

**Quarterly Progress Report**  
**Texas Water Development Board Contract**  
**2004-358-005**

Quarter No. 3 from 6-15-05 through 9-15-05

**Overview**

In January 2005, the Texas Water Resources Institute (TWRI), in conjunction with the Texas Water Development Board (TWDB), administered a request for proposals. At that time, eight projects were awarded funds (studies 1 through 8 shown in Section B). In February 2005, TWRI and TWDB awarded funds to two additional projects (studies 9 and 10 listed in Section B).

TWRI continues to interact with project leaders on a regular basis and offers support to these teams on an as-needed basis.

TWRI is now in the process of posting the proposals for each of these projects on the Institute's Web site. In addition, TWRI will post quarterly reports describing these projects on the Institute's Web site in the near future.

**Listing of Funded Projects**

1. James Bordovsky, Texas Agricultural Experiment Station at Plainview. "Equipment Installation for the Evaluation of Crop Row Direction and Offset Distance from Subsurface Drip Irrigation." \$10,000.
2. John Jifon, Texas Agricultural Experiment Station at Weslaco. "On-Farm Volumetric Measurement of Irrigation Water Use as a Best Management Practice Tool for Water Conservation in Drip Irrigated Vegetables." \$10,000.
3. Allen Knutson, Texas Agricultural Experiment Station at Dallas. "Implementing Biological Control of Saltcedar in the Upper Colorado River Watershed." \$9,577.
4. Leonardo Lombardini, Texas A&M University Horticulture Science Department. "Irrigation Scheduling in Pecan Orchards Using a Soil Water Balance Model." \$9,732.
5. G.J. Michels, Texas Agricultural Experiment Station at Bushland. "Biological Control of Saltcedar at Lake Meredith, Texas." \$6,776.
6. Genhua Niu, Texas Agricultural Experiment Station at El Paso. "Determining Plant Water Use and Crop Coefficients of Selected Nursery and Landscape Plants." \$9,425.
7. Genhua Niu, Texas Agricultural Experiment Station at El Paso. "Impacts of Drought on Salinity Tolerance of Landscape Woody Plants Irrigated with Reclaimed Wastewater." \$9,425.

8. Bobby Stewart, West Texas A&M University. "Seeding Dryland Grain Sorghum in Clumps to Decrease Tillering and Increase Grain Yield." \$9,500.

9. Giovanni Piccinni, Texas Agricultural Experiment Station. "On-Farm Research to Evaluate Irrigation Scheduling Tools to Increase Yield and Control Diseases." \$10,000.

10. John Sij, Texas Agricultural Experiment Station at Vernon. "Managing Water Resources of the Seymour Aquifer Using Subsurface Drip Irrigation." \$10,565.

## Progress/Activities

*1. James Bordovsky, Texas Agricultural Experiment Station at Plainview. "Equipment Installation for the Evaluation of Crop Row Direction and Offset Distance from Subsurface Drip Irrigation."*

### Overview

The overall goal of this project is to quantify the extent to which the physical distance between subsurface drip irrigation systems and the rows in which crops are grown may affect cotton germination, nutrient uptake, and crop yield, as well as water use efficiency.

### Activities Conducted This Quarter

Several major accomplishments have been achieved since June 2005, including the following tasks:

- A submersible pump and a 10 horsepower well motor were installed. This will supply irrigation water for the research site.
- Ditches were dug along the east and west ends of drip irrigation laterals.
- East-west, and north-south drip irrigation laterals were plumbed to appropriate the water supply and manifolds were flushed. The drip systems were partially covered, water packed and pressure tested for leaks.
- The ends of drip irrigation laterals were geographically referenced with global positioning systems.
- The first ditches were covered.
- North-south drip laterals were installed in four zones on 2 acres.
- Ditches were dug along the north and south edges of the field.
- Eight water lines were clustered together. Each water line leads from a different subsurface drip irrigation zone.
- All flush lines and valves have been completed.

### Activities Planned for the Next Quarter

An array of subsurface drip irrigation plots will be installed by October 31, 2005. This irrigation system will provide a water supply and a means of filtering raw water for experiments on the site that will begin in the spring of 2006.



