

Narrow-Border Flood for Citrus: Saving Water While Improving Yields and Net Cash Farm Income

Narrow-border flood (NBF) irrigation of citrus orchards can save one-third the water used by traditional large-pan flood irrigation with negligible investment in equipment yet with higher yields of better quality, substantially enhancing net farm cash income.

NBF also works in other laser-leveled orchards, including most any perennial fruit or nut trees such as pecan, where flood irrigation is a common practice.

SUMMARY

For citrus, surface irrigation makes up the difference between the 24 inches of rain received on average during a growing season and the 45 inches of water needed to raise a good crop. Traditionally, growers have used large-pan flood irrigation, a method that floods the entire grove with about six inches of water, with four to eight separate irrigation events per year.

Texas AWE researchers compared the amount of water used by traditional large-pan flood, NBF, microjet sprinkler spray, and single and dual line drip irrigation.

NBF proved to be a cost-effective irrigation practice and an easy-to-implement alternative for citrus growers currently using traditional flood irrigation. Growers using NBF best met the 45-inch water requirement; every other irrigation method analyzed exceeded this crop requirement. NBF used about 35 percent of the water required for traditional large pan flood. If applied uniformly throughout South Texas citrus groves, this strategy could conserve up to 49,000 acre-feet of water a year.



Above: Large-pan flood irrigation
 Below: Narrow-border flood irrigation



Modifying Traditional Citrus Irrigation Method Reduces Water Use by One-Third

Irrigation Method	Inches of Water Applied		Water Savings over Large-Pan Flood		
	Min – Max	Average	Inches/Acre	AF/Acre	Potential Industry Wide
Large-Pan Flood	60 – 66	62			
Microjet Sprinkler Spray	48 – 56	51	11	0.94	26,200 AF/yr
Single & Dual Line Drip	48 – 50	48	14	1.18	33,000 AF/yr
Narrow-Border Flood	40 – 44	41	21	1.75	49,000 AF/yr

ECONOMICS

With NBF, growers also realized savings in fertilizer. Over time, cultural practices performed in large-pan flood fields create unevenness in soil elevations, leading to non-uniform watering and deep percolation, wasting both water and fertilizer. The raised berms used by NBF, however, channel water faster down rows and underneath the tree canopy. Because NBF irrigation applies water at a faster rate, it more adequately targets the root zone of the trees and retains fertilizer within that target zone.

This directly impacts the quality and the value of the fruit. Texas AWE economic analyses indicate that NBF irrigation produces the highest net cash farm income (NCFI). The projected 10-year average NCFI of \$1,730 per acre is more than double that associated with traditional flood irrigation and almost 23 percent more than drip irrigation.

Narrow-Border Flood Irrigation Doubles Income Over Traditional Flood

Irrigation Method	Pack-Out Schedule	10-Year Averages Per Acre			
		Total Cash Receipts	Total Cash Costs	Net Cash Farm Income	Cumulative 10-Year Cash Flow/Acre
Narrow-Border Flood	High	\$4,270	\$2,000	\$2,270	\$24,800
	Average	\$3,730		\$1,730	\$18,960
	Low	\$3,360		\$1,370	\$14,960
Microjet Spray	High	\$3,870	\$2,130	\$1,730	\$18,950
	Average	\$3,850		\$1,710	\$18,340
	Low	\$3,400		\$1,270	\$13,880
Drip	High	\$3,820	\$2,100	\$1,720	\$18,750
	Average	\$3,510		\$1,410	\$15,400
	Low	\$3,420		\$1,310	\$14,390
Traditional Large-Pan Flood	High	\$3,280	\$2,010	\$1,270	\$13,870
	Average	\$2,830		\$820	\$9,030
	Low	\$2,560		\$550	\$6,030

About Texas AWE

The Texas Project for Ag Water Efficiency (Texas AWE) focuses on affordable and achievable methods for conserving irrigation water through on-farm applications and in-district delivery systems.

Texas AWE was developed and is managed by the Harlingen Irrigation District (HID) with grant funding by the Texas Water Development Board as one of two 10-year Agricultural Water Conservation Demonstration Initiatives in Texas.

Starting in 2004, HID and its project partners have gathered data on ways to manage agricultural water more efficiently. On-farm demonstration sites have proven how new irrigation technologies can conserve water and produce good crop yields, while in-district automation and networked telemetry showcase how water management can support irrigation efficiencies at the farm level.

Project findings are shared on the project website (TexasAWE.org) and at the Rio Grande Center for Ag Water Efficiency through hands-on training and workshops for producers and district personnel. The Center is also the only site in Texas to offer flow meter calibration for producers and other districts.

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ADDITIONAL INFO

Texas A&M researchers also recommend (1) monitoring soil moisture to schedule irrigations appropriately and (2) metering flows to ensure that ideal amounts of water are applied.

Data for on-farm irrigation water use in citrus production were collected in 2011, which saw near zero precipitation throughout the growing season. Most growers had only four inches of rainfall for the entire year, and most of that at the very end of the year, which did very little for citrus growth and yield production. That growing season marked an exceptional year of severe drought conditions in South Texas.

CREDITS

Texas AWE research on water-efficient methods for irrigating citrus has been led by Shad Nelson, Ph.D, Texas A&M University Kingsville – Citrus Center. (See *2011 Annual Report, Appendix A: On-Farm Irrigation of Citrus Crops*, under “Resources” at www.TexasAWE.org)

Mac Young, Shad Nelson, Ph.D, Steven Klose, and Juan Enciso. “Assessing Irrigation Methods Based on Grapefruit Pack-Out in the Lower Rio Grande Valley.” FARM Assistance Focus 2010-4. (August 2010; see report under “Efficient Ag Water Practices [On Farm]” at www.TexasAWE.org)