Barley grass control in a wheat-barley-pasture rotation

Author and organisation:
Catherine Borger, Department of Primary Industries and Regional Development (DPIRD)
Sam Stubna, South East Premium Wheat Growers Association (SEPWA)

Key messages

- Barley grass can have late, staggered cohorts, and so full control requires pre- and post-emergent herbicides.
- Clearfield® crops or pasture 'break crops' allow excellent in-crop control and reduction of barley grass seed production.
- Resistance remains very low at this site. A diverse crop rotation allows a rotation of herbicide groups to avoid resistance development.

Background

Barley grass is one of the major weeds in the southern region. Many southern growers think their barley grass is resistant to grass selective herbicides and may have developed late germination to avoid pre-seeding herbicides. In this area barley grass is a major problem in pastures, and often in break crops as well.

Aim

The trial aims to investigate pre-emergent herbicides in wheat in 2019, crop density and post-emergent herbicides in barley in 2020, and pre-emergent herbicides and grass selective herbicides in vetch in 2021.

Paddock Details

- **Location:** Esperance (-33.1888, 121.4697), Geoff & Maryann Harris
- **Rainfall**
  2019 Total: 197mm
  2019 GSR (April-Oct): 155mm
  2020 Total: 318mm
  2020 GSR (Apr-Oct): 183mm
  2021 Total: 385mm
  2021 GSR (Apr-Oct): 269mm
- **Paddock history**
  2018: vetch pasture
  2017: barley
- **Soil type:** Loamy clay with kopi patches

Trial Details 2019

- Variety: Wheat cv. Mace
- Treatments

1. Treflan® at 2L/ha
2. Sakura® at 118g/ha
3. Treflan® at 2L/ha + Sakura® at 118g/ha
4. Luximax® at 500mL/ha

Note that the initial plans to include an autumn tickle were not possible, as the dry start to the season made the soil too hard to cultivate in autumn.

- Sowing rate: 65kg/ha, 30cm row spacing
- Sowing date: 14 June 2019
- Fertiliser
  14 Jun 2019. DAPSZC at 80kg/ha, UAN at 50L/ha, zinc sulphate at 1L/ha, manganese sulphate at 1L/ha
- Insecticides/fungicides

14 Jun 2019. Flutriafol® 250 at 300mL/ha

- Herbicide
  30 May 2019. Glyphosate 540 at 2L/ha
  3 Jun 2019. Gramoxone® 360 2L/ha + Sharpen® 17g/ha
  14 Jun 2019. Pre-emergent herbicides prior to seeding, according to treatments
- Harvest: 18 November 2019
- Method and Measurements
  Plots of 36m by 1400m, 4 replications.
  18 Jul 2019. Assess crop and barley grass density.
  3 Oct 2019. Barley grass panicle counts. Harvest 20 panicles per plot. Average seed number per panicle and panicle number/m^2 were used to determine barley grass seed/m^2.

Trial Details 2020

- Variety: Barley cv. Spartacus
- Treatments
  1. Barley 40kg/ha, Intercept® at 375mL/ha
  2. Barley 40kg/ha, Intercept® at 500mL/ha
  3. Barley 65kg/ha, Intercept® at 375mL/ha
  4. Barley 65kg/ha, Intercept® at 500mL/ha
- Sowing rate: 40 or 65kg/ha, 30cm row spacing
- Sowing date: 30 April 2020
- Fertiliser
  29 June 2020. Zn, Mn
  Flexi N 50L/ha
- Herbicide
  30 April 2020. Treflan® 2L/ha
  29 June 2020. Intercept® 375 or 500mL/ha
- Method and Measurements
  10 June 2020. Assess initial crop and barley grass density.
  24 September 2020. Assess barley grass panicle density. Collect 20 panicles per plot.
  18 November 2020. Harvest.

Trial Details 2021

- Variety: Vetch cv. Volga
- Treatments

1. Treflan® 1.2L/ha pre-emergent, Quiz® 200g/L 125mL/ha post-emergent.
2. Treflan® 1.2L/ha + diuron 500g/ha pre-emergent, Quiz® 200g/L 125mL/ha post-emergent.
3. Treflan® 1.2L/ha + diuron 500g/ha pre-emergent, Quiz® 200g/L 125mL/ha + Clethodim® 500 mL/ha post-emergent.
4. Ultro® 1.1kg/ha pre-emergent, Quiz® 200g/L 125mL/ha + Clethodim® 500 mL/ha post-emergent.

