Annual Progress Report

For the

Texas Water Development Board

Agriculture Water Conservation
Demonstration
Initiative

Harlingen Irrigation District CC 1

Maximization of On-Farm Surface Water Use Efficiency by Integration of On-Farm Application and District Delivery Systems

Submitted by:
Harlingen Irrigation District
Cameron County #1
Wayne Halbert General Manager
Harlingen, TX

February 28th, 2006

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Appendices

1. 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.

1.1. Advisory Committee Members

Chris Allen – Cooperator
Leonard Simmons – Cooperator
Edward Bauer – Grower
Sam Ruiz – Cooperator
Tom Wetegrove – Grower
Sam Morrow – Cooperator
Dale Murden – Rio Farms General Manager
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 Cooperative Extension
Terry Lockamy – Texas Cooperative Extension
Phillip Stewart – NRCS
Andy Garza – TSSWCB

2. Introduction

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

3. Scope of Work

3.1. Subcontracting Contract Execution

The primary responsibilities for this task were contracted to Axiom-Blair Engineering. The subcontracts with Delta Lake Irrigation District, Texas A&M University Kingsville, Texas Cooperative Extension, and others to provide support and services to perform the work tasks listed below were completed for 2005 and all work for the reissue of those contracts for 2006 has been completed.

3.2. District and On-Farm Flow Meter Calibration and Demonstration Facilities

The design and engineering of the Meter Calibration facility has been completed. The necessary permits for construction have been obtained, including a Section 10 Permit from the US Army Corps of Engineers for erosion protection for the return flow outlets. Contracts for the electrical, plumbing and slab labor have been negotiated and the District is waiting for final review and permission to proceed from the TWDB. The District has purchased a 12,000 gpm diesel engine driven pump to supply calibration water to the facility. The pump is installed in an existing pump house located adjacent to the meter calibration facility site. Intake and discharge piping is in place and the construction of the water diversion box is expected to begin in early March. The Prefabricated metal building has been ordered and the erection of this building will begin upon completion of the slab, which is scheduled for mid April 2006. Appendix “E” contains a more detailed account of the installation activity.

The District contracted the engineering and design for this facility to Axiom-Blair Engineering and a more detailed report of this contract is located in appendix “F”.

3.3. District Dispatch and Irrigation Delivery Scheduling

This task is scheduled to begin in 2006

3.4. On-Farm Flow Measurement Data Collection

Delta Lake Irrigation District has been contracted to perform the task of manual meter information collection. A detailed account of the collection methods and data is located in appendix “A”. This information will be compared with the Harlingen Irrigation District’s automated meter and telemetry system. The telemetry system to monitor deliveries of irrigation water through out the District is scheduled to be complete in late 2006. We will begin the comparison after the District has had ample time to evaluate its system and is confident in the data it provides.

3.5. District Facilities and Policies Required to Support On-Farm Water Conservation

This task scheduled to begin in 2006.

3.6. 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 Cooperative Extension service to perform this task through its FARM Assist program. A more detailed report of the first year’s evaluation, as submitted by Dr. Steven Klose, is located in appendix “B”.

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

The bulk of this task is being performed by Axiom-Blair Engineering. The design and launch of the District’s web page occurred in September – October of 2005. The web page allows us to publish information regarding demonstration sites as well as weather and irrigation water usage. A more detailed report of this task, as submitted by Axiom-Blair, is located in appendix “F”.

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

The majority of this task has been subcontracted to Texas A&M University - Kingsville under the direction of Dr. Shad Nelson. Dr. Nelson and his staff have been working since last spring to establish demonstration sites throughout the Valley. He has also been working closely with Texas A&M Extension Service and Dr. Juan Enciso. Dr. Nelson has been sharing resources and gathering data on sites established by Dr. Enciso. A more detailed report of this task, as submitted by Dr. Shad Nelson, is located in appendix “C”.

3.9. Surge, Automated Surface, and Precision Surface Irrigation

The District has maintained three surge demonstration sites through out the 2005 growing season. Two of these sites will continue through the 2006 growing season.

The first demonstration is in a 35 acre sugarcane field where a P&R surge valve is used, along with a fertigation pump and controller. The applied water is measured with a McCrometer insertion meter installed at the field turnout. This demonstration will show the efficiencies of surge irrigation combined with fertigation, compared to traditional flood irrigation combined with fertigation. Soil samples will be taken before and after the fertigation event to compare the distribution of fertilizer in both field segments. This field is fourth ratoon sugarcane and is being grown using minimum till conservation practices. Due to the age of the crop this demonstration will be terminated after this growing season.

The second demonstration is in a 40 acre cotton field where a Waterman surge valve is used. The applied water is measured with a ten inch McCrometer saddle meter. This demonstration will show the efficiencies of surge irrigation compared to flood. The cotton is planted on sixty inch beds, with three lines of cotton planted on fifteen inch spacing across each bed. This field is grown using minimum till conservation practices. For the 2006 growing season this field will be planted in cotton.

The third demonstration is in a 38 acre field planted in fall corn. The P&R surge valve was used on the west half of the field and traditional furrow irrigation with Poly Pipe was utilized in the east half. A McCrometer insertion meter was used to measure the furrow side and a 10” McCrometer meter in aluminum pipe was used in the surge half. The corn was planted on 40 inch beds and grown using conventional tillage. In 2006 this field will be planted in cotton and an experimental surge valve developed by Harlingen Irrigation District will be used to apply irrigation water.

Along with surge irrigation ADI has been demonstrating flood irrigation in three different fields using three different methods.

The first demonstration is a small hay field planted in Coastal Bermuda. This field is irrigated using flood irrigation and an open permanent ditch. The water is metered with a Semetrics meter installed permanently at the turnout.

The second demonstration is a 37 acre Sugarcane field planted in the fall of 2005. The irrigation water is monitored with McCrometer insertion meters at each turn out and applied to the furrow through Poly pipe. This site is expected to remain in sugarcane for five years.

The third demonstration site is a seven acre vegetable field planted in the fall of 2005. This field is furrow irrigated with gated aluminum pipe. The water is metered with a McCrometer meter in line with the pipe. This site will be planted in corn in the spring of 2006 and flood irrigated in pans. The drain water from one pan will be used to irrigate the second pan. This site is expected to continue for several years with furrow irrigation in the fall and pan irrigation in the spring.

A more detailed report of the surge and flood irrigation sites under the control of the District is located in appendix “D”.

3.10. LESA/LPIC/LEPA Center Pivot Sprinkler Demonstration Sites

The District has two LESA center pivot sites. The first site is located at Rio Farms and has been in a spring cotton, fall corn rotation for several years. Soil moisture is monitored during each of the growing seasons and irrigation water is measured with a McCrometer meter located on the center pivot. This site is scheduled to be planted in soybeans in the 2006 spring season.

The second site is a pasture irrigated with a mini-pivot. This pasture is divided into four separate pastures and the mini pivot is moved to each section for the duration of the irrigation. We monitor moisture in each pasture and the water is metered at the pumping site with a McCrometer meter. This pasture is used for a cow calf operation. We expect to monitor this site for the duration of the project.

A more detailed report of the LESA/LEPA sites is located in appendix “D”.

3.11. Automated and Manual On-Farm Measurements Systems

The District is in the process of installing a multi-million dollar automated meter and telemetry system that will allow for the monitoring and reporting of all water deliveries in the District. Upon completion of this installation in late 2006 the District will begin monitoring and reporting flows for evaluation purposes. Real time flow data will be made available to growers on the District’s web site. The cost and efficacy of the automated collection of flow data with in the District will be compared to the manual collection taking place in the Delta Lake Irrigation District. This evaluation is expected to take place over several years and the results of this evaluation are not expected to be available until the evaluation process is complete.

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

Delta Lake Irrigation District has installed three diesel driven pumps to supply water to a service canal. As part of their revised 2006 contract, Delta Lake Irrigation District will provide the hardware and Harlingen Irrigation District has contracted Axiom-Blair to provide engineering and design for the variable speed and control component of this project. This task is scheduled to begin in the spring of 2006 and be completed by the summer of 2006.

3.13. Field Demonstrations of Projects/ Field Days

Field demonstrations will begin in 2006. We did not feel there was enough data to support any field demonstrations during this first year of operations. Our first field day is scheduled for June 2006. This field day will coincide with a visit from the project coordinators from Texas Tech and the advisory committee from The Texas Alliance for Water Conservation.

3.14. Workshops

The District has scheduled two workshops for early 2006. The first on February 21st is an introduction to an irrigation management model developed by the Blacklands Research Center in Temple Texas. This workshop will introduce local growers to the model for evaluation purposes and give the District an opportunity to evaluate the efficacy of this tool. The second workshop will be held on March 7th. This workshop is a short course on the EPANET hydraulic simulation model for design of irrigation pipeline and pumping plants. The course covers an introduction to pipeline and pump hydraulics and hands-on use of the EPANET software. The course is applicable to irrigated farm managers, surface irrigation district employees, and other users and purchasers of irrigation pipeline and pumping plants.

3.15. Presentations at Water Conservation Meetings

During the past year we have had the opportunity to speak at several water conservation meetings. The first of which was the Valley Water Summit. At this meeting Wayne Halbert, General Manager for Harlingen Irrigation District, presented an overview of this project during one of the breakout sessions. Project presentations were made by Tom McLemore at the Texas Citrus Association and the Texas Vegetable Association annual meetings. Mr. McLemore the ADI Project Manager has worked in conjunction with Texas Citrus Association to make project presentations at local EQIP information meetings.

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

A fact sheet was created to introduce the ADI project to growers and agriculture leaders. This fact sheet was distributed at water conservation meetings, gins and irrigation districts.

Tom McLemore is scheduled to speak at the Texas Water Conservation Association annual meeting along with Dr. Vivien Allen of Texas Tech University. He will be giving a presentation on the Agricultural Water Conservation Demonstration Initiative and its impact on water conservation in the valley.

3.16. Quarterly Progress Report

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

3.17. Program Administrative Work

Harlingen Irrigation District hired a full time secretary/bookkeeper to maintain the accounting records and files for the ADI project. The project’s primary administration is handled by Tom McLemore the Project Manager. Together, along 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. The work involved in reissuing these contracts for 2006 has been completed and the draft contracts delivered to the proper authorities for their review and acceptance.

3.18. 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 first annual report, reproduced and filed it with the Texas Water Development Board.

4. Financial Report by Task

Expense by TASK

	Feb 1, '05 - Feb 15, 06
A- Project Subcontracting	
1-Subcontracting Contract Execution	6,710.00
Total A- Project Subcontracting	**6,710.00**
B-Technical Management Support for Demos	
2-District and On-Farm Flow Meter Cal	143,528.71
4-On-Farm Flow Meas. Data Collection	9,990.62
5-Dist Facilities and Policies	116.26
6-Economic Eval of Demo Tech FARM ASSIST	1,656.21
B-Technical Management Support for Demos -Admin	26,664.82
Total B-Technical Management Support for Demos	**181,956.62**
C-Demonstration Projects	
07-Demo of Internet Based Information	14,862.15
08-On Farm Drip,Flood,and Surge Demo	44,298.78
C-Demonstration Projects - Admin	19,822.96
Total C-Demonstration Projects	**78,983.89**
D- Public Field Days and Demonstrations	
13-Presentations at Water Con. Meetings	3,161.97
Total D- Public Field Days and Demonstrations	**3,161.97**
E-Project Administration and Report Prep	
15-Program Administrative Work	57,710.25
16-Report Prep. Repro. and Distribution	3,021.58
E-Project Administration and Report Prep - Other	16,287.98
Total E-Project Administration and Report Prep	**77,019.81**
Total	**347,832.29**

Annual Progress Report

For the

Texas Water Development Board - Agricultural Water Conservation Demonstration Initiative Grant

Maximization of On-Farm Surface Water Use Efficiency by Integration of On-Farm Application and District Delivery Systems

On-Farm Flow Measurement Data Collection

Delta Lake

Irrigation District

Submitted by
Delta Lake Irrigation District
General Manager:
Troy Allen

Appendix "A"

1. Executive Summary

The Delta Lake Irrigation District (DLID) has been monitoring on farm irrigation sites via manual meter readings for the last several years. These sites encompass a variety of crops including, but not limited to carrots, onions, sugar cane, cotton, grain, citrus, and pastures. Now, together with the ADI Project DLID has collected data to help determine the cost effectiveness of manual meter reading as compared to the automated system used in Harlingen.

2. Scope of Work

2.1 On-Farm Flow Measurement Data Collection

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Data collected consists of Field ID, Grower Name, Start and Ending Times, Dates, and Meter Readings, Hours of Irrigation, Gallons per Minute, and Total Acre-Feet.

After collection and tabulation of the data, the numbers can be used to calculate information vital to the efficiency and well being of the water district. As an example, a carrot field was metered three times between October of 2005 and January of 2006. Figure one shows an example of a meter log for one field over three watering periods.

DATE	FIELD ID	METER SN	CROP	START DATE	STOP DATE	START TIME	STOP TIME	START METER	STOP METER	ACRES	TOTAL ACFT
10/17/05	14 of 45		onion	10/17/05		9:00 AM		105.085		11.870	
10/17/05	14 of 45		onion		10/17/05		10:00 PM		106.812	11.870	1.727
										11.870	
12/30/05	14 of 45		onion	12/30/05		8:00 AM		112.871		11.870	
12/30/05	14 of 45		onion		12/30/05		9:00 PM		114.609	11.870	1.738
01/05/05	14 of 45	12-15-1013	onion	01/05/05		9:00 AM		76.188		11.870	
01/05/05	14 of 45	12-15-1013	onion		01/05/05		4:00 PM		76.342	11.870	0.154

Fig.1 Sample Meter Collection Sheet

By examining one irrigation period at a time, several factors can be determined and used to analyze this farmer's efficiency of water use. By multiplying Total Acre-Feet (TACFT) of the first watering period by 325,850, it is seen that the farmer used 562,742.95 gallons of water over a 13 hour time period.

This leads to the calculation that he was pumping 43287.92 gallons per hour, or 721.47 gallons per minute. To figure the inches applied per acre, the total number of gallons used is divided by 2,7154 and then by total acres irrigated, that figure coming out as 1.75 inches per acre.

The numbers for the second and third watering periods are as follows.

Period 2

Total Acre-Feet	1.738
Total Gallons Used	566327.30
Gallons per Hour	43563.64
Gallons per Minute	726.06
Inches per Acre	1.76

Period 3

Total Acre-Feet	.154
Total Gallons Used	50180.90
Gallons per Hour	7168.70
Gallons per Minute	119.478
Inches per Acre	.156

By taking this information, the district is able to compile it all and insure that things are in working order. The district can now check to see that the farmer has bought enough water, that the meters are working properly, and that the district as a whole is harmonious with the farmers. Figure 2 will show the relationship between inches per acre and hours watered for each of the watering periods discussed above.

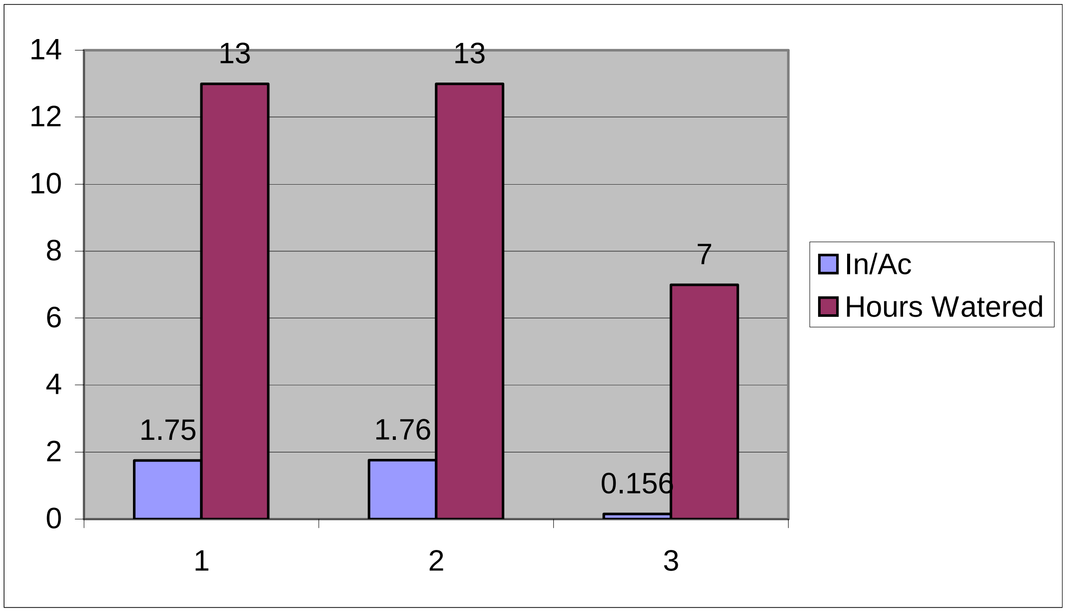


Fig. 2 Inches per acre/hours watered

By constructing a bar graph it is easily seen that in this instance the time needed to water the 11.87 acre onion field for the first two watering periods is consistent with the amount of water put on the field. The visual for the third period however raises a red flag. The amount of time watered (seven hours) should have yielded approximately one inch per acre of water, but that was not the case. In this situation, the meter should be examined for any foreign objects that would obstruct the functionality of the meter, i.e. rocks, sticks, fish etc.

Another trend to take note of is how much the farmer waters the first watering and each successive watering period. Figure 3 will show that the farmer watered a little less each time that he irrigated. This is common, and an indication that he is being frugal and efficient.

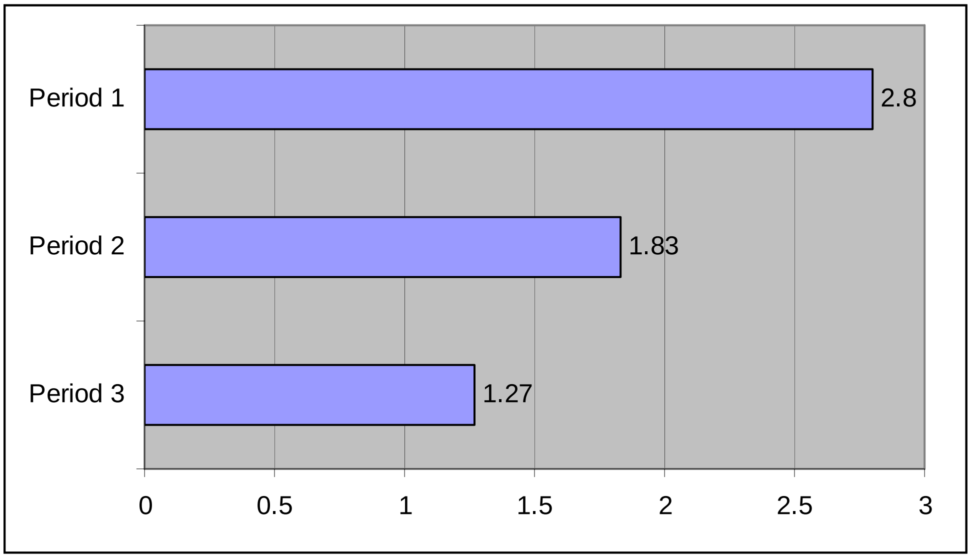


Fig. 3

There are a variety of meters that the manual meter reader must become accustomed to reading. Some meters use acre-feet, and some use gallons as their unit of measure. Another challenge faced by the meter reader is to locate the meter, which can vary from field to field. For example, Pictures 1 and 2 show a meter that is affixed in the most common location, near the valve. Pictures 3 and 4 however illustrate a meter that has been affixed to the top of a drip pump filtration system, on which the meter reader must climb on top of to get the daily readings.

Picture 1 and 2

Picture 3 and 4

An example of a meter that measures in acre-feet can be seen in picture 5. It is clear that the reader must be able to see both the acre-feet reading and the gallons per minute (GPM) reading to properly assess the functionality of the meter.

Picture 5

If the meter is working properly, then certain assumptions can be made, i.e. how long the field will have to be watered, depending on the total acres planted and the GPM. Pictures 6 and 7 demonstrate the progression of the watering process in a cabbage field.

Picture 6 and 7

A major step in the evaluation of manual meter readings vs. automated systems is the budget. Without this, it would be impossible to compare and contrast the validity of the opposing methods. On the next page, Figure 4, is a spreadsheet version of the budget used in the quarterly report. This budget is a reflection of all expenditures through November 2005.

Task Budget	
Category	Total Budget
Task 1	$46,775.00
Task 2	$24,240.00
Totals	$71,015.00

Reimbursable Expenses

	Total Budget	Expenses This Period	Previous Total Expenses	Total Expenses Incurred	Budget Balance
Salary & Wages	$26,000.00	$2,669.65	$4,100.15	$6,769.80	$19,230.20
Fringe (20% of Salary)	$5,200.00	$533.93	$820.03	$1,353.96	$3,846.04
Travel	$11,100.00	$1,251.52	$2,229.04	$3,480.56	$7,619.44
Expendable Supplies	$350.00	$0.00	$0.00	$0.00	$350.00
Capital Equipment	$4,125.00	$0.00	$0.00	$0.00	$4,125.00
Subcontracting Services	$24,240.00	$0.00	$0.00	$0.00	$24,240.00
Total Reimbursable	$71,015.00	$4,455.10	$7,149.22	$11,604.32	$59,410.68
Total Requested for Reimbursement This Period thru 2/13/06		$4,455.10			

Fig. 4

Also necessary is a detailed log of the reader's mileage. Below, in Figure 5 is the log, broken into quarters that were kept by the reader. This is used to determine miles traveled and dollars owed.

Fig. 5

Quarter 2

June 2005				
DATE	TIME	HOURS	SITES	MILES
15-Jun-05	8 AM - 12 PM	4	ALL	108.9
16-Jun-05	8 AM - 12 PM	4	5	101.0
17-Jun-05	8 AM - 12 PM	4	4	61.1
20-Jun-05	8 AM - 12 PM	4	4	60.3
21-Jun-05	8 AM - 12 PM	4	4	54.1
22-Jun-05	8 AM - 12 PM	4	4	60.0
23-Jun-05	8 AM - 12 PM	4	4	51.0
24-Jun-05	8 AM - 12 PM	4	6	60.0
25-Jun-05	8 AM - 10 PM	2	4	42.0
26-Jun-05	8 AM - 10 PM	2	4	48.0
27-Jun-05	8 AM - 12 PM	4	6	62.0
28-Jun-05	8 AM - 12 PM	4	6	59.8
29-Jun-05	8 AM - 12 PM	4	7	75.8
30-Jun-05	8 AM - 12 PM	4	7	81.0
Monthly Totals		52		925.0

July 2005				
DATE	TIME	HOURS	SITES	MILES
1-Jul-05	8 AM - 12 PM	4	5	50.0
2-Jul-05	8 AM - 10 PM	2	4	45.0
3-Jul-05	8 AM - 10 PM	2	4	45.0
4-Jul-05	8 AM - 12 PM	4	5	51.0
5-Jul-05	8 AM - 12 PM	4	5	60.0
6-Jul-05	8 AM - 12 PM	4	6	74.0
7-Jul-05	8 AM - 12 PM	4	10	100.0
8-Jul-05	8 AM - 12 PM	4	4	18.9
9-Jul-05	8 AM - 10 PM	2	3	16.5

10-Jul-05	8 AM - 10 PM	2	3	14.0
11-Jul-05	8 AM - 12 PM	4	7	50.0
12-Jul-05	8 AM - 12 PM	4	7	63.5
13-Jul-05	8 AM - 12 PM	4	4	27.9
14-Jul-05	8 AM - 12 PM	4	12	170.1
15-Jul-05	8 AM - 12 PM	4	7	49.8
16-Jul-05	8 AM - 10 PM	2	4	28.4
17-Jul-05	8 AM - 10 PM	2	7	64.9
18-Jul-05	8 AM - 12 PM	4	7	39.0
19-Jul-05	8 AM - 12 PM	4	10	87.2
21-Jul-05	8 AM - 12 PM	4	7	49.3
22-Jul-05	8 AM - 12 PM	4	8	65.0
23-Jul-05	8 AM - 12 PM	4	4	30.3
24-Jul-05	8 AM - 12 PM	4	9	84.3
25-Jul-05	8 AM - 12 PM	4	7	65.0
26-Jul-05	8 AM - 12 PM	4	7	65.0
27-Jul-05	8 AM - 10 PM	2	2	19.5
28-Jul-05	8 AM - 12 PM	4	10	100.0
29-Jul-05	8 AM - 12 PM	4	5	40.0
Monthly Totals		98		1573.6

August 2005				
DATE	TIME	HOURS	SITES	MILES
1-Aug-05	8 AM - 11 AM	3	4	13.3
3-Aug-05	8 AM - 12 PM	4	9	66.6
4-Aug-05	8 AM - 12 PM	4	8	49.1
5-Aug-05	8 AM - 12 PM	4	9	67.3
8-Aug-05	8 AM - 12 PM	4	10	71.0
9-Aug-05	8 AM - 12 PM	4	10	62.9
10-Aug-05	8 AM - 12 PM	4	8	51.5
11-Aug-05	8 AM - 12 PM	4	10	81.2
12-Aug-05	8 AM - 12 PM	4	10	87.4
13-Aug-05	8 AM - 12 PM	4	6	56.3
15-Aug-05	8 AM - 12 PM	4	10	75.3
16-Aug-05	8 AM - 12 PM	4	10	80.0
17-Aug-05	8 AM - 12 PM	4	5	52.0
18-Aug-05	8 AM - 12 PM	4	5	30.5
19-Aug-05	8 AM - 12 PM	4	10	112.5

25-Aug-05	8 AM - 12 PM	4	5	44.5
26-Aug-05	8 AM - 12 PM	4	10	80.4
29-Aug-05	8 AM - 11 AM	3	5	25.0
30-Aug-05	8 AM - 12 PM	4	10	75.0
31-Aug-05	8 AM - 12 PM	4	10	51.0

Monthly Totals	78	1232.8
Quarterly Totals	228	3731.4

Quarter 3

SEPTEMBER 2005				
DATE	TIME	HOURS	SITES	MILES
1-Sep	8 AM - 10 AM	2	2	15
2-Sep	8 AM - 11 AM	3	3	30
3-Sep	8 AM - 10 AM	2	5	34
4-Sep	8 AM - 10 AM	2	5	34.6
8-Sep	8 AM - 5 PM	8	5	80
14-Sep	8 AM - 12 PM	4	10	90
15-Sep	8 AM - 10 AM	2	3	21
19-Sep	8 AM - 12 PM	4	1	20
23-Sep	8 AM - 12 PM	4	2	29
24-Sep	8 AM - 10 AM	2	2	18
25-Sep	8 AM - 10 AM	2	2	14.4
26-Sep	8 AM - 12 PM	4	16	87.9
27-Sep	8 AM - 12 PM	4	12	45.1
28-Sep	8 AM - 12 PM	4	16	46.5
29-Sep	8 AM - 12 PM	4	16	54.2
30-Sep	8 AM - 12 PM	4	16	57.4

Monthly Totals	55	677.1

OCTOBER 2005				
DATE	TIME	HOURS	SITES	MILES
1-Oct	8 AM - 10 AM	2	5	27.3
2-Oct	8 AM - 10 AM	2	5	25.3

3-Oct	8 AM - 12 PM	4	3	32.1
10-Oct	8 AM - 10 PM	2	2	15.1
13-Oct	8 AM - 10 PM	2	1	35.5
14-Oct	8 AM - 10 PM	2	1	36.1
17-Oct	8 AM - 10 PM	2	2	40.0
18-Oct	8 AM - 12 PM	4	3	90.1
19-Oct	8 AM - 12 PM	4	3	58.2
20-Oct	8 AM - 12 PM	4	4	61.3
21-Oct	8 AM - 12 PM	4	4	41.4
22-Oct	8 AM - 10 PM	2	2	38.0
23-Oct	8 AM - 10 PM	2	2	38.5
25-Oct	8 AM - 12 PM	4	3	43.0
26-Oct	8 AM - 10 PM	2	3	33.0
27-Oct	8 AM - 12 PM	4	5	46.1
28-Oct	8 AM - 12 PM	4	3	41.0
29-Oct	8 AM - 10 AM	2	3	38.3
30-Oct	8 AM - 10 AM	2	3	38.1
31-Oct	8 AM - 12 PM	4	3	89.0
Monthly Totals		58		867.4

NOVEMBER 2005				
DATE	TIME	HOURS	SITES	MILES
1-Nov	8 AM - 12 PM	4	3	47.4
2-Nov	8 AM - 12 PM	4	3	49.1
3-Nov	8 AM - 12 PM	4	3	56.1
4-Nov	8 AM - 12 PM	4	3	47.1
5-Nov	8 AM - 10 AM	2	4	48.1
6-Nov	8 AM - 10 AM	2	3	35.4
7-Nov	8 AM - 12 PM	4	4	48.7
8-Nov	8 AM - 12 PM	4	4	41
9-Nov	8 AM - 12 PM	4	2	27.1
10-Nov	8 AM - 12 PM	4	5	41.7
11-Nov	8 AM - 12 PM	4	3	27.6
12-Nov	8 AM - 10 AM	2	2	42.3
13-Nov	8 AM - 10 AM	2	2	47.1
14-Nov	8 AM - 11 AM	3	2	51
15-Nov	8 AM - 12 PM	4	10	74.1

16-Nov	8 AM - 12 PM	4	2	49.3
17-Nov	8 AM - 12 PM	4	2	48.3
18-Nov	8 AM - 12 PM	4	3	48.1
21-Nov	8 AM - 12 PM	4	10	63.4
22-Nov	8 AM - 10 AM	2	2	43.1
23-Nov	8 AM - 10 AM	2	1	37.1
28-Nov	8 AM - 12 PM	4	1	37.3
29-Nov	8 AM - 12 PM	4	3	36.1
30-Nov	8 AM - 12 PM	4	2	46.3

Monthly Totals	83		1092.8
Quarterly Totals	196		2637.3

Quarter 4

DECEMBER 2005				
DATE	TIME	HOURS	SITES	MILES
12/1/2005	8 AM - 12 PM	4	2	53.1
12/5/2005	8 AM - 12 PM	4	5	44.3
12/8/2005	8 AM - 12 PM	4	2	54.3
12/14/2005	8 AM - 12 PM	4	3	44.3
12/16/2005	8 AM - 12 PM	4	2	43.6
12/25/2005	8 AM - 12 PM	4	ALL	51.3
12/29/2005	8 AM - 12 PM	4	3	41.4
12/30/2005	8 AM - 12 PM	4	3	49.4

Monthly Totals	32		381.7

JANUARY 2005				
DATE	TIME	HOURS	SITES	MILES
1/3/2006	8 AM - 12 PM	4	4	51.3
1/4/2006	8 AM - 12 PM	4	3	37.1
1/5/2006	8 AM - 12 PM	4	4	64.3
1/6/2006	8 AM - 12 PM	4	5	61.4
1/7/2006	8 AM - 10 AM	2	6	64.9
1/8/2006	8 AM - 10 AM	2	5	54.8

1/9/2006	8 AM - 12 PM	4	4	49.3
1/10/2006	8 AM - 12 PM	4	4	44.3
1/11/2006	8 AM - 12 PM	4	3	33
1/12/2006	8 AM - 12 PM	4	2	43.4
1/13/2006	8 AM - 12 PM	4	2	43.1
1/14/2006	8 AM - 10 AM	2	4	37.4
1/15/2006	8 AM - 10 AM	2	4	40.3
1/16/2006	8 AM - 5 PM	8	5	61.3
1/17/2006	8 AM - 5 PM	8	6	73.4
1/18/2006	8 AM - 12 PM	4	3	38.8
1/19/2006	8 AM - 5 PM	4	ALL	63.4
1/20/2006	8 AM - 12 PM	4	3	37.3
1/21/2006	8 AM - 10 AM	2	3	31.7
1/22/2006	8 AM - 10 AM	2	3	27.3
1/23/2005	8 AM - 5 PM	8	5	74.3
1/24/2005	8 AM - 5 PM	8	5	51.3
1/25/2005	8 AM - 5 PM	8	ALL	78.3
1/26/2005	8 AM - 5 PM	8	6	61.5
Nicky	1 PM- 4:30 PM	3.5	n/a	n/a
1/27/2006	8 AM - 12 PM	4	7	55.3
Nicky	8 AM - 4 PM	4	n/a	n/a
1/28/2006	8 AM - 10 AM	2	7	60.3
1/29/2006	8 AM - 10 AM	2	7	44.8
1/30/2006	8 AM - 5 PM	8	10	71.5
1/31/2006	8 AM - 5 PM	8	10	77.3
Nicky	8 AM -4 PM	7	n/a	n/a

Monthly Totals		146.5		1532.4

FEBRUARY				
DATE	TIME	HOURS	SITES	MILES
2/1/2006	8 AM- 5 PM	8	12	81.3
Nicky	8 AM - 3 PM	6	n/a	n/a
2/2/2006	8 AM - 5 PM	8	12	81.5
Nicky	8 AM - 3 PM	6	n/a	n/a
2/3/2006	8 AM - 12 PM	4	9	71.4
2/4/2006	8 AM - 10 AM	2	9	65.8

2/5/2006	8 AM - 10 AM	2	9	63.9
2/6/2006	8 AM - 5 PM	8	6	81.5
2/7/2006	8 AM- 5 PM	8	8	74.3
2/8/2006	8 AM - 5 PM	8	8	65.1
2/9/2006	8 AM - 5 PM	8	6	73.4
2/10/2006	8 AM - 5 PM	4	5	43.1
2/11/2006	8 AM - 10 AM	2	5	52.3
2/12/2006	8 AM - 10 AM	2	5	49.4
2/13/2006	8 AM - 5 PM	8	6	95.3
Nicky	11 AM - 5 PM	5	n/a	n/a
Monthly Totals		89		898.3

And finally, a detailed log of the meter readings must be kept. An electronic copy of this log is included with this report.

