Kellerberrin Demonstration Group

Barley grass control in a pasture-wheat-pasture rotation

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Key messages

- Group 1 (A) selective herbicide in 2019 gave excellent barley grass control, with early application (2-4 leaf) better than late application (Z31). Group 2 (B) herbicide in 2021 pasture gave similar results but control was not as effective.
- Paraquat spray topping in 2019 did not reduce seed set.
- Slashing in 2021 removed all panicles and prevented seed set.
- Effective Group 1 (A) weed control in 2019 combined with Sakura® + Treflan® in 2020 successfully reduced this very dense barley grass population by 98% compared to a rotation of grazing (no herbicide) in 2019 and Treflan® alone in 2020, but barley grass was still dense in 2021.
- The seedbank lasts 3-4 years, particularly in dry years where not all seed can emerge.

Background

In the central eastern wheatbelt, barley grass is mainly an issue in pasture. While barley grass also grows in crop, it is rarely the most prominent cropping weed. Further, in pasture, late control may be preferred so that the barley grass can be grazed early in the season. The KDG group aimed to investigate grass selective herbicides, spray topping and pre-emergent herbicides in crop to find the best combination of practices that would control barley grass while also removing other grass weed species.

Aim

The trial aims to investigate Group 1 (A) herbicides and spray topping in 2019, pre-emergent herbicides in 2020 and Group 2 (B) herbicides and slashing in 2021.

Paddock Details

- **Location:** North Kellerberrin (-31.4194, 117.7877), Gavin Morgan
- **Rainfall**
  2019 Total: 192mm
  2019 GSR (Apr-Oct): 183mm
  2020 Total: 225mm
  2020 GSR (Apr-Oct): 125mm
  2021 Total: 326mm
  2021 GSR (Apr-Oct): 223mm
- **Paddock history**
  2018: wheat
  2017: pasture
- **Soil type:** Duplex sandy loam over clay

Trial Details 2019

- Variety: Volunteer pasture (wheat and clover)
- Treatments

1. Untreated
2. Targa® 100 at 250mL/ha applied at 2-4 leaf stage
3. Targa® 100 at 250mL/ha applied at 2-4 leaf stage + paraquat at 400mL/ha spray topped
4. Targa® 100 at 250mL/ha applied at Z31
5. Targa® 100 at 250mL/ha applied at Z31 + paraquat at 400ml/ha spray topped
6. Paraquat at 400mL/ha spray topped

- Herbicide
  5 July 2019. Targa® at 2-4 leaf stage
  19 August 2019. Targa® at Z31
  24 September 2019. Paraquat spray topped
- Method and Measurements
  Plots of 20m by 12m, 3 replications.
  5 July 2019. Assess initial barley grass density.
  17 October 2019. Assess barley grass plant number and panicle number, and collect 20 panicles per plot. Pasture biomass samples were taken from each quadrat to assess dry biomass.

Trial Details 2020

- Variety: Wheat cv Scepter
- Treatments
  Treflan® at 2L/ha or Sakura® 118g/ha + Treflan® 2L/ha.
  Note that all treatments were replicated twice in each block (6 replications) to allow the plots to be divided in 2020 (3 replications).
- Sowing rate: 50kg/ha, 25.4cm row spacing
- Sowing date: 27 May 2020
- Fertiliser
  27 May 2020. Agstar 60kg/ha
- Herbicide
  27 May 2020. Pre-emergent herbicide treatments.
  8 July 2020. Jaguar® 1L/ha, MCPA LVE 570 400mL/ha
- Method and Measurements
  17 June 2020. Assess initial barley grass density.
  25 October 2020. Assess barley grass density and panicle number. Collect 25 panicles per plot.
  6 November 2020. Harvest.

