

Phytalk System: a Precision Tool to Monitor Plants under Deficit Irrigation

A proposal to TAES/TWRI

Investigator: Daniel I. Leskovar
Associate Professor
Texas A& M Reserach and Extension Center, Uvalde, TX 78801
Ph: 830-278-9151 - Fax: 830-278-1570
E-mail: d-leskovar@tamu.edu

Amount of Funding Requested: \$ 10,000

Project Need: Vegetable production in southwest Texas regions is strictly regulated on water use. Currently growers in the Edwards Aquifer region are allowed to pump 24 inches/acre per year. In addition, demand for high quality and nutritious vegetables has increased. In the U.S. Texas ranks 7th in bell peppers (2001 Texas Agricultural Service Statistics). Between 1970 and 1998, bell pepper consumption has increased from 2.2 to 7.2 pounds per capita. Specialty red colored bells and poblano peppers are very popular in the Texas markets and consumer demand is increasing rapidly. They also bring a higher price than similar-sized green bells (price/pound up to \$1.80). However most colored and poblano peppers are produced out-of-state, Mexico, and Europe. Last year, from our water conservation studies we were able to produce, ship and market for the first time poblano peppers from the Wintergarden to HEB market in San Antonio. This outcome was possible through a concerted effort with Constanzo Farms, San Antonio Water Systems (SAWS), Texas Department of Agriculture (TDA), CHEP USA (related story in <http://vic.tamu.edu/home/pages/sciencere1.htm>). Parallel to our water studies and through collaborative work with Dr. Crosby, pepper breeder at TAMU Weslaco Center, we are screening genotypes to develop new varieties with superior drought tolerance and fruit quality for South Texas.

The overall goal of this project is to develop irrigation strategies to maintain or enhance fruit quality of vegetables, while saving water in the Edwards Aquifer region. The specific objective of this work is to determine how deficit irrigation and growing season affect plant growth, physiological responses, fruit quality, and water use efficiency of peppers. The requested funds will be used to purchase a phytomonitoring equipment which is based on real-time plant-sensing techniques and incorporates measurement protocols and a data acquisition system. This tool will be an excellent addition for improving irrigation and precision agriculture projects that involve the participation of graduate students.

Description of the Project: Studies will evaluate deficit irrigation strategies under subsurface drip irrigation (SDI) for the production of high cash value peppers during spring and fall season. Specific emphasis will be given to plant growth, plant water status, and fruit size. We plan to monitor diurnal changes of leaf temperature, stem growth, fruit growth, and overall plant water status during early and late ontogeny. Studies will be conducted in the field using a red colored bell pepper selected from our previous projects. We also plan to use this system on poblano

peppers. Deficit irrigation rates are 100 %, 75% and 50% PET, which will be adjusted based on estimated crop coefficients during development. We will monitor spring-transplanted peppers as well as fall peppers established after ratooning with a mid summer pruning technique as described in Kahn and Leskovar (2001). Ratooning is a low cost practice that has proven to enhance bell pepper quality. We hypothesized that ratooning has a two prong effect. First, it decreases the ET due to a reduced canopy size. Second, it allows an efficient re-direction of photosynthates to the harvestable portion of the plants (e.g. flowers and fruits), which compete, more favorable with leaf or stem growth. The end result is a vigorous vegetative re-growth, high fruit set, rapid fruit development, an increase in the harvest index and in the number of Fancy fruits. We will also continue evaluating the genetic variation of several pepper types exposed to a control and a deficit irrigation treatment. Those peppers include poblanos, bells, habaneros and long green chiles. All peppers will be raised as transplants in the greenhouse prior to field transplanting. Experiments will be arranged in a split-plot design with four replications.

Expected Outcomes: The results of this project would enhance our understanding of plant responses to water stress. We expect to develop intensive water-crop irrigation strategies for high cash value crops such as specialty peppers with the ultimate goal to save water and increase profitability to producers. From the fall production we expect water savings of up to 10 inches per acre compared to spring production. Along with industry collaborators we will present information at the local, regional and state meetings. An annual field demonstration and news print publications will also disseminate results. Support for the applicability of this research and demonstrations will be provided by agribusiness related to drip technology and state organizations, including TDA, SAWS, and the Edwards Aquifer Authority (EAA).

Budget: The requested funding will be used to purchase an integrated control system for data input (Phytec-LPS-05 MA or similar), and phytomonitoring sensors for plant growth: leaf temperature, sap flow, stem growth, and fruit absolute displacement sensors (15 to 100 mm diameter). Salaries for a graduate student will be provided by a SAWS grant. Other supplies will be provided by a current ATP grant. Lab, field equipment for water conservation strategies (drip system, filters, valves, injectors, Center pivot) are already in place at the Uvalde Center. Support is also provided by T-Systems International (drip tape) and transplant nurseries.