

Protecting Fruit Trees, Helping a Rural Economy

Most of California's rural economy relies on agricultural production, an \$18 billion industry annually. One in 10 California residents is employed in agriculture, from farm to market.

Income from tree fruits contributes substantially to many communities. Just one—peaches—yields \$100 million in annual income and accounts for more than half the total U.S. annual production—some 1,700 million pounds, out of 2,600 million.

Plant diseases can raise havoc with tree fruit crops. Yield and grower income would be significantly reduced if it weren't for research by Agricultural Research Service scientists.

ARS plant pathologist Jerry K. Uyemoto and coworkers at the University of California-Davis, are helping the cling peach industry to ensure that new peach trees are virus-tested and used to establish new orchards. Under ideal circumstances, these trees will continue to be high producers for 18 to 25 years.

Peach ringspot disease, caused by *Prunus* necrotic ringspot virus (PNRSV), has probably been a problem ever since peach trees were first planted in California, around the turn of the century. The virus is easily spread by using infected seedlings as rootstock, by grafting buds from infected trees, and even by infected pollen. PNRSV is hard to detect visually because the leaves usually look normal, unlike some other viral diseases. Its presence is reflected in decreased yields.

Between the mid-1950's and early 1960's, methods were developed to help growers avoid the virus—although it wasn't easy. Most relied on heat therapy to eliminate the virus from propagated material.

Potted trees were heated to 103°F for 10 to 30 days. That allowed new shoots to grow away from virus-infected portions. The new shoots were clipped and grown, then retested. Those that proved to be virus-free were used as new plantings.

Despite the expense of the procedure and up to 8 weeks to complete it, just about every major peach grower in California planted these certified trees. However, because of difficult economic times of the late 1970's and early 1980's, many growers sought cheaper, noncertified tree stock. And, because some

“While older identification techniques could only be done during the summer and took at least 30 days to complete, ELISA takes only a day and can be performed in spring, before buds are collected for grafting,” he says.

In 1988, the California Department of Food and Agriculture began a screening program using this technology. Samples from some 20,000 *Prunus* trees that nurseries use as sources of budwood and seed are tested each year for PNRSV and another virus called prune dwarf virus (PDV).

“The ELISA testing program has provided a very valuable tool to nurseries,” says Robert Woolley, chairman of the California Fruit Tree, Nut Tree, and Grapevine Improvement Advisory Board.

“Nurseries can efficiently screen hundreds of trees early in the growing season, before collecting budwood or seed, making it easier to prevent propagation of virus-infected trees,” he adds. Woolley is owner of Dave Wilson Nursery in Hickman, California, a small community about 20 miles east of Modesto, in the San Joaquin Valley.

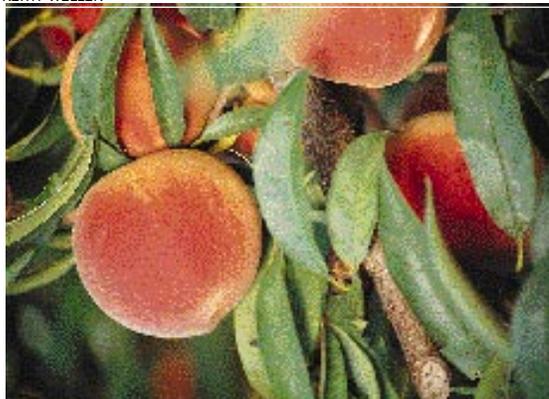
But not all growers are buying certified virus-free stock.

“They should be,” says Uyemoto, who conducted a survey in 1988 to learn the extent of the disease. It showed that, depending on peach tree age, the incidence of PNRSV ranged from about 11 to 49 percent.

“Based on an average yield of 20 tons of peaches per acre, growers lost more than 3-1/2 tons per acre. That translates into a loss of \$720 per acre, assuming the crop sells for \$200 a ton,” says Uyemoto.