Overall, the intent of this project and the outcome are coming together in such a way that the benefits are clear. By having this information the district is able to better serve it and the farmers that rely on the water. Working in much the same way that a checks and balances system would operate enable DLID and the farmers alike to be efficient, helpful, and honest in their efforts to reach their individual goals.

Annual Progress Report

For the

Texas Water Development Board - Agricultural Water Conservation Demonstration Initiative Grant

Maximization of On-Farm Surface Water Use Efficiency by Integration of On-Farm Application and District Delivery Systems

Economic Evaluation of Demonstrated Technologies, FARM Assistance Program

FARM Assistance

Helping Agriculture Make Informed Decisions

Submitted by:
Texas Cooperative Extension, FARM Assistance
Dr. Steven Klose

February 15th, 2006

Appendix "B"

Table of Contents

1. Scope of Work

Economic Evaluation of Demonstrated Technologies, FARM Assistance Program

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. TCE 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. Analyses of the 2005 site demonstrations are included. A summary of the contact, status, and analysis conducted for 2005 demonstrators and potential 2006 demonstrators follows:

2. 2005 Demonstrations

Tom McLemore (fall corn, surge irrigation)
- Conducted introductory/informational meeting
- Conducted initial data collection, and developed preliminary analysis
- Conducted verification/validation meeting
- Completed and delivered FARM Assistance Strategic Analysis
- Completed demonstration site evaluation (included)

Chris Allen (cotton, surge irrigation)
- Conducted introductory/informational meeting
- Conducted initial data collection, and preliminary analysis
- Conducted verification/validation meeting
- Completed demonstration site evaluation (included)

Wayne Halbert (sugarcane, surge irrigation)
- Conducted initial data collection, and developed preliminary analysis
- Conducted verification/validation meeting
- Completed demonstration site evaluation (included)

3. 2006 Potential Demonstrators

Sam Ruiz	Held introductory meeting with cooperator and provided information requirements Several attempts to conduct initial data collection have been cancelled by Mr.Ruiz
Bruce Gamble	Held introductory meeting with client and provided information Conducted initial data collection, and preliminary analysis Completed and delivered FARM Assistance Strategic Analysis
Paul Hillar	Held introductory meeting with cooperator who declined to participate
Dale Murden (Rio Farms)	Discussed project participation by telephone Mr. Murden has not been available for an initial data collection meeting
Jim Hoffman	Held introductory meeting with cooperator and provided information requirements Scheduled initial data collection meeting for late February
Sam Morrow	Held introductory meeting with cooperator and provided information requirements Scheduled initial data collection meeting for late February
Jim Pawlik	Held introductory meeting with cooperator and provided information requirements Conducted initial FARM Assistance data collection and preliminary analysis
Juan Ramirez	Held introductory meeting with cooperator and provided information requirements
Oscar Alvarez	Held introductory meeting with cooperator and provided information requirements Scheduled initial data collection meeting for late February

4. Fall Corn, Surge Irrigation Demonstration

Table 1A provides the basic cost of production assumptions for the fall corn surge irrigation demonstration (McLemore). For the purpose of presenting economic viability and outlook for the 38 acre site, several of the costs are derived from custom rates and estimates of per acre overhead charges typical for the region. The assumptions are intended to make the illustration relevant to a wide range of producers in the Lower Rio Grande Valley area.

The analysis consists of a baseline scenario and one alternative. The baseline scenario represents the status quo (basic flood irrigation) projected for a 10-year period. For each 10-year outlook projection, commodity price trends follow projections provided by the Food and Agricultural Policy Research Institute (FAPRI, at the University of Missouri) with costs adjusted for inflation over the planning horizon. The fall corn analyzed here is most often a double crop enterprise following a spring planted crop. As a result the analysis includes only a portion ($35/acre) of the total cash rent ($70/acre) ordinarily paid. A result of including only the double crop fall corn is that the profitability of the 38 acre field presented here does not represent the full profit potential of the field.

The alternative outlook represents the purchase and use of a surge valve for surge technology irrigation. The alternative assumes a cost of the surge valve of $1800. The surge valve expense is evenly distributed over the 10-year period with the assumption of no financing costs. For the current analysis no other differences were assumed for the surge valve scenario. Demonstration findings suggest no change in production costs or yields. While the surge valve technology did demonstrate a water savings, current water pricing structures do not provide a financial incentive for reduced water use. Therefore, the surge valve scenario is simply $1800 worse off compared to the baseline flood irrigation scenario. Future analyses are planned to evaluate the potential financial incentives for surge technology and water savings under hypothetical volumetric pricing of water.

A detail of the income and expense projection for the baseline is provided in Table 1B. The detailed income statement results from the simplistic (no risk) forecast assuming average prices and yields. The more comprehensive projection including price and yield risk is illustrated in Table 1C and Figure 1A. Table 1C. presents the average outcomes for selected financial projections, while the graphical presentation illustrates the full range of possibilities for net cash farm income. Total cash receipts average $11,490 over the 10-year period and cash costs average just over $10,000. Average Net Cash Farm Income (NCFI) rises slightly from 2005 reaching $1,500 before declining in the later years due to cost inflation outpacing increases in price and yield. The risk projections indicate about a 25% chance of a negative NCFI (Table 1C), with possible NCFI values ranging from a $1,500 loss to over $4,500 in profit (Figure 1A).

Table 1A. Fall Corn, Surge Irrigation Demonstration

SUMMARY OF CROP ACREAGE, YIELD, AND VARIABLE COSTS IN 2005.

	Fall Corn
PLANTED ACRES	38
BASE ACRES	6.27
YIELD UNITS	bu
BUDGETING YIELD	80.35
FARM PROG YLD DIR	79
FARM PROG YLD CCP	79
PRICES/YIELD UNIT	2.6
VARIABLE PRODUCTION COSTS ($/ACRE)	
SEED	45
FERTILIZER	30
HERBICIDES	15
INSECTICIDES	0
FUNGICIDES	0
CUSTOM APPLICATION	3.5
MACHINE / EQUIPMENT	25
IRRIGATION	42
TILLAGE/HARVST FUEL	6
HARVESTING, HAULING, DRYING & CHECKOFF: $/YIELD UNIT	0.404
HARVEST COST/ACRE	0
BOLL WEEVIL COST/ACRE	0
LABOR COST /ACRE	15
CROP INSURANCE	
YIELD ELECTION (FRACTION)	0
YIELD COVERAGE GUARANTEE	0
PRICE ELECTION (FRACTION)	0
PRICE GUARANTEE	0
PREMIUM RATE ($/ACRE)	0
PREMIUM COSTS	0

Table 1B. Fall Corn 2005 Demonstration, Base Scenario

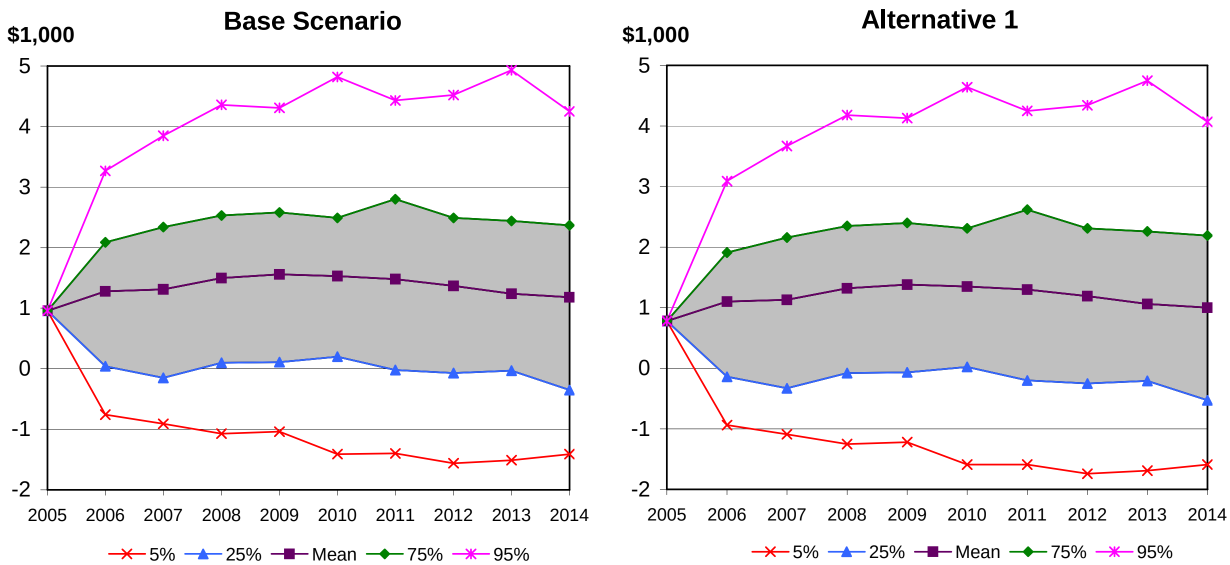
INCOME STATEMENT FOR YEARS 2005 - 2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CASH INCOME (NET OF SHARE LEASE)										
CASH RECEIPTS FOR CROPS	7,939	8,390	8,737	9,059	9,354	9,621	9,828	9,969	10,113	10,224
DECOUPLED DIRECT PAYMENTS	868	868	868	868	868	868	868	868	868	868
DECOUPLED CCPs	1,610	1,602	1,572	1,533	1,487	1,404	1,284	1,177	1,076	1,017
MARKETING LOAN PAYMENTS	0	65	0	0	0	0	0	0	0	0
MPCI CROP INSURANCE INDEMNITY	0	0	0	0	0	0	0	0	0	0
TOTAL CASH RECEIPTS	**10,417**	**10,924**	**11,177**	**11,461**	**11,709**	**11,893**	**11,981**	**12,014**	**12,058**	**12,109**
CASH FARM EXPENSE (NET OF SHARE LEASE)										
CROP PROD & HARVEST COSTS										
SEED COSTS	1,710	1,729	1,753	1,773	1,803	1,832	1,864	1,894	1,919	1,947
FERTILIZER COSTS	1,140	1,269	1,228	1,195	1,208	1,232	1,261	1,286	1,311	1,334
HERBICIDE COSTS	570	568	562	559	563	570	578	587	595	604
INSECTICIDE COSTS	0	0	0	0	0	0	0	0	0	0
FUNGICIDE COSTS	0	0	0	0	0	0	0	0	0	0
CUSTOM APPLICATION	133	143	139	136	137	139	141	143	146	148
MACHINE & EQUIPMENT	950	962	983	1,011	1,043	1,071	1,102	1,134	1,165	1,199
IRRIGATION COSTS	1,596	1,722	1,671	1,628	1,643	1,665	1,693	1,720	1,747	1,779
FUEL & LUBE COSTS	228	246	239	233	235	238	242	246	250	254
HARVESTING COSTS	1,234	1,375	1,349	1,329	1,356	1,389	1,428	1,466	1,506	1,550
CROP INSURANCE PREMIUMS	0	0	0	0	0	0	0	0	0	0
BOLL WEEVIL COSTS	0	0	0	0	0	0	0	0	0	0
HIRED LABOR COSTS	570	585	600	617	632	648	665	684	702	722
SUB-TOTAL OF PROD COSTS	8,131	8,600	8,525	8,480	8,620	8,783	8,975	9,161	9,341	9,536
CASH RENT FOR CROPLAND	1,330	1,330	1,330	1,330	1,330	1,330	1,330	1,330	1,330	1,330
RENT PASTURE	0	0	0	0	0	0	0	0	0	0
MANAGEMENT COSTS	0	0	0	0	0	0	0	0	0	0
MANAGEMENT BONUS	0	0	0	0	0	0	0	0	0	0
ADDITIONAL MGMT. COSTS	0	0	0	0	0	0	0	0	0	0
HIRED LABOR COSTS	0	0	0	0	0	0	0	0	0	0
PROPERTY TAXES	0	0	0	0	0	0	0	0	0	0
PERSONAL PROPERTY TAXES	0	0	0	0	0	0	0	0	0	0
SALES TAXES FOR INPUTS	0	0	0	0	0	0	0	0	0	0
OTHER TAXES	0	0	0	0	0	0	0	0	0	0
ACCOUNTANT & LEGAL FEES	0	0	0	0	0	0	0	0	0	0
UNALLOCATED MAINTENANCE	0	0	0	0	0	0	0	0	0	0
UTILITIES	0	0	0	0	0	0	0	0	0	0
OTHER FUEL & LUBE	0	0	0	0	0	0	0	0	0	0
LIABILITY INSURANCE	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS COSTS	0	0	0	0	0	0	0	0	0	0
LESS EXPENSES PREVIOUSLY PAID	0	0	0	0	0	0	0	0	0	0
PLUS PREPAID EXPENSES	0	0	0	0	0	0	0	0	0	0
SUB-TOTAL OF CASH COSTS	9,461	9,930	9,855	9,810	9,950	10,113	10,305	10,491	10,671	10,866
INTEREST ON LONG-TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON INTERMED. DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON OPERATING DEBT	0	0	1	1	1	1	1	0	0	0
INTEREST ON CARRYOVER DEBT	0	0	0	0	0	0	0	0	0	0
TOTAL CASH EXPENSES	**9,461**	**9,930**	**9,855**	**9,810**	**9,951**	**10,114**	**10,306**	**10,491**	**10,671**	**10,866**
NET CASH FARM INCOME	**956**	**994**	**1,321**	**1,650**	**1,758**	**1,779**	**1,675**	**1,523**	**1,387**	**1,243**

Table 1C. Base vs. AlternativeScenario

	Fall Corn Flood Irrigation	Fall Corn Surge Irrigation
Crop Receipts ($1000)		
2005	7.94	7.94
2006	8.39	8.39
2007	8.74	8.74
2008	9.07	9.07
2009	9.36	9.36
2010	9.62	9.62
2011	9.83	9.83
2012	9.97	9.97
2013	10.07	10.07
2014	10.21	10.21
2005-2014 Average	**9.32**	**9.32**
Total Cash Receipts ($1000)		
2005	10.42	10.42
2006	11.21	11.21
2007	11.17	11.17
2008	11.32	11.32
2009	11.51	11.51
2010	11.64	11.64
2011	11.79	11.79
2012	11.86	11.86
2013	11.91	11.91
2014	12.04	12.04
2005-2014 Average	**11.49**	**11.49**
Total Cash Costs ($1000)		
2005	9.46	9.64
2006	9.93	10.11
2007	9.86	10.04
2008	9.81	9.99
2009	9.95	10.13
2010	10.11	10.29
2011	10.31	10.49
2012	10.49	10.67
2013	10.67	10.85
2014	10.87	11.05
2005-2014 Average	**10.15**	**10.33**
Average Annual Operating Expense/Receipts		
2005	0.91	0.93
2006	0.90	0.92
2007	0.90	0.92
2008	0.89	0.90
2009	0.89	0.90
2010	0.89	0.91
2011	0.90	0.91
2012	0.91	0.92
2013	0.92	0.93
2014	0.92	0.94
2005-2014 Average	**0.90**	**0.92**
Net Cash Farm Income ($1000)		
2005	0.96	0.78
2006	1.28	1.10
2007	1.31	1.13
2008	1.50	1.32
2009	1.56	1.38
2010	1.53	1.35
2011	1.48	1.30
2012	1.37	1.19
2013	1.24	1.06
2014	1.18	1.00
2005-2014 Average	**1.34**	**1.16**
Prob. Net Cash Income < Zero (%)		
2005	1.00	1.00
2006	24.00	30.00
2007	26.00	29.00
2008	22.00	25.00
2009	23.00	25.00
2010	21.00	24.00
2011	25.00	26.00
2012	26.00	28.00
2013	27.00	29.00
2014	27.00	31.00

Figure 1A. Projected Variability in Net Cash Farm Income for Fall Corn Demonstration, Base and Alternative Scenarios.



Note: Percentages indicate the probability that Net Cash Farm Income is below the indicated level.
The shaded area contains 50% of the projected outcomes.

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5. Cotton, Surge Irrigation Demonstration

Table 2A provides the basic cost of production assumptions for the cotton surge irrigation demonstration (Allen). For the purpose of presenting economic viability and outlook for the 38.5 acre site, several of the costs are derived from custom rates and estimates of per acre overhead charges typical for the region. The assumptions are intended to make the illustration relevant to a wide range of producers in the Lower Rio Grande Valley area.

The analysis consists of a baseline scenario and one alternative. The baseline scenario represents the status quo (basic flood irrigation) projected for a 10-year period. For each 10-year outlook projection, commodity price trends follow projections provided by the Food and Agricultural Policy Research Institute (FAPRI, at the University of Missouri) with costs adjusted for inflation over the planning horizon. 2005 for this demonstration site produced a yield below the normal expectation for irrigated cotton in the region because 2005 was the first year of production for the site following a number of years of sugarcane production. 2006 and future years are expected to return to normal yields averaging 980 lbs./acre up from 783 lbs./acre in 2005.

The alternative outlook represents the purchase and use of a surge valve for surge technology irrigation. The alternative assumes a cost of the surge valve of $1800. The surge valve expense is evenly distributed over the 10-year period with the assumption of no financing costs. For the current analysis no other differences were assumed for the surge valve scenario. Demonstration findings suggest no change in production costs or yields. While the surge valve technology did demonstrate a water savings, current water pricing structures do not provide a financial incentive for reduced water use. Therefore, the surge valve scenario is simply $1800 worse off compared to the baseline flood irrigation scenario. Future analyses are planned to evaluate the potential financial incentives for surge technology and water savings under hypothetical volumetric pricing of water.

A detail of the income and expense projection for the baseline is provided in Table 2B. The detailed income statement results from the simplistic (no risk) forecast assuming average prices and yields. The more comprehensive projection including price and yield risk is illustrated in Table 2C and Figure 2A. Table 2C presents the average outcomes for selected financial projections, while the graphical presentation illustrates the full range of possibilities for Net Cash Farm Income (NCFI). Total cash receipts average almost $30,000 over the 10-year period and cash costs average just under $22,000. Average NCFI rises slightly from 2005 to just over $9,000 before declining in the later years due to cost inflation outpacing increases in price and yield. The risk projections indicate about a minimal chance of a negative NCFI (Table 2C), but possible NCFI values are quite risky ranging from a low of around $2,000 to over $16,000 (Figure 2A).

Table 2A. Cotton, Surge Irrigation Demonstration

SUMMARY OF CROP ACREAGE, YIELD, AND VARIABLE COSTS IN 2005.

	Cotton	Cotton Seed
PLANTED ACRES	38.5	38.5
BASE ACRES	35	0
YIELD UNITS	lb	ton
BUDGETING YIELD	738	0.62
FARM PROG YLD DIR	650	0
FARM PROG YLD CCP	650	0
PRICES/YIELD UNIT	0.45	99.07
VARIABLE PRODUCTION COSTS ($/ACRE)		
SEED	54	0
FERTILIZER	38	0
HERBICIDES	19	0
INSECTICIDES	37.5	0
FUNGICIDES	0	0
CUSTOM APPLICATION	37	0
SCOUTING / OTHER	0	0
IRRIGATION	40	0
TILLAGE/HARVST FUEL	55	0
HARVESTING, HAULING, DRYING & CHECKOFF:		
$/YIELD UNIT	0.08	0
HARVEST COST/ACRE	56	0
BOLL WEEVIL COST/ACRE	28	0
LABOR COST /ACRE	15	0
CROP INSURANCE		
YIELD ELECTION (FRACTION)	0.65	0
YIELD COVERAGE GUARANTEE	633.75	0
PRICE ELECTION (FRACTION)	1	0
PRICE GUARANTEE	0.4361	0
PREMIUM RATE ($/ACRE)	8.25	0
PREMIUM COSTS	317.625	0

Table 2B. Cotton 2005 Demonstration, Base Scenario

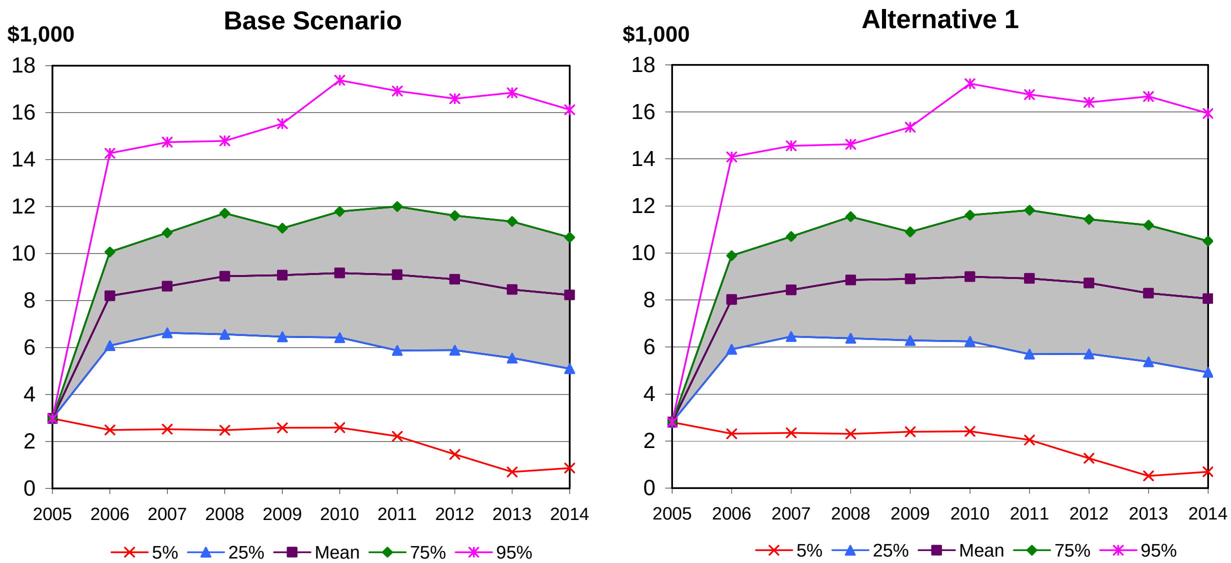
INCOME STATEMENT FOR YEARS 2005 - 2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CASH INCOME (NET OF SHARE LEASE)										
CASH RECEIPTS FOR CROPS	15,151	21,570	22,752	23,288	23,790	24,304	24,785	25,292	25,369	25,454
DECOUPLED DIRECT PAYMENTS	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290	1,290
DECOUPLED CCPs	2,654	2,655	2,655	2,655	2,639	2,544	2,357	2,165	1,984	1,876
MARKETING LOAN PAYMENTS	3,978	4,626	3,856	3,528	3,294	3,000	2,698	2,384	2,136	2,108
MPCI CROP INSURANCE INDEMNITY	0	0	0	0	0	0	0	0	0	0
TOTAL CASH RECEIPTS	**23,072**	**30,140**	**30,552**	**30,761**	**31,012**	**31,138**	**31,130**	**31,131**	**30,779**	**30,728**
CASH FARM EXPENSE (NET OF SHARE LEASE)										
CROP PROD & HARVEST COSTS										
SEED COSTS	2,079	2,102	2,131	2,156	2,192	2,227	2,266	2,302	2,333	2,367
FERTILIZER COSTS	1,463	1,629	1,576	1,533	1,550	1,581	1,619	1,651	1,682	1,711
HERBICIDE COSTS	732	729	722	717	723	731	742	754	764	775
INSECTICIDE COSTS	1,444	1,419	1,412	1,415	1,435	1,458	1,486	1,516	1,543	1,571
FUNGICIDE COSTS	0	0	0	0	0	0	0	0	0	0
CUSTOM APPLICATION	1,424	1,537	1,492	1,453	1,467	1,486	1,512	1,535	1,559	1,588
SCOUTING & OTHER	0	0	0	0	0	0	0	0	0	0
IRRIGATION COSTS	1,540	1,662	1,613	1,571	1,586	1,607	1,634	1,660	1,686	1,717
FUEL & LUBE COSTS	2,118	2,285	2,218	2,160	2,181	2,210	2,247	2,282	2,318	2,360
HARVESTING COSTS	4,429	5,583	5,430	5,300	5,360	5,442	5,545	5,644	5,744	5,861
CROP INSURANCE PREMIUMS	318	318	318	318	318	318	318	318	318	318
BOLL WEEVIL COSTS	1,078	1,078	1,078	1,078	1,078	1,078	1,078	1,078	1,078	1,078
HIRED LABOR COSTS	578	593	608	625	640	657	674	693	712	732
SUB-TOTAL OF PROD COSTS	17,201	18,933	18,597	18,327	18,530	18,795	19,120	19,432	19,737	20,076
CASH RENT FOR CROPLAND	2,888	2,888	2,888	2,888	2,888	2,888	2,888	2,888	2,888	2,888
RENT PASTURE	0	0	0	0	0	0	0	0	0	0
MANAGEMENT COSTS	0	0	0	0	0	0	0	0	0	0
MANAGEMENT BONUS	0	0	0	0	0	0	0	0	0	0
ADDITIONAL MGMT. COSTS	0	0	0	0	0	0	0	0	0	0
HIRED LABOR COSTS	0	0	0	0	0	0	0	0	0	0
PROPERTY TAXES	0	0	0	0	0	0	0	0	0	0
PERSONAL PROPERTY TAXES	0	0	0	0	0	0	0	0	0	0
SALES TAXES FOR INPUTS	0	0	0	0	0	0	0	0	0	0
OTHER TAXES	0	0	0	0	0	0	0	0	0	0
ACCOUNTANT & LEGAL FEES	0	0	0	0	0	0	0	0	0	0
UNALLOCATED MAINTENANCE	0	0	0	0	0	0	0	0	0	0
UTILITIES	0	0	0	0	0	0	0	0	0	0
OTHER FUEL & LUBE	0	0	0	0	0	0	0	0	0	0
LIABILITY INSURANCE	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS COSTS	0	0	0	0	0	0	0	0	0	0
LESS EXPENSES PREVIOUSLY PAID	0	0	0	0	0	0	0	0	0	0
PLUS PREPAID EXPENSES	0	0	0	0	0	0	0	0	0	0
SUB-TOTAL OF CASH COSTS	20,089	21,821	21,484	21,215	21,417	21,683	22,008	22,320	22,624	22,964
INTEREST ON LONG-TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON INTERMED. DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON OPERATING DEBT	0	8	9	1	0	0	0	0	0	0
INTEREST ON CARRYOVER DEBT	0	0	0	0	0	0	0	0	0	0
TOTAL CASH EXPENSES	**20,089**	**21,829**	**21,493**	**21,216**	**21,417**	**21,683**	**22,008**	**22,320**	**22,624**	**22,964**
NET CASH FARM INCOME	**2,984**	**8,311**	**9,059**	**9,545**	**9,595**	**9,455**	**9,122**	**8,812**	**8,155**	**7,764**

Table 2C. Base vs. AlternativeScenario

	Cotton Flood Irrigation	Cotton Surge Irrigation
Crop Receipts ($1000)		
2005	15.15	15.15
2006	21.55	21.55
2007	22.72	22.72
2008	23.00	23.00
2009	23.75	23.75
2010	24.20	24.20
2011	24.92	24.92
2012	25.55	25.55
2013	25.38	25.38
2014	25.48	25.48
2005-2014 Average	**23.17**	**23.17**
Total Cash Receipts ($1000)		
2005	23.07	23.07
2006	30.03	30.03
2007	30.11	30.11
2008	30.25	30.25
2009	30.49	30.49
2010	30.85	30.85
2011	31.10	31.10
2012	31.22	31.22
2013	31.10	31.10
2014	31.20	31.20
2005-2014 Average	**29.94**	**29.94**
Total Cash Costs ($1000)		
2005	20.09	20.27
2006	21.83	22.01
2007	21.49	21.67
2008	21.22	21.40
2009	21.42	21.60
2010	21.68	21.86
2011	22.01	22.19
2012	22.32	22.50
2013	22.62	22.80
2014	22.96	23.14
2005-2014 Average	**21.76**	**21.94**
Average Annual Operating Expense/Receipts		
2005	0.87	0.88
2006	0.74	0.74
2007	0.72	0.73
2008	0.71	0.72
2009	0.71	0.72
2010	0.72	0.72
2011	0.72	0.73
2012	0.73	0.74
2013	0.74	0.75
2014	0.75	0.76
2005-2014 Average	**0.74**	**0.75**
Net Cash Farm Income ($1000)		
2005	2.98	2.80
2006	8.20	8.02
2007	8.61	8.43
2008	9.03	8.85
2009	9.08	8.90
2010	9.17	8.99
2011	9.10	8.92
2012	8.90	8.72
2013	8.47	8.29
2014	8.24	8.06
2005-2014 Average	**8.18**	**8.00**
Prob. Net Cash Income < Zero (%)		
2005	1.00	1.00
2006	1.00	1.00
2007	1.00	1.00
2008	1.00	1.00
2009	1.00	1.00
2010	1.00	1.00
2011	1.00	1.00
2012	1.00	1.00
2013	2.00	3.00
2014	1.00	3.00

Figure 2A. Projected Variability in Net Cash Farm Income for Cotton Demonstration, Base and Alternative Scenarios.



Note: Percentages indicate the probability that Net Cash Farm Income is below the indicated level.
The shaded area contains 50% of the projected outcomes.

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6. Sugarcane, Surge Irrigation Demonstration

Table 3A provides the basic cost of production assumptions for the sugarcane surge irrigation demonstration (Halbert). For the purpose of presenting economic viability and outlook for the 38 acre site, several of the costs are derived from custom rates and estimates of per acre overhead charges typical for the region. While the actual demonstration was conducted on an already established field of sugarcane, the illustration projection was developed as though the establishment year of the sugarcane crop is the first year of the projection (2006) in order to present the full cycle of the typical multi-year production of sugarcane. These assumptions are intended to make the illustration relevant to a wide range of producers in the Lower Rio Grande Valley area.

The analysis consists of a baseline scenario and one alternative. The surge demonstration results are similar to cotton and fall corn, in that, the surge technology produces no financial differences other than the cost of the surge valve ($1,800). In this case, the analysis is developed to highlight the implications of financing strategies for purchasing sugarcane grinding rights. The baseline scenario represents an outright purchase of sugarcane grinding rights ($750/acre) with no financing. The alternative presents a strategy of financing 100% of the purchase for 4 years. While the baseline scenario produces a negative cash position and subsequent negative carryover cash balances, no interest was charged on carryover balances. The purpose is to illustrate the amount of cash flow a producer would have to support. Some may support that cash flow with extended term debt (as in the alternative), and others may be able to self finance the purchase (as in the base) with no direct interest cost. For each 10-year outlook projection, commodity price trends follow projections provided by the Food and Agricultural Policy Research Institute (FAPRI, at the University of Missouri) with costs adjusted for inflation over the planning horizon.

A detail of the income and expense projection for the baseline is provided in Table 3B, followed by a cash flow summary (Table 3C). The income and cash flow statement results from the simplistic (no risk) forecast assuming average prices and yields. The more comprehensive projection including price and yield risk is illustrated in Table 3D and Figures 3A and 3B. Table 3D presents the average outcomes for selected financial projections, while the graphical presentation illustrates the full range of possibilities for Net Cash Farm Income (NCFI) and cash flow requirements. Total cash receipts average just over $30,000 initially and decline as the productive capacity of the sugarcane diminishes until the sixth year when the land is idle. Cash costs also reflect the sugarcane production cycle, requiring roughly $30,500 in the initial year, about one-half that amount in subsequent years and approximately $4,500 in the idle year. Average NCFI also follows the sugarcane production cycle producing no profit in the initial year, but averages approximately $4,600 per year for the assumed 6-year sugarcane cycle. The risk associated with prices and yields suggests that, in a normal production year, NCFI (Figure 3A) could range as much as $7,000 to $8,000 plus or minus the average expected NCFI. The average cash flow balances (lines in Figure 3B) are intended to illustrate the cash requirements or positive flows generated by the enterprise. The bars indicate the probability of the net cash impact being negative in a specific year. The alternative indicates a more positive cash impact early as the cost of grinding rights are spread over a number of years. The probability of the enterprise creating net cash shortages in the alternative scenario is also much smaller in the early years. In the later portion of the time horizon, the definitive cost of financing under the alternative reduces the net cash flow generated by the enterprises. It is important to note here that, although not included, the base could also create definitive interest charges depending on the whole farm's ability to support the cash requirements of the enterprise.

Table 3A. Sugarcane, Surge Irrigation Demonstration

SUMMARY OF CROP ACREAGE, YIELD, AND VARIABLE COSTS.

