Agricultural Water Conservation Demonstration Initiative

2009

Harlingen Irrigation District

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:

- Danny Allen – Cooperator
- Leonard Simmons – Grower
- Edward Bauer – Grower
- Sam Morrow – 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
- Tom McLemore – HID Project Manager

The District has contracted the services of several irrigation researchers and engineers to carry out some of the tasks of the project. Dr Shad Nelson of Texas A&M University Kingsville is tasked with the Drip, Micro-jet, and flood irrigation in citrus and vegetables demonstrations. Dr Juan Enciso and Xavier Peries with Texas AgriLife Extension Service are tasked with the LESA/LEPA and other sprinkler demonstrations. Dr Steven Klose and Allan “Mac” Young are tasked with the economic evaluations of all of the demonstration sites. Dr. Al Blair of Axiom-Blair Engineering provides technical assistance and contracting services. Robyn Hadley with WaterPR is tasked with the public relations and report writing.

District personnel are also very involved in the project. Danny Allen works with the cooperators in the surge demonstrations and maintains monitoring equipment and meters. Heather Jones tracks all expenditures and aids in the dissemination of information through newsletters and other publications.

The ADI project continues to work closely with the cooperators of the demonstration sites and maintains a good relationship with many of the original cooperators as well as a few new ones. In the 2009 2010 season the Project maintained 30 demonstration sites with 16 cooperators.

2009 turned out to be a more normal year than 2008 for the ADI project. The beginning of the season was dry and irrigation took place at a rather fast clip. The dry weather remained throughout the growing season and the beneficial rains seemed to be nonexistent. The Valley did receive some moisture in June and July but most of the row crops had reached maturity by that time. This rain came at a rather bad time seeing as most of the crops in the RGV had yet to be harvested. September through December proved to be a more normal year for the Valley as we received some good rains unfortunately the weather brought a freeze which devastated our sugar cane crop and some of our citrus.

The dry season gave us time to repair the monitoring equipment that was damaged during the 2008 hurricane. We continue to have some problems with some devices but no more than you would expect with the technology that is available today. Most of our cooperators are coming to rely on the soil moisture devices and rain gages and for the most part have learned to use them to their advantage. We continue to encourage others to use these devices as they try to better manage their irrigation water.

Our sub contractors continue to work with the cooperators to monitor irrigation practices on the demonstration sites. Dr. Shad Nelson, Dr. Juan Enciso, Xavier Peries, Mac Young, and Danny Allen have done an outstanding job working with the cooperators this past year. Their expertise and diligence is what is making this project a success.

Educating the growers and irrigation district personnel in the use of irrigation technologies and water conservation techniques, is one of our goals in the ADI project. In the fall of 2009 we conducted a flow measurement short course titled “Introduction to Flow Measurement for Agricultural Water Conservation”. There were 18 students from across the state and Louisiana. The course was taught by Dr. Al Blair and Dr. Ian McCann. We will continue to educate and inform the public of the technologies and techniques necessary to better manage our water.

One of the avenues we have developed for education is through an Irrigation Expo. The District hired a public relation firm (WaterPR) to aid in the planning and execution of this first ever event in the Rio Grande Valley. The “Texas Irrigation Expo” will take place in the fall of 2010. The event will include vendors of water conservation technologies, sponsors from water conservation organizations as well as speakers, and information booths, which will provide information on water conservation and the ADI project. We are looking forward to this becoming an annual event.

2009 was a productive year. This report contains the annual update and progress made in the Agricultural Demonstration Initiative Project as indicated in the Scope of Work in 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 2009. 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.

The demonstration sites continue to exhibit a savings in irrigation water compared to the Valley's traditional methods of irrigation. Below is an illustration of water savings on the Citrus sites. Notice the variability in the water saving (inches) for amount irrigated in the 2009-10 growing season for our Citrus growers. The Drip has the highest variability due to 1-line and 2-line drip systems coupled together to get the average inches irrigated. One cooperator tends to irrigate his trees a lot in both Microjet Spray and Drip Systems. Interestingly enough, the lowest variability is in the Border Flood Irrigation Systems and the highest water saving system this past year. This is more incentive to promote the Border Flood method in regards for growers in the Valley. All the original data and a graphical comparison are shown on the next page.

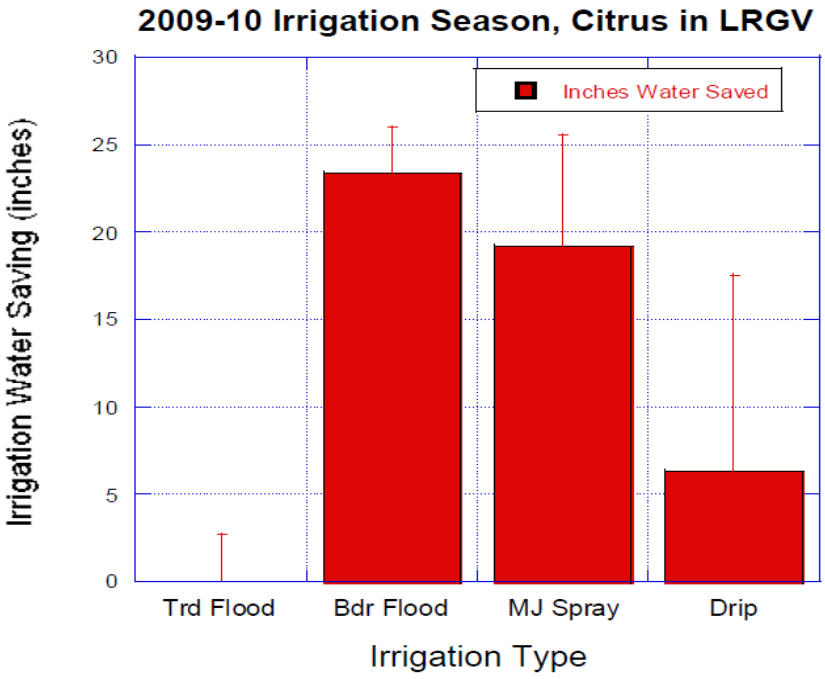


Figure 1 Water Savings Comparison

2009 Work Accomplished by Task

Subcontracting Contract Execution

The primary work for this task was completed by District personnel. The subcontracts with SDN Consulting Inc., AgriLife Extension FARM Assist, and Texas AgriLife Extension Weslaco, Water PR, La Playa Mapping and Axiom Blair, to provide support and services to perform the work tasks listed below were completed in 2009.

District and On-Farm Flow Meter Calibration and Demonstration Facilities

The construction of the Flow Meter Calibration Facility is complete. The District and other local conservation entities continue to use the facility for meetings and training events. The District has completed a canal management and water measurement short course event in 2009 and scheduled a Soil Moisture short course for early spring 2010. We anticipate more such events as the year progresses.

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 2009 FARM Assistance activities are provided, including outreach and education publications produced. Summaries of each 2009 demonstration site analysis are included in the 2009 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 4 whole-farm and 23 demonstration site analyses for 10 ADI participants in the 2009-2010 project periods. 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 2009 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 1 publication in outreach and education efforts. In July 2008, Hurricane Dolly destroyed most crop demonstration sites and greatly impacted 2008-2009 yields, especially in citrus. In turn, limited noteworthy results were available for reporting and publication in 2009. The publication was *Focus* Series 2009-6, *New Orchard Establishment: Flood and 1-Line Drip Irrigation Illustration for Rio Red Grapefruit in the Lower Rio Grande Valley*, was published in July 2009.

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

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. In an effort to better monitor our water deliveries, the District contracted La Playa Mapping to aid in displaying the water order ticket data on a large video display in the District office. As water orders are made the video display will illustrate the location of the order in the district by highlighting the associated block of land on the District map. This will provide our water master and canal riders with an up-to-date visual reference of water orders. As we refine the display process the information will also be displayed on our web page for the general public to view. Our goal in this process is to give the canal riders and water master a better grasp of the water ordered at anytime throughout the day which will allow him to more efficiently order water for the entire district.

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 February 2010 all Citrus and Onion growers do have yield results because citrus trees have not yet been harvested, rains have prevented growers from entering fields to harvest, or growers are waiting for the packing sheds to provide the o.k. to bring in their harvest. Some of the Lower Rio Grande citrus producers have done early picks of Rio Red grapefruit for early markets, however, total yield data will be provided from these growers after all citrus trees have

been harvested and packing shed have returned total harvest year 2009-2010 results. This data will most likely not be available until the later end of the 1st quarter of 2010 (May 2010).

Rainfall during 2009 was extremely low during the first 9 months of the year with approximately 10% of annual precipitation falling during this time. An extensive drought that started in September 2008 started to be overcome on the 1st of September 2009. Rainfall since this date has been fairly continuous and recorded annual rainfall for 2009 in the Lower Rio Grand Valley ranged from 13 to 22 inches.