*The drip system was installed in the summer of 2005.*

2. John Jifon, Texas Agricultural Experiment Station at Weslaco. “On-Farm Volumetric Measurement of Irrigation Water Use as a Best Management Practice Tool for Water Conservation in Drip Irrigated Vegetables.”

**Overview**

The overall objective of this study is to determine if affordable water meters can be used to accurately measure the amount of water used for irrigation and to calculate water use efficiency. By establishing such a methodology, comparisons can be made about the volume of water use as well as the amount of water that can be saved from the use of drip versus furrow irrigation systems.

**Activities Conducted This Quarter**

During the 2004-2005 onion growing season, experiments were established in commercial-scale onion fields at sites near Weslaco and Los Ebanos in the Lower Rio Grande Valley of Texas. Portable “totalizing” water meters measured the volume of water supplied to individual plots during the growing season. Information on water supplied to crops was used in combination with data about crop evapotranspiration or ETc, soil moisture, and onion yields to calculate crop water use efficiencies (i.e., the pounds of onions produced compared to the gallons of water that were applied).

At Los Ebanos, a commercial grower managed the irrigation scheduling using empirical data. At Weslaco, irrigation scheduling was based on crop ET calculations and soil moisture data.

Results at Weslaco show that the volume of irrigation water applied was less than estimated crop ET needs, in large part because the irrigation schedules were based on weather monitoring and taking soil moisture readings. However, at Los Ebanos the amount of water applied was 35% more than the amount estimated for crop ET needs since a less scientific approach was used to calculate irrigation schedules.

Results also show that the volume of water applied to furrow-irrigated plots was 46% greater than drip-irrigated fields. Onion yields in drip irrigated plots were twice as great as yields from furrow-irrigated fields.

***Estimated onion crop evapotranspiration (ETc), water supply and growth environment characteristics for the study sites.***

	Weslaco	Los Ebanos
Onion ETc (mm)	513	407
Growing season rainfall (mm)	93	140
Total water applied (mm) † SDI	472	549
Cropping cycle duration (days) ††	187	164

†Total of irrigation applied plus rainfall.

††From planting to harvest.

3. Allen Knutson, Texas Agricultural Experiment Station at Dallas. "Implementing Biological Control of Saltcedar in the Upper Colorado River Watershed."

### **Overview**

The overall goal of this project is to establish nursery sites for rearing large numbers of a specific species of beetle that can be used to biologically control water wasting saltcedar in the Upper Colorado River watershed. These studies are concentrated along Beals Creek near Big Spring, Texas.

### **Activities Conducted This Quarter**

Studies were carried out to identify how beetles that devour saltcedar can best be established in the field. Some of the conditions that were assessed include the season or time of year to release the beetles, the number of beetles that need to be released at each site, and whether or not the beetles should be released in open fields. Research was conducted beginning in July 2005 to measure the impact of beetles that feed on carbohydrate reserves. In this effort, beetles were placed in 16 cages at Lake Thomas.

The populations of these beetles increased dramatically in July and August of 2005 at the study site near Big Spring. Beetle populations now number in the tens of thousands. By September 2005, roughly 100 saltcedar trees covering more than 2 acres were defoliated by beetles introduced by this project. In August and early September, researchers gathered beetles from the Big Spring research site and released them at 18 more research locations in the region.

### **Activities Planned for the Next Quarter**

A field day will be held September 22, 2005 to let stakeholders tour the Big Spring research site. Cooperating agencies and Extension personnel will take part in the field day. Sites in the Big Spring watershed and at Lake Thomas will be monitored through the spring of 2006. Large numbers of beetles will be collected from the field through October 2005, will be placed in field cages and refrigerators, and will be used to establish new beetle populations in spring 2006.



*After beetles were introduced, several saltcedar trees near Big Spring were damaged and turned brown.*

4. Leonardo Lombardini, Texas A&M University Horticulture Science Department. "Irrigation Scheduling in Pecan Orchards Using a Soil Water Balance Model."

**Overview**

The overall goal of this project is to introduce an alternative method for scheduling irrigation in pecan orchards through the use of a soil water balance model. Validating the model in pecan orchards will allow this methodology to be used in different regions with varying climate conditions and to conserve water.

