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# HARLINGEN IRRIGATION DISTRICT NEWSLETTER

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Visit *TexasIrrigationExpo.org* to view event information, registration, and more.

## Texas Irrigation Expo to be Held in McAllen

**Mark your calendars for December 9 & 10 because the 2011 Texas Irrigation Expo is on its way, and you can be sure it will be bigger and better than before!**

**This year's event will be held at the McAllen Convention Center in McAllen, Texas. Like last year, the 2011 Expo will feature a multitude of presentations and speakers on the topic of agricultural irrigation and water conservation. The Expo serves as a fantastic opportunity to network with leaders in agriculture, while also giving participants a platform for informing the public of new developments and demonstrating water conservation technologies. The Expo is free and open to the public. Pre-registration is requested. Sponsorships and exhibit spaces are also available for the event. Registration information is available at the Expo website, www.texasirrigationexpo.org.**

Texas Irrigation Expo | 2011

**The science contest will be held again this year, with categories for junior high, high school, and college students. Cash prizes will be awarded. More information will be posted on the event website soon.**

**This statewide exposition on agricultural irrigation was first held in October 2010. The first Expo had over 230 attendees, and included presentations by expert speakers, tours of demonstration sites currently using on-farm water conservation tools and techniques, a science contest for students, and exhibitors displaying the latest technology and equipment. The Harlingen Irrigation District coordinated the event as part of the state's *Agricultural Water Conservation Demonstration Initiative*, which is funded through a grant from the Texas Water Development Board.**

**Be sure to visit www.texasirrigationexpo.org for more information and to register for this event.**

# Surface Irrigation Management

Dr. Juan Enciso, Jose Morales, Hugo Perea and Mac Young
Texas AgriLife Extension
Shad Nelson, Texas A&M University-Kingsville, Citrus Center

There have been great advances in the adoption of new technologies to conserve water in the LRGV. According to a survey conducted by Texas AgriLife Extension and the irrigation districts of the LRGV, about 67% of the irrigated land has been laser leveled. Approximately 95% of the irrigated land in the LRGV is surface irrigated; from that percentage, 56% is irrigated with flexible plastic pipe "poly-pipe," 10% with PVC gated pipe, and about 33% is still being irrigated using earth ditches and siphon tubes. The survey results also revealed that 5% of the land is irrigated with pressurized irrigation systems (2% sprinkler irrigation and 3% drip irrigation). This 2008 survey gives guidance to what technologies the farmers prefer or are locked into and which ones we can promote to enhance our water conservation efforts. There has been a significant increase in the adoption of poly-pipe technology due to better control of irrigation. Adapting poly-pipe and water metering at the farm level has reduced water usage by an average of 20%. Additionally, poly-pipe use allows water measurement to be easier, and reduces water percolation losses along with labor costs. However, even with these reductions, it is possible to be more efficient and to increase irrigation uniformities by selecting the correct flow-rate per furrow.

A study was conducted to determine the amount of runoff and water depths applied on six sites during two irrigation events in 2009 and 2010 (Figure 1).

In 2009, four out of the twelve irrigation evaluations, which normally hold approximately 6.4 inches in 3 ft of soil depth, applied a water depth greater than 9 inches. One site (site FE) produced 2.27 inches and 6.43 in/ac of runoff during the first and second irrigation (Figure 2). The irrigation amounts applied and runoff produced in 2009 were excessive.

