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## An Evaluation of Flood Irrigation and Compost Use in South Texas Rio Red Grapefruit Production

Mac Young, Extension  
Shad Nelson, TAMUK  
Steven Klose, Extension  
Juan Enciso, Extension



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Department of Agricultural Economics  
Texas AgriLife Extension Service  
Texas A&M University System

[farmassistance.tamu.edu](http://farmassistance.tamu.edu)



*A study by Nelson et al. (2008) evaluated the use of annual compost applications as a means of preserving soil moisture content in the root zone of citrus trees and maintaining Rio Red grapefruit yields under flood irrigation.*

The citrus industry in South Texas is ranked third in citrus production in the USA, after Florida and California. Citrus production in the Lower Rio Grande Valley (LRGV) of South Texas is well known for its superior red grapefruit varieties, with Rio Red grapefruit dominating 70% of all grapefruit grown in this region. Irrigation performed by citrus growers in the LRGV is primarily done using flood irrigation, as water is delivered from canal systems diverted from the Rio Grande River.

Water scarcity is not an uncommon problem in this semi-arid region as periodic droughts make water conservation an important issue along the Rio Grande River. A cultural practice not commonly performed in citrus production to conserve water is the application of compost underneath the tree canopy. A study by Nelson et al. (2008) evaluated the use of annual compost applications as a means of preserving soil moisture content in the root zone of citrus trees and maintaining Rio Red grapefruit yields under flood irrigation. The results of this multi-year study demonstrated irrigation water savings and slightly higher average citrus yields beyond the first year of compost application.

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. 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. The following analysis evaluates the potential financial incentives for applying compost relative to not using compost.

## Assumptions

A ten-year (2010-2019) financial outlook projection is developed for two scenarios (compost and no compost). Table 1 gives average yields and irrigation water applied over five consecutive growing seasons (2003-2007) for Rio Red grapefruit by no compost and compost under flood irrigation (Nelson). Water savings by applying compost was equivalent to one six-inch flood irrigation event, due to extended soil moisture content under the tree canopy of compost-treated trees.

Estimated 2010 production and irrigation costs were based on the Nelson study referenced and information provided by collaborators involved in the ADI project and was assumed to be typical for the purpose of this case analysis. Yields were held constant and based on 2003-07 averages—no compost 23.6 tons/acre and compost 25.7 tons/acre.

Average grapefruit price—\$142.51/ton—was calculated from actual 2005-09 prices received by ADI producers. These are

Table 1. Average 2003-2007 Grapefruit Yields & Flood Irrigation Water Applied, Lower Rio Grande Valley					
Year	Yields (Tons/Acre)		Irrigation (Ac. In)		Rain (Ac. In.)
	No Compost	Compost	No Compost	Compost	
2003	29.2	27.6	24.0	18.0	28.7
2004	29.7	35.6	30.0	24.0	27.6
2005	17.0	19.5	54.0	48.0	17.3
2006	19.0	20.9	48.0	42.0	19.3
2007	23.0	24.9	42.0	36.0	23.6
5-Yr Avg.	23.6	25.7	39.6	33.36	23.3



**Table 2. 10-Year Average Per acre Financial Indicators for Grapefruit, Lower Rio Grande Valley (\$1000)**

Scenario	10-Year Averages Per Acre			Cumulative 10-Yr Cash Flow /Acre
	Total Cash Receipts	Total Cash Costs	Net Cash Farm Income	
No Compost	3.37	1.99	1.38	15.11
Compost	3.67	2.25	1.42	15.51

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.