Rain gauge equipment used in combination with soil moisture sensing equipment provides a good means of determining when rain events sufficiently impact soil water content vs. irrigation events. The most reliable rain gauge was a single tipping bucket setup in connection to a WatchDog datalogger, without soil moisture sensing equipment. The dates for precipitation and total amount of rainfall corresponded very well to rainfall data at various weather stations located in the region. Whereas rain gauges equipped to Decagon equipment provide inaccurate rainfall data, most possibly due to the tipping bucket rain gauge locate high in the air above the tree canopy affixed to 1" diameter pipe. This setup is too susceptible to erroneous reading by wind shear tipping the rain gauge.

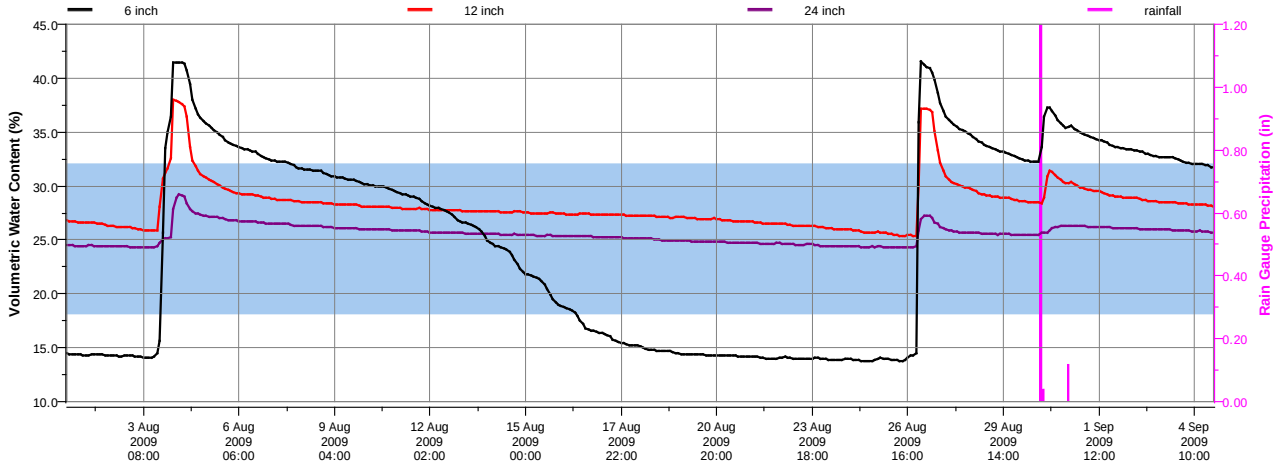


Figure 2 Decagon Soil Moisture Chart

In the chart above, where a rise in soil volumetric water content without a pink line (rainfall) suggests an irrigation event. In this way the number of precipitation and irrigation events can be determined. This procedure was used to best estimate total 2009-10 harvest year precipitation and irrigation amounts when compared to grower supplied information.

At most sites there are two types of soil moisture sensor set-ups. The two types of sensors are: 1)Decagon data logger units equipped with ECHO soil moisture probes, and 2) Irrometer Data logging stations coupled with Watermark sensors. Decagon equipment in various grower's fields led to periodic failure or permanent loss of soil moisture sensors in 2009. This is the fifth year of using this equipment in the field and we may be seeing the on-farm life span for such equipment and expect further failures to occur in 2010. We do not plan to replace this equipment as the cost of the equipment is high and requires a computer to download and see the data. This is fine for a researcher, but is impractical for a grower who has limited time to periodically check soil moisture status or has hired hands that may use the information for irrigation scheduling.

In 2009, all sites were equipped with Irrometer data logging stations equipped with WaterMark soil moisture sensors, replacing WatchDog data logging units that had a on-farm life span of only 2 to 3 years. The Irrometer system is very user friendly as the grower or irrigator can push a button can see the soil moisture status of each sensor location. Watermark sensors are comprised of a matrix material that converts electrical resistance to a calibrated reading of Centibars or kilopascals (kPa), which are equivalent; of soil water tension. At total water submersion during an irrigation or heavy rain event, WaterMark sensors should be reading zero. Since the WaterMark sensors are relatively inexpensive ($25 each), they can easily be replace if

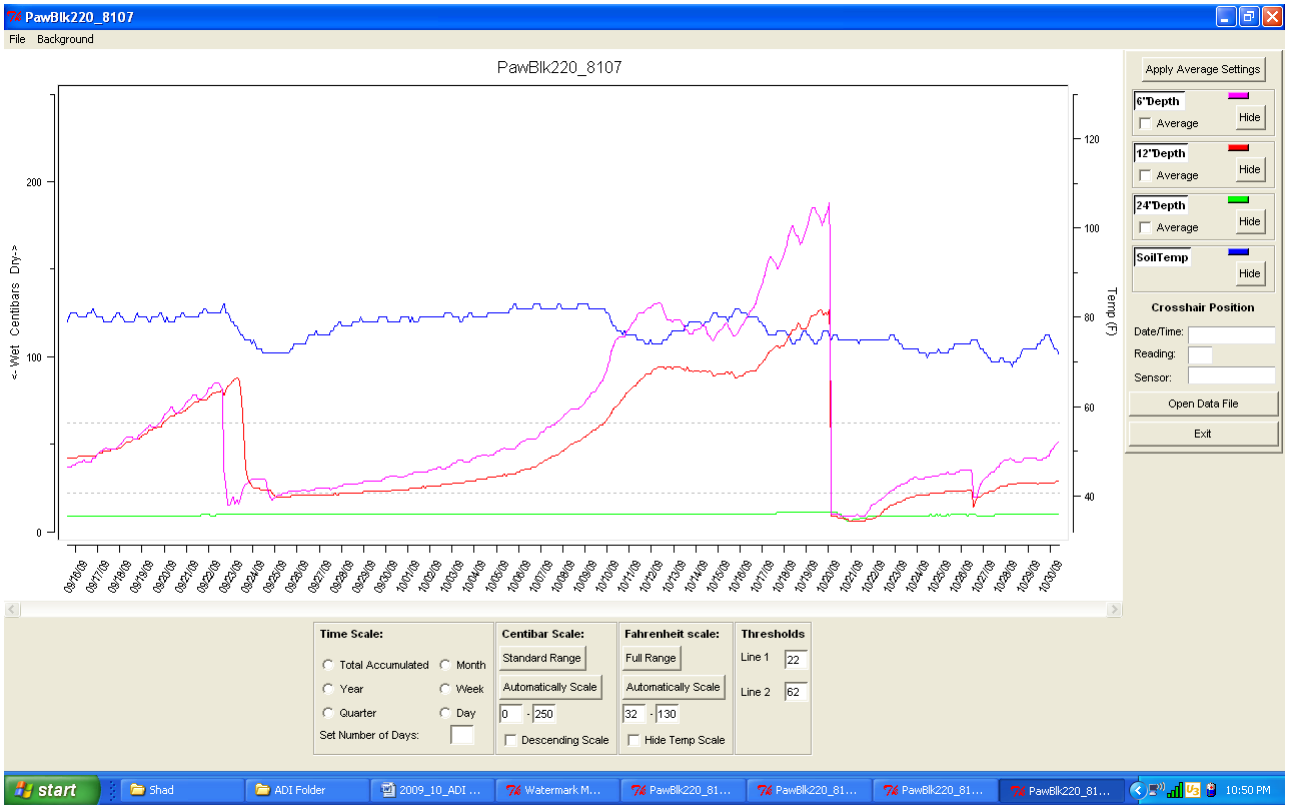


Figure 3 Water Mark Soil Mosture Chart

and when they permanently lose soil contact or no longer come back to near zero readings.

In the chart above, a sharp decrease in all soil moisture sensor as observed on Oct 20, 2009 indicates a flood irrigation event, whereas rainfall events generally lead to a slower, and separated decrease in soil moisture readings and not to as low a centibar reading.

In 2009, two newly established young citrus sites were created and Irrometer stations installed with soil moisture equipment. One is a drip irrigated site for newly planted orange trees for collaborator #4, and the other is 4-year-old grapefruit trees for collaborator #1. These growers utilize the equipment to better manage their irrigation scheduling and have asked for an increased number of soil moisture stations to evaluate water in the rooting zone of newly planted citrus trees. This is evidence that our work with these growers is having a positive impact to assess water use and improve water conservation at the farm level, regardless of the irrigation system preference of the grower.

Outcomes: 2009-10

Evaluating alternative irrigation practices to traditional flood irrigation in citrus grove management:

The average annual water savings in acre-feet over the past 5 years was 1.61 (drip irrigation), 1.28 (micro-jet spray irrigation), and 0.84 (narrow border-flood) over conventional flood irrigation for citrus growers utilizing alternative irrigation practices throughout the Lower Rio Grande Valley.

2009 was a challenging year for growers in South Texas as little to no rainfall occurred from late September 2008 thru August 2009. This led to increased irrigation demand for this perennial crop, thus resulting in higher overall water use compared to other past years. Harvest results and irrigation use efficiency data is forthcoming as growers will receive citrus yield results in March 2009.

