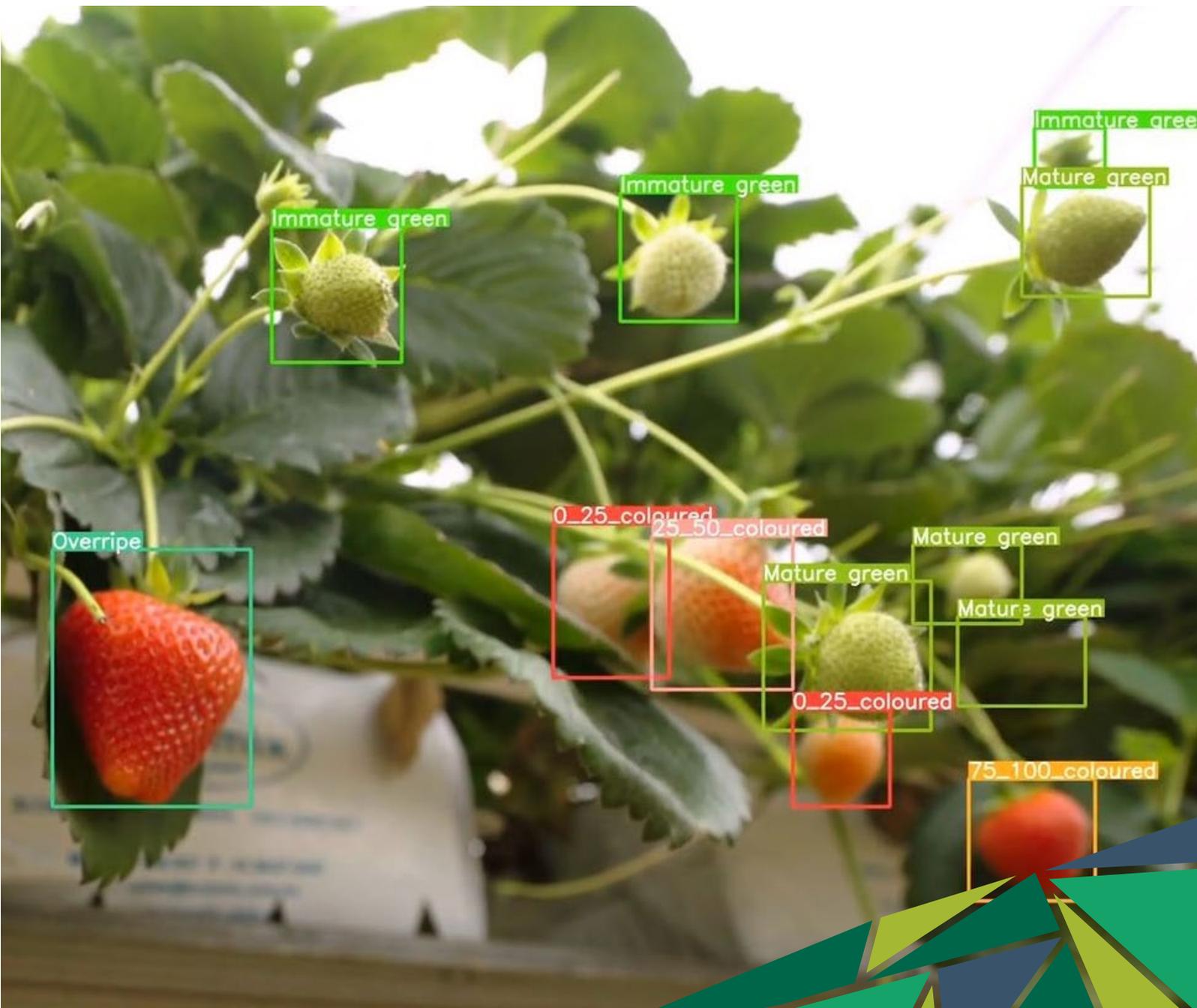


# 'GreenView' Crop Insight Technology BY BITWISE AGRONOMY



**HINKLER AGTECH INITIATIVE**  
A CASE STUDY BY CENTRAL QUEENSLAND UNIVERSITY



*This trial was undertaken as part of CQUniversity's Hinkler AgTech Initiative.*

*The Initiative aimed to increase the productivity and profitability of the Bundaberg region's agricultural sector through greater availability and utilisation of agricultural technology (AgTech).*

*An extensive consultative process undertaken with agribusinesses identified on-farm needs that may be addressed using AgTech. Trials of selected AgTech products and services were then undertaken in partnership with agribusinesses and technology providers to determine the technologies' efficacy in on-farm conditions.*

*This case study provides an overview of findings from one of the technology trials, including grower feedback and considerations for other growers when deciding whether to utilise the technology in their own enterprise.*



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## Introduction

Australian agriculture is seeing a rapid emergence of new technologies that are changing traditional farming practices. Agricultural technology (AgTech) promises improved productivity and yield and the ability for growers to make better decisions, but the rate of uptake of AgTech remains impeded by several factors. These factors include a lack of awareness by growers of potential technology solutions, difficulty in evaluating the on-farm efficacy of technology and a gap between grower needs and technology developments. The aim of this case study is to assist growers by providing background information on a commercially available technology, including details of its performance and value proven through on-farm trials.

