Could annual ryegrass become a problematic summer weed?

By Michael Thompson[1] and Bhagirath Chauhan[1]

AT A GLANCE…

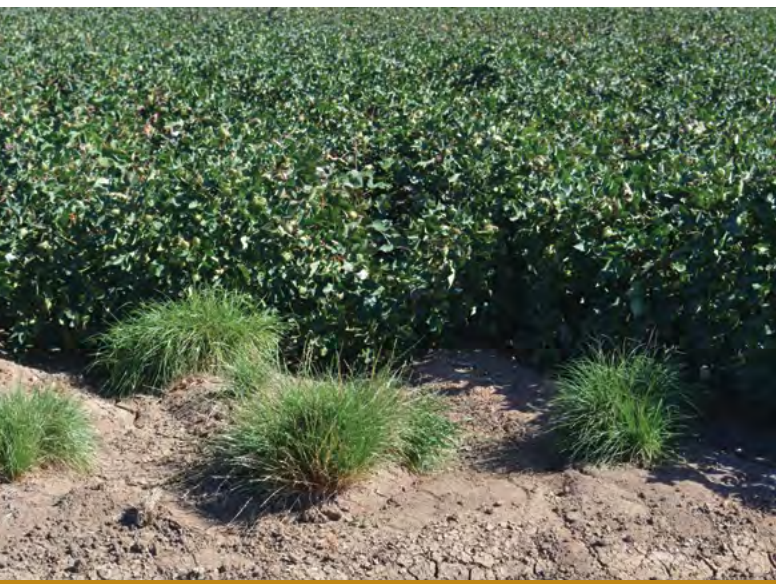
- Annual ryegrass in Australia may become a problem year round.
- Herbicide resistant annual ryegrass in summer could become a reality in fields of grain crops.

WEEDS have a damaging impact on Australian agriculture with an estimated annual cost of $4 billion to the agriculture industry. Among Australian weeds, the winter weed annual ryegrass is the most costly crop weed, causing an estimated revenue loss of $93 million per year.

It can cause 50 per cent yield loss in wheat due to its highly competitive nature, competing with the crop for nitrogen as early as the two leaf stage. Dense growth of annual ryegrass can produce up to 45,000 seeds per square metre, with a single plant capable of producing up to 1000 seeds. In addition, annual ryegrass can also be infected with the Ergot fungus, which may contaminate crops and contribute to lower yields.

Seeds of annual ryegrass are dormant for a period of time after development, which helps to prevent the germination of the seed while conditions are unfavourable for plant growth. Dormancy prevents seeds germinating after temporary moisture availability during a dry season and contributes to the survival of the seed until a time when rainfall is sufficient to support growth. In annual ryegrass, this period of dormancy usually lasts eight to nine weeks with germination in autumn/winter – but this can be affected by the environmental conditions during seed development.

The occurrence of herbicide resistance is an increasing problem for the management of annual ryegrass. In Australia, some populations of this weed have developed resistance to a wide range of herbicides with some populations developing resistance to multiple herbicides. Of particular note is the appearance of glyphosate resistance in annual ryegrass. Glyphosate has been rapidly adopted by growers since it became available, particularly due to its high effectiveness as a herbicide and because of the availability of glyphosate-tolerant crops. Resistance to these herbicides makes it increasingly more difficult to control the occurrence of annual ryegrass and creates the need to manage annual ryegrass through other means.



Annual ryegrass in cotton during summer.

Due to increased resistance to herbicides, effective management of annual ryegrass requires an improvement in our knowledge of its germination and emergence patterns. Germination requires the imbibition of water into the seed, but also requires certain temperatures and levels of light. While many seeds will germinate in light after a period of dormancy, some seeds require dark. Emergence also tends to occur at lower rates the deeper the seeds are buried in the soil, with the highest emergence rate occurring around one to two cm below the soil surface.

In recent years, instances of annual ryegrass germinating in the summer months have been detected, despite previously being limited to the winter season. Populations of the weed are becoming a problem in crops of Roundup Ready cotton (see photo), which adds the concern of glyphosate resistance to the already concerning adaptation to summer conditions. The summer populations of annual ryegrass may also move into fields used for grain crops.

In summer fallow fields, annual ryegrass may become a problem and could be difficult to deal with, especially in cases of glyphosate resistant populations. In addition, this weed is mainly considered a problem in southern regions of Australia – but anecdotal evidence suggests that annual ryegrass is spreading to the north.

While information is available on the growth of winter annual ryegrass and how to manage it, there is currently a lack of knowledge about summer adapted populations due to the small time period since their observation. We proposed this research idea in late 2015 but this issue was not given a priority at the time. Now, a new GRDC project has begun, which will focus on understanding the dormancy patterns and germination requirements of summer populations compared with winter populations. There will also be an investigation into the genetics involved in dormancy to identify what has led to this recent adaptation to summer conditions.

An important part of this new project involves the collection of seeds from summer growing and winter growing populations of annual ryegrass. Any information on the occurrence and location of annual ryegrass populations that have established over this past summer season (2018–19), or that occur in future summer seasons, would be greatly appreciated.

