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## Robots may become essential on US farms

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LOS ANGELES --

With authorities promising tighter borders, some farmers who rely on immigrant labor are eyeing an emerging generation of fruit-picking robots and high-tech tractors to do everything from pluck premium wine grapes to clean and core lettuce.

Such machines, now in various stages of development, could become essential for harvesting delicate fruits and vegetables that are still picked by hand.

"If we want to maintain our current agriculture here in California, that's where mechanization comes in," said Jack King, national affairs manager for the California Farm Bureau.

California harvests about half the nation's fruits, nuts and vegetables, according to the state Food and Agriculture Department. The California Farm Bureau Federation estimates that the job requires about 225,000 workers year-round and double that during the peak summer season.

More than half of all farm workers in the country are illegal immigrants, according to U.S. Department of Labor statistics.

Last year, amid heightened immigration enforcement, California's seasonal migration was marked by spot worker shortages, and some fruit was left to rot in the fields.

"There's a lot of very nervous people out there in agriculture in terms of what's going to be available in the labor force," said Robert Wample, viticulture and enology program director at California State University, Fresno.

Mechanized picking wouldn't be new for some California crops such as canning tomatoes, low-grade wine grapes and nuts.

But the fresh produce that dominates the state's agricultural output - and that consumers expect to find unblemished in supermarkets - is too fragile to be picked by the machines now in use.

The new pickers rely on advances in computing power and hydraulics that can make robotic limbs and digits operate with near-human sensitivity. Modern imaging technology also enables the machines to recognize and sort fruits and vegetables of varying qualities.

"The technology is maturing just at the right time to allow us to do this kind of work economically," said Derek Morikawa, whose San Diego-based Vision Robotics has been working with the California Citrus Research Board and Washington State Apple Commission to develop a fruit picker.

The process involves sending a mechanized scanning unit into orchards and orange groves. Equipped with digital-imaging technology, it creates a three-dimensional map displaying the location, ripeness and quality of fruit. A robotic picker then follows the maps, using its long mechanical arms to carefully pluck the ripe produce.

A prototype was tested last month, but it is still a few years from being ready for widespread commercial use, said Ted Batkin, a grower and president of the citrus board.

A set of scanning and harvesting units will likely cost about \$500,000 when the equipment reaches market, Morikawa said.

Elsewhere, a team led by wine specialists at California State University, Fresno, is working on an automated picker to further mechanize the wine-grape business.

Growers of low- and mid-grade wine grapes already use mechanical harvesters, but picking and sorting premium grapes still requires a human touch.

The new technology includes a device called a near-infrared spectrometer, which measures the sugar levels and chemical content of grape samples before they are picked, Wample said. The data is then plotted to a global positioning system map, which a mechanical harvester uses to navigate the vineyards and pluck specific bunches at ideal ripeness.

The system has been under development for the past four years and is being tested in vineyards. The approximate cost of the two components is \$230,000.

Salinas Valley-based Ramsay Highlander sells machines that partially automate lettuce picking by using band saws or water knives to cut the lettuce from the earth and convey it into bins for cleaning and processing.

The company is nearing completion on a new model that picks, cleans, cores and packs lettuce and other greens, chief executive Frank Maconachy said. It will likely cost between \$250,000 and \$400,000, he said.

"Because of the immigration issue, migrant workers are becoming a difficult entity to find," Maconachy said. "If growers have a crop that needs to be harvested and there aren't the people to do it, they'll need to find a mechanized way to do it."

Philip Martin, an agricultural economist at the University of California, Davis, said it was still unclear if heightened immigration enforcement would drive away enough workers to justify huge expenditures by growers on new machinery.

And the number of variables involved makes it difficult to determine how much, if anything, growers could save by switching to automated systems.

But some growers are excited by the prospect of having robots and a few trained technicians who know how to operate them replace the droves of manual laborers they currently depend on.

"It will open up a lot of opportunity for better paying jobs in the agriculture industry and perhaps get us out of the mentality that being a farm worker is a dirty job," said Batkin, the citrus farmer.



Ramsay Highlander, Inc. / AP Photo

This undated image provided by Ramsay Highlander, Inc., shows company technicians operating a mechanical harvester on a lettuce field in the Imperial Valley near El Centro, Calif. With authorities promising tougher border tactics, farmers who rely on immigrant labor are eyeing an emerging generation of fruit-picking robots and high-tech tractors designed to do everything from pluck premium wine grapes to clean and core lettuce.