Effect of water stress and irrigation timing on citrus pest management and water use:

A study was performed on irrigation timing before and after chemical application in citrus groves to control citrus pests. Pest assessments in conjunction with determination of pesticide movement in soil and uptake in citrus trees resulted in our finding that soil moisture status prior to chemical application will dictate chemical efficacy. Our preliminary findings suggest that avoiding irrigation near chemical application will prevent chemical loss, improve pest control efficacy, and save water by reducing the need to irrigate at least one 0.5 acre-ft flood irrigation event per year.

Evaluation of water savings using surge irrigation in citrus:

One goal is to target a site in 2010 to evaluate surge irrigation practices the practicality of this irrigation method for established citrus groves that currently use large pan flood irrigation methods. This practice has been shown to have up to 40% water savings in sugarcane rows using poly-pipe and may be a possible alternative irrigation methodology for citrus grower during times of water scarcity or high water prices.

Leveraging of Project Resources:

The results on various on-farm management strategies, such as fertilization and water impacts on citrus, compost utilization on soil-water status and citrus yield, irrigation management on onions, impacts of irrigation practices on chemical fate and transport in South Texas soils and citrus pest control were published in the articles, newsletters, presented at professional meetings, and were the catalyst to obtaining additional external grant funds to support the goals of the Rio Grande Basin Initiative projects discussed above. The outcomes

from Dr. Nelson's collaborative efforts with Harlingen Irrigation District, Texas Water Development Board, Texas AgriLife Extension, Texas A&M University-Kingsville Citrus Center, and TAMUK graduate students are presented in the information that follows below.

Surge, Automated Surface, and Precision Surface Irrigation

The District has maintained the following demonstration sites throughout the 2009 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.

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 2009 growing season and will continue through the 2010 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.

Arroyo Colorado BMPs Assessment for NPS Pollution at the Farm Level

With TSSWCB and TWRI, we are working on an additional 2-year project (2009-2010) that is designed to assess the BMPs that are in place at the field level, on 6 sites (6 cooperators within the watershed), and see how they impact NPS pollution into the Arroyo Colorado. This

work is not funded by the ADI project but several of the ADI sites are being used for data collection to support the Arroyo Colorado Assessment project.

Each site is monitored for 2 irrigations a year, during a similar season, for water quality parameters and water quantity data.

Monitoring includes:

- Irrigation depth and water quality parameters (temp., pH, DO, EC, salinity, nitrates, nitrites, orthophosphates, KN, TSS, phosphorus, etc.)
- Runoff flow (initial and peak), volume, and water quality parameters (same as above)
- Ground water or tile-drained water quality parameters (same as above).

Field Demonstrations of Projects/ Field Days

The Harlingen Irrigation District (HID) began contracting with Austin-based WaterPR in May 2009 to plan and execute the "Texas Irrigation Expo 2010" in October 2010 that will serve to educate agricultural producers around the state on the best management practices for on-farm water conservation.

In the past two quarters (September 2009 through March 2010), the following progress has been made on the event by HID and WaterPR:

Task 1 – Event Planning and Organization

The overall program and the budget were determined after meetings in Harlingen with ADI participants. Contracts were signed with the main subcontractors for the venue (the Rio Grande Valley Livestock Show Grounds) and catering (Wray & Company). Because the event will be free to the general public, and we're planning for 200-300 attendees, sponsors are being recruited to cover food and beverage expenses.

The event will begin on Wednesday, Oct. 20, 2010 with exhibitor move-in, followed by a private reception with sponsors, exhibitors, irrigation district general managers and board members, and other invited guests. The program begins the morning of Thursday, Oct. 21, with presentations focused on on-farm water conservation, with optional site tours in the afternoon to demonstration sites via chartered buses. That evening, a reception will be held and the winners of a statewide science contest focused on water conservation will be announced. On Friday morning, Oct. 22, there will be additional educational programming before the event ends at noon.

A draft program has been created and is available on the Irrigation Expo's website, www.texasirrigationexpo.org). All of the speakers have been invited, and only a few still need to be confirmed. The program will include content on why the ADI program was created by the state legislature, why the TWDB is involved, what it takes to be a cooperator, and case studies of different types of technology currently being used on demonstration sites.

An online system for general registration was added to the website in March 2010.

Task 2 – Event Publicity

Three news releases have been distributed to statewide media, with a special emphasis on agricultural media – the first one announced the event, the second one announced the science contest, and the third one announced the program and sponsors (as of March 2010).

One-page flyers and posters were created to advertise the event and the science contest. Packets of information about the science contest were also distributed to schools in the Rio Grande Valley.

Sponsors who signed up before December 31, 2009 had their logos included in a registration brochure that was created for the general public. The brochure was handed out to

hundreds of people who attended the Rio Grande Valley Livestock Show in Mercedes in March 2010. Registration systems have also been set up for the general public through Constant Contact (www.constantcontact.com), which we're also using for e-newsletter blasts.

Three mass e-mails have been sent to approximately 200 contacts – the first one announcing online sponsor/exhibitor registration was available, the second one with a deadline reminder to sign up as a sponsor to have a logo published in the general registration brochure, and the third one announcing the draft program and the initial sponsors.

In another effort to publicize the event, we created a pop-up banner display and promotional items (pens and koozies) that were handed out at the Rio Grande Valley livestock show. The display and promotional items will be used at numerous other events over the coming months.

Task 3 – Recruitment and Support of Equipment Exhibitors and Event Sponsors

Online registration systems were set up in the fall of 2009 on the website for sponsors and exhibitors. Payment processing is handled by PayPal. Sponsor logos and links to their websites are added to the website as they sign up. Additionally, information about the science contest is available to be downloaded from the website, as are news releases that have been distributed.

A four page, full-color brochure was created to encourage sponsors and exhibitors to sign up. It was distributed at several events, including the national Irrigation Association conference in San Antonio in December, and the Texas Water Conservation Association's fall 2009 and spring 2010 conference. As of March 2010, we have seven Platinum Sponsors ($1,000 each), two Silver Sponsors ($500 each), two Bronze Sponsors ($250 each), and seven exhibitors. In addition to the paid exhibitors, we're offering free table-top exhibit space to state and federal government entities, universities, and non-profits that involved with water issues.

Task 4 – Technical Presentations

As stated under Task 1, the technical program is mostly complete. There are a few speakers who need to be confirmed. HID has a template for an invitation letter to invite more speakers, as needed.

Workshops

The District conducted a three day short course on water measurement in January 2010. The course focused on flow measurement in open channel canals and closed pipe systems. The training took place at the Flow Meter Calibration Facility and was taught by Dr. Al Blair and Dr. Ian McCann. There were eighteen students from across the state in attendance. Each attendee took part in classroom lectures as well as on-hands flow measurement in open canals and closed pipe systems. Attendees also participated in real time flow measurement in the District's main

Figure 4 Closed pipe measurement at the FMC

canal. District personnel along with a representative from CC Lynch inc. instructed students in the use of a Price meter and a Stream Pro acoustic-doppler open channel flow device, each one of these devices are used by the United States Geological Survey as primary flow measurement devices.

Figure 5 Flow measurement with Price AA meter

Presentations at Water Conservation Meetings

The ADI Project manager Tom McLemore made a presentation about the ADI project at the annual Rio Grande Basin Initiative (RGBI) Conference. The conference took place in McAllen and was attended by researchers and RGBI cooperators from across the state. The presentation focused on water savings technologies being demonstrated in the ADI project and the economic impact these technologies could have on the Rio Grande Valley.

Wayne Halbert and Tom McLemore attended the Texas Alliance for Water Conservation Annual meeting in Lubbock, TX. Wayne Halbert presented information on the Harlingen Irrigation District ADI project and other projects ongoing in the District.

The sub contractors involved in the ADI project often are invited to speak, write papers and make presentations that aid in the outreach efforts of the ADI project. Focus articles written by Texas AgriLife Extension Service Farm Assistance program are directly related to ADI demonstration sites and are used in our newsletters. A list of the outreach activities of our subcontractors is included in this report.

Extension Publications:

Young, M., Klose, S.L., Kasse, G., Nelson, S., and Enciso, J. (2009, July). *New orchard establishment: Flood and 1-line drip irrigation illustration for Rio Red grapefruit in the Lower Rio Grande Valley.* FARM Assistance Focus 2009. Texas A&M AgriLife Extension.

Presentations at Professional Meetings:

Nelson, S.D., T. McLemore, J. Enciso, X. Peries, M. Young, and S. Klose. (2009, May). Overview of Agricultural Water Conservation Demonstration Initiative (ADI) Projects in the Lower Rio Grande Valley. Annual Consortium for Irrigation Research and Education (CIRE) Conference. Amarillo, TX.

Newsletters:

Nelson, S., & Enciso, J. (2009, June). Compost Use for Citrus Water Conservation and Sustaining Yield. *Citrus Center Newsletter.* Vol. 27, No. 3, p. 3.

Nelson, S. (2009, December). TAMU-Kingsville Citrus Center Students Sweep Graduate Agricultural Division Awards. *Citrus Center Newsletter.* Vol. 27, No. 6, p. 1-2.

