WeedSeeker® technology

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Take home messages

- **significant reductions in water and chemical use can be achieved when weed sensing technology (WeedSeeker®) is used, compared with blanket applications.**
- **erect plants compared with prostrate plants require less spray.**

Background

Herbicides represent a significant proportion of farm expenditure. Keeping input costs low is an essential tool for minimising financial risk, particularly when climate and production are variable. In recent years, the value of controlling summer weeds has been evident, especially when the spring has been dry. That being said, spraying conditions and the range of weeds that occur over summer mean that robust rates of herbicides are required to ensure adequate control. Growers often need to decide whether the weed population warrants the use of expensive products and high herbicide rates.

Weed sensing technology has the potential to provide farmers with the ability to spray only the weeds that are present. This also allows robust rates to be employed. Weedseeker® technology use sensors that measure infra-red and invisible red light reflectance off the ground. The reflectance is captured and analysed by an electronic circuit inside the sensor. If the light signature for chlorophyll (green pigmentation of plants) is identified (less red light reflected), the spray nozzle is triggered and chemical is sprayed directly onto the green weed. This technology has the ability to avoid spraying bare ground, to target specific weeds and to spray at high concentrations. If this technology proves to be effective, farmers will no longer need to apply blanket summer sprays, reducing cost and increasing efficiency.

BCG has been funded by the Rural Industries Research and Development Corporation (RIRDC) to investigate the effectiveness of weed sensing technology in the Wimmera Mallee region.

A replicated field trial was established at Corack to identify the potential savings that can be achieved at various plant densities of canola, wheat and barley. These crops were chosen to represent a broadleaf weed, volunteer cereal and grass weed. This study will assist farmers to identify thresholds and determine when the benefits of weed sensing technology outweigh a blanket application and vice versa.

Aim

- to quantify the reduction in water use for various weed species at different plant densities
- to identify thresholds for particular weed types and determine when weed sensing technology benefits outweigh blanket spray applications

Method

Canola, wheat and barley seed were broadcast using a small plot seeder (out of the ground) at different densities and then incorporated by harrows behind the seeder. Each crop type was chosen to allow comparisons of water use between weeds of different shape and size. Canola (c.v. Hurricane) was chosen to represent a broadleaf weed (radish); wheat (c.v. Yitpi) was selected to symbolise volunteer wheat; and barley (c.v. Gairdner), due to its low-lying, prostrate nature, was chosen to represent annual grass (brome grass).

Location:	Corack
Replicates:	3
Plot size:	30m x 1.8m
Crop types:	canola (wild radish), wheat (volunteer wheat), barley (brome grass).
Plant density:	1,5,10, 20, 40, 60, 80 plants/m^2
Sowing:	1 July 2011
Water application:	12 August 2011
Spraying conditions:	speed (8km/hr); pressure (2.5 bar); water 90L/ha
Crop growth stage:	GS15.5

A ute-mounted boom fitted with weed sensing technology (Weedseeker) was used to spray each plot. The boom was filled with a known volume of water (10L) before spraying each plot. After each plot had been sprayed, the remaining water was measured to determine how much water the boom had applied. A blanket application was applied to the control plots.

Results

Spray used for various plant types and densities

Significant differences were measured for the volume of water used for barley, wheat and canola and various plant densities (1, 5, 10, 20, 40, 60, 80 and blanket spray). Interactions between crop type and plant density were also evident. The lowest spray volume was used on wheat when compared with barley and canola. Low barley densities of 1 to 10 plants/m^2 used more spray than canola, but this reversed when plant densities reached 20 plants/m^2 (Table 1).

Table 1. Volume (ml) of spray used for different plant types and densities using weed sensing technology and the percentage of spray used compared with the control (blanket) spray

Plant density/m^2	Weed Type					
	Barley (simulating brome grass)		Wheat (simulating volunteer wheat)		Canola (simulating wild radish)	
	Water used (ml)	% of blanket spray*	Water used (ml)	% of blanket spray*	Water used (ml)	% of blanket spray*
1	423	40	191	18	85	8
5	587	56	288	27	371	35
10	727	69	282	27	600	57
20	652	62	555	53	811	77
40	629	60	420	40	868	83
60	708	67	651	62	934	89
80	755	72	562	54	952	91
Blanket spray	1049	100	1049	100	1049	100
Sig.diff. (plant density) **LSD (P=<0.05) CV%**	**P=<0.001** **40** **3.3**		**P=<0.001** **24** **2.7**		**P=<0.001** **25** **2.0**	
Sig.diff (plant density x crop type) **LSD (P=<0.05) CV%**	**P=<0.001** **35** **3.1**					

**% water use compared with blanket spray water use.*

Cost of summer spray and weed sensing technology

Table 2 summarises the approximate cost of a summer herbicide spray mix, combined with the spraying operation cost for Weedseeker versus a farmer's boom spray. A contract Weedseeker rate of $12.50/ha (excluding GST) was applied and was compared with the farmer's boomspray cost of $5.00/ha. The table below shows that Weedseeker costs $7.50/ha more to use. This means, in this case, at least a 28.5% saving of chemical application is needed to make up for this difference.

Table 2. Cost of summer herbicide spray using Weedseeker® and a farmer's boom spray

Cost of application	Cost ($/ha)
Weed sensing unit (contract + diesel)	13.5
Farmer owned boom (+ diesel)	6.0
Cost difference	**7.50**

Interpretation

Trial results showed that spraying plants with Weedseeker used significantly less water than a blanket spray, especially at lower plant densities. The economic analysis showed that plant density thresholds of 80 plants/m^2 or less for barley (simulated brome grass) and wheat (simulated volunteer wheat) and less than 20 plants/m^2 for canola (simulated wild radish) would be necessary to cover the Weedseeker application cost, when compared with using the farmer's own boom. By recovering more than the Weedseeker application cost, which in this example is $7.50/ha, then other advantages or economic savings can be achieved.

The trial suggested that plants with a prostrate growth habit such as barley and canola used a greater amount of spray than those with an erect physical structure such as wheat. Broadleaf and prostrate weeds would therefore use more chemical compared with erect grass weeds.

This trial investigated only a one spray approach. Further studies could assess the long term effectiveness of a one and/or two sprays and the effectiveness of the application, in particular, weed coverage.

Commercial practice: what this means to the farmer

Once the break even cost of the weed sensing technology is achieved, further savings could be used to spray a greater area, increase the rate of application for particular herbicides, or simply save the money.

When using weed sensing technology, careful herbicide selection would be necessary to ensure small weeds do not evade control. Commercial booms are typically equipped with twin lines, allowing the contractor to put a low rate of chemical (e.g. Roundup) into the blanket line and apply at a low water volume (50L/ha). This means that expensive chemicals can be applied through the Weedseeker line. The sensitivity of the technology can then be adjusted so that Weedseeker applies only the expensive chemicals to the larger weeds.

Whilst this technology shows potential for growers to reduce their chemical costs, it is not cheap to set up. To set up a 30m boom costs about $100,000-130,000 (about $4,500 per metre). Significant savings and greater efficiencies would see this investment pay off over a relatively short period, but further information is needed.

Through this project, BCG has investigated the effectiveness of a commercial Weedseeker boom. A paddock survey during summer will also be conducted to determine the potential savings that may be found with a second spray application.

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