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Weeds

Demonstrating integrated weed management strategies to control barley grass in low rainfall zone farming systems

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Location
Minnipa Agricultural Centre, paddock S3
Rainfall
Av. Annual: 324 mm
Av. GSR: 241 mm
2019 Total: 254 mm
2019 GSR: 234 mm
Soil type
Red sandy loam
Paddock history
2019: Compass barley
2018: Scepter wheat
2017: Volga vetch
Rainfall
27 m x 620 m x 3 reps (3 paddock seeder strips (27 m each) wide)

Key messages

- **In 2019 the IMI system had the lowest barley grass plant numbers.**
- **The Cultural Control strategy did not achieve the desired outcome of having a more even seed spread and increased competition in the inter row for barley grass weed control.**
- **The medic pasture produced low dry matter compared to the cereal systems, had the highest barley grass population and the lowest competitive ability with the barley grass.**
- **The loss of Group A herbicides to control barley grass within local pasture systems has the potential to change rotations and decrease farm profitability.**

Why do the trial?

Barley grass possesses several biological traits that make it difficult for growers to manage it in the low rainfall zone, so it is not surprising that it is becoming more prevalent in field crops in SA and WA. A survey by Llewellyn *et al*. (2015) showed that barley grass has now made its way into the top 10 weeds of Australian cropping in terms of area infested, crop yield loss and revenue loss.

The biological traits that make barley grass difficult for growers to manage in low rainfall zones include:

- early onset of seed production, which reduces effectiveness of crop-topping or spray-topping in pastures,
- shedding seeds well before crop harvest, reducing harvest weed seed control effectiveness compared to weeds such as ryegrass which has a much higher seed retention,
- increased seed dormancy, reducing weed control from knockdown herbicides due to delayed emergence, and
- increasing herbicide resistance, especially to Group A herbicides, used to control grass weeds in pasture phase and legume crops.

Barley grass management is likely to be more challenging in the low rainfall zone because the growing seasons tend to be more variable in terms of rainfall, which can affect the performance of the pre-emergence herbicides. Furthermore, many growers in these areas tend to have lower budgets for management tactics, and break crops are generally perceived as more risky than cereals. Therefore, wheat and barley tend to be the dominant crops in the low rainfall zone. This project is undertaking coordinated research with farming systems groups across the Southern and Western cropping regions to demonstrate tactics that can be reliably used to improve the management of barley grass.

How was it done?

On 27 March 2019 a meeting was held between seven growers, four MAC staff, one consultant and Dr. Gurjeet Gill to discuss the issue of barley grass in upper EP farming systems. A three year broad acre management plan (2019-21) was developed to be implemented with five different strategies to be tested and compared in a replicated broad acre farm trial on the MAC farm (Table 1).

These management strategies will be tested over the three year rotation with the focus on barley grass weed management and weed seed set.

Three replicated broad acre strips of three seeder widths (27 m wide) were sown in MAC paddock S3 on 17 May. Barley was sown at a seeding rate of 65 kg/ha, with GranulockZ fertiliser at 50 kg/ha, and 1.2 L/ha glyphosate, 1.5 L/ha trifluralin and 400 g/ha diuron. The 'Higher cost' chemical strategy hay cut barley was sown at 95 kg/ha, and the 'Cultural control' double seeding rate was inter row sown with a final seeding rate of 120 kg/ha and was only sprayed with 1.2 L/ha glyphosate. The IMI strategy with Scope barley was sprayed on the 16 July with 700 ml/ha Intervix.

The self-regenerating medic pasture was sprayed on 17 May with propyzamide @ 1 L/ha, followed with Targa Bolt @ 190 ml/ha, Broadstrike @ 25 g/ha and clethodim @ 250 ml/ha on 2 July. Due to high levels of barley grass escapes it was also sprayed with paraquat @ 1.2 L/ha on 3 September. The hay cut occurred on 26 September prior to which it was sprayed with 1.8 L/ha Weedmaster DST on 3 September.

Crop establishment, dry matter, barley grass numbers, barley grass seed set, grain yield and quality were assessed during the growing season. The dry matter hay cut was taken on 26 September and the other dry matter cuts a week later on 3 October. Late barley grass samples were taken and panicles sent to Roseworthy for the assessment of barley grass seed set and herbicide resistance testing. The 27 m strips were harvested with the plot header (3 times) per treatment on 28 October and grain quality was assessed.

What happened?

There were differences in plant establishment with the higher seeding rates resulting in an increase in barley plant numbers, as shown in Table 1. The highest plant establishment was in the Higher cost chemical strategy (sown at 95 kg/ha for a hay cut), and the Cultural Control strategy (sown at 120 kg/ha).

The Cultural Control strategy was a double sown system, with 60 kg/ha barley seed spread on top of the ground and 60 kg/ha sown over the top to give a total seeding rate of 120 kg/ha. Although this strategy had higher plant numbers, the seeding system did not achieve the desired outcome of greater seed distribution to increase competition with weeds, due to seed being buried in a dry part of the raised furrow reducing the germination. The cultural control strategy resulted in similar barley grass weed control as the district practice.

Barley grass weed numbers increased between 25 June and 28 August, indicating late germination patterns requiring a vernalisation (cold) are present in this population. Barley grass weed numbers were lowest in the IMI strategy. The medic pasture systems had the highest barley grass weed population with an average of 127 barley grass weeds/m2. Despite using propyzamide @ 1 L/ha on 17 May with 7.8 mm of rainfall in the following two days to activate the chemical, weed control in the pasture phase was disappointing. Some barley grass had already germinated before the application of propyzamide, which could have reduced its efficacy.