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. The District has also completed their fourth annual report, reproduced and filed it with the Texas Water Development Board. The District Newsletter is published

twice a year with information pertaining to the ADI program as well as all other conservation projects taking place in the District.

Financial Report by Task

The financial report consists of all expenditures to support the ADI project for the reporting period of March 2009 to February 2010.

Expenses by Category

Salary	$89,399.09
Fringe	$16,680.32
Travel	$1,227.40
Expendable Supplies	$7,469.91
Capital Equipment	$3,584.90
Subcontracting Services	$152,002.27
Construction	$0.00
Reproduction	$52.54
Totals	**$270,416.43**

Expenses by Task

Task A	$1,650.00
Task B	$50,359.81
Task C	$138,136.46
Task D	$37,344.62
Totals	**$270,416.43**

District Matching Funds by Task

Since the beginning of the ADI project the District has provided matching funds to support the efforts of the project. The Texas Water Development Board has accepted a total of $2,541,488.96 in matching funds to date from the District. Below is a summary of the matching funds from 2004 to the end of this reporting period.

TASK	Matching Funds
Total A- Project Subcontracting	$750.00
Total B-Technical Management Support for Demos	$1,922,333.36
Total C-Demonstration Projects	$483,522.65
Total D- Public Field Days and Demonstrations	$182.00
Total E-Project Administration and Report Prep	$134,700.95
Total Matching Funds	**$2,541,488.96**

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.

$295,000 Experiential Learning and Career Development in Agricultural and Natural Resources. July 2009-June 2011. PD: S.D. Nelson CoPDs: R.L. Stanko, K.C.McCuistion. USDA/CSREES HSI Grants. (Approximately 20% of total funds will pay for student labor on projects related to ADI goals, or $60,000).

$28,000 USDA/CSREES RGBI. On-Farm Water Savings Project in South Texas Citrus Production. PI: S.D. Nelson, CoPI: M. Setamou. Aug 2009-July 2010. (All funds pay for graduate student labor and water use research pertinent to ADI goals).

$20,000 Bayer Crop Science. Effects of Water Timing on Temik Effectiveness in Citrus Pest Control. PI: M. Setamou, CoPI: S.D. Nelson. Mar 2009-Jan 2010. (All funds pay for graduate student labor and supplies for water use research pertinent to ADI goals).

$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 2010. (All funds pay for graduate student labor and water use research pertinent to ADI goals).

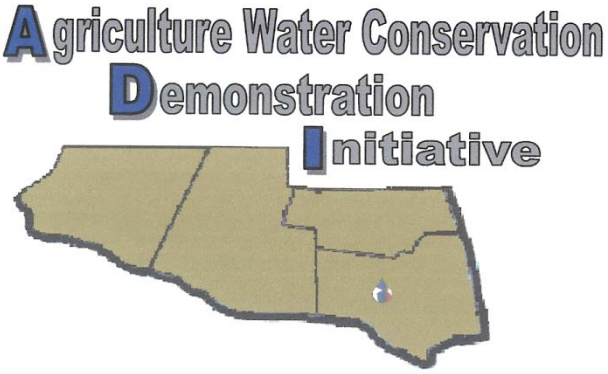
$21,000 Bayer Crop Science. Effects of Water Stress on the Efficacy of Temik and Effectiveness of Selected Bayer Products. PI: M. Setamou, CoPI: S.D. Nelson. April 2008-March 2009. (All funds pay for graduate student labor and water use research pertinent to ADI goals).

$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. (All funds pay for supplies and travel related to graduate projects and water use research pertinent to ADI goals).

$7,500 Experimental Techniques in Animal & Wildlife Sciences, ANSC 4385. K. McCuistion, S. Nelson, and M. Garcia. Jan 2010-Dec 2010. QEP 2010 Quality Enhancement Plan Grants. TAMU-Kingsville. (All funds pay for training, supplies and travel related to undergraduate research projects pertinent to ADI goals).

Harlingen Irrigation District Agricultural Water Conservation Demonstration Initiative

HID, TAMUK, TCE Combined
Demonstration Site Summaries
For the 2009-2010 Growing Season



Site Summary Table of Contents

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 AgriLife Extension Service 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 AgriLife Extension Service FARM Assistance program under the direction of Dr. Steven Klose and Mac Young.

Site: #01A -2009-2010

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 '09: 300 lbs/ac 21-0-0-24

Sensor information:

Soil moisture: Irrometer data logger with Watermark sensors and a Decagon data logger EM-50, equipped with ECHO-10 soil moisture probes were placed at 6", 12", and 24" depths. Sensor data is downloaded monthly and provided to grower for water management and irrigation scheduling as needed.

Irrigation schedule and amounts:

Total irrigation:	28.00 ac/in
Total rainfall:	17.89 in
Total water input:	45.89 ac/in

Irrigation method:

Farmer uses 12" concrete outlet riser valve attached to poly-pipe. Farmer channels water more directly under the canopy (root zone) by using raised berms in between citrus tree rows. This method allows water to travel faster to the end of the row and grower will apply on average a 4-inch irrigation application amount using this method, as opposed to 6-inch irrigation event found in traditional flood irrigation practices. The grower will reform the raised berms after each year's harvest in order to channel water at a faster rate to the end of the bed. This has been shown to be an effective water conserving irrigation method over traditional flood irrigation for mature citrus. The site is equipped with a 10 inch Turbine-type flow meter.

Observations made during the crop season:

The majority of rainfall did not arrive until early Sept 2009, the South Texas region was under stressful drought conditions since the previous Sept 2008. Rainfall since Sept 2009 has been prevalent since and has limited the need for irrigation since Oct 2009. A total of 7 separate flood irrigation events were performed during the 2009-10 growing season. Fruit on the trees looks very good this season and has yet to be harvested as of the end of January 2010. Anticipated yield results are forthcoming for April 2010 and 1st quarter report 2010.

Yield:

2009: TBA; 2008: 20.04 ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1,285 lb/ac.in.
WUE: 2009: TBA; 2008: 696 lb/ac.in.

Economic Summary: Demonstration Site 1A

The Demonstration Site 1A analysis consists of a 10-year financial outlook (2009-2018) 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 $140/ton. 2009 producer costs and overhead charges are producer estimated rates.

Total cash receipts average $3,505/acre over the 10-year period and cash costs average $1,987/acre, including $200/acre irrigation costs. Net cash farm income (NCFI) averages $1,518/acre due largely to the price being held at a constant $140/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 -$680/acre to $3,840/acre.

Site: #01B –2009-2010

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: Mar 09-Mar 10
Irrigation district: None-Class B water owner
Irrigation system: Narrow border flood, polypipe

Fertilizer applied:

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: 28.00 ac.in
Total rainfall: 19.83 in.
Total water input: 47.83 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:

2009: TBA; 2008: 11.65 Ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 917 lb/ac.in.
WUE: 2009: TBA; 2008: 450 lb/ac.in.

Economic Summary: Demonstration Site 01B

The Demonstration Site 1B analysis consists of a 10-year financial outlook (2009-2018) for the 15 acres of Valencia oranges under narrow border flood irrigation. The orchard was assumed to be eight years old. The Valencia orange price is held constant at $110/ton. 2009 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 $2,003/acre, including $200/acre irrigation costs. Net cash farm income (NCFI) averages approximately -$353/acre due largely to the price being held at a constant $110/ton. The risk associated with prices and yields suggests a 77.9% chance of negative NCFI. In a normal production year, NCFI could range as much as -$1,400/acre to $603/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 53% in 2009 and then rises to 94% or less in 2017.

Site: #01C-2009-2010

Photo courtesy of TWDB by Russell Rankratz, 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'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: 28.00 ac.in
Total rainfall: 21.76 in.
Total water input: 49.76 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 water conserving irrigation method for flood irrigating mature citrus.

Observations made during the crop season:

Good water management during intense drought season during the later end of 2008 through August 2009 has produced quality looking fruits Rio Red grapefruit yields

Yield:

2009: TBA; 2008: 22.6 Ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1,778 lb/ac.in.
WUE: 2009: TBA; 2008: 872 lb/ac.in.

Economic Summary: Demonstration Site 1C

The Demonstration Site 1C analysis consists of a 10-year financial outlook (2009-2018) for the 85 acres of Rio Red grapefruit production under narrow border flood irrigation. The orchard was assumed to have mature trees. The Rio Red grapefruit price is held constant at $140/ton. 2009 production costs and overhead charges are producer estimated rates.

Total cash receipts average $3,505/acre over the 10-year period and cash costs average $1,987/acre, including $200/acre irrigation costs. Net cash farm income (NCFI) averages $1,518/acre due largely to the price being held at a constant $140/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 -$671/acre to $3,835/acre.

Site: #01D- 2009-2010

Photo courtesy of TWDB by Russell Rankratz, 2009.

