# Testing crop row placement and pre-emergence herbicide options for brome grass on Mallee sand

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## Background

Brome grass is the costliest weed to grain production in the Mallee region despite herbicide resistance being relatively low. This paper brings together research trials from 2015 and 2016 addressing the potential for greater efficacy of pre-emergence herbicides on brome and the potential for better crop competition on non-wetting sands. For growers looking to often seed earlier and reduce reliance on Group B herbicides, pre-emergence herbicides can be an important part of brome management strategies but trifluralin often has limited efficacy. Previous trials at the MSF Karoonda site looking at a range of pre-emergence herbicides have shown the potential for greater than 75% brome control, but also the potential for variability under different early-season conditions. Improving crop competition can greatly improve herbicide efficacy. Other trials on non-wetting sandy soil at the Karoonda site have shown the potential for better crop establishment and large reductions in brome seed set suppression through seeding the crop on or near last year's crop row (e.g. McBeath et al 2015). In 2016 the interactions between pre-emergence herbicide options and crop row placement were investigated.

## Methodology

***2015 Pre-emergence herbicide trial:***

Field experiments were conducted on Mallee sand in Karoonda in South Australia during 2015. The trial in 2015 included two seeding times: 30 April and 20 May, 2015. Following a pre-seeding knockdown herbicide treatment, the pre-emergent herbicide treatments were applied (Table 1).

The experiment was conducted in factorial randomized block design with four replications. The wheat c.v. *Kord* was then sown using no-tillage at 70 kg/ha using knife points (28 cm spacing) into retained stubble from the 2014 cereal crop with 50 kg/ha DAP and 45 kg/ha Urea applied at seeding. The plots were sown under marginal soil moisture conditions at both seeding times, leading to poor crop emergence that led to patchy competition from the crop (30 April seeding: 49 crop plants/m$^2$; 20 May seeding: 21 crop plants/m$^2$). No post-emergence grass herbicide was applied. Brome grass counts were conducted on all plots on 20 August and brome panicles were counted at maturity.

***2016 On-row/off-row pre-emergence herbicide trial:***

Following demonstrated benefits of increased water and nutrient harvesting along with reduced brome grass populations for on-row sowing on water repellent sands, a range of pre- and early post- emergent herbicide options were tested in combination with on-row or inter-row seeding. One trial tested more standard pre-emergence options while a nearby trial compared higher trifluralin rates with higher cost Avadex-based treatments.

Each trial had 4 replications. The row spacing used was 28 cm. All plots were sown 31 May 2016 into cereal stubble and received DAP @ 50 kg/ha and Urea @ 24 kg/ha on a water repellent dune soil. Measurements will include disease risk, disease incidence, starting nitrogen (N) and water, microbial activity, N supply potential, crop emergence, biomass, weed density, weed seed production and crop yield. Rainfall at the Karoonda site during the 2016 season was very high (decile 10) with >40mm rainfall received in each month except for Feb and April. Two plots in Trial 1 were omitted from the statistical analysis due to lack of consistent row position alignment.

## Results and discussion

***2015 Pre-emergence herbicide trial:***

Different herbicide treatments significantly (P<0.01) affected brome panicle density with several performing better than Trifluralin at 1.5 L/ha. (Table 1). Application of Sakura + AvadexXtra, Sakura + Metribuzin were the most effective treatments at reducing brome seed production (Table 1). Sakura on its own and Sakura + Metribuzin or Sakura + Avadex produced similar levels of control.

Overall, there were significantly more panicles (P<0.001) in late sown plots compared to early sown plots, most likely due to the poorer crop establishment in the late sown plots. However, seeding time did not interact with herbicide treatment effects. Due to the patchy weed emergence, the difference in brome plant numbers between herbicide treatments was not significantly different, but differences in weed growth became evident through the season leading to significant differences in seed production (Table 1).

***Table 1.*** *Brome panicle density as affected by different herbicide treatments*

| Treatment | Panicles/m2 |
|---|---|
| Trifluralin (1.5 L/ha); | 60 |
| Trifluralin + Metribuzin (1.5 L/ha + 150 g/ha) | 34 |
| Trifluralin + Metribuzin + AvadexXtra (1.5 L/ha+150 g/ha+2.0 L/ha) | 51 |
| Trifluralin + AvadexXtra (1.5 L/ha + 2.0 L/ha) | 58 |
| Sakura (118 g/ha) | 26 |
| Sakura + AvadexXtra (118 g/ha + 3.2 L/ha) | 16 |
| Sakura + Metribuzin (118 g/ha + 150 g/ha) | 18 |
| | **LSD 31** |

Only the treatments including Sakura in 2015 resulted in significantly (P<0.01) better brome control than trifluralin alone (measured by number of panicles/m2). Sakura alone resulted in 55% less brome panicles than trifluralin alone, and Sakura + Avadex resulted in 72% less brome panicles than trifluralin alone. Sakura's extended residual soil activity, which can restrict root growth of brome, combined with the dry spring, was probably responsible for the reduced seed set. The higher cost of Sakura and other treatments needs to be considered.