**Activities Conducted This Quarter**

Training about how to safely operate and gather water use data from a neutron moisture probe was completed in this quarter by a graduate student involved in this project. Water use data was collected from nine pecan trees at the Texas A&M University Storey Experimental Pecan Orchard in College Station. Each of the pecan trees had similar characteristics in terms of tree height, canopy width, the diameter of trunks, and competition from nearby trees. Risers were placed on the sides of pecan tree trunks to facilitate irrigation. Leaf water potential was measured at dawn before irrigation was applied on September 5, 2005, and on the morning of September 9, 2005 one day after an irrigation event.

**Plans for the Next Quarter**

In the future, the research team will insert 36 neutron probes at a depth of 12 feet at the site. The probes will be used on a regular basis to gather data about soil moisture and the amount of water that is available to the roots of pecan trees.



*Students measure water trends in pecans.*

5. G.J. Michels, Texas Agricultural Experiment Station at Bushland. "Biological Control of Saltcedar at Lake Meredith, Texas."

### **Overview**

The overall goal of this study is to determine if the deployment of the saltcedar beetle (*Diorhabda elongata*) can be a successful biological control agent to manage saltcedar populations near Lake Meredith and in the Canadian River watershed and thus conserve water.

### **Activities Conducted This Quarter**

Between May and August 2005, three generations of saltcedar beetles fed on a 31-acre study site near Lake Meredith. Populations grew and the beetles dispersed throughout the area. One adult beetle was observed 1 kilometer away from the site where the beetles were originally released in 2004.

Beetle populations expanded rapidly at the original release site throughout July and August 2005. More than 50% of the saltcedar foliage in the experimental cages was damaged by the beetles.

Because the populations of beetles is growing and overflowing, new tents to house these insects were erected at the study site and at a nearby area where burns were used to treat saltcedar.

### **Plans for the Next Quarter**

Future efforts will evaluate strategies to rear beetles in the field. This data will allow researchers to better understand how beetles will survive and overwinter in the field and to better predict population trends.



*Saltcedar beetles are being introduced at Lake Meredith as a biological control.*

6. Genhua Niu, Texas Agricultural Experiment Station at El Paso, and Raul Cabrera, Cynthia McKenney and Wayne Mackay, Texas Agricultural Experiment Station at Dallas. "Determining Plant Water Use and Crop Coefficients of Selected Nursery and Landscape Plants."

### **Overview**

The overall goal of this project is to determine the water use and crop coefficients of selected landscape plants. The study will compare the differences in water use and crop coefficients that result when these species are grown in El Paso and Dallas. The project will also investigate water use trends in plants grown in containers versus plant species grown in landscapes.

### **Activities Conducted This Quarter**

In June 2005, 3-gallon containerized plants were placed in field plots. Later, they were placed in 15-gallon lysimeters. Containers were regularly weighed to determine water use and evapotranspiration. Water use and water use per leaf area was estimated by calculating soil moisture depletion. Weather data have been recorded since July 1, 2005 and are being used to compute crop coefficients. Species evaluated in this project include abelia, butterfly bush, holly, and oleander.

### **Plans for the Next Quarter**

This experiment will be terminated in the fall of 2005 as plants go dormant. However, data from this study will be used to determine plant water use and coefficients in future growing seasons.



*Containerized plants used in this study.*

7. Genhua Niu, Texas Agricultural Experiment Station at El Paso. “Impacts of Drought on Salinity Tolerance of Landscape Woody Plants Irrigated with Reclaimed Wastewater.”

**Overview**

The overall goal of this study is to evaluate the relative salinity tolerance and water use of selected shrubs and tree species under well-irrigated and drought-stressed conditions. The project will also analyze how these species take up sodium and chloride ions and translocate them into parts of the growing plant.

**Activities Conducted This Quarter**

Trees and shrubs grown in 3-gallon containers were placed in the field in July 2005 and irrigated with waters containing three levels of salinity (0.8, 2 and 4 dS/m). Saline irrigation water was synthesized by adding sodium chloride to local tap water.

Plant growth was recorded and photos were taken periodically to document how plant growth changed in response to salinity treatments.

**Plans for the Next Quarter**

This experiment will be terminated in the fall when plants go dormant. It may be beneficial to repeat these studies using a different soil media. Soil media used in this study contains a high level of peat that rapidly accumulates salts.



