FARM Assistance Focus

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Assessing Irrigation Methods Based on Grapefruit Pack-Out in the Lower Rio Grande Valley

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The overall profitability of a crop is directly linked to the pack-out or quality and quantity of the fresh fruit produced and sold each year.

Grapefruit is the major citrus crop in the Lower Rio Grande Valley of Texas (LRGV). USDA reports that grapefruit accounts for 18,500 acres, 67.8% of the total citrus acreage in the region. Fresh and processed grapefruit sales contribute significantly to the overall economy of the region and agriculture industry of the state. Grapefruit sales make up 80.0% of all citrus sales in the state of Texas and have averaged $53.2 million per year since the 2004-05 crop year. Approximately 91% of gross revenue comes from fresh market grapefruit sales.

The overall profitability of a crop is directly linked to the pack-out or quality and quantity of the fresh fruit produced and sold each year. The preferred pack-out grade is categorized as 'fancy,' followed by 'choice'. The remaining fruit is largely processed for juice. Within the fancy and choice grades, fruit is separated into different size classes with the largest, highest quality fruit receiving the higher prices for sale to the fresh market.

There is an increasing need to evaluate water conservation practices in the LRGV as this region has rapid growing population and economy, increasing the overall area demand for water from the Rio Grande River. Furthermore, since citrus is a perennial crop that requires irrigation water year-round from the Rio Grande, the preservation of citrus production in South Texas will require more water saving irrigation practices. Analyzing grapefruit fresh pack-out vs. juice production is one way to measure the cost-effectiveness of alternative irrigation methods as efficient water delivery systems in citrus production.

The Agricultural Water Conservation Demonstration Initiative (ADI) project is a coordinated effort between the Texas Water Development Board, Harlingen Irrigation District, South Texas agricultural producers, Texas AgriLife Extension Service (Extension), Texas A&M University-Kingsville and other agencies. It is designed to demonstrate state-of-the-art water distribution 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 for water consumption by various field, vegetable and citrus crops.

Texas A&M System research and extension scientists work with citrus growers to gather data on water use, yield production and irrigation use efficiency. Whereas, extension economists conduct the economic analyses of ADI demonstration results, evaluating the potential impact of adopting alternative water conserving technologies. Extension economists work 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.

Four typical irrigation technologies in producing Rio Red grapefruit studied in the ADI project—flood, border flood, micro-jet spray sprinkler, and drip—were compared to evaluate the impact on fresh pack-out and potential profitability of using various irrigation methods (Table 1). The following analysis evaluates the potential financial incentives for using the various systems. The investment costs of micro-jet spray and drip systems were also included.

Assumptions

Table 1 provides average pack-out percentages over five consecutive growing seasons (2005-2009) for Rio Red grapefruit

Table 1: Average 2005-2009 Grapefruit Pack-Out Percentages by Irrigation Method, Lower Rio Grande Valley

Irrigation Method	Category	Pack-Out Percentages		
		Average	High	Low
Flood	Fancy	43.6	53.1	37.3
	Choice	21.0	19.3	23.6
	Juice	35.4	27.6	39.1
	Total	100.00	100.00	100.00
Border Flood	Fancy	47.3	56.7	41.3
	Choice	23.0	21.2	22.7
	Juice	29.7	22.1	36.0
	Total	100.00	100.00	100.00
Drip	Fancy	45.4	51.9	42.2
	Choice	16.7	11.7	22.6
	Juice	37.9	36.4	35.2
	Total	100.00	100.00	100.00
Micro-Jet	Fancy	46.8	48.1	39.3
	Choice	17.3	13.8	19.4
	Juice	35.9	38.1	41.3
	Total	100.00	100.00	100.00
Average	Fancy	45.8	48.8	43.3
	Choice	19.5	18.3	20.8
	Juice	34.7	32.9	35.9
	Total	100.00	100.00	100.00

by irrigation method. Pack-out percentage data for each growing season represents the average pack-out across multiple ADI participants (2 growers per irrigation method). Annual pack-out percentages were categorized (low, average or high) by the level of fancy fruit produced. Estimated 2010 production, irrigation and systems costs were based on information provided by collaborators involved in the ADI project and was assumed to be typical for the purpose of this case analysis. Actual yields were adjusted for 'shrink' or the loss of product weight due to dust, twigs, debris, and loss of moisture. Yields were held constant and based on 2005-09 averages—flood 17.2 tons/acre, border flood 21.1 tons/acre, micro-jet 22.5 tons/acre, and drip 21.1 tons/acre.

