Agworld

DIGITIZING AND AUTOMATING FRUIT ORCHARDS TO IMPROVE RESULTS

CONNECTING THE INDUSTRY

CASE STUDY

■ CHALLENGE

Margins in fruit orchards have been decreasing steadily over the past decades due to a variety of factors. Fruit orchards are traditionally labor intensive and the reliance on labor has not started to significantly decrease yet, while both labor costs and labor shortages are rising. Orchardists and their advisors are constantly looking for new and novel technologies that enable trees to produce the maximum amount of fruit they can carry while trying to reduce their reliance on labor at the same time. Another challenge for orchardists is the ever-increasing regulatory burden and quality control measures needed, forcing them to keep meticulous records and being able to produce reports and overviews at any time within the season.

■ RESULTS

By introducing robotics, farm management software, IOT-enabled devices, bud-counting technology, and other technologies, orchardists are able to start automating tasks within their orchards and reduce the reliance on labor, consistently achieve high yields, and constantly generate accurate farm data.

Introduction

Fruit orchards are an important part of the agricultural sector around the world, producing a wide range of different fruits for uses such as domestic consumption, processing and export. What sets fruit orchards apart from most other agricultural sectors is that many parts of the fruit growing process are still very labor intensive and the traceability needs for fruit are the highest within the industry. The per-acre crop values are so high within the fruit industry that orchardists are some of the first to adopt new and novel technologies that can help them make better and quicker decisions. Fruit orchardists are always looking at which processes to automate first and which technologies should be adopted before others, which is what this case study explores in further detail.

Harvest Automation

The first mechanized grain harvesters were introduced in the first half of the 19th century, with more advanced tractor drawn or self-propelled harvesters becoming common after WWII, and more advanced models still being released every year. What this has meant for the grain industry is that the number of staff needed per acre harvested has dramatically decreased, keeping costs low and the industry viable. For fruit orchards however, the harvesting process has barely changed over the past decades, with humans still at the center of the fruit picking process today.

Naturally the process of mechanizing grain harvest is inherently easier than

mechanizing fruit harvest as, unlike with grain, the trees remain standing and fruit is delicate to handle. With increasingly advanced fruit identification and picking technologies available today however, the concept of having robotic pickers operate in orchards is coming closer than ever before.

Mitch McNab, a fifth generation fruit grower based in Ardmona, Victoria, completed a Nuffield Farming Scholarship in 2016 on how robotics can be implemented into apple and pear production, and has been working on adopting robotics into the family's 170 acre orchard since. Mitch: "Our cost of production is quite high because the labor makes up about 60% of our cost of production and out of that 60%, 50% are harvesting costs. So, if we can reduce our harvesting costs substantially, that obviously brings down our cost of production pretty quickly as well."

Mitch continues: "We are running robotic apple picking trials this year with 'Ripe Robotics' in our orchard and are hoping to start commercial trials in the next apple season. I like this specific provider of picking robots as they aim to build a higher number of robots for a lower cost each, so you can have more machines running in the orchard instead of just having one expensive machine, which protects our downside risk in case of breakdowns. The aim is to pay the robotics provider per kilogram of fruit or per bin picked instead of owning machines ourselves, which allows for a higher utilization rate of the machines as they can then be used across multiple orchards throughout the different seasons. Although this won't do away with manual labor completely, it will certainly decrease the number of laborers needed."

"Automation has not eliminated our need for labor, but it's fixing issues and pain points, and makes us more efficient with the people that we have."

Heidi Morris
Agronomist, Washington Fruit, Yakima, WA

Orchard Automation

While automated fruit harvesting is still in its infancy, many other processes in the orchard have already been automated throughout orchards, with packing sheds being a prime example. Washington Fruit, a 12,000 acre apple, cherry and wine grape grower based in the state of Washington, have upgraded their packing line and warehouse to include robotics and automation, which has reduced their need for manual labor on the packing line. Heidi Morris, agronomist with Washington Fruit, explains: "Automation has not eliminated our need for labor, but it's fixing issues and pain points, and makes us more efficient with the people that we have. Technology empowers our key staff to work better and smarter, and reduces the need for additional labor during seasonal peaks."

