Management of herbicide resistant Barley grass in pulse crops

Ben Fleet[1], Lovreet Shergill[1], Gurjeet Gill[1], & Barry Mudge[2]

[1]School of Agriculture, Food & Wine, University of Adelaide

[2]Upper North Farming Systems

Key messages

- Increasing incidence of barley grass in cropping paddocks in southern Australia is likely to be associated with selection of more dormant biotypes by weed management practices used by growers.
- In some districts, barley grass management is now being complicated by the evolution of group A resistance. However, there appear to be several effective potential herbicide alternatives for barley grass control in broadleaf crops.
- Integrated weed management strategies are critical to delay onset of herbicide resistant barley grass.

Why do the trials?

Feedback from growers and consultants in southern Australia has clearly shown increasing spread of barley grass. In a recent survey by Fleet and Gill (2008), farmers in low rainfall districts in South Australia and Victoria reported increasing incidence of barley grass in their crops. Research undertaken at the University of Adelaide has shown that barley grass has developed increased seed dormancy in response to management practices used in cropping systems. Presence of increased seed dormancy in this grass weed species has enabled it to escape pre-sowing control tactics used by the growers. This explains why barley grass is a problematic weed in cereal crops. However, in some locations like Port Germein and Baroota districts, it has now become largely impossible to control in pulse crops. This is likely due to the presence of group A (fop & dim) herbicide resistance. Currently in these locations barley grass control is reliant on growing Clearfield wheat and the use of imidazolinone (group B) herbicides. This management strategy is at high risk of collapsing from the additional development of group B herbicide resistance. Previous studies have shown that resistance to group B herbicides can develop relatively quickly. Presence of large densities and repeated exposure to group B herbicides could rapidly lead to group B resistance in such barley grass populations. The extent of this resistance needs to be understood and effective management strategies to manage resistant barley grass in pulse crops developed.

How was it done?

In 2012 a field trial was conducted at Baroota to evaluate possible herbicide options for controlling herbicide resistant barley grass in pulse crops (Kaspa peas). At the trial site, there was a very high background population of barley grass that was strongly suspected to be resistant to group A herbicides. Herbicide treatments were developed for experimental purposes only and many are not currently registered (Table 1.). Assessments included control of barley grass, crop safety and yield. Herbicide resistance at the site was confirmed in a pot study at the University of Adelaide.

Two random surveys were conducted to evaluate the extent of herbicide resistant barley grass. The first focused on cropping paddocks between Port Pirie and Port Augusta, where most reports of resistance have been. The second survey focussed on problem barley grass regions on Eyre Peninsula and included transects from Kimba to Wirrulla, Kimba to Buckleboo, Cowell to Smoky Bay via Elliston, and Darke Peak to Kopi via Port Neill and Tooligie. Samples from these surveys will be screened at the University of Adelaide for herbicide resistance during 2013.

What happened?

Barley grass collected from the trial site at Baroota, was screened for resistance. It is clear that the repeated exposure of the Baroota population to group A herbicides has resulted in high level of resistance (Figure 1). This population has confirmed resistance to quizalofop (Targa), haloxyfop (Verdict) and clethodim (Select).

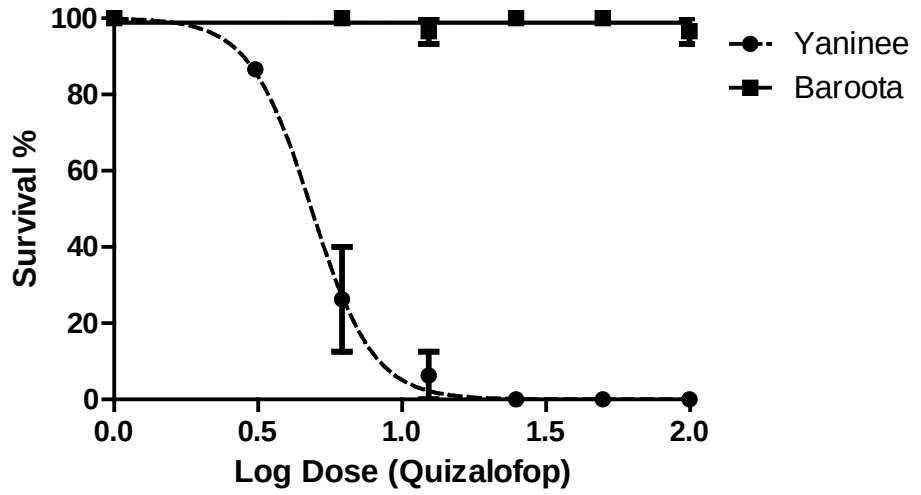

Figure 1. Effect of quizalofop (e.g. Targa) on the survival of barley grass field population from Baroota (Pt Germein) and the susceptible population from Yaninee. Herbicide rates are 0, 1/8, ¼, ½, 1, 2, & 4 x field rate (300 mL/ha of herbicide)