	Sugarcane
PLANTED ACRES	38
BASE ACRES	0
YIELD UNITS	ton
BUDGETING YIELD	50
FARM PROG YLD DIR	0
FARM PROG YLD CCP	0
PRICES/YIELD UNIT	16
VARIABLE PRODUCTION COSTS ($/ACRE)	
SEED	0
FERTILIZER	90
HERBICIDES	25
INSECTICIDES	0
FUNGICIDES	0
CUSTOM APPLICATION	0
SCOUTING / OTHER	0
IRRIGATION	70
TILLAGE/HARVST FUEL	65.79
HARVESTING, HAULING, DRYING & CHECKOFF:	
$/YIELD UNIT	0
HARVEST COST/ACRE	0
BOLL WEEVIL COST/ACRE	0
LABOR COST /ACRE	16
CROP INSURANCE	
YIELD ELECTION (FRACTION)	0.65
YIELD COVERAGE GUARANTEE	0
PRICE ELECTION (FRACTION)	1
PRICE GUARANTEE	16
PREMIUM RATE ($/ACRE)	20
PREMIUM COSTS	760

Table 3B. Sugarcane 2005 Demonstration, Base Scenario

INCOME STATEMENT FOR YEARS 2006 - 2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CASH INCOME (NET OF SHARE LEASE)										
CASH RECEIPTS FOR CROPS	30,400	28,576	24,320	21,280	18,240	0	30,400	28,576	24,320	21,280
DECOUPLED DIRECT PAYMENTS	0	0	0	0	0	0	0	0	0	0
DECOUPLED CCPs	0	0	0	0	0	0	0	0	0	0
MARKETING LOAN PAYMENTS	0	0	0	0	0	0	0	0	0	0
MPCI CROP INSURANCE INDEMNITY	0	0	0	0	0	0	0	0	0	0
TOTAL CASH RECEIPTS	**30,400**	**28,576**	**24,320**	**21,280**	**18,240**	**0**	**30,400**	**28,576**	**24,320**	**21,280**
CASH FARM EXPENSE (NET OF SHARE LEASE)										
CROP PROD & HARVEST COSTS										
SEED COSTS	0	0	0	0	0	0	0	0	0	0
FERTILIZER COSTS	3,420	3,308	3,219	3,255	3,320	0	3,466	3,532	3,593	3,655
HERBICIDE COSTS	950	940	934	942	952	0	982	995	1,009	1,023
INSECTICIDE COSTS	0	0	0	0	0	0	0	0	0	0
FUNGICIDE COSTS	0	0	0	0	0	0	0	0	0	0
CUSTOM APPLICATION	0	0	0	0	0	0	0	0	0	0
SCOUTING & OTHER	0	0	0	0	0	0	0	0	0	0
IRRIGATION COSTS	2,660	2,582	2,515	2,539	2,573	0	2,657	2,699	2,748	2,799
FUEL & LUBE COSTS	2,500	2,427	2,364	2,386	2,418	0	2,497	2,537	2,583	2,630
HARVESTING COSTS	0	0	0	0	0	0	0	0	0	0
CROP INSURANCE PREMIUMS	760	760	760	760	760	0	760	760	760	760
BOLL WEEVIL COSTS	0	0	0	0	0	0	0	0	0	0
HIRED LABOR COSTS	608	624	641	657	674	0	711	730	751	772
SUB-TOTAL OF PROD COSTS	10,898	10,641	10,434	10,538	10,697	0	11,073	11,253	11,444	11,640
CASH RENT FOR CROPLAND	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800
RENT PASTURE	0	0	0	0	0	0	0	0	0	0
MANAGEMENT COSTS	0	0	0	0	0	0	0	0	0	0
MANAGEMENT BONUS	0	0	0	0	0	0	0	0	0	0
ADDITIONAL MGMT. COSTS	0	0	0	0	0	0	0	0	0	0
HIRED LABOR COSTS	0	0	0	0	0	0	0	0	0	0
PROPERTY TAXES	0	0	0	0	0	0	0	0	0	0
PERSONAL PROPERTY TAXES	0	0	0	0	0	0	0	0	0	0
SALES TAXES FOR INPUTS	0	0	0	0	0	0	0	0	0	0
OTHER TAXES	0	0	0	0	0	0	0	0	0	0
ACCOUNTANT & LEGAL FEES	0	0	0	0	0	0	0	0	0	0
UNALLOCATED MAINTENANCE	0	0	0	0	0	0	0	0	0	0
UTILITIES	0	0	0	0	0	0	0	0	0	0
OTHER FUEL & LUBE	0	0	0	0	0	0	0	0	0	0
LIABILITY INSURANCE	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS COSTS	0	0	0	0	0	0	0	0	0	0
LandPrep	3,800	0	0	0	0	0	4,364	0	0	0
Seed	5,700	0	0	0	0	0	6,546	0	0	0
Planting	5,700	0	0	0	0	0	6,546	0	0	0
Irr&Prop Tax	567	578	589	603	617	634	652	669	687	706
LESS EXPENSES PREVIOUSLY PAID	0	0	0	0	0	0	0	0	0	0
PLUS PREPAID EXPENSES	0	0	0	0	0	0	0	0	0	0
SUB-TOTAL OF CASH COSTS	30,465	15,019	14,823	14,941	15,114	4,434	32,982	15,722	15,932	16,146
INTEREST ON LONG-TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON INTERMED. DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON OPERATING DEBT	0	6	13	19	28	2	109	64	31	0
INTEREST ON CARRYOVER DEBT	0	23	27	14	0	0	4	27	0	0
TOTAL CASH EXPENSES	**30,465**	**15,047**	**14,864**	**14,974**	**15,142**	**4,436**	**33,095**	**15,812**	**15,963**	**16,146**
NET CASH FARM INCOME	**-65**	**13,529**	**9,456**	**6,306**	**3,098**	**-4,436**	**-2,695**	**12,764**	**8,357**	**5,134**

Table 3C. Sugarcane 2005 Demonstration, Base Scenario

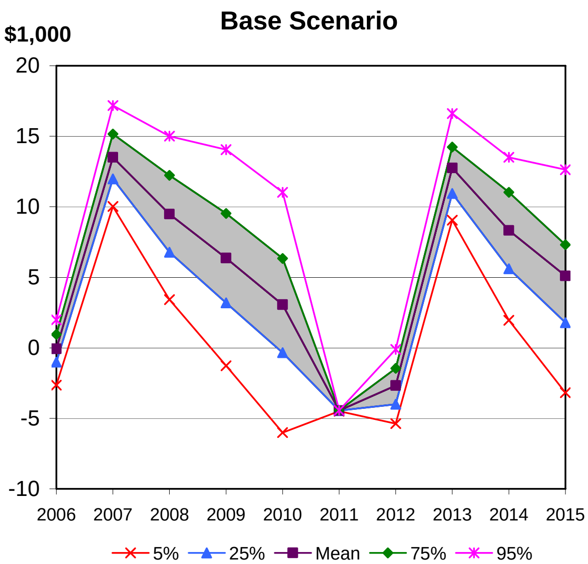
CASHFLOW STATEMENT FOR YEARS 2006 - 2015

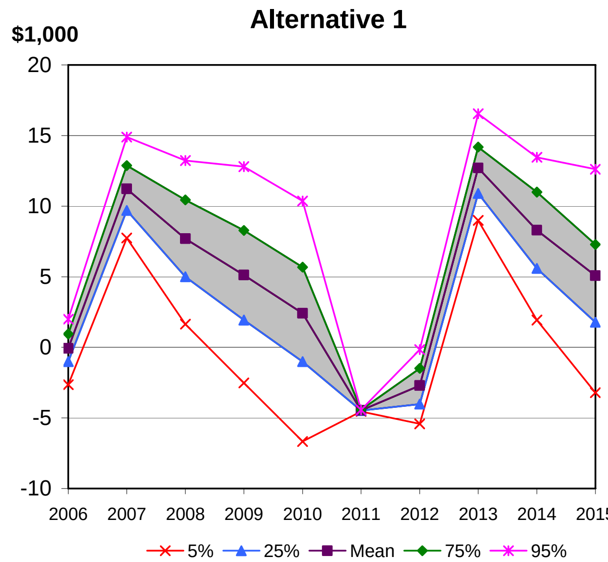
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BEGINNING CASH	**0**	**0**	**0**	**0**	**726**	**3,824**	**0**	**0**	**9,461**	**17,833**
PLUS:										
NET CASH FARM INCOME	-65	13,529	9,456	6,306	3,098	-4,436	-2,695	12,764	8,357	5,134
OFF-FARM SALARY FARMER	0	0	0	0	0	0	0	0	0	0
OFF-FARM SALARY SPOUSE	0	0	0	0	0	0	0	0	0	0
NON-TAXABLE INCOME	0	0	0	0	0	0	0	0	0	0
INTEREST ON CASH RESERVES	0	0	0	0	0	3	0	0	16	38
INVESTMENT EARNINGS/DIVIDENDS	0	0	0	0	0	0	0	0	0	0
NEW CAPITAL INVESTED IN FARM	0	0	0	0	0	0	0	0	0	0
CORPORATE DIVIDENDS EARNED	0	0	0	0	0	0	0	0	0	0
PARTNERSHIP CASH DRAWS	0	0	0	0	0	0	0	0	0	0
CASH INVESTED FROM OWNERS	0	0	0	0	0	0	0	0	0	0
SELL MACH./LIVESTOCK/CROPS	0	0	0	0	0	0	0	0	0	0
PROCEEDS FROM ASSETS SOLD	0	0	0	0	0	0	0	0	0	0
TOTAL CASH AVAILABLE	**-65**	**13,529**	**9,456**	**6,306**	**3,824**	**-608**	**-2,695**	**12,764**	**17,833**	**23,005**
MINUS:										
DOWN PYMT NON-MACH PURCHASE	28,500	0	0	0	0	0	0	0	0	0
CASH DIFFERENCE MACH REPLACED	0	0	0	0	0	0	0	0	0	0
PAYOFF MACHINERY BOUGHT										
REG. PRINCIPAL PAY. LONG-TERM	0	0	0	0	0	0	0	0	0	0
ACC. PRINCIPAL PAY. LONG-TERM	0	0	0	0	0	0	0	0	0	0
REG. PRINCIPAL PAY. INTR-TERM	0	0	0	0	0	0	0	0	0	0
ACC. PRINCIPAL PAY. INTR-TERM	0	0	0	0	0	0	0	0	0	0
PAY OPERATING LOAN CARRYOVER	0	28,565	15,037	5,581	0	0	608	3,303	0	0
FIXED INVESTMENT CONTRIBUTION	0	0	0	0	0	0	0	0	0	0
ADDITIONAL INVESTMENTS	0	0	0	0	0	0	0	0	0	0
CASH PAID TO PRTNSHIP/CORPS	0	0	0	0	0	0	0	0	0	0
PARTNERSHIP CASH WITHDRAWAL	0	0	0	0	0	0	0	0	0	0
FEDERAL INCOME TAX PAYMENTS	0	0	0	0	0	0	0	0	0	0
STATE INCOME TAX PAYMENTS	0	0	0	0	0	0	0	0	0	0
SELF-EMPLOYMENT+SOC SEC TAXES	0	0	0	0	0	0	0	0	0	0
TOTAL CASH OUTFLOWS	**28,500**	**28,565**	**15,037**	**5,581**	**0**	**0**	**608**	**3,303**	**0**	**0**
SURPLUS OR DEFICIT CASH	-28,565	-15,037	-5,581	726	3,824	-608	-3,303	9,461	17,833	23,005
ENDING YEAR CASH RESERVE	**0**	**0**	**0**	**726**	**3,824**	**0**	**0**	**9,461**	**17,833**	**23,005**

Table 3D. Base vs. AlternativeScenario

	Sugarcane Grinding Rights Purchased	Sugarcane Grinding Rights Financed
Crop Receipts ($1000)		
2006	30.39	30.39
2007	28.56	28.56
2008	24.34	24.34
2009	21.34	21.34
2010	18.22	18.22
2011	0.00	0.00
2012	30.42	30.42
2013	28.57	28.57
2014	24.30	24.30
2015	21.27	21.27
2006-2015 Average	**22.74**	**22.74**
Total Cash Receipts ($1000)		
2006	30.39	30.39
2007	28.56	28.56
2008	24.34	24.34
2009	21.34	21.34
2010	18.22	18.22
2011	0.00	0.00
2012	30.42	30.42
2013	28.57	28.57
2014	24.30	24.30
2015	21.27	21.27
2006-2015 Average	**22.74**	**22.74**
Total Cash Costs ($1000)		
2006	30.47	30.47
2007	15.05	17.33
2008	14.86	16.65
2009	14.97	16.22
2010	15.15	15.81
2011	4.45	4.46
2012	33.10	33.14
2013	15.82	15.86
2014	15.97	16.00
2015	16.16	16.19
2006-2015 Average	**17.60**	**18.21**
Average Annual Operating Expense/Receipts		
2006	1.00	1.00
2007	0.53	0.53
2008	0.62	0.62
2009	0.73	0.73
2010	0.91	0.91
2011	0.00	0.00
2012	1.09	1.09
2013	0.55	0.55
2014	0.67	0.67
2015	0.80	0.80
2006-2015 Average	**0.69**	**0.69**
Net Cash Farm Income ($1000)		
2006	-0.07	-0.07
2007	13.51	11.23
2008	9.48	7.70
2009	6.37	5.12
2010	3.07	2.41
2011	-4.45	-4.46
2012	-2.68	-2.71
2013	12.75	12.71
2014	8.33	8.30
2015	5.10	5.08
2006-2015 Average	**5.14**	**4.53**
Prob. Net Cash Income < Zero (%)		
2006	54.00	54.00
2007	1.00	1.00
2008	1.00	1.00
2009	11.00	16.00
2010	29.00	34.00
2011	99.00	99.00
2012	95.00	95.00
2013	1.00	1.00
2014	1.00	1.00
2015	14.00	14.00

Figure 3A. Projected Variability in Net Cash Farm Income for Sugarcane Demonstration, Base and Alternative Scenarios.





Note: Percentages indicate the probability that Net Cash Farm Income is below the indicated level.
The shaded area contains 50% of the projected outcomes.

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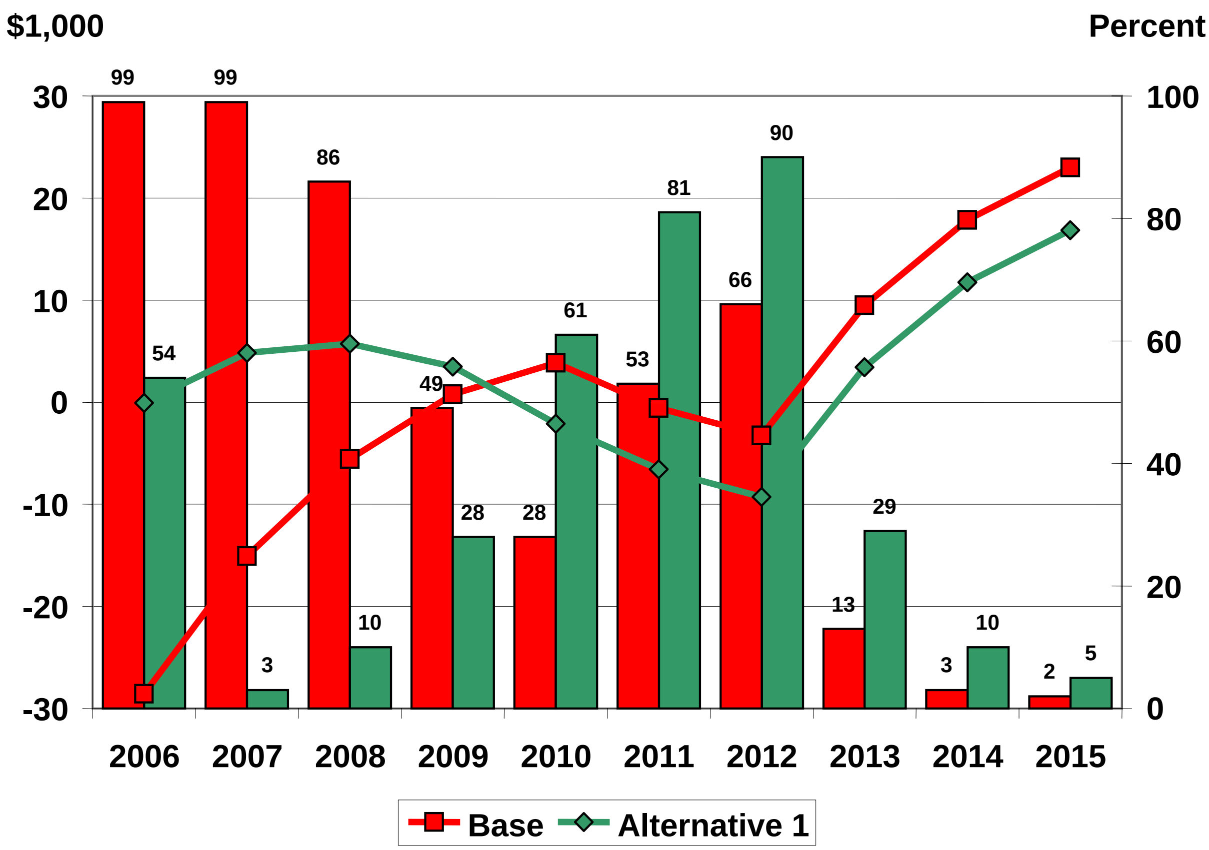
Figure 3B. Ending Cash Reserves and Probability Cash Shortfall for Sugarcane Demonstration, Base and Alternative Scenarios.



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On-Farm Drip and Furrow Flood Irrigation in Annual and Multi-Year Crops

ADI

Annual Report

Submitted by
Texas A&M University-Kingsville, Citrus Center

Dr. Shad Nelson

and

Texas A&M Extension Service, Weslaco, TX
Dr. Juan Enciso

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

Texas A&M University-Kingsville and Texas A&M Extension Service 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 12 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, celery, tomato, corn, cotton and sorghum. Irrigation practices to grow these crop are flood, polypipe furrow/flood, drip, and microjet spray.

Current aim this past year has been to establish contact with collaborators/growers in the LRGV willing to work with us to monitor water use and crop production over a long period of time. This work was 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 2005 we had 12 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 is not to redirect the water management practices of the growers, so that we can establish a "baseline" data base that represent 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 2 (2006). To assist in monitoring water use and crop water consumption each site has been (or is in process of being) equipped with soil moisture sensors with real-time automatic datalogging units. On-site rain gauges are also (or will be) supplied and attached to datalogging equipment for determination of annual rainfall and for verification of when irrigation events occurred versus rain events. This data will be collected and monitored in tandem with water metering equipment. Water meters are (or will be) supplied at each location to keep track of the quantity of water applied during an irrigation event and over the growing season to each cropping site. The collection of this data is in its initial stages and not a lot of concrete information has been gathered over the past year as the main priority has been to establish new sites and commitments with collaborators.

The following is a list of current collaborators, the types of crops monitored during the Fall 2005 and Spring 2006 period. The list also covers the type of soil moisture sensing equipment and rain gauge systems in place. Depths of soil moisture sensors and placement within the soil profile or bed. A list of collaborators under the direction of Dr. S. Nelson (and grad students Ram Uckoo and Eddie Esquivel) and others under Dr. J. Enciso (and science technician Xavier Peries).

<u>Field Sites under direction of Dr. Nelson, Ram Uckoo & Eddie Esquivel:</u>

1. Pawlik Farms: Jimmy Pawlik 4 cropping sites (McAllen, TX)
Rio Red (narrow borders), Rio Red (flood), Valencia (flood); Onion 2005 (Drip)
Installed: 2 ECHO probe locations; Goal: install rain gauge

Installed: Datalogger Unit: EM1507 (mature Rio Red grapefruit; narrow borders)
Perrenial Crop: Soil Probes Depths: 6" (Port 1), 12" (Port 2), 24" (Port 3), 36" (Port 4) and 48' (Port 5)

Installed: Datalogger Unit: EM15-- (initial failure-reinstalled 2/15/06) (onions; drip)
Winter 2006 Crop: Soil Probes Depths: [Bed center: 6" (Port 1), 12" (Port 2), 24" (Port 3)], [Bed Edge:12" (Port 4) and 24" (Port 5)]

Installed: Datalogger Unit: EM15—(installed 2/15/06) (young Valencia oranges; flood)
Perrenial Crop: Soil Probes Depths: 6" (Port 1), 12" (Port 2), 24" (Port 3), 36" (Port 4) and Raingauge (Port 5)

2. Valley Onions: Richard Treadaway 2 cropping sites
Fall Onions (Drip) & Celery (Furrow) 2005
Goal: install ECHO probe soil moisture monitoring equipment & rain gauge

3. Juan Ramirez Farm 3 cropping sites
Rio Red grapefruit, Blood Navel orange, Tangerine (all flood)
Installed: Datalogger Unit: EM1506-ECHO probes
Perrenial Crop: Soil Probes Depths: 6" (Port 1), 12" (Port 2), 24" (Port 3), 36" (Port 4) and Raingauge (Port 5)

4. Sam & Josh Ruiz 1 cropping site
Fall Tomato 2005 (furrow)
Goal: Install ECHO probes and rain gauge at next planting cycle

5. Bruce & Vicki Gamble 2 cropping sites
Fall corn 2005 (drip and furrow)
Goal: Install ECHO probes and rain gauge at next planting cycle

6. Rio Farms, Monte Alto 1 cropping site
Young 2-3 yr old Grapefruit & Oranges, (flood irrigated)
Installed: Young trees, fenced in farm site to prevent theft.
Goal: Convert to drip or microjet spray when tree age, install soil moisture sensors, rain gauge and water metering equipment.

<u>Field Sites under direction of Dr. Juan Enciso and Xavier Peries:</u>

7. Duda Valley Onions 2 cropping sites (Edinburg, Hidalgo County, Monte Cristo Rd)

Fall Onions 2005 (West site and East site; Drip)
Installed: 2 WatchDog/WaterMark soil moisture systems
Installed Datalogger Units: ADI-4 (East site) and ADI-5 (West Site)
Winter 2006: Soil Probes Depths: 6" (Port A), 12" (Port B), 18" (Port C) and 1 pressure transducer plugged into Texas A&M donated datalogger (East Site)
Winter 2006: Soil Probes Depths: 6" (Port A), 12" (Port B), 18" (Port C) and 1 pressure transducer plugged into Texas A&M donated datalogger (West Site)
Goal: install rain gauge if needed

8. Tetra Fruit & Vegetable 1 cropping site (Rio Grande City, Starr County, Exp. 83)

Onions (Drip): Fall 2005-Winter 2006, 80" beds, subsurface drip irrigation.
Installed: 2 WatchDog/WaterMark soil moisture systems, and rain gauge supplied by TAMU
Installed: Datalogger Unit: ADI-3 with raingauge donated
Winter 2006: Soil Probes Depths: 6" (Port A), 12" (Port B), 18" (Port C) and 1 pressure transducer plugged into Texas A&M donated datalogger and raingauge

9. Sweet-N-Tasty Citrus, Jim Hoffman 3 cropping sites (Hidalgo County, Monte Cristo Rd)

Rio Red grapefruit (microjet) and Marrs oranges (drip), Valencia oranges (microjet)
Installed: 3 WatchDog/WaterMark soil moisture systems, and rain gauge

Installed: Datalogger Unit: ADI-1 (old Rio Red grapefruit; jet)
Perrenial Crop: Soil Probes Depths: 6" (Port A), 18" (Port B), 30" (Port C) and
1 Irrigation Sensor (Port D)

Installed: Datalogger Unit: ADI-6 (old Marrs oranges; drip)
Perrenial Crop: Soil Probes Depths: 6" (Port A), 18" (Port B), 30" (Port C) and
1 Irrigation Sensor (Port D)

Installed: Datalogger Unit: ADI-7 (young Valencia oranges; jet) with ADI-R raingauge
Perrenial Crop: Soil Probes Depths: (Port B "6-inch", Port C "18-inch", 30-inch –free and measured by hand)
1 Irrigation Sensor on/off **(Port D not working: no recording)**

10. Julian Sauls Farm 1 cropping site (La Feria, Cameron County, Solis Rd)
Valencia oranges (microjet)
Installed: WatchDog/WaterMark soil moisture systems from TAMU, and rain gauge
Installed: Datalogger Unit: ADI-2 with raingauge ADI-R3
Perrenial Crop: Soil Probes Depths: 12” (Port A), 24” (Port B), 36” (Port C) and 1 pressure transducer/irrigation sensor (Port D)

11. Bruce Shields Farms, Monte Alto (Hidalgo County) 2 cropping sites
Cotton and Sorghum under furrow irrigation; planting cotton Feb 1, 2006
Installed: rain gauge, flow meter, and can use ET from Rio Farms
Needs: Soil moisture sensing equipment (1-2 logger stations)

12. Mr. Boone La Grange, Rio Grande City (Starr County) 3 cropping sites
Honeydews, Tomatoes, and Peppers under drip irrigation (planting mid-Feb 2006)
Installed: rain collector on site, flow meter on-site (pumps straight from river)
Needs: Soil moisture sensing equipment (2 logger stations)

Project Plans for the Demonstration Sites for Mar 2006-Feb 2007

1. **All sites require metering devices. This project year will focus on accurate metering of water. Improvement in how metering data is collected will be discussed with the collaborators listed below. Many growers have this equipment, but improvement in data collection and accuracy is needed.**

2. **All sites require rain gauge metering devices. This year will focus on installing automatic rain collection at each site.**

3. **Soil moisture sensing devices will collect data for the purpose of evaluating to what depth irrigation water is moving within different cropping systems and soil types. This soil moisture sensors will also serve as a means of determining when irrigation events occurred and will be used to validate or check against rainfall and water metering data.**

4. **Total irrigation and rainfall distribution will be used at the end of the growing season and compiled with harvest data to determine water use efficiency (WUE) and irrigation use efficiency (IUE) for citrus and annual crops in the Valley.**

5. **An objective is to compile the data in a GIS program where this data can be displayed for specific locations in the Valley where the demonstration projects are located.**

Reporting: A total of two quarterly formal reports were turned into the Harlingen Irrigation District (HID) in August and November 2005 detailing work accomplishments. One informal quarterly report summary was provided to HID prior to this time as the first quarter time was spent negotiating subcontract agreements between HID & TAMUK.

Soil Moisture Determination

WatchDog® dataloggers equipped with WaterMark® sensors (Spectrum Technologies, Inc.)

WatchDog® dataloggers equipped with WaterMark® soil moisture sensors (left) are used at various field locations to track water content within the soil profile over the growing season. Data is downloaded periodically to a computer (right) and some growers have adopted this technology as a means of irrigation scheduling.

WaterMark sensor calibration in the laboratory to specific soil types (left) was performed to better assess what the optimum sensor reading range is appropriate to know when to irrigate. Irama Wesselman, Environmental Engineering M.S. graduate student (right) worked on sensor calibration and is developing a “fuzzy logic” model that takes into account ET and soil moisture sensor reading to determine when to irrigate fields.

Soil Moisture Determination

Decagon ECH_2O® probes and EM-50 datalogging equipment were purchased from HID and distributed among Tom McLemore, Juan Enciso and Shad Nelson to install at ADI demonstration sites.

Above: Decagon dataloggers support 5 sensor placement locations (right) and installed in drip irrigated onions at ADI collaborator Jimmy Pawlik Farms (left).
Below: Fall onions planted in November 2005, raised beds with single drip tape located bed center 2” below surface (right). Dr. Nelson kneels next to soil moisture sensors placed bed center (6”, 12”, and 24” depths) and edge of bed (12” and 24” depths); this data logger was within 2 months after installation due to field worker tampering (right).


Jimmy Pawlik Farms, Mature Citrus

Pawlik Farms has mature citrus under flood irrigation. One of the proposed water conservation strategies that Jimmy Pawlik uses is forming raised border space closer to the tree line to prevent excessive water use where the tree canopy typically does not cover. Forming these “narrow borders” allows for more rapid flood irrigation events and may conserve significant amounts of water compared to flooding the entire area. Flood irrigation from his “narrow border” orchard will be compared to another orchard on Pawlik farms that is under conventional flood irrigation.

Eddie Esquivel and Ram Uckoo, TAMUK M.S. graduate students, within Jimmy Pawlik’s Rio Red grapefruit under “narrow border” flood irrigation (**above**). Below: Observe raised border outside tree canopy. Irrigated using polypipe to minimize water loss in earthen ditch (left). ECH2O sensors installed at site in December 2005 (right).

Sam and Josh Ruiz' Farm, Vegetable Grower

Sam and Josh Ruiz are bothers that have agreed to collaborate with ADI. Initial meeting with Sam was positive and we went to visit him with Tom McLemore and Farm Assist personnel, Steven Klose and Mac Young. Sam introduced us to a field site where tomatoes were recently planted. Ruiz' have the capability to run drip irrigation as they have a portable filtration system. Attempts to make secure dialog and contact with the Ruiz's has been challenging for both ourselves and Farm Assist. More work is needed in 2006 to establish a solid relationship with Sam and Josh Ruiz so that data collection and exchange can be more easily accomplished.

Above: Portable sand filtration unit at Sam Ruiz' Farm (left) and Tom McLemore (right). **Below:** Collaboration established with Farm Assist group, Steven Klose and Mac Young (left) by introducing them to our ADI collaborators (left); (right) from left to right, Mac Young, Steven Klose, Shad Nelson, and Tom McLemore.

Rain Gauge and Soil Moisture Equipment at Juan Ramirez Citrus Farm

Decagon automatic raingauges were purchased and have the capacity of measuring precipitation in 0.01 mm increments (above).

ADI collaborator Juan Ramirez has a citrus farm with mature citrus (Rio Red grapefruit, Blood navel oranges, and tangerine) under flood irrigation. Ram Uckoo, TAMUK M.S. graduate student equipped this EM-50 datalogger with 4 ECH_2O soil moisture probes (left) and a raingauge attached to the top of a metal pipe extending above the mature citrus tree canopy (left).

WatchDog and WaterMark sensor installation at Jim Hoffman's farm

Above: ADI collaborator Jim Hoffman (left) raises young citrus under microjet (right) where soil moisture sensor equipment was installed.
Below: Ram Uckoo and Xavier Peries install soil moisure sensors installed under mature citrus (left) and young citrus trees (right) at Hoffman's farm. Xavier Peries works with Dr. Juan Enciso and downloads the data every week and supplies this data to the ADI project free of charge.

Dr. Julien Sauls' Young Citrus Farm

WatchDog dataloggers were equipped with soil moisture sensors and also a pressure sensor installed into the drip line to record when and how long each irrigation even lasted. This allows for a more accurate measure of irrigation use and can easily be compared against rainfall events. When soil moisture sensors decrease in value it is an indication of more water near the sensors (i.e. irrigation or precipitation). Having the pressure sensor installed allows for a precise knowledge of when each irrigation event occurred. Julien Sauls has young (6 yrs) Valencia oranges just now starting to produce.

Above: Xavier shows pressure sensor (left; installed in drip line) to students (right).
Below: Four student interns from Monterey Tech, Mexico volunteered many hours on data collection to during 2005 (left) and assisted Xavier Peries (right) in water conservation projects and data management.

Dought Severity Stress on Citrus

Average annual rainfall within the LRGV is approximately 25 inches. This past 2005 year the Valley experience below average rainfall and drought stress became apparent on many citrus trees with trees developing disease symptoms such as gummosis (see trunks , below). Gummosis symptoms were not as noticeable during 2003-2004 on citrus tree trunks as the sugary exudate is water soluble and dissolves readily during high precipitation years like 2003-2004.

Average annual rain for LRGV ~ 25 inches

2003 – 28.9 inches rainfall

2004 – 32.7 inches rainfall

2005 – 17.4 inches rainfall

Evidence of Gummosis (oozing orange exudate) on citrus tree trunks under microjet and drip irrigation, November 2005.

Additional Demonstration Sites

Data collection from designated research sites funded by the Rio Grande Basin Initiative at the TAMUK Citrus Center South Farm has been under evaluation to compare the impact of flood, drip and microjet spray irrigation on Rio Red grapefruit production. Results from this work is donated at no cost to the ADI and will provide accurate predictions of water savings, water use efficiency and irrigation use efficiency for mature citrus production. This site has been evaluated for 3 years, starting in 2003.

Eddie Esquivel assisting with annual Rio Red grapefruit harvest (left) and sorting of fruit into fresh and juice marketable class sizes (right).

Individual Rio Red grapefruit yield differences from tree fertilized annually with 1 lb N/tree/yr (left) versus unfertilized tree (right); harvested December 2005.

TAMUK Citrus Center South Farm Water Conservation Studies

The objective of this work is to evaluate irrigation use efficiency (IUE) of flood, drip and microjet spray irrigation in Rio Red grapefruit production. This project has been monitored for the past 3 growing seasons (2003 – 2005). Water applications are metered and annual harvest data is used to determine IUE (yield/unit water). This data is provided at no cost to the ADI project, but information gathered is useful for determining projected saving if drip and microjet spray irrigation practices are put into effect in the LRGV.

Annual Water Saved Over Flood Irrigation

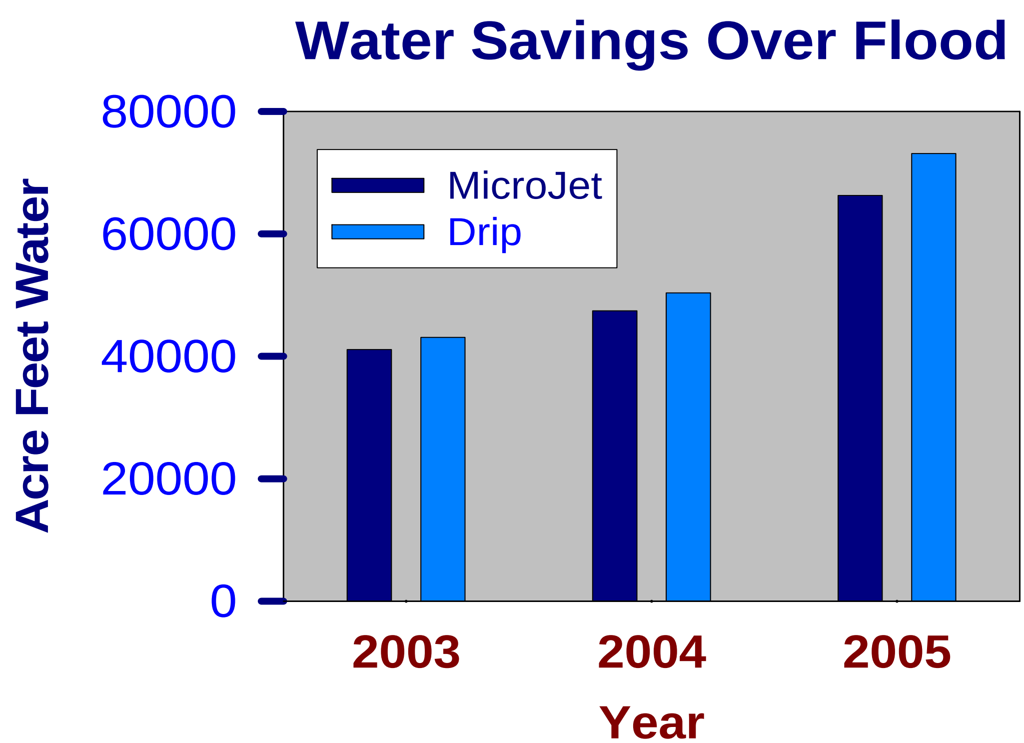
2003 – water savings for Microjet Spray (18.3 inches) and Drip (19.2 inches) irrigation.