McNab Orchards have also automated their packing operations, in cooperation with four neighbors in their case in order to achieve economies of scale according to Mitch: "We have an automated apple and pear grader by Maf Roda from France, and we have automated the packing part of the facility as well. We still employ people in the packing shed, but less than
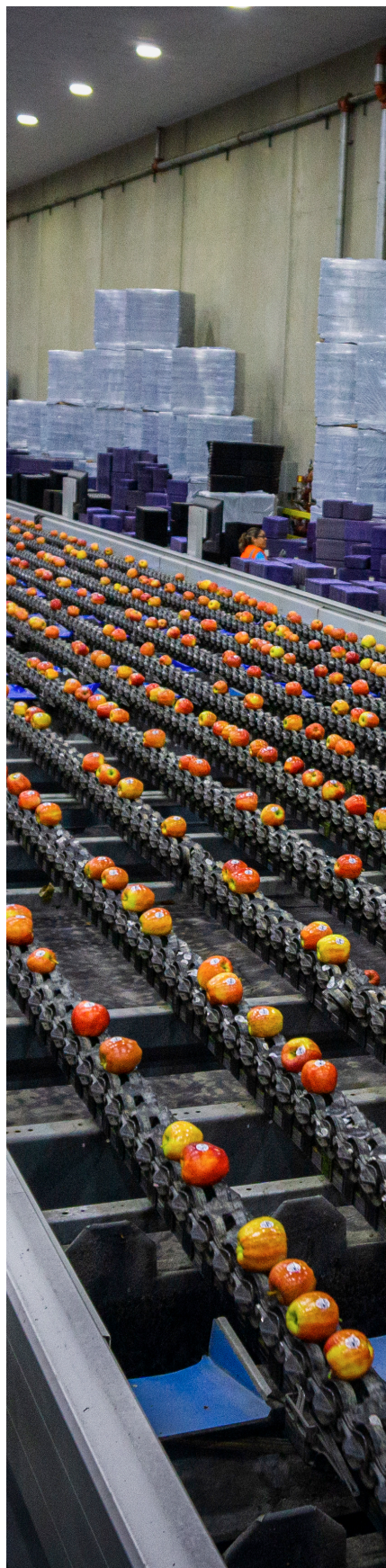
Because we record all our orchard data in Agworld we can be sure that we'll easily pass the auditing process, and provide more than enough information to the auditors without having to spend a lot of time on it."

Mitch McNab
Orchards Manager
McNab Orchards, Ardmona, VIC

we would need without these machines. Automating certain processes can be really expensive and cost-prohibitive if we have to do it by ourselves, so it makes sense to work together with other orchards on this. By working together we can also create a year-round supply of fruit for our clients, which is very beneficial for marketing purposes."

During the growing season of fruit crops it is essential to manage the orchard as consistently and accurately as possible, which is why orchardists are starting to adopt autonomous tractors into their operation as well. Connor Kingman, CEO and Founder of Kingman Ag services, explains: "Orchardists are finding it difficult to get skilled operators for their machinery during the growing season and are therefore looking to adopt driverless technology such as offered by Kingman Ag."

Connor continues: "For operations such as spraying and mowing in an orchard for example, it's very important that the operators do everything right - and you'd be surprised how many operators don't drive a consistent speed, they might miss a complete row sometimes, or other mistakes are made. And, as we all know, mistakes can get very expensive, so it pays for them to adopt driverless technology instead. This also helps mitigate some of the labor issues as one employee can now run up to 5 different tractors with implements at the same time instead of just 1. Most importantly though, you can't get more accurate than automated machinery, and this is paying dividends big time for orchardists!"

Capturing data for traceability

As all fruit eventually ends up consumed by humans, either directly or after processing, retailers, exporters and food processors are putting an increased focus on traceability and being transparent to consumers about how their fruit is grown. Because of this, both orchardists and agronomists have a strong focus on capturing all data pertaining to the growing season on an Ag Data Ecosystem like Agworld. Heidi Morris explains: "Washington Fruit utilizes Agworld for recommendation writing and to capture all data of the actual sprays applied. Because of this we're also able to do our run reports for re-entry intervals, pre-harvest intervals, and how much of each product we're applying per acre."

Heidi continues: "Our fruit gets sold domestically or ends up exported to either Canada or Mexico, which means that we have different crop management standards to adhere to. We make sure that our applications meet the most restricted standards so that our marketing desk keeps all their options open. As soon as they sell the fruit from a particular part of our orchard, it's easy for us to provide the correct reports they need with a specific batch of fruit from Agworld. Having this data available and rapidly being able to report on it is key for us, being such a large orchard operation."

Mitch McNab adds to this: "We export a lot of our plums from Australia to China and their protocols require us to have a really strong traceability element of all chemical applications, where the fruit was harvested from, who harvested it, on which dates, etc, to meet the protocol standards. Because we record all our orchard data in Agworld we can be sure that we'll easily pass the auditing process, and provide more than enough information to the auditors without having to spend a lot of time on it."
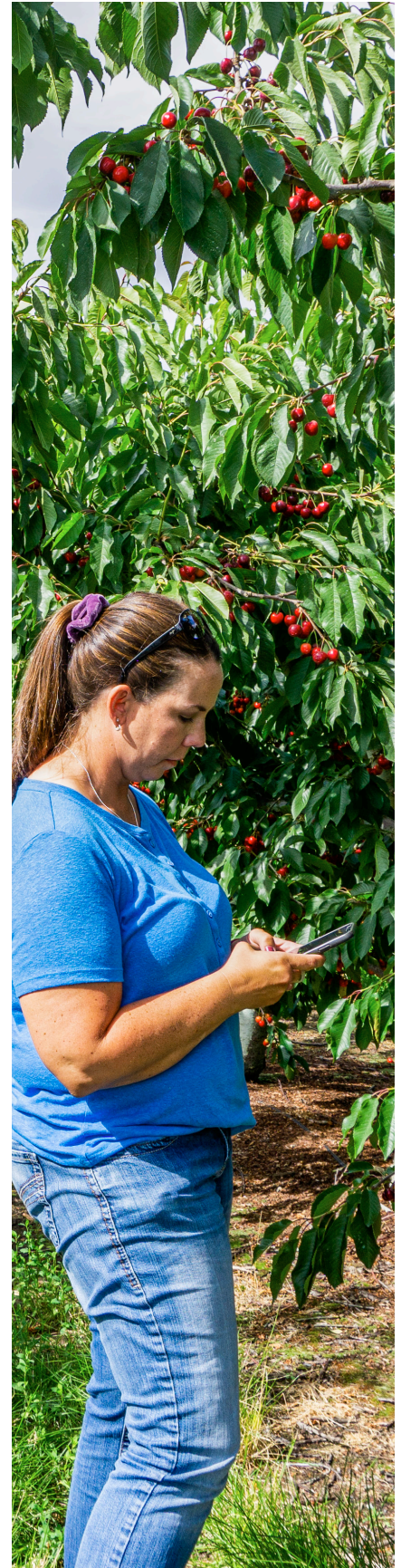
Gathering IoT Data

