Agricultural Water Conservation Demonstration Initiative

Harlingen Irrigation District

2008

The Harlingen Irrigation District-Cameron County No. 1, under the auspices of a grant from the Texas Water Development Board, is sponsoring the Agricultural Water Conservation Demonstration Initiative (ADI), a multi-year project to conduct a study of the maximization of on-farm surface water use efficiency by integration of on-farm application and district delivery systems. This document contains the third annual progress report to the Texas Water Development Board.

Submitted by
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Executive Summary

The Harlingen Irrigation District-Cameron County No. 1, under the auspices of a grant from the Texas Water Development Board, is sponsoring the Agricultural Water Conservation Demonstration Initiative (ADI), a multi-year project to conduct a study of the maximization of on-farm surface water use efficiency by integration of on-farm application and district delivery systems. The ten-year project includes participation by Harlingen Irrigation District Cameron County No. 1, Delta Lake Irrigation District, Texas A & M University-Kingsville, USDA-Natural Resources Conservation Service, Rio Farms, Inc, Texas Cooperative Extension Service and agricultural producers in Cameron, Hidalgo and Willacy counties. This Project proposes to assist in the implementation of the agricultural water conservation management strategies, as identified in the Region M Approved Regional Water Plan and the Texas State Water Plan and will further agricultural water conservation in Texas. The project supplements on-going conservation efforts in the Lower Rio Grande Valley

The District has formed an advisory committee consisting of growers, demonstration co-operators, scientists and representatives of grower organizations. The primary responsibilities of this committee are to offer guidance and perspective to the project as a whole. The committee meets on a quarterly basis to discuss the progress and goals of the project. Our hopes are for this committee to become one of the main conduits for disseminating information to the growers of the Rio Grande Valley. Those members are:

- Chris Allen – Cooperator
- Leonard Simmons – Grower
- Edward Bauer – Grower
- Sam Morrow – Grower
- Harold Siever - Grower
- Troy Allen – Delta Lake Irrigation District Manager
- Ray Prewitt – Texas Citrus Mutual
- Dr.. Shad Nelson – Texas A&M Kingsville
- Dr. Juan Enciso – Texas A&M Extension Service
- Dr. Al Blair – Axiom-Blair Engineering
- Dr. Steven Klose – Texas AgriLife Extension
- Enrique Perez – Cameron County Extension
- Andy Garza – TSSWCB

2008 was an extremely challenging year for ADI. The beginning of the season was dry and irrigation took place at a rather fast clip. Then in the summer we were hit with hurricane Dolly and in a period of 3 weeks the Rio Grande Valley (RGV) received over 60 inches of rain. This rain came at a rather bad time seeing as most of the crops in the RGV had yet to be harvested. In our citrus crops many of the fruit were stripped from the trees in the high wind. In the row crops high winds and massive amounts of rain caused a lot of damage and subsequently many of the crops were not harvested. Sugarcane is the only crop that seemed to flourish with the high rainfall amounts.

The monitoring equipment that is installed at our demonstration sites suffered damage also. The rain gauges failed in the high winds and soil moisture data loggers failed due to high water standing in some fields. Our site data reflects the loss of crops and data and is noted by site. Fortunately this project allows for years like this and we have next year to gather more data to support our demonstrations.

This report contains the annual update and progress made in the Agricultural Demonstration Initiative Project as indicated in the Scope of Work of the Contract between Harlingen Irrigation District – Cameron County No. 1 (HIDCC1 or the District) and the Texas Water Development Board (TWDB). A description of the overall progress, problems encountered delays in the timely completion of work, or change in the deliverables or objectives of the contract are discussed; as well as any corrective actions necessary.

The Site Summaries section contains all of the data collected at the on-farm demonstration sites in 2008. The demonstration site is designated by a number that identifies the grower and the entity responsible for the site. The sites data consists of a description of the site including soil type and irrigation as well as other pertinent information.

2008 Work Accomplished by Task

Subcontracting Contract Execution

The primary work for this task was completed by District personnel. The subcontracts with Texas A&M University Kingsville, Texas AgriLife Extension FARM Assist, and Texas AgriLife Extension Weslaco to provide support and services to perform the work tasks listed below were completed for 2008 and work for the reissue of those contracts for 2009 is underway.

District and On-Farm Flow Meter Calibration and Demonstration Facilities

The construction of the Flow Meter Calibration Facility is complete. This year there were a few measurement devices added to enhance the calibration process. The District and other local conservation entities continue to use the facility for meetings and training events. The District has scheduled a canal management and automatic gate training event for early summer. We anticipate more such events as the year progresses.

On-Farm Flow Measurement Data Collection

Delta Lake Irrigation District has been contracted to perform the task of manual meter information collection. This task was completed in early 2008 and the contract with Delta Lake Irrigation District was not renewed. The data collected from this task will be used to aid in developing guidelines for irrigation metering programs along with a cost and efficacy comparison to automated metering.

In the fall of 2009 Harlingen Irrigation District will continue with the manual meter automatic meter comparison. The District will designate a large area of the District to meter the water deliveries using propeller meters and an employee designated to read the meters. This same area will have adequate automatic metering in place to compare to the manual method. Once we have complete two growing seasons, the District should have enough data collected and combined with the data collected in Delta Lake ID in 2006 and 2007 be able to effectively compare the two methods of metering.

Economic Evaluation of Demonstrated Technologies

A significant component of the demonstration project is the economic evaluation of each on farm technology. The District contracted Texas AgriLife Extension service to perform this task through its FARM Assist program. Economic summaries of each site are included in the Demonstration Site Summary Report for sites that economic analysis has been completed.

Activities and continual progress regarding the FARM Assistance task of the ADI project of the Harlingen Irrigation District revolves around two primary objectives. The first is collaborating with project management team and coordinating the FARM Assistance program into the project concepts, including participation in management team meetings, planning sessions, producer meetings, and contributions to project promotional materials. Extension faculty also supported the overall project effort of recruiting project demonstrators. The second

objective is the completion of the economic analysis for project demonstrations. Economic analyses for individual demonstrators range from conducting an evaluation of the site demonstration to providing the complete FARM Assistance strategic analysis service for the demonstration participant.

An overall economic summary of 2008 FARM Assistance activities are provided, including outreach and education publications produced. Summaries of each 2008 demonstration site analysis are included in the 2008 Site Summary Report.

Texas AgriLife Extension Service's Financial and Risk Management Assistance (FARM Assistance) program has been working directly with ADI cooperators in the Lower Rio Grande Valley. FARM Assistance conducts economic evaluations demonstrating the financial benefit and/or viability of water conservation practices on the farming operations. Additionally, individual cooperators are provided FARM Assistance planning services for their entire operation, demonstrating the value of long-range financial planning to the farm manager. One ADI cooperator indicated, "The FARM Assistance program has been an excellent tool in helping me evaluate the direction I need to proceed with my farm operation."

FARM Assistance specialists completed 10 whole-farm and 21 demonstration site analyses for 10 ADI participants in the 2008-2009 project period. One surge vs. flood grain sorghum site was excluded due to crop loss from hurricane Dolly. Individual studies have included irrigated cotton, corn, grain sorghum, sugarcane, vegetables, onions, citrus, and other crops, and have demonstrated furrow, surge, drip, micro-jet, flood, and narrow-border flood irrigation methods.

Economic analyses of the 2008 demonstrations reflect some differences in the financial outlook for surge, drip, micro-jet spray (citrus) and narrow border flood (citrus) irrigation technology compared to traditional furrow and flood irrigation. These demonstrations have shown the potential for water savings but, under current "per event" pricing structures, water savings do not necessarily translate into cost savings for producers. While the FARM Assistance analyses indicate limited existing economic incentives for adoption of conservation practices, these demonstrations clearly illustrate the value of water saving methods under conditions of limited water availability and/or volume pricing.

FARM Assistance completed 2 publications and one poster in outreach and education efforts. The first publication was *Focus* Series 2008-5, *1-Line Drip and Micro-Jet Spray Irrigation Illustration for Rio Red Grapefruit in the Lower Rio Grande Valley*, was published in July 2008. The second was *Focus* Series 2008-6, *2-Line Drip and Micro-Jet Spray Irrigation Illustration for Rio Red Grapefruit in the Lower Rio Grande Valley*, was also published in July 2008. A poster, *Evaluating Alternative Irrigation Systems and Water Pricing in Rio Red Grapefruit Production in the Lower Rio Grande Valley*, was presented at the 2009 Annual Meeting of the Southern Agricultural Economics Association, February 1-3, 2009, in Atlanta, Georgia.

Demonstration of Internet Based Information Real-Time Flow, Weather, and Water User Accounting System

The bulk of this task is being performed by Axiom-Blair Engineering. The design and launch of the District's web page occurred in September of 2005. The web page allows us to publish information regarding demonstration sites as well as weather and irrigation water usage. A water order tracking page has been added to the Districts web site and we are working on tying water tickets to on-farm meters.

This past year we continued to develop the web pages for our canal riders to give them the ability to monitor specific areas of the irrigation delivery system. These pages were developed to be accessible with the mobile phones issued to the canal rider or through a traditional web browser. These pages contain river level, main canal level, canal flow at all of our metering bridges as well as river pump and re-lift pump flow amounts. The District purchased laptop computers for the canal riders. The laptops enable the canal riders to have up-to-date information about the canal delivery system in their vehicles as well as their mobile phones. Along with making this information available to mobile stations the District has been working on a large display system to provide up to date water orders and delivery status in the District main office. This system will consist of a large wall mounted computer monitor that will display a map of the district with subdivision block lines and all information pertaining to each block. As irrigation water is ordered the block will illuminate and produce an overall picture of irrigation orders and pump demands. The delivery status will be updated daily providing a more comprehensive picture of the Districts water needs.

The District continues to work to bring the water user information to the internet. This year great strides were made to migrate the water ticket database from the Districts main water accounting system to the internet and make it usable to the grower. While this continues to be challenging, we feel confident that by the end of the 2009 contract year we should be able to provide this service to our growers.

Drip and Furrow Flood Irrigation in Annual Crops and Multi Year Crops

Texas A&M University-Kingsville Citrus Center and Texas AgriLife Research and Extension at Weslaco have teamed together to establish various water conservation demonstration sites throughout the Lower Rio Grande Valley (LRGV). The project managers (Dr. Shad Nelson, TAMU-Kingsville and Dr. Juan Enciso, TAES, Weslaco) have made contact with 20 growers/collaborators in the Valley to monitor on farm irrigation at different demonstration sites. These sites encompass a variety of crops including, but not limited to young and mature citrus (grapefruit, orange and tangerine), onions, sugarcane, cotton and turfgrass. Irrigation practices to grow these crops are flood, polypipe furrow/flood, bordered flood, drip, microjet spray and overhead sprinkler.

Current aim this past year has been to continue previously established demonstration sites with collaborators/growers in the LRGV to monitor water use and crop production over a long several consecutive growing seasons. Although initial approval for this work started in 2004, establishment of on-farm demonstration sites took significant planning and work in 2004-05.