2004 -- water savings for Microjet Spray (22.0 inches) and Drip (21.3 inches) irrigation.

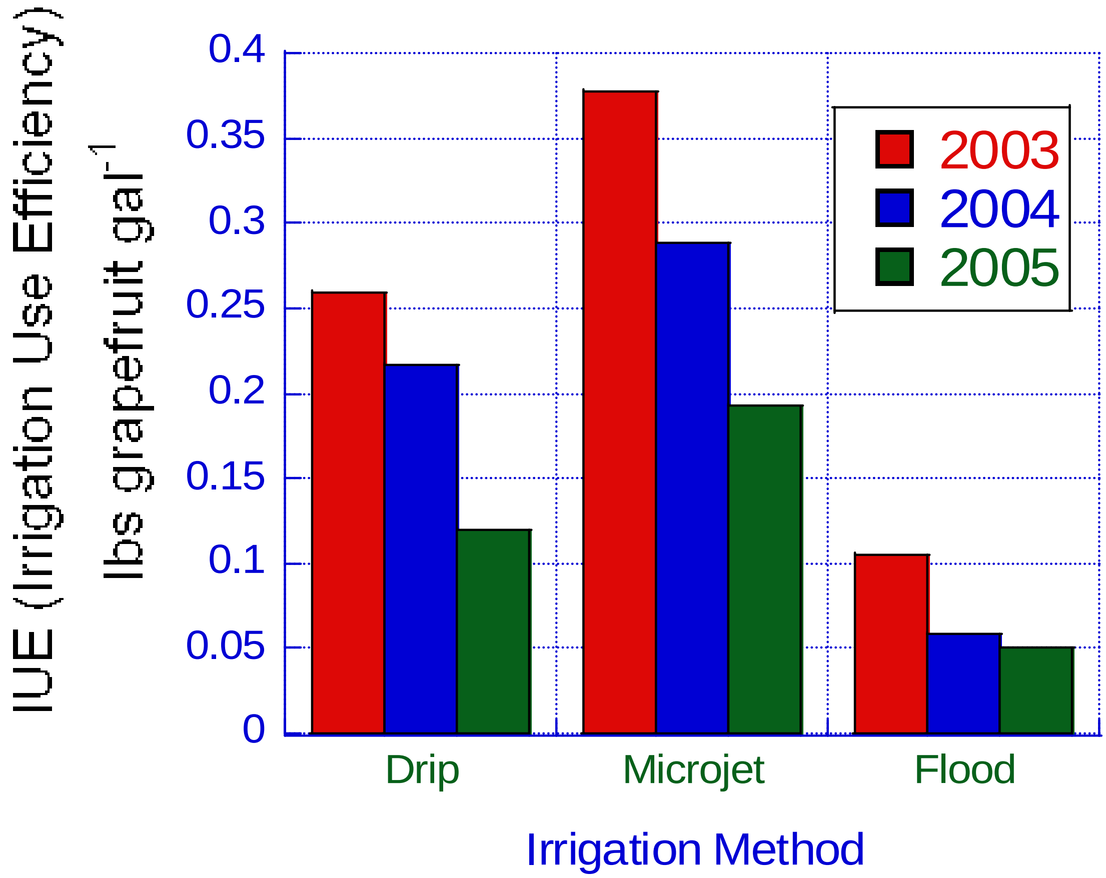
2004 -- water savings for Microjet Spray (29.5 inches) and Drip (32.5 inches) irrigation.

There is an estimated 27,000 acres of citrus in the LRGV. If all citrus were converted to drip or microjet spray irrigation the amount of water savings for the LRGV would be between **1.3 to 2.4 x 10^{10} gallons annually**.

The graph below puts this into Acre-Feet/year of water saved.



Irrigation Use Efficiency for Rio Red Grapefruit



A typical flood irrigation event in the LRGV uses between 4 to 8 inches of water per delivery. In this study each flood irrigation event used 6 inches of water. In 2003, 2004, and 2005, there were 4, 5, and 7 separate flood irrigation events (24 - 42 inches per year). The amount of delivered from drip and microjet irrigation each year was significantly less (see amount of water saved over flood highlighted in bold on previous page). If and when water supplies become limiting in the LRGV and the cost of water to irrigate crops increases, the graph above demonstrates that more yield per quantity of water can be produced using drip or microjet spray over flood irrigation. This data was collected from TAMUK Citrus Center South Farm and is free information provided to the ADI project.

Appendix “D”

Harlingen Irrigation District Demonstration Sites

Table of Contents

Index of Graphs and Pictures

Surge in Fall Corn

Co-Operator: McLemore Farms **Crop:** Fall Corn **Field size**: 38 acres
Surge acres: 18 **Furrow acres**: 20 **Plant date:** 8-10-05
Soil type: HA (Harlingen Clay)

The purpose of this demonstration is to show the use of surge technology along with furrow irrigation on fall corn.

The field was divided into two sections, the west 18 acres being surge and the east 20 acres furrow. The field was planted dry and irrigated using surge on the whole field. The decision to split the field was made at a later time to better compare the two technologies.

Soil Moisture Testing

TDR Soil moisture probe access tubes were placed in three sites at a depth of six feet; South east corner, middle and North West corner.

Equipment used

1. Waterman surge valve
2. AP Moisture probe
3. 18" Poly pipe
4. Circular flume and logger

Tail Water Measurement

Initial tail water measurement was taken using a Mace HVFlo depth/velocity meter. This device was loaned to the project for evaluation and returned after the first irrigation. Tail water will be measured with a circular flume and logger in the drain for subsequent irrigations.

Soil Moisture Sampling Schedule

Soil moisture sampling will begin three days after completion of irrigation. Samples will be taken with the AP Probe at 6", 12", 24"and 30", every day for one week and then once a week until the next irrigation.

Irrigation Information

Date	Irrigation Information	Acres	Time	AVG GPM	CFS	Meter Start	Meter Stop	Acre Feet (Meter)	Tail water AC/F	Water Applied	Inches per acre
8/12/2005	Surge	38.00	72.00	1042.57	2.32	94.49	108.31	13.82	0.70	13.12	4.14
9/1/2005	Furrow	20				357.4	364.03	6.61	0.7	5.91	3.55
9/1/2005	Rain										1.5
9/16/2005	Surge	18	50	937.58	2.09	108.3	116.94	8.63	0.7	7.93	5.29
9/17/2005	Furrow	20	24	1520.64	3.39	364	370.75	6.72	0.7	6.02	3.61
10/20/2005	Furrow	20				370.7	377.47	6.74	1.6	5.14	3.08
10/21/2005	Surge	18				117	125.57	8.6	2.8	5.8	3.87

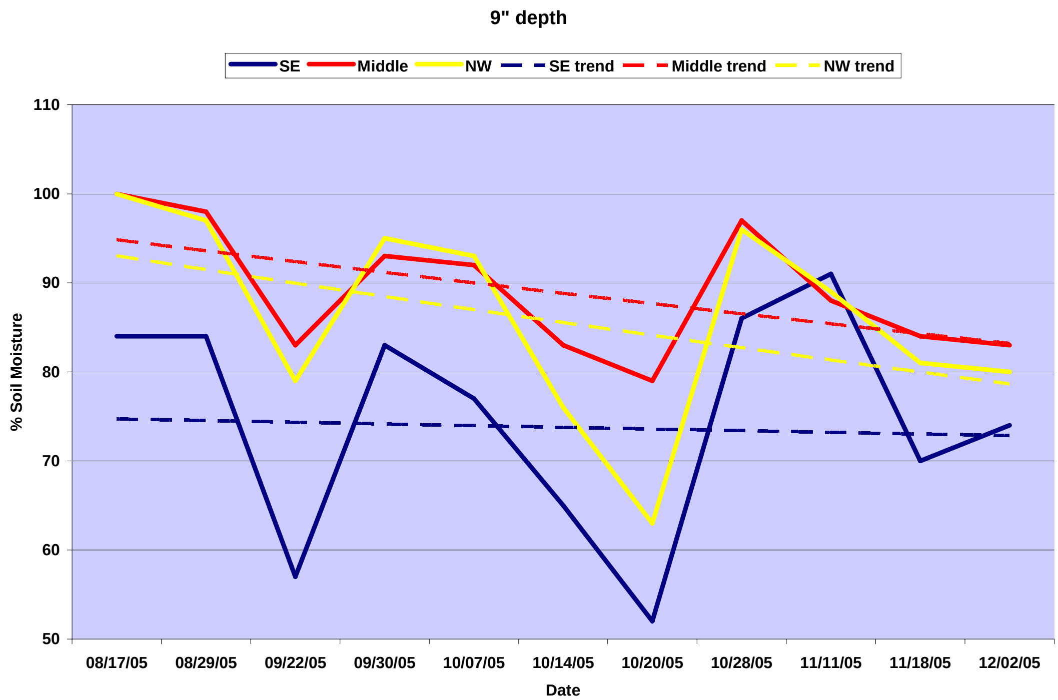
Total Inches Surge	**13.30**
Total Inches Furrow	**10.24**
Total Rain	**1.5**

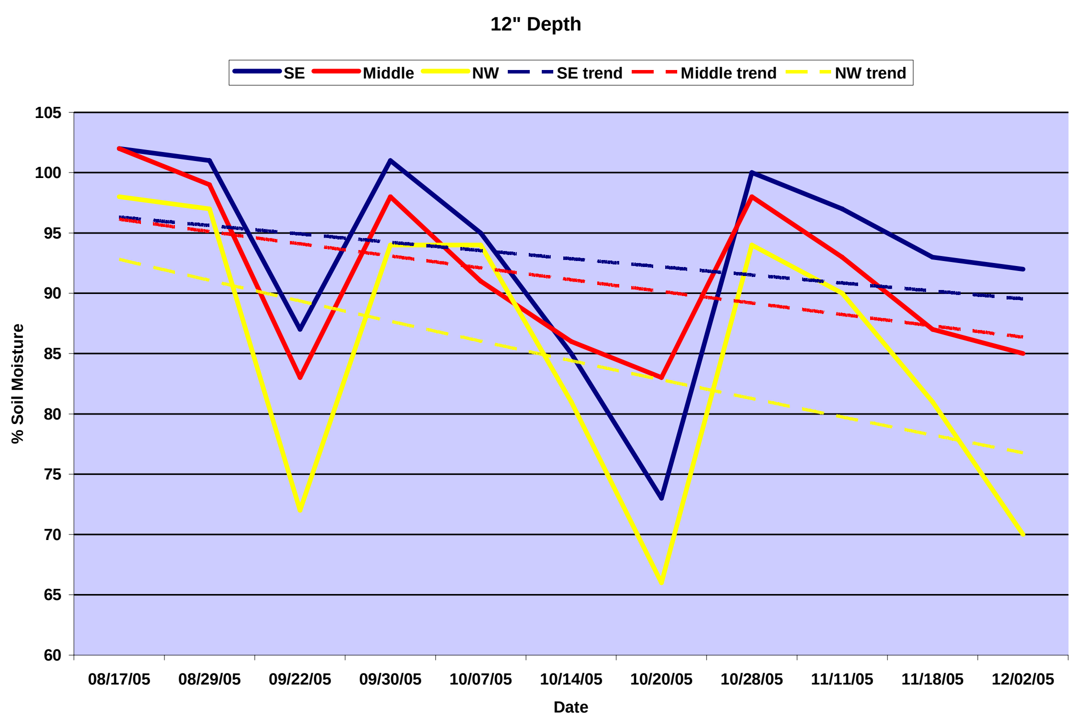
Corn Irrigation Data

Waterman surge valve in corn field during first irrigation

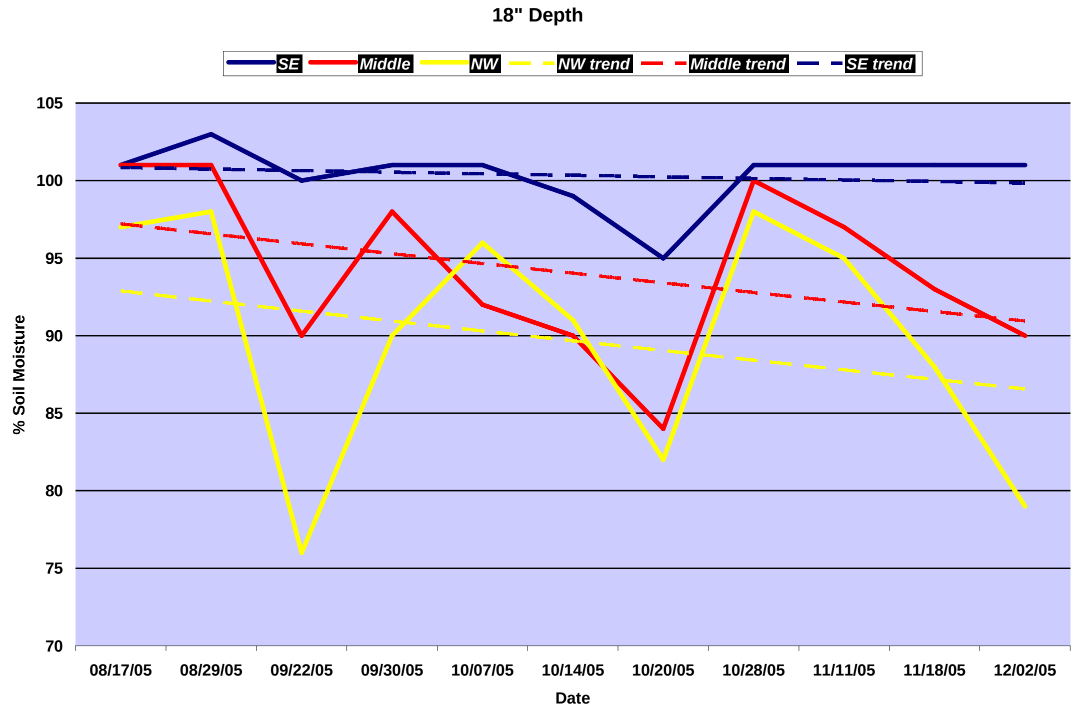
Fall Corn

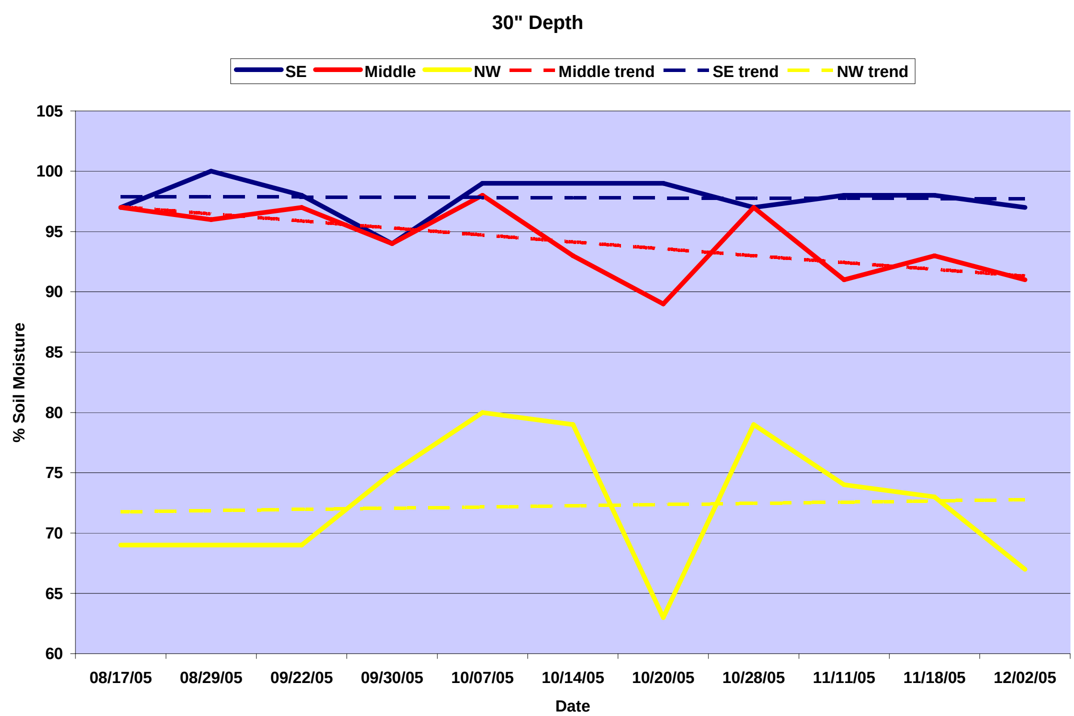
Soil Moisture Graphs



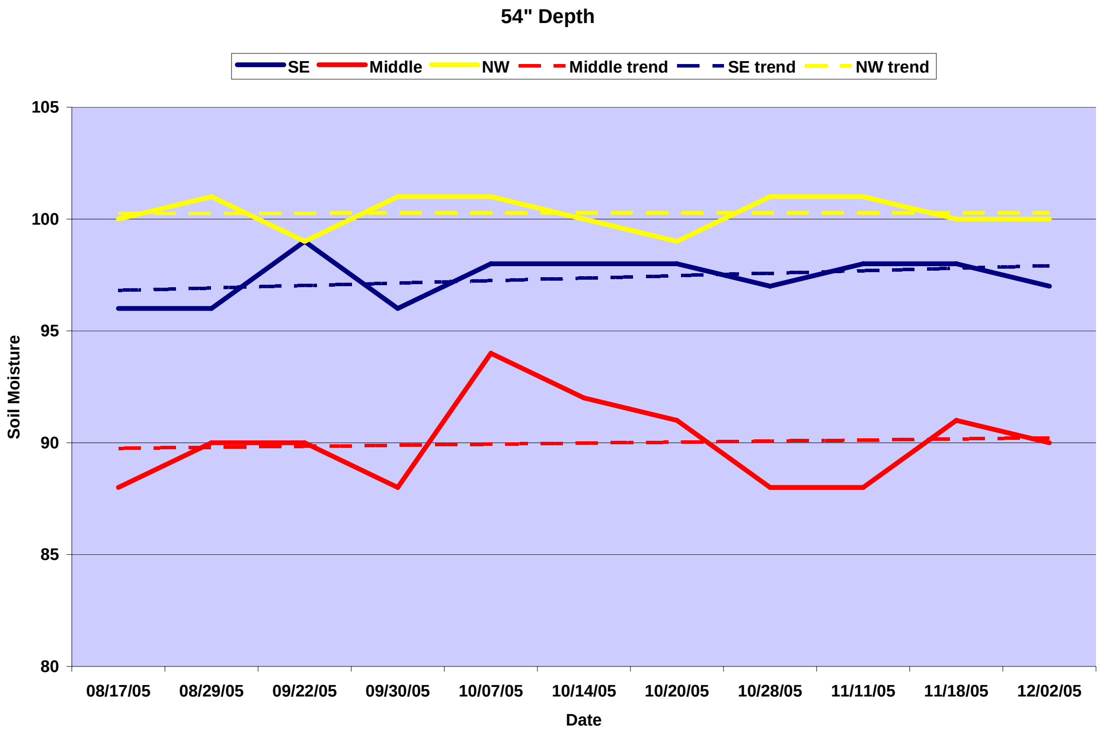


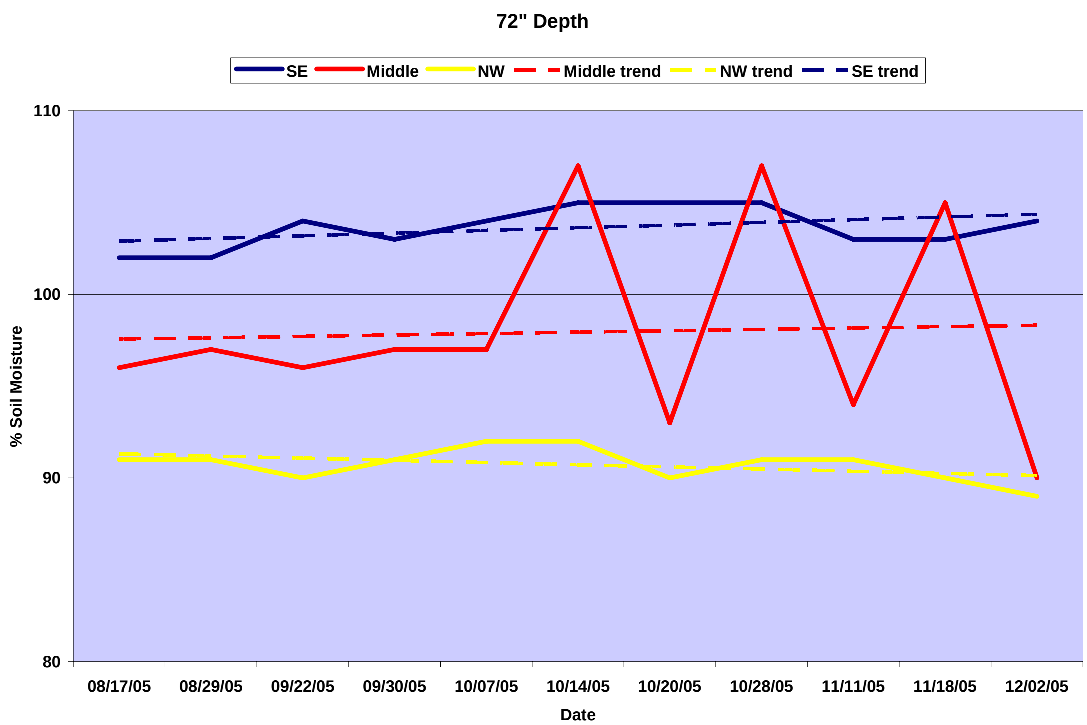
Corn Soil Moisture Graphs 1





Corn Soil Moisture Graphs 2





Corn Soil Moisture Graphs 3

Surge in Spring Cotton

Co-Operator: Chris Allen **Crop:** Cotton **Field Size**: 37.45 acres
Surge Acres: 20.4 **Furrow Acres**: 17.05 **Soil Type**: (HA) Harlingen Clay

The purpose of this demonstration is to show the use of surge technology on a cotton field. The field was divided into two sections. The north section, 17.3 acres, was flood irrigated using 18” polypipe. The second section, 20.3 acres, was flood irrigated utilizing surge irrigation. A 10” flow meter was used to measure the incoming flow of water and the 3” Honda pump was used to pump the captured tail water through a 15” flow meter.

Soil Moisture Testing

TDR Soil moisture probe access tubes were placed in twelve sites to a depth of three feet. Neutron probe access tubes were placed in three sites at a depth of three feet.

Equipment used

1. Waterman surge valve with a Waterman controller
2. AP Moisture probe
3. Neutron probe
4. 18” Poly pipe
5. 10” McCrometer flow meter in Al tube
6. 15” McCrometer flow meter in PVC tube
7. 3” Honda pump

Controller Settings

The 10” waterman surge valve was initially programmed using the furrow length option of 1300’. After 8 hours the advance rate was deemed unsatisfactory and the program changed to 3 hour intervals. The inflow rate was adjusted to approximately 750 g.p.m. which is half the rate of the flood irrigated section to allow the measurement of any infiltration differences.

Flood Irrigation Description

The same 10” McCrometer was utilized in both sections to measure the amount of water applied. All 117 rows were irrigated simultaneously.

Soil Moisture Sampling Schedule

Soil moisture sampling will begin three days after completion of irrigation. Samples will be taken with the AP Probe at 6”, 12”, 24”, and 30” every day for one week and then twice a week until the next irrigation cycle.
Samples will be taken with the neutron probe at 12”, 24” and 30” once a week. A neutron probe will be used as a benchmark for the AP Probe.

General Observations

The entire field is leveled to a .05/1000’ fall to the west and north with a row length of 1280’. Drainage was good with no water standing 6 hours after the irrigations were completed.

This cotton crop followed 10 years of continuous sugar cane production. The field consists of a uniform soil type of Harlingen Clay across the 40-acre field and down to a depth of 30”.

This uniformity of soil type is reflected in the soil moisture measurements following a similar pattern/curve at various depths.
The bulk density of the soil increases and the infiltration rate decreases with depth.
There was very little soil moisture fluctuation at the 30” depth.
The magnitude of the soil moisture fluctuations decreases as the depth increases
The surge irrigation applied less inches of water per acre than the furrow irrigation but required 50% longer to complete. The surge irrigation valve was programmed to alternate three times per irrigation cycle.

The same flow rate (gpm) per furrow was used for comparison purposes between the surge and furrow irrigation. This rate was approximately 25 gpm per furrow.

The cotton plant appeared most vigorous and healthy when the soil moisture measurements at the 18” depth were around 90% to 93%.
The same irrigation schedule was followed for the entire field.
The irrigations caused noticeable leaf yellowing for a period of 7 – 12 days and recovery time was the same for both irrigation types.

The cotton plants in the surge irrigated section were not as vigorous as their furrow irrigated counterparts.
Liquid fertilizer (N32) was applied through the irrigation water on two separate irrigations at a rate of 15 gpa and then 10 gpa.

The yield was one bale/ac for both the furrow and surge irrigated sections.

Conclusions

Utilizing the surge irrigation technology allowed the use of less water without reducing yield or requiring more frequent irrigations.

Irrigation Information

Date	Method	Acres	Time	AVG GPM	CFS	Meter Start	Meter Stop	Acre Feet (Meter)	Tail water AC/F	Water Applied	Inches per acre
5-May-05	Furrow	17.05	19	1500	3.342	108.604	114.607	6.003	0.387	5.616	3.95
8-May-05	Surge	20.4	78	750	1.671	114.607	122.223	7.616	0.451	7.165	4.21
31-May-05	Rain										1.60
8-Jun-05	Furrow	17.05	24	2,629.44	5.859	59.25	70.87	11.62	0.507	11.11	7.82
10-Jun-05	Surge	20.4	37.5	1,203.48	2.682	70.960	79.27	8.31	0.485	7.825	4.60
1-Jul-05	Furrow	17.05	21.75	2,866.49	6.387	79.28	90.76	11.48	0.46	11.02	7.76
2-Jul-05	Surge	20.4	36	1,252.11	2.790	90.76	99.06	8.3	0.368	7.932	4.67
20-Jul-05	Rain										3.9

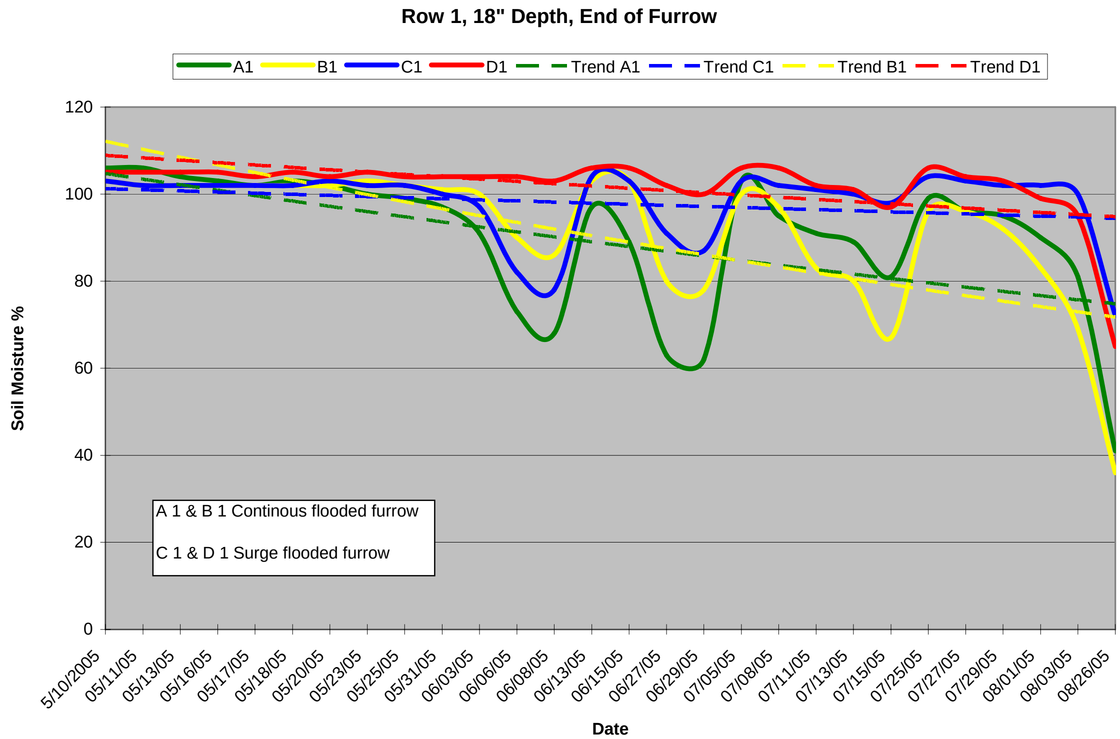
Total inches Surge	**13.48**
Total inches Furrow	**19.53**
Total Rain	**5.50**

Cotton Irrigation Data

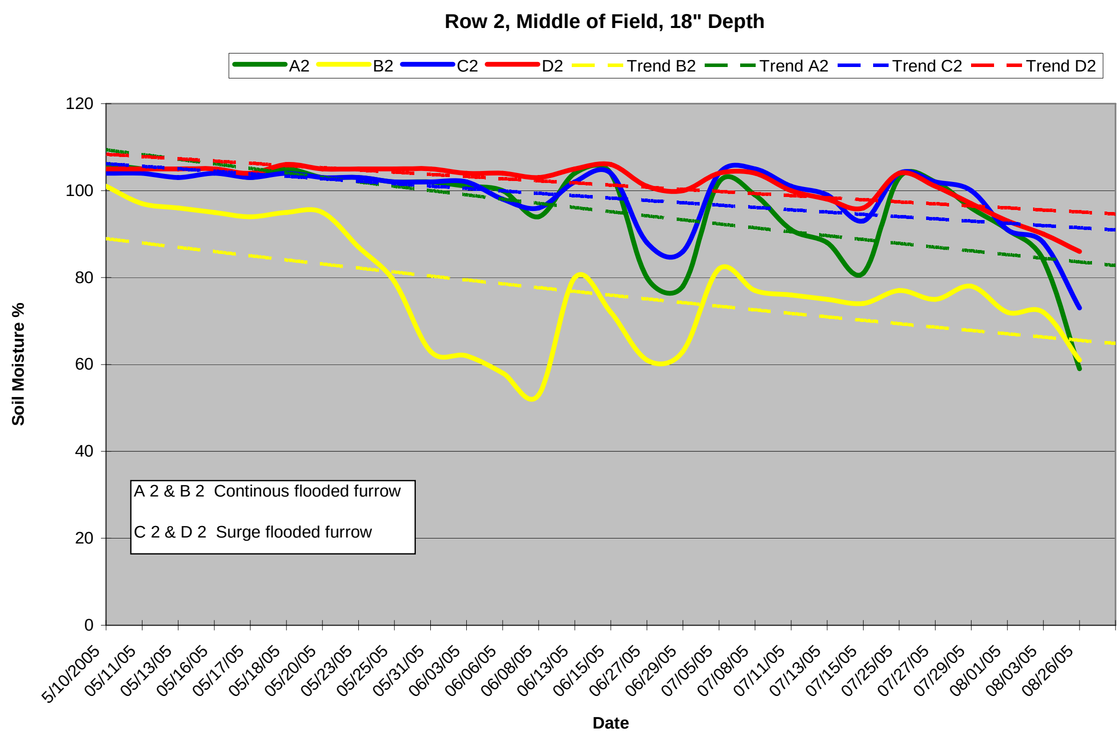
Waterman Surge Valve and Tail Water Measurement

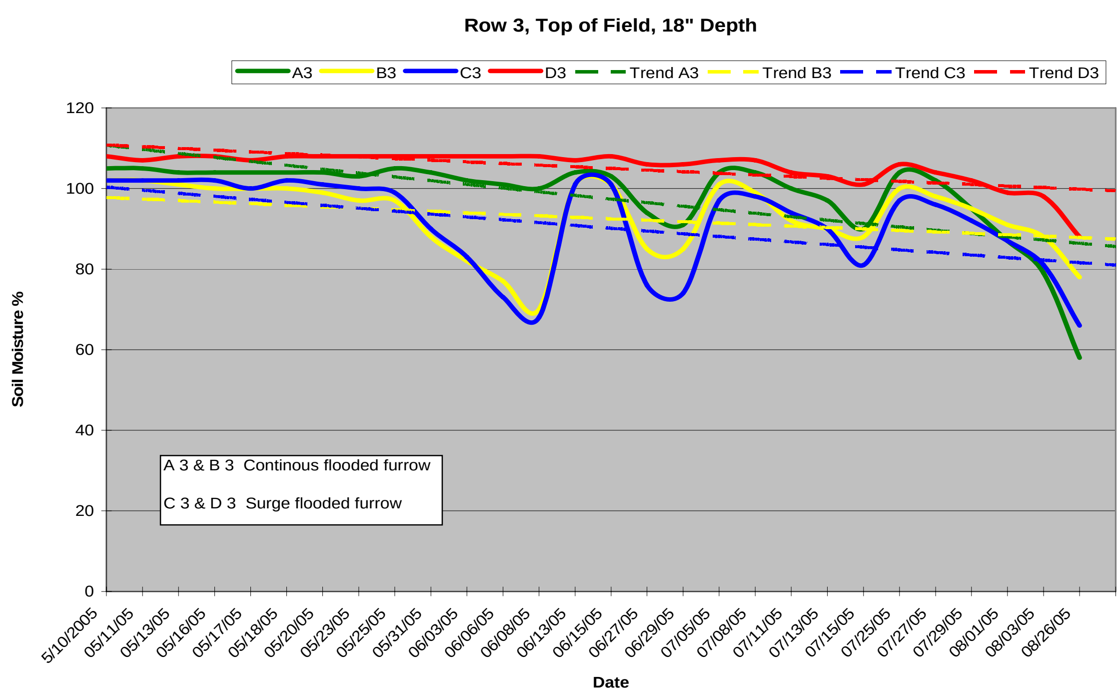
Moisture Probe Installations in Cotton Field.

