Jack Kelly Clark

Taste tests help Kearney researchers to evaluate consumer preferences.

"Farm to palate" postharvest research ensures high-quality produce

Scientific support for fruit production at the UC Kearney Research and Extension Center (KREC) doesn't stop when the plants are harvested. Consumer demand for quality fruit at grocery stores has increased interest in the highly technical scientific field of postharvest research, which focuses on fruit packaging, handling and transportation.

"After biting into a mealy or off-flavor peach, consumers won't likely buy any more," says Kearney postharvest scientist Carlos Crisosto. "We can improve the eating experience by carefully managing the peach's journey from the farm to the consumer's palate. That expands and strengthens the market for fresh fruit."

For more information

KAC Fresh Fruit Postharvest Information: www.uckac.edu/uckac/research

At Kearney, the postharvest program accelerated in 1992 when a donation from local stone-fruit grower LeRoy Giannini allowed for the construction of a 9,566-square-foot research facility. The building was named the F. Gordon Mitchell Post Harvest Center in honor of the namesake's extensive contributions to postharvest science. Mitchell, a UC Davis pomologist, retired in 1992.

Two postharvest research scientists are headquartered at the Kearney center, UC Davis pomologist Crisosto and UC Riverside subtropical horticulturist Mary Lu Arpaia. In addition, a wide variety of off-site UC scientists make use of the state-of-the-art facilities, which include 21 walk-in and four reach-in fruit storage chambers, and small-scale processing equipment that duplicates the standard industry machinery.

Protecting fruit flavor. Crisosto focuses on stone fruit, kiwifruit and table grapes (see page 103). With the peach industry, he is addressing the fact that peach consumption in the United States has remained unchanged over the last decade. In surveys, consumers misunderstood the difference between "mature" and "ripe" peaches, and were turned off by lack of flavor, flesh browning and mealiness.

In collaboration with UC Cooperative Extension farm advisors Kevin Day and Harry Andris and pomologist R. Scott Johnson, Crisosto has looked at fertilization, irrigation, bruising thresholds, storage temperature, handling, packing materials, contamination and other factors that can make fruit less attractive or palatable.

Their research has resulted in the development of a preconditioning protocol for shippers and a ripening protocol for receivers. The researchers went still further, educating supermarket fruit handlers on how to protect fruit flavor. "The establishment of this new delivery system is giving excellent results. Fruit are moving faster and a premium has been paid for preconditioned fruit," Crisosto says.

In kiwifruit, Crisosto has developed ripening protocols and bin storage techniques. He determined optimum maturity time and which packing materials deliver the fruit to the store with less shrivel and pitting. Crisosto and Kearney-based plant pathologist Themis Michailides developed a curing treatment for kiwifruit to reduce the incidence of the fungal disease botrytis.

Farming practices and postharvest quality. Arpaia's focus is on citrus and avocado. She and her staff continue to collaborate with other citrus researchers to gauge how farming practices influence postharvest quality. For example, they are just completing a multiyear project with two UC Riverside entomologists and one plant physiologist examining the impact of glassy-winged sharpshooter on the postharvest quality of navel and Valencia oranges. Arpaia's group has also collaborated on projects evaluating the impact of fertilization and irrigation practices. Recently, she and her colleagues conducted taste testing to determine the minimum maturity level for navel orange harvest.

That work comes on the heels of a successful multiyear project that determined the ideal time for avocado growers to harvest their crop. "We came up with a way to measure dry weight before ripening and then linked that back to how well people enjoyed eating the fruit," Arpaia says.

With information from the project, Arpaia has established minimum maturity standards for the new varieties of avocados that have been released by UC.

Consumer acceptance. An extensive fresh-fruit sensory program was developed over the last 9 years by Gayle Crisosto, postharvest staff research associate. She has conducted taste and appearance tests on crops such as peaches, plums, nectarines, table grapes, cherries and kiwifruit. Crisosto has worked with American consumers and native Japanese tourists to test their acceptance of early-harvested Bing cherries at different levels of maturity. The Japanese consumers were satisfied with lower maturity than the American consumers. "This

shows that fruit preferences in Asia are different than those in the United States," Crisosto says.