Demonstration sites were initiated in late spring to early summer 2005 where initial cooperation was challenging among growers in the Valley. After several months of developing relationships of trust with Valley growers that informal discussion resulted in more firm collaborative commitments. By the end of 2006 we had 14 committed growers as willing participants to collaborate with us in on-farm water conservation demonstration sites. Many of these sites have more than one cropping system for monitoring.

Our initial goals for demonstration sites was not to redirect the water management practices of the growers, so that we could establish a "baseline" data base that best represents current water use in the Valley. The baseline data will be used to evaluate water consumption per cropping system and irrigation method. It is projected that this collection of baseline data will continue through Project Year 6 (2010). To assist in monitoring water use and crop water consumption each grower's field site has been equipped with soil moisture sensors with real-time automatic data logging units. On-site rain gauges are also installed and attached to data logging equipment for determination of annual rainfall and for verification of when irrigation events occurred versus rain events. We have found the rain gauges to be unreliable during high wind and rain events (like during Hurricane Dolly in 2008), and during these times it is better for us to utilize weather station data that is close to the grower's field site.

This past year marks 4 years of data collection that will be compiled and compared with all irrigation methods currently used in the LRGV. Publications and future comparisons will include bordered flood vs. traditional and traditional vs. new alternative irrigation methods, i.e., microjet, drip irrigation, dual drip irrigation and stress irrigation methods. Comparing yields with each type of irrigation system may also be compared utilizing on-farm projections supplied by ADI.

As of April 2009 some growers have Citrus yield results back from the packing sheds, however, due to Hurricane Dolly harvest damage to fruit many growers still have fruit on their trees and may not expend resources to harvest the fruit at all this season. For this reason, best estimates were used in the 2008-09 report that projects yields based on current 2009 yields obtained by packing shed and past yields. Some of the Lower Rio Grande citrus producers have done early picks of Rio Red grapefruit for early markets. Most of our collaborators have irrigation water use data and these amounts have been reported here.

Rainfall during 2008 peaked during hurricane season with Hurricane Dolly with a large volume of rain falling between the months of June through September. On-site rain gauges during the force of the hurricane gave erroneous readings due to the wind-blown rain and high wind gust buffeting the galvanized pipe supports. Citrus crop losses were estimated between 10 to 50 percent depending on location within the Lower Rio Grande Valley. Rainfall nearly ceased Valley wide after September 2008. Total rainfall during the majority of the Citrus growing season for 2008-09 ranged from 26-29 inches.

Equipment used for soil moisture collection and tipping bucket rain gauges has fared well for the past year. Changes implemented were to replace ¾ inch diameter galvanized pipe supports with 1 inch diameter pipe to help stabilize rain gauges in the orchards. Decagon equipment measuring the dielectric constant of the soil to find the volumetric water content is performing well with minimum failures of sensors or data loggers. Only one data logger from Decagon has failed and some sensors since the original installation.

At most sites there are two types of soil moisture sensor set-ups. Decagon and Irrometer or Watchdog Data loggers coupled with Watermark sensors. Watermark sensors are comprised of a granular matrix material that converts electrical resistance to a calibrated reading of centibars or kilopascals (kPa), providing a relationship to soil water tension. The relative low cost of the Watermark sensors and Irrometer data logging unit and the ease of farmers to read real-time data at the push of a button in the field have made these a preferred and resourceful tool to our collaborating growers.

A new demonstration site was initiated in the 2008-2009 season with collaborator # 4 and includes a traditional flood Rio Red grapefruit plot. This 40 acre block has similar soil properties as the collaborator's microjet and drip irrigation blocks. This is the first location where we have three types of irrigation practices with one soil type. In addition, evaluation of dual-line drip verses single-line drip continues with collaborator #28 under the direction of Dr. Juan Enciso and Xavier Pieres of Texas Agrilife Research. Three Irrometer data logger stations with 7 sensors per station were set up in a pattern to better evaluate the wetting front in soil and under the tree canopy. Soil moisture measurements focus on the 12 inch soil depth where the majority of feeder roots take up water due to a higher root density.

Water Savings:

Comparison of water use from traditional flood irrigation to alternative irrigation practices, such as narrow border-flood, micro-jet spray, and drip irrigation, exhibited water savings in each case. The table below illustrates this savings each year for utilizing these practices over traditional or conventional irrigation practices.

Practice	*Average Annual Water Use in ac/ft*	*Annual Savings compared to flood irrigation in ac/ft*
Traditional Flood	3.65	0
Border Flood	2.76	.84
Micro-jet Spray	2.3	1.28
Drip	1.9	1.61

In respect to the total citrus industry in the LRGV consisting of 28,000 acres; if every acre implemented these alternative irrigation practices we could see a water savings of:

Narrow-Border Flood: 23,520 Acre-ft Saved Annually
Micro-Jet Spray: 35,840 Acre-ft Saved Annually
Drip Irrigation: 45,080 Acre-ft Saved Annually

These results are from the averages of 3 growing seasons of data acquired from all Citrus collaborators for the 2008-09 growing season.

Benefits from These Efforts:

The most promising information from the Texas Water Development Board and Harlingen Irrigation District's (ADI) Agricultural Water Conservation Demonstration Initiative project is as follows:

1. Water can be saved using low-water use systems (Spray and Drip) for those growers interested in investing in these systems and anticipate future Rio Grande River water restrictions during periods of drought or increased water demand from municipal use.
2. For growers not interested in spending money on low-water use systems, a significant amount of water can still be saved by changing a simple cultural field practice by raising border between citrus tree rows (Narrow-Border Flood) to increase the rate at which water travels down the length of the field.
3. All four irrigation methods produce good citrus yields and growers are making money utilizing alternative irrigation methods besides the conventionally established large-pan flood irrigation method.

A 5 year evaluation of bark-chip compost as a potential water conserving practice has demonstrated that soil moisture content is higher on average under composted than non-composted citrus trees. In the five-year research study, results showed increased citrus root growth near the soil within the first year after application. Furthermore, by the second year after compost application 'Rio Red' grapefruit yields on average from compost-treated trees exceeded that of non-composted trees. Increased yields from compost-treated trees continued to exceed that from non-composted trees for another three subsequent years.

The impact of these findings to citrus growers in the LRGV is that incorporation of compost can improve soil physical properties, conserve soil moisture during periods of drought, and potentially improve profits through higher average yields.

Surge, Automated Surface, and Precision Surface Irrigation

The District has maintained the following demonstration sites throughout the 2008 growing season; 3 surge, and 2 surface flood. Surge irrigation continues to be a promising irrigation practice for selected areas of the District. Some farmers find the added management required to operate the surge valve to be tedious but have found ways to implement the irrigation practice on their farm none the less. The large permanently installed surge valve that was developed by the District is still in operation and proves to be very effective at saving water in its application.

Due to Hurricane Dolly much of the data collected on the sites was compromised. Dolly delivered over sixty inches of rain water at the time of harvest for our sites. Because of this many of our sites will not have complete data. We will continue to monitor these sites through the next growing season.

Figure 1 Large surge valve developed by HID

LESA/LPIC/LEPA Center Pivot Sprinkler Demonstration Sites

Harlingen Irrigation District contracted with Texas Cooperative Extension to maintain and collect data on sprinkler systems in the Rio Grande Valley. The contract allowed for the hiring of one person to maintain and collect data on four demonstration sites. Xavier Peries has been working in this position for the 2008 growing season and will continue through the 2009 growing season.

Irrigation uniformities and energy costs are being evaluated for center pivots and side rolls. Flexibility on the irrigation network is being analyzed for these irrigation systems.

Several pastures and turf production farms combine flood with sprinkler irrigation to conserve water, increase pasture quality and reduce costs. Irrigation evaluations were conducted in three farms. Farmers were provided with a chart that explained the water needed in the soil according to the readings of his Watermark sensors and his application rates. Farmers were able to conserve approximately.7 ac-ft/yr per acre because they were able to match his application to the water demand as measured with soil water sensors which had been previously calibrated in the lab for each soil type.

Automated and Manual On-Farm Measurements Systems

The District has installed a multi-million dollar automated meter and telemetry system, funded through a U.S. Bureau of Reclamation Water Conservation Project, that allows for the monitoring and reporting of all water deliveries in the District. Upon completion of this installation in late 2006 the District began monitoring and reporting flows for evaluation purposes. Real time flow data has been made available to growers on the District's web site. The cost and efficacy of the automated collection of flow data within the District will be compared to the manual collection taking place in the "On-Farm Flow Measurement Data Collection" task. This evaluation is expected to take place over several years and the results of this evaluation are not expected to be available until the evaluation process is complete.

Variable Speed Pump Control and Optimization of Delivery of On-Farm Demands

Delta Lake Irrigation District has installed three diesel driven pumps to supply water to a service canal. As part of their revised 2006 contract, Delta Lake Irrigation District will provide the hardware and Harlingen Irrigation District has contracted Axiom-Blair to provide engineering and design for the variable speed and control component of this project. The installation of the variable speed controllers is complete and in the testing phase of the project.

Figure 2 Variable Speed Controller SCADA and Radio Unit

Figure 3 Variable speed controller components installed on the pumps

Field Demonstrations of Projects/ Field Days

In June of 2008 ADI conducted a tour of the demonstration sites with TWDB personnel and ADI advisory committee members. The tour visited all of the demonstration sites in Cameron County and multiple sites in Hidalgo County. This tour gave everyone involved a chance to visit with the grower and learn the methods he uses to conserve water on his farm. The tour concluded with a lunch hosted by Harlingen Irrigation District.

Figure 4 Booth at RGV Irrigation Conference

The ADI staff participated in the Rio Grande Valley Irrigation Conference in October. The conference put on by Texas AgriLife Extension Service gave ADI personnel an opportunity to talk to visitors about water scheduling and soil moisture monitoring as well as showcase the irrigation technologies that are demonstrated through the ADI project.

As part of our cooperative agreement with Texas AgriLife extension Service and Juan Enciso irrigation scheduling demonstrations were conducted on two (28 and 34) of the ADI sites. The knowledge and use of irrigation scheduling with soil water sensors such as Watermark sensors was transferred through demonstration to the farmers. The sensors improved irrigation management on several farms by guiding farmers in the frequency of watering and the amount of time of the irrigation. Looking at the moisture status at various depths once or twice a week helped them avoid infrequent and heavy irrigation. A farmer explained that “the sensor he installed at 18-inch profile depth was too wet while most roots were in the upper profile; therefore he was wasting water.” Farmers with drip irrigation are irrigating more often (twice a week) but with shorter times. Farmers have increased their yields. In citrus, Rio Red farmers are increasing their yields from 20-22 tons/acre to 28-30 tons/acre. There are about 28,000 acres of irrigated citrus in the Lower Rio Grande Valley. We had demonstrations in approximately 2,000 acres of citrus and about 4 inches of water were conserved during the season on these demonstrations by using irrigation scheduling. There is potential to conserve more water as more farmers adopt this technology. There is a potential to conserve about 9400 ac-ft by improving the scheduling of irrigation on citrus.

