Barley Grass, an Emerging Weed Threat

RESEARCH

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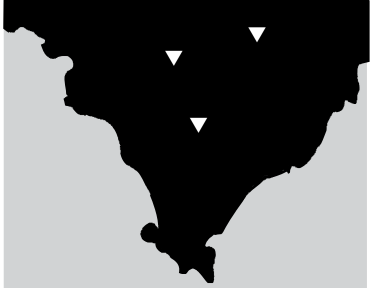
Searching for answers



Location: Minnipa Ag Centre
Rainfall
Av Annual: 325 mm
Av GSR: 242 mm
2009 Total: 421 mm
2008 GSR: 333 mm

Yield
Potential: 5.2 t/ha
Actual: 4.3 t/ha

Paddock History
2008: Wheat
2007: Wheat
2006: Wheat

Soil Type
Sandy clay loam

Plot size
20 m x 1.5 m x 4 reps

Location: Buckleboo
Michael & Mary Schaefer

Rainfall
Av Annual: 305 mm
Av GSR: 216 mm
2009 Total: 315 mm
2008 GSR: 247 mm

Yield
Potential: 2.7 t/ha (W)
Actual: 1.8 t/ha (W)

Paddock History
2008: Wheat
2007: Oaten Hay
2006: Oats

Soil Type
Red clay loam

Plot size
14 m x 6 m x 4 reps

Key messages

- **Barley grass is becoming more prevalent in many cropping districts.**
- **The ecology of barley grass has changed making it a more problematic weed in crops.**
- **Herbicides trialled provided various levels of control, with Sakura providing the highest and most consistent control.**

Why do the trial?

Barley grass has historically been a problematic weed in pastures or where crops were sown dry without an effective knockdown. However, a number of growers had suggested that they were now finding barley grass regularly in their crops. This was supported by our recent survey where growers ranked their most problematic weeds currently, compared with 5 years ago. Results from this showed that on Eyre Peninsula barley grass had moved from fifth worst weed to third in the last five years. In the Upper North barley grass now appears at fourth position and is found in the top ten weeds in Lower and Mid North. In the Mallee, while not quite in the top five weeds, it has moved up in ranking significantly over this time. The reasons behind this change in ranking were unknown. This could be due to a run of dry seasons where growers have increasingly used dry and early sowing, resulting in no or ineffective herbicide knockdown. Alternatively the behaviour of barley grass may have changed in response to crop management practices. In addition, some growers reported that barley grass had remained a significant issue, even when paddocks were not dry sown. Following this, investigations have begun to understand why barley grass is becoming more problematic and how it can be best managed.

How was it done?

Barley grass seed was collected, just prior to harvest in 2008, from a number of cropping paddocks across Eyre Peninsula (Yaninee, Minnipa, and Buckleboo), Lower North (Owen and Roseworthy) and Yorke Peninsula (Arthurton). Seed biology of these populations was studied in laboratory tests. Initially, the germination pattern of these populations was studied, to assess seed dormancy. Investigations then followed into the effect of light, seed scarification, plant hormones and temperature on seed dormancy to understand field behaviour of these populations.

Also five field trials were set up at three locations on Eyre Peninsula.

Location 1, Buckleboo:

- Herbicide efficacy trial: two times of sowing (TOS), 22 April and 15 May; see Table 1 for herbicide treatments. Plots were 6 x 14 m in size and herbicide treatments covered a single pass with the air-seeder. Measurements taken included crop density, weed density at two timings, weed seed head density, weed seed production, crop yield, screenings and barley grass contamination of grain.
- Seed-bank study: soil cores taken to track decline in barley grass soil seed-bank when no new seed is added, to establish how many years of control are required to exhaust barley grass seed-bank.

Location:
Lock
Andrew & Jenny Polkinghorne

Rainfall
Av Annual: 340 mm
Av GSR: 260 mm
2009 Total: 356 mm
2008 GSR: 315 mm

Yield
Potential: 4.1 t/ha
Actual: 2.3 t/ha

Paddock History
2008: Wheat
2007: Wheat
2006: Peas

Soil Type
Calcareous loam

Plot size
14 m x 6 m x 4 reps

Location 2, Lock:

- Herbicide efficacy trial: as above, but only one TOS (16 May). Set up similarly to above, but plot size 6 x 12 m.

- Seed-bank study: as per Buckleboo.

Location 3, Minnipa

- Herbicide efficacy trial: two times of sowing (22 April and 21 May), herbicide treatments same as other sites (Table 1). TOS-2 also had two seeding system treatments, disc (K-Hart) and Knife point (DBS). Plots were sown with plot seeder and were 1.5 x 20 m in size.

- Seed-bank study: as per Buckleboo.