***2016 On-row/off-row pre-emergence herbicide trial:***

*Pre-sow soil tests*

The surface soil water measured in the top 10cm at seeding in the on-row (4mm) than inter-row (2mm) in Experiment 1 (P<0.05) but the same effect was not measured in Experiment 2 where non-wetting characteristics were less evident. Starting mineral N amounts were not significantly different, but N supply potential through the season was estimated to be significantly higher (P<0.05) on-row (51 kg/ha) compared to inter-row (38 kg/ha), for an above average rainfall season.

At the time of the pre-seeding knockdown, most brome grass that had emerged was in last year's crop row. The density of brome emerged in last year's crop row was at least 7 times higher than the density of brome in the inter-row (173 Vs 13/m2 in Trial 1 and 20 Vs 3/m2 in Trial 2), reflecting the better germination conditions in last year's row and possibly greater concentration of seed in the furrows.

*Crop establishment*

On row seeding significantly improved early crop emergence in each trial (P<0.001) but ongoing rainfall lead to improved emergence on inter-row sown plots by July (Table 2). The long-wet season is likely to have reduced the competitive impact of differences in crop density on weed suppression.

***Table 2.*** *Wheat emergence when sown on last year's crop row or in the inter-row.*

| Sowing position | Wheat plants/m2 | | |
|---|---|---|---|
| | 22 June | 6 July | |
| **On-row (Trial 1)** | 87 | 94 | |
| **Inter-row (Trial 1)** | 31 | 59 | |
| **On-row (Trial 2)** | 74 | 101 | |
| **Inter-row (Trial 2)** | 59 | 74 | |

*Brome density*

Brome density as measured August 10 was not significantly affected by the pre-emergence or row treatment. Trial 1 had an average brome density of 31 plants/m2 and Trial 2 had 12 plants/m2 but both were very patchy.

*Brome seed set*

In the wet and long 2016 season there were good opportunities for late emerging weeds to continue to set seed. The wet winter also allowed late germination and establishment of crop plants that reduced the crop density advantage that came from better early germination from on-row seeding. There was no significant difference in brome seed set between on-row and off-row treatments. None of the trial 1 pre-emergence herbicide treatments significantly reduced brome seed set but the Trial 2 treatments aimed at achieving greater longevity of control were near significant (P=0.1). As with previous years, Sakura + Avadex performed well (Table 3).

***Table 3.*** *Brome panicle density as affected by different herbicide treatments (treatment effects P=0.10)*

| Treatment | Brome panicles/m2 |
|---|---|
| Nil On row | 34 |
| Nil Inter row | 45 |
| Trifluralin (2.5) On row | 3 |
| Trifluralin (2.5) Inter row | 7 |
| Trifluralin (1.5) + Avadex (1.6) On row | 28 |
| Trifluralin (1.5) + Avadex (1.6) Inter row | 22 |
| Sakura (118) + Avadex (1.6) Inter row | 1 |

Average wheat yield was 2.4 t/ha in Trial 1 with no significant effect of treatment. In Trial 2 where overall weed densities were lower, the average wheat yield was 2.6 t/ha. Although nil herbicide had the lowest average yield and Sakura + Avadex had the highest average yield followed by on-row Trifluralin+ Avadex, there were no statistically significant treatment differences.

## Implications

Substantially better brome control and seed set reduction is possible by using pre-emergence options other than trifluralin. The costly Sakura+Avadex treatment is likely to be the most effective. However, the results from 2016 highlight that consistency of performance of all pre-emergence herbicides for brome remains a problem. The additional herbicide cost needs to be evaluated against the better level of control, including the longer-term seedbank benefits. On-row seeding on non-wetting sand showed that it can substantially improve early crop emergence. Seasonal conditions will affect efficacy of both pre-emergence herbicides and the impact of additional crop competition on brome seed set suppression. Given the possibility of seasonal conditions that will lead to poor efficacy, keeping seedbanks generally low and having alternative options to reduce weed seed set are important when managing the risk of 'blowouts' in brome populations.

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## References

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