



FARM Assistance



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Increased Water Use Efficiency
and Profitability in Citrus Production
Possible in the Lower Rio Grande Valley

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“With reduced water supplies, conservation efforts to increase water use efficiency and to ensure sustainability of area production are of utmost importance.”

A prolonged 2011-13 drought in the Texas-Mexico Rio Grande River watershed and new reservoirs constructed in Mexico in recent years have severely depleted water storage levels in the Amistad and Falcon reservoirs. This drought scenario is a repeat of 1999-2001. Declining water levels have culminated in farm-use restrictions imposed by water districts and higher irrigation costs in 2013. Yields and fruit quality issues are also concerns as restrictions limit the amounts and frequency of irrigation events.

Citrus production in the Lower Rio Grande Valley of Texas (LRGV) is a significant part of the area

economy. It involves approximately 27,300 irrigated acres. In 2012, the estimated value of citrus production was \$69.77 million and the economic impact was estimated to be \$130.1 million (Robinson, 2013). Grapefruit accounts for 68% of the acreage and 80% of all citrus sales. Overall crop value is directly linked to the quantity and quality of the harvest or fresh fruit pack-out (fancy and choice) vs. juice market. As the percent of the crop grading fancy increases, so does the average sales price. Average prices decline as more choice and, especially, juice grade is produced. As a result, any analysis must include the impact on fresh pack-out vs. juice.

are of utmost importance. More efficient water delivery methods, such as border flood, drip and micro-jet spray, offer the potential to save water (Young, 2010). Moreover, these irrigation methods also have other agronomic benefits such as minimizing the movement of nutrients out of the root zone and reducing pest control due to lower soil applied pesticide and fungicide loss by leaching (Nelson, 2013).

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. The ten-year project was initiated in 2004 and was 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’s scope included measuring and evaluating the efficiency of water diverted from the Rio Grande River for irrigation consumption by various field, vegetable and citrus crops.

Water use efficiency and the economics of water savings can be explained by comparing producer delivery systems. Four irrigation technologies typically used in Rio Red grapefruit production were studied as part of the AWE project—flood, border flood, micro-jet spray, and drip. These 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.

Irrigation supplementing annual rainfall is required to sustain grapefruit and other fruit production in the LRGV. Without irrigation, there would be no fruit production. The average annual rainfall in the LRGV is approximately 26 inches (Enciso, 2005), with normal total tree water requirements to produce a crop reaching 50 inches (Sauls, 2008). Historically, flood is the dominate irrigation method and currently accounts for 80% of all citrus.

With reduced water supplies, conservation efforts to increase water use efficiency and to ensure sustainability of area production

Table 1: Average 2005-2012 Grapefruit Pack-Out Percentages by Irrigation Method, Lower Rio Grande Valley

Irrigation Method	Category	Pack-Out Percentages		
		Average	High	Low
Flood	Fancy	45.8	53.1	37.3
	Choice	22.3	19.3	23.6
	Juice	<u>31.9</u>	<u>27.6</u>	<u>39.1</u>
	Total	100.00	100.00	100.00
Border Flood	Fancy	48.0	56.7	45.6
	Choice	23.9	21.2	26.9
	Juice	<u>28.1</u>	<u>22.1</u>	<u>27.5</u>
	Total	100.00	100.00	100.00
Drip	Fancy	47.3	51.9	42.2
	Choice	16.9	11.7	22.6
	Juice	<u>35.8</u>	<u>36.4</u>	<u>35.2</u>
	Total	100.00	100.00	100.00
Micro-Jet	Fancy	46.4	48.1	41.8
	Choice	17.1	13.8	21.1
	Juice	<u>36.5</u>	<u>38.1</u>	<u>37.1</u>
	Total	100.00	100.00	100.00
Average	Fancy	46.9	48.8	43.3
	Choice	20.00	18.3	20.8
	Juice	<u>33.1</u>	<u>32.9</u>	<u>35.9</u>
	Total	100.00	100.00	100.00

“Results indicate that the highest net cash farm income (NCFI) was with border flood.”

Assumptions

Table 1 provides average pack-out percentages over eight growing seasons (2005-2012) for Rio Red grapefruit by irrigation method. Pack-out percentage data for each growing season represents the average pack-out across multiple AWE participants (2 growers per irrigation method). Annual pack-out percentages were categorized (low, average or high) by the level of fruit produced. Estimated 2013 production, irrigation and systems costs were based on information provided by collaborators involved in the AWE 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 2005-12 averages—flood 18.9 tons/acre, border flood 21.2 tons/acre, micro-jet 23.0 tons/acre, and drip 21.1 tons/acre.

