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Comparing double knock herbicides treatments on the control of awnless barnyard grass (NSW pot experiment 2015)

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Key findings

All of the double knock treatments were very effective in controlling mid-late tillering awnless barnyard grass (BYG).

Herbicides, apart from haloxyfop or glyphosate, have the potential to be used as the first spray in double knock treatments to control mid-late tillering awnless BYG.

Research questions

1. How effective are a range of double knock treatments, using herbicide groups A, C or H followed by group L to control awnless BYG?
2. How do herbicides applied as a single treatment compare to double knocking with paraquat (group L)?
3. Can effective control be obtained using a split application of paraquat on mid-tillering awnless BYG?

Aims

The main aim of the experiment was to determine whether a range of systemic herbicides have the potential to control mid-tillering awnless BYG when used in combination with a following application of paraquat, in a double knock control strategy. If successful then such double knock combinations could replace the industry practice of purely relying on glyphosate or paraquat based treatments. The use of more diverse herbicide groups would reduce the resistance selection pressure on Group M (glyphosate) and L (paraquat) products.

Methods

Site

- Tamworth: Tamworth Agricultural Institute glasshouse

Herbicide treatments

- 13 (12 herbicide treatments + one untreated control)

Growth stages

- Late tillering (15 tillers) to inflorescence emergence (Z50–59)

Pot size and design

- 8 cm square pots; one plant per pot, thinned down from two plants
- Randomised complete block design 13 treatments × six replicates (78 pots)
- Pots moved outside for two weeks before spraying to simulate plants grown under field conditions

Spraying

- Herbicides applied using a hand-held boom sprayer; water volume 100 L/ha for all herbicides. Uptake spray oil (0.5% v/v) used with all treatments.

Herbicide timing

- 1st application (single) – 30/11/2015; temperature 29 °C, relative humidity 42%; wind 3 km/h
- 2nd application (double knock with paraquat) – 7/12/2015; temperature 23 °C, relative humidity 19%; wind 5 km/h

Measurements

- Brownout score three days after treatment (DAT) (rating system 0–10 where 0 = green and healthy and 10 = brown and dead)
- Biomass control % (visual estimate) compared with untreated control at 14 DAT and 42 DAT
- Plant counts of survivors 42 DAT
- Destructive sampling of green biomass 42 DAT (dry weight, g)
- Note all DAT assessments were following the second double knock herbicide application of paraquat

Treatments

Trt. No.	Herbicides and rates per hectare	Double knock (DK) or single application
1	Untreated	
2	Balance® 100 g	Single
3	Balance® 100 g fb Paraquat (250 g/L) 2 L	DK
4	Atrazine (500 g/L) 6 L	Single
5	Atrazine (500 g/L) 6 L fb Paraquat (250 g/L) 2 L	DK
6	Simazine (500 g/L) 3 L	Single
7	Simazine (500 g/L) 3 L fb Paraquat (250 g/L) 2 L	DK
8	Terbuthylazine (750 g/kg) 1 kg	Single
9	Terbuthylazine (750 g/kg) 1 kg fb Paraquat (250 g/L) 2 L	DK
10	Haloxyfop (520 g/L) 300 mL	Single
11	Haloxyfop (520 g/L) 300 mL fb Paraquat (250 g/L) 2 L	DK
12	Paraquat (250 g/L) 2 L	Single
13	Paraquat (250 g/L) 2 L fb Paraquat (250 g/L) 2 L	DK
Note: All treatments applied at 100 L/ha with TT 110-01 nozzles. All treatments had Uptake™ added at 0.5% v/v. fb = followed by		

Results

There were significant but mild reductions in BYG brownout scores when Balance® (Trt 3), atrazine (Trt 5), simazine (Trt 7) or terbuthylazine (Trt 9) were followed by (fb) paraquat compared with paraquat (Trt 13) as the first application (Figure 1). However this mild form of antagonism did not carry through into longer term assessments. All of the double knock treatments were very effective in controlling mid-late tillering awnless BYG, with control levels between 93–100% at 42 DAT (Figure 2 & Figure 3.) These control levels were evident as early as the 14 DAT assessments (data not shown). Haloxyfop (Trt 11) and paraquat (Trt 13) double knock treatments achieved 99.7% and 100% control respectively by 14 days after the 2nd knock (data not shown).

