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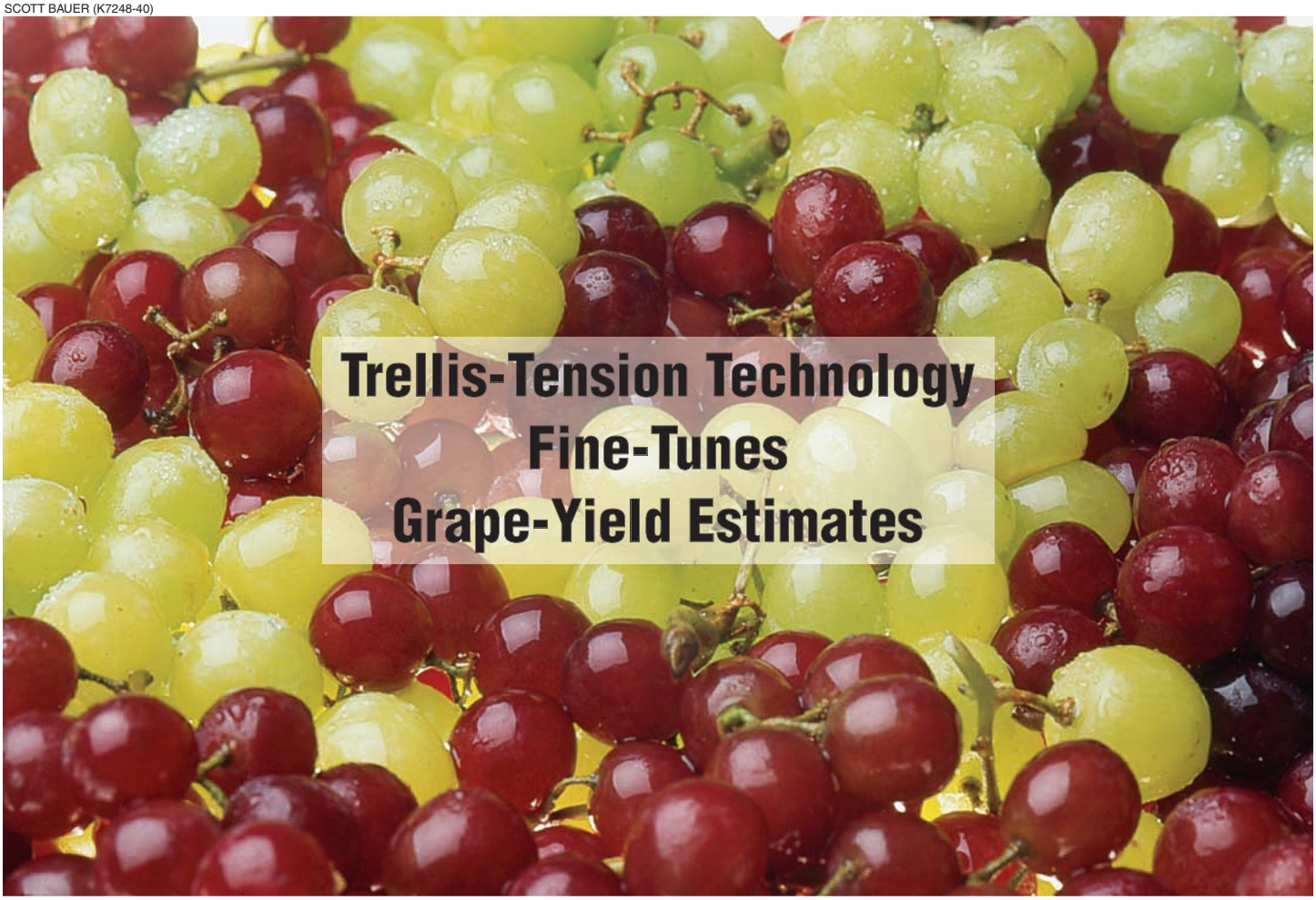


Trellis-Tension Technology Fine-Tunes Grape-Yield Estimates

For Julie Tarara, a day at the office can actually be quite pleasant. That's because the ARS horticulturist's work often takes her to the scenic vineyards of Washington's Yakima Valley, in the south-central portion of the state.