Cotton and corn farmers were able to apply irrigation when it was most needed. By placing soil moisture sensors (Watermark or capacitance probes) at different depths into soil profile, and by monitoring the available water left to the plant, they avoid over-irrigating (waste of water and money, leaching or run-off of nutrients) or stress. Irrigation scheduling saves an average of 4 to 6 in/ac on row crops and can lead to a huge water potential savings of 104,000 ac-ft valley wide.

Workshops

Harlingen Irrigation District hosted an information workshop about the Texas Agricultural Technical Assistance Program October 30th at the Palm Air in Weslaco, TX. The Texas Agricultural Technical Assistance Program is a new project overseen by the Texas Comptroller of Public Accounts, State Energy Conservation Office (SECO). This program will provide the agricultural producers of Texas with the technical assistance they need to make cost-effective, energy efficient choices. SECO is working with EnSave Inc. to deliver this program to the agriculture and ranching industry. SECO helps Texas make the most of domestic energy by reducing state and local government energy costs and promoting cost effective, clean energy technologies. SECO is committed to supporting the American agricultural sector by providing agricultural producers with cost-effective solutions for reducing operating costs while saving energy. Lunch was provided following the workshop.

Presentations at Water Conservation Meetings

The ADI project manager was invited to speak at the 2008 Border Water Infrastructure Conference Two nations, one border; two international rivers - the Colorado and the Rio Grande - were the focus of a May 2008 conference on the prospect of cooperative bi-national approaches to solving water infrastructure needs. The 1-1/2 day conference was sponsored by the Water Education Foundation and the California Department of Water Resources. The conference included topics such as: Infrastructure and Funding Needs Overview, Border-area Population Growth and Demographics, Emerging Opportunities for Bi-national Cooperation, Project Examples: Conveyance Improvement, Agricultural Water Use Efficiency and Desalination, Tools for Meeting Future Urban Needs, Evaluating Past Infrastructure Assessments.

The ADI project holds a quarterly progress meeting at the beginning of each quarter. Reports of progress on the demonstration projects are made by each subcontractor and questions concerning all aspects of the project are discussed. Local growers are invited to attend and encouraged to ask questions and offer insight to the water issues in the Rio Grande Valley.

The District has published two newsletters highlighting the Agricultural Water Conservation Demonstration Initiative and related topics. This news letter has been distributed to over seven hundred recipients across the state of Texas. Our goal is to publish the newsletter on a quarterly basis and use it as one of the conduits for disseminating information to the growers of the Rio Grande Valley as well as other interested parties across the state.

Extension Publications:

Young, M., Klose, S.L., Kasse, G., Nelson, S., Enciso, J. and Jupe, M. (2008). *2-line drip and micro-jet spray irrigation illustration for Rio Red grapefruit in the Lower Rio Grande Valley*. (FARM Assistance Focus 2008-6 pp. 1-3). Texas A&M AgriLife Extension.

Young, M., Klose, S.L., Kasse, G., Nelson, S., Enciso, J. and Jupe, M. (2008). *1-line drip and micro-jet spray irrigation illustration for Rio Red grapefruit in the Lower Rio Grande Valley.* (FARM Assistance Focus 2008-5. pp. 1-3). Texas A&M AgriLife Extension.

Enciso, J., Sauls, J.W., Wiedenfeld, R.P. and Nelson, S.D. (2008). *Impacts of irrigation on citrus in the Lower Rio Grande Valley*. (Publication B-6205, pp 14).Texas A&M System AgriLIFE Extension.

Presentations at Professional Meetings by TAMUK personnel:

On October 29, 2008, H. Esquivel and Dr. Nelson presented a poster at the Rio Grande Valley Irrigation conference on the ADI project. Title: *Water savings with on-farm citrus irrigation practices in Lower Rio Grande Valley.*

On October 26-30, 2008. Dr. Nelson presented an oral presentation in Wuhan, China focused on on-farm irrigation results from the ADI project and citrus irrigation. Nelson, S.D., H. Esquivel, R. Uckoo, X. Peries and J. Enciso. 2008. Titled *Using Alternative Irrigation and Water Monitoring Technologies for Improving On-Farm Water Conservation in South Texas Citrus Production*. 11th International Citrus Congress.

On November 30, 2008. Dr. Nelson had a journal article accepted for publication. Nelson, S.D., R.M. Uckoo, H. Esquivel, J.M. Enciso, and K. Jones. 2008. *Compost effects in 'Rio Red' grapefruit production on a heavy textured soil*. *Dynamic Soil, Dynamic Plant*. 2:(In Press).

Nelson, S.D., Esquivel, H., Uckoo, R., Peries, X. & Enciso, J. (2008, October). *Using Alternative Irrigation and Water Monitoring Technologies for Improving On-Farm Water Conservation in South Texas Citrus Production.* Presentation at the 11th International Citrus Congress. Wuhan, China.

Nelson, S.D. (2008, September). *Fertilization and composting impacts on citrus production.* Presentation at a Texas Ag Industries Association, Rio Grande Valley Regional Meeting, Edinburg, TX

Nelson, S.D. (2008, November). *ADI and RGBI progress on water conservation and composting in citrus production.* Presentation at a Citrus Advisory Committee Meeting, Weslaco, TX

Quarterly Progress Report

Harlingen Irrigation District has completed and filed three quarterly progress reports and associated reimbursement requests.

Program Administrative Work

Harlingen Irrigation District has maintained the accounting records and files for the ADI project. The project's primary administration is handled by Tom McLemore the Project Manager and the ADI Secretary Heather Jones. Together, with the Irrigation District's General Manger Wayne Halbert, we have issued and maintained subcontracts with Texas A&M University - Kingsville, Delta Lake Irrigation District, Texas Cooperative Extension and Axiom-Blair Engineering.

Report Preparation, Reproduction, and Distribution

The district has completed and filed three quarterly progress reports and the respective reimbursement request. In mid 2008 the District at the request of the Texas Water Development Board wrote and published a three year report of the ADI project. This report was completed with the aid of Water PR, an agricultural public relations and communications firm. The District has also completed their fourth annual report, reproduced and filed it with the Texas Water Development Board.

Financial Report by Task

Expense Item	Revised Budget	3rd Qtr 2008	4th Qtr 2008	1st Qtr 2009	2nd Qtr 2009	2008/2009
Salary	$ 844,600.00	$ 28,288.00	$ 25,644.00	$ 13,879.00	$ 21,271.00	$ 89,082.00
Fringe	$ 168,920.00	$ 7,534.47	$ 6,613.65	$ 2,366.70	$ 4,665.52	$ 21,180.34
Travel	$ 30,000.00	$ 502.89	$ 507.86	$ -	$ 26.91	$ 1,037.66
Expendable Supplies	$ 195,400.00	$ 975.25	$ 1,026.78	$ 646.26	$ 5,932.70	$ 8,580.99
Capital Equipment	$ 290,000.00	$ 112.57	$ -	$ -	$ -	$ 112.57
Subcontracting Services	$ 1,988,405.00	$ 66,568.35	$ 16,821.17	$ 57,206.95	$ 36,443.15	$ 177,039.62
Construction	$ 225,000.00			$ -	$ -	$ -
Reproduction	$ 32,900.00			$ 2,269.17	$ 176.37	$ 2,445.54
Totals	**$ 3,775,225.00**	**$ 103,981.53**	**$ 50,613.46**	**$ 76,368.08**	**$ 68,515.65**	**$ 299,478.72**
Quarters	**$ 40.00**					

Task Expenses	Task Budget	3rd Qtr 2008	4th Qtr 2008	1st Qtr 2009	2nd Qtr 2009	
Task A	**$ 114,000.00**	$ 841.28	$ 854.00	$ -	$ -	$ 1,695.27
Task B	**$ 1,538,050.00**	$ 19,050.55	$ 20,321.15	$ 14,522.95	$ 8,902.18	$ 62,796.82
Task C	**$ 837,695.00**	$ 73,510.21	$ 21,898.24	$ 55,746.41	$ 45,574.83	$ 196,729.69
Task D	**$ 548,700.00**	$ 841.28	$ 998.76	$ 220.00	$ -	$ 2,060.03
Task E	**$ 736,780.00**	$ 9,738.22	$ 6,541.32	$ 5,878.72	$ 14,038.64	$ 36,196.90
Totals	**$ 3,775,225.00**	**$ 103,981.53**	**$ 50,613.46**	**$ 76,368.08**	**$ 68,515.65**	**$ 299,478.72**

Below is a list of supporting funds by task provided by the Harlingen Irrigation District. These funds are off budget matching funds provided by the District to support the ADI project.

District Matching Funds by Task

March 2008 through February 2009

District Expence (ADI)		
Task A - Project Subcontracting	$	375.00
Task B - Tech Management Support for Demo	$	6,539.10
Task C - Demonstration Projects	$	37,710.76
Task D - Public Field Day and Demo	$	1,278.14
Task E - Project Admin and Report Prep.	$	1,197.06
Total District Expence (ADI)	**$**	**47,100.06**

Additional External Grant Funds

The following is a list of additional external grant funds that support the ADI project. These funds are brought to the project through our cooperation with Texas A&M Kingsville.

$296,000

Increasing Student Learning and Career Development Through Agricultural and Natural Resources Based Research. Hispanic Serving Institutions grants. USDA/CSREES Award # 2006-38422-17008. PI: S.D. Nelson, Co-PIs: J.C. Laurenz, R.L. Stanko, T.L. McGehee. July 2006-June 2009.

$ 30,000

Effects of Water Stress on the Efficacy of Selected Pesticides in Citrus Pest Management. TAMU-Kingsville Research Development Funds, University Research Grant Award. PI: M. Setamou, CoPI: S.D. Nelson. Sept. 1, 2007-Aug. 15, 2008.

$ 21,000

Bayer Crop Science. Effects of Water Stress on the Efficacy of Temik and Effectiveness of Selected Bayer Products. PI: M. Setamou, CoPI: S.D. Nelson. April 2008-March 2009.

$ 30,000

USDA/CSREES Rio Grande Basin Initiative Grant. Effects of Water Deficit Irrigation on the Efficacy of Pesticides in Citrus Pest Management. PI: S.D. Nelson, Co-PI: M. Setamou. June 2008-May 2009.

$ 7,000

Texas Citrus Producers Board. PI: S.D. Nelson, Co-PI: M. Setamou, H. Esquivel. Sept. 2008-Aug 2009. Approach for a Sustainable Organic System for Organic Farming in the LRGV.