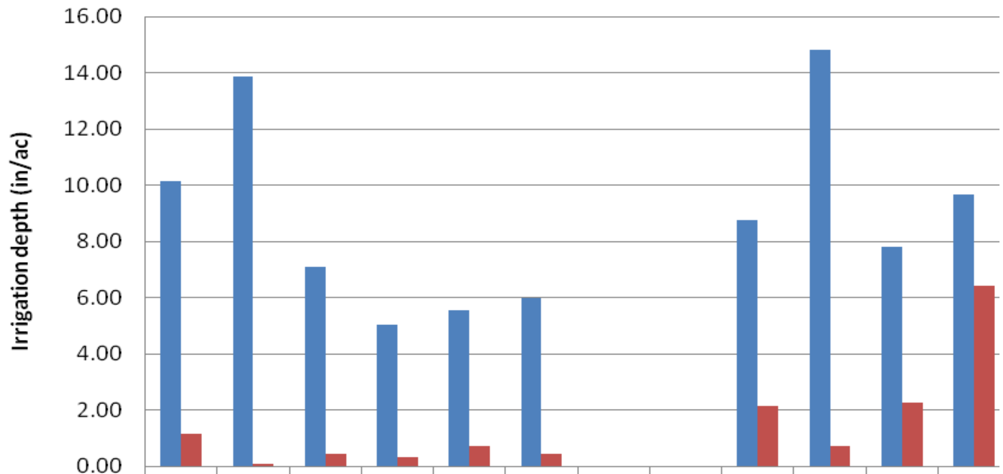
All the irrigation depths applied in 2010 were lower than 9 in/ac and the runoff amounts were lower than 1.6 in/ac (Figure 3). The greatest runoff was 1.59 in/ac for site FD during the second irrigation. Farming reports were given to farmers in 2009 that could have influenced the better results obtained during the 2010 growing season. Reducing runoff has a positive impact on the environment because less nutrient loadings are carried to the natural drainage system. In fact, most of the drainage of the Lower Rio Grande goes to the Arroyo Colorado, which then directly discharges into Laguna Madre. In this study, we also evaluated the effect of different best management practices on nutrients such as nitrates, nitrites, total phosphorus, and total nitrogen on runoff. We found that the amount of runoff increased the nutrient loadings that are discharged from the farm. We believe that if we keep monitoring the application efficiencies of randomly selected surface irrigation systems, we could then determine how well the farmer is irrigating and give them some feedback about the number of rows to irrigate, stream sizes per row, and target irrigation depths to which we could then reduce runoff and deep percolation and have a better impact on water conservation and water quality.

One of the main concerns for water conservation is the event of water shortages due to a seasonal drought. Irrigation districts' laws and regulations limit the amount of runoff for those conditions. Therefore, this study can be used as guidelines for farmers to manage the irrigation systems under the possible drought condition. The next steps of this project will be:

1. To develop irrigation guidelines to manage furrow irrigation considering the soil texture and length of the furrows.

2. To provide recommendations on outlet sizes for poly-pipes to improve irrigation efficiency.

Figure 1. Site FA fertigating during the first irrigation. Irrigation flow-rate was measured at the inlet. Right picture shows the flume to measure runoff volume at the corner of the field.




| | FA-1 | FA-2 | FB-1 | FB-2 | FC-1 | FC-2 | FD-1 | FD-2 | FE-1 | FE-2 | FF-1 | FF-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Irrigation | 10.14 | 13.87 | 7.09 | 5.05 | 5.56 | 6.00 | | | 8.75 | 14.83 | 7.80 | 9.68 |
| Runoff | 1.16 | 0.10 | 0.45 | 0.32 | 0.70 | 0.45 | | | 2.14 | 0.73 | 2.27 | 6.43 |

**Figure 2. Irrigation depth versus surface runoff recorded on the six demonstration sites during two irrigation events in 2009.**

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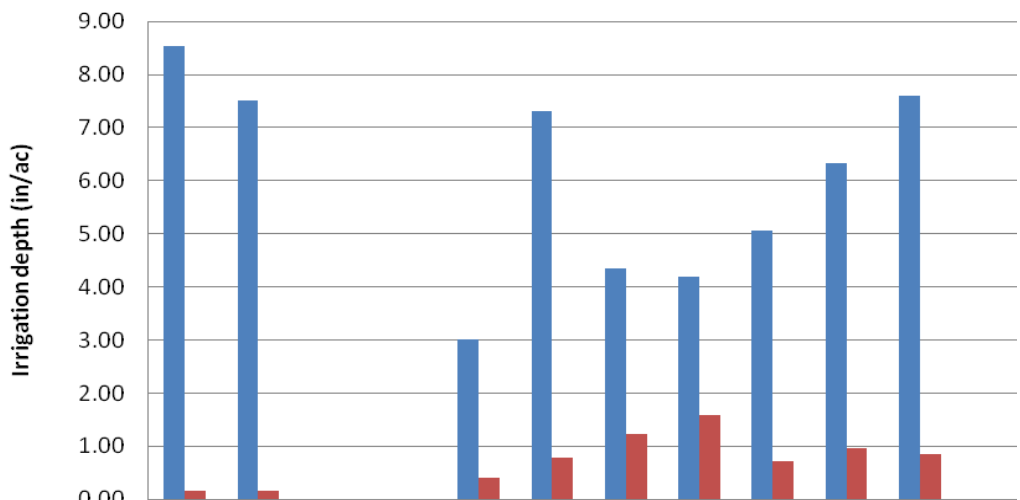