Average crop prices—fancy $308.96/ton, choice $103.22/ton, and juice $11.99/ton—were calculated from actual 2005-09 prices received by ADI producers. These are net prices received by the collaborators, adjusted for harvest, packing, and commission charges. Average prices for all collaborators were used to minimize price differences due to tree age, harvest timing and management. Projected 2010-2019 prices were held constant at expected levels. These assumptions are intended to make the analysis relevant to typical grapefruit and citrus producers in the Lower Rio Grande Valley area.

The cost, yield and price data utilized in the analysis included information from two or more ADI producers for each irrigation method. Soil types, rainfall and management practices were assumed identical, and except for irrigation costs, all input costs and management practices were assumed to be the same across irrigation scenarios. For each 10-year outlook projection, input prices and overhead cost trends follow projections provided by the Food and Agricultural Policy Research Institute (FAPRI, at the University of Missouri).

Results

Comprehensive projections, including price and yield risk, for the four irrigation methods are illustrated in Table 2 and Figure 1. Table 2 presents the average outcomes for selected financial projections, while the graphical presentations illustrate the full range of possibilities for net cash farm income.

By using 5-year average pack-out percentages, results indicate that the highest net cash farm income (NCFI) was with border flood (Table 2 and Figure 1). The projected 10-year average NCFI for border flood was $1,730/acre, 1.2% more than micro-jet, 22.7% more than drip, and more than double flood. An assessment of high to low pack-out also reflects similar results. Border flood's advantage over conventional flood is largely reflective of higher average yields (21.1 tons/acre for border flood and 17.2 tons/acre for flood). The advantage over micro-jet and drip is directly linked to overall costs. Average cash costs were $2,000/acre for border flood, 4.8% less than drip and 6.1% less than micro-jet. The cost per acre differences largely reflects additional investment costs for drip and micro-jet systems that override water and operating cost savings.

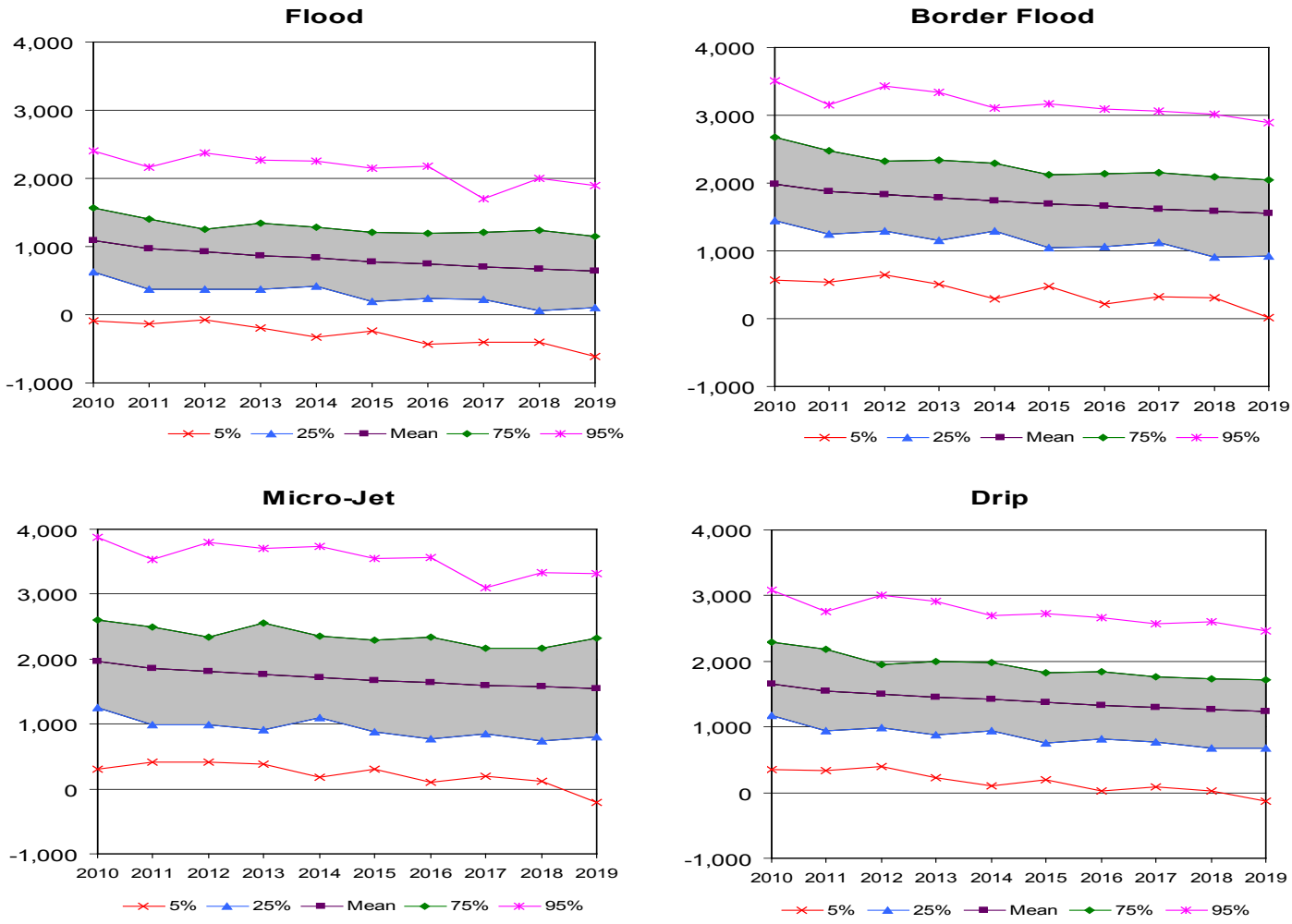
The NCFI advantage of border flood is also reflected in the ability to generate cash flow (Table 2). The 10-year cumulative cash flow balances illustrate the potential pre-tax cash requirements or flows generated