Site Description:

Acres: TBA (New Site as of Jan 2010)
Soil type: silty clay loam 0--36 inches
Crop variety: Rio Red grapefruit
Harvest season: Mar 09-Mar 10 (Young trees)
Field characteristics: 15' x 24' spacing (115 trees/Acre)
Irrigation district: None-Class B water owner
Irrigation system: Very Narrow bordered flood, polypipe

Fertilizer applied: Unknown

Sensor information:

Soil moisture: Irrometer data logger with Watermark sensors were placed at 6", 12", and 24" depths. This site was newly establish in January 2010. Sensor data is to be downloaded monthly and provided to grower for water management and irrigation scheduling as needed.

Irrigation schedule and amounts:

Total irrigation: ??? ac.in
Total rainfall: 21.00 in.
Total water input: ??? ac.in

Irrigation method:

Farmer uses 12" concrete outlet valve and attaches turbine-type meter to valve and poly-pipe. Farmer concentrates irrigation directly under within the root zone by using raised berms in between rows and just outside of the young tree canopy (Grapefruit).

Observations made during the crop season:

This grower utilizes an annual cropping between the rows of newly establishing young citrus to prevent wind abrasion on the trees. The annual crop is harvested at the end of the summer. Soil is irrigated by channeling was at a very narrow region near the young tree canopy dripline.

Yield: 2009: TBA Ton/ac

Water use summary:

IUE: 2009: TBA lb/ac.in.
WUE: 2009: TBA lb/ac.in.

Economic Summary:

There is no economic assessment on this newly acquired demonstration site for 2010.

Site: #01G – 2009-2010

Site Description:

Acres: 33.0
Soil characteristics: Rio Grande silt loam, Loam at 6", 12" and 24" depths.
Crop variety: Yellow Onion (Cougar var.)
Irrigation district: None-Class B water owner
Field characteristics: Onions planted mid Oct '09, anticipate March harvest. 48 in. beds, 80 in. center-to-center; 6 onion lines per bed
Irrigation system: Furrow Irrigated

Fertilizer applied:

Oct '09: 50 gals/ac 15-10-5; Nov '09: 10 gals/ac 12-0-0-26

Soil moisture sensors:

Watermark sensors not installed this season as extremely wet winter season made field entry disruptive to install sensor equipment.

Irrigation schedule and amounts:

Total irrigation:	2.80 ac/in
Total rainfall:	12.20 inches (significant rain Oct. '09-Feb. '10)
Total water input:	14.00 ac/in

Irrigation method:

Furrow irrigated by polypipe from 10" irrigation header

Observations made during the crop season:

Onions crop for 2009-10 still in the field at end of January. Expected harvest date in mid-March. Cool season rains have provided much of the moisture for the crop this season.

Yield:

2009 TBA; 2008 below; 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 (2009-2018) for the 33 acres of onion production under furrow irrigation. Crop returns were assumed to be $1,400/acre in 2009-2018. 2009 production costs and overhead charges are producer estimated rates.

Total cash receipts average $1,402/acre over the 10-year period and cash costs average $1,285/acre, including $198/acre irrigation costs. Net cash farm income (NCFI) averages $117/acre due largely to crop revenue being held constant. The risks associated with prices and yields suggest a 29.2% chance of negative NCFI. In a normal production year, NCFI could range as much as -$303/acre to $515/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 7% in 2009 and then declines to 1% or less by 2013.

Site: # 02A – 2009-2010

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 – 450 lbs/ac 34-0-0-12 split application

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: 24.00 ac.in.
Total rainfall: 16.15 inch
Total water input: 40.15 ac.in.

Irrigation method:

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. Water delivered is approximately 4 inch irrigation event per acre. Grower flood irrigated six times in 2009 growing season.

Yield:

2009: TBA; 2008: 17.1 ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 961.1 lb/ac.in
WUE: 2009: TBS; 2008: 538.3 lb/ac.in

Economic Summary:

The Demonstration Site 02A analysis consists of a 10-year financial outlook (2009-2018) for the 11 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 $125/ton. 2009 production costs and overhead charges are producer estimated rates.

Total cash receipts average $2,075/acre over the 10-year period and cash costs average $1,670/acre, including $243/acre variable irrigation costs in 2009. Net cash farm income (NCFI) averages $405/acre due largely to the price being held constant at $125/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 $909/acre to $1,364/acre plus or minus the expected NCFI for the site. Reflecting the potential of negative NCFI, the probability of carryover debt is 40% or less during 2009 and then generally declines to 4% or less in 2018.

Site: # 02B –2009-2010

Photo courtesy of TWDB by Russell Rankratz, 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.

Irrigation Method:

This site was irrigated using microjet spray irrigation using water from an on-site reservoir holding pond. In 2009, there were 17 separate irrigation events where an average of 240 gallons water was applied per tree per irrigation event. The irrigation system is allowed to run 24 hours and a 2” turbine meter was installed at end of season, March 2007.

Irrigation schedule and amounts:

Total irrigation: 15.25 ac.in
Total rainfall: 16.15 inch
Total water input: 31.40 ac.in

Observations made during the crop season:

Good rainfall during months of Sept 2009-Feb 2010; whereas, prior to this time for one year the Rio Grande Valley was in drought conditions. Fruit was still on the tree by the end of January 2010. 2009 yield data will be forthcoming from the packing shed by April-May 2010.

Yield:

2009: TBA; 2008: 11.1 Ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1,768.5 lbs/ac.in
WUE: 2009: TBA; 2008: 765.8 lbs/ac.in

Economic Summary: Demonstration Site 02B

The Demonstration Site 02B analysis consists of a 10-year financial outlook (2009-2018) 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 $150/ton. 2009 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 $2,550/acre over the 10-year period and cash costs average $1,924/acre, including $302/acre variable irrigation costs in 2009. Net cash farm income (NCFI) averages $626/acre due largely to the price being held constant at $150/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 -$1,250/acre to $1,250/acre. The probability of carryover debt is 51% or less during 2009 and then declines to 1% or less in 2018.

Site: # 02C – 2009-2010

Site Description:

Acres: 4.0
Soil characteristics: sandy clay loam 0-18 inches, heavy caliche layer at 18”
Crop variety: formerly Rio Red grapefruit
Irrigation district: United
Irrigation system: Former Drip Irrigation Site
Field characteristics: formerly 15’ x 24’ spacing (115 trees/Acre)

Observations made during the crop season:

The trees at this drip site location were removed in early 2009 after the majority of trees were extremely stressed and had severe decline due to excessive water in the rooting zone following Hurricane Dolly in 2008. The site was replanted with various citrus varieties under newly established microjet irrigation. This has not been established as a new ADI site for 2009.

Site # 03 A -2009-2010

Photo courtesy of TWDB by Russell Rankratz,

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:

Jan ’09 Ammonium Sulfate at 1 lb N/tree/yr [550 lbs. ac.

(21-0-0)].

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 Amount:

Conventional flood irrigation applies approximately 6 inch water depth over the entire irrigated soil surface per irrigation event. Only 3 irrigation events during the 2009 growing season, which is 3 to 5 flood irrigation events less than other flood irrigators.

Irrigation schedule and amounts:

Total irrigation:	18.00 ac.in
Total rainfall:	23.11 inch
Total water input:	41.11 ac.in

Observations made during the crop season:

This site went through an extended period without irrigation during the first 4 months of the year and this grower did not irrigate from Sept 2008 through May 2009. The orchard was only flood irrigated 3 times during the 2009 growing season. This has resulted in small sized fruit that is still on the tree as of the end of January 2009.

Yield:

2009: TBA; 2008: 22.7 Ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1,892 lbs/ac.in
WUE: 2009: TBA; 2008: 899 lbs/ac.in

Economic summary:

Not available at report time. The owner of this site may be looking at turning this location into housing property soon as the farm manager overseeing the site has been keeping the trees alive, but not really paying attention to producing the best crop for 2009.

Site # 04 A – 2009-2010

Photo courtesy of TWDB by Russell Rankratz, 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 equipped with Tipping bucket rain gauge. 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. To monitor lateral soil water movement from the drip tape, we installed WaterMark sensors at the 12" soil depth at 1, 2, and 3 feet away from the dripline.

Water meter:

Grower has own meters.

Irrigation schedule and amounts:

Total irrigation:	17.00 ac.in
Total rainfall:	19.74 inch
Total water input:	36.74 ac.in

Irrigation method:

Single line Drip system; 5/8" polyethylene line with emitters every 48". 17 separate drip irrigation events occurred in 2009. Grower targets a 1.0 ac-in water application per irrigation event.

Observations made during the crop season:

Severe drought conditions in 2009 growing season until September, then steady rains have been received through Feb 2010. Grapefruit still on the trees as of the end of Jan 2010.

Yield:

2009: TBA; 2008: 18.6 ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1951.6 lbs/ac.in
WUE: 2009: TBA; 2008: 812.5 lbs/ac.in

Economic Summary:

The Demonstration Site 04A analysis consists of a 10-year financial outlook (2009-2018) 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 $125/ton. 2009 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 $2,500/acre over the 10-year period and cash costs average $1,850/acre, including $123/acre irrigation costs in 2009. Net cash farm income (NCFI) averages $650/acre due largely to the price being held constant at $125/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 -$370/acre to $2,299/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 12% in 2009 and declines to only 3% in 2010.