Similar work was carried out with 400 American and 250 native Chinese consumers to determine the two ethnic groups' acceptance of 'Redglobe' table grapes at different maturity levels.

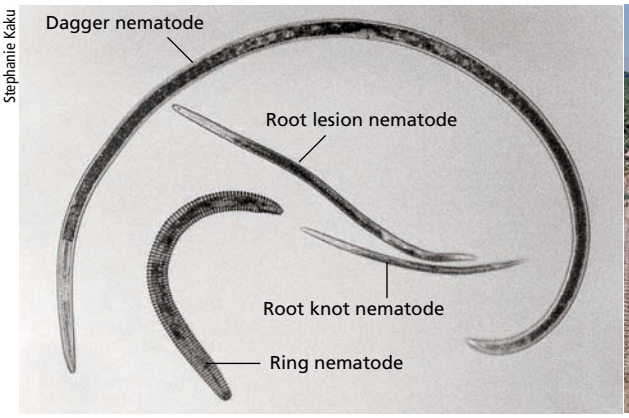
At Kearney, Crisosto conducts fruit tasting tests with panels drawn from staff who have been screened for their taste acuity and trained for a specific test. "Most of the panelists enjoy it," she says. "They get a break from their work and they know they are making a positive contribution to the furtherance of our scientific knowledge of fruit quality."

Managing fungal diseases. UC Riverside plant pathologist Jim Adaskaveg is leading postharvest pathology research on stone fruit, pome fruit, kiwifruit, pomegranates and citrus. Recently, he initiated a citrus incubation program at the postharvest center that protects the Korean market for the California citrus industry. In 2003, Korea closed its market to California oranges after detecting the fungal disease Septoria spot. After negotiation and study, Adaskaveg and his team, working with the citrus industry and the U.S. Department of Agriculture, arrived at a plan. The team collects and incubates fruit samples at the center, then assesses them 20 days later for Septoria spot. Fruit positive for the disease are identified and photographed, and the results are provided to the packinghouses. This program was in part responsible for maintaining the $100 million citrus trade between the two countries.

For other crops, Adaskaveg and his team have developed several new reduced-risk postharvest fungicides. They are evaluating new application strategies to improve disease control (see page 109) and have identified diseases like sour rot that have recently become more of a problem for the stone fruit industry.

Ultimately, all the scientists working on postharvest studies at KREC share the same goal, Gayle Crisosto says. "We want to consistently provide good-tasting fruit to the consumer so they'll come back for more." — *Jeannette Warnert*

Stephanie Kaku



A variety of plant parasitic nematodes can sap nutrients from the roots of trees, vines and field crops.

Michael V. McKenry

Vines stunted by root knot nematodes.

After years of hosting an orchard or vineyard, nematodes will have colonized and reproduced to levels that would put a new planting in grave danger.

UC nematologists battle tiny underground pests

Nematodes are the most numerous multicell animals on earth. One cup of soil can contain thousands of the tiny worms. Some are beneficial, but many cause significant damage to agricultural crops.

"You can see insects, and diseases often cause visible symptoms," says Philip Roberts, a UC Riverside nematologist. "The underground feeding of nematodes can be just as harmful, but it is much more difficult to detect."

Roberts and UC Riverside nematologist Mike McKenry, who is based at the UC Kearney Research and Extension Center, preside over a specialized program that offers pest management professionals and growers the latest information on nematode problems and solutions. Their work is particularly important due to past and upcoming bans on chemicals that have traditionally been used to rid soils of nematodes before planting, such as DBCP and methyl bromide.

Perennial crops. As part of his focus on perennial crops, McKenry has pursued "chemigation" as an alternative to preplant methyl bromide soil fumigations. McKenry has developed methods and equipment that use water to carry low-fuming biocides (with short half-lives), 5 feet deep. Large volumes of water can also prevent biocides from escaping at the field surface. By 1991, he demonstrated that in highly porous soils, chemigation with biocides such as metam sodium could provide nematode control equivalent to that of methyl bromide. "Today, new products and equipment for preplant chemigation are plentiful," McKenry says.

A promising new natural treatment for nematodes