Average crop prices—fancy \$285.80/ton, choice \$99.52/ton, and juice \$5.44/ton—were calculated from actual 2005-12 prices received by AWE 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 2013-2022 prices were held constant at expected levels. These assumptions are intended to make the analysis

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	3.33	2.20	1.13	12.04
Flood-Average	3.01	2.20	0.81	8.55
Flood-Low	2.60	2.20	0.40	4.22
Border Flood-High	3.97	2.16	1.81	19.18
Border Flood-Average	3.53	2.16	1.36	14.46
Border Flood-Low	3.44	2.16	1.28	13.56
Drip-High	3.52	2.28	1.24	13.17
Drip-Average	3.35	2.28	1.07	11.36
Drip-Low	3.16	2.28	0.88	9.33
Micro-Jet- High	3.65	2.31	1.33	14.16
Micro-Jet-Average	3.60	2.31	1.29	13.70
Micro-Jet-Low	3.39	2.31	1.08	11.49

****Based on 2005-2012 data.**

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. Irrigation costs by scenario were different primarily due to the amount of water applied under each irrigation method. 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

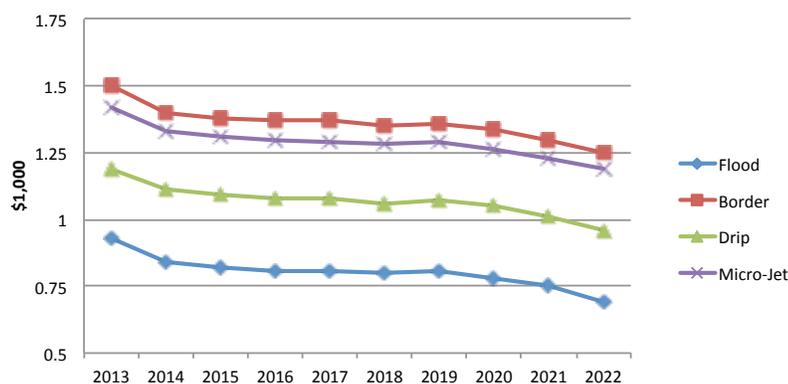
Comprehensive projections, including price and yield risk, for the four irrigation methods are illustrated

in Table 2 and Figure 1. Table 2 presents the average outcomes for selected financial projections, while the graphical presentation illustrates a NCFI comparison of the four irrigation systems.

By using 8-year average pack-out percentages, yields and water use data, the results reflect the extremes in annual rainfall patterns in the LRGV ranging from consecutive years of drought (2010-2012) to excessive rainfall years, which adds more credibility to the overall findings. Results indicate that the highest net cash farm income (NCFI) was with border flood (Table 2 and Figure 1). The projected 10-year average annual NCFI for border flood was \$1,360/acre, 5.4% more than micro-jet, 27.1% more than drip, and 67.9% more than 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 annual yields (21.2 tons/acre for border flood and 18.9 tons/acre for flood) and higher

“Border flood may have a NCFI or profitability advantage over flood, drip, and micro-jet irrigation systems in grapefruit production based on fresh vs. juice pack-out harvest.”

Figure 1. Net Cash Farm Income Per Acre for Grapefruit, Average Pack-Out



average fresh pack-out. The advantage of border flood over micro-jet and drip is directly linked to higher average fresh pack-out as well as overall costs. Average cash costs were \$2,040/acre for border flood, 5.6% less than drip and 6.85% 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 downward NCFI trends in Figure 1 are largely due to projected prices and yields being held constant, whereas production costs increase over the 10-year period.

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 using the four irrigation methods. Border flood, on average, generated a cumulative cash flow of 5.5% more than micro-jet, 27.3% more than drip, and 69.1% more than flood. Cumulative cash flow results assessing high and low variations in pack-out also favor border flood.

Summary

The results indicate that border flood may have a NCFI or profitability advantage over flood, drip, and micro-jet irrigation systems in grapefruit production based on fresh vs. juice pack-out harvest. Border flood’s cost advantage over flood, drip and micro-jet irrigation systems is also a factor. These results reaffirm the findings in Focus 2010-4 (Young, 2010) with minor differences based on 8 years vs. 5 years of production and market history.

Actual yields and pack-out percentages vary based on rainfall, soil types, tree age, pruning, and other management practices. Eight-year averages lend credence to the results that raising borders between citrus tree rows may be the best option. However, other issues such as terrain, availability of labor, 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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