of water shortages.

Assumptions

Table 1 provides the basic water use and irrigation cost assumptions for cotton comparing furrow (38-acre site) and drip (17-acre site) irrigation methods. The drip system was designed with 80" line spacing. For the purpose of presenting comparative costs, two water price levels ($1 and $5) were assumed for the two sites. 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 drip irrigation at $1 and $5 per acre inch costs for irrigation water.

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 Costs Per Acre	Drip System Costs Per Acre/Yr
1	Furrow	20.24	$1.00	$20.24	$7.00	$12.00	$39.24	
2	Drip	9.66	$1.00	$9.66	$0.00	$24.00	$33.66	$142.60
3	Furrow	20.24	$5.00	$101.20	$7.00	$12.00	$120.20	
4	Drip	9.66	$5.00	$48.30	$0.00	$24.00	$72.30	$142.60

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Table 2: 10-year Average Per Acre 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	0.79	0.50	0.29	1.00	0.66
2	Drip	0.79	0.61	0.18	22.50	0.84
3	Furrow	0.79	0.58	0.21	3.90	0.76
4	Drip	0.79	0.68	0.11	28.30	0.89

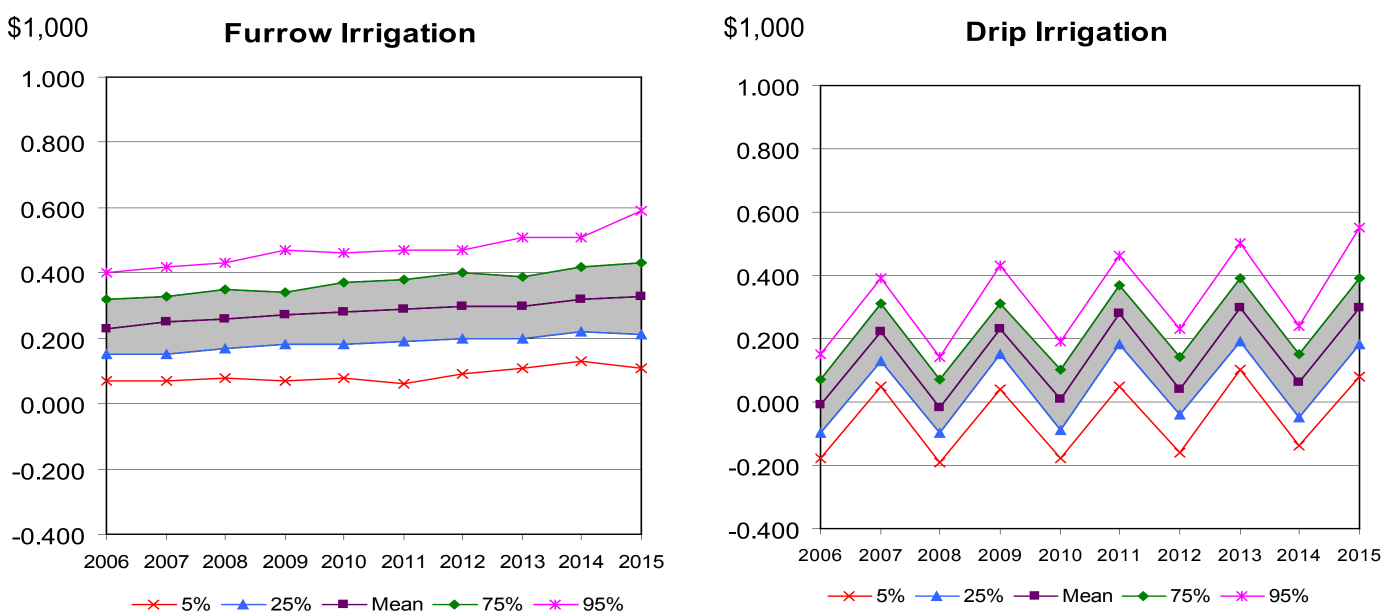
Scenarios 1 and 3 represent basic furrow flood irrigation at a price of $1/acre inch and $5/acre inch, respectively, projected for a 10-year period. Scenarios 2 and 4 represent the purchase and use of drip technology irrigation with the price of water at $1/acre inch and $5/acre inch, respectively. The two drip scenarios assume an average cost of $142.60/acre/year for the system. The drip pump and filter system expense is evenly distributed over the 10-year period at $22.60/acre/year and the drip tape is replaced every two years at $240/acre with the assumption of no financing costs. For the current analysis, no other differences were assumed for the drip scenario. Due to first-time operator issues resulting in moisture stress to the drip site, one flood watering (5.46 acre inches) was applied to the drip site in June 2006.