Harlingen Irrigation District
Agricultural Water Conservation Demonstration Initiative

HID, TAMUK, TCE Combined
Demonstration Site Summaries
For the 2008-2009 Growing Season

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HARLINGEN IRRIGATION DISTRICT
CAMERON COUNTY #1

TEXAS A&M UNIVERSITY KINGSVILLE

FARM Assistance
Helping Agriculture Make Informed Decisions

AgriLIFE EXTENSION
Texas A&M System

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Site Summary Introduction

The following pages contain summaries of the demonstration sites maintained by all entities involved in the Agricultural Water Conservation Demonstration Initiative. Each site is designated by a site number, these site designations were developed to maintain the anonymity of the producers involved in the program. The first digit is the entity responsible for gathering data from the site, the second digit is the producer, and the third digit is a letter designating the field within the site. Site numbers beginning with "0" or "1" are maintained by Texas A&M University-Kingsville under the direction of Dr. Shad Nelson. Site numbers beginning with "2" or "3" are maintained by Texas A&M Extension Center under the direction of Dr. Juan Enciso. The sites beginning with "4" or "5" are maintained by Harlingen Irrigation District under the direction of Danny Allen. The economic summaries are provided by Texas A&M Extension FARM Assistance under the direction of Dr. Steven Klose and Mac Young.

Many of our sites were negatively affected by hurricane Dolly. Because of this some of the data is missing. The missing data is notated in individual site descriptions.

Site: #01A – 2008-2009

Site Description:

Acres: 50
Soil type: clay loam 0-6 inches, sandy clay loam 6-36 inches
Field characteristics: 15’ x 24’ spacing (115 trees/Acre)
Crop variety: Rio Red grapefruit
Harvest season: Feb 08-Mar 09
Irrigation district: None-Class B water owner
Irrigation system: Narrow bordered flood, polypipe

Fertilizer applied:

Mar ’08: 5 gals/ac and June ’08 5 gals/ac foliar spray 12-24-12; Aug ’08: 6 gals/ac N-32; Feb/Mar ’09: 300 lbs/ac 21-0-0-24

Sensor information:

Soil moisture: Decagon data logger EM-50, ECHO-10 probes, Probes set at 6”, 12”, and 24” depths; and 10 inch Turbine-type flow meter.

Irrigation schedule and amounts:

Total irrigation:	31.58 ac/in
Total rainfall:	26.40 in
Total water input:	57.98 ac/in

Irrigation method:

Farmer uses 12” concrete outlet valve and attaches turbine meter to valve and poly-pipe. Farmer waters only directly under the canopy (root zone) by using raised berms in between rows (Grapefruit). Farmer reforms raised berms after each harvest in order to channel water at a faster rate to the end of the bed as a potential water conserving irrigation method for flood irrigating mature citrus.

Observations made during the crop season:

Heavy rainfall during months of June through September ; Hurricane Dolly, July 23.

Yield:

20.0 Ton/ac

Water use summary:

IUE: 1,285 lb/ac.in.
WUE: 696 lb/ac.in.

Economic Summary: Demonstration Site 1A

The Demonstration Site 1A analysis consists of a 10-year financial outlook (2008-2017) for the 50 acres of Rio Red grapefruit under narrow border flood irrigation. The orchard was

assumed to have mature trees. The Rio Red grapefruit price is held constant at $155/ton. 2008 producer costs and overhead charges are producer estimated rates.

Total cash receipts average $3,880/acre over the 10-year period and cash costs average $1,753/acre, including $200/acre irrigation costs. Net cash farm income (NCFI) averages $2,127/acre due largely to the price being held at a constant $155/ton. The risk associated with prices and yields suggests some chance of negative NCFI. In a normal production year, NCFI could range as much as -$20/acre to $4,380/acre.

Site: #01B – 2008-2009

Site Description:

Acres: 15.0
Soil type: clay loam 0-18 inches, loam 18-36 inches
Crop variety: Valencia oranges
Field characteristics: 15’ x 23’ spacing (124 trees/Acre)
Harvest season: Feb 08-Mar 09
Irrigation district: None-Class B water owner
Irrigation system: Narrow border flood, polypipe

Fertilizer applied:

Mar ’08: 5 gals/ac and June ’08 5 gals/ac foliar spray 12-24-12; Oct’08: 6 gals/ac N-32; Feb/Mar ’09: 300 lbs/ac 21-0-0-24

Sensor information:

No soil moisture sensors for Valencia orchards. Turbine-type flow meter

Irrigation schedule and amounts:

Total irrigation: 29.28 ac.in
Total rainfall: 26.40 in.
Total water input: 55.68 ac.in

Irrigation method:

Farmer uses 12” concrete outlet valve and attaches turbine meter to valve and poly-pipe. Farmer waters only directly under the canopy (root zone) by using raised berms in between rows (Oranges/Grapefruit). Farmer reforms raised berms after each harvest in order to channel water at a faster rate to the end of the bed as a potential water conserving irrigation method for flood irrigating mature citrus.

Observations made during the crop season:

Valencia oranges are located in same irrigation block as Rio red grapefruit site #01C with similar soil characteristics.

Yield:

11.7 Ton/ac

Water use summary:

IUE: 917 lb/ac.in.
WUE: 450 lb/ac.in.

Economic Summary: Demonstration Site 01B

The Demonstration Site 1B analysis consists of a 10-year financial outlook (2008-2017) for the 15 acres of Valencia oranges under narrow border flood irrigation. The orchard was assumed to be six years old. The Valencia orange price is held constant at $110/ton. 2008 production costs and overhead charges are producer estimated rates.

Total cash receipts average $1,649/acre over the 10-year period and cash costs average $1,684/acre, including $200/acre irrigation costs. Net cash farm income (NCFI) averages approximately -$35/acre due largely to the price being held at a constant $110/ton and increasing yields through 2009 as trees mature. The risk associated with prices and yields suggests a 56% chance of negative NCFI. In a normal production year, NCFI could range as much as -$867/acre to $3,867/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 53% in 2008 and then declines to only 48% or less in 2017.

Site: #01C- 2008-2009

Site Description:

Acres: 85.0
Soil type: clay loam 0-18 inches, loam 18-36 inches
Crop variety: Rio Red grapefruit
Harvest season: Feb 08-Mar 09
Field characteristics: 15' x 24' spacing (115 trees/Acre)
Irrigation district: None-Class B water owner
Irrigation system: Narrow bordered flood, polypipe

Fertilizer applied:

Mar '08: 5 gals/ac and June '08 5 gals/ac foliar spray 12-24-12; Oct'08: 6 gals/ac N-32; Feb/Mar '09: 300 lbs/ac 21-0-0-24

Sensor information:

Soil moisture: Decagon data logger EM-50, ECHO-10 probes, Probes set at 6", 12", and 24" depths; and Davis Instruments Rain gauge located on adjacent Site #01C. Watchdog datalogger and Watermark sensors placed at same depths. Turbine-type flow meter

Irrigation schedule and amounts:

Total irrigation: 29.28 ac.in
Total rainfall: 26.40 in.
Total water input: 55.68 ac.in

Irrigation method:

Farmer uses 12" concrete outlet valve and attaches turbine meter to valve and poly-pipe. Farmer waters only directly under the canopy (root zone) by using raised berms in between rows (Grapefruit). Farmer reforms raised berms after each harvest in order to channel water at a faster rate to the end of the bed as a potential water conserving irrigation method for flood irrigating mature citrus.

Observations made during the crop season:

Hurricane Dolly did not seem to drastically reduce Rio Red grapefruit yields

Yield:

22.6 Ton/ac

Water use summary:

IUE: 1,778 lb/ac.in.
WUE: 872 lb/ac.in.

Economic Summary: Demonstration Site 1C

The Demonstration Site 1C analysis consists of a 10-year financial outlook (2008-2017) for the 85 acres of Rio Red grapefruit production under narrow border flood irrigation. The orchard was assumed to be 7 years old. The Rio Red grapefruit price is held constant at $155/ton. 2008 production costs and overhead charges are producer estimated rates.

Total cash receipts average $3,880/acre over the 10-year period and cash costs average $1,753/acre, including $200/acre irrigation costs. Net cash farm income (NCFI) averages $2,127/acre due largely to the price being held at a constant $155/ton and increasing yields from maturing trees. The risks associated with prices and yields suggest some chance of negative NCFI. In a normal year, NCFI could range from -$23/acre to $4,553/acre.

Site: #01G – 2008-2009

Site Description:

Acres: 33.0 (23 ac. yellow, 5 ac. white, 5 ac. red onions)
Soil characteristics: Rio Grande silt loam, Loam at 6", 12" and 24" depths.
Crop variety: Yellow Onion (Cougar var.); White and Red onions
Irrigation district: None-Class B water owner
Field characteristics: Onions planted mid Oct '08, March harvested.
48 in. beds, 80 in. center-to-center; 6 onion lines per bed
Irrigation system: Furrow Irrigated

Fertilizer applied:

Oct '08: 50 gals/ac 15-10-5; Nov '08: 10 gals/ac 12-0-0-26

Soil moisture sensors:

6", 12" and 24" depths, Watermark sensors and Watchdog data logger for easy viewing of real time readings.

Irrigation schedule and amounts:

Total irrigation:	34.14 ac/in
Total rainfall:	0.30 inches (very little rain Oct. '08 to Mar. '09)
Total water input:	34.34 ac/in

Irrigation method:

Furrow irrigated by polypipe from 10" irrigation header

Observations made during the crop season:

None

Yield:

50 lb onion bags
Yellow onions: 22.5 Tons/ac (20,717 bags/23 ac)
White onions: 19.9 Tons/ac (3,986 bags/5 ac)
Red onions: 22.3 Tons/ac (4,461 bags/5 ac)

Water use summary:

Onion Type	IUE (lbs/in)	WUE (lbs/in)
Yellow	1,485	1,471
White	1,315	1,302
Red	1,471	1,457

Economic Summary: Demonstration Site 1G

The Demonstration Site 1G analysis consists of a 10-year financial outlook (2008-2017) for the 33 acres of onion production under furrow irrigation. Crop returns were assumed to be $1,000/acre in 2008 and $1,500/acre in 2009-2017. The low returns per acre in 2008 reflect increased production and over supply. 2008 production costs and overhead charges are producer estimated rates.

Total cash receipts average $1,454/acre over the 10-year period and cash costs average $1,209/acre, including $198/acre irrigation costs. Net cash farm income (NCFI) averages $244/acre due largely to crop revenue being held constant. The risks associated with prices and yields suggest a 24.7% chance of negative NCFI. In a normal production year, NCFI could range as much as -$466/acre to $700/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 87% in 2008 and then declines to 2%

Site: # 02A – 2008-2009

Site Description:

Acres: 14.0
Soil characteristics: sandy clay loam 0-24 inches, sandy clay 24-36 inches
Crop variety: Henderson grapefruit
Irrigation district: United
Field characteristics: 15’ x 24’ spacing (115 trees/Acre)
Irrigation system: Narrow bordered flood

Fertilizer applied:

Granular - 300lbs/ac 34-0-0-12 Fall; 150lbs/ac 34-0-0-12 Spring

Soil moisture sensors:

Decagon data logger EM-50, ECHO-10 probes, Watermark data logger and watermark sensor probes also set at 6, 12, 24 and depths;

Irrigation schedule and amounts:

Total irrigation: 36.00 ac.in.
Total rainfall: 28.28 inch
Total water input: 64.28 ac.in.

