UF/IFAS CITRUS STATE

Artificial intelligence is strengthening citrus

By Scott Angle, jangle@ufl.edu, @IFAS_VP

Machines are great mules that have reduced the burden of hard human labor in the field. Now the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) is strengthening its expertise in how machines can take on a great deal more mind work for you and future generations.

Artificial intelligence (AI) doesn't replace a trained set of eyes or the complete picture of your operation that you know best. But we're on the brink of putting, as UF/IFAS professor Arnold Schumann says, "an expert in your hand."

You probably know Schumann best for his citrus under protective screen that has shown so much success in keeping out psyllids. Now he's working on a robot to patrol his screened-in experimental grove. Through AI, the robot learns how to spot insects, identify whether they're psyllids and quickly alert staff.

Photo courtesy of Arnold Schumann

Arnold Schumann's psyllid scouting vehicle seeks to attract, capture and identify flying insects in a "smart" trap.

WORKING SMARTER

He's also working on how to make your smartphone into an AI-powered diagnostic tool (that expert in your hand). His prototype can distinguish between HLB and other diseases with similar symptoms. It also identifies nutrient deficiencies, so you can fertilize accordingly.

If the past decade's most dramatic advances were in genetics and genomics, I see the coming decade as one characterized by leaps forward in AI. It has recently been reported that more data has been generated in just the last three years than all data previously generated. AI has the power to analyze and turn that data into decisions.

AI aims to boost your citrus intelligence. Schumann's tool doesn't just tell you what to do, it can help tell you why. It retrieves photos of classic symptoms you can compare to the tree in front of you, and it provides links to the relevant documents in the UF/IFAS Electronic Data Information Source library. That puts you in the driver's seat to ground-truth your smartphone's recommendations.

In addition to Schumann, a professor at the Citrus Research and Education Center (CREC), UF/IFAS scientists at the Gulf Coast and Indian River research and education centers are working toward AI-informed solutions to industry challenges. Yiannis Ampatzidis of the Southwest Florida Research and Education Center is developing an AI-driven Agroview system that can count tens of thousands of citrus trees at a time with 98 percent accuracy from a drone.

MAJOR INITIATIVE

We are already on the leading edge of agricultural applications of AI. We've long had one of the nation's top agricultural and biological engineering departments where much of this work is housed.

A recently announced $70 million campus-wide AI initiative will catapult UF/IFAS to greater achievement by bringing AI to bear on the challenges facing Florida agriculture. It will also

deploy AI across the curriculum, including that of the College of Agricultural and Life Sciences, to transform the future of the workforce.

The initiative is supported by a $25 million gift from UF alumnus Chris Malachowsky and $25 million in hardware, software, training and services from NVIDIA, the Silicon Valley-based technology company he cofounded and a world leader in AI and accelerated computing. UF is investing an additional $20 million in the initiative, which will create an AI-centric data center that houses the world's fastest AI supercomputer in higher education.

It's exciting to be in citrus at the dawn of an era in innovation that holds so much promise.

ERA OF INNOVATION

Innovation has always been essential to making you more efficient and competitive in global markets. AI, in my opinion, represents the next great iteration in this phenomenon that's been playing out at least since the founding of CREC more than a century ago.

AI banks the memories that matter most. Its memory retrieval system isn't cluttered by where it left its car keys or when the in-laws' birthdays are. Nor does it dedicate space to memories of the pre-HLB halcyon days. It's focused on the future, and that's why UF/IFAS is putting it to work to make that future as bright as possible.

It's exciting to be in citrus at the dawn of an era in innovation that holds so much promise. Our forefathers went through this, first with machinery like the tractor, then with crop improvement chemistry, then with genetics. It's incumbent upon us to write together the story our ancestors will tell about how AI was a game changer in the 2020s.

Scott Angle is the University of Florida's vice president for agriculture and natural resources and leader of UF/IFAS.

Peptide Holds Promise

By Rick Dantzler, CRDF chief operating officer

The day news broke in July that Hailing Jin of the University of California, Riverside had discovered a gene associated with disease resistance in finger limes that had inhibited *Liberibacter crescens*, a relative of *C*Las that can be grown in culture, I contacted her. We arranged a conference call that week between Pat Ouimet, chair of the Citrus Research and Development Foundation (CRDF) Research Management Committee and Bill Dawson, an expert in peptides who CRDF had just brought on to help us in exactly these kinds of matters.

We learned several encouraging things from Jin. First, though, what is it that she has discovered?

Jin was studying how the gene sequence of the finger lime, a citrus variety which has shown tolerance to HLB, differed from the gene sequence of citrus varieties susceptible to HLB. She noticed that a gene associated with resistance in finger lime had only a partial protein — called a peptide — and not a completely intact protein. This anomaly caused her to wonder if it was this peptide that was inhibiting *Liberibacter crescens* (not *C*Las). Consequently, she tested this peptide against *Liberibacter crescens*, and sure enough, it inhibited its growth. She then tested the peptide against potatoes that had been infected with the potato liberibacter, and it greatly inhibited the growth of that bacterium as well.

Next came tests on citrus infected with HLB. Since HLB is not in commercial citrus groves in California, Jin had only plants in a biocontainment facility to work with, which were few. She inoculated the plants with the peptide, which resulted in symptomless plants with no *C*Las. Jin says her data suggest the peptide works in two ways: by directly reducing the bacteria and by inducing increased resistance in infected plants.

She has already produced the peptide, an important step in scaling up any naturally occurring compound for commercial use. The peptide also appears to directly kill the bacterium and not just reduce the plant's resistance, another benefit. Finally, the road to Environmental Protection Agency registration should be relatively quick because the peptide comes from a naturally occurring product that humans have been consuming for hundreds of years.

A week later, we had a second conference call, this time with more scientists, to determine what needed to be done to get to the bottom of what Jin had discovered and if CRDF could help. The game plan is still evolving, but Megan Dewdney (University of Florida Institute of Food and Agricultural Sciences) and Greg McCollum (U.S. Department of Agriculture Agricultural Research Service) are working with Jin. Next steps will include applying the peptide to HLB-infected Hamlin trees of fruit-bearing age to see if it has therapeutic value and further testing the peptide on greenhouse trees and other dependable assays.

Are there reasons to be cautious? Yes. The peptide has been tested on relatively few citrus plants, and there is still a lot to learn. Also, field trials in commercial environments have yet to be conducted. Nevertheless, it is encouraging.

CRDF Grower Dollars at work for you

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