

BY DEBORAH PARKER WONG

# The Dawn of Agtech

Guided by a set of sensors, Vitrover uses three small mowing heads that can cut grass within 2 cm (0.8 in) from the base of a vine. [Photo by Sylvie Monin]



**Agricultural drones may be creating plenty of buzz, but their terrestrial cousins — the robots — are poised to make their commercial debut.**

**N**ext year promises to be the year of the agricultural robot. With the altruistic vision of creating a sustainable society where future generations are free from worry about food security and safety, the world's first robotic lettuce farm will go into production in 2017.

Kyoto, Japan-based company, Spread, has retooled an indoor vertical lettuce plant where robots will

plant, water, harvest and trim up to 30,000 heads of lettuce every day. The automated plant will reduce labor costs by 50%, cut energy use by 30% and recycle 98% of the water needed to grow the crops. The company has plans to build similar robot farms to grow staple crops and plant protein around the world.

Growing lettuce in a greenhouse is a far cry from managing a vineyard, but

## AT A GLANCE

- + Driverless and remotely operated tractors are being adapted for vineyard work.
- + French company Vitrover has commercialized a vineyard mower robot.
- + Improved accuracy and falling prices for sensors will advance robotic pruning technology.
- + Higher minimum wages and triple-digit growth in agtech funding will speed adoption.

from apple harvesting robots that can carry bins of fruit weighing half a ton, to grapevine pruning rovers that make surgical cuts, several breeds of agricultural robots designed specifically for use in the vineyard are preparing to make their commercial debut in the near future.

While each area of agriculture presents its own challenges, for example, apple trees must be dramatically modified (downsized and espaliered) for optimal mechanical picking, vineyards that have been intentionally developed for mechanical harvesting are already well suited to robotic monitoring, spraying, mowing and pruning.

One such application is the driverless tractor currently being field tested in California vineyards by Mendon, Utah-based Autonomous Solutions, Inc. (ASI). The company operates in several industries including mining and automotive, where the technology automates

repetitive tasks like durability testing for Ford vehicles. "Sensors are the largest cost-driver in an autonomous system," says Matt Nielsen, marketing director at ASI. "Now that accuracy is improving and sensor prices are dropping, return on investment will help speed the adoption of robotics in farming industries."

Labor is an evergreen topic in California where, in an increasingly tight labor market, fragile crops like raspberries can take precedence over other high-value crops like peaches and wine grapes. Advances in mechanical harvesting, destemming and sorting technologies have given winegrowers more control during harvest, but vineyards still require year-round maintenance that relies on skillfully trained human hands.

When asked what motivated them to develop an autonomous robot that could tackle labor-intensive

vineyard tasks, researchers universally replied, "the growing shortage of labor." And while it's a fact that some jobs will be lost to robots, the belief is that they'll create far more interesting jobs for people.

"Until now, the cost of the robots had been a wash with labor rates, but the minimum wage hike has spurred investment," says Bret Wallach, CEO of San Diego-based Vision Robotics. The company has been working with Lodi, Calif., producers Vino Farms and Lange Twins, as well as Napa Valley's Trinchero Family Estates and Beringer, who describe pruning as their "pain point" to develop a robot that can spur prune bilateral cordon grapevines at the rate of one second per cut.

Vision Robotics' over-row pruner is equipped with multiple sets of cameras that model a three-dimensional image of the vine well ahead

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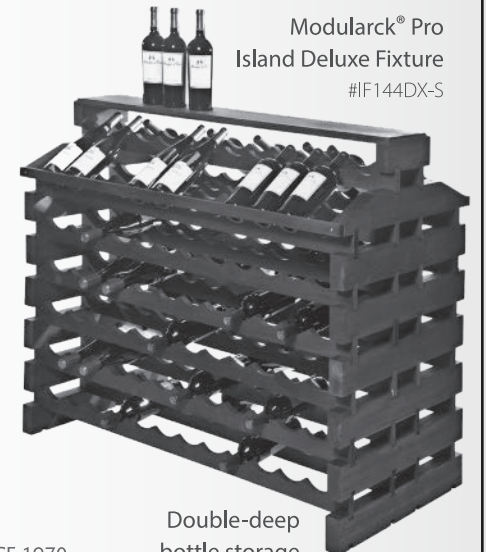
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of two robotic pruning shears. "This holistic approach enables the system to apply whatever pruning rules an operator desires," says Wallach.

Vision Robotics has an orange picker, lettuce thinner and a blueberry harvester that minimizes damage to the fruit already in production but, according to Wallach, in the past, wine grape growers have been reluctant to fund research and development at a private company. "We have about 18 months of fully funded work ahead of us to bring the pruner to market," he says.

### BIGGER ISN'T ALWAYS BETTER

Pruning is just one of many tasks being delegated to the agbots. In addition to labor costs, wine growers in St. Emillion, France, are faced with a host of concerns and legal actions around chemical inputs in the vineyard and their impact on public health and the environment.

Enter the Vitirover, a vineyard mower robot invented by Xavier David Beaulieu (owner with his brother, Alain, of Chateau Coutet in St. Emilion), and developed by Vitirover, of which Arnaud de la Fouchardière is CEO and Beaulieu technical director.