| | FA-1 | FA-2 | FB-1 | FB-2 | FC-1 | FC-2 | FD-1 | FD-2 | FE-1 | FE-2 | FF-1 | FF-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Irrigation | 8.54 | 7.50 | | | 3.00 | 7.32 | 4.34 | 4.20 | 5.07 | 6.34 | 7.59 | |
| Runoff | 0.15 | 0.17 | | | 0.40 | 0.79 | 1.22 | 1.59 | 0.72 | 0.97 | 0.86 | |

**Figure 3. Irrigation depth versus surface runoff recorded on the six demonstration sites during two irrigation events in 2010.**

# Furrow vs. Surge Irrigation in Cotton Assuming Restricted Water Availability in the Lower Rio Grande Valley

**Mac Young, Steven L. Klose, Valorie Reynolds**
**Department of Agricultural Economics**
**Texas AgriLife Extension**
**Texas A&M University System**

The Lower Rio Grande Valley has been the beneficiary of plentiful water from the Rio Grande River in normal rainfall years over many decades. However, a substantial population growth in recent years, coupled with the ongoing needs of irrigated production agriculture, has increased the overall demand for water in the area. In addition, periodic drought years, such as 2006 and 2009, have pressured water supplies and spurred an interest in evaluating water conservation practices. As a result, water use demonstrations on irrigated crops, such as furrow and surge irrigation, have been established. Evaluating the economic viability of the site demonstrations allows for an assessment of furrow and surge irrigation as efficient water delivery systems, especially in times of limited water availability.

The Agricultural Water Conservation Demonstration Initiative (ADI) project is a multi-faceted effort involving the Texas Water Development Board, the Harlingen Irrigation District, South Texas agricultural producers, Texas AgriLife Extension (Extension), and other agencies. It is designed to demonstrate state-of-the-art water distribution network management and on-farm, cost-effective irrigation technologies to maximize surface water use efficiency. The project includes maximizing the efficiency of water diverted from the Rio Grande River for irrigation consumption by various field, vegetable and citrus crops.

Extension conducts the economic analyses of demonstration results to evaluate the potential impact of adopting alternative water conserving technologies. Extension works individually with agricultural producers using the Financial And Risk Management (FARM) Assistance financial planning model to analyze the impact and cost-effectiveness of the alternative irrigation technologies.

In 2010, a furrow vs. surge valve technology demonstration associated with the ADI project was completed to analyze potential water application and irrigation costs scenarios in cotton production (Table 1). Irrigation water in the Lower Rio Grande Valley is currently sold on a per-watering basis regardless of amount used. For example, in a growing season a cotton crop under furrow irrigation may be watered 3 different occasions (typically 6 inches applied per watering) at a price of $7 per watering. In this example, a producer would pay $21 in water costs. Labor and poly-pipe would add to the total irrigation costs per acre. Under surge irrigation, a producer potentially may apply less water, but a surge valve would be an added cost at about $1,800 and the cost for 3 watering events would still be $21. The following analysis evaluates the potential financial incentives for using surge technology under volumetric water pricing and metered delivery scenarios.

## Assumptions

Table 1 provides the basic water use and irrigation cost assumptions for cotton furrow and surge irrigation. For the purpose of evaluating these technologies, five water pricing scenarios were established. Increasing water pricing scenarios represent conditions of increasingly limited water availability, metered delivery, and volumetric pricing.