IoT-enabled devices are rapidly becoming more available throughout the agricultural sector, and fruit orchards are some of the earlier adopters of sophisticated IoT-enabled devices due to the high crop-value per acre. Gathering data in orchards has always been key for in-crop decision making processes, and new technologies such as insect traps, weather stations, sap meters and many other IoT enabled devices continue to provide an increasing amount of data at regular intervals that can be used to support in-crop decisions.

Where the findings during manual crop scouting often provide a binary result, you either find what you are looking for or not and therefore either apply what you have in mind or you don't, IoT-enabled devices tend to provide a lot more data on a more regular basis, opening up many more options for the agronomist and orchardist.

Yakima Valley based consultant Reed Brit, Ron Britt and associates, specializes in fruit orchards and hops and says he notices an increase in IoT enabled measuring devices in orchards, although not all data gathered can be actioned yet according to Reed: "There is a lot we can do with technology already, but we're right on the cusp of knowing how to actually use the technology so that it benefits us. As with all data though: just because we can measure it doesn't mean we need it and just because we have it doesn't mean we need to use it; it's all about deciding how and why to use the available data in a specific and correct context. "

Reed continues: "One of the things we're seeing more and more of is the electronic traps that can monitor the insects as they come in and they come out, and the different algorithms are getting better at identifying different insects so they can separate them out. The big issue is figuring out how to properly use this information. When you have a digital trap, you can gather information on a daily basis, but we still have to figure out how to respond to this information. Because of the way orchards work we usually can't respond to new data immediately, so what makes a daily trap count better than a weekly trap count?"

Utilizing IoT Data

While some IoT enabled measuring devices already trigger immediate actions, such as the Semios pheromone mating disruption system for example, this is still more of an exception than rule. Semios Founder and CEO Dr. Michael Gilbert remarks: "Semios is the first system available to orchardists that combines a mesh network of IoT-enabled measuring devices such as weather stations and insect traps with variable rate mating disruption devices that disperse pheromones. This means that we not only capture a large amount of orchard data throughout the season, but we also have the tools to analyze this data based on historic data and modeling, and turn it into orchard-specific actionable insights."

Michael continues: "We apply the data we collect in a way that informs the best action at the right time. From dispersing mating disruption pheromones synchronized with the actual phenology of the target insect to measuring soil moisture and automating irrigation scheduling or providing frost control alerts paired with remote control of wind machines, we give orchardists better information to simplify decision making for key crop events throughout the season."

Heidi Morris adds to this: "At Washington fruit we're looking at any kind of 'smart technology' that can help us gather more reliable data and decrease our need for manual labor, and bud counting is one of those processes that we're working on automating. Instead of someone manually counting buds throughout the season, we now take photos at regular intervals and use an AI-powered scanning software to give us reliable counts, inform our pruning decisions and give us accurate yield estimates. Not only does this make our data more reliable, it also makes the process a lot easier and quicker."
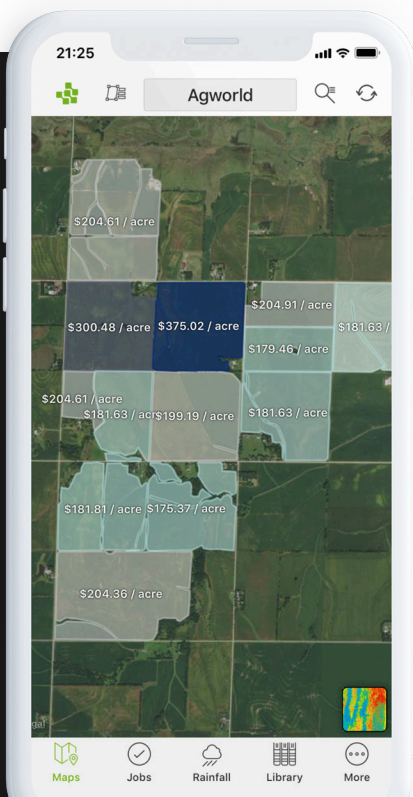
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