Site: #04 B - 2009-2010

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: 24.00 ac.in
Total rainfall: 19.74 inch
Total water input: 43.74 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. Grower applies approximately 1.0 ac-in. per irrigation event and applied 24 separate irrigation events in 2009.

Observations made during the crop season:

Drought conditions were alleviated in Early September 2009 as rains came and have continued through February 2010. Approximately 90% of 2009 rainfall fell after Sept 1, 2009.

Yield:

2009: TBA; 2008: 18.8 ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1320.5 lbs/ac.in
Wue: 2009: TBA; 2008: 681.3 lbs/ac.in

Economic Summary:

The Demonstration Site 04B analysis consists of a 10-year financial outlook (2009-2018) 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 $125/ton. 2009 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 $2,500/acre over the 10-year period and cash costs average $2,030/acre, including $183/acre irrigation costs in 2009. Net cash farm income (NCFI) averages $470/acre due largely to the pricing being held constant at $125/ton. The risk associated with prices and yields suggests significant chance of negative NCFI. In a normal production year, NCFI could range as much as -$605/acre to $2,132/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 24% in 2009 and declines to only 5% in 2012.

Site: #04 C – 2009-2010

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:

1 lb N/tree/year in split granular applications

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:	42.00 ac.in
Total rainfall:	19.74 inch
Total water input:	61.74 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:

2009: TBA; 2008: 22.9 ton/ac

Water use summary:

IUE: 2009: TBA; 2008: 1246.7 lbs/ac.in
WUE: 2009: TBA; 2008: 659.5 lbs/ac.in

Economic Summary:

The Demonstration Site 04C analysis consists of a 10-year financial outlook (2009-2018) for the 14 acres of Rio Red grapefruit under traditional flood irrigation. The orchard trees were assumed to have mature trees. The Rio Red grapefruit price is held constant at $125/ton. 2009 production costs and overhead charges are producer estimated rates.

Total cash receipts average $2,500/acre over the 10-year period and cash costs average $1,740/acre, including $161/acre irrigation costs in 2009. Net cash farm income (NCFI) averages $760/acre due largely to the pricing being held constant at $125/ton. The risk

associated with prices and yields suggests significant chance of negative NCFI. In a normal production year, NCFI could range as much as -$270/acre to $2,407/acre. Reflecting the potential of negative NCFI, the probability of carryover debt is 4% in 2009 and increases to 21% in 2018.

Site: #04 D - 2009-2010

Site Description:

Acres: 35.0 (210 acres planted; 20 acres as Valencia oranges)
Soil characteristics: sandy clay loam, 0-36 inches
Crop variety: Rio Red grapefruit
Irrigation district: Delta lakes
Irrigation system: Single line drip
Field characteristics:20' x 25' spacing (115 trees/Acre)

Fertilizer applied:

Unknown, New drip site established with 1-year-old trees March 10, 2009.

Soil moisture sensor monitoring:

Irrometer data logger with 3 Watermark sensors set at 6, 12 and 24 inches under center of tree canopy and one sensor placed 12" deep in the soil located one foot away from the drip tape to ensure lateral water movement.

Irrigation schedule and amounts:

Total irrigation:	11.00 ac.in (estimated)
Total rainfall:	19.74 inch
Total water input:	30.74 ac.in (estimated)

Irrigation method:

Single line Drip irrigation with emitters spaced every 2.0 feet.

Observations made during the crop season:

Trees at this new location are under stress due to high salt conditions. This osmotic pressure has an affect on accurate soil moisture reading from WaterMark soil matric sensors as they are inadequate to accurately inform the grower when to re-irrigate this site.

Yield:

Not Applicable; no fruit

Water use summary:

Not Applicable; no fruit

Economic Summary:

The Demonstration Site 04D analysis consists of a 10-year financial outlook (2009-2018) for the 35 acres of Rio Red grapefruit under 1-line drip irrigation. The orchard trees were assumed to have been planted in 2009. The Rio Red grapefruit price is held constant at $150/ton. 2009 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 expenses are evenly distributed ($75/acre/year) over a 20-year period with the assumption of no financing costs. Irrigation labor amounted to $54.34/acre, irrigation fuel $28.30/acre, and water costs $40.33/acre. Total cash irrigation costs were $122.97/acre, assuming 7 irrigation events. Irrigation fuel used was electricity.

The cost of installing drain tile was also evenly distributed ($30/acre/year) over a 20-year period with no financing costs assumed. The cost of planting trees ($54,740) and land preparation charges ($297) was also included in 2009.

Results reflect positive net cash farm income in the 5th year and a 10-year payout to recover all establishment costs. Total cash receipts were zero in 2009-20010 and average $1,980/acre over the 10-year period. Cash costs average $1,910/acre, including $123/acre cash irrigation costs. Net cash farm income (NCFI) is negative the first four years and builds to $1,080/acre in the 10th year. This somewhat reflects the price being held at a constant $150/ton and projected increases in production costs. The risk associated with prices and yields suggests a significant chance of negative NCFI in the initial years and little or no risk after the trees reach maturity. Cash reserves are expected to be negative over most of the 10-year projection period and reach only $27,420 or $780/acre by 2018. The average cash flow balances are intended to illustrate the cash requirements or flows generated using the 1-line drip irrigation method. The positive cash reserves in 2018 reflect the recovery of all establishment costs incurred. Reflecting the deficit cash reserves in 2009-2017, the probability of carryover debt is 99% or less during 2009-2013, and then declines to 34% or less in 2018.

Site: #05A – 2009-2010

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 '09, 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:

No Irrometer data logger with Watermark sensors placed in field site during 2009 due to rains throughout growing season.

Irrigation schedule and amounts:

Total irrigation: 4.00 ac.in (estimated based on rainfall data and past irrigation)
Total rainfall: 17.69 inch (majority of rain fell Nov '09-Jan '10)
Total water input: 21.69 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:

2009: TBA; 2008: 22.8 lbs/ac.in (20,042 50-lb bags/22 ac)

Water Use Summary:

IUE: 2009: TBA; 2008: 2539 lbs/ac.in
WUE: 2009: TBA; 2008: 2504 lbs/ac.in

Site: #06D - 2009-2010

Site Description:

Acres: 10.0 ac (experimental plot)
Crop variety: Rio Red grapefruit
Harvest season: Mar '09-Mar '10
Irrigation district: Hidalgo Cameron 9
Irrigation system: Traditional Flood
Field characteristics: 16' x 25' spacing (105 trees/Acre)

Fertilizer applied:

Mar '09: 220 lb/ac 46-0-0 urea

Soil moisture sensor monitoring:

No soil moisture sensors set up at this research site, field managed by research station farm manager with irrigation typically once every month. Eight separate irrigation events in 2009. Each irrigation event provided a 6 inch water depth.

Rain gauge:

Tipping bucket style rain gauge with WatchDog data logger

Water meter:

10" turbine-type flow meter

Irrigation schedule and amounts:

Total irrigation: 48.00 ac.in
Total rainfall: 21.00 inch
Total water input: 69.00 ac.in

Irrigation method:

Traditional Flood

Observations made during the crop season:

High level of water applied to this site with trees harvested prior to January 2010. Rainfall was measured directly by hand each day at this location providing exactly 21 inches rainfall in 2009.

Yield:

2009: TBA; 2008: 21.3 Tons/ac
All fruit harvested prior to January 2010, waiting on results from packing shed.

Water use summary:

IUE: 2009: TBA; 2008: 1,181 lbs/ac.in
WUE: 2009: TBA; 2008: 668 lbs/ac.in

Site: #07A – 2009-2010

Site Description:

Acres: 7.3 (flood) Block N-O1
Soil characteristics: sandy clay loam, 0 – 36”
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 ’09: 220 lb/ac 46-0-0 urea

Soil moisture sensor monitoring:

Soil moisture equipment not at this research site other than Davis Instrument Rain gauge and Watchdog Data logger. Irrigation scheduling perform by farm manager based on ETc and duration since last irrigation event. Each irrigation equivalent to a 6 inch irrigation application.

Rain gauge:

Watchdog Data logger attached to rain gauge 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. A total of seven irrigation events were performed in 2009.

Total irrigation:	42.00 ac.in
Total rainfall:	16.50 inch
Total water input:	58.50 ac.in

Irrigation method:

Traditional flood; each irrigation a 6 inch irrigation event. Total of seven irrigation events in 2009.

Yield:

2009: TBA; 2008: 4.92 Ton/ac
All fruit harvested prior to January 2010, waiting on results from packing shed.