Soil Moisture Graphs



Cotton Soil Moisture Graphs 1





Cotton Soil Moisture Graphs 2

Surge in Sugar Cane

Co-Operator: Wayne Halbert **Crop**: Sugar Cane **Field size**: 36.38 acres
Soil type: (HA) Harlingen Clay

The purpose of this demonstration is to show the use of surge technology combined with fertigation on a sugarcane field.

The field was divided into three sections, two 14.69 acre sections and one 7 acre section. In one 14.69 acre section flood irrigation was applied through 22” polypipe and fertilizer was injected at a rate of 27 gals per acre. A total of 400 gallons was applied to the 14.69 acres In the second 14.69 acre section surge irrigation was applied through 22” polypipe and fertilizer was injected using the surge controller fertigation pump at a rate of 33 gallons per acre. A total of 490 gallons was applied to the 14.69 acres.

Soil Nutrient Testing

Soil samples were taken at twelve points in the field prior to the first fertigation. Each point was sampled at 1’, 2’, and 3’ depths. All samples taken at each level were combined and one sample per level will be tested for nutrient levels.

Soil Moisture Testing

TDR Soil moisture probe access tubes were placed in twelve sites at a depth of 3 feet. Neutron probe access tubes were placed in four sites at a depth of three feet.

Equipment Used

1. P&R surge valve with a Star controller and fertigation optional control software and pump.
2. AP Moisture probe
3. Neutron probe
4. 22” Poly pipe
5. 3” dewatering pump
6. 15” McCrometer saddle meter modified to fit pump
7. 15” McCrometer insertion meter

Tail Water Measurement

The tail water was measured by damming the drain and pumping with a 3” pump through a 15” McCrometer modified with fittings to except the discharge hose of the pump.

Soil Moisture Sampling Schedule

Soil moisture sampling began three days after completion of irrigation. Samples were taken with the AP Probe at 6", 12", 24", and 30" every day for one week. Then twice a week until the next irrigation cycle.
Samples were taken with the neutron probe at 12", 24" and 30" once a week. The neutron probe will be used as a benchmark for the AP Probe.

General Observations

The demonstration site is a 40 acre tract with a uniform soil type of Harlingen Clay. The rows are all 1280' in length. There are 2 rows with 3 sample sites per row for the furrow irrigation portion and 2 rows with 3 sample sites per row for the surge irrigation portion. The sample tubes are installed 100' in from the beginning of the row, at the middle of the row, and 100' in from the end of the row.

The field currently has a 5th year ratoon crop of sugar cane. The furrow irrigated portion of the field is well drained while the lower half of the surge irrigated portion is flatter and drained noticeably slower with water remaining in excess of 12 hrs. in the extreme SE corner (D1 sample site).

Fertilizer (N32) was applied through the irrigation water using both irrigation methods. Soil fertility analysis showed that the Nitrogen was definitely increased in the top 1' of the soil in both the surge and furrow irrigation samples. The field has not been harvested.

The amount of water applied (inches of water per acre) in the irrigations is shown in the irrigation data table

The widest fluctuations in the soil moisture readings at all depths occur after 7/15/05.The Middle of Furrow charts, at all depths, show the steepest trend lines indicating a greater rate of soil moisture loss than recorded elsewhere in the field.

Everyone who irrigates mature sugar cane faces the difficulty of insuring an even irrigation with all rows "coming out". All fields have inherent furrow irregularities which cause some rows to "run faster" than others. It is impossible to see the advancing water column in mature sugar cane and extremely difficult to insure uniform wetting of all rows. Excessive runoff is avoided by turning off the rows as the water column reaches the end of the row. However, dry spots will remain dry and there isn't any practical way of altering this fact while the crop is being grown.

Conclusion

The surge irrigated portion of the field is visibly shorter than the furrow irrigated portion. The water use is definitely less while the irrigation intervals are the same. The tons of sugar produced are not yet available. This crop is scheduled for harvest in late spring 2006.

Irrigation Information

Date	Irrigation Type	Acres	Meter Start	Meter Stop	Acre Feet (Meter)	Tail water AC/F	Water Applied	Inches per acre
5/5/2005	Furrow	14.69	16.13	20.30	4.18	0.28	3.90	3.19
5/6/2005	Surge	14.69	20.30	20.64	3.50	0.64	2.86	2.34
5/25/2005	Furrow	14.69	579.87	584.27	4.40	0.29	4.11	3.36
5/26/2005	Surge	14.69	584.33	586.55	2.22	0.71	1.51	1.23
5/31/2005	Rain				0.00		0.00	1.6
6/9/2005	Surge	14.69	586.43	588.50	2.07	0.20	1.87	1.53
6/10/2005	Furrow	14.69	588.50	591.50	3.00	0.20	2.80	2.29
6/22/2005	Furrow	14.69	594.01	597.86	3.85	0.33	3.52	2.88
6/23/2005	Surge	14.69	597.86	599.63	1.77	0.16	1.61	1.32
7/6/2005	Surge	14.69	599.59	601.70	2.11	0.20	1.91	1.56
7/7/2005	Furrow	14.69	601.70	607.47	5.77	1.00	4.77	3.90
7/20/2005	Rain				0.00		0.00	3.9
8/2/2005	Furrow	14.69	609.24	613.37	4.13	0.2	3.93	3.21
8/3/2005	Surge	14.69	613.37	615.3	1.93	0.3	1.63	1.33
8/17/2005	Surge	14.69	615.3	617.1	1.80	0.03	1.77	1.45
8/18/2005	Furrow	14.69	617.1	621.13	4.03	0.09	3.94	3.22
8/31/2005	Rain							1.8
10/2/2005	Furrow	14.69	468.5	472.4	3.90	0.2	3.70	3.02
10/2/2005	Surge	14.69	466.82	468.5	1.68	0.2	1.48	1.21
10/10/2005	Rain							9.4

Total Furrow Ac/Ft	**30.68**
Total Surge Ac/Ft	**14.64**
Total Rain inches	**16.7**

Sugarcane Irrigation Data

Sugarcane pictures

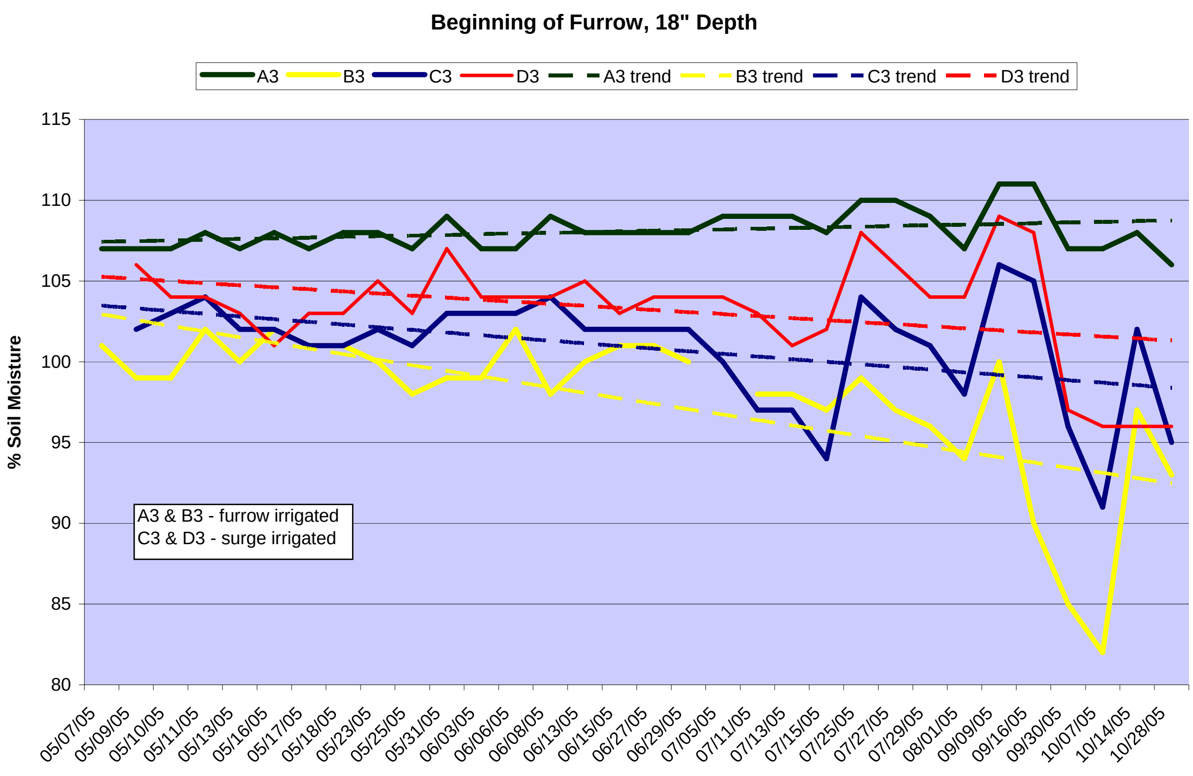
P&R Surge Valve

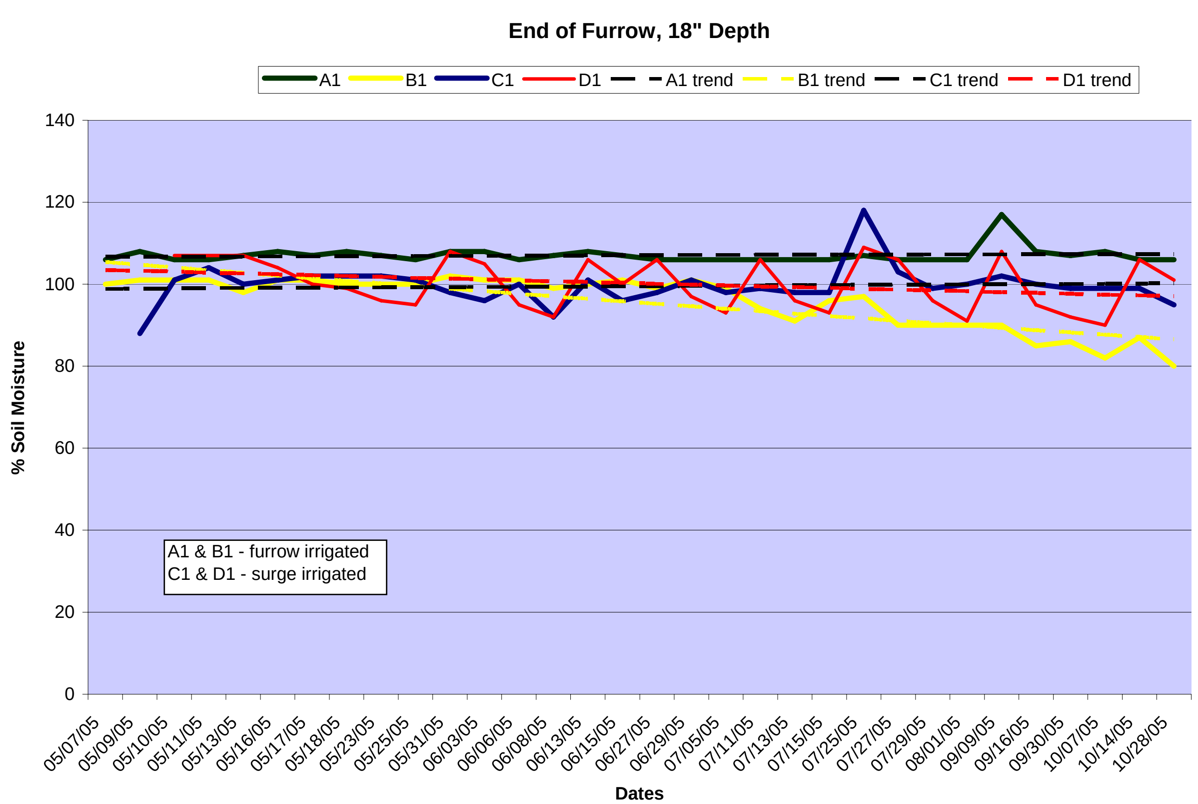
Soil Moisture Probes in Sugarcane

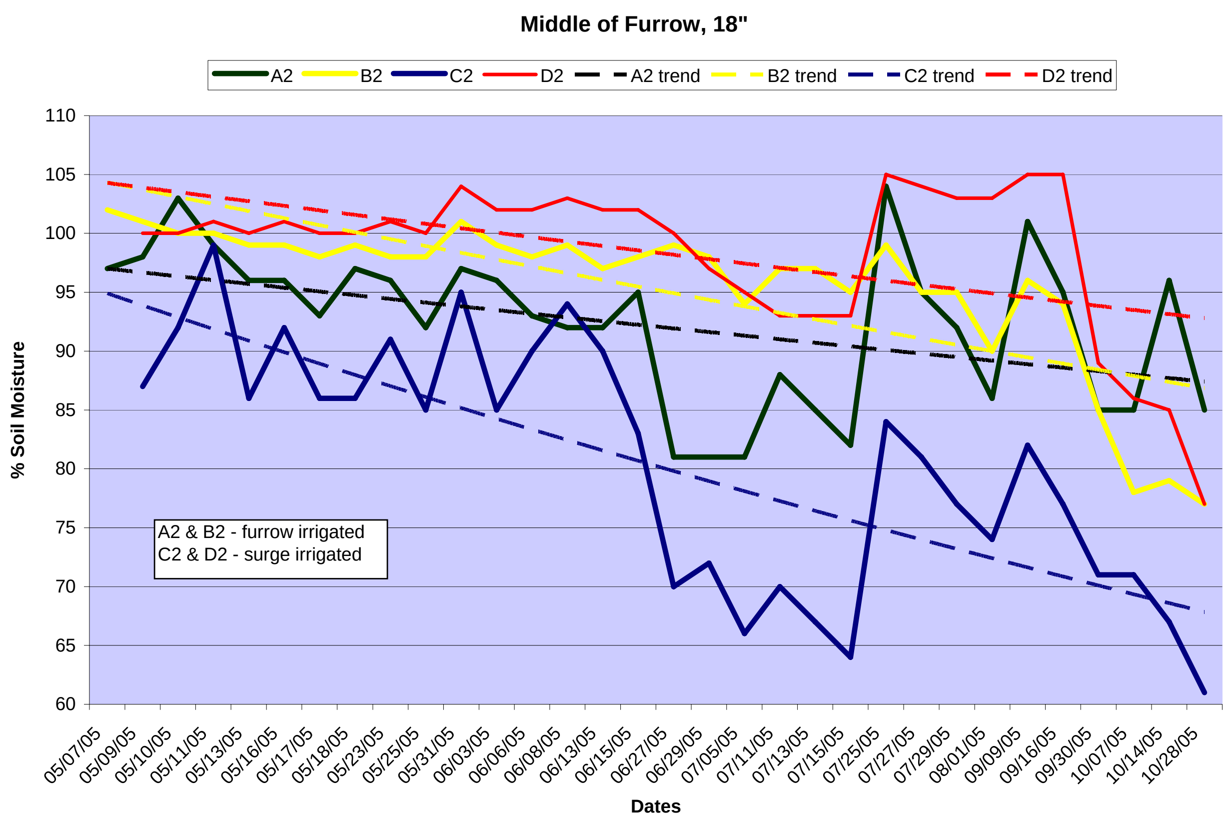
Soil Sampling in Sugarcane

Tail Water Measurement in Sugarcane

Soil Moisture Graphs







Sugarcane Soil Moisture Graphs

Center Pivot at Rio Farms

This site is located at Rio Farms and has been in a spring cotton fall corn rotation for several years. Soil moisture is monitored during each of the growing seasons and irrigation water is measured with a McCrometer meter located on the center pivot. This site is scheduled to be planted in soybeans in the 2006 spring season.

General Observations Rio Farms Cotton

The field is 80 acres located on rolling terrain with sandy loam topsoil. The topsoil depth varies from 18" to 24" below of which is an extremely tight layer of reddish clay. The sloping terrain and sandy soil obviously precludes efficient use of furrow irrigation. The field is irrigated with a center pivot utilizing drop hoses with a single rotating sprinkler nozzle.

The cotton crop started off with excellent vigor and soil moisture levels. It appeared that the farmer deliberately employed a deficit watering strategy. Two sample sites were chosen in each quadrant of the circle.

The soil moisture charts show the fluctuations in the percentage of available soil moisture during the sample period. Sites A & B, located on high ground in the NE quadrant, show very uniform curves and trend lines which correlate with uniform soil and application rate. Sample site C has a similar elevation and soil type and trended similar to A & B. Sample site D which was in the SE quadrant is located approximately 6' lower than site C and had a heavier mixture of clay which allowed it to increase its readings throughout the sampling period and at all depths. Sample sites E & F were located in the NW quadrant of the circle. Site F, which was the furthest west and the lower of the two sites, consistently had the lowest readings of available moisture. Site F had a greater mixture of clay & sand and was extremely tight soil. Sample sites G & H were located in the SW quadrant of the circle. These sites yielded mostly mid-range soil moisture readings and were the lowest elevations in the field.

Conclusions

The center pivot delivers a consistent irrigation pattern across its circle. The variations in soil types and elevations do have an effect on soil moisture retention. The field yielded an average of 1.25 bales per acre with a total irrigation 9.88" of water per acre. This corresponds to 63.2 lbs. of lint per acre-inch of water applied.

General Observations Rio Farms Fall Corn

The field is 80 acres located on rolling terrain with sandy loam topsoil. The topsoil depth varies from 18" to 24" below of which is an extremely tight (water impermeable) layer of reddish clay. The sloping terrain and sandy soil obviously precludes efficient use of furrow irrigation. The field is irrigated with a center pivot utilizing drop hoses with a single rotating sprinkler nozzle. The corn crop started off with uniform emergence and soil moisture levels were well maintained throughout the season. One sample site was chosen in each quadrant of the circle. The soil moisture charts show the fluctuations in the percentage of available soil moisture during the sample period. Site A was located in the NE quadrant, site B was located in the SE quadrant, site C was located in the NW quadrant, and site D was located in the SW quadrant. The soil moisture trend for site C has the steepest slope indicating the most rapid depletion of available soil moisture whereas site D has a mostly positive soil moisture trend. The greatest variations in moisture measurements occurred in the 9/28/05 to 10/20/05 time period.

Conclusions

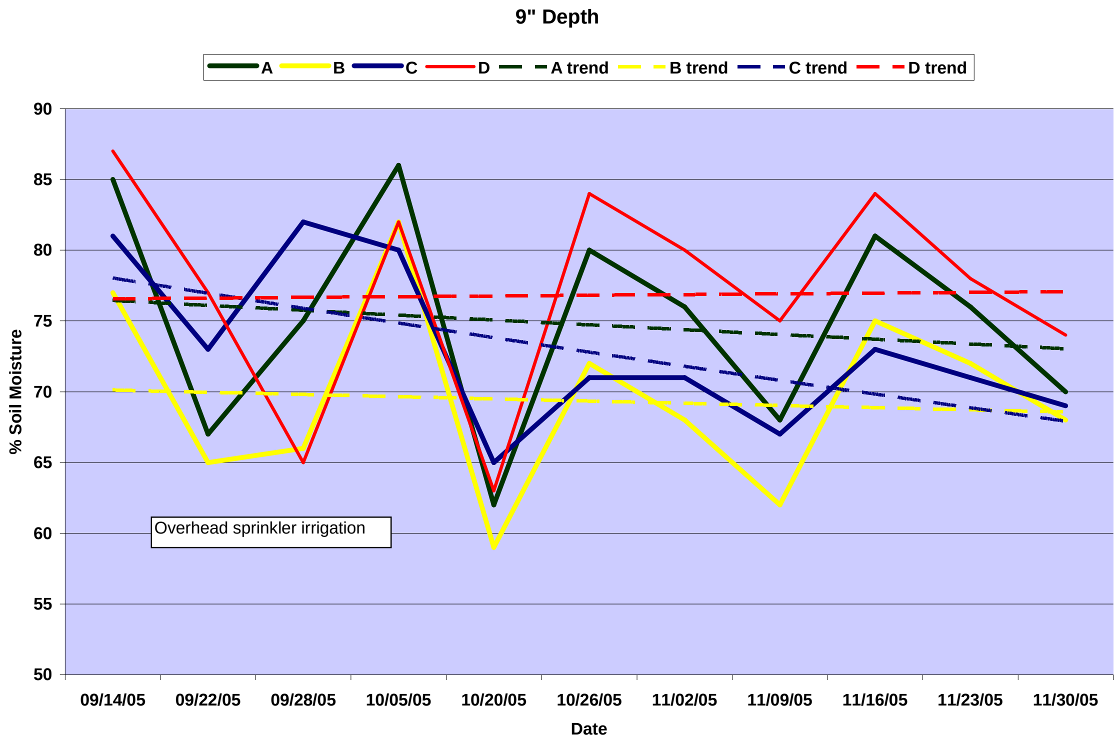
The center pivot delivers a consistent irrigation pattern across its circle. The variations in soil types and elevations do have an effect on soil moisture retention as evidenced by the divergent soil moisture trends noted at all depths. One of the benefits of a center pivot irrigation system is the ability to minimize soil moisture fluctuations by precisely controlling the irrigation timing and application rates.

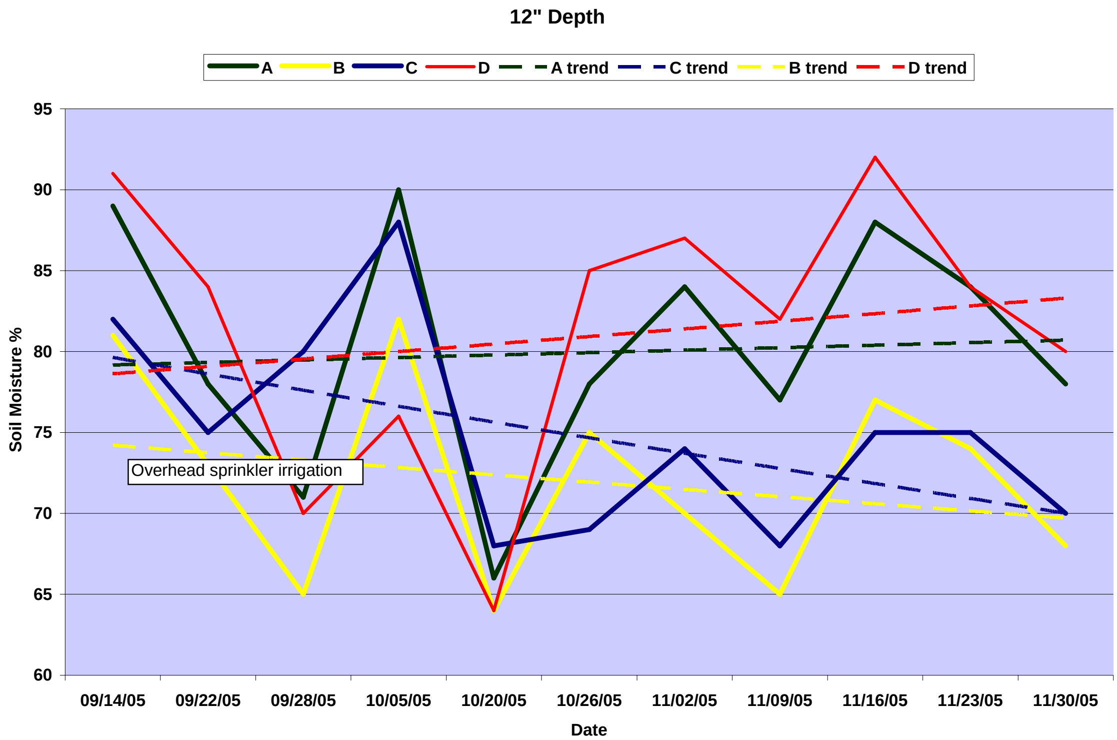
Irrigation Data

Date	Opperator	Irrigation Information	Acres	Meter Start	Meter Stop	Acre Feet (Meter)	Inches per acre	Total Water
5/27/2005 - 6/20/2005	Rio Farms	Cotton	80	398.086	463.969	65.883	9.88	
		Rain					8.50	18.38
9/1/2005 - 12/01/2005	Rio Farms	Corn	80	463.969	585.945	121.98	18.30	
		Rain					0.97	19.27

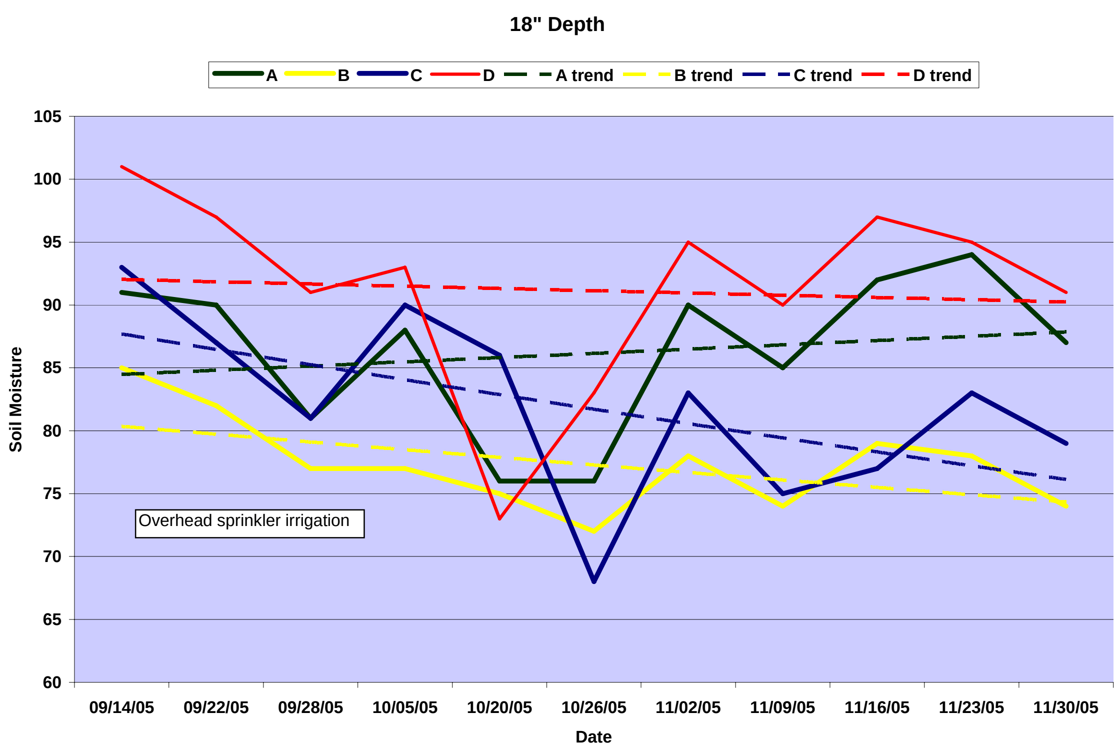
Center Pivot Irrigation Data

Center Pivot Soil Moisture Graphs

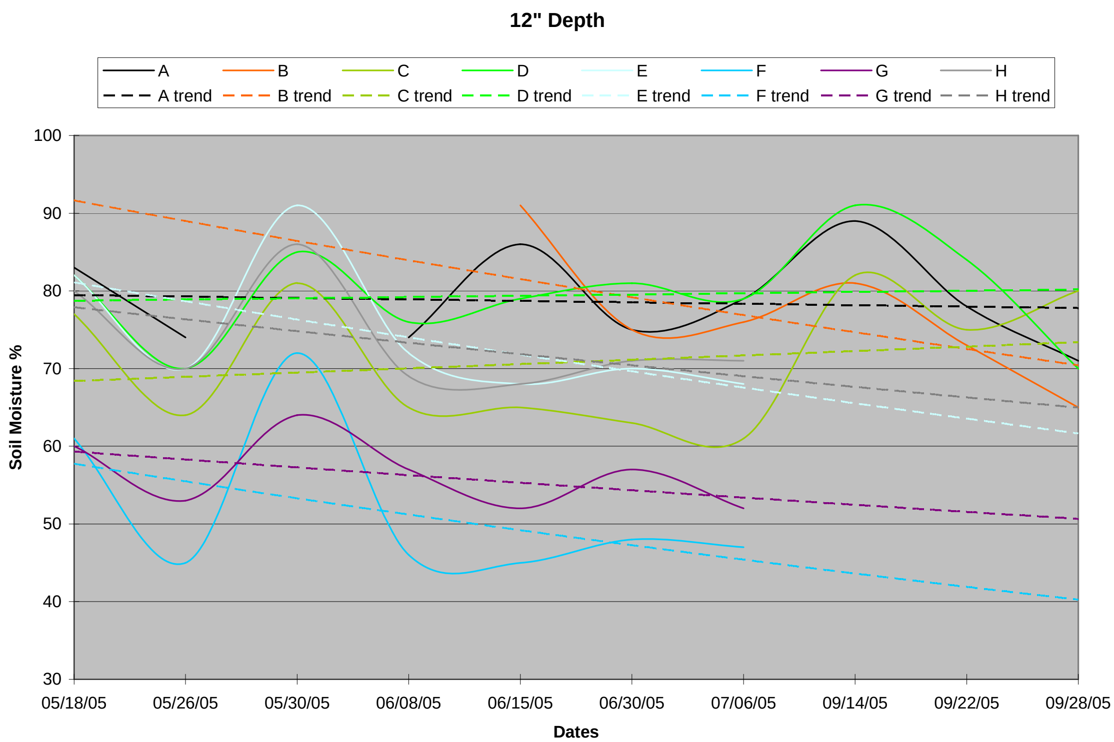




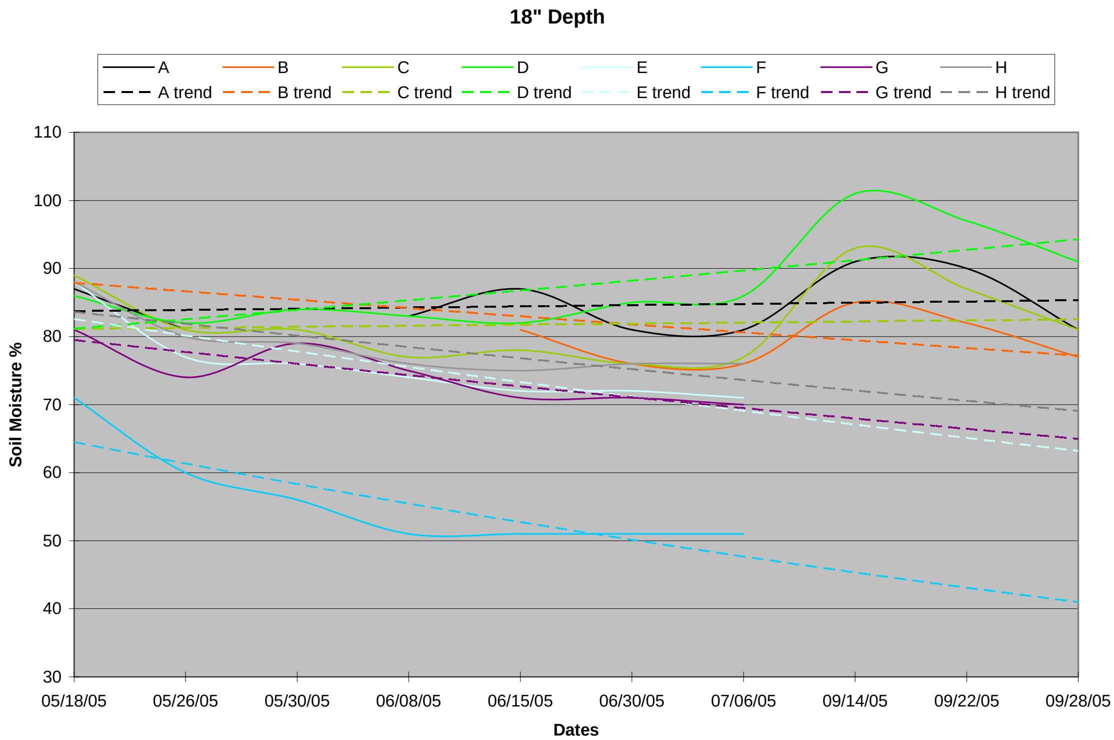
Center Pivot Corn Soil Moisture Graphs 1



Center Pivot Corn Soil Moisture Graphs 2



Center Pivot Cotton Soil Moisture Graphs 1



Center Pivot Cotton Soil Moisture Graphs 2

Rio Farms Pictures

Pivot on Spring Cotton

Pivot Nozzles

Pivot Power Unit

Spring Cotton Under Pivot

Fall Corn Under Pivot

Taking Soil Moisture readings in Fall Corn

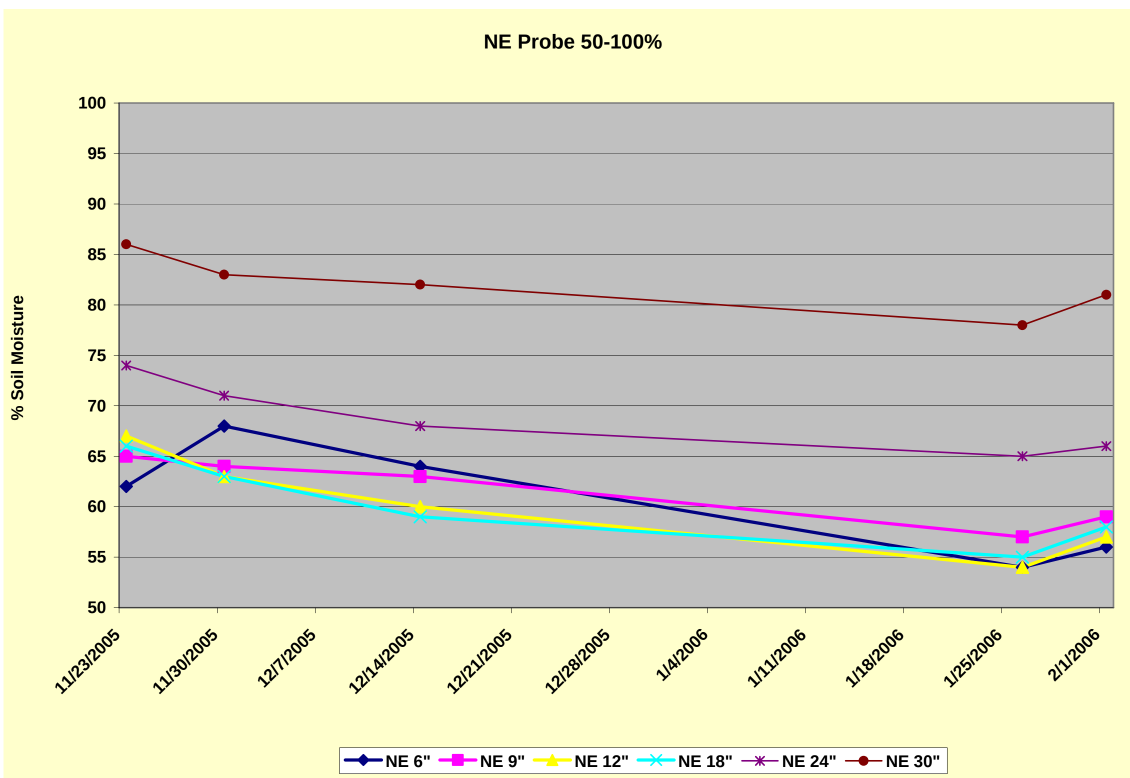
Alvarez Mini Pivot

A site we acquired in late 2005 is a pasture irrigated with a mini-pivot. This pasture is divided into four separate pastures and the mini pivot is moved to each section for the duration of the irrigation. We monitor moisture in each pasture and the water is metered at the pumping site with a McCrometer meter. This pasture is used for a cow calf operation. We expect to monitor this site for the duration of the project.