Irrigation method:

Watered 6 times throughout growing season, estimated 6 inch watering event per irrigation
Farmer reforms raised berms between rows to channel water at a faster rate to the end of the bed. Farmer uses 12” concrete outlet valve and we installed a 10-inch pipe with Siemens Transit-time meter installed in March 2007.

Yield:

17.3 Ton/ac

Water use summary:

IUE: 961 lb/ac.in
WUE: 538 lb/ac.in

Economic Summary:

The Demonstration Site 02A analysis consists of a 10-year financial outlook (2008-2017) for the 14 acres of Henderson grapefruit under border flood irrigation. The orchard trees were assumed to have mostly mature trees with some replanted trees reaching maturity over the next

few years. The Henderson grapefruit price is held constant at $162/ton. 2008 production costs and overhead charges are producer estimated rates.

Total cash receipts average $2,722/acre over the 10-year period and cash costs average $1,231/acre, including $135/acre variable irrigation costs in 2008. Net cash farm income (NCFI) averages $1,491/acre due largely to the price being held constant at $162/ton. The risk associated with prices and yields suggests some chance of negative NCFI. In a normal production year, NCFI could range as much as $1,357/acre to $1,643/acre plus or minus the expected NCFI for the site.

Site: # 02B – 2008-2009

Site Description:

Acres: 8.0
Soil characteristics: sandy clay loam 0-36”
Crop variety: Rio Red grapefruit
Irrigation district: United
Field characteristics: 15’ x 24’ spacing (115 trees/Acre)
Irrigation system: Microjet spray

Fertilizer applied:

Granular -300lbs/ac 34-0-0-12 Fall; 150lbs/ac 34-0-0-12 Spring

Soil moisture sensor monitoring:

Decagon data logger EM-50, ECHO-10 probes, Probes set at 6, 12, 24 and 36 inch depths; Watchdog Data logger and 6”, 12” and 24” watermark soil moisture sensors, Davis Instruments Rain gauge.

Water meter:

2 inch turbine meter installed at end of season in March 2007.

Irrigation schedule and amounts:

Total irrigation: 21.60 ac.in
Total rainfall: 28.28 inch
Total water input: 49.88 ac.in

Observations made during the crop season:

Heavy rains during June through September, 2008; due to rains irrigation above average is added to this block to help drain holding tank.

Yield:

19.1 Ton/ac

Water use summary:

IUE: 1,769 lbs/ac.in
WUE: 766 lbs/ac.in

Economic Summary: Demonstration Site 02B

The Demonstration Site 02B analysis consists of a 10-year financial outlook (2008-2017) for the 8 acres of Rio Red grapefruit under micro-jet spray irrigation. The orchard trees were assumed to have mostly mature trees with some replanted trees reaching maturity over the next two years. The Rio Red grapefruit price is held constant at $202/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a micro-jet spray system at a cost of $1,800 per acre. The micro-jet spray system expense is evenly distributed ($180/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $3,460/acre over the 10-year period and cash costs average $1,411/acre, including $135/acre irrigation costs in 2008. Net cash farm income (NCFI) averages $2,049/acre due largely to the price being held constant at $202/ton. The risk associated with prices and yields suggests some chance of negative NCFI. In a normal production year, NCFI could range as much as -$250/acre to $4,125/acre.

Site: # 02C – 2008-2009

Site Description:

Acres: 4.0
Soil characteristics: sandy clay loam 0-36 inches
Crop variety: Rio Red grapefruit
Irrigation district: United
Irrigation system: Drip Irrigation
Field characteristics: 15’ x 24’ spacing (115 trees/Acre)

Fertilizer applied:

Granular -300lbs/ac 34-0-0-12 Fall; 150lbs/ac 34-0-0-12 Spring

Soil moisture sensor monitoring:

No data sensor equipment installed, soil profile contains hard limestone and caliche deposits not allowing installation of watermark sensors on this block.

Irrigation schedule and amounts:

Total irrigation:	15.30 ac.in
Total rainfall:	28.28 inch
Total water input:	43.58 ac.in

Observations made during the crop season:

Installed 2 inch water meter in June ’07 to determine water delivered to drip irrigated acreage. (Note: Attempted to install soil moisture sensing equipment. Due to a heavy layer of thick caliche; no equipment was installed.)

Yield:

16.8 Ton/ac

Water use summary:

IUE: 2,198 lbs/ac.in
WUE: 771 lbs/ac.in

Economic Summary: Demonstration Site 02C

The Demonstration Site 02C analysis consists of a 10-year financial outlook (2008-2017) for the 4 acres of Ruby Red grapefruit under drip irrigation. The orchard trees were assumed to have mature trees. The Ruby Red grapefruit price is held constant at $162/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a drip system at a cost of $1,200 per acre. The drip system expense is evenly distributed ($120/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,593/acre over the 10-year period and cash costs average $1,358/acre, including $135/acre irrigation costs in 2008. Net cash farm income (NCFI) averages $1,235/acre due largely to the price being held constant at $162/ton. The risk associated with prices and yields suggests some chance of negative NCFI. In a normal production year, NCFI could range as much as -$1,000/acre to $4,500/acre.

Site # 03 A -2008-2009

Site Description:

Acres: 41.3
Soil characteristics: Sandy clay loam 0-36 inches
Crop variety: Rio Red grapefruit
Irrigation district: Harlingen 1
Irrigation system: Conventional Flood
Field characteristics: 15’ x 24’ spacing (115 trees/Acre)

Fertilizer applied:

Unknown

Soil moisture sensor monitoring:

Decagon data logger EM-50, ECHO-10 probes, Probes set at 6, 12, and 24 inch depths; Irrometer Watermark Data logger and Watermark soil moisture sensors at same depths; Davis Instruments Rain gauge.

Irrigation schedule and amounts:

Total irrigation:	24.00 ac.in
Total rainfall:	27.51 inch
Total water input:	50.51 ac.in

Observations made during the crop season:

This site is set up with high mounted (30”) freeze protection watering system. This system could be set up as drip or micro jet irrigation in the future.

Yield:

22.7 Ton/ac
(Estimated, fruit still on trees by late April and may not be picked this year due to Hurricane Dolly and poor market value not making this year worth harvesting)

Water use summary:

IUE: 1,892 lbs/ac.in
WUE: 899 lbs/ac.in

Site # 04 A – 2008-2009

Site Description:

Acres: 16.5
Soil characteristics: sandy clay loam 0-24 inches, clay 24-36 inches
Crop variety: Rio Red grapefruit
Irrigation district: Hidalgo 1
Irrigation system: Drip Irrigation
Field characteristics: 15’ x 24’ spacing (115 trees/Acre)

Fertilizer applied:

20 gal./ac. 7-21-0 & 5 gal./ac N-32

Soil moisture sensor monitoring:

Decagon data logger EM-50, ECHO-10 probes at 6, 12 and 24 inches. Also installed is an Irrometer data logger with 3 Watermark sensors also at 6, 12 and 24 inch depth under tree canopy and 12 inch sensor at drip line of canopy, Tipping bucket rain gauge.

Water meter:

Grower has own meters

Irrigation schedule and amounts:

Total irrigation:	19.05 ac.in
Total rainfall:	26.71 inch
Total water input:	45.76 ac.in

Irrigation method:

Single line Drip system; 5/8” polyethylene line with emitters every 48”

Observations made during the crop season:

Excessive rainfall amounts during months of June through September, including Hurricane Dolly July 23

Yield: 21.3 Ton/ac

(Estimated, fruit harvested in late April and waiting for final results from packing shed)

Water use summary:

IUE: 2,236 lbs/ac.in
WUE: 931 lbs/ac.in

Economic Summary: Demonstration Site 04A

The Demonstration Site 04A analysis consists of a 10-year financial outlook (2008-2017) for the 16 acres of Rio Red grapefruit under 1-line drip irrigation. The orchard was assumed to have mature trees. The Rio Red grapefruit price is held constant at $100/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a 1-line drip system at a cost of $1,500 per acre. The 1-line drip system expense is evenly distributed ($150/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,000/acre over the 10-year period and cash costs average $1,920/acre, including $68/acre irrigation costs in 2008. Net cash farm income (NCFI) averages $70/acre due largely to the price being held constant at $100/ton. The risk associated with prices and yields suggests some chance of negative NCFI. In a normal production year, NCFI could range as much as -$1,118/acre to $1,536/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 53% in 2008 and declines to only 30% in 2017.

Site # 04 B – 2008-2009

Site Description:

Acres: 30
Soil characteristics: clay loam, 0-6 inches, clay, 6 -36 inches
Crop variety: Rio Red grapefruit
Irrigation district: Hidalgo 1
Irrigation system: Microjet spray
Field characteristics: 15' x 24' spacing (115 trees/Acre)

Fertilizer applied:

20 gal./ac. 7-21-0 & 5 gal./ac N-32

Soil moisture sensor monitoring:

Decagon data logger EM-50, ECHO-10 probes at 6, 12 and 24 inches. Also installed is an Irrometer data logger with 3 Watermark sensors also at 6, 12 and 24 inch depth under tree canopy and 12 inch sensor at drip line of canopy; grower has own meters.

Irrigation schedule and amounts:

Total irrigation:	28.47 ac.in
Total rainfall:	26.71 inch
Total water input:	55.18 ac.in

Irrigation method:

Microjet spray system. Single riser with 360 degree rotation spray emitter placed at the middle between trees to minimize spray on tree trunk.

Observations made during the crop season:

Excessive rainfall amounts during months of June through September, including Hurricane Dolly July 23

Yield:

22.5 Ton/ac
(Estimated, fruit harvested in late April and waiting for final results from packing shed)

Water use summary:

IUE: 1,581 lbs/ac.in
WUE: 816 lbs/ac.in

Economic Summary: Demonstration Site 04B

The Demonstration Site 04B analysis consists of a 10-year financial outlook (2008-2017) for the 6 acres of Rio Red grapefruit under micro-jet spray irrigation. The orchard trees were assumed to have mature trees. The Rio Red grapefruit price is held constant at $100/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a micro-jet spray system at a cost of $2,500 per acre. The micro-jet spray system expense is evenly distributed ($250/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,000/acre over the 10-year period and cash costs average $1,800/acre, including $90.50/acre irrigation costs in 2008. Net cash farm income (NCFI) averages -$60/acre due largely to the pricing being held constant at $100/ton. The risk associated with prices and yields suggests significant chance of negative NCFI. In a normal production year and mature trees (2011-2015), NCFI could range as much as -$1,380/acre to $1,598/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 56% in 2008 and declines to only 50% in 2017.

