UC Cooperative Extension advisor provides first-of-its-kind avocado irrigation data

Study findings from Southern California avocado orchards help growers save water and money.

by Michael Hsu

Perched precariously on the steep hillside of an avocado orchard in San Diego County, Ali Montazar began to form a theory as to why there are so few studies of irrigation for avocados.

"Perhaps no one likes to do research on a nearly 45% slope and erect 30-foot-high towers to collect data from sensors above the canopy!" said Montazar, University of California Cooperative Extension irrigation and water management advisor for Riverside, San Diego and Imperial counties. "But if you're on flat land looking at almonds or pistachios, everyone is happy to do such research there."

Despite the ruggedness of the terrain (avocados are often planted on hillsides in California production systems), Montazar persisted in advancing his groundbreaking research to optimize irrigation for Hass avocado trees. California is the #1 state in the United States in avocado production, with the crop valued at more than $523 million, according to recent statistics.

A researcher with the California Avocado Commission (CAC), one of the primary funders of this project, was certainly glad Montazar finished his work unscathed.

"Water for avocado is the single biggest input, dollar-wise, that growers have — it tops harvest costs; it tops fertilizer costs," said Tim Spann, a CAC research consultant who was formerly the director of the CAC research program. "Ensuring that growers are putting out irrigation at optimal rates goes directly to their bottom line."

The need for efficient and effective irrigation scheduling is especially acute in Southern California, where most of the state's avocados are grown.

"This region is under pressure due to a variety of water issues, facing uncertain water supplies, mandatory reductions in water use and rising costs of water," said Montazar, noting that San Diego County has some of the highest water costs in the nation.

Instruments measured high frequency temperature and net radiation above the experimental sites at avocado orchards across Southern California. *Photo:* Ali Montazar.

Data-based crop coefficients crucial for determining water needs

Crop coefficients are numbers used to calculate the amount of water a particular crop needs, given a variety of environmental and plant factors. Noting that as much as 50% of an avocado grower's production costs go to irrigation, Montazar set out to develop more reliable crop coefficients for avocado, based on real-world data.

"This is huge; we have never had a project like this conducted for avocados in California," Spann said. "The crop coefficient we used previously was developed out of a salinity project done 20-plus years ago."

Because avocado growers had been using that roughly estimated crop coefficient (as well as coefficients borrowed from citrus), Montazar sought to calculate "true" crop coefficients by measuring actual evapotranspiration from orchards across California's avocado-growing regions.

For three years, Montazar and his team collected data from sites scattered across the four counties where avocados are primarily grown: Riverside, San Diego, Orange and Ventura.

"We used cutting-edge remote sensing technology and ground-based data for this research, which had never been used for avocados at this scale," Montazar added.

The scientists found that the actual evapotranspiration numbers — and therefore the crop coefficients — varied widely based on site-specific conditions and factors such as slope and row orientation, soil type and condition, canopy size and management, age of orchard and seasonal changes.

"Growers can rely on these numbers, because they come from their practices and may represent a wide range of site and environment features," Montazar said. "We conducted this study in 12 different commercial sites in actual cropping systems."

Montazar and Spann both observed that, in general, growers were likely overwatering during certain times of year.

"Overall, the biggest surprise was that Ali has shown we actually need less water than what most of us had previously thought — which is definitely a good thing," Spann said. "Even if growers don't fully utilize this information that he's produced, we can still communicate with them that: 'Look, our old information that we were providing you — that avocados need about three acre-feet per year — is probably on the high side. At the very least, dial it back 10% or something like that.'"

Scientists share research, develop tools to aid growers

Montazar said that he is developing crop-coefficient curves and user-friendly tools that growers can refer to — factoring in those variables such as growing region, crop canopy and topography features, and soil types and conditions — and thus determine more precisely the optimal amount of water to apply.

He also said the newly developed crop coefficients will be plugged into an existing irrigation calculator, and have also been used to verify the satellite data-based models available to growers through OpenET.

In addition, Montazar and his colleagues have been sharing the results of the research in the California Avocado Commission newsletter, which goes to 4,000 growers, at CAC meetings, and during more than 10 in-person field days, workshops and webinars. The results also have been presented at several international and national conferences.

"The avocado community has been very supportive," Montazar said. "Maybe it's because of the high water-costs in this region, and the fact that this information is an immediate need for water-efficiency enhancement in avocados. Avocado growers are very interested in adopting technology and any improvement in irrigation management; I observed a strong eagerness for these results, which I find very encouraging."

In turn, Spann said avocado growers have been immensely appreciative of Montazar's attention to this much-needed area of study.

"When he reached out, it was wonderful — we've never really had someone with his level of expertise, specifically on irrigation, working on avocados like this," Spann explained. "It's always nice to work with farm advisors, who don't have the additional burdens of teaching and having students and so forth — they can really dedicate themselves to a project. They're truly interested in helping the grower."

Sensors mounted on towers high above the avocado orchard canopy were crucial in collecting real-world data for more precise crop coefficients. *Photo:* Ali Montazar.

And, based on those conversations with growers, Montazar is already formulating his next research project — quantifying, at several sites, the actual effects on avocado yield of following his new crop coefficients to apply irrigation water.

The avocado crop coefficient paper can be found at https://doi.org/10.1016/j.agwat.2025.109481. The project was also supported by the California Department of Food and Agriculture Specialty Crop Block Grant Program.

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