Florida Citrus Advanced Technology Program

QUARTERLY & FINAL REPORTS: Control of Citrus Greening, Canker & Emerging Diseases of Citrus

Instructions Complete the fields based on your project specs. When finished, save the form to your local disk using a unique name. Then, go to **http://research.fcprac.com**, and log in with your user name and password using Researcher Login in the lower left. Find this project title and click on **Submit a Report**. Update your profile information if needed, then upload this report as directed.

2009-2010 REPORT	CATEGORY (drop-down)	TODAY'S DATE (m/d/yr)
◉ *Quarterly Report* ○ *Annual Report* ○ *Final*	Management	1/15/10

WHAT IS THE "HEADLINE" FOR THIS REPORT (e.g. a one-sentence "newspaper headline" describing what you accomplished)

Precision hoop sprayer saves up to 90% pesticide spray in young trees compared to broadcast spraying

TITLE and CONTACT INFORMATION

Proposal Title Advanced control system for variable rate application of fertilizer and pesticide to trees in the presence of greening and canker

Principal Investigator Arnold W. Schumann	*PI Last Name* Schumann
Email schumaw@ufl.edu	*FDACS Contract Number* 72358
Phone (863) 956-1151	*Project Duration (years)* 1 *Year of Project* 1
Organization University of Florida - CREC	*Total Direct Funds (current year)* $29,846

REPORT UPDATE (650 words; provide details about your headline)

The new variable rate controller continues to perform well in the approximately 50 units currently deployed in Florida citrus groves. Testing is continuing on the addition of a liquid crystal display, with the current focus being to implement all the user input and operation status functions via a single color touchscreen and rugged weatherproof enclosure. The elimination of all physical switches and pilot lights from the enclosure will increase the durability of the controller and make it easier to upgrade all of its functions by using virtual switches and status lights on the display.

We have completed tests on the latest range of ultrasonic and optical sensors with the variable rate controller in order to offer alternative sensor packages to the users. The different sensor beam widths and speeds now available could have advantages in different grove situations (e.g. bedded flatwoods versus ridge) and the controller should be able to accept an array of different sensors, including optical, ultrasonic and microwave (radar).

Effective systemic insecticides like imidacloprid have a labeled annual application rate limit of active ingredient (0.56 kg/ha) which constrains their application frequency to about 4.5 per year when broadcast with air-blast sprayers. Variable rate technology and band application can extend the efficacy of such rate-limited agrochemicals per planted hectare by precision placement of active ingredient only to the tree canopies. A sprayer used in young groves must have a very fast response speed because the tree canopies and adjacent spaces are small.
A precision row sprayer with a hoop-shaped boom was developed for young citrus, using the prototype variable rate control system. By using a fast solenoid valve (<0.2 s), the sprayer is capable of real-time pesticide flow control according to the presence of citrus tree canopies. The sprayer system consists of a WAAS GPS receiver, near-infrared diffuse reflectance optical sensors, electric solenoid valve and two embedded microcontrollers with synchronized look-ahead and adjustable buffering. Spray savings were estimated to exceed 90% in the first year, and average 50 to 75% by the time the trees become productive, thus allowing more efficient and flexible use of rate-limited pesticides and reducing production costs for greater profitability. A video of this sprayer is available at http://128.227.177.113/pa/Video.html

We are conducting research on finding ways to change the pesticide spray flow rate in real time instead of the simple on/off actions currently employed. In conjunction with sensor information about canopy density, the proportional flow control would allow customization of spray amounts as needed per unit of canopy and its condition. So far the stepper motor valves tested have shown potential for effective proportional flow control, with response times better than 0.5 s.