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 (950 lbs. per acre) between furrow and drip irrigation methods.

Results

A comprehensive projection including price and yield risk for furrow and drip 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 per acre for selected financial projections, while the graphical presentation illustrates the full range of possibilities for net cash farm

Figure 1. Projected Variability in Net Cash Farm Income Per Acre for Cotton ($1/acre inch).



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There is no economic incentive to switch to the new drip technology as the cost of the drip system more than offsets the potential water cost savings.

income for each demonstration site. Cash receipts average $790/acre 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 $500/acre for Scenario 1 to $680/acre for Scenario 4. Drip irrigation saves approximately 10.58 inches of water, resulting in a $5.58/acre variable cost savings at a price of $1/acre inch or a $47.90/acre savings assuming a $5/acre inch price of water (Table 1). Per acre irrigation cost savings for the drip demonstration sites were partially offset by higher than expected labor cost per acre due to operator issues. Normally, labor costs for a drip system should be less.

Average Net Cash Farm Income (NCFI) is the highest for Scenario 1 (furrow) at $290/acre followed by Scenario 3 (furrow) at $210/acre (Table 2). The lowest per acre NCFI was in the two drip scenarios. The additional average $142.60/acre/year cost for the drip offsets the savings from lower water usage. At the $5 per acre inch water price, the average NCFI for drip was $110/acre or 52% lower than furrow at $210/acre. NCFI rises slightly in all scenarios from 2006 to 2016 but is significantly more erratic in the drip scenarios due to the cost of replacing the drip tape every 2 years (Figure 1). Risk projections indicate a significantly higher chance of a negative NCFI for the two drip scenarios due to the high per acre system costs (Table 2). At the high water price rates in Scenarios 3 and 4, the chance of negative NCFI averages 3.9% for furrow and 28.3% for drip.

Ending cash reserves for a farm site are presented to indicate the potential accumulated (positive or negative) site contribution to a farm's overall cash flow and liquidity picture. Higher NCFI in the furrow scenarios perpetuates more growth in ending cash reserves (Table 3). With $1/acre inch water price, ending cash reserves are expected to grow to $2,850/acre in Scenario 1 and $1,420/acre in Scenario 2 during the projection period. Assuming a $5 per acre inch water price, projections reflected a slower growth in accumulated cash for both furrow and drip irrigation (Table 3).

Summary

The case study results of furrow vs. drip irrigation methods for cotton comparing water application rates and irrigation costs show significant economic implications. At both low and high water prices, there is no economic incentive to switch to the new drip technology as the cost of the drip system more than offsets the potential water cost savings. This one example provides evidence to the idea that a drip irrigation system will have to generate additional revenues through higher yields in addition to any water savings, to be a viable technology investment for cotton production in the region. Additional analysis is needed to further evaluate various drip system designs, potential yields, water savings, and, particularly, labor requirements and costs per acre in row crops.

Table 3: Ending Cash Reserves Per Acre in Year 2015 for Cotton, Volumetric Pricing

Scenario	Irrigation Method	Cost per Acre Inch	Ending Cash Reserves ($1,000)
1	Furrow	$1.00	2.85
2	Drip	$1.00	1.42
3	Furrow	$5.00	2.07
4	Drip	$5.00	1.05

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