The number of acres under furrow & surge was the same (19.5 acres each). The average prices received in 2010 were $.74 per pound for cotton and $151 per ton for cottonseed. A five-year average yield of 1,000 pounds per acre was assumed. Production costs were derived from actual producer costs and estimates of per acre overhead charges. They are assumed to be typical for the region and were not changed for analysis purposes. The price of water in 2010 was $1.17/acre inch or $14/acre foot. These assumptions are intended to make the illustration relevant to a wide range of producers in the Lower Rio Grande Valley area.

The two demonstration sites were located adjacent to one

Table 1: Furrow and Surge Irrigation Cost Per Acre for Cotton

| Water Pricing Scenario | Water Price ($/Ac In) | Water Applied (Ac In) | Water Cost/Acre | Poly-Pipe & Labor Cost/Acre | Variable Irrigation Cost/Acre | Surge Valve Costs/Ac/Yr (Over 10 Years) | Total Irrigation Costs/Acre |
|---|---|---|---|---|---|---|---|
| | | | **Furrow** | | | | |
| 1 | 1.17 | 18 | $21.06 | $37.00 | $58.06 | N/A | $58.06 |
| 2 | 2.34 | 18 | $42.12 | $37.00 | $79.12 | N/A | $79.12 |
| 3 | 3.51 | 18 | $63.18 | $37.00 | $100.18 | N/A | $100.18 |
| 4 | 4.68 | 18 | $84.24 | $37.00 | $121.24 | N/A | $121.24 |
| 5 | 5.85 | 18 | $105.30 | $37.00 | $142.30 | N/A | $142.30 |
| | | | **Surge** | | | | |
| Water Pricing Scenario | Water Price ($/Ac In) | Water Applied (Ac In) | Water Cost/Acre | Poly-Pipe & Labor Cost/Acre | Variable Irrigation Cost/Acre | Surge Valve Costs/Ac/Yr (Over 10 Years) | Total Irrigation Costs/Acre |
| 1 | 1.17 | 14 | $16.38 | $37.00 | $53.38 | $9.23 | $62.61 |
| 2 | 2.34 | 14 | $32.76 | $37.00 | $69.76 | $9.23 | $78.99 |
| 3 | 3.51 | 14 | $49.14 | $37.00 | $86.14 | $9.23 | $95.37 |
| 4 | 4.68 | 14 | $65.52 | $37.00 | $102.52 | $9.23 | $111.75 |
| 5 | 5.85 | 14 | $81.90 | $37.00 | $118.90 | $9.23 | $128.13 |

The two demonstration sites were located adjacent to one another and considered a controlled experiment for comparison purposes. Differences in soil types, rainfall and management practices did not affect irrigation water application, production costs, and yields. The surge site assumes a surge valve cost of $1,800. The surge valve expense is evenly distributed over the 10-year period ($180) with the assumption of no financing costs. For the analysis, no other major differences were assumed for the furrow and surge sites.

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. Demonstration findings reflect no significant differences in yields between furrow and surge.

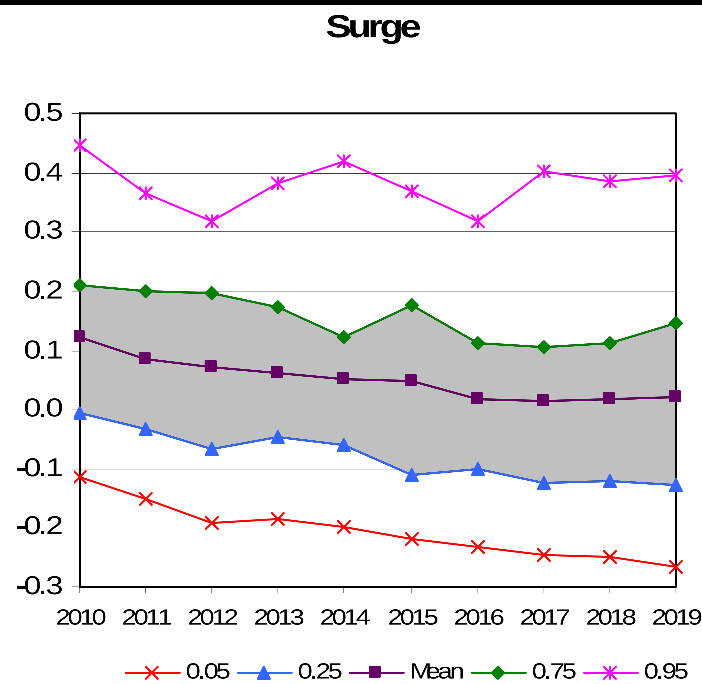
Table 2: 10-Year Average Financial Indicators for a Irrigated Cotton