After four generations of prototypes, the unassuming Vitirover made its debut during the 2016 Bordeaux *en primeur* tastings at the heels of Bernard Magrez, owner of four classified growths of Bordeaux including the 13th century Château Pape Clément and some 50 estates worldwide.

The compact, solar-powered rover, which weighs just 44 pounds and covers 200 meters (218.7 yards) per hour, is designed to manage the grass in a 2-hectare (4.9 acre) plot. "It's a paradigm shift brought about by the huge discrepancy between the fragile nature of the vine and the brutality of the traditional machines {tractors and such}," says de la Fouchardière, who cites that growers can hurt or cut up to 2% of their vine stock due to plowing. Guided by a set of sensors, Vitirover uses three small mowing heads that can cut grass



Xavier David Beaulieu and Arnaud de la Fouchardière raise a glass to Vitirover in St. Emillion, France. [Photo by Pierre de Ferluc]

within 2 cm (0.8 in) from the base of the vine.

The rover, which is controlled remotely through a smartphone application, works autonomously within an area bounded by GPS coordinates. "It requires zero training. In two clicks, you can operate the bot," says de la Fouchardière, who makes it clear that the company doesn't sell robots. "Producers can subscribe to the service they want — in this case, the grass management of their vine plots." He estimates the cost of managing 2 hectares of grass using the rover to run €900 (\$1,026) annually.

Cover crop management is the first of several tasks corresponding to several tools that can be plugged on the robot. The company has also designed other tasks for Vitirover, from mapping weather, identifying pests and estimating yields to applying pheromones and precision



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spraying. "Different sensors gather data, which is analyzed by our software to produce reports that can be used as decision making tools to manage the vineyard, vine stock by vine stock," says de la Fouchardière.

According to de la Fouchardière, the company will deliver as many as 100 Vitirovers in 2016 to clients in Medoc, St. Emillion, Germany, England and Belgium, and is seeing demand from winegrowers in California, Italy, Spain and South Africa.

## OPTIMIZING VINEYARD MANAGEMENT

In Rioja, Spain, Professor Javier Tardaguila, head of the Televitis Group at the University of La Rioja, and a group of eight partners from France, Italy, Germany and Spain, are in the final year of their three-year project to commercialize the VineRobot.

Described as a multi-sensor scouting robot developed for use by all types of winegrowers, VineRobot is being beta tested on 80 acres in the Garonne Valley in Southwest France at the Les Vignerons de Buzet Societe Cooperative Agricole. Its developers include Burgundy-based inventor Christophe Millot, creator of WALL-YE, who specializes in the development of pattern recog-

nition (GisMapTrace) and mapping software (GisMap).

Billed as faster than manual monitoring and more cost effective than scouting with drones or planes, the first commercial version of VineRobot will use chlorophyll-based fluorescence to assess the nitrogen content in leaves and measure vegetative growth. Another complex sensor that combines fluorescence and RGB machine vision measures the anthocyanin content and composition of berries. Developers are planning to include water status and yield assessment sensors in future generations.

"This on-the-go and noninvasive technology will provide insight into the heterogeneity and the state of the vineyard and is expected to replace some lab chemical analysis," says Tardaguila.

According to Tardaguila, VineRobot works autonomously at three speeds — from 1.5 to 5 km (0.9 to 3.1 miles) — gathering information about the vineyard and generating the data as simple maps that can be read on a tablet, computer or smartphone. Using this highly accurate data, winegrowers can make key decisions about vineyard inputs and picking decisions that will influence both yield and quality of the wine. "The navigation strategy developed

for the robot received the 2015 ITSC Select Paper Award by the American Society of Agricultural and Biological Engineers," he says.

Although Tardaguila was non-committal about the price of the robot, he expects it will be reasonable, given the unit doesn't require complex training to operate and only needs simple maintenance. By comparison, Millot's vineyard robot WALL-YE, which has been in development since 2010, has a price tag of \$32,000. WALL-YE employs six cameras and two arms that execute a rich set of functions, including the ability to de-sucker, prune and monitor soil and vine health. Millot has made security a priority, building in systems that lock out unauthorized use and destroy the robot's hard drive in dangerous situations. WALL-YE was demonstrated for the first time in the United States at the 2014 Precision Farming Expo in McMinnville, Ore., but there are no indications that the robot is in commercial use.

Given their huge potential, it's not surprising that drones and robotics are getting a lot of attention in the media and from the investment industry. Investment into drones and robotics startups in the United States increased 237% to \$389 million in 2015. The Association for Unmanned Vehicle Systems International predicts 80% of drones will be used for agriculture in the near future, although some industry experts have called their efficacy into question. California companies, including drone developer 3D Robotics and Blue River Technologies, a startup using computer vision and machine learning to weed crops, attracted investment from a mix of agtech venture capital firms and high-profile Silicon Valley venture capitalists.

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*Comments? Please e-mail us at [feedback@vwmmmedia.com](mailto:feedback@vwmmmedia.com)*



**VineRobot is a multi-sensor scouting robot currently being tested in the Garonne Valley in Southwest France.**