Bitwise Agronomy's 'GreenView' system uses imagery collected from Go-Pro cameras to produce maps showing fruit counts and ripeness stages in berries and other small crops. The system assists growers with managing crop variability, improving labour efficiency and increasing crop forecast accuracy. Bitwise is an established Australian company and 'GreenView' is being successfully deployed by 70 commercial berry growers throughout 11 different countries.



FIGURE 2: Go-Pro Fitted to Quadbike Capturing Data in Strawberry Crop

## What Does the Technology Deliver?

The Bitwise 'GreenView' system provides growers with a quick method of capturing accurate data on berry and grape crops. The data includes counts of fruit at different growth stages and can be analysed to provide short and long-term production forecast. This information allows growers to detect crop variability early in the growing season, enabling them to take corrective action to mitigate yield losses. Growers can also use the data to assess their overall crop performance and make informed decisions about irrigation, pruning, harvesting, and fungicide/pesticide applications.

Bitwise provides the data and analyses in either raw format or via an electronic dashboard as individual images and whole-of-crop maps. Images are captured in a side-on "street view" and can be plotted on a 3-dimensional map so growers can easily navigate through their 'virtual farm'. The interactive dashboard can perform crop-wide comparisons for growth over time and enable the grower to view their entire crop from a bird's eye view to quickly assess when and where a particular management task is needed.



FIGURE 3: Example of Data provided by the Greenview system



A human can count:

**4-6** Blueberry Plants A DAY

GreenView can count:

**2,000** Blueberry Plants AN HOUR

FIGURE 4: Comparison Between Human and Greenview Counting Capacities

## What is Required from the Grower?

Growers wishing to deploy the Bitwise 'GreenView' technology are required to subscribe to one of four plans offered by Bitwise. Annual subscription prices range from \$2000 / annum for the Essential Plan (Raw data only, limited to 1 farm < 50ha) to \$5000 for the Ultimate Plan (Reports provided by Bitwise online dashboard, limited to 2 farms < 150ha, include live interactive maps and yield calculator). For more than two farms greater than 150ha in size, Bitwise offer a 'bespoke' solution that is tailored to specific grower needs and priced accordingly in consultation with the grower.

The grower needs to purchase one or more off-the-shelf Go-Pro cameras to capture the imagery. The cameras can be attached to a tractor, quad bike or other existing machinery suitable for driving between crop rows. If a grower has had no experience with Go Pro cameras, they may need to spend some time familiarising themselves with their mode of operation and ensuring they are set up and attached appropriately to record the most accurate images. A Go-pro clamp or mount will also be required. Go-pro also offer additional equipment that may be useful, such as charger covers and battery systems for longer data capture times. Bitwise does offer online support, including user manuals, for GoPro set-up. Once the imagery is captured, the grower is responsible for uploading analysis via Google share drive. Given the potential volume of data collected and uploaded via GreenView it is recommended that growers ensure they have access to a fast and reliable internet connection.

Given the variability in crops and farming practices, growers may need to invest time and labour into ground truthing the generated data to ensure that accurate fruit counts and descriptions are being reported. For example, if ground truthing demonstrates that the system consistently

counts 80% of fruit, then the grower knows they need to apply an additional factor of 20% to recorded data. Depending on the nature and extent of the crop, this work can require significant labour resources and may be best outsourced to an agronomic provider or research organisation.



FIGURE 5: Typical GreenView Go-Pro Set-ups

## How Does the Technology Work?

The GreenView system captures imagery of fruit and plants taken through a Go-Pro camera attached to a farm vehicle driven between the plant rows.

The images are captured in a side-on 'street view' format and uploaded via the internet to be processed through an Artificial Intelligence (AI) software system maintained and operated by Bitwise Agronomy. Once the AI system analyses the imagery, it presents the data back to the grower via an online interactive dashboard.

The dashboard presents the data in a range of formats and management blocks, enabling the grower to make whole-of-crop management decisions quickly and easily.

The dashboard also features a crop forecasting calculator, allowing growers to project yields for labour and resource management weeks in advance.

The more growers that upload data via the Bitwise software, the more the system's AI improves. The new data helps the software count fruit and identify plant health in various conditions, providing greater accuracy across more farming systems.



FIGURE 6: Example of Greenview Imagery of Strawberry Crop



FIGURE 7: Example of Greenview Imagery of Blueberry Crop

## Technology Provider

Bitwise Agronomy was founded in 2020 by a viticulturalist with extensive experience in data analytics and AI technology and is based in Tasmania, Australia. The company now consists of a 15-strong international team with the GreenView system being deployed by over 70 growers in 11 countries.