There, along with ARS colleagues Paul E. Blom and John C. Ferguson, Tarara is field-testing an automated system for estimating grape yields. The system is based on tension changes in trellis wire that supports the vines.

The idea is to help growers and processors keep closer tabs on how crop yield is shaping up before harvest so they can adjust their pruning, watering, picking, or juice-making operations accordingly.

Predictions: The Earlier, The Better

"With reliable yield prediction earlier during the growing season, managers may decide to thin a crop or adjust their irrigation schedule," explains Tarara, with ARS's Horticultural Crops Research Unit in Prosser, Washington. Conversely, "If a processor or winery has an accurate estimate in advance of harvest, they can schedule their picking times and run their operations more efficiently."

Currently, yield estimates are based on counting the number of grape (or "berry") clusters on sample or "sentinel" vines, followed by counting and weighing individual berries. This is usually done 60 days after the vines flower and again 85 days after that bloom. The averages are then compared to records from seasons past for estimating the current crop's likely yield.

"The traditional hand-sampling method provides a snapshot of the crop at one or two points during the season. But it doesn't provide any information about what happens between sampling dates," notes Tarara.

Traditional Way's Other Drawbacks

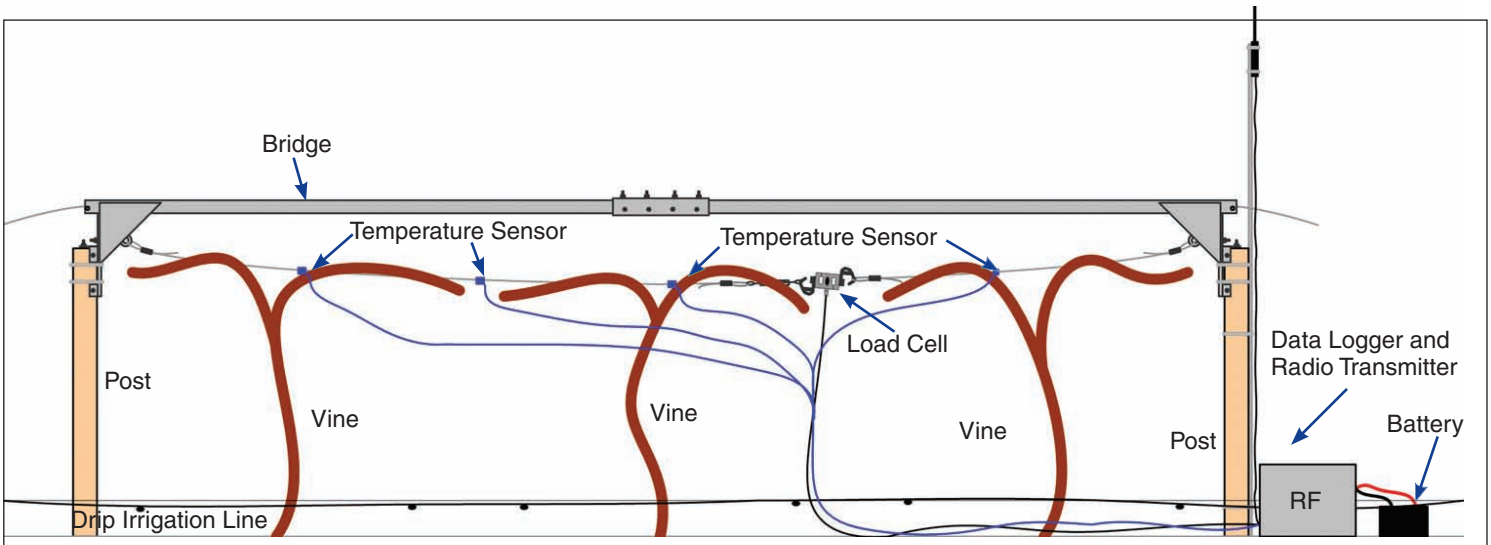
The traditional method is also labor-intensive, time-consuming, and sometimes imprecise. The latter can be costly if, for example, a winery acts on an inflated yield estimate and orders more barrels than is necessary. The pain of that mistake is in the price tag: a new American oak barrel starts at around $300, while a new French oak one costs around $600 to $800.