The herbicide treatments trialled achieved various levels of barley grass control in field peas. Sakura, Raptor (imazamox) and Propyzamide provided excellent control of barley grass, which was reflected in significant increases in grain yield of field peas (Table 1). Outlook (dimethanamid) appeared to be relatively ineffective early in the season but its performance improved with time, so it may also have a useful role in field peas.

Table 1. Effect of different herbicide treatments on grain yield of field peas and reduction in group A resistant barley grass seed production at Baroota (SA) in 2012. Control treatment (knockdown alone) allowed seed set of potentially >65,000 seeds/m^2.

Treatments	Seed set reduction (%)	Pea yield (t/ha)
Sakura @ 118 g/ha IBS	99	2.29
Boxer Gold @ 2.5 L/ha IBS	74	1.41
Outlook @ 1 L/ha IBS	93	2.14
Raptor @ 45 g/ha + BS1000 0.2% PE	100	2.08
Trifluralin @ 2.0 L/ha + Avadex Xtra @ 2L/ha	71	1.32
Metribuzin @ 200 g/ha PSPE	46	0.82
Propyzamide 500 @ 1.5 L/ha	100	2.29
Diuron 900@ 1 kg/ha + Trifluralin @ 2.0 L/ha IBS	78	1.58
Trifluralin 2.0 L/ha IBS	68	1.19
Control	-	0.82
LSD (P=0.05)		0.33

What does this mean?

Barley grass, like annual ryegrass, has the capacity to become highly resistant to group A herbicides (Figure 1). Even though resistance takes longer to develop in barley grass, its proactive resistance management is still vital. An integrated weed management strategy, combining multiple control tactics to reduce seed set, is required to delay the development of herbicide resistance. For example in a non-group A resistant population, pre-emergent herbicide + post-emergent group A herbicide + crop-topping could be used to reduce the risk of selection for resistance.

Sakura (pyroxasulfone), propyzamide, and Outlook (dimethanamid) showed much promise for controlling group A resistant barley grass, pending their possible registration. Raptor (imazamox) also provided highly effective control of this barley grass population. As some farmers are already using Clearfield wheat to manage barley grass, it would be inadvisable to use Raptor which is also an imidazolinone herbicide. Such heavy reliance on group B herbicides could render them ineffective in relatively short time and this would be particularly bad news under situations where group A resistance has already developed.

Acknowledgements

Research on barley grass reported here was undertaken in a current GRDC funded project (UA00105). The authors would also like to thank Rob Dennis, for providing the field trial site and sowing the peas; Rupinder Saini, Amrit Riar and Malinee Thongmee for their technical assistance.

Contact details

Ben Fleet, University of Adelaide
benjamin.fleet@adelaide.edu.au
(08) 8313 7950

Category

2. "Searching for answers"- we know what the problem is and we're trying to find out what we can do about it.

Trial Information

Location:	
Town or district:	Baroota
Farmer Name:	Rob Dennis
Group:	Neashaby Ag Bureau, Upper North Farming Systems
Rainfall:	
Av. Annual:	330mm
Av. GSR:	230mm
2012 Total:	390mm
2012 GSR:	230mm
Yield:	
Potential:	1.5 t/ha
Actual:	0.8 to 2.3 t/ha
Paddock History:	
2011:	Mace wheat
2010:	Morava vetch
2009:	Feed barley
Soil Type:	Mallee Loam
Plot size:	13.5m x 5m
Replicates:	4
Sowing details:	Sown 10th May 2012, Kaspa field peas @ 90 kg/ha with DAP @ 60 kg/ha, knifepoint press-wheel on 10" spacing
Yield Limiting Factors:	Barley grass very dense (why site selected) except plots with good control, and dry finish to season