- Sowing rate: 40kg/ha, 30cm row spacing
- Sowing date: 22 April 2021
- Herbicide
  22 April 2021. Paraquat 360 1L/ha
  22 April 2021. Pre-emergent treatments.
  12 June 2021. Post-emergent treatments.
- Method and Measurements
  21 May 2021, 10 June 2021, 5 August 2021. Assess initial crop and barley grass density, and late barley grass density.
  1 October 2021. Assess barley grass panicle density and pasture biomass. Collect 20 panicles per plot.

Results 2019

The Mace wheat had an average density of 114 plants/m^2, and was not significantly affected by treatments (Table 1).

The barley grass had an average density of 9 plants/m^2. There were more plants following Treflan® (12.9 plants/m^2) compared to Sakura® (6.5 plants/m^2), Sakura® + Treflan® (8 plants/m^2) and Luximax®

(9.1 plants/m^2, Table 1), although plant density following Luximax® was not significantly lower than Treflan®. The barley grass panicles were not significantly different between treatments but were slightly higher in the treatments without Sakura®. Barley grass seed production was lowest following Sakura® + Treflan® and Sakura® alone (136 and 189 seeds/m^2, Table 1).

Crop yield was low in all treatments, due to very low rainfall during the 2019 season (Table 1). However, yield was lowest in treatment 1 with Treflan® alone, probably due to the higher weed density.

Table 1 Crop and barley grass density, barley grass panicle and seed production and wheat yield for each treatment. P and LSD values are included for separation of means. Note that barley grass panicle and seed production means are back-transformed from a square root transformation.

Treatment	Wheat density/m^2	Barley grass density/m^2	Barley grass panicles/m^2	Barley grass seed/m^2	Wheat yield (kg/ha)
Treflan® at 2 L/ha	111	12.9	43.2	279	278
Sakura® at 118 g/ha	122	6.5	25.1	189	333
Treflan® at 2 L/ha + Sakura® at 118 g/ha	110	8.0	23.4	136	343
Luximax® at 500 mL/ha	114	9.1	44.6	346	314
P	0.058	0.033	0.098	0.036	0.029
LSD	8.86	4.41	NS	25.13	41.81

Results 2020

In 2020 there was no significant difference in initial crop density, as establishment was low and variable, due to dry conditions and soil variability (Table 2). Initial barley grass was uniform across the trial (with an average of 78 plants/m^2). In these seasonal conditions, with such a dry start, the pre-emergent application of Treflan® was unlikely to provide effective weed control. While there were significant differences in barley grass density and seed production in 2019, weeds in all 2019 treatments produced enough seed to renew the soil seed bank for emergence in 2020.

Intercept® herbicide provided excellent weed control across the trial, with an average of 3.7 barley grass panicles/m^2 and 58 seeds/m^2. While late cohorts of barley grass obscured the difference between low and high rates of Intercept® at the time of weed panicle assessment at anthesis, the difference in control by Intercept® herbicide was evident in the yield. There was 1.52t/ha barley grain yield following Intercept® at 375mL/ha and 1.82t/ha following Intercept® at 500mL/ha (P:0.05, LSD: 0.225). Yield at the low and high seeding rates (1.63 and 1.70t/ha respectively) were not significantly different, probably due to the dry start and low initial crop density.

The grey clay soil at this site has ‘kopi patches’ with toxicity in the subsoil. Crop emergence is always sparse on these patches, leading to poorly competitive crop and potential weed blow-outs. The use of Intervix® in this barley ensured good control of barley grass. However, the soil constraints in this field are exacerbating the weed issues. Soil amelioration options to try going forward may include use of surfactants and high seeding rates to improve establishment on the water repellent soils. While high seeding rates had no impact in this season due to a very dry start, they’re generally a good option where establishment is poor. On the kopi patches, application of gypsum in combination with stubble retention would probably improve structure and increase leaching of boron or salts, but gypsum is a long-term solution (10-20 years), and the value is reduced if the soil is saline. Any kind of mulch (sand, gravel, organic) would reduce evaporation and allow salts/boron to leach deeper into the soil profile, but this option is costly. Since soil amelioration programs can be expensive, it is often best to trial solutions like mulching over a smaller area. Careful consideration should be given to the best type of amelioration, overall cost, and potential benefit in terms of improved crop growth and weed control.