| Water Pricing Scenario | Water Price ($/Ac In) | 10-Year Averages/Acre: Total Cash Receipts ($1000) | Total Cash Costs: Furrow ($1000) | Total Cash Costs: Surge ($1000) | Net Cash Farm Income: Furrow ($1000) | Net Cash Farm Income: Surge ($1000) | Cumulative 10-Yr Cash Flow/Acre: Furrow ($1000) | Cumulative 10-Yr Cash Flow/Acre: Surge ($1000) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.17 | 1.020 | 0.888 | 0.892 | 0.132 | 0.128 | 1.395 | 1.353 |
| 2 | 2.34 | 1.020 | 0.920 | 0.916 | 0.100 | 0.104 | 1.058 | 1.091 |
| 3 | 3.51 | 1.020 | 0.953 | 0.942 | 0.067 | 0.078 | 0.709 | 0.821 |
| 4 | 4.68 | 1.020 | 0.988 | 0.969 | 0.032 | 0.051 | 0.349 | 0.544 |
| 5 | 5.85 | 1.020 | 1.024 | 0.996 | -0.004 | 0.024 | -0.021 | 0.262 |

## Results

Comprehensive projections, including price and yield risk for surge irrigation, are illustrated in Table 2 and Figure 1. Table 2 presents the average outcomes for selected financial projections in all 5 scenarios.

The graphical presentation in Figure 1 illustrates the full range of possibilities for net cash farm income in scenario 4 for both furrow and surge irrigation. Cash receipts average $1,020/acre over the 10-year period for the three sites. Average cash costs range from $888/acre to $1,024/acre for the various water pricing scenarios.



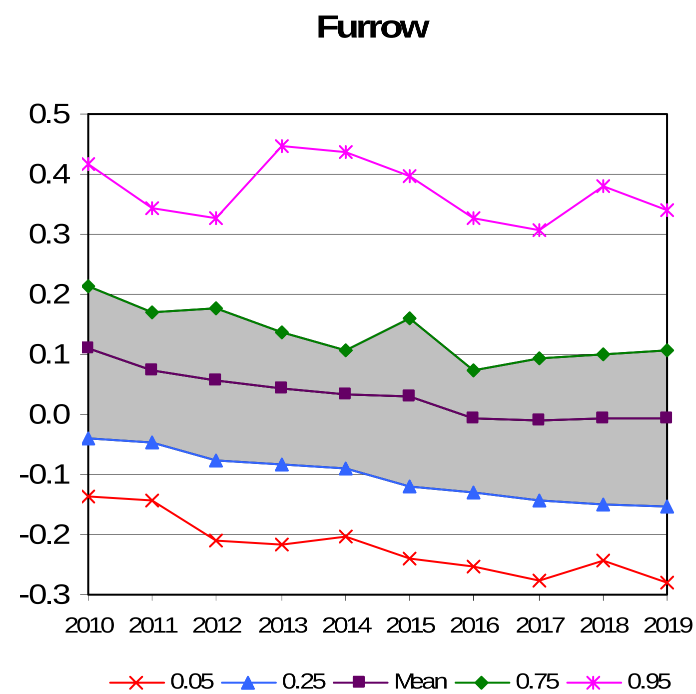




**Figure 1. Projected Variability in Net Cash Farm Income Per Acre for Furrow vs. Surge Irrigation in Cotton.** ***Note: Percentages indicate the probability that Net Farm Income is below the indicated level. The shaded area contains 50% of the projected outcomes.***

Using average net cash farm income (NCFI) as a barometer, surge becomes more profitable than furrow in scenario two—$2.34/acre inch or $28/acre foot—or about double the current water price (Table 2; Figure 1). At this water price level, the additional cost of a surge valve is covered by the water cost savings from using less water. The NCFI advantage under surge improves significantly as the price for irrigation water increases.