He adds that the loss is actually more than that, since growers have fixed production costs per acre. They

KEITH WELLER



(K4956-6)

growers had diseased trees that seemed to be economical, the industry pretty much ignored the problem.

Then, Uyemoto was hired by ARS in October 1986 to investigate virus diseases of the *Prunus* species, which includes almond, peach, cherry, and prune. He developed diagnostic tools such as one using ELISA (enzyme-linked immunosorbent assay) to spot infections.

“These tools are quick and very sensitive to the numerous virus strains that cause mild to severe damage to trees,” says Uyemoto, who is in the ARS Crops Pathology and Genetics Research Unit at Davis.

must spend the same on water, fertilizer, equipment, labor, and mortgage per acre—regardless of yield.

“A previous survey showed that many newly planted trees were infected with ringspot virus. Although these viruses can be carried by pollen, the new trees were presumably infected before planting,” says Uyemoto.

Losses mount when ringspot is present along with prune dwarf. The resulting disease complex is known as peach stunt, and yield losses can be two to three times those from ringspot alone. There is no cure for an infected orchard tree.

While it’s impossible to prevent necrotic ringspot virus from moving from a diseased orchard to a healthy one, it’s more likely to spread from infected trees within an orchard. That’s why it’s so important to detect infected trees as early as possible, so they can be removed.

“The ELISA program has reduced the incidence of viruses in recent plantings of peaches,” says Uyemoto.

“A survey in April 1992 showed that among ELISA-tested nursery stock, only 2 peach trees tested positive to PDV and 3 to ringspot—out of 210 tested. This is quite a contrast to the 25 percent we found in 1987,” he says.

“Certain varieties that we grow—especially the Carson cling peach—are more susceptible than others, and we use certified stock,” says John Starn. He cultivates 200 acres of peaches near Hughson, California, just south of Modesto.

Starn says that the ARS research has benefited everyone; nurseries have happier customers, and growers have healthier trees. “It increased everyone’s awareness of the problem,” he adds.

Cherry Management Improved

Cherry production brings in from \$20 to \$60 million annually to California growers.

Uyemoto’s research is also helping the cherry industry.

Buckskin disease of sweet cherry trees cannot be eradicated but can be controlled to keep growers in business. The disease is so named because cherries are small and turn buckskin color rather than their normal deep purple.

“It’s a fickle disease. Some growers experience catastrophic losses; their whole orchards die

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within 2 or 3 years, while other growers are unaffected,” says Uyemoto. “Now, all orchards can be protected.

“Buckskin disease, also called X-disease, is caused by a micro-organism that is carried from infected trees to new victims by mountain leafhoppers, *Colladonus montanus*, and by Flor’s leafhoppers, *Fieberiella florii*.”

Uyemoto was a member of a team that developed several steps over the past 20 years that growers can take to keep their orchards in peak production. The steps focus on close insect monitoring and control, along with prompt removal of infected trees.

Researchers studied orchards in El Dorado County, east of Sacramento. Uyemoto says one grower followed the recommendations and confined the disease to an average infestation rate of 3 percent in his orchard during a 6-year period. Another grower, who ignored the problem, saw more than 60 percent of his orchard infected over a 5-year period.

The management program is cost effective too, according to Joseph A. Grant, farm adviser for San Joaquin County in Stockton, California. He calculates direct loss to his county’s growers would run more than \$2 million each year. But with insect control and tree removal on about 80 percent of the county’s 7,100 acres of cherry trees, that loss is reduced by two-thirds, for an annual benefit of almost \$1.4 million. Insect control costs run about \$70 per acre.

In collaboration with colleague Bruce Kirkpatrick at the University of California at Davis, Uyemoto’s latest research focuses on developing more sensitive tests to better identify the disease-causing organism.

A test called PCR—polymerase chain reaction—is more accurate and may put the finger on additional plants that serve as reservoirs for the X-disease organism.

In developing cherry tree recommendations, ARS also worked closely with the California Cherry Advisory Board. ARS research on peaches was supported by the California Cling Peach Advisory Board.—By **Dennis Senft**, ARS.

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