Queensland cotton grower Jamie Grant with SwarmFarm robot 'Victor'. (PHOTO: Cindy Benjamin)

In collaboration with SPAA, Australian Grain presents a series of articles on a wide range of precision agriculture technologies and how best to put PA to Work on your farm.

Robots take CTF to next level

The Grant family of Jimbour in Queensland have for many years been forward-thinking in their approach to adopting new technology, but robots are enabling fundamental changes to their practices concerning weeds, writes Cindy Benjamin for SPAA.

Since their move to Controlled Traffic Farming (CTF) in the 1990s, the soils on the Grant family's farms near Jimbour on the Darling Downs just keep improving. Their 1800 hectare farming operation, Kielli Pastoral Co, centres on dryland cotton with French white millet grown as a summer cover crop.

Jamie and Susie Grant have found that adopting new technology is so much more than just having an easier or better way to do a task; it has enabled fundamental changes in their farming system. This is a significant motivation for Jamie, as he enjoys the challenge of taking an idea and seeing what opportunities it can present in how they farm. Some of the big ticket items have been in the field of precision agriculture, such as CTF, optical weed detection and, most recently, robotics.

"Each of these advances has built on the previous one," he said. "We are farming moisture here and the past 10 years have demonstrated the power of CTF, minimum tillage and cover cropping to conserve moisture."

SPAA Society of Precision Agriculture AUSTRALIA

Farm details…

Owners: Jamie and Susie Grant.

Location: Jimbour, Queensland.

Farm size: 1800 hectares.

Enterprises: Dryland cotton and French white millet (summer crop).

Average annual rainfall: 660 mm.

Soil: Predominately black clay.

Next-gen management

More than 15 years ago, Jamie and Susie invested in optical spray technology to better manage their fallow weeds, but it was never the full solution. The problem of treating weeds of varying size and maturity meant that weeds were an ongoing drain on their precious soil moisture stores.

"When we bought one of the first WeedSeekers into Australia, we knew we would reduce our herbicide use in the fallow, but the time taken to treat weeds using the optical weed detection technology was a limiting factor," Jamie said.

"Before long, we had moved to a wider WeedSeeker boom just to get across the country quick enough. Then we added a broadacre spray behind the WeedSeeker to pick up the smaller weeds."

Jamie Grant has been assisting in field trials of auto-filling systems for the robots.
(PHOTO: Cindy Benjamin)

But Jamie said this system did not suit his operation due to "labour and timeliness factors".

When he heard about the development of the SwarmFarm robots, he nominated to be part of the early testing phase, becoming the first grower to deploy a SwarmBot – named 'November' – under commercial conditions.

"I could see the potential for them to revolutionise the way we farmed," he said. "We have since leased a second robot – 'Victor' – practically eliminating the need for a broadacre sprayer. The next modification will be to give the robots higher clearance so we can conduct in-crop weed control right up to canopy closure in the cotton."

The two robots are identical in terms of operational ability, but they are 'personalised' on farm by their names.

Jamie and Susie were CTF pioneers, so the move to lightweight machines for all their field operations, other than harvesting, has been the ultimate aim. Jamie expects the robots to be able to undertake all spraying, ground preparation, planting and fertilising operations and wheeltrack renovation within the next few years. But progress relies on the fine-tuning of the robots' auto-refilling capability.

The current use of the two robots for fallow weed spraying, each fitted with a 9 m WEED-IT boom and 1000-litre tank, has halved the Grant family's herbicide use compared to their former 27 m wide WeedSeeker boom.

"We are spraying and treating smaller and smaller weeds, with few misses," Jamie said. "We are on the front foot with weeds now, so we can take advantage of any planting opportunities that arise without having to wait to spray weeds ahead of the planter."

"The next modification will be to give the robots higher clearance so we can conduct in-crop weed control right up to canopy closure in the cotton." – Jamie Grant

The robots work at a slow, steady pace, providing a stable platform for the boom and enabling the sensors to pick up very small weeds – down to just 5 mm in diameter. The operation is repeated every two weeks, so weeds never have the opportunity to mature or set seed.

Glyphosate is very effective on small weeds and any misses or hard-to-kill weeds are captured with an application of Starane (Group I) or Biffo (Group N). After planting cotton, Jamie applies paraquat to be on the safe side when it comes to minimising the risk of glyphosate resistance.

Weeds and resistance

The WeedSeeker typically sprayed between five and seven per cent of the paddock area, compared with the WEED-IT on the robots spraying two to three per cent of the paddock, due to the small size of the weeds and the spray pattern used. The use of the robots extends past fallow weeds, with Jamie using them to apply foliar fertiliser and in early in-crop weed control.

