Irrigation Alternatives Lead to Reduced Water Use While Maintaining Crop Yields

SUSTAINABLE WATER USE FOR PROCESSING TOMATOES

By Stacie Clary, Western SARE

In an average year, California agriculture irrigates 9.6 million acres using roughly 34 million acre-feet of water (California Department of Water Resources, 2014). The conventional belief is that agriculture accounts for 80% of human water use in the state. Furrow irrigation is the principal irrigation method in California, representing about 50% of all irrigated acreage in the state. California's tomato growers, who produce more than 90% of the nation's processed tomatoes (those used for pastes, sauces, and canned tomato products) and nearly half of the world's total processed tomato tonnage (California Tomato Growers Association), rely on furrow irrigation, and according to UCCE it is the largest before-harvest cost of field operations in processing tomato production.

As competition for limited water increases, improving water-use efficiency will become ever more critical to farmers' long-term productivity.

University of California, Davis graduate student Felipe Barrios-Masias saw promise in alternative irrigation methods that could use less water but still produce high yields, leading to increased agricultural sustainability and efficiency. One such method is partial root drying (PRD). According to Barrios-Masias, at the time he received his Western SARE graduate student grant for Irrigation Alternatives for Sustainable Water Use of Processing Tomatoes, information was available on general crop physiological responses to the PRD technique, but strategies for reliable management needed to be tested for individual crops.

His findings were striking–farmers could use 25% less water while maintaining yields.

SEARCHING FOR A SOLUTION

To improve crop water economy, Barrios-Masias' project looked at using the PRD technique to reduce the amount of water supplied and increase crop water use efficiency (yield/water applied) on tomatoes. The trials evaluated yield and cultivar response to alternate furrow irrigation (irrigating every other furrow instead of all furrows). The project's specific objectives were to:

- Conduct an on-farm case study to obtain data on a typical soil water budget and cultivar responses with alternate furrow irrigation
- Evaluate water use and physiological, phonological, and morphological responses of different processing tomato cultivars to controlled full- or alternate-furrow irrigation regimes.
- Increase understanding of PRD and alternate furrow irrigation management among producers as a means of reducing total applied water, potential pollution, and production costs.

Campbell Research and Development was a project collaborator and they, along with the Jackson Lab at UC Davis, assisted Barrios-Masias in outreach to producers. Field trials were held at the Campbell Research and Development Station and also on four farms in adjacent fields with three different field types. Having such an industry partner helped the project because "they know tomatoes and they were interested in reducing their water use," says Louise Jackson, Barrio-Masias' major professor.

WHAT WAS LEARNED

Barrios-Masias was pleased with the results, saying he was surprised by how much reduction in water use they saw. The solid data demonstrated that increased water use efficiency is possible with water use reductions of at least 25% in on-farm trials, with no effect on yields and fruit quality. This reduction could help keep agricultural land in production providing food for people, especially in drought years.

Some tomato growers were previously using the irrigation technique to manage disease. Barrios-Masias presented the results from his project at tomato growers' meetings to good reception.

"It is apparent to me that processing tomatoes have a great potential to perform well under lower water availability. This is one of the main outcomes of the SARE project," says Barrios-Masias.

POST-PROJECT ACTIVITIES

Barrios-Masias and Jackson say that due to the potential shown by the research results and the data collected, they were able to leverage the SARE funds in the form of a specialty crop grant and expand to conduct more research.

Right after the project's completion, most growers did not think they had to implement the practice in regard to water use as they had access to water. However, now that California is facing a severe drought, with the data they have a choice; they can choose to plant less area or they can opt to reduce their water use. According to Jackson, "There was more use of alternate furrow irrigation last summer on furrow irrigated fields."

WESTERN SARE

The Sustainable Agriculture Research and Education program (SARE) is a program of the National Institute of Food and Agriculture, U.S. Department of Agriculture that functions through competitive grants conducted cooperatively by farmers, ranchers, researchers, and agricultural professionals to advance farm and ranch systems that are profitable, environmentally sound, and good for communities.

Western SARE annually awards grants to help sustain agriculture, the environment, and rural communities. Producers are actively involved in every funded project. In addition to involving farmers and ranchers at all levels of decision-making and encouraging on-farm research, Western SARE encourages projects that involve partnerships among scientists, landowners, Extension professionals, rural communities, and environmental interest groups. The Western region includes 13 states and four Pacific Island protectorates. It manages five grants programs:

- Research and Education
- Ag Professional + Producer
- Farmer/Rancher
- Professional Development
- Graduate Student

INFORMATION ABOUT THE GRANTS PROGRAMS AS WELL AS AN EXTENSIVE LEARNING CENTER AND SEARCHABLE DATABASE CAN BE FOUND AT **WESTERNSARE.ORG**.