



Knockdown control of feathertop Rhodes grass and barnyard grass in fallow

Trial location: Mallowa, NSW

Weed target: Feathertop Rhodes grass (*Chloris virgata*) (FTR), Barnyard grass (*Echinochloa spp*) (BYG)

Crop: Fallow

Application: 100L/ha Rainwater 110015 AIXR @ 2 Bar 6km/hr 4 Reps

Application timing at this location

	Date	Weed size at Timing 1	Time	Wind	Temp	RH%	Delta T
Timing 1 (T1)	22/12/2025	2 cohorts 'Tillering' and 'Advanced'	8am	10kph S	30.5°C	83%	3.8
Timing 2 (T2)	23/12/2025		9am	6kph WSW	25°C	98%	0.4
Timing 3 (T3)	29/12/2025		8am	13kph SW	20°C	59%	5
Timing 4 (T4)	29/12/2025		3pm	4kph SSW	32°C	26%	14
Timing 5 (T5)	19/01/2026		9am	4kph W	27°C	50%	7.5

For the trial reported here, first applications were applied at Timing 1 with the double knock being applied at Timing 3 or Timing 5.

Site background

Summer grass weeds such as feathertop Rhodes and barnyard grasses become more difficult to control as weed size increases and as application conditions deteriorate.

Both feathertop Rhodes grass and barnyard grass were present at this site. Barnyard grass was believed to be predominantly *Echinochloa colona* (awnless barnyard grass) but some *Echinochloa crus-galli* (common barnyard grass) may also be present. For this publication we have referred to the population collectively as barnyard grass (*Echinochloa spp.*). There were two cohorts of each weed. Plots were scored individually for each species and assessments separated into 'tillering' (1-3 tiller) and 'advanced' (3 tiller to commencement of flowering) weed sizes at application.

All plots were crossed sprayed with 2.4 L/ha of paraquat (250 gai/L) to create a double knock for those trials and treatments where this was required. Two paraquat cross spray strips were applied, one at 7 days after the main application timing and the other at 28 days after the first application timing. This created a matrix of no double knock; and double knocks applied at either 7 or 28 days between treatments.

Soil moisture was adequate at the first application timing (local BOM sites report ~50mm 10 days prior to the first application timing). There was a 4-6mm rainfall event the night of the first application timing.

Treatments were assessed for initial brownout 16 days after the first application and scored for biomass reduction at 40 days after the initial application.

No formal resistance testing was conducted on this population, but it is expected that there will be some level of glyphosate resistance present in the feathertop Rhodes grass and 'probably' also in the barnyard grass.

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Comparison of alternate knockdown herbicides applied to different weed growth stages – Feathertop Rhodes grass and barnyard grass. With and without a double knock.

Treatment list – Application timing 1

1	Crucial® (600g/L glyphosate)	5.5 L/ha
2	Untreated	
3	Crucial®	1.8 L/ha
4	Crucial® + 2,4-D amine (625 g/L 2,4-D)	1.8L/ha + 1.7 L/ha
5	Crucial® + Terrad'or® (700 g/kg tiafenacil)	1.8 L/ha + 40 g/ha + 1% Hasten
6	Crucial® + Voraxor® (250 g/L saflufenacil + 125 g/L trifludimoxazin)	1.8 L/ha + 100 mL/ha + 1% Hasten
7	Crucial® + Verdict® (520 g/L haloxyfop)	1.8 L/ha + 150 mL/ha + 1% Hasten
8	Crucial® + Cavero® (55g/L epyrifenacil)	1.8 L/ha + 270 mL/ha + 1% Hasten
9	Verdict®	150 mL/ha + 1% Hasten
10	Cavero®	375 mL/ha + 1% Hasten
11	Biffo® (200 g/L glufosinate)	3.75 L/ha
12	Biffo® + Voraxor®	3.75 L/ha + 100 mL/ha + 1% Hasten
13	Biffo® + Balance® (750 g/kg isoxaflutole)	3.75 L/ha + 100 g/ha + 1% Hasten
14	Biffo® + Cavero®	3.75 L/ha + 270 mL/ha + 1% Hasten
15	Paraquat (250 g/L paraquat)	2.4 L/ha
16	Paraquat + Balance®	2.4 L/ha + 100 g/ha + 1% Hasten

2% liquid AMS was added to all treatments

Cavero® (55 g/L epyrifenacil) is a new Group 14 herbicide that is not yet commercially available.