Liquidity or cash flow also improves with surge irrigation at higher water prices. Higher NCFI in scenarios 2-5 perpetuates a growth in ending cash reserves over the 10-year projection period (Table 2). Ending cash reserves are expected to grow to $1,091/acre for surge compared to $1,058 for furrow in water pricing scenario 2. In higher pricing scenarios, the cash flow advantage of surge is more significant.

## Summary

Although surge offers the opportunity to conserve irrigation water in cotton and other field crops, the incentive for producers to switch to the new technology is minimal under current water delivery methods and water pricing levels. Demonstration results indicate that incentives to in-

*(Continued on page 7)*

# Evaluating Water Use and Yield from Various Irrigation Systems in Citrus Production

**Shad D. Nelson[1], Mac Young[2] and Juan Enciso[3]**
**[1]Texas A&M University-Kingsville Citrus Center, Weslaco; [2]Texas AgriLife Extension Service, Corpus Christi; [3]Texas AgriLife Research and Extension Center, Weslaco, TX**

Scientists from the Texas A&M System have been collaborating with and gathering data from citrus grower participants in the ADI program throughout the Lower Rio Grande Valley between 2005 to 2009. Location of citrus groves covered three counties in the LRGV with demonstration sites located in the McAllen, Edinburg, Weslaco and Harlingen regions of South Texas. One objective of this work was to evaluate the impacts of different irrigation types on overall irrigation water use and its associated effect on 'Rio Red' grapefruit yield. Four irrigation methods were focused on for this study: conventional large pan flood (Flood), border flood (Brd Fld), microjet sprinkle spray (MJ Spray), and drip (Drip) irrigation.

Most citrus growers in the LRGV utilize Flood irrigation where multiple (2 to 5) rows of trees are irrigated, where the irrigation water is allowed to run over the entire area under the trees until all rows of trees are covered in water. A typical Flood event will apply 4 to 6 inches of water over the entire land area. This method of irrigation has been considered to use more water than is necessarily needed, as extra water is applied between the tree rows where the tractors and equipment maneuver. An alternative form of flood irrigation is 'border flood', where raised berms are formed between each row of citrus trees so that irrigation water can be channeled down the citrus rows at a faster rate and localizing. In this study, all growers using Brd Fld practices maintained a single wide 3 to 4 foot border between the tree rows. This is thought to save water as water is localized underneath the tree canopy and not between the tree rows. Drip and MJ Spray irrigation methods are thought to save even more water because they are high pressure systems applying water at a lower rate. In this study, growers using MJ Spray had one sprinkler per tree, where sprinkler placement was 12 inches above ground level, underneath the canopy and placed between two adjacent trees within the same row. Drip irrigation growers used single-line or dual-line irrigation systems placed underneath the tree canopy within the same tree row.

## Observations and Results

Total rainfall was monitored for each growing season from 2005 through 2009. Although monthly rainfall patterns can differ substantially from demonstration site to site, the total annual rainfall only differed between 2 to 4 inches annually at each site. The average annual rainfall for the LRGV is shown in Figure 1 and varied from 20 to 28 inches annually between 2005-2009. Although rainfall averages are informative, such data does not represent years of low rainfall or excessive rainfall. For example, one hurricane in 2008 supplied over half of the total rainfall observed in that year, whereas, throughout the rest of the year rainfall was low. Regardless of precipitation levels during the 2005-2009 growing seasons, there was not a strong inverse correlation between rainfall and irrigation use among the citrus growers (Fig. 1). The amount of total irrigation water applied by citrus grower was more dependent upon the irrigation system used, with water use following the trend of Flood > Brd Fld > MJ Spray = Drip throughout the growing seasons.

