



HINKLER AGTECH INITIATIVE

Intelligent Spray Control System

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

Australian horticulture is experiencing rapid rises in input costs. These costs constitute a large portion of overall operational costs, and their increase has been identified as a major pain point for industry. One major area of concern is the cost of pesticide and herbicide sprays, which are essential for protecting crops and maintaining yields. Optimising the use of sprays can reduce the number and volume of applications, which benefits the environment and human health and assists with reducing chemical resistance and improves efficacy.

The Technology

Smart Apply's 'Intelligent Spray Control System' varies spray application rates according to crop canopy size and density and can be fitted to a grower's existing tower spray unit.

LiDAR (pulsed laser) sensors mounted at the front of the unit detect the position, size and density of the tree canopy on either side of the unit as it is driven between rows. The spray application rate is adjusted via solenoid-controlled valves on the spray nozzles, based on the detected density of the canopy and tractor speed.

The Smart Apply system can be configured to either 'section control' or 'density-based control' spray application:

- **Section control** - chemical is applied only when the LiDAR sensors detect tree canopy. The number of spray nozzles activated up the tower varies according to tree height and all nozzles are switched off when passing gaps between trees. This control method is most beneficial to younger orchards with larger spacings between trees.
- **Density-based control** - flow rate is adjusted based on canopy density (i.e. more spray is applied to dense foliage areas).

In addition to controlling spray rates, the Smart Apply system captures and maps real-time data including tree height, canopy density and chemical usage. This data is uploaded to the Cloud during the spraying process and can be accessed by the grower to provide additional crop insights.

The Trial

This was the first trial of the Smart Apply system in Queensland macadamias, so a proof-of-concept demonstration, using a Smart Apply unit mounted to a small ATV and configured to simulate a tower spray fan, was first undertaken on a commercial macadamia orchard. This unit was trialed on three separate blocks consisting of small trees (2-3m high), medium trees (4-6m high) and fully mature trees (6-7m high) respectively. Data were collected for both 'section control' and 'density-based' variable spray control methods. Following this initial demonstration, the unit was fitted to the grower's existing spray system and trialed in commercial, on-farm conditions.

RESULTS

SECTION CONTROL

The Smart Apply system successfully restricted spray application to the tree canopy area by shutting off all nozzles when detecting spaces between trees in young orchards, or by shutting off upper nozzles on the tower sprayer for shorter trees.

Spray medium volumes were reduced by 65% when using Smart Apply section control, compared to conventional (blanket) spraying.

DENSITY-BASED CONTROL

Savings in spray volume from density-based spraying were estimated at 77% in young orchards, compared to conventional spraying. This saving decreased to 16% in mature orchards due to denser and more uniform canopies.

Based on these demonstration results, the grower installed the Smart Apply system onto an existing tower spray unit and continues to use it on a fully commercial basis.

Variable-rate Control Method	Tree Stage	% Saving in Spray Volume
SECTION CONTROL	Small (1-2yrs)	65
	Medium (4-5yrs)	31
	Mature	7
DENSITY-BASED	Small (1-2yrs)	77
	Medium (4-5yrs)	55
	Mature	15

Further Information

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

For further details on the 'Smart Apply' spray system, visit: smartapply.com

For further information regarding sales of the 'Smart Apply' system in Australia, contact RDO Equipment, Bundaberg: rdoequipment.com.au

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

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Australian Government



Value to Business

The Smart Apply system helps to reduce input costs through reduced chemical usage. By reducing chemical usage, the number of trips required to refill spray tanks and measure chemical is also reduced and the efficiency of spray operations is significantly improved. The effectiveness of the crop protectant applied may also be improved by optimising application rates according to crop canopy (area or density). These outcomes help to minimise the environmental impact of chemical applications and prolong the effectiveness of pesticides against pest or pathogen populations.

The LiDAR data collected during operation of the Smart Apply system can also help growers to identify areas of poor tree health and investigate potential issues. This data can also be used to relate yield data to canopy area/density and to inform pruning or other crop management practices.

Each Smart Apply fit out is a bespoke installation, so final pricing will vary according to the type of spray rig used. The cost of the demonstration unit used in this trial, including installation and monitoring by RDO Equipment, was \$60,000* and this is a representative price for installation in most high-volume spray units deployed in the permanent cropping sector.

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

When deciding whether to use this technology, growers should consider:

- Tree age and/or canopy variability to assess potential savings through reduced spray volume and operational efficiency.
- The potential benefits from orchard characterisation data collected when using the 'Smart Apply' system.
- Availability of local technical support. Support in the Bundaberg region is through RDO Equipment.