A strip of 2.4 L/ha paraquat 250 was cross applied to all plots to create a double knock with 7 days separation between applications. Another strip of 2.4 L/ha paraquat 250 was cross applied to all plots with 28 days between applications.

Weed size at herbicide application

Herbicide registrations for feathertop Rhodes grass control in fallow are limited. Where registered, application is generally restricted to pre-tillering or early tillering application. While more products are registered for control of barnyard grasses, most labels require application at the seedling to early tillering growth stages. Many labels do not differentiate between *E. colona* (awnless barnyard grass) and *E. crus-galli* (barnyard grass).

At this site, two weed germinations were present at the initial application timing. One cohort was at the 1 to 3 tiller growth stage, which would generally be considered to be the upper growth stage for most herbicide labels. Another larger cohort (>3 tiller to commencement of flowering) was also present. While a considerable percentage of the weed population was larger than what is supported on product labels, this weed size is often what growers elect to target with fallow herbicide applications, so it was considered appropriate to commence the trial to demonstrate the effectiveness of different herbicide options and combinations on these weeds at different growth stages.

Overall performance of all treatments was disappointing. While weed size may explain the poor performance on the larger cohort of each species, the relative lack of performance on the tillering cohort is somewhat unexplained. Several different herbicide modes of action were applied to the two species, and most treatments delivered less than satisfactory control – this suggests that ‘resistance’ to a particular mode of action is unlikely to be the major reason for poor performance, however it is expected that glyphosate resistance is probably contributing to poorer control of glyphosate at this site. Likewise, applications were made on different days and

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under different conditions at application (in different trials at this location) – which again suggests that ‘application conditions’ may not be the primary reason for substandard results.

The appendix shows the results of all the first pass herbicides applied alone or with the double knock (at two timings). Both weed sizes and both species are reported.

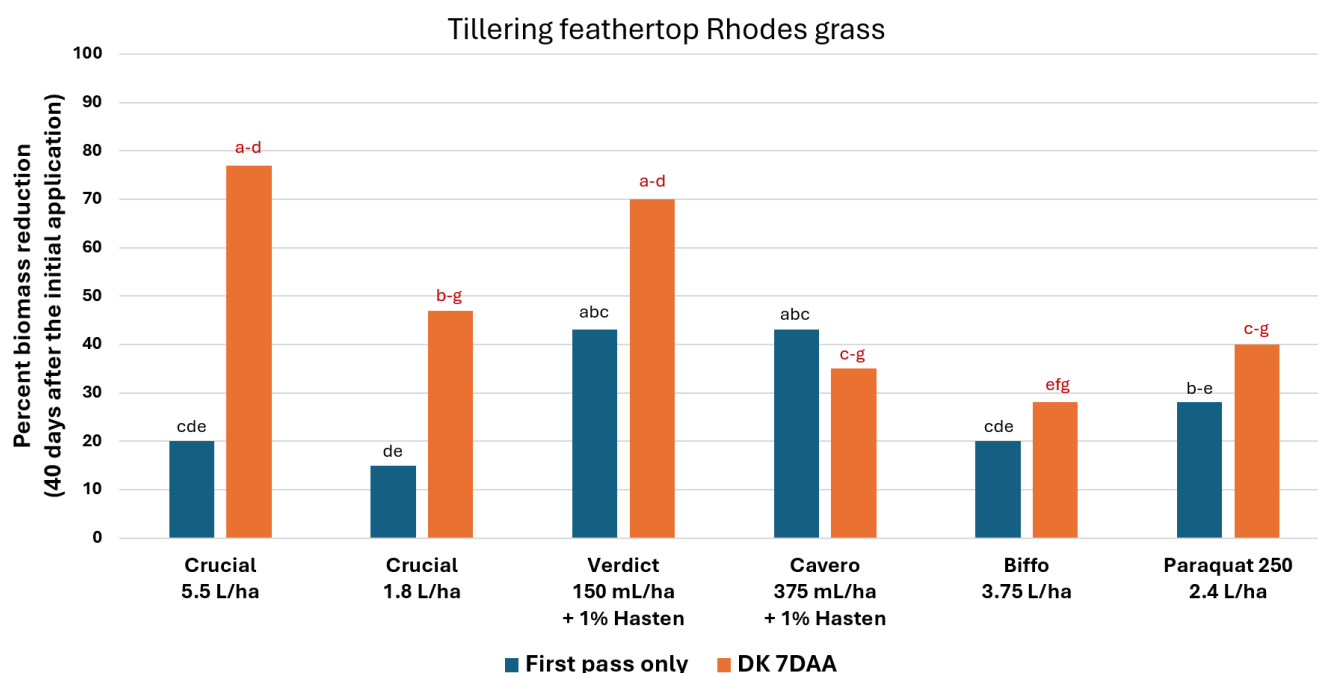
The performance of all herbicides was very poor on the larger weed cohort. This supports the lack of label registrations for use on weeds of this size and highlights the need for growers to ensure that grass weeds are targeted in fallow well before weeds reach the mid-tillering stage.