"We are working towards eliminating the need for the high clearance Spra-Coupe for in-crop spraying," he said.

Using the robots, the Grants said they had reduced the amount of herbicide used in-crop by spraying the inter-row area and not the cotton plants. Achieving this has been as simple as blanking off three nozzles over each cotton row.

"Although the sensors on the WEED-IT respond to some of the cotton leaves in the inter-row, there is still a large reduction in the amount of herbicide used compared to the blanket spray using the Coupe," Jamie said.

After rain, 28 per cent weed cover is the highest weed density that the Grants have sprayed using the robots. At this density, they would have previously chosen to use the broadacre sprayer rather than the WeedSeeker boom.

Jamie said the robots had handled the situation well, but they had required several refills. He hopes to get to a point where the robots only require checking and filling once a day and has been assisting SwarmFarm with on-farm trials of auto-filling systems.

Victor and November also start and stop spraying in response to weather conditions, as detected by their on-board weather station.

"The robots will not deviate from the set weather parameters," he said. "A weather app is being developed and will soon be available to monitor and record the whole spray operation and weather conditions at the time of spraying."

Conserving moisture

The Grants have not grown a winter crop for more than 20 years and have phased out other summer crops, such as sorghum, in preference for dryland cotton. For the past 15 years, French millet has been grown as a summer cover crop on half of the cropped area.

Prior to the current season, the past three years have been exceptionally dry with the Grants' farms receiving just 100 mm, 150 mm and 200 mm in each of those years, respectively.

"The black cracking clays here are very deep and can store immense amounts of soil moisture. But 10 straight years of very low rainfall had really depleted the stored soil moisture and without the millet cover crop we would have had no crop at all in the past three seasons," Jamie said.

"The millet improves water infiltration from the early storms in spring and we have been able to store and use even the smallest amounts of rain."

Millet is planted in October then sprayed out when the stalks have reached maximum cellulose level but before the plants sets seed. The cellulose-rich stalks reach about a metre in height within about six weeks of planting. When the crop is sprayed out, the stalks collapse to produce

The robots work at a slow, steady pace, providing a stable platform for the boom and enabling the sensors to pick up weeds 5 mm in diameter. (PHOTO: Cindy Benjamin)

mulch cover that protects the soil surface from evaporation and erosion, while allowing rapid infiltration of rainfall. There is also a benefit in weed suppression, mainly over summer.

"Millet is a shallow-rooted crop that uses very little water when it is just grown for mulch," Jamie said. "If it was grown for grain, we would use twice as much water and lose two-thirds of the ground cover. For us, the ground cover is much more valuable than the grain."

This year, Jamie is implementing a new cropping regime that will see an average one-third increase in cotton production off the same arable area with no appreciable change in input costs. Jamie expects the system to even out the peaks and troughs of good and bad seasons averaged over 10 years.

Although this year has brought more rain, Jamie and Susie were concerned that the current system had 'bottled' and if dry seasons were to return soon, they would struggle to maintain their current level of cotton production.

The plan is to plant cotton on 3 m row spacing across the whole cropped area (instead of on rows 1.5 m apart on half the farm). Between the cotton rows will be a 1.5 m swath of millet on 380 mm rows, leaving 750 mm between the edge of the millet and the adjacent cotton row. The following year, the cotton rows will be planted through the centre of the millet swath.

Jamie expects this system to increase infiltration and storage of moisture across the farm and to support a higher yielding cotton crop.

"During summer, the farm will be better protected from erosion with ground cover spread over the whole farm, and in a good rainfall season the soil reserves should be refilled and available for use in a subsequent drier year," he said. "We have done a small, 9 m wide trial of the new configuration and the difference in yield was phenomenal."

Importantly, this change will not affect the permanent wheeltracks that have been in place for more than 20 years and the adaptations required for the machinery has been minimal. By planting in the opposite direction the following year, Jamie will avoid having to make changes to their machinery setup.

Details: @SwarmFarm ■

VALE WENDY WESTON 1961/2022

It is with deep sadness that we inform you of the passing of SPAA Executive Officer, Wendy Weston, unexpectedly at home in Victoria on January 17, 2022.

Wendy had been with SPAA since July 2021 and was helping lead the organisation through some exciting changes.

SPAA president Frank D'Emden said Wendy was a champion of not for profits and member-based organisations and threw herself into learning about the Precision Agriculture sector.

"She was not just a co-worker but a good friend, and we'll miss her more than words can express. Our thoughts are with Wendy's family, her husband Paul and adult daughter Gemma, and her dear friends who are also understandably devastated," Frank said.

"I was fortunate enough to work closely with Wendy during the past six months. She was an accomplished professional and a remarkable woman who was making a real difference to SPAA."