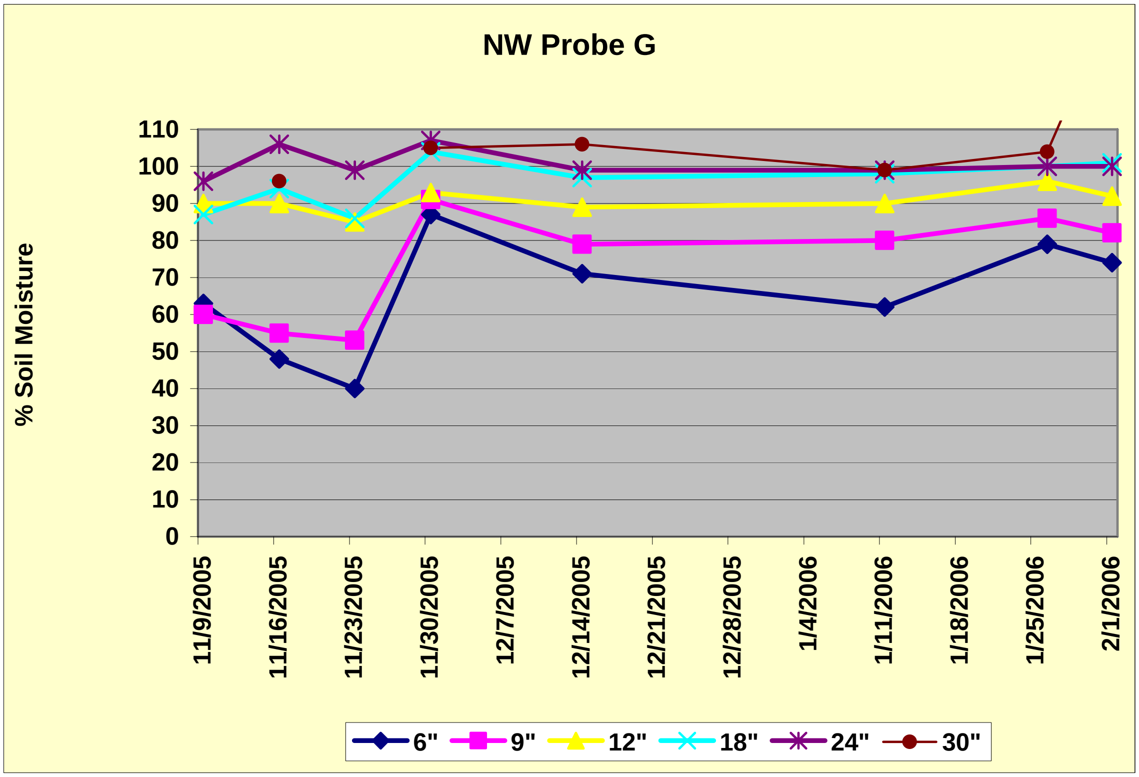
Irrigation Data

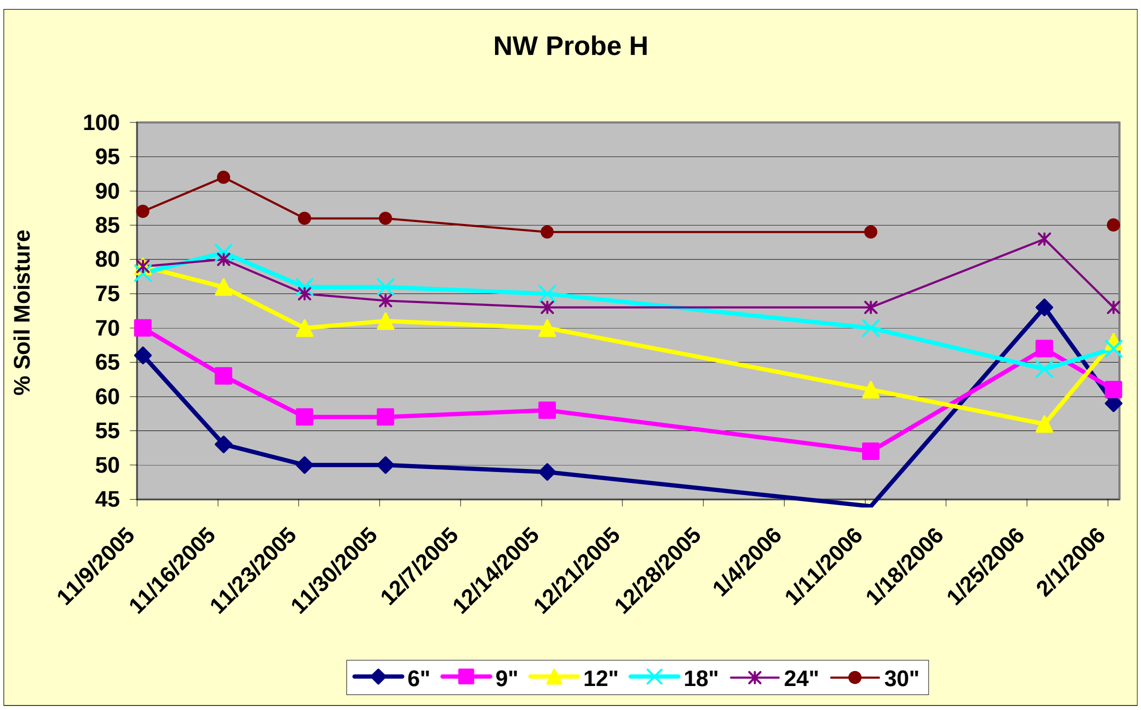
Since November of 2005 there has been 88.7 acre feet of irrigation water applied to these pastures. These fields have also received 1.14 inches of rain.

Soil Moisture Charts



Mini Pivot Soil Moisture 1





Mini Pivot Soil Moisture 2

Mini Pivot Pictures

Mini Pivot Pump

Mini Pivot

Mini Pivot Nozzle

Mini Pivot Control Box

Flood demonstration on coastal Bermuda

Cooperator: Jack Garrett **Crop:** Coastal Bermuda **Field Size**: 8 acres
Soil type: (HA) Harlingen Clay

The purpose of this demonstration is to monitor water usage on grass for hay using open ditch flood as the irrigation method. This field will be monitored throughout the season measuring all water applied along with soil moisture on a weekly basis.

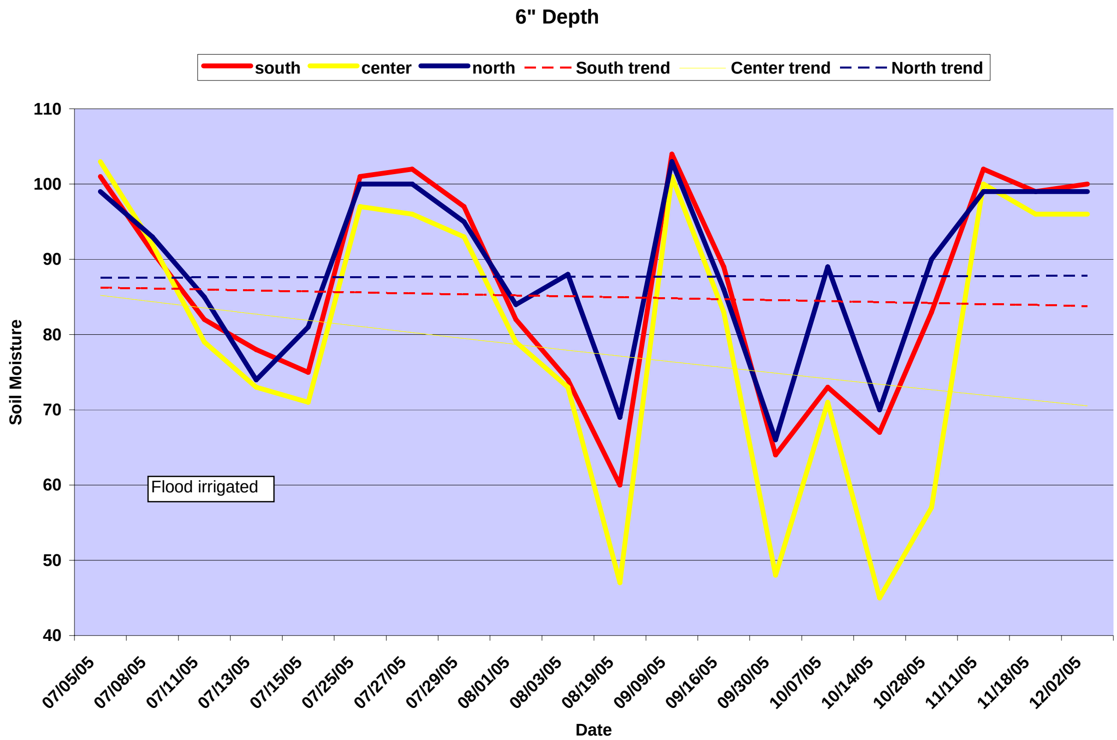
Irrigation Data

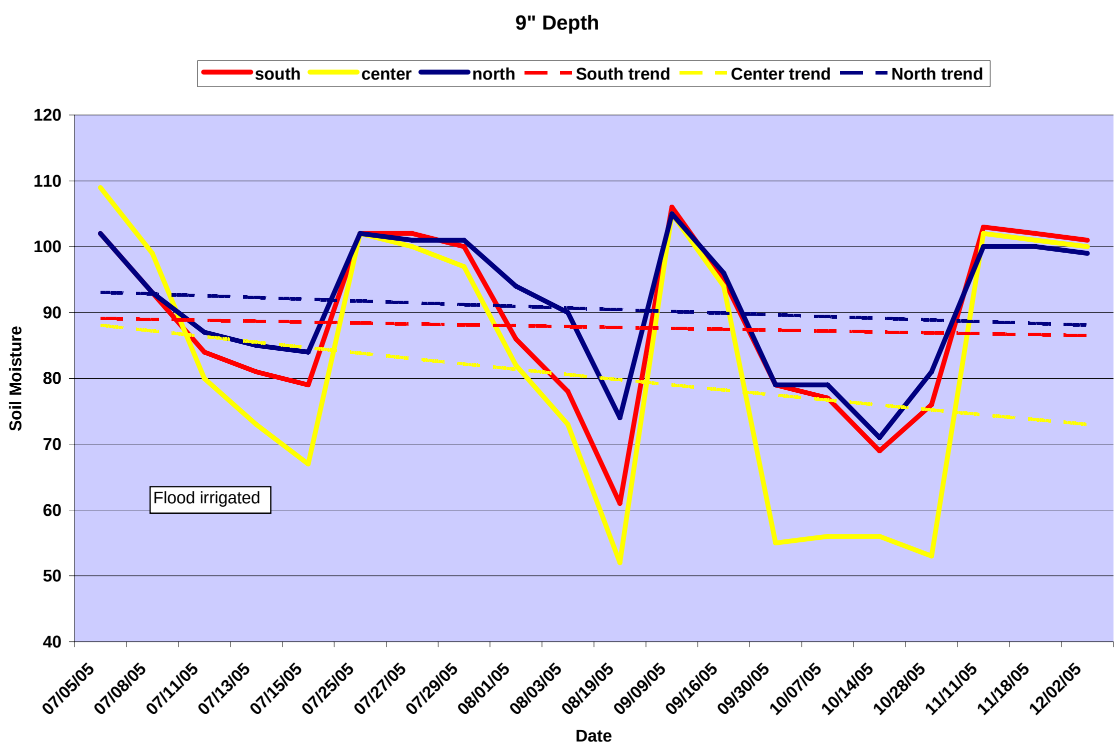
Date	Opperator	Irrigation Information	Acres	Acre Feet (Meter)	Water Applied Ac/Ft	Inches per acre
June 28, 2005	Garrett	Flood	8	1.67	1.67	2.51
July 20, 2005	Garrett	Rain				3.50
August 19, 2005	Garrett	Flood	8	2.5	2.5	3.75
August 31, 2005		Rain				1.80

Total Flood 6.26
Total Rain 5.30

Garrett Hay Field

Soil Moisture Graphs


6" Depth
south
center
north
South trend
Center trend
North trend
110
100
90
80
70
60
50
40
Soil Moisture
Flood irrigated
07/05/05
07/08/05
07/11/05
07/13/05
07/15/05
07/25/05
07/27/05
07/29/05
08/01/05
08/03/05
08/19/05
09/09/05
09/16/05
09/30/05
10/07/05
10/14/05
10/28/05
11/11/05
11/18/05
12/02/05
Date


9" Depth
south
center
north
South trend
Center trend
North trend
120
110
100
90
80
70
60
50
40
Soil Moisture
Flood irrigated
07/05/05
07/08/05
07/11/05
07/13/05
07/15/05
07/25/05
07/27/05
07/29/05
08/01/05
08/03/05
08/19/05
09/09/05
09/16/05
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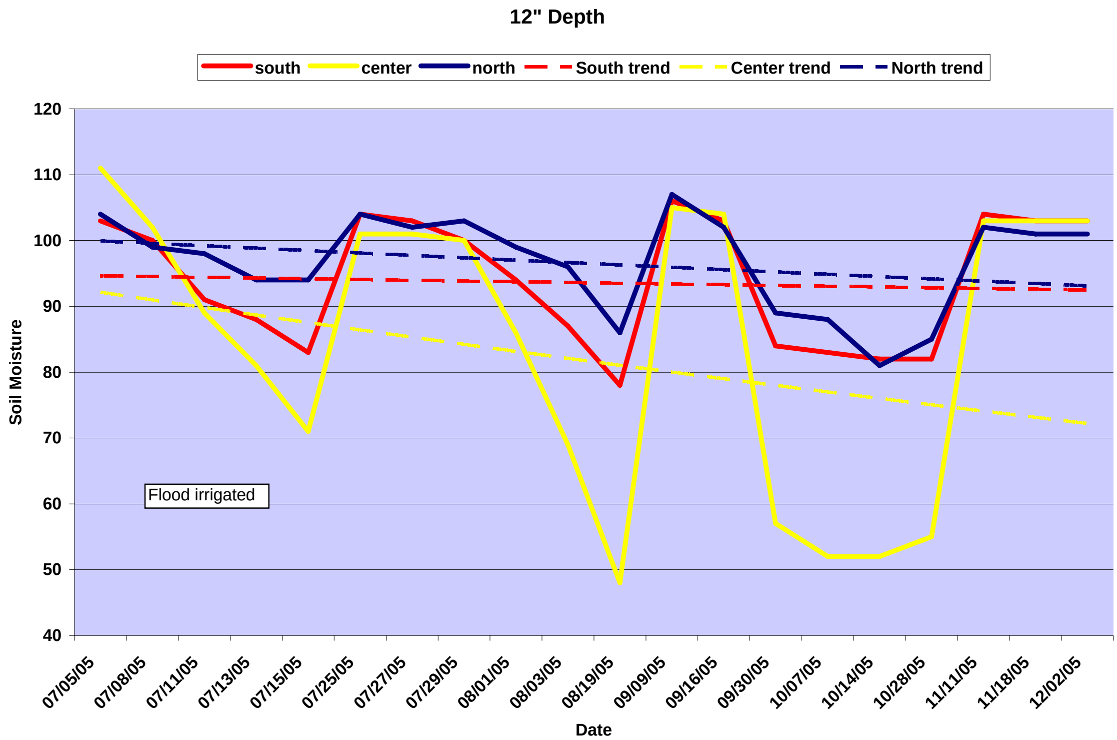
10/07/05
10/14/05
10/28/05
11/11/05
11/18/05
12/02/05
Date


12" Depth
south
center
north
South trend
Center trend
North trend
Soil Moisture
120
110
100
90
80
70
60
50
40
Flood irrigated
07/05/05
07/08/05
07/11/05
07/13/05
07/15/05
07/25/05
07/27/05
07/29/05
08/01/05
08/03/05
08/19/05
09/09/05
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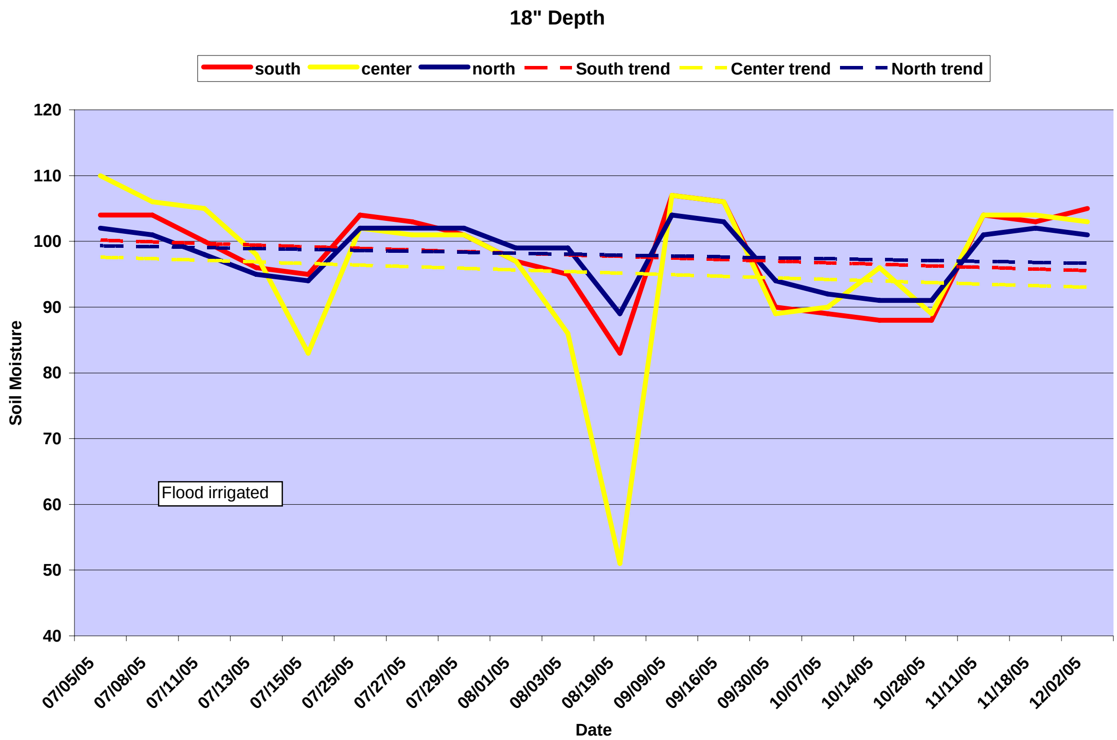
11/18/05
12/02/05
Date


18" Depth
south
center
north
South trend
Center trend
North trend
Soil Moisture
120
110
100
90
80
70
60
50
40
Flood irrigated
07/05/05
07/08/05
07/11/05
07/13/05
07/15/05
07/25/05
07/27/05
07/29/05
08/01/05
08/03/05
08/19/05
09/09/05
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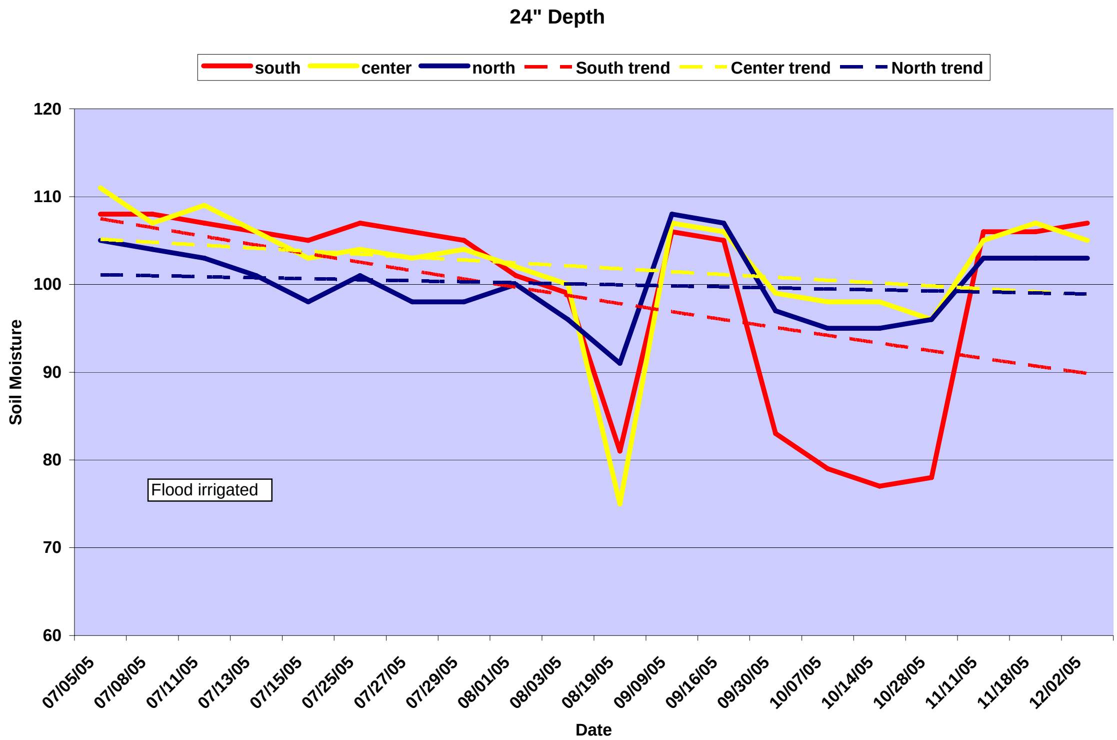
11/18/05
12/02/05
Date


24" Depth
south
center
north
South trend
Center trend
North trend
120
110
100
90
80
70
60
Soil Moisture
Flood irrigated
07/05/05
07/08/05
07/11/05
07/13/05
07/15/05
07/25/05
07/27/05
07/29/05
08/01/05
08/03/05
08/19/05
09/09/05
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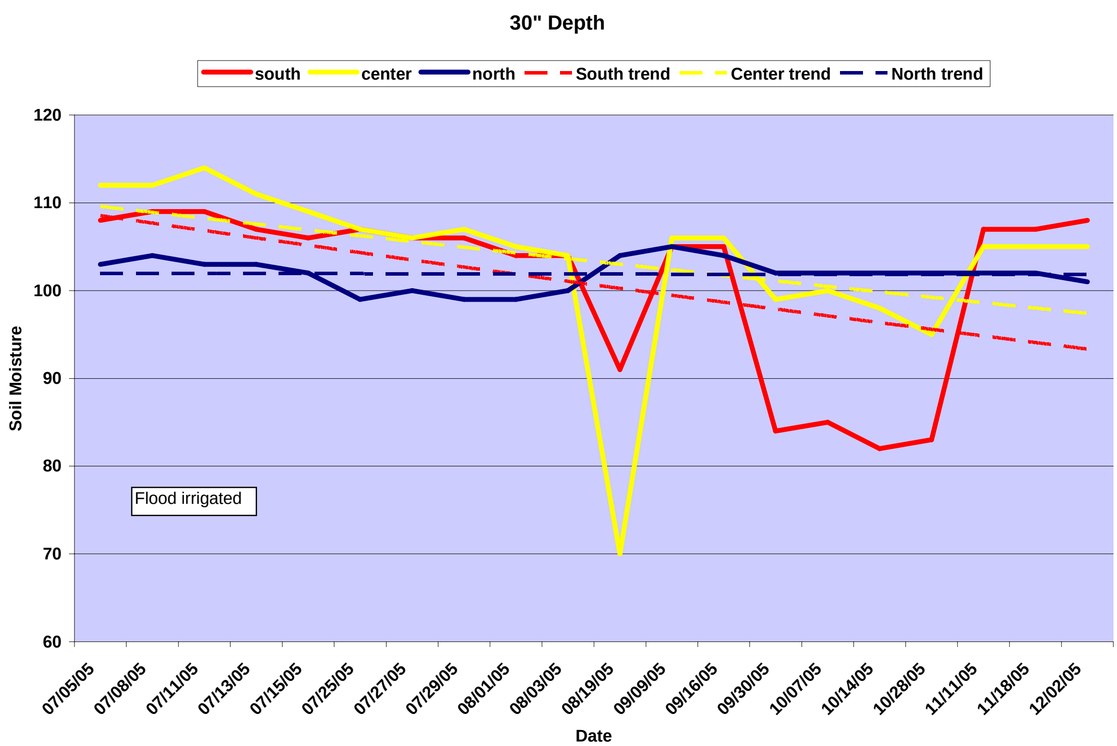
11/18/05
12/02/05
Date


30" Depth
south
center
north
South trend
Center trend
North trend
120
110
100
90
80
70
60
Soil Moisture
Flood irrigated
07/05/05
07/08/05
07/11/05
07/13/05
07/15/05
07/25/05
07/27/05
07/29/05
08/01/05
08/03/05
08/19/05
09/09/05
09/16/05
09/30/05
10/07/05
10/14/05
10/28/05
11/11/05
11/18/05
12/02/05
Date

General Observations Jack Garrett Pasture

The site is a 7-acre field of coastal Bermuda grass with a uniform soil type of Harlingen clay. The field is flood irrigated by cuts in the open ditch and drains from the north to south. The north sample site showed the most stable soil moisture readings while the center site showed the largest fluctuations of soil moisture.

Conclusion

The irrigations are scheduled to provide feed for the farmer's own cattle. The intent is not to maximize production. Less soil moisture is lost to evaporation than in traditional row crops which have some soil exposed to direct sunlight along with repeated cycles of swelling and cracking. Thus the clay soil holds its moisture noticeably longer in this cultivation versus row crop cultivation.

Valerius Water Cannon

Co-Operator: Wesley **Valerius** **Crop:** Tifton 185 **Field Size**: 22 acres

The purpose of this demonstration is to evaluate the distribution uniformity of a Traveling Water Cannon. The field measures 1340' North and South by 740' East and West. A line of catch cans were placed east and west across the field at a 10' spacing. The amount of water captured was measured with a graduated measuring device. The results were recorded and graphed to show the distribution of the water. Water usage will also be monitored along with yield.

The uniformity tests were performed by Xavier Peries of Texas A&M Extension Service under the direction of Dr. Juan Enciso.

Uniformity of Water Distribution

6 studies were done on this canon:
Test 1, 2, and 3 for the 6/14 through 6/17/05 irrigation.
Test 4, 5, and 6 for the 6/22 through 6/25/05 irrigation.
Each test evaluated the water distribution between 2 runs, or between 2 passages of the canon.
Here are the results:

TEST 1
(Data for collector #7 through 25, included)
Coeff of Uniformity: 63.27%
Depth of Irrigation: 7.65 mm
Wind (Harlingen ref at 4.00 am and 4.00 pm, then I just used the mean value):
2.755 and 1.855 mph, thus mean of 2.305 mph

TEST 2
(Data for collector #25 through 44, included)
Coeff of Uniformity: 83.36%
Depth of Irrigation: 9.82 mm
Wind (Harlingen ref at 4.00 am and 4.00 pm, then I just used the mean value):
1.855 and 1.665 mph, thus mean of 1.76 mph

TEST 3
(Data for collector #44 through 64, included)
Coeff of Uniformity: 88.03%
Depth of Irrigation: 8.63 mm
Wind (Harlingen ref at 4.00 am and 4.00 pm, then I just used the mean value):
1.665 and 2.35 mph, thus mean of 2 mph

TEST 4
(Data for collector #9 through 21, included)
Coeff of Uniformity: 66.16%
Depth of Irrigation: 5.23 mm
Wind (Harlingen ref at 4.00 am and 4.00 pm, then I just used the mean value):
Mean of 1.73 mph

TEST 5
(Data for collector #21 through 35, included)
Coeff of Uniformity: 87.33%
Depth of Irrigation: 6.66 mm
Wind (Harlingen ref at 4.00 am and 4.00 pm, then I just used the mean value):
Mean of 1.88 mph

TEST 6
(Data for collector #35 through 48, included)
Coeff of Uniformity: 85.71%
Depth of Irrigation: 6.74 mm

At this time, I cannot explain the differences observed.