Water use summary:

IUE: 2009: TBA; 2008: 273.3 lbs/ac.in
WUE: 2009: TBA; 2008: 154.6 lb/ac.in

Site #:24A – 2009-2010

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:

Watermark sensors (6, 12, 24-inch depth underneath canopy, and 12-inch depth at canopy drip line) connected to data logger (WM monitor) Portable flow meter / Rain gauge connected to a data logger on-site

Irrigation schedule and amounts:

Total irrigation: 42.0 inches/acre (in 12 events: Jan.'09-Jan.'10)
Total rainfall: 20.3 inches/acre (Jan.'09-Jan.'10)
Total water input: 62.3 inches/acre (Jan.'09-Jan.'10)

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:

In February 2009, the Echo-20 probes were removed and replaced by the actual soil moisture monitoring device. The orchard has been sold to another owner but we will also work with him. Irrigation events usually occurred when the 6, 12, and 24" horizon profiles reached 75, 74, and 17cb of soil tension (13%, 28%, and 90% AW, respectively).

Yield:

Only 1st picking occurred so far.

Site #28A – 2009-2010

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 811 lb / 0 lb / 74 lb (fertigation, side-dressing) or **101 / 0 / 9 lb net/acre** type N32 (60 gal), 0-0-62 (120 lb), and 28-0-0-5 (185 gal)Sensor and flow meter information:

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors connected data logger (two complete sets)
Water meter installed at the pump house / Rain gauge connected to a data logger on-site

Irrigation schedule and amounts:

Total irrigation: 28.0 inches/acre (Mar.'09-Dec.'09)
Total rainfall: 17.0 inches/acre (Mar.'09-Dec.'09)
Total water input: 45.0 inches/acre (Mar.'09-Dec.'09)

Irrigation method:

Irrigation scheduling was based on soil moisture and an average of 0.86 inch/acre was applied each time (total of 33 applications) 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:

Irrigation was triggered when 6, 12, and 24" profiles reached 118, 46, and 24 cb, respectively (0%, 60%, and 100% AW, respectively). January 2010 freeze was blamed for many fruit drop, thus affecting yield.

Yield:

14,860 lbs/acre

Water use Summary: Demonstration Site 28A
IUE: 526 lbs/inch of water applied by irrigation
WUE: 304 lbs/inch of water received (irrigation + rainfall)

Site #:28B - 2009-2010

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 251 lb / 0 lb / 0 lb (fertigation) or **36 / 0 / 0 lb net/acre** type N32 (70 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: 40.0 inches/acre (Apr'09-Dec'09) including 1 flood event of 6 inch per ac. so far
Total rainfall: 16.3 inches/acre (Apr'09-Dec'09) so far
Total water input: 56.3 inches/acre (Apr'09-Dec'09) so far

Irrigation method:

Irrigation scheduling was based on soil moisture and was applied each time by drip; 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:

43,400 lbs/acre

Water use summary

IUE: 901 lbs/inch of water applied by irrigation
WUE: 588 lbs/inch of water received (irrigation + rainfall)

Site #:28C - 2009-2010

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 343 lb / 391 lb / 74 lb (fertigation, side-dressing) or **43 / 49 / 9 lb net/acre** type 32-0-0 (80 gal), 5-34-0 (100 gal), and 0-0-62 (120 lb)

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: 35.5 inches/acre (Apr'09-Dec'09) including 1 flood event of 6 inch per ac. so far
Total rainfall: 16.3 inches/acre (Apr'09-Dec'09) so far
Total water input: 51.8 inches/acre (Apr'09-Dec'09) 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:

43,400 lbs/acre

Water use summary:

IUE: 971 lbs/inch of water applied by irrigation
WUE: 618 lbs/inch of water received (irrigation + rainfall)

Site #:28D - 2009-2010

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 1,543 lb / 594 lb / 0 lb (fertigation)
or **220 / 85 / 0 lb net/acre** type
28-0-0 (430 gal), 5-34-0 (152 gal), and 9-0-0 (65 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: 40.8 inches/acre (Jan'09-Nov'09)
Total rainfall: 11.1 inches/acre (Jan'09-Nov'09)
Total water input: 51.9 inches/acre (Jan'09-Nov'09)

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 when 6, 12, and 24" profiles reached 45, 24, and 26 cb, respectively (60%, 90%, and 90% AW, respectively). January 2010 freeze was blamed for many fruit drop, thus affecting yield.

Yield:

28,100 lbs/acre

Water use summary:

IUE: 689 lbs/inch of water applied by irrigation
WUE: 480 lbs/inch of water received (irrigation + rainfall)

Site # 28E - 2009 - 2010

Site Description:

Acres: 8.0
Soil type: Sandy Loam (up to 30-inch depth)
Crop Variety: Rio Red (Planted 1992)
Irrigation system: Drip (surface double line 30-inch emitter)
Field characteristics: 115 trees/acre; no ground cover; drain tiles
Fertilizer applied: total NPK 919 lb / 594 lb / 0 lb (fertigation) or **115 / 74 / 0 lb net/acre**
type 28-0-0 (250 gal), 5-34-0 (152 gal), and 9-0-0 (50 gal)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth "underneath canopy" and 12-24-inch depth "canopy drip line") connected to 3 data loggers (Watermark Monitor).
Water meter installed at the pump house / Rain gauge connected to a data logger on-site

Irrigation schedule and amounts:

Total irrigation: 30.6 inches/acre (Apr'09-Dec'09) including 1 flood event of 6 inch per ac. So far
Total rainfall: 16.3 inches/acre (Apr'09-Dec'09) So far
Total water input: 46.9 inches/acre (Apr'09-Dec'09) So far

Irrigation method:

Irrigation scheduling was based on soil moisture and was applied each time by drip; 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 by soul moisture. Below the canopy drip lines, the 12" South exposure experienced greater depletions than the North exposure (Irrigation triggered at 102cb vs. 85cb).

Yield:

43,400 lbs/acre

Water use summary

IUE: 1,159 lbs/inch of water applied by irrigation
WUE: 689 lbs/inch of water received (irrigation + rainfall)

Site #30A – 2009-2010

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:

Total irrigation: 19.8 inches/acre (Jan'09-Dec'09)
Total rainfall: 15.4 inches/acre (Jan'09-Dec'09)
Total water input: 35.2 inches/acre (Jan'09-Dec'09

Irrigation method:

Irrigation scheduling was not based on soil moisture.
Water is provided by the district (pipeline).

Observations made during the crop season:

Irrigation was triggered when 6, 12, and 24" profiles reached 128, 164, and 82 cb, respectively, at which level there is 0%AW.

Site #30B – 2009-2010

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:

Total irrigation: 6.4 inches/acre (Jan'09-Dec'09)
Total rainfall: 15.4 inches/acre (Jan'09-Dec'09)
Total water input: 21.8 inches/acre (Jan'09-Dec'09)

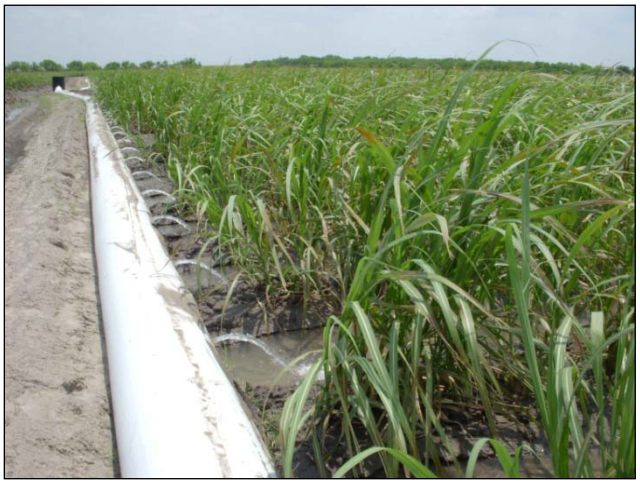
Irrigation method:

Irrigation scheduling was not based on soil moisture.
Water is provided by the district (pipeline).

Observations made during the crop season:

Irrigation was triggered when 6, 12, and 24" profiles reached 111, 72, and 42 cb, respectively, at which level there is 0%, 0%, and 50%AW.

Site #:32A – 2009-2010



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 11,928 lb / 0 lb / 0 lb (side dressing) or **186 / 0 / 0 lb net/acre** type 32-0-0 (52 gal/acre)

Sensor and flow meter information:

Watermark sensors (6, 12, 24, 36-inch depth) connected to data logger (WM monitor)
Portable flow meter / Rain gauge connected to a data logger on-site

Irrigation schedule and amounts:

Total irrigation: 47.8 inches/acre (Feb '09 to Dec '09) in 9 events (average of 5.3 inches/acre/event)
Total rainfall: 21.4 inches/acre (Feb '09 to Dec '09) so far
Total water input: 69.2 inches/acre (Feb '09 to Dec '09) so far

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:

In February 2009, the Echo-20 probes were removed and replaced by Water Mark sensors. Irrigation was triggered when 6, 12, 24 and 36" profiles reached 55, 45, 2, and 4 cb, respectively (30%, 50%, 100%, and 100% AW, respectively).