For the rest of this trial summary we have elected to largely concentrate discussion on the ‘tillering’ growth stage, which is more closely aligned to labelled growth stage of these weeds. Despite all treatments being less than commercially acceptable, the performance of glufosinate appeared to mostly be similar between weed species, whereas there was a slight trend for glyphosate or haloxyfop treatments to be marginally inferior against FTR. Double knocking these treatments improved control for several treatments, but rarely did this achieve a result that would be considered ‘commercially acceptable’.

Product comparison – with and without a standard double knock

Graphs below compare the single active ingredient treatments applied at the first application timing, with and without a standard paraquat double knock at 7 days after the first application.

As a stand-alone application, no treatment provided greater than 60% control of either FTR or BYG in this trial. There did not appear to be a glyphosate dose response for the glyphosate alone in either species.

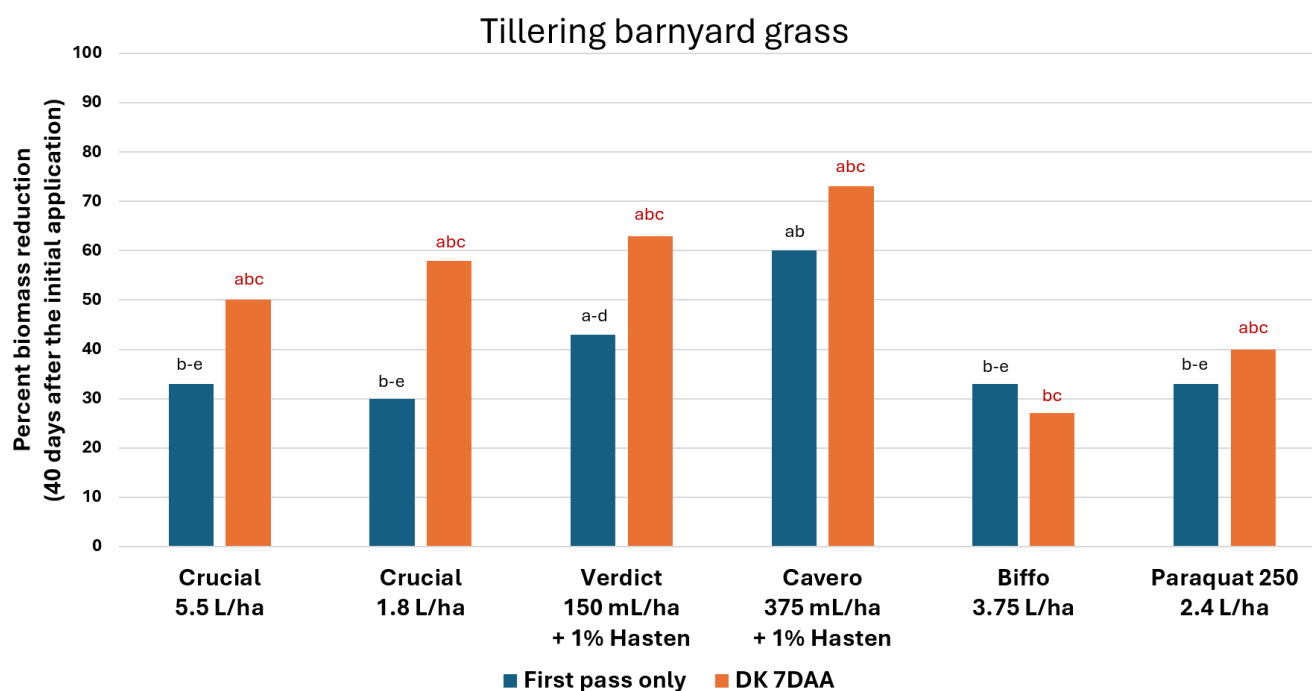


The paraquat double knock generally increased the final efficacy of the systemic herbicides applied as the first pass (glyphosate and haloxyfop) but generally did not provide the same level of increased performance when the double knock followed a contact herbicide applied as the first pass (epyrifenacil, glufosinate, paraquat).