Test Procedure

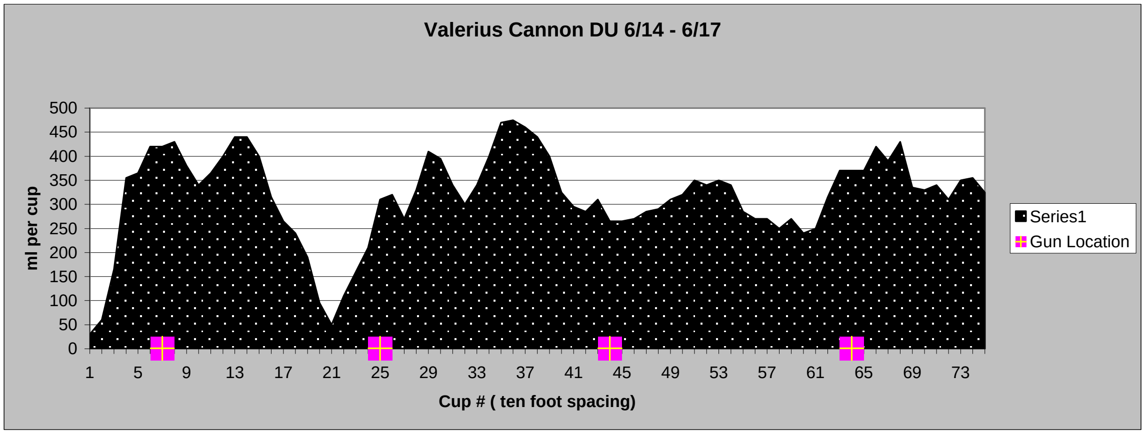
TEST PROCEDURE FOR DETERMINING THE UNIFORMITY OF WATER DISTRIBUTION

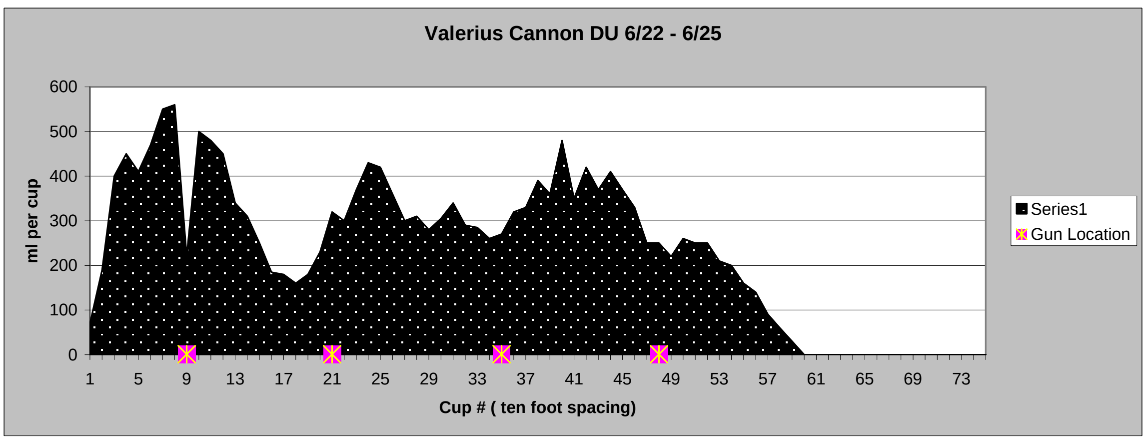
Effective Length of Machine (m)	125
Number of Collectors Installed	33
Number of Collectors Used in Analysis (n)	33
% of Collectors Omitted from Analysis	0.00

Collector Line No.	
Diameter of Collector (mm)	111.125
Area of Collector Opening (mm²)	9693.781

Collector & Tow er No. (C & T)	Location of C & T (m)	Time w ater in collector (h)	Catch Volume (ml)	Adjust catch Volume (ml)	Depth Applied (mm)	Depth by Distance	Evaporated Water from Collector	Absolute (Di - av D)	Si by abs (Di - av D)
i	Si	Ti	Vi	Vai	Di	Si*Di	Ei		(pivot only)
1	3.00	1.20	150.00	150.00	15.47	46.42	0.00	7.12	21.35
2	6.00	1.20	300.00	299.90	30.94	185.62	0.10	8.35	50.08
3	9.00	1.20	350.00	349.90	36.10	324.86	0.10	13.50	121.54
4	12.00	1.20	100.00	99.90	10.31	123.67	0.10	12.29	147.43
5	15.00	1.20	200.00	199.90	20.62	309.32	0.10	1.97	29.55
6	18.00	1.20	210.00	209.90	21.65	389.76	0.10	0.94	16.89
7	21.00	1.20	230.00	229.90	23.72	498.04	0.10	1.13	23.63
8	24.00	1.20	240.00	239.90	24.75	593.95	0.10	2.16	51.76
9	27.00	1.20	200.00	199.90	20.62	556.78	0.10	1.97	53.18
10	30.00	1.20	300.00	299.90	30.94	928.12	0.10	8.35	250.39
11	33.00	1.20	350.00	349.90	36.10	1191.15	0.10	13.50	445.64
12	36.00	1.20	100.00	99.90	10.31	371.00	0.10	12.29	442.28
13	39.00	1.20	200.00	199.90	20.62	804.24	0.10	1.97	76.82
14	42.00	1.20	200.00	199.90	20.62	866.10	0.10	1.97	82.73
15	45.00	1.20	200.00	199.90	20.62	927.97	0.10	1.97	88.64
16	48.00	1.20	200.00	199.90	20.62	989.83	0.10	1.97	94.55
17	51.00	1.20	200.00	199.90	20.62	1051.69	0.10	1.97	100.46
18	54.00	1.20	300.00	299.90	30.94	1670.62	0.10	8.35	450.69
19	57.00	1.20	350.00	349.90	36.10	2057.43	0.10	13.50	769.74
20	60.00	1.20	100.00	99.90	10.31	618.33	0.10	12.29	737.14
21	63.00	1.20	200.00	199.90	20.62	1299.15	0.10	1.97	124.09
22	66.00	1.20	200.00	199.90	20.62	1361.02	0.10	1.97	130.00
23	69.00	1.20	300.00	299.90	30.94	2134.68	0.10	8.35	575.89
24	72.00	1.20	350.00	349.90	36.10	2598.86	0.10	13.50	972.30
25	75.00	1.20	100.00	99.90	10.31	772.92	0.10	12.29	921.42
26	78.00	1.20	200.00	199.90	20.62	1608.47	0.10	1.97	153.64
27	81.00	1.20	200.00	199.90	20.62	1670.34	0.10	1.97	159.55
28	84.00	1.20	200.00	199.90	20.62	1732.20	0.10	1.97	165.46
29	87.00	1.20	200.00	199.90	20.62	1794.07	0.10	1.97	171.36
30	90.00	1.20	200.00	199.90	20.62	1855.93	0.10	1.97	177.27
31	93.00	1.20	200.00	199.90	20.62	1917.80	0.10	1.97	183.18
32	96.00	1.20	200.00	199.90	20.62	1979.66	0.10	1.97	189.09
33	99.00	1.20	200.00	199.90	20.62	2041.53	0.10	1.97	195.00
Cumul	1683.00	39.60	7230.00	7226.80	745.51	37271.53	3.20	181.37	8172.70
Average	102.00	2.40	438.18	437.99	22.59	1129.44	0.10	5.50	247.66

Distribution Graphs





Water Cannon Pictures

Tractor and Reel

Pump and Motor

Cannon during irrigation

Appendix E

Flow Meter Calibration Facility

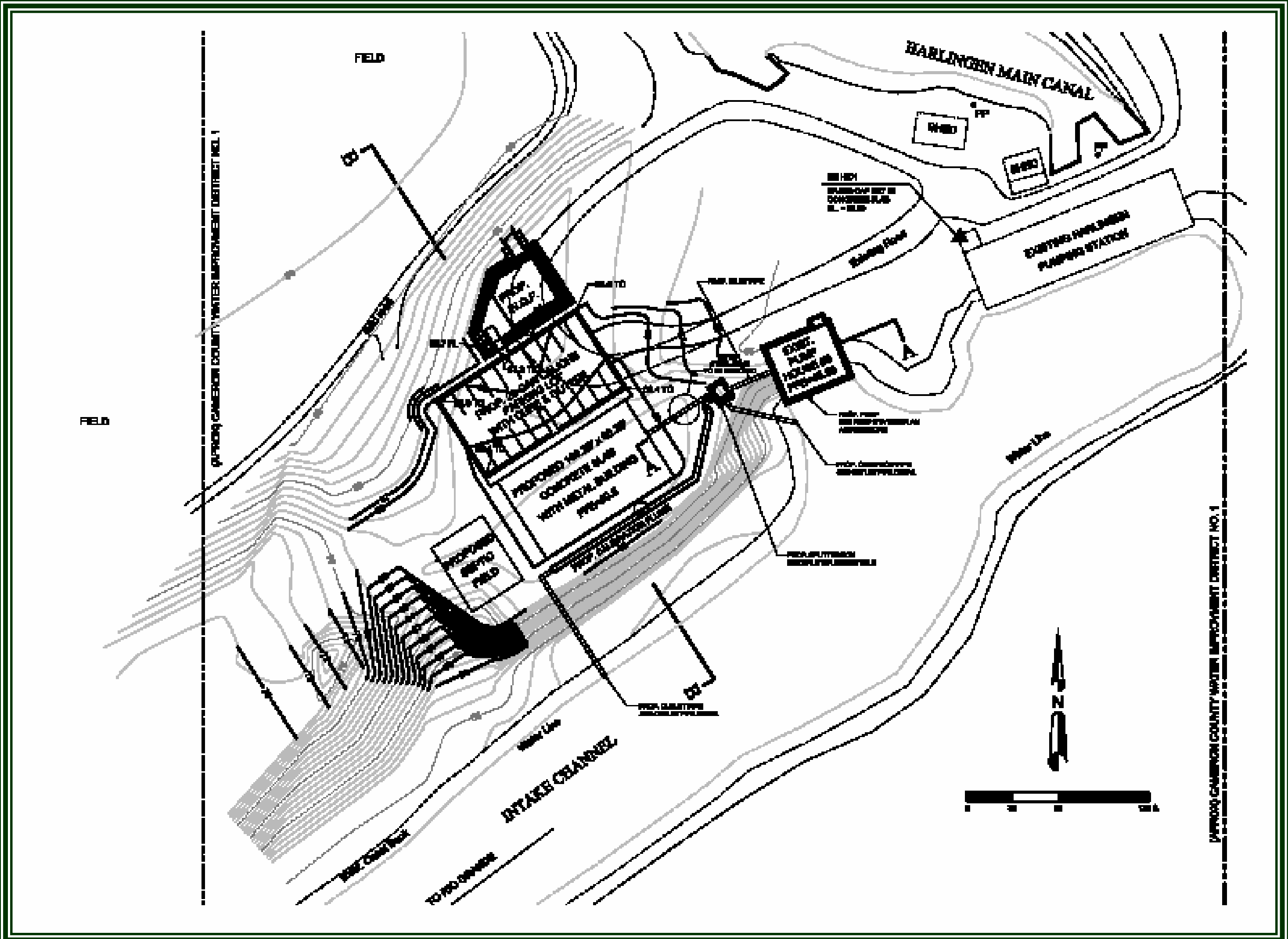


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Table of Pictures

1. Flow meter Calibration Pump Installation

The flow meter calibration facility pump installation began with the purchase of a 12,000 gallon per minute self priming pump. The pump is driven by a 190 hp diesel engine. The pump and engine are mounted on a steel skid and installed as one unit. The pump was purchased through an open bidding process from Odessa Pump Company.

FMC Pump Delivered by Odessa Pump Company

The Harlingen Irrigaiton District hired Power Pro Company to bore the intake and discharge holes into the wall of our existing Number 6 pump house. This process took over a week due to the thickness of the walls.

Power Pro boring intake holes in wall.

Once the boring was completed the District installed the pump, manufactured the intake and discharge pipes and installed them into the pump house.

FMC Pump being lowered into the Number 6 pump house.

Pump Intake

Pump
Discharge

2. Meter Calibration Building Construction

The District advertised bids for construction of the Facility building and office. After receiving only one bid for approximately 75% greater than the estimated cost the District received permission to act as the prime contractor, subcontracting the concrete, building and office work. The District filed a cost estimate, with supporting documentation for machinery, labor and supervisory cost, with the Texas Water Development Board and received permission to proceed with the building purchase and contract negotiation.

Two contracts have been issued. One for the concrete labor to Jose Farias in the amount of $24,995 and one for the plumbing and electrical work to Parrish Electrical and Plumbing in the amount of $15,825 for the electrical and $6,975 for the plumbing. These contracts have been forwarded to TWDB for review and approval and included in this report as attachments A and B. The pre-built metal building has been purchased from Mueller buildings and is expected to be delivered in mid March 2006.

The site has been surveyed, the building location identified and all local building permits have been issued. The District has begun land and sub foundation preparation. The water quality pond has been completed as well as the installation of the silt fence.

Building site, excavation and backfill.

Completed backfill and compaction

Silt fence installation

3. Attachment A

Harlingen Irrigation District Cameron County No. 1
301 E. Pierce
Harlingen Texas 78550

Service Contract for Electrical and Plumbing Work

The Harlingen Irrigation District Cameron County No. 1 (hereinafter "District") and Larry Parish Electric and Plumbing (hereinafter "Contractor") agree to all terms and conditions of this Contract which includes the following documents:

1. Contract for Construction Services and/or Materials (this document)
2. Appendices A and B of this Contract
3. Exhibit "A" – Site Layout Drawings
4. Exhibit "B" – Office Specifications
5. Exhibit "C" – Electrical and Plumbing Specifications

Service Item(s)

The Purchase service consist of the following:

All labor, machinery , tools and materials necessary to complete the electrical and plumbing construction specified in Exhibit "A" and Exhibit "B".

Purchase Price

The price for all goods and services provided by the Contract under this Contract, including delivery and all other costs, shall not exceed $15,825 for all electrical work and $6,975 for all plumbing work.

Delivery/Completion Date

The contractor shall complete the work no later than May 31, 2006. The contractor shall notify the Project Manager of the expected commencement date 14 days prior beginning any work at the building site.

Termination for Convenience of The District

The District reserves the right to terminate the Contract, or any part of it, for the District's sole convenience. In the event of such termination, the Contractor shall immediately stop all work hereunder, and shall immediately cause any and all suppliers and subcontractors to do the same. The Contractor shall be paid a reasonable termination charge consisting of a percentage of the Contract price reflecting the percentage of the work performed prior to the notice of termination, plus actual direct costs resulting from termination. The Contractor shall not be paid for any work done after receipt of the notice of termination, nor for any costs incurred by the Contractor's suppliers or subcontractors which the Contractor could reasonably have avoided. The Contractor shall not unreasonably anticipate the requirements of this Contract.

Termination for Cause

The District may also terminate the Contract, or any part of it, for cause in the event of any default by the Contractor, or if the Contractor fails to comply with any of the terms and conditions of this Contract. Late deliveries, deliveries of products which are defective or which do not conform to the Contract, and failure to provide the District, upon request, with adequate assurances of future performance shall all be non-exclusive causes allowing the District to terminate the Contract for cause. In the event of termination for cause, the District shall not be liable to the Contractor for any amount (except for products and/or services already received and accepted by the District as satisfactory), and the Contractor shall be liable to the District for any and all damages sustained by reason of the default which gave rise to the termination. If it should be determined that the District has improperly terminated the Contract for default, such termination shall be deemed a termination for convenience.

Warranty

The Contractor expressly warrants that all services, equipment, parts, or materials furnished under the Contract (hereinafter referred to as "goods") shall conform to all terms, conditions, specifications, and standards contained in the Contract, are new and have never been previously used, and are free from defect in material or workmanship for a minimum of 1 year from the time of delivery or completion of the service. The Contractor warrants that all such goods will conform to any statements or representations made to the District, or appearing on the containers or labels or advertisements for such goods and that any goods will be adequately contained, packaged, marked and labeled. The Contractor warrants that all goods furnished hereunder will be merchantable, and will be safe and appropriate for the purpose for which goods of that kind are normally used. If the Contractor knows or has reason to know the particular purpose for which the District intends to use the goods, the Contractor warrants that such goods will be fit for such particular purpose. The Contractor warrants that goods furnished will conform in all respect to samples. Inspection, test, acceptance or use of the goods furnished hereunder shall not affect the Contractor's obligation under this warranty, and such warranties shall survive inspection, test, acceptance and use. The Contractor's warranty shall run to The District, its successors, and assigns.

The Contractor agrees to replace or correct defects of any goods not conforming to the foregoing warranty promptly, without expense to the District, when notified to such nonconformity by the District, provided the District elects to provide the Contractor with the opportunity to do so. If the Contractor fails to correct defects in or replace nonconforming goods promptly, the District, after reasonable notice to the Contractor, may make such corrections or replace such goods and charge The Contractor for the cost incurred by the District in doing so. The Contractor recognizes that the District's production requirements may require immediate repairs or reworking of defective goods, without notice to the Contractor. In such event, the Contractor shall reimburse the District for the costs, delays, or other damages which the District has incurred.

Price of Goods or Service

The Contractor warrants that the prices for the goods or service sold to the District hereunder are not less favorable than those currently extended to any other customer for the same or similar goods or services in similar quantities. If the Contractor reduces its price for such goods or services during the term of the Contract, the Contractor agrees to reduce the prices hereof correspondingly. The Contractor warrants that prices and services shown in this Contract shall be complete, and no additional charges of any type shall be added without the District's written consent. Such additional charges include, but are not limited to, shipping, packaging, labeling, custom duties, taxes, storage, insurance, boxing, and crating.

Force Majeure

The District may delay delivery or acceptance occasioned by causes beyond its control. The Contractor shall hold such goods at the direction of the District and shall deliver them when the cause affecting the delay has been removed. The District shall be responsible only for the Contractor's direct additional costs in holding the goods or delaying the performance of this Contract at The District's request. The Contractor shall also be excused if delivery is delayed by the occurrence of unforeseen and unforeseeable events, provided the Contractor notifies the District of such events as soon as they occur, and gives the District its best estimate of revised delivery dates.

Cancellation of Contract by The District

If any delay exceeds 7 days from the original delivery date, the District may cancel the Contract without any liability. If the Contractor's production is only partially restricted or delayed, the Contractor shall use its best efforts to accommodate the District's requirements, including giving the Contract preference and priority over those of other customers which were placed after the Contract.

Patents, Copyrights, and Trade Secrets

The Contractor agrees upon receipt of notification to promptly assume full responsibility for defense of any claim, demand, suit, or proceeding which may be brought against the District or its directors, officers, agents, consultants, or employees for alleged infringement of any patent, copyright, trade secret, or any other intellectual property right, as well as for any alleged unfair competition resulting from similarity in design, trademark or appearance of goods or services furnished hereunder, and the Contractor further agrees to indemnify the District, its directors, officers, agents, consultants, and employees against any and all expenses, losses, royalties, profits and damages including court costs and attorney's fees resulting from any such suit or proceeding, including any settlement. The District may be represented by and actively participate through its own counsel in any such suit or proceeding if it so desires, and the costs of such representation shall be paid by the Contractor. If any good, service, or intellectual property furnished or used under this Contract is adjudged infringing and its use enjoined, the Contractor shall, at its own expense, secure for the District the right to continue using it, or replace it with a noninfringing equivalent, or modify it so it becomes noninfringing.

Indemnification

The Contractor agrees to indemnify and hold harmless the District, its directors, officers, agents, consultants, engineers, and employees against all suits at law or in equity and from all damages, claims and demands arising out of the death or injury of any person or damage to any property alleged to have resulted from the goods ordered through the Contract, and/or resulting from any act or omission of the Contractor, its agents, servants, employees and/or subcontractors, and upon the tendering of any suit or claim to the Contractor, to defend the same at the Contractor's expense as to all costs, fees and damages. The foregoing indemnification will apply to the extent that the death, injury, or property damage is caused by the sole or concurrent negligence of the Contractor and whether the Contractor or the District defends such suit or claims. To the extent that the Contractor's agents, servants, employees or subcontractors enter upon premises occupied by or under the control of the District, in the course of the performance of the Contract, the Contractor shall take all necessary precautions to prevent the occurrence of any injury (including death) to any persons, or of any damage to any property, arising out of acts or omissions of such agents, servants, employees, or subcontractors, and except to the extent that any such damage is due to the District's comparative and direct negligence, and the Contractor shall indemnify, defend and hold the District, its directors, officers, employees, consultants, engineers, and agents harmless from any and all costs, losses, expenses, damages, claims, suits, or any liability whatsoever, including attorney's fees arising out of any act or omission of the Contractor, its agents, servants, employees or subcontractors.

Insurance

The Contractor shall maintain and require its subcontractors to maintain (1) public liability and property damage insurance including contractual liability (both general and vehicle) in amounts sufficient to cover obligations set forth above, and (2) workers' compensation and employer's liability insurance covering all employees engaged in the performance of the Contract for claims arising under applicable workers' compensation and occupation disease acts. The Contractor shall furnish certificates to the District evidencing such insurance which expressly provide that no expiration, termination or modification will take place without prior written notice to the District.

Waste Transportation and Disposal.

Goods, materials, and chemicals supplied hereunder shall be accompanied by a Material Safety Data Sheet (MSDS) if required by applicable federal, state or local law, regulation, rule or ordinance.

Changes

The District shall have the right at any time to make changes in drawings, designs, specifications, materials, packaging, time and place of delivery and method of transportation. If any such changes cause an increase or decrease in the cost, or the time required for the performance, the Contractor shall send, prior to delivery, a written claim for any adjustment in price due to the change. If a claim for adjustment is not received prior to delivery the Contractor waives any such claim..

Inspection and Testing of Goods

Payment for the goods delivered hereunder shall not constitute acceptance thereof. The District shall have the right to inspect the goods and to reject any or all goods that are in the District's judgment defective or nonconforming. Goods rejected and goods supplied in excess of quantities called for may be returned to the Contractor at the Contractor's expense and in addition to the District's other rights. The District may charge the Contractor all expenses of unpacking, examining, repacking and reshipping such goods. In the event the District receives goods whose defects or nonconformity is not apparent on examination, the District reserves the right to request replacement, as well as payment of damages. Nothing contained in the Contract shall in any way relieve the Contractor from the obligation of testing, inspection and quality control.

Inspection of Services

The District, its agents, employees, engineers, consultants, inspector, or any representative of the agency funding the project shall at all time have the right to observe or inspect the services being performed by the Contractor at the project site or elsewhere.

Shipment

If, in order to comply with the District's required delivery date, it becomes necessary for the Contractor to ship by a more expensive way than specified in the Contract, any increased transportation costs resulting there from shall be paid for by the Contractor unless the necessity for such rerouting or expedited handling has been caused by the District. The Contractor shall bear all risk of loss of all merchandise covered by the Contract until such merchandise has been delivered to the designated location.

Delivery

Time is of the essence of this Contract, and if delivery of items or rendering of services is not completed by the time promised, the District reserves the right without liability in addition to its other rights and remedies to terminate this Contract by notice effective when received by the Contractor as to items not yet shipped.

Limitation on The District's Liability -- Statute of Limitations

In no event shall the District be liable for any anticipated profits of the Contractor or for incidental or consequential damages to the Contractor. The District's liability on any claim of any kind for any loss or damage arising out of or in connection with or resulting from the Contract or from the performance or breach thereof shall in no case exceed the price allocable to the goods or unit thereof which gives rise to the claim. The District shall not be liable for penalties of any description. Any action resulting from any breach on the part of the District as to the goods delivered hereunder must be commenced by the Contractor within one year after the date of scheduled delivery.

Waiver

The District's failure to insist on performance of any of the terms or conditions of the Contract or to exercise any right or privilege or the District's waiver of any breach hereunder shall not thereafter waive any other terms, conditions, or privileges, whether of the same or similar type.

Sales Tax

Pursuant to Section 151.309 of the Texas Tax Code, the District is exempt from Texas sales and use tax.

Setoff

The District may deduct or setoff any claims for payment against any amounts due the Contractor by the District arising out of this or any other transaction with the Contractor.

Assignments and Subcontracting

No part of the Contract may be assigned or subcontracted by the Contractor without the prior written approval of the District.

Entire Contract

The Contract constitutes the entire Contract between the Contractor and the District. Any provision contained in any form or document that are not part of this document are rejected.

Payment for Goods or Services Delivered

This is a lump sum contract. No partial payments are allowed. All goods or services meeting the requirements of the Contract and accepted by the District shall be invoiced by the Contractor to the District no later than the last day of month in which such goods were delivered to the District or such services were performed by the Contractor. The District shall mail payment to the Contractor for all goods meeting the requirements of the Contract and accepted by the District by the 10th day of the next month. Any invoices received after the last day of the month and before the 10th day of the next month shall be held for payment until the 10th day of the month after the next month.

Appendix A and B

The Contractor shall properly complete and execute Appendix A and B, attached to this Contract and made a part herein.

Specifications

The following exhibits are attached and made a part of this Contract:

Exhibit "A" Harlingen Irrigation District Flow Meter Calibration Facility Site Layout drawings

Exhibit "B" Harlingen Irrigation District's Flow Meter Calibration Facility Office Specifications pages A1-A7

Exhibit "C" Specifications for the construction of Harlingen Irrigation District's Flow Meter Calibration Facility SECTION 16050 BASIC

ELECTRICAL MATERIALS AND METHODS, SECTION 16140 WIRING, SECTION 16450 GROUNDING,

PLUMPING SPECIFICATIONS are as described in Exhibit "B".

Shop Drawings

Installation Shop Drawings: Prior to installation of the equipment, the Contractor shall furnish 2 copies of shop drawings for electrical work and 2 copies of shop drawings for plumbing work. The contract shall not begin any construction work until the Contract has received approval, in writing, by the District of the proposed work by the Contract as shown on the Shop Drawings. The District shall review and comment on the shop drawings within 7 days after the Contract has submitted such drawings to the District. The Contractor may hand prepare the shop drawing using the Site Layout Drawings contained in Exhibit "A" of this Contract

The Electrical Shop Drawings shall show the location, type, size, and other information regarding all electric wiring, circuits, receptacles, breakers, switches, lighting fixture, and any other electrical device or item. The Contractor shall mark any changes or revision made during the installation on these installation Drawings and they shall be reflected on the final Drawings. These Drawings shall include the following as applicable:

a. Outlines and layout Drawings of equipment Layouts shall show front view and sections, complete with equipment locations, nameplate locations, and legends. Conduit hubs, knockouts, and openings shall be identified and located. Grounding connections shall be located.

b. Schematic diagrams Separate elementary (schematic) diagrams for each section of control equipment. Components shall be identified by reference to the bills of materials.

c. Wiring diagrams Separate connection wiring diagrams for each section which shall:

(1) Identify the panel, side sheet, or door.

(2) Show stud or terminal numbering.

(3) Identify each piece of equipment.

(4) Show wire designations taken from schematics.

(5) Indicate connections to external circuits.

(6) Show connections, cables, and cable designations to external circuits.

d. Interconnection diagrams showing all external control and power connections, including connections to equipment furnished elsewhere in these specifications such as motors, valves, or gates. The interconnection diagram shall include terminal block identification as shown on the equipment or on the applicable manufacturer's Drawings.

Plumbing Shop Drawings:

Final Shop Drawings: The Drawings shall show all changes and revision dates made up to the time the Drawings and data are furnished. The Drawings and data shall show the "as built" equipment and installation.

This Contract entered into and executed as of __February 9th ,2006__

4. Attachment B

The District Cameron County No. 1
301 E. Pierce
Harlingen Texas 78550
Contract for Construction Services

The Harlingen Irrigation District Cameron County No. 1 (hereinafter “District”) and Jose M. Farias (hereinafter “Contractor”) agree to all terms and conditions of this Contract which includes the following documents:

1. Contract for Construction Services and/or Materials (this document)
2. Appendices A and B of this Contract
3. Exhibit “A” – Site Layout Drawings
4. Exhibit “B” – Specifications for the FMC Metal Building and Office

Service Item

The purchased service consists of the following:

All labor, machinery, tools and concrete forms necessary to trench, install reinforcing bar, pour and finish a concrete foundation as specified in Exhibit “A”, The District’s Flow Meter Calibration Facility site layout plans and Exhibit “B” Specifications for the construction of The Districts Flow Meter Calibration Facility Section 03300 CAST IN PLACE CONCRETE , Section 03210 REINFORCING STEEL and Section 03250 CONCRETE ACCESSORIES.

Purchase Price

The price for all goods and services provided by the Contract under this Contract, including delivery and all other costs, shall not exceed $24,995.00 for all labor, machinery, tools and concrete forms necessary to complete foundation/slab.

Delivery/Completion Date

The contractor shall complete the work no later than 15 April, 2006. The contractor shall notify the Project Manager of the expected commencement date 14 days prior beginning any work at the building site.

Termination for Convenience of The District

The District reserves the right to terminate the Contract, or any part of it, for the District's sole convenience. In the event of such termination, the Contractor shall immediately stop all work hereunder, and shall immediately cause any and all suppliers and subcontractors to do the same. The Contractor shall be paid a reasonable termination charge consisting of a percentage of the Contract price reflecting the percentage of the work performed prior to the notice of termination, plus actual direct costs resulting from termination. The Contractor shall not be paid for any work done after receipt of the notice of termination, nor for any costs incurred by the Contractor's suppliers or subcontractors which the Contractor could reasonably have avoided. The Contractor shall not unreasonably anticipate the requirements of this Contract.

Termination for Cause

The District may also terminate the Contract, or any part of it, for cause in the event of any default by the Contractor, or if the Contractor fails to comply with any of the terms and conditions of this Contract. Late deliveries, deliveries of products which are defective or which do not conform to the Contract, and failure to provide the District, upon request, with adequate assurances of future performance shall all be non-exclusive causes allowing the District to terminate the Contract for cause. In the event of termination for cause, the District shall not be liable to the Contractor for any amount (except for products and/or services already received and accepted by the District as satisfactory), and the Contractor shall be liable to the District for any and all damages sustained by reason of the default which gave rise to the termination. If it should be determined that the District has improperly terminated the Contract for default, such termination shall be deemed a termination for convenience.

Warranty

The Contractor expressly warrants that all services, equipment, parts, or materials furnished under the Contract (hereinafter referred to as "goods") shall conform to all terms, conditions, specifications, and standards contained in the Contract, are new and have never been previously used, and are free from defect in material or workmanship for a minimum of 1 year from the time of delivery or completion of the service. The Contractor warrants that all such goods will conform to any statements or representations made to the District, or appearing on the containers or labels or advertisements for such goods and that any goods will be adequately contained, packaged, marked and labeled. The Contractor warrants that all goods furnished hereunder will be merchantable, and will be safe and appropriate for the purpose for which goods of that kind are normally used. If the Contractor knows or has reason to know the particular purpose for which the

District intends to use the goods, the Contractor warrants that such goods will be fit for such particular purpose. The Contractor warrants that goods furnished will conform in all respect to samples. Inspection, test, acceptance or use of the goods furnished hereunder shall not affect the Contractor's obligation under this warranty, and such warranties shall survive inspection, test, acceptance and use. The Contractor's warranty shall run to The District, its successors, and assigns. The Contractor agrees to replace or correct defects of any goods not conforming to the foregoing warranty promptly, without expense to the District, when notified to such nonconformity by the District, provided the District elects to provide the Contractor with the opportunity to do so. If the Contractor fails to correct defects in or replace nonconforming goods promptly, the District, after reasonable notice to the Contractor, may make such corrections or replace such goods and charge The Contractor for the cost incurred by the District in doing so. The Contractor recognizes that the District's production requirements may require immediate repairs or reworking of defective goods, without notice to the Contractor. In such event, the Contractor shall reimburse the District for the costs, delays, or other damages which the District has incurred.

Price of Goods or Service

The Contractor warrants that the prices for the goods or service sold to the District hereunder are not less favorable than those currently extended to any other customer for the same or similar goods or services in similar quantities. If the Contractor reduces its price for such goods or services during the term of the Contract, the Contractor agrees to reduce the prices hereof correspondingly. The Contractor warrants that prices and services shown in this Contract shall be complete, and no additional charges of any type shall be added without the District's written consent. Such additional charges include, but are not limited to, shipping, packaging, labeling, custom duties, taxes, storage, insurance, boxing, and crating.

Force Majeure

The District may delay delivery or acceptance occasioned by causes beyond its control. The Contractor shall hold such goods at the direction of the District and shall deliver them when the cause affecting the delay has been removed. The District shall be responsible only for the Contractor's direct additional costs in holding the goods or delaying the performance of this Contract at The District's request. The Contractor shall also be excused if delivery is delayed by the occurrence of unforeseen and unforeseeable events, provided the Contractor notifies the District of such events as soon as they occur, and gives the District its best estimate of revised delivery dates.

Cancellation of Contract by The District

If any delay exceeds 7 days from the original delivery date, the District may cancel the Contract without any liability. If the Contractor's production is only partially restricted or delayed, the Contractor shall use its best efforts to accommodate the District's requirements, including giving the Contract preference and priority over those of other customers which were placed after the Contract.

Patents, Copyrights, and Trade Secrets

The Contractor agrees upon receipt of notification to promptly assume full responsibility for defense of any claim, demand, suit, or proceeding which may be brought against the District or its directors, officers, agents, consultants, or employees for alleged infringement of any patent, copyright, trade secret, or any other intellectual property right, as well as for any alleged unfair competition resulting from similarity in design, trademark or appearance of goods or services furnished hereunder, and the Contractor further agrees to indemnify the District, its directors, officers, agents, consultants, and employees against any and all expenses, losses, royalties, profits and damages including court costs and attorney's fees resulting from any such suit or proceeding, including any settlement. The District may be represented by and actively participate through its own counsel in any such suit or proceeding if it so desires, and the costs of such representation shall be paid by the Contractor. If any good, service, or intellectual property furnished or used under this Contract is adjudged infringing and its use enjoined, the Contractor shall, at its own expense, secure for the District the right to continue using it, or replace it with a noninfringing equivalent, or modify it so it becomes noninfringing.

Indemnification

The Contractor agrees to indemnify and hold harmless the District, its directors, officers, agents, consultants, engineers, and employees against all suits at law or in equity and from all damages, claims and demands arising out of the death or injury of any person or damage to any property alleged to have resulted from the goods ordered through the Contract, and/or resulting from any act or omission of the Contractor, its agents, servants, employees and/or subcontractors, and upon the tendering of any suit or claim to the Contractor, to defend the same at the Contractor's expense as to all costs, fees and damages. The foregoing indemnification will apply to the extent that the death, injury, or property damage is caused by the sole or concurrent negligence of the Contractor and whether the Contractor or the District defends such suit or claims. To the extent that the Contractor's agents, servants, employees or subcontractors enter upon premises occupied by or under the control of the District, in the course of the performance of the Contract, the Contractor shall take all necessary precautions to prevent the occurrence of any injury (including death) to any persons, or of any damage to any property, arising out of acts or omissions of such agents, servants, employees, or subcontractors, and except to the extent that any such damage is due to the District's comparative and direct negligence, and the Contractor shall indemnify, defend and hold the District, its directors, officers, employees, consultants, engineers, and agents harmless from any and all costs, losses, expenses, damages, claims, suits, or any liability whatsoever, including attorney's fees arising out of any act or omission of the Contractor, its agents, servants, employees or subcontractors.

Insurance

The Contractor shall maintain and require its subcontractors to maintain (1) public liability and property damage insurance including contractual liability (both general and vehicle) in amounts sufficient to cover obligations set forth above, and (2) workers' compensation and employer's liability insurance covering all employees engaged in the performance of the Contract for claims arising under applicable workers' compensation and occupation disease acts. The Contractor shall furnish certificates to the District evidencing such insurance which expressly provide that no expiration, termination or modification will take place without prior written notice to the District.

Waste Transportation and Disposal.

Goods, materials, and chemicals supplied hereunder shall be accompanied by a Material Safety Data Sheet (MSDS) if required by applicable federal, state or local law, regulation, rule or ordinance.

Changes

The District shall have the right at any time to make changes in drawings, designs, specifications, materials, packaging, time and place of delivery and method of transportation. If any such changes cause an increase or decrease in the cost, or the time required for the performance, the Contractor shall send, prior to delivery, a written claim for any adjustment in price due to the change. If a claim for adjustment is not received prior to delivery the Contractor waives any such claim..