Site: #04 C - 2008-2009

Site Description:

Acres: 40
Soil characteristics: clay loam, 0-6 inches, clay, 6 -36 inches
Crop variety: Rio Red grapefruit
Irrigation district: Hidalgo 1
Irrigation system: Traditional Flood
Field characteristics: 20’ x 25’ spacing (87 trees/Acre)

Fertilizer applied:

Unknown

Soil moisture sensor monitoring:

Irrometer data logger with 3 Watermark sensors set at 6, 12 and 24 inches under center of tree canopy

Irrigation schedule and amounts:

Total irrigation:	30.00 ac.in
Total rainfall:	26.71 inch
Total water input:	56.71 ac.in

Irrigation method:

Traditional flood with 5 rows per irrigation pan for Rio Red grapefruit

Observations made during the crop season:

Grapefruit trees hedged during 2008 season

Yield:

18.7 Ton/ac
(Estimated, fruit harvested in late April and waiting for final results from packing shed)

Water use summary:

IUE:	1,247 lbs/ac.in
WUE:	660 lbs/ac.in

Site: #05A – 2008-2009

Site Description:

Acres: 22.0
Soil characteristics: Clay
Crop variety: White Onion
Irrigation district: Delta Lake
Irrigation system: Sub-surface drip
Field characteristics: Onions planted early Oct ’08, and harvested mid Mar ’08; 60 inch beds, 18” emitter spacing with 6 onion lines per bed, rows spaced 7 inches apart.

Soil moisture monitoring:

Irrometer data logger with Watermark sensors; sensors set at depths 6-, 12-, and 24-inch bed center, and 6- and 12-inches at edge of bed.

Irrigation schedule and amounts:

Total irrigation: 17.94 ac.in
Total rainfall: 0.25 inch (little rain Oct ’08-Mar ’09)
Total water input: 18.19 ac.in

Irrigation method:

Drip tape buried center of bed, 4 to 6 inches deep, 7/8 inch tape at low flow rate of 0.24 gph. Irrigation scheduling was not based on soil moisture monitoring but by grower experience. Irrigated using a portable sand filter/ pump combination and metered each time.

Yield:

22.8 Ton/ac (20,042 bags/22 ac)
(Estimated based on previous years with 50 lb onion bags; waiting on final yield amount from grower)
Water use summary:
IUE: 2,539 lbs/ac.in
WUE: 2,504 lbs/ac.in

Site: #06D - 2008-2009

Site Description:

Acres: 10.0 ac (experimental plot)
Crop variety: Rio Red grapefruit
Harvest season: Mar '08-Mar '09
Irrigation district: Hidalgo Cameron 9
Irrigation system: Traditional Flood
Field characteristics: 16' x 25' spacing (105 trees/Acre)

Fertilizer applied:

Mar '08: 220 lb/ac 46-0-0 urea

Insecticide applied:

Jun '08: AgriMek and oil + Enable; Aug '08: Vendex 50 WP + Cupric hydroxide; Oct '08: Micromite, Envidor + Enable

Soil moisture sensor monitoring:

No soil moisture sensors set up at this research site.

Rain gauge:

Tipping bucket style rain gauge with WatchDog data logger

Water meter:

10" turbine-type flow meter

Irrigation schedule and amounts:

Total irrigation:	36.00 ac.in
Total rainfall:	27.63 inch
Total water input:	63.63 ac.in

Irrigation method:

Traditional Flood

Observations made during the crop season:

Trees not in great condition for 2008 year and yet end of season yield was good

Yield:

21.3 Tons/ac

Water use summary:

IUE: 1,181 lbs/ac.in
WUE: 668 lbs/ac.in

Site: #07A – 2008-2009

Site Description:

Acres: 7.3 (flood) Block N-O1
Soil characteristics: sandy clay loam
Crop variety: Rio Red grapefruit , 5 years old
Irrigation district: Hidalgo Cameron 9
Irrigation system: Flood, conventional
Field characteristics: 15’ x 24’ spacing (121trees/Acre)

Fertilizer applied:

Mar ’08: 220 lb/ac 46-0-0 urea

Insecticide applied:

Jun ’08: AgriMek and oil + Enable; Aug ’08: Vendex 50 WP + Cupric hydroxide; Oct ’08: Micromite, Envidor + Enable

Soil moisture sensor monitoring:

Soil moisture equipment not at this site other than Davis Instrument Rain gauge and Watchdog Data logger.

Rain gauge:

Davis Instrument Rain gauge and Watchdog Data logger. Rain data is measured manually by Farm crew and is used to double check rain data logger reliability.

Water meter:

10” turbine-type flow meter

Irrigation schedule and amounts:

Irrigation performed using grower experience and estimations from Etc, typically irrigated at every 4-5 week intervals depending upon rainfall amount.

Total irrigation:	36.00 ac.in
Total rainfall:	27.63 inch
Total water input:	63.63 ac.in

Irrigation method:

Traditional flood

Yield:

4.92 Ton/ac

Water use summary:

IUE: 273.3 lbs/ac.in
WUE: 154.6 lb/ac.in

Site #21D – 2008-2009

Site Description:

Acres: 18.0
Soil type: Sandy Loam (0-12-inch depth) and Sandy Clay Loam (12-24-inch depth)
Crop Variety: Rio Red Grapefruits (planted in 1988)
Irrigation system:
border flood (with poly-pipe)
Field characteristics:
116 trees/acre; no ground cover

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors connected to data logger Portable flow meter

Irrigation schedule and amounts:

Total irrigation	30.7 inches/acre (Feb'08-Jan'09) in 5 events
Total rainfall	31.0 inch/acre (Feb'08-Jan'09) **so far**
Total water input	61.7 inches/acre **so far**

Irrigation method:

Irrigation scheduling was not based on soil moisture; each pan was flooded until water covered the opposite end from the poly-pipe; water was provided by the district (pipeline)

Observations made during the crop season:

Irrigation events usually occurred when 6" horizon profile ranged 115-200cb (0% AW), 12" horizon profile ranged 60-160cb (0-50% AW), and 24" horizon profile ranged 20-40cb (75-100% AW)

Yield:

Not available at time of report

Site #:24A – 2008-2009

Site Description:

Acres: 7.0
Soil type: Sandy Clay Loam (up to 24-inch depth) and Clay Loam (below 30-inch depth)
Crop Variety: Rio Red Grapefruits (Planted 1993)
Irrigation system:
border flood
Field characteristics:
140 trees/acre, laser leveled, no ground cover, drain tiles

Sensor and flow meter information:

Echo-20 probes (2-10, 16-24, 30-38 & 44-52-inch depth) connected to data logger
Portable flow meter

Irrigation schedule and amounts:

Total irrigation	24.5 inches/acre (in 7 events: Mar-Dec'08)
Total rainfall	32.1 inches/acre (Feb-Dec'08)
Total water input	56.6 inches/acre (Feb-Dec'08)

Irrigation method:

There is a border every other row and each pan is irrigated by one alfalfa valve (connected to canal: water provided by the district) until water fills in at the opposite side. Since the grower has a capacity of two heads, he opens four valves at a time (four pans). The design of his system allows him to apply about 3.5 inch for each irrigation. Water advances on the laser leveled ground 100 feet within 20 minutes. Irrigation scheduling was not based on soil moisture.

Observations made during the crop season:

Irrigation events usually occurred when 0-24" horizon profile had about 0% AW while lower profiles were anywhere from FC to 50% AW

Yield:

52,400 lbs/acre

Water use summary:

IUE: 2,139 lbs/inch of water applied by irrigation
WUE: 926 lbs/inch of water received (irrigation + rainfall)

Economic Summary: Demonstration Site 24A

The Demonstration Site 24A analysis consists of a 10-year financial outlook (2008-2017) for the 7 acres of Rio Red grapefruit under border flood irrigation. The orchard was assumed to have mature trees. The Rio Red grapefruit price is held constant at $115/ton. 2008 production costs and overhead charges are producer estimates.

Total cash receipts average $2,584/acre over the 10-year period and cash costs average $1,023/acre, including $157/acre variable irrigation costs. Net cash farm income (NCFI) averages $1,560/acre due largely to the price being held at a constant $115/ton. The risks associated with prices and yields suggest minimal chance of negative NCFI. In a normal production year, NCFI could range as much as -$71/acre to $3,857/acre.

Site #28A – 2008-2009

Site Description:

Acres: 8.0
Soil type: Sandy Loam (up to 30-inch depth)
Crop Variety: Valencia Oranges (Planted 2003)
Irrigation system:
Micro-Jets (1 sprinkler/tree)
Field characteristics: 115 trees/acre; no ground cover; drain tiles
Fertilizer applied: total NPK 129-0-184 (fertigation) or 23-0-16 per acre type 0-0-16 (100gal) and 28-0-0 (40gal)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) and irrigation sensors connected to 2 data loggers
Water meter installed at the pump house

Irrigation schedule and amounts:

Total irrigation	16.0 inches/acre (Apr'08-Jan'09) **so far**
Total rainfall	29.0 inch/acre (Apr'07-Jan'08) **so far**
Total water input	45.0 inches/acre **so far**

Irrigation method:

Irrigation scheduling was based on soil moisture and an average of inch/acre was applied each time (total of applications); water was provided by the district (pipeline) into a reservoir (sand media filtration and pump system)

Observations made during the crop season:

Irrigation is triggered when 6" profile is at cb (% AW), 12" profile is at cb (% AW), and 24" profile is at cb (% AW)

Yield:

Not available at time of report.

Economic Summary: Demonstration Site 28A

The Demonstration Site 28A analysis consists of a 10-year financial outlook (2008-2017) for the 8 acres of Valencia oranges under micro-jet spray irrigation. The orchard trees were assumed to be 5 years old. The Valencia orange price is held constant at $150/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a micro-jet spray system at a cost of $1,000 per acre. The micro-jet spray system expense is evenly distributed ($100/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,324/acre over the 10-year period and cash costs average $1,250/acre, including $150/acre irrigation costs in 2008. Net cash farm income (NCFI) is negative in 2008 reflecting lower levels of production from immature trees. It then increases from $300/acre in 2009 to about $1,360/acre in 2017. The risk associated with prices and yields suggests a minimal chance of negative NCFI after 2010 when the trees reach maturity. In a normal production year and mature trees (2010-2016), NCFI could range as much as $60/acre to $3,625/acre. Due to negative NCFI, the probability of carryover debt is 97% or greater during 2008 and then declines to 1% or less in 2013 as the trees reach maturity and annual production increases.

Site #:28B -2008-2009

Site Description:

Acres: 3.3
Soil type: Sandy Loam (up to 30-inch depth)
Crop Variety: Rio Red Grapefruits (Planted 1992)
Irrigation system: Flood converted to drip in August 2006 (surface double line 30-inch emitter)
Field characteristics: 116 trees/acre; no ground cover; drain tiles
Fertilizer applied: total NPK 1,063-0-378 (fertigation) or 97-0-34 per acre type 28-0-0 (330 gal) and 0-0-16 (115 gal)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) and irrigation sensors connected to data logger
Water meter installed at the pump house

Irrigation schedule and amounts:

Total irrigation	24.6 inches/acre (Feb'08-Jan'09) including 6" by flood **so far**
Total rainfall	29.1 inches/acre (Feb'08-Jan'09) **so far**
Total water input	53.7 inches/acre **so far**

Irrigation method:

Irrigation scheduling was based on soil moisture; water was provided by the district (pipeline) into a reservoir (sand media filtration and pump system)

Observations made during the crop season:

Irrigation triggering occurred

Yield:

Not available at time of report.