Table 2 Crop and barley grass density, barley grass panicles, barley grass seed production and crop yield. P and LSD values are included for separation of means. Note that barley grass panicle and seed production data is back-transformed from a log transformation.

Treatment	Crop density/m^2	Barley grass density/m^2	Barley grass panicles/m^2	Barley grass seed/m^2	Crop yield (t/ha)
Barley 40kg/ha, Intercept® 375mL/ha	57	83	4.7	56	1.3
Barley 40kg/ha, Intercept® 500mL/ha	67	78	1.5	7	1.9
Barley 65kg/ha, Intercept® 375mL/ha	62	72	3.5	40	1.7
Barley 65kg/ha, Intercept® 500mL/ha	52	77	3.8	19	1.7
P	0.452	0.958	0.055	0.166	0.113

Results 2021

In 2021 there was a slight reduction in vetch density following Ultro® PRE, Quiz® + Clethodim® POST, but by the end of the year, there was no difference in pasture biomass (Table 3).

Weed density in August was low in all treatments, but barley grass panicle production was greatest following Treflan® PRE, Quiz® POST, lower following Treflan® + diuron PRE, Quiz® POST, and close to zero in treatments with Quiz® + clethodim (Table 3). Barley grass seed set was also greatest following Treflan® PRE, Quiz® POST, and very low (0-4 seeds/m^2) following treatments with clethodim.

Table 3 Pasture and barley grass density, barley grass panicles, barley grass seed production and pasture biomass. P and LSD values are included for separation of means. Note that barley grass density, panicle and seed production data is back-transformed from a log+1 transformation.

Treatment	Crop density/m^2	Barley grass density/m^2	Barley grass panicles/m^2	Barley grass seed/m^2	Pasture biomass (t/ha)
Treflan® PRE, Quiz® POST	47	1.5	19.3	588	4.6
Treflan® + diuron PRE, Quiz® POST	45	0.9	7.1	185	3.6
Treflan® + diuron PRE, Quiz® + Clethodim® POST	45	0	0	0	4.3
Ultro® PRE, Quiz® + Clethodim® POST	41	0	0.5	4	5.0
P	0.031	0.261	0.001	<0.001	0.196
LSD	3.88	NS	2.46	7.9	NS

Conclusions

The greater crop yield, and visual assessment of the good barley grass control with a higher level of Intercept® highlight the value of this herbicide in 2020. The grower, who was using the trial to test the suitability of Clearfield™ barley to the enterprise, gained the confidence to plant 50% of the barley program to Clearfield™ barley cv. Spartacus in 2021.

However, this trial also highlights the problem with late cohorts of barley grass, and the limited options for controlling late cohorts. The GRDC project UA00156 ('Seed bank ecology') highlighted that it is common for barley grass to have delayed emergence compared to some other winter grass species (like great brome or annual ryegrass). The project further highlighted that, depending on seasonal conditions, barley grass emergence can continue in July and August. These late cohorts are not controlled by post emergent herbicides, and harvest weed seed control may have limited practicality for barley grass, depending on shedding times.

This trial has shown that, in cereal crops, both pre-emergent and post-emergent herbicides can provide excellent weed control, but late emerging cohorts can replenish the seed bank. The pasture rotation in 2021 offered a valuable opportunity to apply control measures later in the season, with two applications of grass selective herbicide. This confirms that break crops, with more herbicide options, are excellent for grass weed control.

The soil constraints in this field are exacerbating the weed issues. A soil amelioration program will increase yield and improve weed control going forward, but amelioration programs can be expensive. Careful consideration should be given to the best type of amelioration, overall cost, and potential benefit.

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