

# Cultivating agricultural innovation

The agricultural sector is evolving thanks to new technology necessitated by a growing global population and the pressures of climate change. The United Nations predicts a global population of 9.7 billion by 2050. The agricultural sector must figure out a way to meet the demands of that expanding population. These challenges are being offset by advancing technologies that are helping farmers increase productivity while also reducing their ecological impact.

Technological advancements are cultivating innovation within the agricultural sector, and these are some of the options farmers are exploring.

- **The internet of things (IoT):** IoT is a vast network of objects embedded with sensors, software and connectivity. Farm operations can use low-cost, high-durability sensors deployed across fields to monitor soil moisture, temperature and nutrient levels in real time. These sensors allow for “variable rate application” of water and fertilizers, ensuring resources are directed only where they are needed. A report by Grand View Research says the smart agriculture market is expected to grow at a compounded annual growth rate of 10.8 percent through 2030.

- **Robotics and automation:** Labor shortages have led to a growing reliance on robotics and autonomous machinery to handle farm work. Modern tractors can be equipped with GPS and LiDAR (light detection and ranging) systems to operate autonomously. Optimized pathfinding helps to reduce soil compaction and more. Specialized robots are capable of selective harvesting, says the Journal of Field Robotics. Fruit pickers can evaluate the ripeness of produce before picking it, minimizing waste. Unmanned aerial vehicles or drones can offer multispectral imagery that enables farmers to identify crop stress before it is visible to people.

- **Biotechnology:** Farming increasingly is being developed in the lab before crops even sprout in the fields. Biotechnology is a pillar of agricultural evolution. Gene-editing tools like CRISPR-Cas9 can develop crop varieties that are more resilient to saline soil conditions and drought. Research published in Nature Communications says that bio-engineered crops have the potential to increase yields by up to 20 percent, even in suboptimal environments. This cuts down the time required to create traits that help plants thrive.

- **Vertical farming:** Vertical farming enables facilities to produce more food per

square foot than traditional farming, according to the Association for Vertical Farming. When coupling this with Controlled Environment Agriculture, which employs hydroponic or aeroponic systems, facilities have greater control over conditions that can affect food sources.

The utilization of different technologies across the agricultural sector is driving innovation and production.



# Securing vintages with regenerative farming

The global wine industry is not immune to the effects of climate change and soil degradation. Through a process of regenerative farming, soil health is protected and vintages can be produced with great success.

## What is regenerative viticulture?

Regenerative viticulture, also known as regenerative agriculture, is farming that emphasizes the regeneration of soil health, says Eco Terreno Wines & Vineyards. These farming practices are organic and ecologically-driven to enhance the ecosystem through a partnership with nature. Regenerative viticulture focuses heavily on soil health, carbon sequestration and biodiversity.

## Components of regenerative viticulture

Five primary principles drive regenerative viticulture: minimizing soil disturbance, keeping the soil covered, maintaining living roots year-round, increasing plant diversity, and integrating livestock. The Regenerative Viticulture Foundation says the goal is to create a “closed-loop” system where the vineyard provides its own nutrients instead of having to use synthetic ones.

## Cover crops

The use of cover crops can increase soil organic carbon



(SOC), which is vital for mitigating the wine industry’s carbon footprint. According to research published in the Journal of Cleaner Production, use of cover cropping in vineyards can increase SOC by up to 1.5 tons per hectare annually, making processes much more eco-friendly. What’s more, cover cropping can improve the water re-

tion capacity of soil. This is essential in regions where drought cycles have been on the rise.

## Animal integration

The primary role of animals in regenerative agriculture is “prescriptive grazing.” By allowing livestock to graze between rows during the dormant season, vintners can eliminate much of the need for mechanical mowing and herbicide application. Data from the Regenerative Viticulture Foundation found sheep can reduce the need for tractor passes by up to 80 percent, significantly lowering the vineyard’s carbon footprint while preventing soil compaction. Animals also convert plant matter into high-quality manure and urine, providing bioavailable sources of nitrogen, phosphorous and potassium.

Chickens and ducks also may be deployed to manage pest populations like mealybugs or snails near vines without the need for synthetic insecticides. Animals also naturally aerate the soil through their beaks, feet and hooves, allowing organic matter to get into the earth more readily.

The future of healthy vineyards may rely on regenerative viticulture, which safeguards the land and ensures successful production cycles.