Inspection and Testing of Goods

Payment for the goods delivered hereunder shall not constitute acceptance thereof. The District shall have the right to inspect the goods and to reject any or all goods that are in the District's judgment defective or nonconforming. Goods rejected and goods supplied in excess of quantities called for may be returned to the Contractor at the Contractor's expense and in addition to the District's other rights. The District may charge the Contractor all expenses of unpacking, examining, repacking and reshipping such goods. In the event the District receives goods whose defects or nonconformity is not apparent on examination, the District reserves the right to request replacement, as well as payment of damages. Nothing contained in the Contract shall in any way relieve the Contractor from the obligation of testing, inspection and quality control.

Inspection of Services

The District, its agents, employees, engineers, consultants, inspector, or any representative of the agency funding the project shall at all time have the right to observe or inspect the services being performed by the Contractor at the project site or elsewhere.

Shipment

If, in order to comply with the District's required delivery date, it becomes necessary for the Contractor to ship by a more expensive way than specified in the Contract, any increased transportation costs resulting there from shall be paid for by the Contractor unless the necessity for such rerouting or expedited handling has been caused by the District. The Contractor shall bear all risk of loss of all merchandise covered by the Contract until such merchandise has been delivered to the designated location.

Delivery

Time is of the essence of this Contract, and if delivery of items or rendering of services is not completed by the time promised, the District reserves the right without liability in addition to its other rights and remedies to terminate this Contract by notice effective when received by the Contractor as to items not yet shipped.

Limitation on The District's Liability -- Statute of Limitations

In no event shall the District be liable for any anticipated profits of the Contractor or for incidental or consequential damages to the Contractor. The District's liability on any claim of any kind for any loss or damage arising out of or in connection with or resulting from the Contract or from the performance or breach thereof shall in no case exceed the price allocable to the goods or unit thereof which gives rise to the claim. The District shall not be liable for penalties of any description. Any action resulting from any breach on the part of the District as to the goods delivered hereunder must be commenced by the Contractor within one year after the date of scheduled delivery.

Waiver

The District's failure to insist on performance of any of the terms or conditions of the Contract or to exercise any right or privilege or the District's waiver of any breach hereunder shall not thereafter waive any other terms, conditions, or privileges, whether of the same or similar type.

Sales Tax

Pursuant to Section 151.309 of the Texas Tax Code, the District is exempt from Texas sales and use tax.

Setoff

The District may deduct or setoff any claims for payment against any amounts due the Contractor by the District arising out of this or any other transaction with the Contractor.

Assignments and Subcontracting

No part of the Contract may be assigned or subcontracted by the Contractor without the prior written approval of the District.

Entire Contract

The Contract constitutes the entire Contract between the Contractor and the District. Any provision contained in any form or document that are not part of this document are rejected.

Payment for Goods or Services Delivered

This is a lump sum contract. No partial payments are allowed. All goods or services meeting the requirements of the Contract and accepted by the District shall be invoiced by the Contractor to the District no later than the last day of month in which such goods were delivered to the District or such services were performed by the Contractor. The District shall mail payment to the Contractor for all goods meeting the requirements of the Contract and accepted by the District by the 10th day of the next month. Any invoices received after the last day of the month and before the 10th day of the next month shall be held for payment until the 10th day of the month after the next month.

Appendix A and B

The Contractor shall properly complete and execute Appendix A and B, attached to this Contract and made a part herein.

Specifications

See attached:

Exhibit "A" The District Flow Meter Calibration Facility site layout plans
Exhibit "B" Specifications for the construction of The District Flow Meter Calibration Facility Section 03300 CAST IN PLACE CONCRETE, Section 03210 REINFORCING STEEL and Section 03250 CONCRETE ACCESSORIES

This Contract entered into and executed as of ____February 14th, 2006

Annual Progress Report for 2005

for Work Under

Maximization of On-Farm Surface
Water Use Efficiency by Integration of On-Farm
Application and District Delivery Systems

Texas Water Development Board
Agricultural Water Conservation
Demonstration Initiative Grant

Submitted to:

Harlingen Irrigation District
Cameron County No. 1
Harlingen, Texas

February 15, 2006

AXIOM-BLAIR ENGINEERING

P.O. Box 150069
Austin, Texas 78715
www.axiomblair.com

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APPENDICES

1. Introduction and Overview

This report contains the annual progress report for the Agricultural Demonstration Initiative Project as indicated in the Scope of Work contained in the contract between Harlingen Irrigation District – Cameron County No. 1 (HIDCC1 or the District) and Axiom-Blair Engineering, L.P. (ABE). A description of the overall progress, description of any problems encountered that have any effect on the study, delay of the timely completion of work or change in the deliverables or objectives of the contract are discussed, as well as any corrective actions necessary.

During the year 2005, ABE was tasked to provide the following general support to the project:

- Subcontracting Contract Execution – assist in the preparation and execution of subcontracts;
- District and On-Farm Flow Meter and Demonstration Facilities – civil engineering services required to design and plan for the construction of a demonstration facility;
- Demonstration of Internet Based Information and Real-Time Flow, Weather and Water User Information (RTIS) – assist in the development of the RTIS system and those services necessary to display the information and coordinate the District's water user system; and
- On-Farm Demonstration of Surge and Center Pivot Irrigation Systems – provide requested technical assistance in the design and specifications of surge or center pivot irrigation systems used for the project.

The following sections address the specific Scope of Work between the District and ABE, and the work completed on each task during 2005.

2. Scope of Work

The Task Descriptions and work provided for each Task is discussed below.

2.1 Subcontracting Contract Execution

2.1.1 Task 1 Description

The Subcontractor will assist the District in preparing and executing the subcontracts with Delta Lake Irrigation District, Texas A&M University Kingsville, Texas Cooperative Extension, and others to provide support and services to perform the work task.

2.1.2 Work Completed

The subcontracts for Delta Lake Irrigation District, Texas A & M University Kingsville, Texas Cooperative Extension, and others were completed. Contract modification work requested by TWDB has been completed.

2.2 District and On-Farm Flow Meter and Demonstration Facilities

2.2.1 Task 2 Description

The Subcontractor will provide civil engineering services for the design of the facilities, including but not limited to preparing site plan drawings, pump and piping system layout, open channel flow measurement system, pump and remote control specifications, construction bid and contracting documents, and preparation of environmental summary reports for submittal by the District to Texas Historical Commission, Texas Parks and Wildlife Department, and the US Army Corps of Engineers.

2.2.2 Work Completed

A Flow Meter Calibration and Demonstration Facility has been approved for construction by the Texas Water Development Board. The necessary approvals for construction have been obtained and are attached to this report as Appendix A.

The District is constructing the facility and clearing and leveling for the site has been completed. Some of the facility equipment (pump/engine) has been purchased, and construction on the site grading and concrete placement has begun at the time this report was prepared.

The site plan for the construction area proposed to house the facility was prepared and submitted for District approval. The site plan drawings are attached to this report, as Appendix B and the Bid Documents are included in Appendix C.

An Environmental Summary was prepared and forwarded to the Corps of Engineers, U.S. Fish and Wildlife, Texas Historical Commission, International Boundary and Water

Commission and Texas Parks and Wildlife, Habitat Assessment and Threatened and Endangered Species divisions for agency review and approval. A copy of the Environmental Summary, including the agency approvals, is attached as Appendix D.

Upon approval of the Environmental Summary, the construction drawings for the pump system, delivery pipeline, return flow pipeline, metal building, slab and office were completed and submitted to Texas Water Development Board for review and sent out for bid. A copy of these drawings is attached as Appendix E. The bid process produced only one bid approximately 75% greater than the original cost estimate. Due to the excess cost, HIDCC1 will become the prime contractor for the project, subcontracting the concrete, building and office construction work.

The remaining design work for the Calibration Facility includes flow meter pipe manifolds and the open channel calibration and demonstration canal.

2.3 Demonstration of Internet Based Information and Real-Time Flow, Weather and Water User Information (RTIS)

2.3.1 Task 3 Description

The Subcontractor shall assist the District in developing the real-time flow, weather, and water user information system (RTIS), including computer programming services such as those necessary to develop the software to display specific District information from the District's existing flow measurement telemetry system and existing water use accounting system on the internet. The Subcontractor shall develop the necessary software to collect real-time rainfall data from five locations selected by the district and co-located at existing flow measurement telemetry nodes and display such rainfall data on the District's web site. The Subcontractor will assist the District in preparing a document that defines the features and capabilities of the RTIS, and the Subcontractor shall use this document in developing the RTIS software. The Subcontractor shall make use of the District's water user accounting system and any programming consultant for the system and such programming consultant shall be retained by the Subcontractor for the purposes of providing the necessary software interface between the water user accounting system and the RTIS.

2.3.2 Work Completed

The initial phase consisted of development of a general website for HIDCC. This task was completed on August 15, 2005. The second phase consists of developing the computer programming necessary to display flow measurement data from HIDCC telemetry server in real-time over the Internet. This phase was completed in November of 2005 and the system is operational. Additional meters and rain gauges are being added to the web display system as such devices become operational.

The third phase consists of development of software for secure access to on-farm flow meter records, water use charges, and water billing by interfacing the Internet server with the District's existing accounting system computer. The District water accounting software is being updated by a third-party at the District's expense, and this software update needs to be completed before significant progress can be made in this phase. Initial work on this phase addresses the accounting and water ticket database fields related to user information such as property identification, crops, requested water amounts, times, etc.

The following is an initial release of the information that outlines the features and uses of the Internet accessed real-time flow, weather, and water user information system (RTIS). The following details how to locate and use the RTIS website, and how to select a pumphouse and water deliveries to view as an example of navigating the website. The source code for this part of the RTIS software system is attached as Appendix F.

2.3.2.1 HID Internet Website RTIS Reporting User Guide – Part I

Welcome to the Harlingen Irrigation District Agricultural Water Conservation Demonstration Initiative Internet Based Information project! This documentation outlines the features of the Internet accessed Real-Time flow, weather and water user Information System (RTIS) and how to use it. The web interface to the system is available on the district's website, which is located at http://www.hidcc1.org. After navigating to the district website, access the Agricultural Water Conservation Demonstration Initiative Internet Based Information page by selecting Projects, then Telemetry as shown below in Figure 2.1.

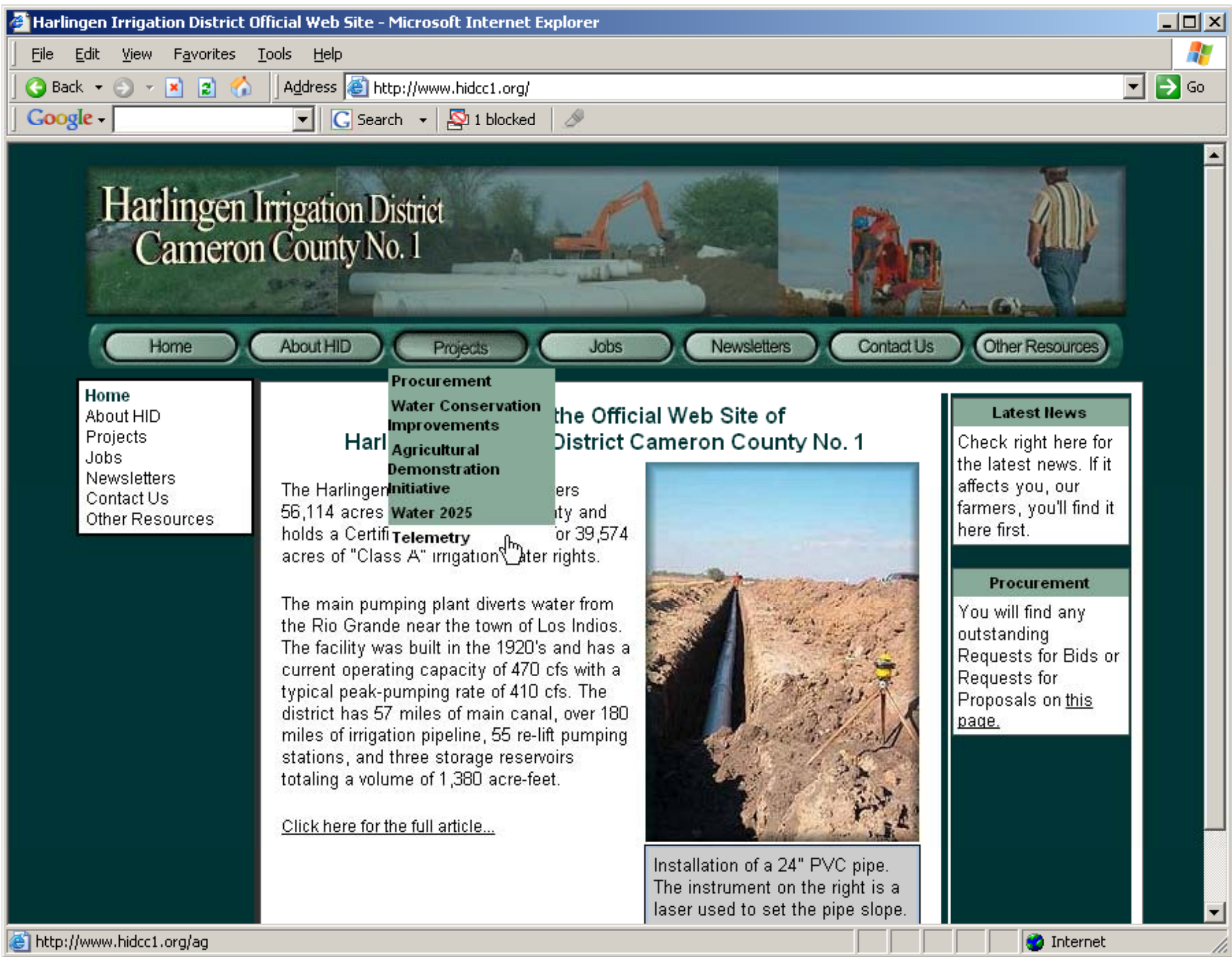

Figure 2.1: Harlingen Irrigation District Web Site Main Screen

On the ADI page, you will see a login box as shown in Figure 2.2, where you will enter your username and password. Be careful to note that your password is case sensitive.

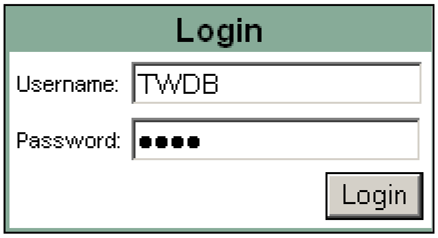

Figure 2.2: Login Screen

After you have logged in to the system, you will see a dropdown box with a list of all of the sites to which you have access. You will start by selecting the site from which you want to view data, for instance Pumphouse 17, as shown in Figure 2.3.

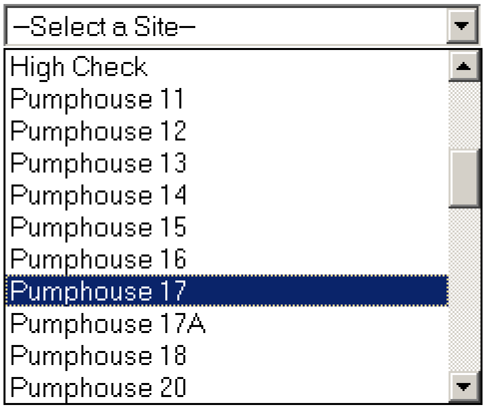

Figure 2.3: Site Selection

Upon selection of the desired site, in our example Pumphouse 17, you will see appear a list of all of the measurements available for that site. (See Figure 2.4)

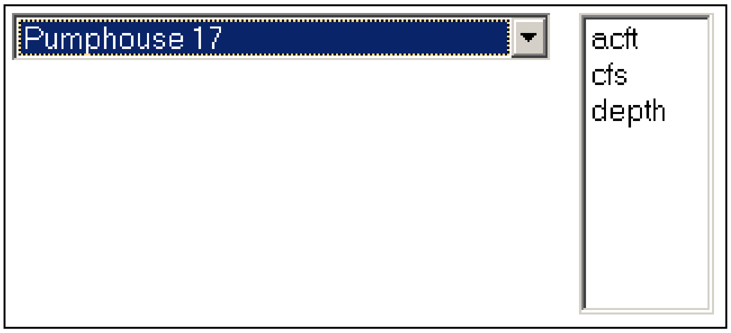

Figure 2.4: Available Data Points

You must now choose which data points you wish to examine, as shown in Figure 2.5. If you want data only for a single measurement, then simply select that item and move to the next step. However, the telemetry web interface provides the functionality to display multiple data points at once. If you want to query for several data points, you may drag-select or control-select the desired items.

To drag-select, place your mouse cursor over the first desired item and press the left mouse button, then drag your mouse down to the last desired item while holding the left mouse button, then release the mouse button. You should see these and any contiguous items highlighted in blue as you drag.

Alternatively to control-select, click and release to select the first item, then while holding the control key, click and release to select any additional items. You should see each item highlighted in blue as you select them.

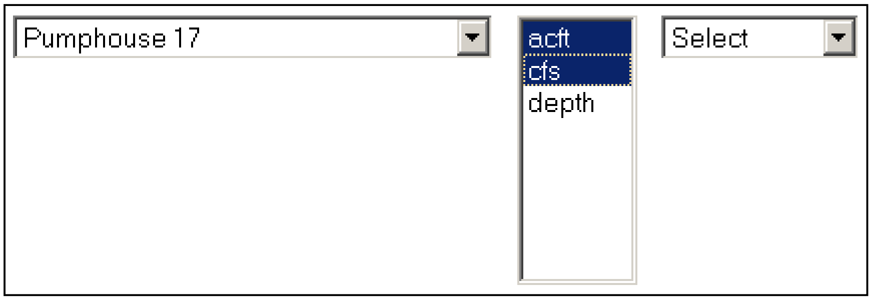

Figure 2.5: Selection of Data Points

Once you have selected the desired items, you should see appear a dropdown box, as in Figure 2.6, containing options to specify the time period for which you wish to retrieve data. The options include By Day, By Month, and Date Range. By Day allows you to retrieve data for one whole day, from 12AM to 12AM. By Month will allow you to generate a report of the selected data points for any given month. Finally, the Date Range option will allow you to receive data for an arbitrary time period.

In our example, we will select the By Month option.

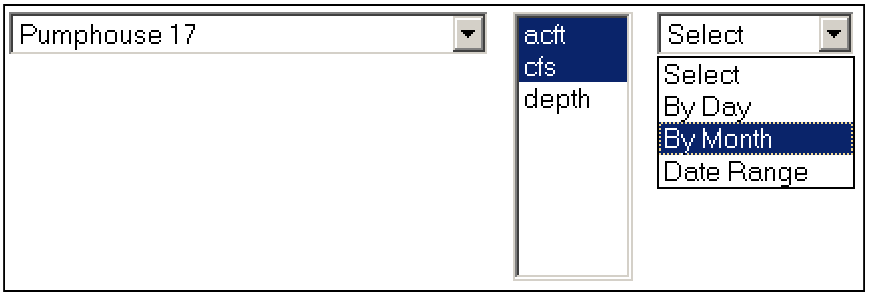

Figure 2.6: Time Period

Upon selection of one of these options you will see appear a combination of input controls that will vary depending on your selection in Figure 2.6. In the next step you will select the date(s) for which you want to retrieve data. Refer to Figure 2.7.

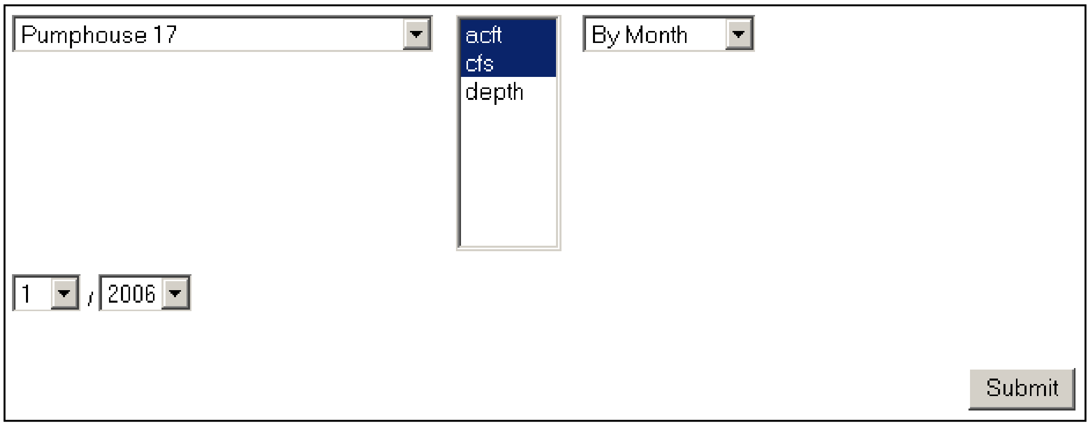

Figure 2.7: Date Selection

In our example, we have selected By Month and will select January of 2006. We are now ready to retrieve our data.

To retrieve the data, click the Submit button, which will now be visible, as shown in Figure 2.8

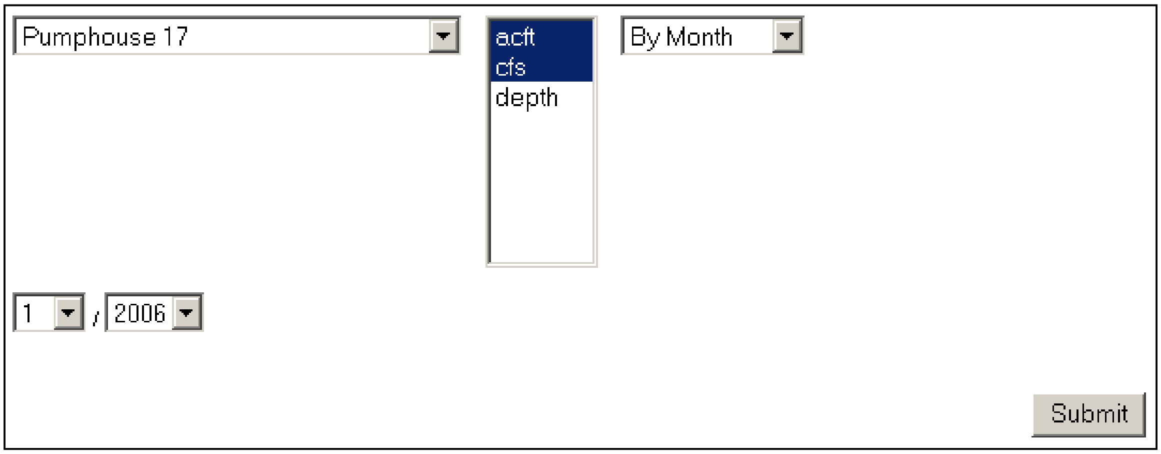

Figure 2.8: Submit

We have now displayed all of the data for our selected data points over the specified time period. Note that having selected a cumulative data point, in this case acft, a total change in this value over the entire time period is calculated for us and is displayed above the graph for this value, as shown in Figure 2.9.

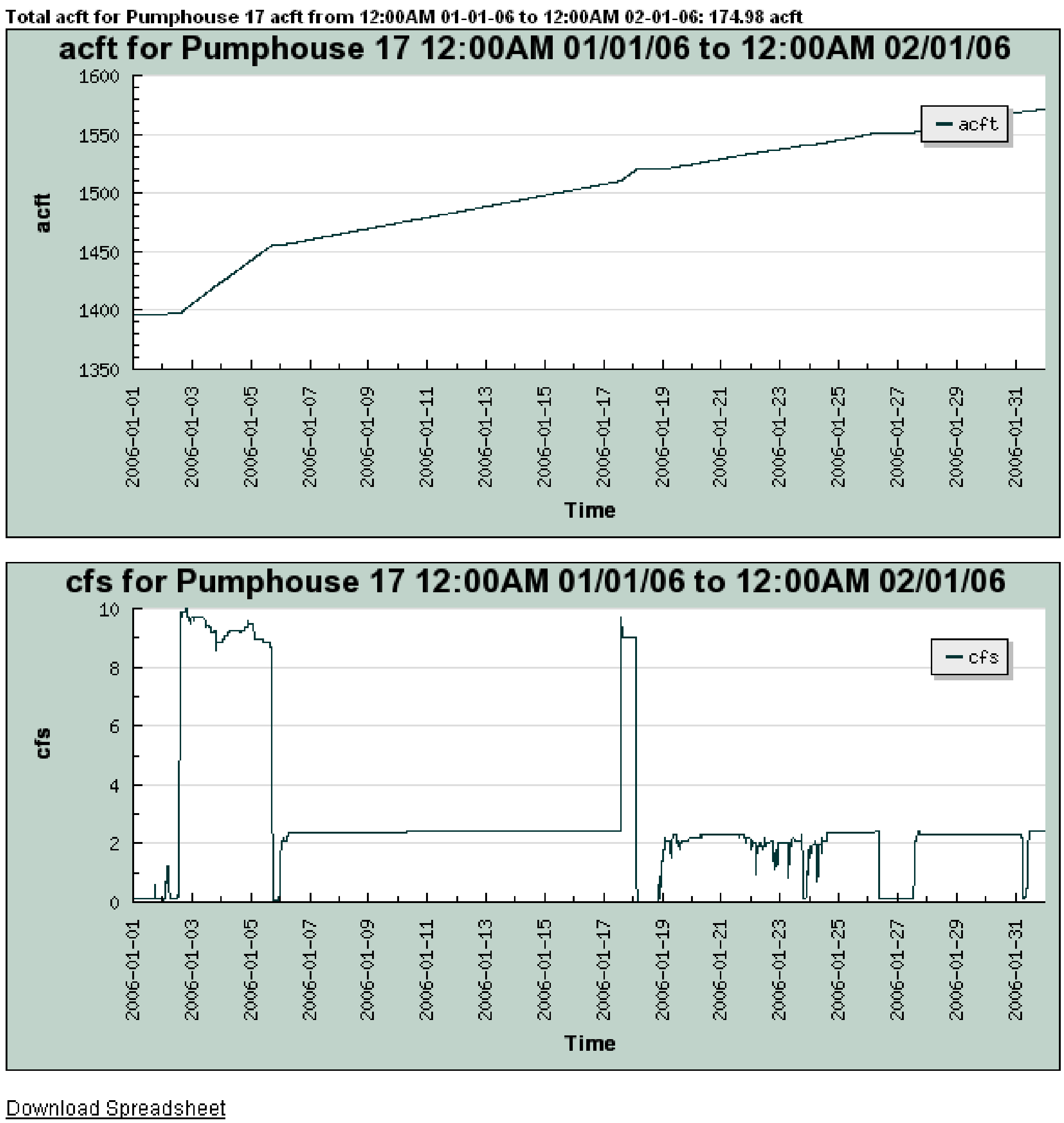

Figure 2.9: Data

Below all of the graphs, you will notice a hyperlink labeled Download Spreadsheet as shown in Figure 2.9. This is a link to a spreadsheet containing all of the data displayed in the graph(s) above. Upon clicking this link, you will likely be prompted regarding what you wish to do with the file. You will need to decide whether you wish to save the file to your computer for later access or open it now for one time inspection, as shown in Figure 2.10. You will likely want to save the file to a familiar location on your computer and then open it with your spreadsheet application. A portion of an example spreadsheet is shown in Figure 2.11.

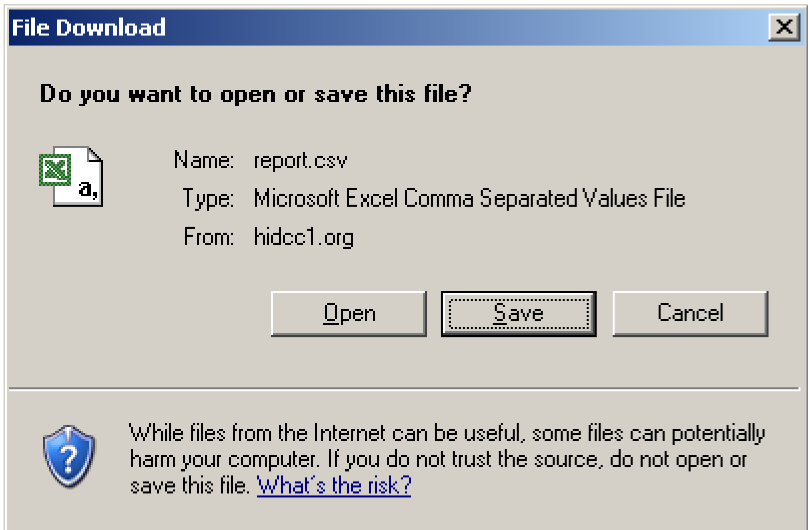

Figure 2.10: File Download

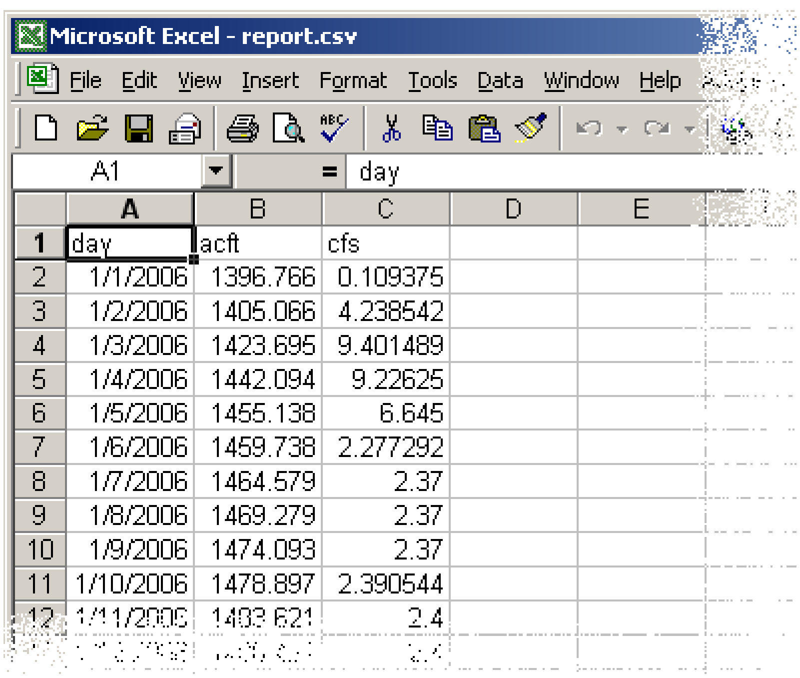

Figure 2.11: Spreadsheet in Excel

2.3.2.2 Additional Features

Along the bottom of the web page, you will notice a link to change your password. After your account is created, you will likely wish to change your password from the randomly generated password you were assigned to something that is easier to remember. Clicking on the Change Password link will allow you to do this. The Change Password dialog appears as shown in Figure 2.12.

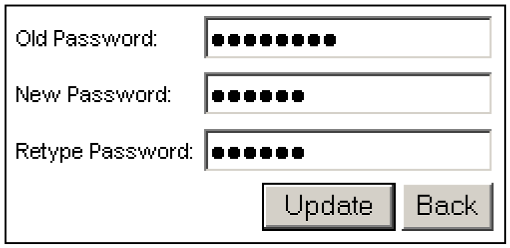

Figure 2.12: Change Password

You must know and type your old password correctly in order to change your password. You will enter your newly chosen password and then retype it for confirmation, as shown above.

2.4 On-Farm Demonstration of Surge and Center Pivot Irrigation Systems

2.4.1 Task 4 Description

The Subcontractor shall provide technical assistance to the District, as requested in writing by the District, in the design and specification of any surge or center pivot irrigation systems used for demonstration projects and assist the District in developing the type of data and methods of data collection need for determining the irrigation efficiency and other water use data of the demonstration project.

2.4.2 Work Completed

No requests for support have been made other than attending technical meetings and advising on the need for detailed specifications for data collection. Some technical assistance will be required during the development of the annual report and analysis of the results from the field demonstrations.

3. Project Task Budget

Table 3.1 indicates the budget and expenditures for each of the four tasks discussed. 58% of the budget has been expended with approximately the same amount of task work being completed.

Table 3.1: Project Task Budget

Task Budget

	Task Budget	Expenses This Period	Previous Expenses	Accumulated Expenses	Balance Remaining	Percent Remaining
Task 1 Sub Contract Excution	$ 8,000.00	$ 1,040.00	$ 8,408.50	$ 9,448.50	$ (1,448.50)	-18%
Task 2 Calibration Facility	$ 66,880.00	$ 16,908.67	$ 39,348.98	$ 56,257.65	$ 10,622.35	16%
Task 3 Internet User Info	$ 131,875.00	$ 12,823.75	$ 13,587.15	$ 26,410.90	$ 105,464.10	80%
Task 4 Surge Support	$ 10,000.00	$ -	$ -	$ -	$ 10,000.00	100%
Total	$ 216,755.00	$ 30,772.42	$ 61,344.63	$ 92,117.05	$ 124,637.95	58%

Expense Budget

	Total Budget	Expenses This Period	Previous Total Expenses	Total Expenses Incurred	Balance Remaining	Percent Remaining
Salary and Wages [1]	$ 191,255.00	$ 27,666.25	$ 60,280.00	$ 87,946.25	$ 103,308.75	54%
Fringe[2] (20% of Salary)		$ -	$ -	$ -	$ -	
Travel	$ 2,500.00	$ 262.50	$ 382.43	$ 644.93	$ 1,855.07	74%
Expendable Supplies	$ 2,500.00	$ 4.88	$ 682.20	$ 687.08	$ 1,812.92	73%
Capital Equipment		$ -	$ -	$ -	$ -	
Subcontracting Services	$ 20,000.00	$ 2,838.79	$ -	$ 2,838.79	$ 17,161.21	86%
Technical/Computer		$ -	$ -	$ -	$ -	0%
Reproduction	$ 500.00	$ -	$ -	$ -	$ 500.00	100%
Overhead		$ -	$ -	$ -	$ -	0%
Profit		$ -	$ -	$ -	$ -	0%
Profit					$ -	0%
Total	$ 216,755.00	$ 30,772.42	$ 61,344.63	$ 92,117.05	$ 124,637.95	58%