Effect of combinations of sowing time, seed rate and herbicides on brome grass management in wheat (Kinnabulla, VIC)

Key messages

- Delay in crop sowing by 25 days did not have a significant (P=0.796) effect on brome grass density in wheat (TOS1 = 8.7 brome plants/m^2 Vs 8.1 plants/m^2 in TOS2). Lack of brome grass establishment during the time gap between TOS1 and 2 is likely to be related to below average rainfall (15.6 mm) during the month of May, which was less than half of the long-term average.
- Brome grass plant density in wheat was only significantly influenced by the herbicide treatments (P<0.001). Intervix alone and as a follow-up treatment after Trifluralin + Avadex provided significantly greater control of brome grass than the knockdown treatment as well as Rexade treatment.
- Even at this low weed density site, sole reliance on the knockdown herbicide treatment allowed brome to set 1753 seeds/m^2 and build-up its seedbank. Application of Rexade reduced brome seed set by 84% compared to the knockdown control. Treatment with Intervix virtually eliminated weed seed set and could play an important role in brome grass management in the Mallee.
- Even though the difference in wheat grain yield between the worst (knockdown only) and the best herbicide treatment (Intervix) was 190 kg/ha, these differences (11%) were statistically significant. Based on 2021 wheat grain prices, effective brome control treatments increased revenue by about $70-80/ha.

Background

Brome grass (*Bromus diandrus*) is a major problem across the Mallee, costing growers $6.7m in lost revenue each year (Llewellyn et al 2016). Brome grass is one of the most competitive weeds, with an aggressive root system removing nitrogen, phosphorus and moisture from the soil that would otherwise be used by the crop. When considering a rotation to control brome grass, it is important to consider different control options over at least three seasons (Kleemann and Gill 2009), including crop type, variety, herbicides, crop competition, harvest weed seed control and fallow management.

A field trial was undertaken in 2021 at Kinnabulla to investigate the effects of time of sowing, crop plant density and herbicide treatments on brome grass control in wheat. Hammer CL was selected for this trial because Clearfield® crops provide an excellent opportunity to achieve selective control of brome grass in wheat. Resistance to imidazolinone herbicides in brome grass remains low, but overreliance on these herbicides could reduce their effective life.

Methods

This field trial was established in a split plot design and investigated combinations of the wheat sowing time, seed rate and herbicides for brome grass control.

Table 1. Management details.

Operation	**Details**
Location	Kinnabulla, Victoria
Seedbank soil cores	April, 2021
Plot size	1.5 m x 10 m
Seeding date	TOS 1: 6 May, 2021; TOS 2: 31 May, 2021
Seeding rate	100, 150 and 200 seeds/m^2
Herbicide treatments	1. Knockdown only (glyphosate 540 g/ha) at 2 L/ha 2. Rexade 100 mL/ha at GS13 3. Intervix 600 mL/ha at GS13 4. Trifluralin (480 g/L) at 2 L/ha + Avadex 2 L/ha Fb Intervix 600 mL/ha at GS 13
Replicates	3
Variety	Hammer CL
Seeder	Knife points, press wheels, 30cm row spacing

All data collected during the growing season was analysed using the Analysis of Variance function in GenStat version 19.0.

Measurements: pre-sowing weed seedbank, crop density, weed density, brome panicle density, brome seed production, wheat grain yield.

Rainfall data for the trial site was obtained from Birchip (Table 2), which is less than 10 km from the site. In 2021, the site experienced an extremely dry autumn with zero rainfall in April. Rainfall in May, when the crop sown, was only half of the long term average for the site. However, rainfall received in spring was higher than the long term average.

Table 2. Rainfall received at Kinnabulla near Birchip in 2021 and the long-term average for the site.

	Rainfall (mm)	
Month	**2021**	**Long-term average**
Jan	36.4	21.2
Feb	0.0	23.1
Mar	3.2	21.0
Apr	0.0	24.4
May	15.6	34.6
Jun	30.8	35.1
Jul	43.6	34.2
Aug	19.2	35.6
Sep	44.2	35.2
Oct	42.2	35.3

Nov	54.4	26.8
Dec	0.0	25.1
Annual total	289.6	351.6
GSR total	195.6	234.4

Results and Discussion

Wheat plant density

Wheat plant establishment was significantly influenced by the seed rate (P<0.001). Plant density achieved was within 10% of the target density.