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None of these double knock treatments provided greater than 80% control, which would generally be considered to be the minimum for a commercially acceptable result. This is consistent with previous research which continues to show that a paraquat double knock can normally lift performance of a systemic first pass application by up to about 30%, so the first pass must still be able to deliver greater than 60% control on its own, for the double knock treatment to achieve high levels of final control.



Glyphosate mixtures

Crucial® at 1.8 L/ha was applied alone and in mixture with a range of commonly mixed fallow herbicides. Control was marginally better against barnyard grass than feathertop Rhodes grass for all treatments in this analysis, however this was not significant.

The addition of 2,4-D was included to test for known antagonism between these herbicides on grass weeds. In this situation, there was no reduction in control observed from the addition of 2,4-D. However, this lack of response is likely to be a factor of the very poor performance of glyphosate in this trial. (In the larger cohort of both species the Crucial® + 2,4-D followed by paraquat treatments resulted in zero control at the final assessment).

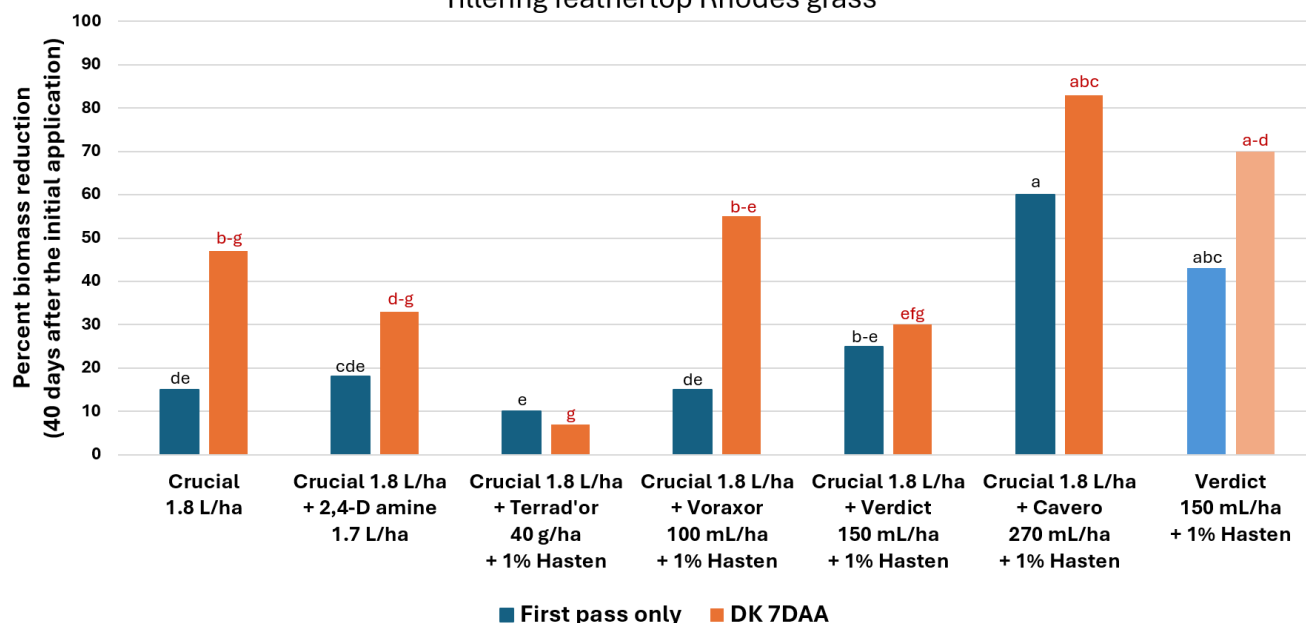
Terrad'or® and Voraxor® are two widely used Group 14 fallow herbicides. These are commonly preferred due to claims of some grass weed activity (both labels claim usefulness against ryegrass in mixtures with glyphosate). In this situation, neither provided any improvement in control of either FTR or BYG relative to Crucial (glyphosate) alone.

Cavero® is a new Group 14 herbicide in development, which is claimed to have activity on grass weeds, either in mixture with a knockdown herbicide such as glyphosate, or as a stand-alone application (at slightly higher application rate). In this trial, the combination of Crucial® + Cavero® was one of the better performing treatments against both weed species.