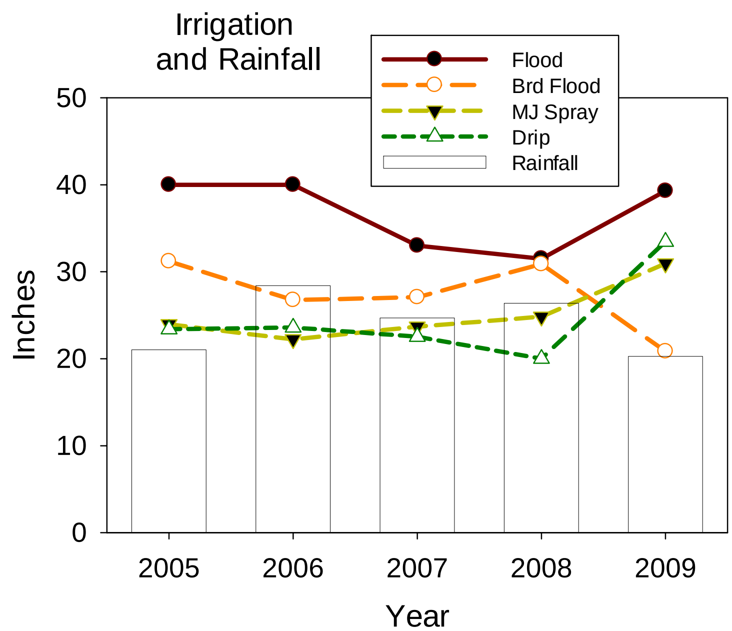



**Fig. 1. Average annual irrigation amount applied per irrigation system and rainfall.**

Compiling all five growing seasons together, total average irrigation use per irrigation system was compared to total average 'Rio Red' grapefruit yield (Fig. 2). In regard to total annual irrigation amount applied, Flood was statistically higher than all other irrigation methods. Whereas Brd Flood, MJ Spray and Drip were not statistically different from one another, but there was a consistent trend

*(Continued on page 7)*

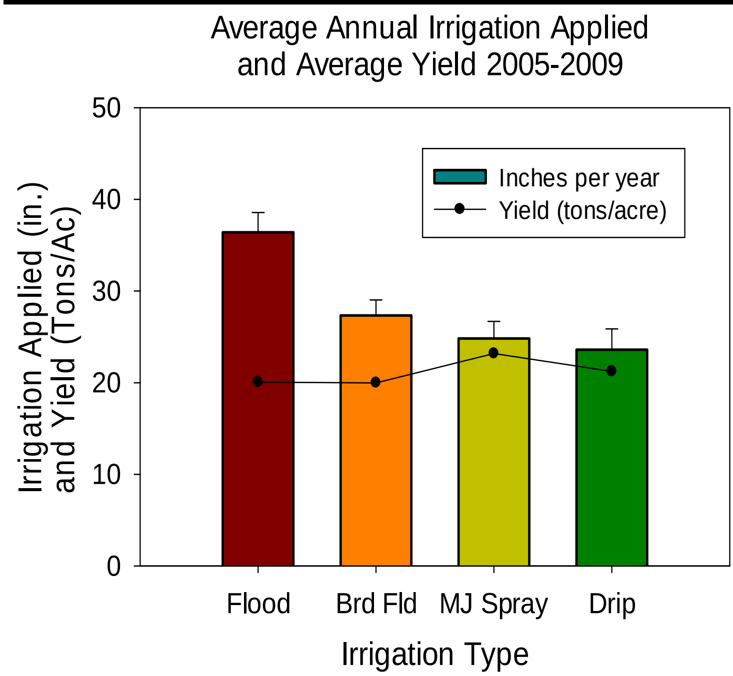



**Fig. 2. Average irrigation water applied vs. average yield per irrigation system.**

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**with Brd Fld slightly higher than MJ Spray and Drip irrigation. It should be noted that Drip growers using a dual-line irrigation system typically used twice the amount of irrigation water annually compared to single-line drip systems, but single-line systems on mature trees typically did not adequately meet citrus evapotranspiration demand during periods of drought and/or summer heat. On average, there was no direct correlation of irrigation method used to citrus yield (Fig. 2). Total average grapefruit yield were statistically similar among all four irrigation system evaluated, with higher yields typically more dependent upon other than individual grower's management practices than irrigation method used. Although total average yields shown here were not dramatically different among irrigation systems, it has been shown that grapefruit pack out percentages and the amount of fruit going into the fresh market for fancy and choice classification was more closely linked to the irrigation method used (Young et al., 2010).**