Because of the online nature of the GreenView system, the Bitwise onboarding and support service is also provided online. This service includes complete instructions on how to operate Go-Pro cameras, upload the data and operate the dashboard. All relevant information is shared via Google Drive and a Bitwise support team is available online to answer any questions and address issues.



## Applications of Technology (Current and Potential)

Since its inception, Bitwise Agronomy has largely focused on the berry and grape industries, but due to demand, is seeing GreenView being deployed in a range of other crops such as cucumbers, tomatoes, chilies, and cranberries.

Bitwise has worked with berry growers in Australia and wine-grape growers in Australia and the UK on identifying variability in their crops. Variability and underperforming plants can impact forecasting accuracy. With the assistance of the Greenview interactive dashboard, growers were able to identify 'high fruiting areas' and 'no fruiting areas'. The grape crops in the UK were subject to two consecutive extreme-weather years and the growers there were also able to compare crop variability on a year-by-year basis. This data assisted them in aligning crop yield forecasts to ambient and forecast weather conditions.

With the assistance of CQUniversity's Hinkler AgTech Initiative, Bitwise undertook a trial of GreenView on baby cucumbers grown in a greenhouse. Two GoPro cameras were mounted to a picking trolley to record flower and fruit counts, including out-of-spec fruit counts (overripe fruit greater than 115mm in length). This was the first time the GreenView system had been deployed in baby cucumbers, so this trial aimed to develop a 'proof of concept' detection model.

The system correctly measured fruit length for 85% of fruit, with improvements continuing to be made as more footage is processed by the



FIGURE 8: High Fruiting Areas Identified by Greenview in a Strawberry Crop



FIGURE 9: No Fruiting Areas Identified by Greenview in a Strawberry Crop

AI software. Three categories of fruit development were also established, including 'flower', 'immature fruit' and 'mature fruit', with these categories found to be the most suitable way to report crop development given the rapid growth rates of this crop. Based on the results of this trial, a new model for detecting, classifying and counting baby cucumbers is now commercially available from Bitwise.



## Value of Technology

Growers who have deployed the GreenView system recognise that the technology not only saves the cost of manual counting and monitoring but is also less prone to error because of its reliance on machine intelligence. Current yield monitoring practices are labour and time intensive and growers usually are only able to perform this task over small sample areas of their farm. The results of this monitoring are often not representative of an entire farm and do not provide any beneficial insight into yield variability. The time-consuming nature of the task means that it is often performed only once during a season, which means trends during crop development are missed.

Growers report that the ability to view yield maps via the Bitwise dashboard allows them to identify crop issues such as irrigation deficiencies, which they can quickly address. Growers can also track crop development over the season and receive insights into the effects of different weather conditions and management practices. Accurate fruit counts at different stages of development also allow for some better overall yield forecasting, allowing growers to forward plan market access and labour requirements.

A big advantage of the GreenView system over other commercial crop-imagery technologies is its relative ease-of use and deployment by the grower. Its use of off-the-shelf GoPro cameras that can be easily mounted to existing farm equipment eliminates the need for dedicated vehicles or aerial-based drones. The compact nature of GoPro cameras also enables the GreenView system to be deployed in relatively confined settings such as greenhouses.

## Additional Considerations

It is recommended that prior to deploying the GreenView system, growers ensure that their internet connection is reliable enough to cope with the volume of data generated by the system. In recognition of the on-farm connectivity challenges throughout regional and rural Australia, Bitwise is working on making GreenView available to growers without reliable internet access, via a future product called 'Bitwise Box'.

Growers may also want to consider the integration of the GreenView system with other technologies such as small autonomous terrestrial vehicles (ATVs). ATVs can be deployed for a range of repetitive on-farm tasks such as spraying and slashing and could be easily fitted with GoPro cameras to record imagery during their deployment.

Bitwise has a formal partnership with Formant, which is a commercial data platform for robots. The partnership provides Bitwise with access to large-scale agricultural robotic fleets which provides their GreenView AI system with more real-world data to continually improve its machine learning algorithms. It also enables Bitwise to expand the reach of GreenView and give actionable insights to more growers.

## REFERENCES AND INFORMATION SOURCES



For further information on the trial of the Bitwise GreenView systems in blueberry and baby cucumber crops in Bundaberg, email CQUniversity's agricultural research team: [agriculture@cqu.edu.au](mailto:agriculture@cqu.edu.au)

Information regarding Bitwise Agronomy and the GreenView system, including case studies, grower testimonials and contact details, is available at: [bitwiseag.com](http://bitwiseag.com)

Summaries of other technology trials undertaken through the Hinkler AgTech Initiative are available at: [bundabergagtechhub.com.au](http://bundabergagtechhub.com.au)



Australian Government



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