PROFILE:
ARNOLD SCHUMANN

Taking technology to the grove

By Ernie Neff

Jerry Mixon's use of netting to keep birds from blueberries helped pique his interest in growing citrus under protective screen (CUPS) to exclude HLB-spreading psyllids. But he credits University of Florida researcher Arnold Schumann with helping him bring his Polk County CUPS project to fruition.

The U.S. Department of Agriculture's November forecast for Florida's 2018–19 orange crop is 77 million boxes, 71 percent more than last season's 45 million boxes. Of these 77 million boxes of oranges, 32 million boxes are non-Valencia varieties, while 45 million boxes are Valencias.

"Arnold was immediately receptive to my many inquiries and allowed me to walk with him as he began the journey of how to make this concept … actually work," Mixon recalls. "I immediately began to incorporate his ideas in my plans for my own CUPS facility. As things progressed, Arnold was available and willing to visit my site."

"Needless to say, I would not be doing and planning more CUPS acres without Arnold's support and guidance," Mixon declares. He has 20 acres of CUPS planted; another 50 acres are under construction.

"Arnold has been a great teacher in areas of tree nutrition and maintaining optimum soil moisture levels," Mixon adds. "To date, the trees have responded extremely well."

GETTING STARTED IN SCIENCE

Schumann's CUPS journey started 8,432 miles from Lake Alfred in Durban, South Africa, his birthplace. He was in high school, he says, when "I realized I had a very strong interest in science, plants and animals." He volunteered to catch and release wild birds in scientific studies, raised tropical fish and got interested in hydroponic crop growing in his father's garden. Hydroponics is a key element of CUPS.

Schumann was the youngest of six siblings; two brothers became electronic engineers. Schumann also got heavily interested in electronics, which plays a major role in agricultural automation, including the frequent irrigation and nutrition occurring in CUPS.

After earning bachelor's and master's degrees in crop science and serving in the South African army, Schumann took a job with the Institute for Commercial Forestry Research. He did weed management research and Extension for sawtimber and pulpwood production.

In 1994, Schumann became a full-time soil science doctoral student at the University of Georgia (UGA). "The most significant thing that came out of that was I found my wife there," he says. Rhonda was working in the Soil Science Department at UGA and studying for her master's degree. The couple married two weeks after they both graduated.

Schumann started working at the South African Sugar Research Institute as a senior soil scientist in September 1997.

PRECISION AGRICULTURE

In February 2001, Schumann became a UF assistant professor of soil science at the CREC. His goal was to determine the causes of spatial variability in tree growth and performance. "Since early in 2001, I became very active in precision agriculture," he says.

Precision agriculture was made possible by the combined use of the global positioning system (GPS) and geographic information systems (GIS). GPS coupled with GIS allowed researchers and growers to see a wide array of soil characteristics, yield and other information for a small piece of land at any given time. They could correlate yields to numerous variables on virtually a tree-by-tree basis.

The precision agriculture tools showed Schumann that small changes in soil organic matter and sand particle coatings were impacting tree growth and performance. He learned that growers could reduce yield variability by using variable rate fertilizer (VRF). "Variable rate fertilizer turned out to be very successful for Florida citrus," he says. It allowed growers to avoid environmental impacts that came with over-fertilization. VRF also increased efficiency since growers could apply only as much nutrients as needed, accurately targeting the roots. Small trees got less fertilizer; large trees got more.

Based on his VRF research, Schumann in 2008 worked with UF and Chemical Containers to patent and license a variable rate controller, which was also modified to create a variable rate sprayer. "It's still being produced by Chemical Containers, and I've worked with them to improve it," he says. The widely used device saves growers as much as 50 percent on agrochemical costs, or millions of dollars a year statewide, he adds.

ACPS LED TO CUPS

Also in 2008, Schumann began a cooperative project with Gapway Groves in Auburndale on an advanced citrus production system (ACPS). The ACPS attempted to get early, sustainable citrus production in the face of HLB through the

The MacGyver of citrus

ACCORDING TO MICHAEL Rogers, director of the Citrus Research and Education Center, Arnold Schumann's nickname is MacGyver. "If you don't know the reference to the 1980s TV show, MacGyver was someone who could use whatever items he happened to have available, along with some ingenious ideas, to develop a solution to about any problem there was," explains Rogers. "That's exactly who Arnold is. Arnold can take a pile of old electronic components and in a few days have built whatever device he needs for his research."

Rogers recalls complaining to Schumann about a neighbor playing obnoxiously loud music from his garage across the street. "Arnold quickly described how he could easily build a device (costing less than $10) to block the radio signal at that house that would make things much quieter in my neighborhood," says Rogers. "But we decided not to go that route due to the legalities of doing so, but he said he could easily do it, and I don't doubt he could!"

use of high-density planting, advanced nutrition through hydroponics and the best rootstock choice.

