HINKLER AGTECH INITIATIVE

Robotic Packing / Sorting 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 on-farm sorting and packing of produce can be the most time-consuming and labour-intensive aspects of a commercial grower's operations. In the face of rising input costs, a nationwide shortage of labour and more stringent workplace regulations, growers are seeking opportunities to improve the safety and efficiency of these processes and free up their labour force for other tasks. Robotic technology can play a role in addressing these challenges while increasing productivity and profitability.

The Technology

The Lyro robotic unit is an autonomous, stand-alone packing and sorting unit. The unit was originally designed for use in warehouse distribution operations and adapted for horticultural applications in this trial. The unit uses advanced vision systems and machine learning to accurately identify and pick up various types of fruits and vegetables, and then sort them into designated bins or packing boxes The system can be programmed to recognise produce based on its size, shape, color, and other characteristics. The unit can also be scaled to handle different volumes and complexities of produce and be integrated into existing operations if required.

The Trial

This trial involved three phases:

PHASE 1 - A prototype Lyro robotic unit was incorporated into a commercial zucchini packing line for 1 week. Zucchinis were required to be selected from the passing conveyor belt and packed into boxes using a predetermined pattern typical of the grower's manually packed boxes. This was the first time a Lyro unit had been deployed for this task, and the purpose of this phase of the trial was to inform the Lyro team on amendments and improvements required for Phases 2 and 3.

PHASE 2 - Based on data and observations from Phase 1, an improved Lyro robotic unit, including new gripper design and shape detection algorithms, was incorporated into the same zucchini packing line used in Phase 1, over a 2-week period.

PHASE 3 - The improved robotic unit was also deployed for a 2-week period to sort pineapple tops by size. Pineapple tops were manually fed into the stand-alone unit via a conveyor belt.

RESULTS

PHASE 1 - During this first development phase, the prototype unit missed detecting a significant number of fruit, failed to pick up a significant portion of detected fruit and did not pack the fruit uniformly in the packing boxes. Based on the data collected in this phase, the Lyro team developed an improved unit, incorporating a new gripper and new shape recognition algorithms.

PHASE 2 - The improved re-designed unit performed significantly better than the prototype model. It detected 95% of fruit and successfully picked up 93% of detected fruit. The predetermined packing pattern required the zucchinis to be packed loosely and parallel within the packing boxes and the unit did not perform as well with this requirement, often dropping the fruit at angles to one another. This misalignment amplified as more layers of fruit were packed. The Lyro team has since made further refinements to the unit to address this issue but has not re-trialed it in a zucchini packing line. The unit was packing approximately the equivalent number of boxes as one human packer.

PHASE 3 - The re-designed unit was able to continuously sort 750-850 pineapple tops per hour into three size categories (small, medium and large) and transfer them through corresponding chutes into bins. The unit sorted the tops at the same pace as a single human worker but did so continuously without a break. Within the configuration of the packing room used in this trial, the tops still needed to be fed manually into the unit.

While the unit did not perform all tasks flawlessly during this trial, both growers gained valuable insights into the potential of robotics being incorporated within their operations. Based on the results of this trial, Lyro has made further refinements to the robotic unit and are deploying it in several horticultural packing and sorting lines throughout Queensland.

Value to Business

The greatest benefit of the robotic unit identified in this trial was its capacity to work continuously at a constant pace. Fatigue and strain injuries are common ailments for workers performing repetitive, physical tasks such as fruit packing and robotics can significantly reduce the risk of such injuries.

The latest version of the unit is capable of packing and sorting 1000 units of produce/hr (crop size and shape dependent) which is approximately equivalent to one human worker.

The Lyro robotic unit is available through a leasing arrangement, starting at $6000/month*, excluding set-up and installation costs. This leasing structure is designed so that growers are able to hire the robot as required for short packing periods, to avoid a large capital outlay for the technology.

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

Robotic units are sophisticated technical equipment made up of multiple hardware and software components. A grower should ensure that they have access to adequate maintenance and support services to keep the equipment operational. They should also ensure that they and their staff have access to appropriate training to ensure they can operate and maintain the equipment. Lyro is a Brisbane-based company and provides set-up and installation services as well as ongoing maintenance of their units.

The integration of robotics into established packing lines may require some bespoke retrofitting to ensure the units are integrated successfully, as many systems are unique and will require pre-planning for optimal return on investment.

Further Information

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

For further details and pricing structure for Lyro robotic units
lyro.io

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

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