TEXAS A&M AGRILIFE RESEARCH

LOWER RIO GRANDE VALLEY REGION

RESEARCH GOALS AND IMPACTS

Texas A&M AgriLife Research and Extension Center at Weslaco

TEXAS A&M AGRILIFE RESEARCH

2015

GOAL

Protect water quality and increase the amount of water available for urban and rural use through new technologies and approaches.

PROGRESS

Improving water quality

- Weslaco Center researchers are identifying the effects of different agricultural management practices on nonpoint source pollution from irrigated farms where effluents are discharged into the Arroyo Colorado.
    - *Two practices with the greatest beneficial impact on nutrient loadings are nutrient management (applying fertilizer according to a soil analysis) and irrigation management (reducing runoff and using non-erosive stream sizes).*

Increasing irrigation efficiency

- A Weslaco researcher developed and evaluated Internet-based applications and mobile phone and tablet apps to improve crop efficiency, productivity, and profitability per unit of irrigation water applied. Researchers developed and evaluated a web-based program with tools to analyze weather data, estimate crop water requirements, estimate heat and chill units or freeze hours, and develop a water balance equation to manage irrigation. This tool has the potential to conserve at least 15% of the total water applied, with a potential economic impact of $180 million per year.
    - *Experiments were conducted to increase the potential for conserving water and increasing net returns per unit of water applied to bioenergy crops such as sorghum and energy cane.*
    - *Researchers also developed sensor technology to detect water, insect, and disease stresses and help breeders select traits for crop improvement.*
- Researchers are developing and using a new method for evaluating the performance and longevity of subsurface drip irrigation (SDI) systems.
    - *Performance and longevity are key factors in the profitability of SDI systems when used for lower-value commodities, such as fiber and grain crops.*
    - *Weslaco Center recommendations for management and maintenance of SDI systems can greatly affect the efficiency and longevity of these systems.*
    - *Optimal use of SDI systems can maintain production with less water, reducing the environmental impacts of agriculture.*

GOAL

Improve agricultural production and efficiency through advances in animal and plant breeding, management, and health.

PROGRESS

Enhancing citrus and vegetable production

- Weslaco Center research — in partnership with the Texas A&M University-Kingsville Citrus Center and the USDA Agricultural Research Service's Kika de la Garza Subtropical Agricultural Research Center — focuses on citrus and vegetable production.
- This partnership also strengthens agribusiness in the Lower Rio Grande Valley through research in
    - *integrated pest management*
    - *biological pest-control techniques*
    - *diseases of honeybee colonies*
    - *the introduction of plant quarantine treatments*
    - *organic farming systems*
    - *postharvest treatment of produce by nonchemical means*
    - *aerial remote sensing to detect agricultural threats*
    - *the selection of pesticide-tolerant vegetable, ornamental, and specialty crops to comply with U.S. labeling and Environmental Protection Agency standards.*

Designing healthier foods, bio-factory crops, and bioenergy crops

- Next-generation crops will improve human health, open larger markets for growers, protect the environment, and help provide new sources of energy. Weslaco Center researchers are using cutting-edge technologies in molecular biology and plant sciences to develop
    - *supernutritious fruits and vegetables*
    - *"biofactory" crops that produce high-value compounds for medical, therapeutic, and industrial uses*
    - *energy crops designed to be used as feedstocks for bioenergy and biofuels production*
- The Texas A&M AgriLife Sugarcane Breeding Program has developed energy cane cultivars with high-biomass yield, in partnership with Chevron Technologies Venture and BP Biofuels. This energy cane, specifically designed for use in biofuels production, can be grown in a wider region of Texas and the United States. By applying next-generation DNA sequencing, this program has identified and isolated genes controlling cold tolerance, which could prevent losses to the $3.8 billion U.S. sugar industry.

Weslaco Center research has developed new sugarcane varieties through genetic improvement that are high in sugar, resistant to disease and insects, cold- and drought-tolerant, have desirable harvest and processing characteristics, and are well suited to South Texas growing conditions.