Yield:

3,820 lbs/acre of sugar and 95,000 lbs/acre of cane

Economic summary:

IUE: 80 lbs of sugar and 1,987 lbs of cane/inch of water applied by irrigation
WUE: 47 lbs of sugar and 1,171 lbs of cane/inch of water received (irrigation + rainfall)

Site #:35A - 2009-2010

Site Description:

Acres: 86.0
Soil type: Harlingen Clay (from 0 to 24-inch depth)
Crop Variety: St Augustine Floratan turf grass (H 06/25/09)
Irrigation system: 1,280 feet-long side-roll sprinklers (40-foot ramps)
Fertilizer applied: total NPK 8,772 lb / 0 lb / 0 lb (broadcast) or **102 / 0 / 0 lb net/acre** type 34-0-0-5 (300 lb/acre)

Sensor and flow meter information:

Watermark (6, 12 & 24-inch depth) sensors connected to a data logger.
No water meter on the site / Rain gauge connected to HID wireless system (pump house #13)

Irrigation schedule and amounts:

Total irrigation: 28.3 inches/acre (Jan'09-Dec'09) in 7 events, all by flood (average of 4.0 inch/acre/event)
Total rainfall: 21.5 inches/acre (Jan'09-Dec'09)
Total water input: 49.8 inches/acre (Jan'09-Dec'09)

Irrigation method:

Irrigation scheduling was not based on soil moisture. This year, the farmer irrigated with flood to keep-up with moisture depletion. Water was provided by the district (pipeline)

Observations made during the crop season:

Irrigation was triggered when 6, 12, and 24" profiles reached 172, 152, and 61 cb, respectively (equivalent to 0% AW for all profiles).

Yield:

75 pallets/acre total

Water use summary:

IUE: 2.7 pallet/inch of water applied by irrigation
WUE: 1.5 pallet/inch of water received (irrigation + rainfall)

Site # 36A - 2009-2010

Site Description:

Acres: 122.0
Soil type: Raymondville Clay Loam (from 0 to 24-inch depth)
Crop Variety: St Augustine Floratan turf grass
Irrigation system: 1,300 feet-long L.E.S.A. center pivot (155-foot spans)

Sensor and flow meter information:

Monitoring since August 2009

Two Watermark (6, 12 & 24-inch depth) sensors transmitters (950T1) sending wireless soil moisture data to a receiver (950R1data logger), powered by a solar panel, and connected to a rain gage.
Water meter attached to the sand-media filter, located downstream from the pivot.

Irrigation schedule and amounts:

Total irrigation: 2.8 inches/acre (Aug'09-Dec'09) in 4 events (average of 0.7 inch/acre/event)
Total rainfall: 16.5 inches/acre (Aug'09-Dec'09)
Total water input: 19.3 inches/acre (Aug'09-Dec'09)

Irrigation method:

Irrigation scheduling was not based on soil moisture. Water was provided by the district (pipeline)

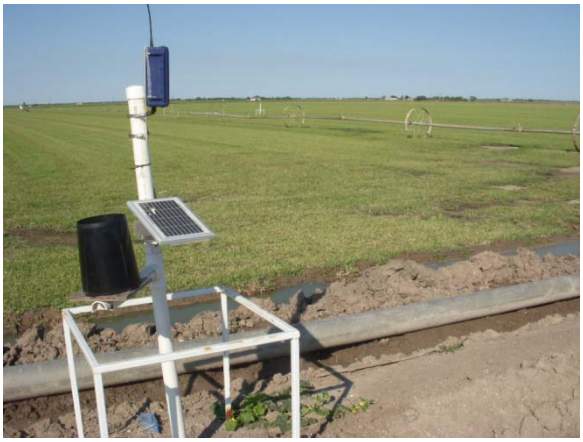
Observations made during the crop season:

Irrigation was triggered when 6, 12, and 24" profiles reached 43, 43, and 50 cb, respectively (equivalent to 25%, 25%, and 0% AW, respectively).

Yield:

Not available

Site # 36B - 2009-2010



Site Description:

Acres: 83
Soil type: Raymondville Clay Loam (from 0 to 24-inch depth)
Crop Variety: St Augustine Floratan turf grass
Irrigation system: 1,280 feet-long side-roll sprinklers (40-foot ramps)

Sensor and flow meter information:

Monitoring since August 2009

Two Watermark (6, 12 & 24-inch depth) sensors transmitters (950T1) sending wireless soil moisture data to a receiver (950R1data logger), powered by a solar panel, and connected to a rain gage.
Water meter attached to the sand-media filter, located downstream from the pivot.

Irrigation schedule and amounts: monitoring since August 2009

Total irrigation: 3.2 inches/acre (Aug'09-Dec'09) in 4 events (average of 0.8 inch/acre/event)
Total rainfall: 16.5 inches/acre (Aug'09-Dec'09)
Total water input: 19.7 inches/acre (Aug'09-Dec'09)

Irrigation method:

Irrigation scheduling was not based on soil moisture. Water was provided by the district (pipeline)

Observations made during the crop season:

Irrigation was triggered when 6, 12, and 24" profiles reached 14, 9, and 6 cb, respectively (equivalent to 0% AW for all profiles).

Yield:

Not available

Site # 41A and 41B 2009-2010

Site Description:

The 39 acre field was planted in seed corn 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. The row length is 1280'.

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 turnrow. 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 flowmeters were used to measure the amount of water applied at the north turnout and at the center turnout.

Irrigation Schedule:

Date	Water Applied per Acre, Surge	Water applied per acre, Flood
1/13/09		10.6"
4/26/09	6.1"	7.7"

Irrigation Method:

The surge controller was programmed to complete the irrigation cycle in 24 hours with the first two alternations to occur at 5 hour intervals with the final setting running until completion. The cooperator used 18" diameter polypipe.

The row length is 1280'.

Observations:

Selecting three alternations in a 24-hour set insured a timely irrigation event and a minimum number of cycles with the benefit of applying 21% less water. Significant soil moisture differences at the 6" and 12" depths were recorded in the month of May. The furrow irrigated section showed relatively little change in soil moisture at the 24" depth while the surge irrigated section did show some moisture loss by the middle of June.

Economic Summary: Demonstration Sites 41A & 41B

The Demonstration Sites 41A & 41B consists of a 10-year financial outlook (2009-2018) for 39 acres (19.5 acres of surge and 19.5 acres of furrow irrigated) seed corn. It is not assumed the seed corn acreage is rotated annually with another crop. The initial corn price, based on the total compensation received by the producer, is $79.11/bushel, including marketing loan deficiency payments. This is a calculated price based on total per acre payment received from the seed company divided by the number of bushels harvested. 2009 production costs and overhead charges are producer estimated rates.

The analysis also includes a $1,800 cost for a surge valve. The surge valve expense is evenly distributed over the 10-year period with the assumption of no financing costs.

Total cash receipts average $658/acre over the 10-year period for both irrigation methods. In addition to market receipts, total receipts include direct and counter-cyclical payments paid to base acres. Due primarily to the $180 per year cost of the surge valve, cash costs average $309/acre per year for the surge irrigation and $300/acre per year for the furrow irrigation. Excluding the surge valve cost per year, irrigation costs in 2009 including water, labor and poly-pipe were $40/acre for both the surge and furrow sites. NCFI averages $349/acre per year for the surge and $358/acre for the furrow. 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 $82/acre plus or minus the average expected NCFI for each site.

Site # 44A 2009-2010

Site Description:

The site is a 38 acre field which was planted in grain sorghum. The irrigation method is furrow irrigation with surge valve technology 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 with sensor sites 100' in from the upper end and 100' in from the lower end. Each site included a soil temperature probe and Watermark soil moisture sensors placed at depths of 6", 12", and 24". The soil moisture readings were recorded on a Watermark 900 series datalogger and radioed to a central datalogger.

Irrigation Schedule:

Date	Amount of Water Applied
April 9, 2009	Flow meter failed to record
May 7, 2009	
May 24, 2009	

Irrigation Method:

The surge valve is located in the center of the field and the field is divided into two settings on each side of the surge valve. The surge valve was programmed to irrigate one section per side during a 24-hour period. During this 24-hour setting there were six alternations per side based on a variable time scale. The surge controller requires the operator to enter the initial setting time period and then calculates the remainder of the settings. Our initial setting time was 30 minutes. The entire field was irrigated in 48 hours.

Observations:

Both sensor sites show spikes in the soil moisture loss at the 24" depth and 6" depth. The usual explanation is an air bubble around the sensor which exaggerates the magnitude of the soil

moisture change. The trend lines remain useful throughout the season with the lower end (North) remaining significantly drier than the upper (South) end. There were no significant rainfall events during the growing season.

Economic Summary: Demonstration Site 44A

The Demonstration Site 44A analysis consists of a 10-year financial outlook (2009-2018) for the 37.8 acres of grain sorghum 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 $7.53/cwt., including marketing loan deficiency payments, if applicable. 2009 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 $458/acre over the 10-year period and cash costs average $293/acre, including $46/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 $149/acre in 2009 to $170/acre in 2018. 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 to $317/acre plus or minus the average expected NCFI for the site.