"The trellis crop monitor we're developing provides information nearly continuously; one can see the actual growth curve of the vine and fruit, which allows calculation of growth rates, visual confirmation that berry size is increasing as expected, and immediate feedback on management practices or weather events that might decrease the crop," says Tarara.

Value of Vineyard Electronics

The monitoring system uses a device called a "load cell" to detect increases in the tension of trellis wire as clusters form and berries enlarge. Another device—a data logger—records wire-tension signals every 10 seconds and formulates an average value every 15 minutes.

Trellis-wire tension caused by wind gusts, perching birds, and even the wire's



Tension on vineyard trellis wires increases as vines yield heavy clusters of ripening grapes. An innovative trellis-tension-monitoring system uses electronic load cells to detect trellis tension changes. Those measures, recorded by a data logger, can be transmitted via radio telemetry to a computer equipped with unique software that translates the measurements into estimates of grape harvest.

natural expansion and contraction as the temperature changes is factored out of the averages.

"Currently, we download the information from the data logger, either through a laptop connection or via radio telemetry," says Tarara. The raw data are then inspected for anomalies, cleaned, and submitted to a software package for processing. In a later step, computer modeling uses season-long values representing the wire-tension changes to predict the likely grape yield.

"When this technology moves out of the research arena and into commercial practice, the data collection—and most of the data processing—will be automated," notes Tarara.

The year 2004 marked the first test run of the monitoring system in commercial vineyards. Tarara first began working on the automated system in 2001 with Ferguson, an electronics technician, and Blom, a postdoctoral biologist—both with ARS in Prosser—and Francis J. Pierce, the director of Washington State University's Center for Precision Agricultural Systems.

Research Role for Sentinel Vines

For those tests, they installed the system in 10 Concord juice-grape vineyards where hand-counts of clusters from nearby sentinel vines could be used for comparison. In spring 2005, they expanded the tests to a small wine vineyard of Merlot grapes managed by WSU's extension center in Prosser. This enabled Tarara's team to try the system on a different trellis configuration and with a lower-yielding wine crop than the juice-grape vineyards.

Data validating the system's yield predictions are forthcoming. Tarara is working with Mercy A. Olmstead at Washington State University "to design and post plots from our experimental sites on her extension viticulture website." It's at www.fruit.wsu.edu/grapeweb/cropload.htm.

"When the technology becomes commercialized," adds Tarara, "I could envision an agricultural service or consulting company maintaining Web postings for individual wineries, processors, or growers."

The Pacific Northwest grape industry is an expanding one, she points out, with acreage increasing in all three states there: Washington, Idaho, and Oregon. Her team's trellis research complements a broader viticulture program at Prosser. The improved vineyard practices and mechanized operations—such as the trellis-tension-measuring technology—will help the region's growers tap into a greater share of the domestic and world grape markets.—By **Jan Suszkiw,** ARS.

This research is part of Crop Production and Protection, an ARS National Program (#305) described on the World Wide Web at www.nps.ars.usda.gov.

For more information on U.S. Patent No. 6,854,337, contact Julie M. Tarara, who is in the USDA-ARS Horticultural Crops Research Unit, 24106 N. Bunn Rd., Prosser, WA 99350; phone (509) 786-9392, fax (509) 786-9277, e-mail jtarara@wsu.edu. ✷