Trial Details 2021

- Variety: Volunteer pasture (wheat and clover)
- Treatments

1. Untreated
2. Raptor® at 45g/ha applied at 2-4 leaf stage
3. Raptor® at 45g/ha applied at 2-4 leaf stage + slashing
4. Raptor® at 45g/ha applied at Z31
5. Raptor® at 45g/ha applied at Z31 + slashing
6. Slashing

- Herbicide
  11 June 2021. Raptor® at 2-4 leaf stage
  2 July 2021. Raptor® at Z31
  20 September 2021. Slashing
- Method and Measurements
  Plots of 20m by 12m, 3 replications.
  28 May 2021. Assess initial barley grass density.
  18 October 2021. Assess barley grass plant number and panicle number, and collect 20 panicles per plot. Pasture biomass samples were taken from each quadrat to assess dry biomass.

Results 2019

The site was volunteer pasture, including wheat and clover. However, the density of pasture plants was very low, since the site was selected for dense, even barley grass infestation. The barley grass had an initial density of 80 plants/m^2, but density ranged from 34 to 122 plants/m^2.

The Targa® herbicide treatments killed 100% of plants, and the dry season prevented further barley grass cohorts from emerging later in the year (Table 1). Plots treated with Targa® at the 2-4 leaf stage had higher pasture biomass than Targa® at Z31, probably because early control reduced weed competition with desirable pasture species.

The untreated control plots had 32 barley grass plants/m^2 at the end of the season, 65 barley grass panicles/m^2 and 433 seeds/m^2 (Table 1). Biomass was still high in the untreated plots because the mature barley grass added to the total pasture biomass weight.

Plots spray topped with paraquat had a similar number of barley grass plants to the untreated control plots but had a lower number of barley grass panicles or seeds than the untreated plots and lower pasture biomass (Table 1). The spray topping may have reduced late panicle production and growth of the barley grass, causing a reduction in pasture biomass. It is unlikely that spray topping reduced the growth of other species in the pasture to reduce biomass, because treatment number 3, with early Targa® (i.e. good initial barley grass control) followed by paraquat spray topping, did not have low pasture biomass (154 g/m^2).

Table 1 Barley grass density, panicles, seeds and dry pasture biomass for each treatment. P and LSD values are included for separation of means. Note that barley grass density, panicle production and seed production means are back-transformed from a square root transformation.

Treatment	Barley grass density/m^2	Barley grass panicles/m^2	Barley grass seeds/m^2	Pasture biomass (g/m^2)
Untreated	32	65	433	145
Targa® at 2-4 leaf stage	0	0	0	145
Targa® at 2-4 leaf stage + paraquat spray topped	0	0	0	154
Targa® at Z31	0	0	0	126
Targa® at Z31 + paraquat spray topped	0	0	0	138
Paraquat spray topped	30	54	318	134
P	<0.001	<0.001	<0.001	<0.001
LSD	0.098	0.194	1.2	7.55

Results 2020

As discussed, Targa® in 2019 controlled all barley grass plants, and seed set was zero. Therefore, the barley grass plants in these treatments in 2020 emerged from a dormant seed bank (Table 2). In 2020, barley grass density was lowest in the treatments with Targa® in 2019 (at a P value of 0.1). Barley grass density, panicle number and seed production were greatest in those plots untreated or spray topped in 2019 and then treated with Treflan® in 2020. Optimal control was in those treatments with Targa® in 2020 and Sakura® + Treflan® in 2021.

The treatments spray topped with paraquat in 2019 had similar barley grass density to the control, indicating that spray topping did not reduce viable seed production in 2019.

The initial average wheat density was 121 plants/m^2, with no differences between treatments and no evidence of herbicide damage. Yield was significantly greater in those plots with lower barley grass density and panicle production, i.e. plots treated with Targa® at the 2-4 leaf stage in 2019 compared to the control, or those plots with Sakura® + Treflan® in 2020. Grain quality was not affected by treatments, with an average of 12.08% protein, 2.58% screenings of 0-2mm and a hectolitre weight of 81.6kg/hL.