Table 2: 10-Year Average Per Acre Financial Indicators for Grapefruit, Lower Rio Grande Valley

Pack-Out Scenario	10-Year Averages Per Acre			Cumulative 10-Yr Cash Flow/Acre ($1000)
	Total Cash Receipts ($1000)	Total Cash Costs ($1000)	Net Cash Farm Income ($1000)	
Flood-High	3.28	2.01	1.27	13.87
Flood-Average	2.83	2.01	0.82	9.03
Flood-Low	2.56	2.01	0.55	6.03
Border Flood-High	4.27	2.00	2.27	24.80
Border Flood-Average	3.73	2.00	1.73	18.96
Border Flood-Low	3.36	2.00	1.37	14.96
Drip-High	3.82	2.10	1.72	18.75
Drip-Average	3.51	2.10	1.41	15.40
Drip-Low	3.42	2.10	1.31	14.39
Micro-Jet- High	3.87	2.13	1.73	18.95
Micro-Jet-Average	3.85	2.13	1.71	18.34
Micro-Jet-Low	3.40	2.13	1.27	13.88

The results indicate that border flood may have a NCFI and cost advantage over flood, drip, and micro-jet irrigation systems in grapefruit production when evaluated using fresh vs. juice pack-out as a barometer.

Figure 1: Projected Variability in Net Cash Farm Income Per Acre for Grapefruit, Average Pack-Out



using the four irrigation methods. Border flood, on average, generated a cumulative cash flow of $18,960/acre, 3.4% more than micro-jet, 23.1% more than drip, and more than double that for flood. Cumulative cash flow results assessing variations in pack-out also favor border flood.

Summary

The results indicate that border flood may have a NCFI and cost advantage over flood, drip, and micro-jet irrigation systems in grapefruit production when evaluated using fresh vs. juice pack-out as a barometer. Whereas actual yields and pack-out percentages may vary based on rainfall, soil types, tree age, pruning, and other management practices, the five-year averages lend credence to the results that raising borders between citrus tree rows may be the best option. Border flood also has a cost advantage over the other three irrigation systems. However, other issues such as terrain, availability of labor, water savings, and cost of water may also play a role in deciding which system is the best fit for an individual producer.

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