Brome grass plant, panicle density and seed production

Delay in crop sowing by 25 days had non-significant (P=0.796) effect on brome grass density in wheat in this trial (TOS1 = 8.7 brome plants/m^2 Vs 8.1 plants/m^2 in TOS2). Lack of brome grass establishment during the time gap between TOS 1 and 2 is likely to be related to dry weather conditions. The site only received 15.6 mm rainfall in May, which is less than half of the long-term average. Therefore, dry soil conditions during the month of May are likely to be responsible for lack of crop sowing time effect on brome grass density. The trial site only received 3.2 mm rainfall during February to April, which would have prevented any weed germination prior to TOS 1.

Brome grass plant density in wheat in this trial was only significantly influenced by the herbicide treatments (P<0.001). The trial site had fairly low weed densities due to low seedbank. Even where only the knockdown glyphosate was used prior to sowing wheat, brome grass plant density was 16.6 plants/m^2. In this trial Rexade, a new post-emergent herbicide, provided only about 30% reduction in brome plant density. Intervix alone and as a follow-up treatment after Trifluralin + Avadex provided significantly greater control of brome grass than the knockdown treatment as well as Rexade (Table 3).

Trends observed for brome grass panicle production were very similar to those for its plant density (Table 3). Reduction in brome panicle density by Rexade was greater than its effect on brome plant density, which is consistent with its label claiming suppression of weeds that survive the treatment. Treatment with Intervix by itself or after pre-emergent spray provided >90% reduction in brome panicles.

Table 3. . Effect of herbicide treatments on brome grass plant density (P<0.001) and brome panicles (P<0.001). Means followed by different letters represent significant differences (P=0.05).

Treatment	**Brome plants/m^2**	**Brome panicles/m^2**
Knockdown only (Glyphosate 540g/L @ 2L/ha)	16.6 b	37.0 c
Rexade 100 mL/ha at GS13 brome	11.4 b	18.2 b
Intervix 600 mL/ha at GS13 brome	4.0 a	0.5 a
Trifluralin 2 L/ha + Avadex 2 L/ha Fb Intervix 600 mL/ha at GS13 brome	1.6 a	3.1 a

Results for brome grass seed set were consistent brome panicle density (Table 4). Herbicide treatments again provided significant reduction in brome seed production (P<0.001). Even at this low weed density site, sole reliance on knockdown herbicide treatment allowed brome to set large amount of seed and build-up its seedbank. Application of Rexade reduced brome seed set by 84% compared to the knockdown control. Treatment with Intervix virtually eliminated weed seed set and could play an important role in the Mallee systems.

Table 4. Effect of herbicide treatments on brome grass seed production in wheat (P<0.001). Means followed by a different letter indicate significant differences (P=0.05).

Treatment	**Brome grass seeds/m^2**
Knockdown only (Glyphosate 540g/L @ 2L/ha)	1753 c
Rexade 100 mL/ha at GS13 brome	283 b
Intervix 600 mL/ha at GS13 brome	0 a
Trifluralin 2 L/ha + Avadex 2 L/ha Fb Intervix 600 mL/ha at GS13 brome	16 a

Wheat grain yield

Wheat grain yield in this trial was significantly influenced by the herbicide treatment (P<0.001) as well as the interaction between crop seed rate and herbicide (P=0.016). The interaction was largely due to increase in yield at higher seed rates in weaker herbicide treatments especially the knockdown only treatment. Even though difference in wheat grain yield between the worst and the best herbicide treatment was 190 kg/ha, these differences (11%) were statistically significant (Table 5). Brome grass is well known for its ability to be highly competitive with crops on sandy soils in low rainfall regions. As a rule of thumb, brome grass competition reduces wheat yields by 0.5% per brome plant. So 17 plants/m^2 of brome present at this site would be expected to reduce wheat yield by about 9%, which is close to 11% measured in this trial.

Based on 2021 wheat grain prices, effective brome control led to yield improvement of 190 kg/ha which would increase revenue by about $70-80/ha. Therefore, growers facing moderate brome infestations in this region are likely to improve their gross margins by selecting effective herbicide options.

Table 5. Effect of herbicide treatments on wheat grain yield (P<0.001). Means followed by a different letter indicate significant differences (P=0.05).

Treatment	**Wheat grain yield (t/ha)**
Knockdown only (Glyphosate 540g/L @ 2L/ha)	1.553 c
Rexade 100 mL/ha at GS13 brome	1.657 b
Intervix 600 mL/ha at GS13 brome	1.700 a
Trifluralin 2 L/ha + Avadex 2 L/ha Fb Intervix 600 mL/ha at GS13 brome	1.743 a