Table 2 Barley grass density, panicles, seeds and wheat yield for each treatment. P and LSD values are included for separation of means. Note that barley grass density, panicle and seed production means are back-transformed from a log_{10}+1 transformation.

Treatment 2019	Treatment 2020	Barley grass density/m^2	Barley grass panicles/m^2	Barley grass seeds/m^2	Yield t/ha
Untreated	Treflan®	162	311	5754	0.71
Targa® at 2-4 leaf stage	Treflan®	24	37	646	1.26
Targa® at 2-4 leaf stage + spray topped	Treflan®	36	68	1318	1.31

Targa® at Z31	Treflan®	38	148	3020	0.97
Targa® at Z31 + spray topped	Treflan®	20	270	5888	0.97
Spray topped	Treflan®	186	205	3890	1.03
Untreated	Sakura® + Treflan®	21	35	589	1.44
Targa® at 2-4 leaf stage	Sakura® + Treflan®	3	11	9	1.55
Targa® at 2-4 leaf stage + paraquat spray topped	Sakura® + Treflan®	8	8	52	1.54
Targa® at Z31	Sakura® + Treflan®	72	55	977	1.24
Targa® at Z31 + paraquat spray topped	Sakura® + Treflan®	6	28	437	1.43
Spray topped	Sakura® + Treflan®	22	80	1349	1.20
P		0.096	<0.001	<0.001	0.045
LSD		13.8	5.3	12.2	0.49

Results 2021

All treatments with Sakura® + Treflan® in 2020 had lower barley grass density than Treflan® alone (27.5 or 166.3 barley grass plants/m^2, P <0.001, LSD: 2.0). The 2020 treatments had no impact on panicle number or seed production in 2021.

There was no significant difference in barley grass density (Table 3). However, seed production was reduced following herbicide. Slashing removed all panicles before maturity and prevented seed set. Pasture biomass was high in all treatments and was not affected by barley grass control.

Table 3 Barley grass density, panicles, seeds and pasture biomass for each treatment. P and LSD values are included for separation of means. Note that barley grass density, panicle and seed production means are back-transformed from a log_{10}+1 transformation.

Treatment 2021	Barley grass density/m^2	Barley grass panicles/m^2	Barley grass seeds/m^2	Pasture biomass t/ha
Untreated	102	597	2343	3.2
Raptor® at 2-4 leaf stage	32	486	691	2.8
Raptor® at 2-4 leaf stage + slashed	45	1	0	2.6
Raptor® at Z31	109	357	218	1.6
Raptor® at Z31 + slashed	58	0	0	2.5
Slashed	101	0	0	2.3
P	0.201	0.004	<0.001	0.246
LSD	3.2	369.1	229.1	2.51

Conclusions

In 2019, selective weed control was highly effective and early weed control led to higher pasture biomass production than late weed control. However, weed emergence was still high in 2020 in the plots with Treflan® alone. Since there was zero seed set in the Targa® treatments in 2019, these plants have emerged from the dormant seed bank. Prior research (GRDC project UA00156) highlighted that even in irrigated/ideal conditions it takes 3-4 years to eradicate a barley grass seed bank. In the field, with dry seasons and potentially non-wetting soil, it may take longer than 3-4 years. The low rainfall in 2019 would have reduced potential emergence of barley grass, allowing a larger proportion of the seed bank to remain dormant until the following year.

Since the paraquat spray topping treatments in 2019 both had similar barley grass density to the control plots in 2020, it is clear that spray topping did not reduce seed production. It is difficult to get the timing of a spray top right, particularly in a dry season like 2019 when barley grass plants can mature rapidly.

Sakura® + Treflan® in 2020 gave better control than Treflan® alone, and the difference was still evident in 2021. While early, effective Group 1 (A) weed control in 2019 combined with Sakura® + Treflan® in 2020 successfully reduced this very dense barley grass population by 98%, weed density was still high in 2021.

Selective herbicide was not as effective in the 2021 pasture, but still reduced barley grass seed production. Slashing was highly effective in preventing seed set.

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