What happened?

Dormancy studies showed that many of these barley grass populations had high levels of seed dormancy at maturity and in some populations dormancy persisted for a long time (Figure 1). Populations ranged anywhere from 80% germination (Yaninee) in March, as would be expected in barley grass, to populations such as that from Minnipa that did not germinate in the lab tests even though all populations had highly viable seeds. This finding explains why barley grass is becoming a greater problem in crop, as it avoids knockdown herbicide with its dormancy and then germinates in crop where control is far more limited.

The mechanisms of this dormancy have been studied with various influences on dormancy, such as light, seed husk, and cold requirement (chilling). The chilling effect (Figure 2) seemed to be the most influential in the highly dormant populations. This means that the dormant barley grass requires not only moisture, but a period of colder temperatures to germinate. This is also evident when comparing barley grass plant numbers between the first time of sowing and the second at Buckleboo with 376 plants /m2 and 95 plants /m2 respectively. This is a large reduction in barley grass due to about three weeks of cooler moist conditions in late autumn-early winter encouraging a break in dormancy and allowing better control of barley grass with knock down herbicide before seeding.

Barley grass control from herbicide treatments at each field site is shown in Table 2. Barley grass control has been reported as seed set reduction from the control treatment. This has been used to demonstrate reduction in the paddocks barley grass seed bank, and future barley grass infestations. At all the sites, knockdown herbicide alone provided unacceptable barley grass control as shown by seed set/m^2 in brackets. For the post emergent treatments Monza provided higher and more consistent control over Atlantis. This could possibly be due to Monza's longer soil residual, enabling it to have activity on even the later cohorts of barley grass. Out of the lower cost pre-emergent treatments, metribuzin, diuron and Logran mix seemed to give the most consistent control. Sakura provided the highest and most consistent control over all the herbicides trialled. Sakura has not been released onto the market yet, but is expected to be available in 2011.

Table 1 Herbicide treatments at Buckleboo, Lock and Minnipa, 2009

Herbicide Treatments
1. Control (only knockdown herbicide pre-seeding)
2. Trifluralin (480 g/L) @ 1.6 L/ha (immediately before sowing, IBS)
3. Trifluralin (480 g/L) @ 1 L/ha + Logran (triasulforon 750 g/kg) @ 30 g/ha (IBS)
4. Metribuzin (750 g/kg) @ 150* g/ha (IBS)
5. Trifluralin (480 g/L) @ 1 L/ha + Diuron (900 g/kg) @ 500 g/ha (IBS)
6. Metribuzin (750 g/kg) @ 150* g/ha + Diuron (900 g/kg) @ 250 g/ha + Logran (triasulfuron 750 g/kg) @ 30 g/ha (IBS)
7. Monza (sulfosulfuron 750 g/ha) @ 25 g/ha (post emergent, PE)
8. Atlantis (mesosulfuron-methyl 30 g/L)
9. Boxer Gold (prosulocarb 800 g/L, S-metolachlor 120 g/L) @ 2.5 L/ha (IBS)
10. Sakura (pyroxasulfone) @ 118 g/ha (IBS)
**180 g/ha Metribuzin applied at Minnipa due to heavier soil texture* *Surfactants also applied as per product label* *The above herbicide treatments are for research purposes and may not be registered*