- AgriLife Research has signed a commercial license agreement with Syngenta for a novel promoter technology in transgenic sugarcane and energy cane for enhanced biofuel production.
- Weslaco Center research has developed new sugarcane varieties through genetic improvement that are high in sugar, resistant to disease and insects, cold- and drought-tolerant, have desirable harvest and processing characteristics, and are well suited to South Texas growing conditions.

Making fruit and vegetable crops resistant to disease

- Weslaco Center scientists are conducting applied research to incorporate disease-resistance genes into crops important to South Texas agriculture. A Weslaco Center researcher has developed citrus varieties containing natural spinach plant defensin genes, which make them resistant to citrus greening, a widespread and difficult-to-control disease. In May 2015, he received an Experimental Use Permit from the Environmental Protection Agency for these varieties, which have been exhaustively shown to be safe. The next step toward commercialization is to test the trees for any effects on fruit quality or taste. If commercialized, these trees could save the $13 billion per year U.S. citrus industry from being devastated by citrus greening.
- Other current disease-resistance research projects at Weslaco are in potatoes and sugarcane, including the development of transgenic sugarcane that is resistant to viruses and to a broad spectrum of insects that transmit plant viruses.
- A Weslaco Center tomato breeder crossed heat-tolerant and pest- and disease-resistant germplasm obtained from Texas A&M, USDA's National Plant Germplasm System, and other public breeding programs to develop a base breeding population. Cultivars developed from the program are expected to help revitalize Texas's tomato production to satisfy local demand of more than 2 million pounds of tomatoes per year.
- Spinach breeding at Weslaco has resulted in the identification of 21 lines that are highly resistant to white rust, from the University of Arkansas collection, and 11 USDA lines with desired leaf characteristics that will be used to develop breeding and mapping populations. Molecular markers linked to white rust resistance have been identified and will be used to speed up cultivar development to reduce cost and yield losses resulting from white rust disease.
- Weslaco scientists are researching plant disease vector biology, ecology, and management; epidemiology; and disease resistance as they relate to vegetable integrated pest management practices.
    - *Results of plant disease vector research combined with integrated pest management will reduce both insect pest management costs and growers' losses to plant diseases.*

GOAL

Add value to raw agricultural products and expand market channels through new product development and enhancements to existing commodities.

PROGRESS

- Collaborating with industry partners, a Weslaco Center researcher developed improved agronomic practices within a stress-physiology program that has resulted in significant yield increases of greater than 30% and improved water- and nitrogen-use efficiencies of alternative crops for value-added products. These advancements translate into significant savings in water, fertilizer, herbicide, and pesticide costs and have improved the prospects of a sustainable and profitable bio-based economy in Texas.
    - *Research on citrus greening (or Huanglongbing), a bacterial disease threatening the U.S. citrus industry, has identified key nutrition management factors that allow growers to sustainably manage and prolong the productive life of infected trees and groves.*

GOAL

Capitalize upon data from high-throughput sequencing, proteomics, metabolomics, metagenomics, and other advanced technologies to develop systems biology tools for improving agricultural productivity.

PROGRESS

- At Weslaco, a new high-throughput, microbial hairy-root platform is being developed to culture, propagate, and study plant pathogens such as *Candidatus* spp. This platform will enable transformative studies of multiple devastating plant pathogens that until now have been uncultivable.
- Weslaco scientists have identified several novel spinach defensin genes using genomics and bioinformatics tools. The genes are currently being characterized and will be used to impart resistance to citrus greening and to zebra chip disease in potatoes. Efforts are also underway to identify tomato and potato central stress regulatory networks.
- Using comparative genomics approaches, Weslaco Center researchers identified several new genes that are potentially useful to improve cold tolerance, salinity tolerance, and nitrogen-use efficiency as well as resistance to such diseases as smut and orange rust.