The ACPS experiment started well but was abandoned after four years when the entire block became infected with HLB. The grove is still alive as a commercial block, but under standard grove management. "We got them (the trees) off to a running start," Schumann says. "Even though it wasn't 100 percent successful, we learned from that." All psyllids did not carry the HLB causal agent when the ACPS experiment started, but did four years later. "We saw that we *had* to stop the psyllids," Schumann says. That knowledge led him to CUPS.

In 2011, former CREC colleague Tim Spann invited Schumann to visit a California grower who was using ACPS principles to grow fresh citrus under screening. The setup was very similar to the CUPS that Schumann would later establish, except that the screen wasn't psyllid-proof because California didn't have HLB in groves. The grower was getting as much as 1,600 boxes per acre and averaging 1,000 boxes.

Schumann believes fresh red grapefruit growers using CUPS should be profitable long term, even though grapefruit has been one of the most difficult varieties to grow in the face of HLB.

Schumann knew he had to try something similar, but with psyllid-proof screen. Former UF researcher Barret Gruber constructed a CUPS at the Indian River Research and Education Center in 2013, a year before Schumann's CREC CUPS went up. The cost of constructing a CUPS is approximately $40,000 per acre.

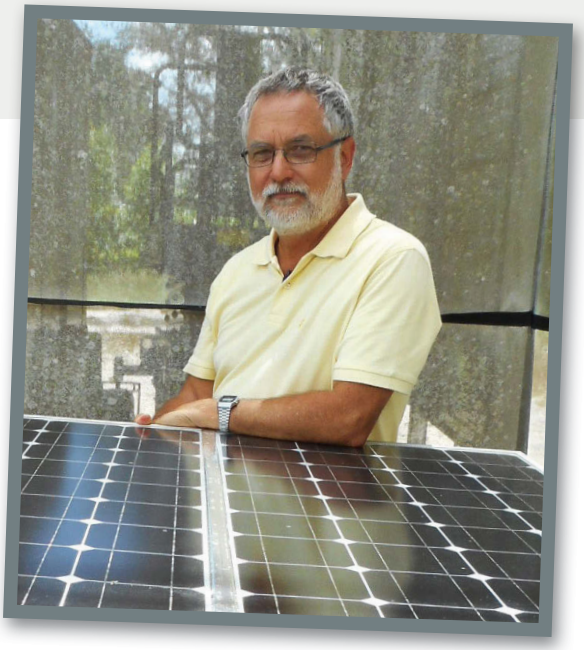
CUPS SUCCESS

After four years, only one psyllid has been found on a trap in the CREC CUPS; no HLB has been detected.

"The simplest and best pathway to successful fresh fruit production in CUPS has been red grapefruit," Schumann says. The grapefruit is one of 18 varieties grown in the project. Schumann reported at Citrus Expo in August that the red grapefruit produced 824 boxes per acre in year three. He predicts yields of more than 850 boxes in year four. Schumann believes fresh red grapefruit growers using CUPS should be profitable long term, even though grapefruit has been one of the most difficult varieties to grow in the face of HLB.

For use in the CREC CUPS, Schumann and his team have built a working remote-controlled spray machine and are developing a solar-powered, autonomous scouting machine.

Schumann believes his biggest contribution to the citrus industry has been providing "beneficial use of technology." He says technology has improved efficiencies, which leads to lower costs, higher yields and profits. Technology has also led to environmental protection, including improvement in best management practices, he says.



Arnold Schumann

BORN: Oct. 4, 1962, in Durban, South Africa

EDUCATION: Bachelor's (1985) and master's (1987) degrees in crop science from the University of Natal (now University of KwaZulu-Natal); doctorate (1997) in soil science from the University of Georgia

MILITARY: Compulsory South African army service, 1987–88; worked in military intelligence

PROFESSION: University of Florida Institute of Food and Agricultural Sciences professor of soil and water sciences, working at the Citrus Research and Education Center (CREC); also an adjunct professor at the Mechanical Engineering Department, Dalhousie University in Halifax, Nova Scotia

FAMILY: Wife Rhonda, a senior chemist at the CREC; stepdaughter Sylvia

HOBBIES: Wildlife photography, especially birds; growing vegetables hydroponically at home

NEW AMERICAN: Became a naturalized U.S. citizen in 2014

WHAT'S NEXT?

Schumann says it's "very tricky" to predict what research he might pursue next. "We're following a moving target — HLB," he says. "I can, with certainty, say I'll be working on HLB for years."

Mixon says Schumann has been "forward-thinking in topics such as the use of robotics in field scouting and pesticide application." Those developments, Mixon predicts, "will be work that down the road could provide great efficiency not only in CUPS but throughout the ag industry."