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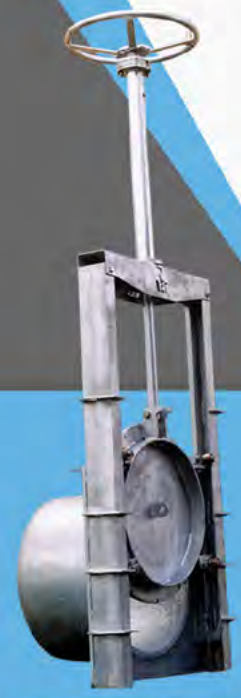

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Robotic reality opens up chipping and microwave potential

By Cindy Benjamin, WeedSmart

IF a herbicide resistant weed never sets seed then it won't be long before the resistance is eradicated. This is easy to say, but has been mighty hard to achieve because it is so time consuming.

Enter now the power of robotic weed control. Frequent scouting for, and removal of small weeds, is now a practical reality with a commercial robotic platform available for broadacre cropping operations.

Tom Holcombe, SwarmFarm Robotics Field Operations Lead says the theory has been proven recently in trials in Central Queensland, where weed blow-outs in fallows on two sites were brought under control using repetitive herbicide applications.

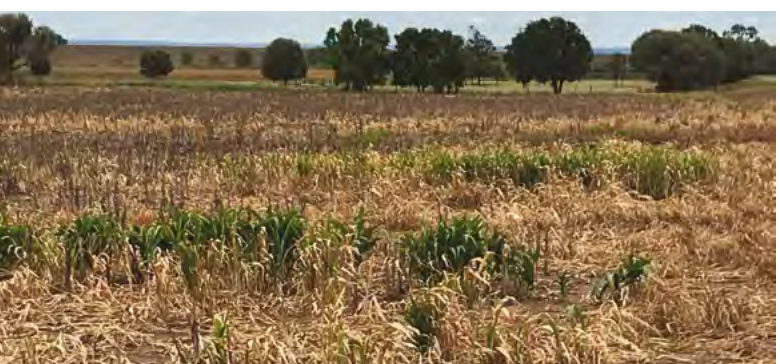
Tom Holcombe, SwarmFarm Robotics Field Operations Lead sees optical weed-seeking microwave units on a robotic platform as the next big thing in non-chemical weed control.

The two sites were on separate properties in the Springsure district of Central Queensland. One site was 44 hectares of fallow at 'Kilmore', following dryland sorghum, with weeds managed from August 2017 to March 2018. The other was 28 hectares at 'Denlo Park', following dryland cotton, with weeds managed from October 2017 to March 2018.

"To control weeds present in high numbers at both sites we decided that the robots would spray on a fortnightly basis to regain control," says Tom. "This regular and repetitive spraying achieved excellent control at each of the sites, avoiding the need to cultivate."

Over a period of eight weeks of routine, fortnightly spraying with knockdown herbicides using a Weedit mounted on the robot, the weed density dropped from the initial 20 per cent of the area, when it was considered out of control, down to approximately two per cent of the trial area.

This use pattern would be considered impractical and inadvisable in a conventional herbicide spraying program. The robotic platform made it possible, and it was effective due to the continual knocking of the same weeds until death was achieved and seed set prevented.



Repetitive herbicide applications brought this weed blow-out under control in just eight weeks of intense management using a robotic sprayer.

Having several small microwave units teamed with the Weedit sensors and mounted on a robotic platform removes the time and power constraints that have so far prevented microwave weed control being a realistic option for broadacre operations.

A commercial robotic platform also brings the opportunity to use optical weed sensing technology in conjunction with non-herbicide weed control tactics such as chipping and microwaving.

Both SwarmFarm (with Queensland state government funding) and The University of Western Australia (with GRDC funding) have shown that optical sensing works well with a chipping tyne implement that is activated only when a weed is 'spotted'. This makes cultivation for weed control site-specific and is compatible with zero-till farming.

Another prototype that SwarmFarm developed within the Queensland government's Strategic Cropping Land Mitigation funded project was a small microwave unit that activates only when a weed is present (as detected using a Weedit sensor).

"There has been a lot of interest in the potential of microwave for weed control, but the power and time involved has kept this technology out of reach," says Tom. "Having several small units teamed with the Weedit sensors and mounted on a robotic platform opens up a whole new set of opportunities."

"Time is no longer a constraint because the robot can stop and apply the necessary treatment without keeping an operator and tractor tied up, and the more often it is used, the smaller the weeds will be – needing less time and power to kill them."

The power constraint is also more realistic than trying to apply a 'blanket' microwave treatment across a whole paddock. Since only a few units on a multi-unit bar are likely to be activated at any one time, the power draw is far less and small weeds are much easier to kill than large weeds.

"There is also a soil health benefit given that the weeds can be controlled without affecting the soil biota of the whole paddock," he says.

"We are particularly keen on the development of a microwave rig now that we have proven the potential for this technology to be a very effective double-knock to take out weeds that survive a herbicide treatment, and even for its application on organic farms to dramatically reduce the reliance on cultivation," says Tom.

For more information about managing patches of herbicide resistant weeds, visit the Weedsmart website: *www.weedsmart.org.au*