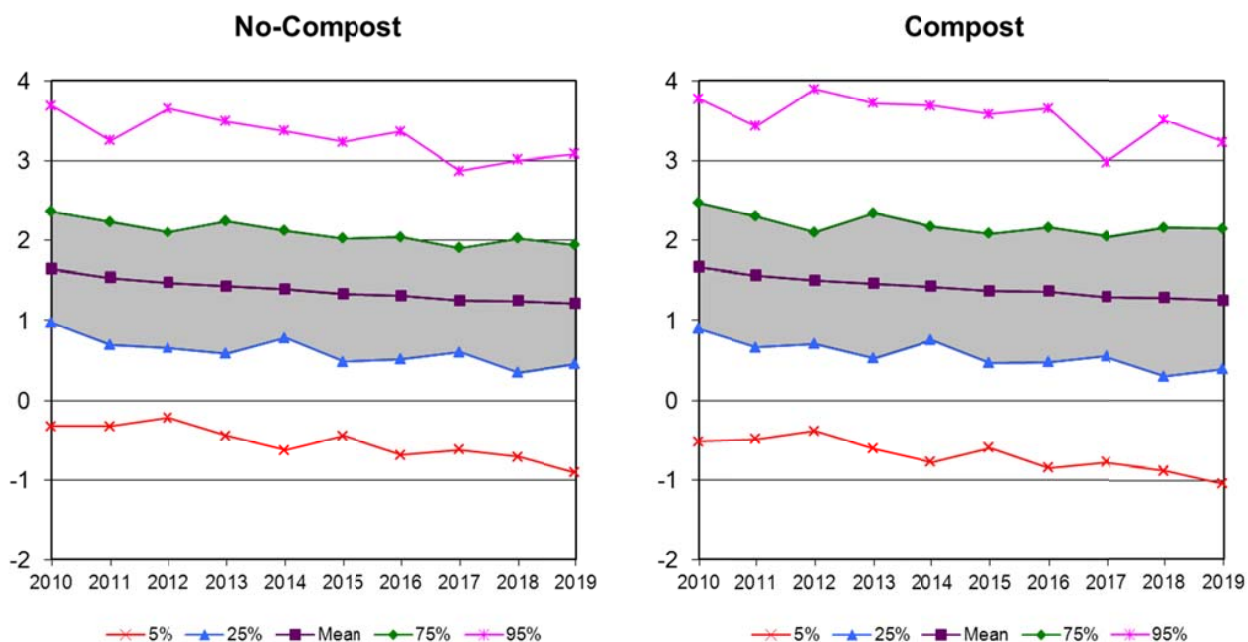
For analysis purposes, it was assumed that 100 lbs. of compost were applied each year per tree (115 trees /acre x 100 lbs.) or 11,500 lbs. (5.75 tons/acre). At \$50/ton, the cost of compost was estimated to be \$287.50/acre. Labor to apply the compost was assumed to be 2 hours/acre per year at a cost of \$10/hour or \$20/acre per year. The cost, yield and price data utilized in the analysis included information from two or more ADI producers for the flood irrigation method. Irrigation costs, input

costs and management practices were assumed to be the same across both 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 no compost and compost scenarios under flood irrigation 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.

**Figure 1. Projected Variability in Net Cash Farm Income Per Acre for Grapefruit, Flood Irrigation.**





*The results indicate that, under flood irrigation, composting may have a NCFI and cash flow advantage over not using compost in citrus production.*

Results indicate that composting may be slightly more profitable than traditional non-composting production (Table 2 and Figure 1). The projected 10-year average net cash farm income (NCFI) for composting was \$1,420/acre, 2.9% more than non-composting. Composting's advantage over conventional no composting is largely reflective of higher average yields (25.7 tons/acre for composting and 23.6 tons/acre for no-composting). Another advantage is directly linked to water savings (33.6 acre inches applied with composting and 39.6 acre inches with no composting) and, subsequently, lower irrigation costs. The yield and water savings advantages override additional costs involved in composting. Average cash costs were \$2,250/acre for composting, 13.1% more than no compost. The cost per acre differences largely reflects additional input costs for compost and labor.

The NCFI advantage of composting under flood irrigation 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 flows generated using compost or not using compost. On average, composting resulted in a cumulative cash flow of \$15,510/acre, 2.6% more than no compost.

## Summary

The results indicate that, under flood irrigation, composting may have a NCFI and cash flow advantage over not using compost in citrus production. Whereas actual yields and irrigation water use may vary based on rainfall, soil types, tree age, pruning, and other management practices, the five-year averages give merit to the results that composting is a viable option in grapefruit production. However, other issues such as availability of compost, labor, and cost of water may also play a role in deciding the practical use of compost for an individual producer.

The study by Nelson et al. (2008) reflected the potential for higher yields and water savings with composting using flood irrigation. Furthermore, this study on composting led to additional benefits, such as increased soil organic matter content, enhanced soil tilth, improved root growth and soil exploration for nutrients, and higher nutrient status in the citrus crop. The results demonstrated in our study here indicate that composting could also improve profitability and cash flow. If irrigation water becomes more limited and/or water prices increase from current levels, comparable yield increases in concert with water use savings, could

further improve profitability with the use of more water conserving irrigation practices like border flood, drip and micro-jet spray irrigation methods.

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## Reference

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