Paraquat (Trt 12) was the most effective standalone single herbicide treatment with 86% control at 42 DAT (Figure 2 & Figure 3). The remaining single treatments (Trt 2, 4, 6, 8 and 10) did not reach commercially acceptable levels of control. However, a split application of paraquat fb paraquat (Trt 13) resulted in 100% control.

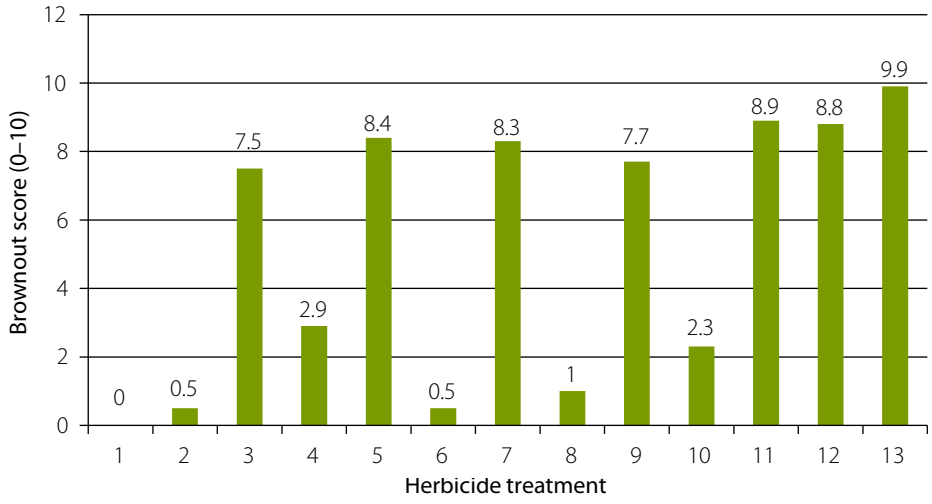

Figure 1. *Brownout score (%) three days after single herbicide applications and double knocking with paraquat on awnless barnyard grass*
LSD (0.05) = 0.6

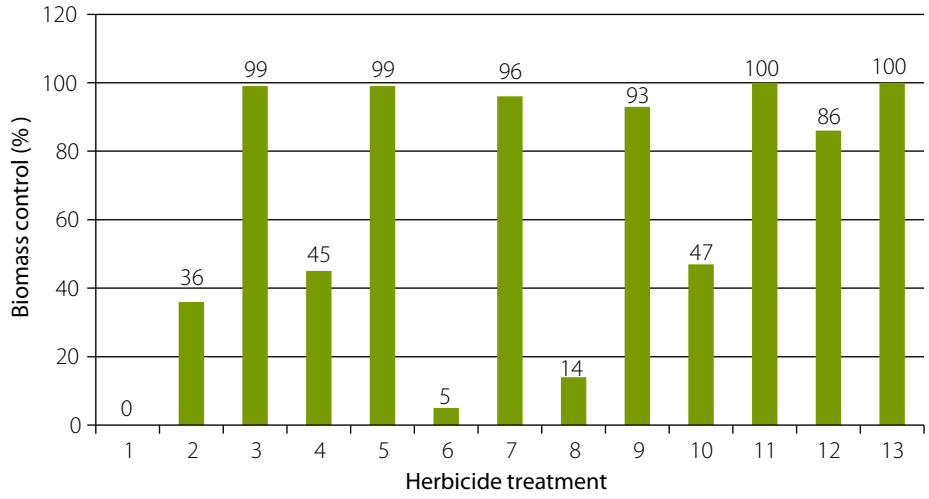

Figure 2. *Biomass control (%) 42 days after single herbicide applications and double knocking with paraquat on awnless barnyard grass*
LSD (0.05) = 10

