

# Robocrop replaces eye and brain for better weed control

By Malcolm Taylor

**R**obotic weeding is now a reality for Australian cotton growers after a successful demonstration in October of a tillage implement with precision video guidance.

Narrow row spacings (15 inch spaced rows on two metre beds) are a common commercial practice for southern cotton production on the lower Murrumbidgee and Lachlan Rivers. The narrow row system is favoured for more rapid crop development, earlier harvest and higher water use efficiencies. But the Achilles heel of narrow row cotton has been late weed germinations — despite the widespread adoption of Roundup Ready varieties.

Establishing after the glyphosate tolerance window has closed, these late weeds are expensive to hand chip due to the difficulty of adapting conventional wide row cultivator bars for the purpose. In recent seasons, chipping costs have exceeded \$100 per hectare in some crops, even after receiving one or two over-the-top glyphosate treatments.

At Ravensworth (on the lower

## AT A GLANCE

- Robotic crop weeding uses vision guidance to control tillage implements.
- The Robocrop precision guided hoe effectively tracks on narrow row cotton to give precise, high speed inter-row cultivation.

Murrumbidgee) conventional manually-guided cultivator bars have been adapted for narrow row cotton. But the required bar is heavy and very slow to operate. With the tight clearances of the four rows on a two metre bed, working speed is limited in initial passes to only 3–4 km per hour.

And GPS guidance has not proven capable of reliably guiding inter-row cultivations in narrow row crops.

### Replacing the eye and brain

Vision guidance of cultivation has been under development in the UK, Denmark and the US for over 15 years. Concurrent development of faster micro-processors and colour video cameras assisted in overcoming many of the hurdles encountered when trying to replace the human eye and brain to guide a hoe.

Recent commercialisation of a British

developed robotic weeding system has opened the door to precise and rapid tillage in a range of high value crops.

Developed at the Silsoe Research Institute in England in the late 1990s, the Robocrop system has been commercially available for three years and is successfully used in a range of row crops in Europe including maize, sugar beet, onions, peas, lettuce and winter cereals.

Robocrop uses a colour video camera to scan ahead of the tillage bar. Images are analysed for green pixilation and peaks matched to a pre-determined grid pattern based on the crop row spacing.

Signals are relayed back to electro-hydraulic valves that control a sideshift used to position the tillage bar in relation to the crop rows. No satellite signals are used — instead a real-time video image is taken of the crop ahead. Multiple or discontinued rows do not cause guidance problems to the system. The machine will also follow curves, and correct for GPS errors, or follow contours in dryland crops or headlands.

Parallelograms are fitted across the bar to enable accurate depth control and avoid root damage or excessive moisture loss

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Robotic weeding works well at night, enabling 24 hour operation at critical times.

from cultivating too deeply. Soil flow is even when knives are suspended off these parallelograms as clearances can be minimised and intra-row weeds can often be buried. The cultivators are designed for very shallow tillage producing low draft, and subsequently low horsepower requirements.

The system currently has available models up to 12 metres wide for any crop row configuration.

### Southern NSW demonstrations

For the October demonstrations a six metre Robocrop precision guided hoe was fitted with bean knives and ridging units (Alabama sweeps). With the crops at the cotyledon/one true leaf stage, speeds of up to 10 km per hour did not create excessive soil throw, so crop guards weren't needed.

Speeds of up to 18 km per hour were also tested without a loss of guidance, but crop burial was excessive at this speed.

Robotic weeding is unaffected by wind, enabling operations to continue when inter-row or overall spraying can't be done due to drift hazards.

This is significant in the Riverina as October and November are the windiest months of the year.

Ron Harris, from Ramps Ridge Partnership, Ravensworth inspected the Robocrop in action, having previously seen the machine operating in a winter crop of faba beans. Ron was impressed with the



A real-time video image of the crop ahead allows the machine to follow curves, correct for GPS errors, or follow contours in dryland crops or headlands.

speed and lightness of the machine but suggested that additional crescent knives and smaller Alabama sweeps would have given better ground engagement.

The machine can be custom equipped with these, and other tool bar variations, to suit local conditions.

Greg Toole, regional agronomist with Twynam, arranged a demonstration at Gundaline Station near Hay to address a number of concerns associated with Roundup Ready cotton varieties. He expressed concern at the likelihood of

developing glyphosate resistant weed populations if inter-row cultivation remains absent from the narrow row cotton farming system.

Late weed germinations (after the glyphosate tolerance window has closed) are proving costly to southern cotton growers in both chipping costs and yield. Greg's interest in robotic weeding stemmed from its ability to address both problems in a cost effective manner.

Operator fatigue is also reduced with robotic weeding enabling skilled operators to achieve more in greater comfort. The system also works effectively at night using standard tractor work lamps. This allows maximum machine productivity when crop and soil conditions demand.

Robocrop is likely to find widespread application in cotton as it presents an opportunity to inter-row cultivate at good speed — and at higher levels of precision with less root injury — than that possible using manual guidance of heavy cultivators. This may also assist in the management of root diseases such as Fusarium wilt.

The system also adds another valuable option for Integrated Weed Management, and other strategies, aimed at avoiding the development of glyphosate resistance or tolerance in weed populations.

With Robocrop's high operating speeds, excellent accuracy and round the clock capability, tough weeds like fleabane may have just met their match.

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The robotic weeder cultivating at 10 km per hour in narrow row (15 inch) cotton in southern NSW.