HINKLER AGTECH INITIATIVE

Crop Imagery and Analysis Technology

INTRODUCTION

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 summary 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.

Background

The number and extent of horticultural crops being grown in protected cropping environments (greenhouses) is increasing throughout Australia. In an increasingly competitive and consumer-driven environment, it is critical for growers to identify issues such as nutrient deficiencies, pest infestations and diseases as soon as possible to ensure optimum crop quality and productivity. Growers are turning to technologies that can quickly and easily collect crop data and provide insights that assist with making well-informed and timely management decisions.

The Technology

Bitwise Agronomy's 'Greenview' technology is an artificial intelligence (AI) based software system that analyses crop imagery to provide a range of data and insights. Growers use off-the-shelf GoPro cameras attached to existing farm machinery to capture video footage while performing tasks such as mulching, mowing or spraying. The footage is uploaded to the GreenView system which uses AI to analyse and process the imagery. Based on this analysis, Bitwise provides, via an interactive dashboard, a range of crop data and insights including fruit count, yield estimations and maps. This information can be used to make informed decisions about picking schedules, irrigation, pest management and other aspects of crop management.

The Trial

The 'Greenview' system was deployed in two crops in the Bundaberg area:

- *Baby cucumbers (protected cropping)* - A GoPro camera was 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.

- *Blueberries* - A GoPro camera was mounted to both a trolley and a tractor to record fruit counts in five categories: flower; petal fall; green; light purple and blue.

Ground truthing of trial results was undertaken by manually counting the flowers / fruit on selected 'sample' plants to compare with the number of flowers/fruit detected by Bitwise from the GoPro imagery of those same plants. A 'visibility factor' was then calculated as the ratio between the number of fruit / flowers detected on the sample plant by Bitwise and the number manually counted on that same plant. This visibility factor was then applied to all plants in the crop to estimate the total yield (fruit count) for each crop. This total yield estimate could be viewed by the grower via an online dashboard.

Results

Based on the results of this trial, a new model for detecting, classifying and counting baby cucumbers is now commercially available for protected cropping growers. A two-camera, portrait-orientation GoPro setup was found to provide the best visual coverage of the crop. The system correctly measured fruit length for 85% of fruit, with improvements continuing to be made as more footage is processed by the 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.

In blueberries, a single GoPro camera set up in a landscape orientation was mounted to the front of a tractor so that data capture could occur while other operations were taking place. However, given the much larger areas covered in this trial than in baby cucumbers, battery life was an issue for this trial, with only small areas able to be recorded before charging was required. Portable battery systems are available for GoPro cameras and would eliminate this issue. Another issue in these protected cropping systems was the cameras sometimes shutting down due to overheating within the hot greenhouse environment. In these instances, data needed to be manually uploaded to the Google drive. This was time consuming, because the videos were often broken into segments due to size and needed to be organised into block/date folders.

Value to Business

Current yield monitoring practices are labour and time intensive, meaning growers are only able to perform this task over small areas, which is often not representative of a farm and as a result does not provide any insight into yield variability. The time-consuming nature of the task also means that it is often performed only once during a season, which means trends during crop development are missed. Both growers involved in this trial recognised that the Bitwise technology not only saved the cost of manual counts but was also less prone to error because it relies on more accurate algorithms and machine intelligence.

Growers also commented that the ability to view yield maps on the reporting platform allowed them to identify crop issues such as irrigation deficiencies, which they were able to quickly address. The growers were also able to track crop development over the season and receive insights into the effects of different weather conditions and management practices. Fruit counts also allowed for some degree of yield forecasting, allowing both growers to forward plan market access and labour requirements.

Growers wishing to deploy the 'GreenView' technology are required to subscribe to one of four plans offered by Bitwise. Subscription prices range from $2000/annum* for the Essential Plan (Raw data only, limited to 1 farm < 50ha) to $5000/annum* for the Ultimate Plan (Reports provided by Bitwise online dashboard, limited to 2 farms <150ha, includes 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 grower needs.

Grower Feedback

Trial Summary Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I see value in this technology					✔
I found the technology easy to use				✔	
The technology was easy to integrate within my business					✔
I was satisfied with the service provided by the AgTech company				✔	
I intend using this technology in my business					✔
I recommend this technology to other growers				✔	

Other Considerations

While Bitwise algorithms and detection models are available for a range of crops, the visibility factor will vary between individual farms due to variables such as camera setups, pruning practices and crop varieties. Some time commitment may therefore be required to develop this visibility factor to ensure the accuracy of vision-based technology when first being adopted. Consideration should also be given to the long durations and connectivity resources required to upload the large amounts of GoPro imagery that is necessary for technology that requires large amounts of high-quality visual data.

Further Information

For further information on this trial and results, email CQUniversity's agricultural research team:
agriculture@cqu.edu.au

For further details on Bitwise products and services, visit:
bitwiseag.com

Summaries of other technology trials undertaken through the Hinkler AgTech Initiative are available at:
bundabergagtechhub.com.au

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