Table 1. The five different management strategies and crops for each season (2019-2021) at Minnipa Agricultural Centre, paddock S3.

Strategy	2019	2020	2021
District Practice	Compass barley	Self-regenerating medic pasture (Gp A)	Scepter wheat
IMI system	Scope barley (with IMI (Gp B) applied)	Sultan sown medic pasture (IMI tolerant)	Razor CL wheat (IMI tolerant)
Higher cost herbicide	Compass barley for hay cut sown at higher seeding rate	Scepter wheat (Gp K - Sakura) with harvest weed seed control (HWSC) chaff lines and burning	Spartacus barley (with IMI if needed)
Two Year Break	Self-regenerating medic pasture (Gp A)	TT canola (Gp C, Triazines)	Scepter wheat with harvest weed seed control (chaff lines and burning)
Cultural Control	Compass barley at double seeding rate	Self-regenerating medic pasture (Gp A)	Scepter wheat with no row spacing for competition and HWSC

IMI = imidazolinone herbicides (Gp B).

Table 2. Plant and barley grass weed numbers, dry matter, yield and grain quality in GRDC Low Rainfall Barley Grass Management farm trial, 2019.

Barley grass weed control strategy, barley variety and seeding rate (kg/ha)	Crop establishment 25 June (plants/m²)	Early barley grass numbers 25 June (plants/m²)	Late barley grass numbers 28 Aug (plants/m²)	Late dry matter 3 Oct (t/ha)	Yield 28 Oct (t/ha)	Protein (%)	Screenings (%)
District Practice Compass (70 kg/ha)	134	2.3	8.5	6.0	2.08	14.2	4.4
IMI system Scope (70 kg/ha)	128	1.7	0	5.0	1.06	15.1	10.5
Cultural Control Compass (120 kg/ha)	187	3.7	8.3	5.5	1.84	13.5	4.0
Higher cost herbicide (hay) Compass (95 kg/ha)	164	3.3	3.6	6.8*	-	-	-
Two Year Break Self -regenerating medic pasture	146	123.5	129.5	0.9	-	-	-
LSD (P=0.05)	*28*	*29.6*	*8.0*	*0.9*	*0.4*	*1.1*	*1.2*

**Sampled on 26 August*

The pasture system also received Targa Bolt @ 190 ml/ha, Broadstrike @ 25 g/ha and clethodim @ 240 ml/ha on 2 July, with poor barley grass weed control. Poor efficacy of the Group A herbicides is likely to be associated with resistance to this group. Paraquat @ 1.2 L/ha was sprayed in the pasture phase on 3 September to prevent weed seed set.

Compass barley sown at 95 kg/ha for a hay cut produced the greatest dry matter, with the Scope barley producing significantly lower dry matter and grain yield than Compass. Grain protein in Scope barley was higher than Compass, which was most likely due to its lower yield and higher screenings. The medic pasture produced lower dry matter compared to the cereal systems and had a lower competitive ability with barley grass compared to barley.

What does this mean?

Barley grass seed germination occurred between late June and August indicating a late germinating population that avoids early weed control with pre-sowing herbicide applications. Germination patterns of the barley grass populations from different low rainfall regions has been assessed at Roseworthy as part of this research project.

The Cultural Control strategy with a double inter row sown system @ 120 kg/ha did not reduce the barley grass numbers compared to the district practice system, as it did not achieve the desired outcome of having a more even seed spread and increased competition in the inter row for barley grass weed control.

The IMI system had the lowest barley grass weed numbers indicating the Group B system is still working at MAC, and is an effective strategy. However, the IMI herbicide system tends to be quite prone to evolution of resistance in weeds. Therefore strategic use of the IMI herbicide system must be used to maximise the effectiveness and long term use of this system. Growers also need to be aware of herbicide breakdown and plant back periods, especially in low rainfall seasons to avoid bare paddocks.

The medic pasture produced lower dry matter compared to the cereal systems. It also had the highest barley grass weed population and the lowest competitive ability with the barley grass compared to the barley systems. The high levels of barley grass escapes when sprayed with Group A herbicides indicated herbicide resistance is becoming a major issue on MAC and in this region. The loss of Group A chemicals within our pasture break system has the potential to totally change farming systems. Currently farmers on upper EP rely on self-regenerating medic based systems with a profitable livestock enterprise, with grass control applied to prevent weed seed set in spring. The loss of the ability to control barley grass weeds using Group A herbicides will result in medic pasture having to be sprayed out using glyphosate in spring. This will reduce the feed base and carrying capacity, incur later sowing times in the cropping phase to gain weed control or more cropping dominate systems with other break crops (canola, vetch, lentils) and alternative herbicide groups which will increase risk and impact on profitability.

To ensure Group A resistance is kept in check, farmers may want to make sure any suspected resistant plants are dealt with in pasture systems by following up with a knockdown herbicide as early as possible to prevent seed set. Always have follow up options to control any survivors and to preserve Group A herbicides. Using alternative chemical groups by including canola or introducing Clearfield systems as a different rotational break may also be an option. The loss of Group A herbicides within current farming systems may result in high barley grass seed bank carry over. Reducing the weed seed bank is pivotal to managing all grass weeds.

If barley grass herbicide resistance is suspected, the first step is to test the population to know exactly what you are dealing with. This project has the ability to test barley grass populations for suspected herbicide resistance over the next two seasons, so contact Amanda Cook if you would like an Eyre Peninsula population tested. This paddock scale MAC research is ongoing for the next two seasons to assess the different barley grass weed management strategies.

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