Economic Summary: Demonstration Site 28B1

The Demonstration Site 28B1 analysis consists of a 10-year financial outlook (2008-2017) for the 5 acres of Marrs under 2-line drip irrigation. The orchard trees were assumed to have mature trees. The Marrs orange price is held constant at $120/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a 2-line drip system at a cost of $1,000 per acre. The 2-line drip system expense is evenly distributed ($100/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,036/acre over the 10-year period and cash costs average $1,300/acre, including $180/acre irrigation costs in 2008. Net cash farm income (NCFI) averages $738/acre due largely to the price being held constant at $120/ton. The risk associated with prices and yields suggests a small chance of negative NCFI. In a normal production year, NCFI could range as much as -$480/acre to $2,860/acre. Due to negative NCFI, the probability of carryover debt is 28% or less in 2008 and then declines to 4% or less in 2010.

Economic Summary: Demonstration Site 28B2

The Demonstration Site 28B2 analysis consists of a 10-year financial outlook (2008-2017) for the 3 acres of Rio Red grapefruit under 2-line drip irrigation. The orchard was assumed to have mature trees. The Rio Red grapefruit price is held constant at $115/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a 2-line drip system at a cost of $1,000 per acre. The 2-line drip system expense is evenly distributed ($100/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,533/acre over the 10-year period and cash costs average $1,423/acre, including $200/acre variable irrigation costs. Net cash farm income (NCFI) averages $1,110/acre due largely to the price being held at a constant $115/ton. The risks associated with prices and yields suggest a minimal chance of negative NCFI. In a normal production year, NCFI could range as much as -$400/acre to $4,000/acre. The probability of carryover debt is 19% or less during 2008 and then declines to 4% or less in 2010.

Site #:28C – 2008-2009

Site Description:

Acres: 8.0
Soil type: Sandy Loam (up to 30-inch depth)
Crop Variety: Rio Red Grapefruits (Planted 1992)
Irrigation system: Micro-Jets (1 sprinkler/tree)
Field characteristics: 116 trees/acre; no ground cover; drain tiles
Fertilizer applied: total NPK 1240-0-528 (fertigation) or 144-0-61 per acre type 28-0-0 (385 gal) and 0-0-16 (300 gal)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) and irrigation sensors connected to data logger
Water meter installed at the pump house

Irrigation schedule and amounts:

Total irrigation	18.1 inches/acre (Feb'08-Jan'09) **so far**
Total rainfall	29.1 inches/acre (Feb'08-Jan'09) **so far**
Total water input	47.2 inches/acre **so far**

Irrigation method:

Irrigation scheduling was based on soil moisture and an average of an inch per acre was applied each time by Micro-Jet; water was provided by the district (pipeline) into a reservoir (sand media filtration and pump system)

Observations made during the crop season:

Soil moisture levels

Yield:

Not available at time of the report.

Economic Summary: Demonstration Site 28C

The Demonstration Site 28C analysis consists of a 10-year financial outlook (2008-2017) for the 8 acres of Rio Red grapefruit under micro-jet spray irrigation. The orchard was assumed to have mature trees. The Rio Red grapefruit price is held constant at $115/ton. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a micro-jet spray system at a cost of $1,000 per acre. The micro-jet spray system expense is evenly distributed ($100/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,531/acre over the 10-year period and cash costs average $1,423/acre, including $200/acre variable irrigation costs. Net cash farm income (NCFI) averages $1,108/acre due largely to the price being held at a constant $115/ton. The risks associated with prices and yields suggest a minimal chance of negative NCFI. In a normal production year, NCFI could range as much as -$413/acre to $4,000/acre. The probability of carryover debt is 19% or less during 2008 and then declines to 4% or less in 2010.

Site #:28D – 2008-2009

Site Description:

Acres: 7.0
Soil type: Sandy Loam (up to 30-inch depth)
Crop Variety: Marrs and Navel Oranges (Planted 1991)
Irrigation system: Drip (surface double line 30-inch emitter)
Field characteristics: 115 trees/acre; no ground cover; drain tiles
Fertilizer applied: total NPK 700-390-350 (fertigation) or 100-56-50 per acre type 28-0-0 (200 gal), 0-0-16 (200 gal) and 5-34-0 (100 gal)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) and irrigation sensors connected to data logger
Water meter installed at the pump house

Irrigation schedule and amounts:

Total irrigation	24.6 inches/acre including 1 flood event of 6 inch per ac. (Jan'08-Dec'08)
Total rainfall	30.7 inches/acre (Jan'08-Dec'08)
Total water input	55.3 inches/acre

Irrigation method:

Irrigation scheduling was based on soil moisture and an average of 0.9 inch/acre was applied each time; water was provided by the district (pipeline) into a reservoir (sand media filtration and pump system)

Observations made during the crop season:

Irrigation was triggered at when 6" sensor reached an average of 100cb (0% AW), 12" sensor reached an average of 67cb (35% AW), and 24" sensor reached an average of 15cb (100% AW)

Yield:

17,000 lbs/acre

Water use summary:

IUE: 691 lbs/inch of water applied by irrigation

WUE: 307 lbs/inch of water received (irrigation + rainfall)

Economic Summary: Demonstration Site 28D1

The Demonstration Site 28D1 analysis consists of a 10-year financial outlook (2008-2017) for the 3.5 acres of Navel oranges under 2-line drip irrigation. The orchard was assumed to have mature trees. The early orange price is held constant at $140/ton. 2008 production costs and overhead charges are producer estimates.

The analysis also includes the purchase and use of a 2-line drip system at a cost of $1,000 per acre. The 2-line drip system expense is evenly distributed ($100/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $1,891/acre over the 10-year period and cash costs average $1,297/acre, including $180/acre variable irrigation costs. Net cash farm income (NCFI) averages $594/acre due largely to the price being held at a constant $140/ton. The risks associated with prices and yields suggest some chance of negative NCFI. In a normal production year, NCFI could range as much as -$429/acre to $2,457/acre. Due to negative NCFI, the probability of carryover debt is 24% or less in 2008 and then declines to 4% or less in 2011.

Economic Summary: Demonstration Site 28D2

The Demonstration Site 28D2 analysis consists of a 10-year financial outlook (2008-2017) for the 3.5 acres of Marrs oranges under 2-line drip irrigation. The orchard was assumed to have mature trees. The early orange price is held constant at $120/ton. 2008 production costs and overhead charges are producer estimates.

The analysis also includes the purchase and use of a 2-line drip system at a cost of $1,000 per acre. The 2-line drip system expense is evenly distributed ($100/acre/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $2,037/acre over the 10-year period and cash costs average $1,300/acre, including $180/acre variable irrigation costs. Net cash farm income (NCFI) averages $737/acre due largely to the price being held at a constant $120/ton. The risks associated with prices and yields suggest some chance of negative NCFI. In a normal production year, NCFI could range as much as -$471/acre to $3,327/acre. Due to negative NCFI, the probability of carryover debt is 28% or less in 2008 and then declines to 4% or less in 2010.

Site #30A – 2008-2009

Site Description:

Acres: 30.0
Soil type: Sandy Loam
Crop Variety: Pasture Bermuda grass (Tifton 85)

Irrigation system:

625-foot center pivot (MESA) with 62 rotating spray applicators and a terminal gun
Fertilization: 250 lbs/acre of Nitrogen

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth connected to 1 data logger. Water meter located at the pump.

Irrigation schedule and amounts:

Monitoring since 06/24/08

Total irrigation	0.0 inches/acre (Jul'08-Jan'09) **so far**
Total rainfall	24.4 inches/acre (Jul'08-Jan'09) **so far**
Total water input	24.4 inches/acre **so far**

Irrigation method:

No irrigation scheduling practices was noticed at this time; water is provided by the district (pipeline).

Observations made during the crop season:

Soil moisture levels averaged at 74cb for 6-inch profile, 98cb for 12-inch profile, and 50cb for 24-inch profile

Site #30B – 2008-2009

Site Description:

Acres: 30.6
Soil type: Sandy Loam
Crop Variety: Pasture Bermuda grass (Tifton 85)

Irrigation system:

642-foot center pivot (MESA) with 126 spray applicators; no terminal gun
Fertilization: 250 lbs/acre of Nitrogen

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth connected to 1 data logger. Water meter located at the pump.

Irrigation schedule and amounts:

Monitoring since 06/24/08

Total irrigation	0.0 inches/acre (Jul'08-Jan'09) **so far**
Total rainfall	24.4 inches/acre (Jul'08-Jan'09) **so far**
Total water input	24.4 inches/acre **so far**

Irrigation method:

No irrigation scheduling practices was noticed at this time; water is provided by the district (pipeline).

Observations made during the crop season:

Soil moisture levels averaged at 37cb for 6-inch profile, 24cb for 12-inch profile, and 19cb for 24-inch profile

Site #:31A – 2008-2009

Site Description:

Acres: 9.4
Soil type: Sandy Loam (up to 24-inch depth)
Crop Variety: Rio Red Grapefruits (Planted 1990)
Irrigation system: Drip (surface single line; 4-feet drip emitter; flow 1GPH)
Field characteristics: 116 trees/acre; no ground cover
Fertilizer applied: total NPK 116-0-0 (side dressing) type N 30% (60gal/acre)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) and irrigation sensors connected to data logger
Water meter installed on a drip line

Irrigation schedule and amounts:

Total irrigation	11.1 inches/acre (Feb'08-Dec'08)
Total rainfall	43.5 inches/acre (Feb'08-Dec'08)
Total water input	54.6 inches/acre

Irrigation method:

Irrigation scheduling was not based on soil moisture. Instead, automatic irrigation occurs whenever the canal is full. Water was provided by the district (canal)

Observations made during the crop season:

The grove was sold to a new owner in June 2008. Since then, drip irrigation events were very scarce. Soil moisture greatly depleted after Hurricane Dolly as no irrigation was applied between October and December. June was very dry too (all sensors above 120cb at all times) and crop stress may have occurred.

Yield:

38,900 lbs/acre

Water use summary:

IUE: 3,505 lbs/inch of water applied by irrigation
WUE: 712 lbs/inch of water received (irrigation + rainfall)

Site #:31B – 2008-2009

Site Description:

Acres: 5.0
Soil type: Sandy Clay (6 & 24-inch depth) and Clay (12-inch depth)
Crop Variety: Rio Red Grapefruits (Planted 1991)
Irrigation system: Border flood (with poly-pipe)
Field characteristics: 220 trees/acre; no ground cover
Fertilizer applied: total NPK 220-0-0 (side dressing) type N 30% (60gal/acre)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors connected to a data logger
Portable flow meter

Irrigation schedule and amounts:

Total irrigation	51.9 inches/acre (Feb'08-Jan'09) in 8 events **so far**
Total rainfall	29.5 inches/acre (Feb'08-Jan'09) **so far**
Total water input	81.4 inches/acre **so far**

Irrigation method:

Irrigation scheduling was not based on soil moisture. Each pan was flooded until water covered the opposite end from the poly-pipe. Water was provided by the district (pipeline)

Observations made during the crop season:

Soil moisture levels were showing that irrigation events occurred around 98cb for 6" profile (0% AW), 99cb for 12" profile (0% AW), and 67cb (0% AW). Therefore, stress may have occurred. Water meter readings were not accurate.