*Chinese elm (left) and green ash (right) grown with saline water in this project.*

8. Bobby Stewart, West Texas A&M University. *“Seeding Dryland Grain Sorghum in Clumps to Decrease Tillering and Increase Grain Yield.”*

### **Overview**

The rationale behind this project is to investigate, through field research, whether growing grain sorghum in clumps has the potential to increase yields under water-short conditions. Previous studies suggest that growing grain sorghum in clumps may produce fewer tillers and less vegetative growth early in the season, thus leaving more water in the soil that can be used in the critically important grain-filling period.

### **Activities Conducted This Quarter**

Project funds were used to purchase light sensors that were placed in plots at the Nance Ranch at West Texas A&M University in Canyon, Texas, and at the USDA-ARS site at Bushland, Texas. The light sensors measure specific wavelengths to determine if grain sorghum plants are producing tillers. Information is recorded in a data logger purchased with project funds. If it can be shown that growing grain sorghum in clumps results in fewer tillers being produced early in the growing season, there should be more water left in the soil to support grain filling. Similar studies are now being initiated to determine if planting cotton in clumps can shorten the growing season, thus limiting the risk of freeze damage early in the growing season.

Dr. Stewart presented information on the project to the Texas Grain Sorghum Producers Board in August 2005. Because of this project and related efforts, interest in growing grain sorghum in clumps is increasing in the region. Farmers in Wilbarger and Wichita counties planting grain sorghum in clumps achieved yields of up to 3,500 pounds per acre. Preliminary research results suggest that this method may increase yields by 15% to 20%.

### **Plans for the Next Quarter**

Monitoring will continue until crops mature in October, and a report will be developed. .



*West Texas A&M students examine whether tillering is occurring in grain sorghum plants.*

9. Giovanni Piccinni and Kenneth White, Texas A&M University Agricultural Research and Extension Center at Uvalde, and Thomas Gerik, Blackland Research and Extension Center at Temple. *“On-Farm Research to Evaluate Irrigation Scheduling Tools to Increase Yield and Control Diseases.”*

### **Overview**

The goal of this project is to reduce the production costs of crops grown in the Rio Grande region by improving irrigation efficiency in stressful environments (i.e., where heat and drought stress occur) while controlling diseases such as aflatoxin and common root rot. The research will identify irrigation scheduling and farm management tools and educate growers about how to use these methods to deal with factors that stress corn crops.

### **Activities Conducted This Quarter**

The Precision Irrigators Network (PIN) is now finishing data collection from the crops grown in the spring and summer of 2005 in Uvalde, Medina, Bexar, Frio, Atascosa, Dimmit, and Maverick counties.

“Water mark” sensors were purchased for 15 participating farmers to record water use data. County Extension agents in the study area traveled to these farms each week and gathered water information on water use, soil moisture, and the growth stages (phenology) of plants during the season. The location of pivot irrigation systems was recorded with a global positioning system.

These data are being used as inputs to the Texas A&M University “CropMan” model that will analyze the relationships between water supplies, water use, and crop yields.

### **Plans for the Next Quarter**

A final report will be published in the near future that will describe the extent to which the use of the PIN improved the efficiency of water use in these crops.

10. John Sij, Texas Agricultural Experiment Station at Vernon. “Managing Water Resources of the Seymour Aquifer Using Subsurface Drip Irrigation.”

### **Overview**

The overall objective of this project is to research and demonstrate how subsurface drip irrigation systems have the potential to conserve water and increase yields and profits for agricultural producers at sites in the Rolling Plains where groundwater resources are limited. The project will install, test, and monitor subsurface drip irrigation systems being installed at the Chillicothe Research Station. Research results will be demonstrated to agriculture producers in the region through demonstrations, field days, and Extension efforts.

### **Activities Conducted This Quarter**

A groundwater well has been installed with a pumping capacity of 150 to 175 gallons per minute. The site for the drip irrigation research plots has been prepared.

### **Plans for the Next Quarter**

A field tour and demonstration day is planned for the Chillicothe Research Station on September 29, 2005. Material for the pump house has been purchased, and a concrete slab will likely be poured in October 2005. The research team is waiting on additional funding from other sources to let bids to install a drip irrigation system.



*This water well was installed at the Chillicothe Research Station during the summer of 2005.*