

# Study helps researchers better estimate citrus crop yields

January 28 2014, by Brad Buck

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Citrus crop-yield estimates may be more accurate, thus ensuring higher productivity and more revenue, if an algorithm proves as successful as it did in a recent University of Florida study.

Wonsuk "Daniel" Lee's study, published in the January issue of the journal *Biosystems Engineering*, could eventually help Florida's \$9 billion-a-year citrus industry.

Lee, a UF agricultural and biological engineering professor, used an algorithm to find immature citrus in photos taken under different light conditions and fruit that was hidden by leaves and branches. He and his colleagues found 80 percent of the immature fruit.

The accuracy rate means growers can use the model to know well before harvest how much fruit is on their trees, Lee said. Therefore, they can more easily plan harvesting, predict crop yields and possibly make more money, he said.

Harvesting accounts for about 30 percent of the cost of citrus production, Lee said. With Lee's system, growers can determine the optimal time to harvest much earlier, he said.

Traditionally, growers have estimated [crop yields](#) on the number of boxes they believe their mature [citrus trees](#) can produce, based on years of experience examining their groves, Lee said. The U.S. Department of Agriculture also publishes a monthly crop yield estimate, based on

examining tree sizes at select locations around the state and then gauging the number of fruit each branch is expected to yield.

"This gives growers a more accurate rate than just guessing," Lee said, although he noted that his method isn't yet ready to be used to estimate yield for an entire grove. But when that day comes, he said, growers will benefit: "If you know the exact yield, you can predict the price."

Traditionally, growers manage groves in units of varying acres. Growers harvest more citrus in some parts of their groves than others possibly because of differences in soil from one acre to another, water or disease, Lee said.

The study, co-authored by UF computer and information sciences doctoral student Subhajit Sengupta, details the yield-estimation method, which may also someday help growers identify the least productive parts of their groves so they can find out why.

"You have to find the cause of those and correct those so you can increase yield and profit, eventually," he said.

Using a [digital camera](#), two of Lee's former students took 240 photos of fruit from a research grove at UF's Institute of Food and Agricultural Sciences on the Gainesville campus. Because of the scope of the study, these are preliminary findings, Lee said, but they hold promise for growers seeking to boost the accuracy of their crop-yield estimates.

The findings are part of Lee's research goal of developing an electronic system that can "see" and count fruit, a concept called machine vision.

The system includes a digital camera, a portable computer, GPS receiver and software designed by Lee and his graduate students. Ultimately, growers would like a machine that drives itself through groves, but

researchers aren't there yet, Lee said.

In smaller groves, it's possible to photograph every tree, Lee said. But for those that span thousands of acres, operators would photograph trees in representative parts of the grove and use the results to make projections.

For now, Lee said, he and one of his graduate students are working on developing the self-running machine vision system that growers want.

Provided by University of Florida

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