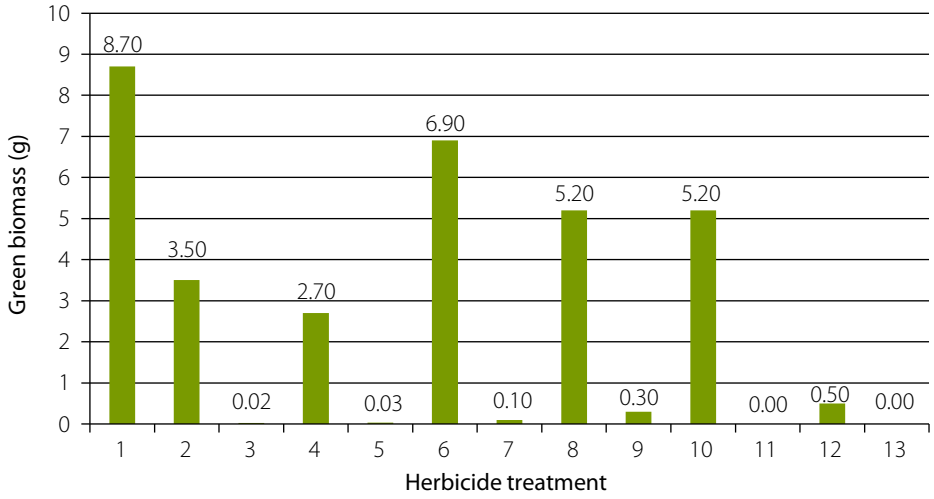

Figure 3. *Green biomass (g) 42 days after single herbicide applications and double knocking with paraquat on awnless barnyard grass*
LSD (0.05) = 1.85

Summary

Applying herbicides in a double knock strategy with paraquat were very effective in controlling mid-late tillering awnless BYG. All herbicides examined in this experiment appear to have the potential to be used as the first spray in a double knock strategy followed by paraquat. All of the double knock treatments in this experiment achieved 93–100% control at 42 DAT. This theoretically would provide farmers with varying options for controlling mid-late tillering awnless BYG, especially populations that have developed glyphosate resistance.

Further experimental work under field conditions investigating these double knock combinations is required to verify the robustness of these double knock strategies for the control of awnless BYG. These double knock strategies might also have further applicability in the control of awnless BYG within crops as inter-row sprays in wide row sowing configurations.

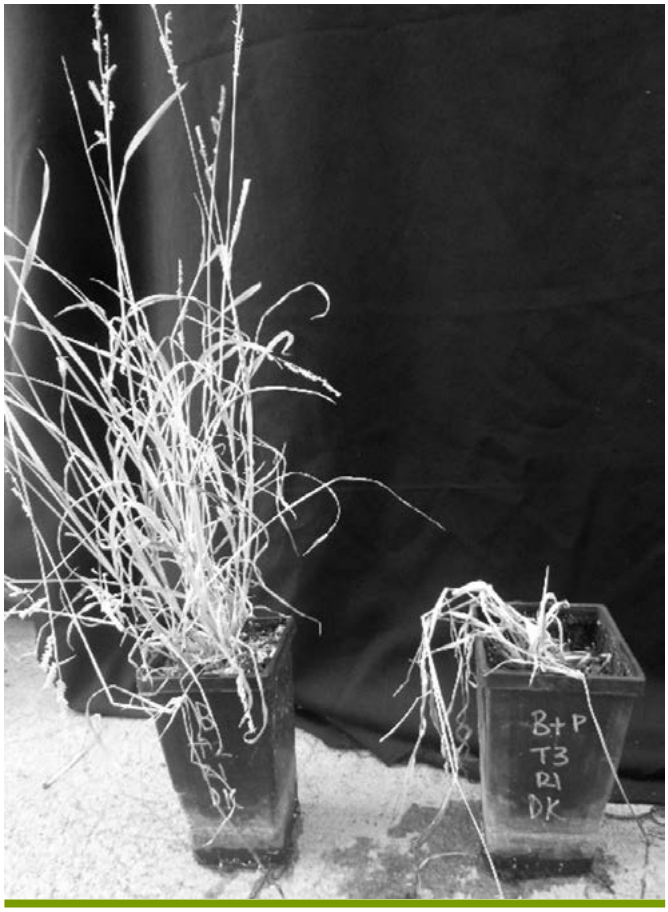

Plate 1. *Balance® 100 g/ha compared to Balance® 100 g/ha fb Paraquat (250g/L) 2 L/ha, 42 days after application of the double knock treatment*

Acknowledgements

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