Yield:
Not available at time of report.

Site #:31C – 2008-2009

Site Description:

Acres: 10.0
Soil type: Sandy Clay Loam (up to 24-inch depth)
Crop Variety: Rio Red Grapefruits (Planted 1991)
Irrigation system: Border flood (with poly-pipe)
Field characteristics: 116 trees/acre; no ground cover
Fertilizer applied: total NPK 116-0-0 (side dressing) type N 30% (60gal/acre)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors connected to a data logger.
Portable flow meter

Irrigation schedule and amounts:

Total irrigation	33.6 inches/acre (Feb'08-Jan'09) in 9 events
Total rainfall	29.5 inches/acre (Feb'08-Jan'09)
Total water input	63.1 inches/acre

Irrigation method:

Irrigation scheduling was not based on soil moisture. Each pan was flooded until water covered the opposite end from the open ditch. Water was provided by the district (pipeline)

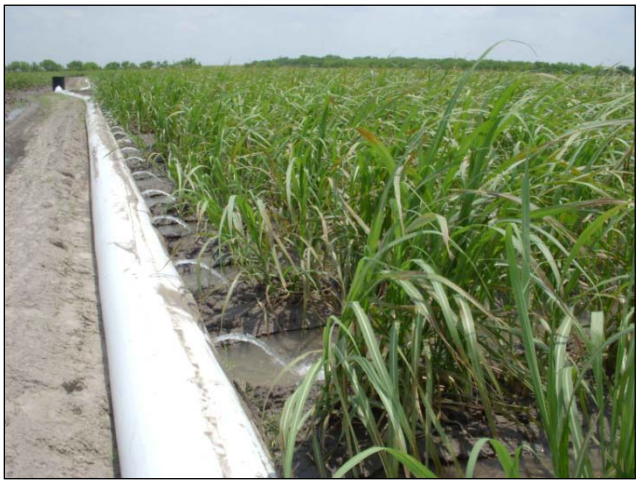
Observations made during the crop season:

Soil moisture levels were showing that irrigation events occurred around 134cb for 6" profile (0% AW), 147cb for 12" profile (0% AW), and 53cb (50% AW). Therefore, stress may have occurred.

Yield:

Not available at time of report.

Site #:32A – 2008-2009



Site Description:

Acres: 64.0
Soil type: Sandy Clay Loam (from 0 to 40-inch depth)
Crop Variety: Sugar Cane 12-10 (P 11/01/06; H 02/07/08 "1st ratoon")
Irrigation system: furrow (by poly-pipe)
Field characteristics: 60-inch beds; 1,030 foot-long rows; 3 to 4 stocks/ linear foot at planting; drain tiles
Fertilizer applied: total NPK 22-104-0 (side dressing) type 11-52-0 (200lbs/acre)

Sensor and flow meter information:

Echo-20 probes (2-10, 8-16, 20-28 & 32-40-inch depth) connected to data logger
Portable flow meter

Irrigation schedule and amounts:

Total irrigation	23.5 inches/acre (March '08 to Jan '09) in 4 events
Total rainfall	32.2 inches/acre (March '08 to Jan '09)
Total water input	55.7 inches/acre

Irrigation method:

Irrigation scheduling was not based on soil moisture; water was running until it reached the end of the furrows; water was provided by the district (pipeline)

Observations made during the crop season:

Irrigations occurred when Vol. Water Content was at 13.0% (0% AW) for the 6" profile, 21.1% (45% AW) for the 12" profile, 22.4% (50% AW) for the 24" profile, and 30.8% (100% AW) for the 36" profile.

Yield:

11,300 lbs/acre of sugar and 96,600 lbs/acre of cane

Water use summary:

IUE: 480 lbs of sugar and 4,104 lbs of cane/inch of water applied by irrigation
WUE: 203 lbs of sugar and 1,734 lbs of cane/inch of water received (irrigation + rainfall)

Site #:34A – 2008-2009

Site Description:

Acres: 9.4
Soil type: Sandy Clay Loam (0 to 24-inch depth)
Crop Variety: Rio Red Grapefruits (Planted1990)
Irrigation system: Border flood (with poly-pipe)
Field characteristics: 116 trees/acre, with ground cover
Fertilizer applied: total NPK 125-0-0 (side dressing) type 21-0-0

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors with manual readings (3 times a week)
Portable flow meter

Irrigation schedule and amounts:

Total irrigation	29.0 inches/acre (Feb'08-Jan'09) in 7 events
Total rainfall	43.2 inches/acre (Feb'08-Jan'09)
Total water input	72.2 inches/acre

Irrigation method:

Irrigation scheduling was based on soil moisture. Each area connected to a WM station was flooded independently, based on the readings, until water covered the opposite end from the poly-pipe. Water was provided by the district (pipeline)

Observations made during the crop season:

Soil moisture levels were showing that irrigation events occurred when we had 63cb at 6" (0% AW), 38cb at 12" (50% AW), and 25cb at 24" (100% AW)

Yield:

Not available at time of report

Site #:35A – 2008-2009

Site Description:

Acres: 86.0

Soil type: Harlingen Clay (from 0 to 24-inch depth)

Crop Variety: St Augustine Floratan turf grass (H 10/09/07)

Irrigation system: 1,280 feet-long side-roll sprinklers (40-foot ramps)

Fertilizer applied: total NPK 800-100-300 (side dressing) type 4-1-2

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors connected to a data logger. No water meter on the site.

Irrigation schedule and amounts:

Total irrigation of 32.8 inches/acre (Jan'08-Dec'08) in 12 events, including about 17.9" by flood

Total rainfall of 34.4 inches/acre (Jan'08-Dec'08)

Total water input of 67.2 inches/acre

Irrigation method:

Irrigation scheduling was based on soil moisture. This year, the farmer combined side-roll sprinkler irrigation with flood to keep-up with moisture depletion. Water was provided by the district (pipeline)

Observations made during the crop season:

Soil moisture levels were showing that irrigation events occurred when we had 172cb at 6" (0% AW), 113cb at 12" (0% AW), and 45cb at 24" (40% AW)

Yield:

60 pallets/acre

Water use summary:

IUE: 1.8 pallet/inch of water applied by irrigation

WUE: 0.9 pallet/inch of water received (irrigation + rainfall)

Economic Summary: Demonstration Site 35A

The Demonstration Site 35A analysis consists of a 10-year financial outlook (2008-2017) for the 86 acres of Floratan St. Augustine production under side-roll irrigation. The price is held constant at $65/pallet. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a side-roll system at a cost of $349 per acre. The expense is evenly distributed ($35/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $3,900/acre over the 10-year period and cash costs average $2,039/acre, including $228/acre variable irrigation costs. Net cash farm income (NCFI) averages $1,861/acre over the 10-year period. The risk associated with prices and yields suggests a minimal chance of negative NCFI. In a normal production year, NCFI could range as much as $1,116/acre to $2,570/acre.

Site # 41, Field 41A and 41B 2008

Site Description:

The 39 acre field was planted in grain sorghum and divided into three equal sections, utilizing surge irrigation in the center section of the field. The soil type is Harlingen Clay (HA). The field has a slope of .0005' to the West and the same slope to the North.

Sensor Installation:

One row located 50 rows from the North side was selected for installing a Watermark 900M monitor to record data for the furrow irrigation section. One other site 75' north of the field turnout (center) was used to collect data for the surge irrigation section. The sensor sites were located 150' inside of the east turn row. Each sensor site consisted of a soil temperature probe set at a 9" depth, and soil moisture sensors buried at 6", 12", and 24". Portable McCrometer flow meters were used to measure the amount of water applied at the north turnout and at the center turnout.

Irrigation Schedule:

Date	Irrigation Type	Acres	Inches per acre
4/15/2008	Surge	9.4	5.92
5/9/2008	Surge	9.4	9.90
4/15/2008	Furrow s	13.6	6.80
5/9/2008	Furrow s	13.6	3.64
4/15/2008	Furrow n	15.2	8.90
5/9/2008	Furrow n	15.2	6.00

Rainfall

This site received over 50 inches of rain during the harvest period.

Irrigation Method:

The surge controller was programmed to complete the irrigation cycle in 24 hours with the first alternation to occur at the 5 hour interval. The cooperator used 18" diameter polypipe. The surge controller was programmed to alternate 3 cycles in a 24-hour period.

The row length is 1280'.

Observations:

This site was not harvested due to damage from Hurricane Dolly.

Economic Summary: Demonstration Site 41A

No economic data due to damage from hurricane Dolly

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Site # 44, field 44A 2008

Site Description:

The site is a 38 acre field which was planted in seedcorn. The irrigation method is furrow irrigation with poly-pipe and the soil type is mainly Harlingen Clay. Field slope is approximately .0005' from the North and .00025' to the East.

Sensor Installation:

One furrow was selected in the center of the field with a sensor site 150' inside of the Southern turn row. Watermark soil moisture sensors were buried at a depth of 6", 12", and 24". A soil temperature probe was buried at a depth of 9". A Watermark monitor was used to continuously collect readings. The rain gauge at pump house 27 was used to collect the rainfall events.

Irrigation Schedule:

Date	Inches per acre
3/14/2008	3.75
4/16/2008	3.82
5/9/2008	4.46

Rain Fall:

Date	Amount
2/12/2008	4.5"
5/20/2008	1"

Irrigation Method:

The field was furrow irrigated utilizing surge irrigation and 18" poly-pipe.

Yield:

29 bu/ acre

Observations:

This site was used to demonstrate the wireless WaterMark data logger. The logger worked as advertised allowing the grower to monitor soil moisture from the nearby barn rather than having to go into the field to read the datalogger.

Economic Summary: Demonstration Site 44A

The Demonstration Site 44A analysis consists of a 10-year financial outlook (2008-2017) for the 37.8 acres of seed corn production under surge irrigation with poly-pipe. It is not

assumed the seed corn acreage is rotated annually with another crop. The initial price is $29.81/bu., including marketing loan deficiency payments, if applicable. 2008 production costs and overhead charges are producer estimated rates.

The analysis also includes the purchase and use of a surge valve at a cost of $2,200. The surge valve expense is evenly distributed ($220/year) over the 10-year period with the assumption of no financing costs.

Total cash receipts average $905/acre over the 10-year period and cash costs average just under $281/acre, including $42/acre variable irrigation costs. In addition to market receipts, total receipts include direct and counter-cyclical payments paid to base acres. Net cash farm income (NCFI) increases throughout the 10-year period from $603/acre in 2008 to $650/acre in 2017. The risks associated with prices and yields suggest some chances of negative NCFI. In a normal production year, NCFI could range as much as $159/acre plus or minus the average expected NCFI for the site.