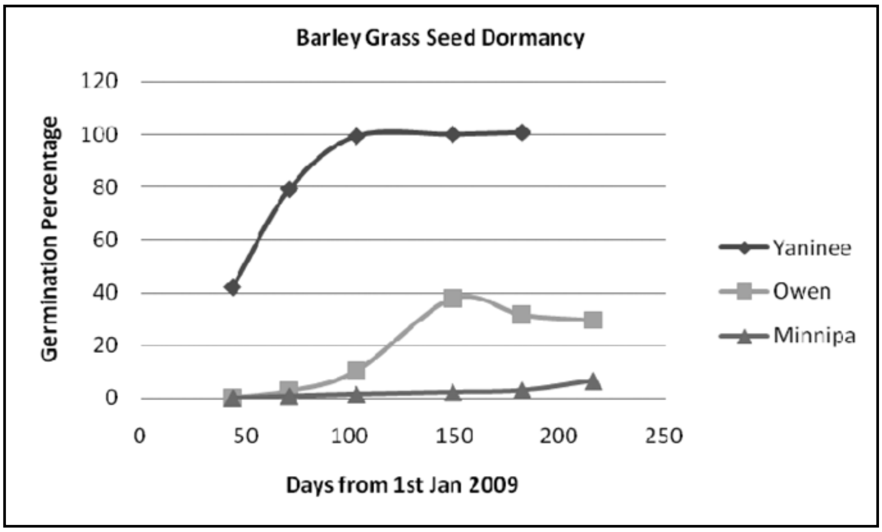


Figure 1 Barley grass seed dormancy

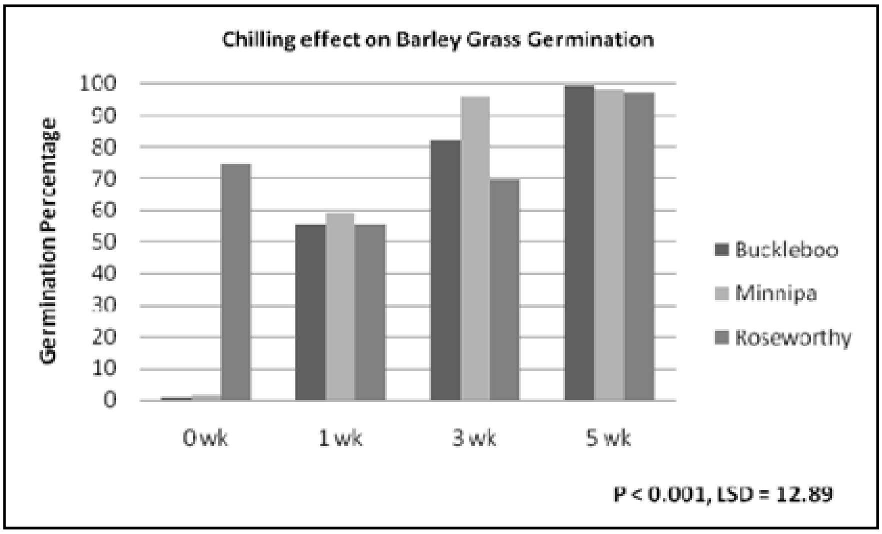


Figure 2 Effect of chilling on germination of three barley grass populations.
Cold treatments ranged from no cold treatment to 5 weeks cold treatment

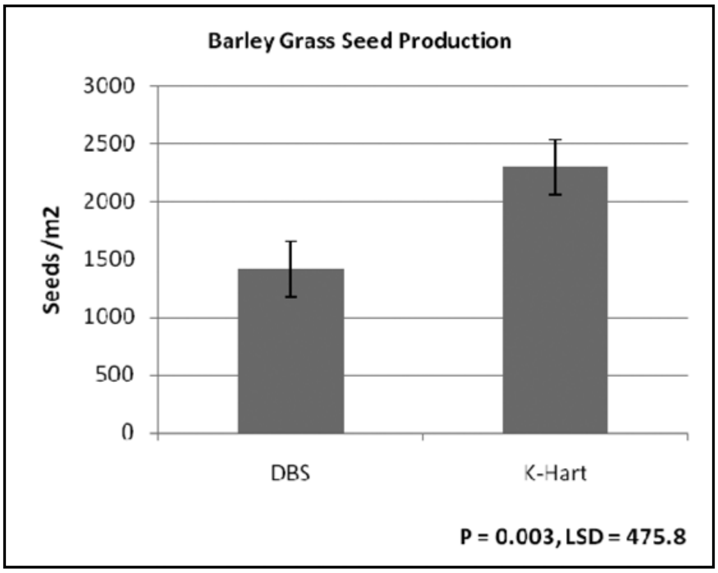


Figure 3 Seeding system effect on barley grass seed production

The Minnipa TOS-2 trial had both herbicide treatments and seeding system treatments. While there were no herbicide treatments that were affected by seeding system treatments, the disc (K-Hart) had 16% more barley grass plants than the knife point (DBS) and resulted in more barley grass seed production as shown in Figure 3. These results indicate that unlike annual ryegrass, barley grass is not disadvantaged by the disc seeding system. Reasons for this are likely to be related to the nature of the barley grass seed. The sterile florets and thick husk would increase the surface area of the seed for water absorption and could protect the seed from fluctuations in moisture and the ability of the seed for self-burial, would make it well adapted to seeding systems that keep seed on the soil surface.