**References:**
**Young, M., S. Nelson, S. Klose, and J. Enciso. Aug 2010. Assessing irrigation methods based on grapefruit pack-out in the Lower Rio Grande Valley. Texas AgriLife Extension. FARM Assistance Focus 2010-4. pp. 1-3. http://coastalbend.tamu.edu/Extension/Risk%20Management/2010-4.pdf**

*In memoriam*

## Vivia Halbert

**1946-2011**

**There are no words to express our thanks to all of you for your prayers, support and friendship during the past several weeks. We are overwhelmed by the love so many have shared with us in every way. Thank you all from the Halbert family.**

## TEXAS WATER DAY AT THE CAPITOL

**WEDNESDAY, APRIL 27, 2011**
**Activities from 9AM – 3PM**

**See exhibits in the Capitol Extension Conference Room & Gallery from all over the state showcasing education programs on our most important resource!**

**Also, there will be a Workshop on Water* held in the Capitol Auditorium (Extension Building) from 9AM – 2PM.**

**The Workshop will include presentations on Texas Water Issues, Energy/Water Nexus, and a special presentation by Author James Workman, "Heart of Dryness: How the Last Bushmen Can Help Us Endure the Coming Age of Permanent Drought, Offering Unexpected Solutions."**

**Register at http://www.texaswater.org/**

***There is no charge for the Workshop, but registration is needed for the lunch headcount.**

*(Continued from page 5)*

**vest and adopt surge irrigation would begin with volumetric pricing and almost a doubling in water price to $2.34/ acre inch.**

**The incentives for producers to switch to surge are more substantial at higher prices for irrigation water. In drought or other high water demand situations where the availability of water is restricted or limited, economic forces will ration supplies through higher prices and water will likely be metered. Water use efficiency will then become more crucial in controlling water cost.**

**This case study assumes higher water prices throughout the 10-year projection period. If water shortages and higher prices occur only in one year then return to previous levels, producers likely will have less incentive to change to the new surge technology. However, if long-term expectations are for higher pricing and/or metering to manage water supplies and delivery, surge technology will likely be viewed as a viable alternative for producers in the Lower Rio Grande Valley. In summary, the economic incentives for producers to switch to surge irrigation systems will likely be determined by the future availability and cost of water.**

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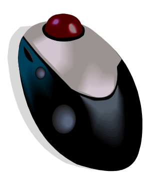
**Visit our Web Site at**
**www.hidcc1.org**



# Message from the Manager

The District is involved in several projects this year. In February we completed placing a portion of Canal 26 into a 42" PVC pipeline in preparation for the Bass Pro Shop development. This pipeline will service the area between Expressway 77 and Palm Valley and is anticipated to provide water for the landscaping and water features to be incorporated into the development.

We have recently completed the Hurricane Dolly NRCS-funded project to repair certain areas of our drainage systems in both Adams Gardens and Harlingen Districts. The District continues to work with the various drainage entities seeking solutions to problems exposed by recent flooding from the storms of the past three years. IBWC plans considerable modifications to both the North Floodway and Rio Grande levee systems that will impact the districts.

The District is progressing well in our canal gate automation project. Most of the gates are installed and most are being operated in the automation mode. This system will allow us to keep our main canal system stable around the clock, providing optimum conditions for water delivery with minimum variation. The system allows for adjustments by the canal riders from the office, their homes or vehicles. We look forward to the many possibilities that this system opens for us to better serve our customers.

The Texas Water Conservation Advisory Council will be working on agricultural water conservation initiatives including promotion of best management practices, reporting mechanisms and other useful tools to help the State agencies determine how we are progressing towards goals of water conservation as is set out in state and regional water plans. Any concerns or ideas that you would like to see presented to this group would be greatly appreciated. Just give us a call.

Sincerely,
Wayne Halbert, General Manager