Table 2 Barley Grass control in terms of seed production (%) across field sites, 2009

Herbicide	Buckleboo TOS-1 (22 April)	Buckleboo TOS-2 (15 May)	Lock (16 May)	MInnipa TOS-1 (22 April)	MInnipa TOS-2 (21 May)
Control (only knockdown herbicide)	0 % a (8702 seed/m^2)	0 % (1625 seeds/m^2)	0 % ***a*** (3059 seeds/m^2)	0 % ***b*** (6524 seeds/m^2)	0 % ***a*** (4248 seeds/m^2)
Trifluralin @ 1.6 L/ha (IBS)	-2 % ***a***	48 %	7 % ***ab***	-27 % ***a***	47 % ***b***
Trifluralin @ 1 L/ha + Logran @ 30 g/ha (IBS)	55 % ***c***	6 %	14 % ***ab***	43 % ***d***	75 % ***d***
Metribuzin @ 150 - 180 g/ha (IBS)	19 % ***b***	46 %	4 % ***ab***	19 % ***c***	42 % ***b***
Trifluralin @ 1 L/ha + Diuron @ 500 g/ha (IBS)	14 % ***b***	-5 %	28 % ***b***	-9 % ***b***	74 % ***d***
Metribuzin @ 150 - 180 g/ha + Diuron @ 250 g/ha + Logran @ 30 g/ha (IBS)	62 % ***d***	53 %	28 % ***b***	35 % ***d***	68 % ***d***
Monza @ 25 g/ha (PE)	54 % ***cd***	47 %	53 % ***bc***	58 % ***e***	64 % ***cd***
Atlantis @ 330 mL/ha (PE)	15 % ***b***	2 %	13 % ***ab***	26 % ***cd***	40 % ***b***
Boxer Gold @ 2.5 L/ha (IBS)	49 % ***c***	61 %	4 % ***ab***	37 % ***d***	57 % ***c***
Sakura @ 118 g/ha (IBS)	92 % ***e***	60 %	64 % ***c***	70 % ***f***	96 % ***e***
Barley Grass seed production as percentage of Control herbicide treatment for each site, Statistical ($P \leq 0.05$) differences displayed with letters for each site					

Wheat yields for each herbicide treatment at each site are displayed below in Table 3. Increased yields seem to be related to improvements in barley grass control. This shows up well when comparing the two sites at Buckleboo, where the herbicide treatments that had higher barley grass control having virtually no difference between TOS-1 and TOS-2. While those with lower levels of control yielded higher in the TOS-2, which had lower barley grass density.

What does this mean?

Barley grass is now a problematic crop weed for many growers. This appears to be due to high levels of seed dormancy in many paddock populations. High dormancy and chilling requirement in barley grass would enable these populations to avoid knockdown herbicides and germinate in crop where control options are far more limited. Herbicides trialled showed variable levels of control, with Sakura providing the highest and most consistent control.

Further barley grass work on the mechanisms behind increased dormancy, seed-bank life and control will continue in 2010.

Table 3 Wheat yields (t/ha) for all field sites, 2009

Herbicide	Buckleboo TOS-1 (22 April)	Buckleboo TOS-2 (15 May)	Lock (16 May)	MInnipa TOS-1 (22 April)	MInnipa TOS-2 (21 May)
Control (only knockdown herbicide)	1.0 *ab*	1.5 *a*	2.2	2.4 *b*	3.9
Trifluralin @ 1.6 L/ha (IBS)	0.9 *a*	1.7 *ab*	2.2	2.0 *a*	4.3
Trifluralin @ 1 L/ha + Logran @ 30 g/ha (IBS)	1.8 *e*	1.8 *b*	2.3	2.9 *c*	4.2
Metribuzin @ 150 - 180 g/ha (IBS)	1.0 *ab*	1.7 *b*	2.5	2.4 *b*	3.8
Trifluralin @ 1 L/ha + Diuron @ 500 g/ha (IBS)	1.0 *b*	1.8 *b*	2.6	2.3 *ab*	4.3
Metribuzin @ 150 - 180 g/ha + Diuron @ 250 g/ha + Logran @ 30 g/ha (IBS)	1.8 *ef*	1.8 *b*	2.3	2.8 *c*	4.3
Monza @ 25 g/ha (PE)	1.7 *e*	1.8 *b*	2.3	2.8 *c*	4.2
Atlantis @ 330 mL/ha (PE)	1.3 *c*	1.8 *b*	2.3	2.6 *bc*	4.0
Boxer Gold @ 2.5 L/ha (IBS)	1.5 *d*	1.7 *ab*	2.4	2.5 *bc*	4.3
Sakura @ 118 g/ha (IBS)	1.9 *f*	1.8 *b*	2.7	2.7 *bc*	4.3
Statistical ($P \leq 0.05$) differences displayed with letters for each site					

Recommendations from work done in 2009 include:

- Take barley grass seriously as a crop weed.
- Be sure to achieve maximum control at every opportunity particularly in pasture phases and break crops where high levels of control can be achieved. Consider barley grass control when deciding on herbicides in cereal.
- Assess barley grass escapes in spring and undertake seeding in problem barley grass paddocks right at the end of your seeding program. This approach will not delay overall seeding time for the farm, but gives barley grass longer exposure to chilling conditions, thereby achieving higher germination which can be controlled by knockdown herbicide before seeding.

Acknowledgements

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