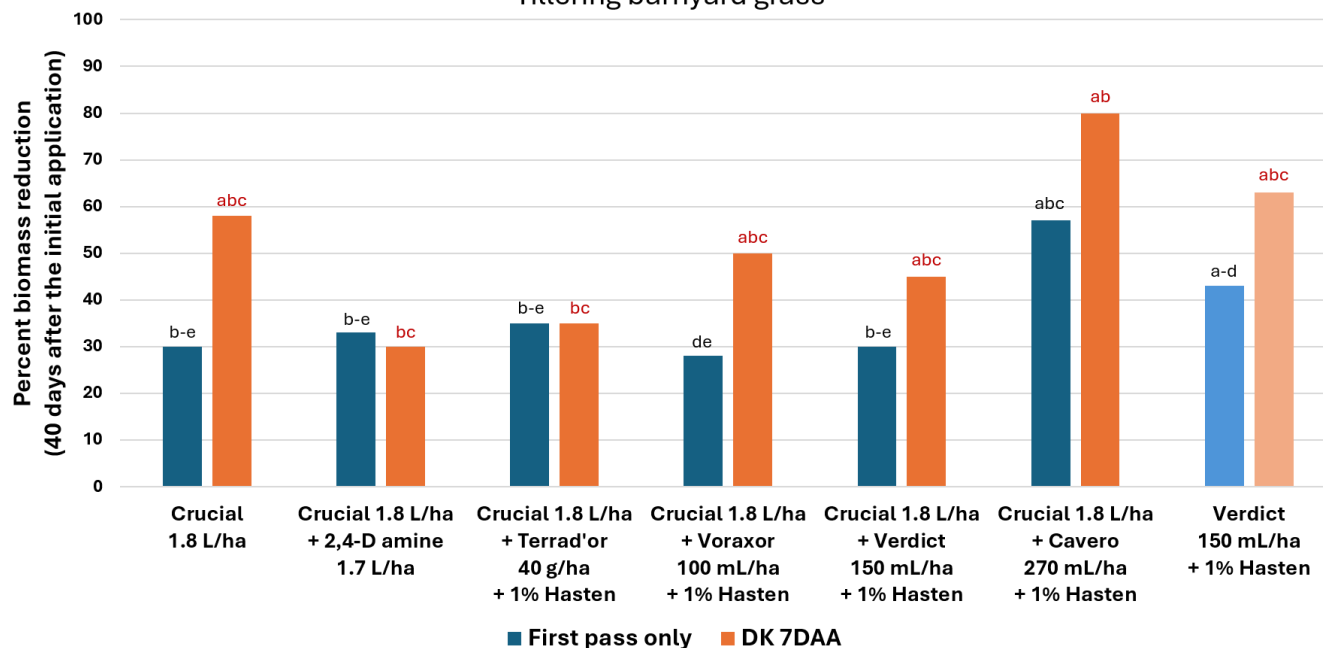
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Tillering feathertop Rhodes grass



Tillering barnyard grass



As a result of declining glyphosate performance against summer grasses, there has been considerable use of Verdict® (haloxyfop) in fallow. Despite glyphosate resistance in several summer grasses, many users still want to include glyphosate in the mix for other weeds. This results in frequent questions around the efficacy of glyphosate + haloxyfop mixes. In this trial there has been no advantage of adding Verdict® to Crucial® in either weed species, compared to Crucial® alone – either as a one pass application or as a double knock. However, there is a tendency for the tank mix to be inferior to Verdict® applied alone (included in the graphs), and in the

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case of the double knock application against FTR this was statistically significant. This reduction in control from the tank mix versus the solo application of a Group 1 has been seen previously in other trials on these grass weeds.

Contact herbicide mixtures

Selected mixtures with Biffo® (glufosinate) and paraquat were also tested.

Contact herbicides should be applied to small, pre-tillering weeds. Notwithstanding that weeds in this trial were already too large for optimal results, the levels of control from solo applications were still considered disappointing.

The Biffo® label recommends application parameters of temperature not greater than 33°C and relative humidity above 50% for optimal performance. In this trial the temperature was 30.5°C and relative humidity 83% (Delta T = 3.8) at application timing, which should be suitable for glufosinate application. This suggests that weed size is most likely the factor that has resulted in the substandard results experienced.

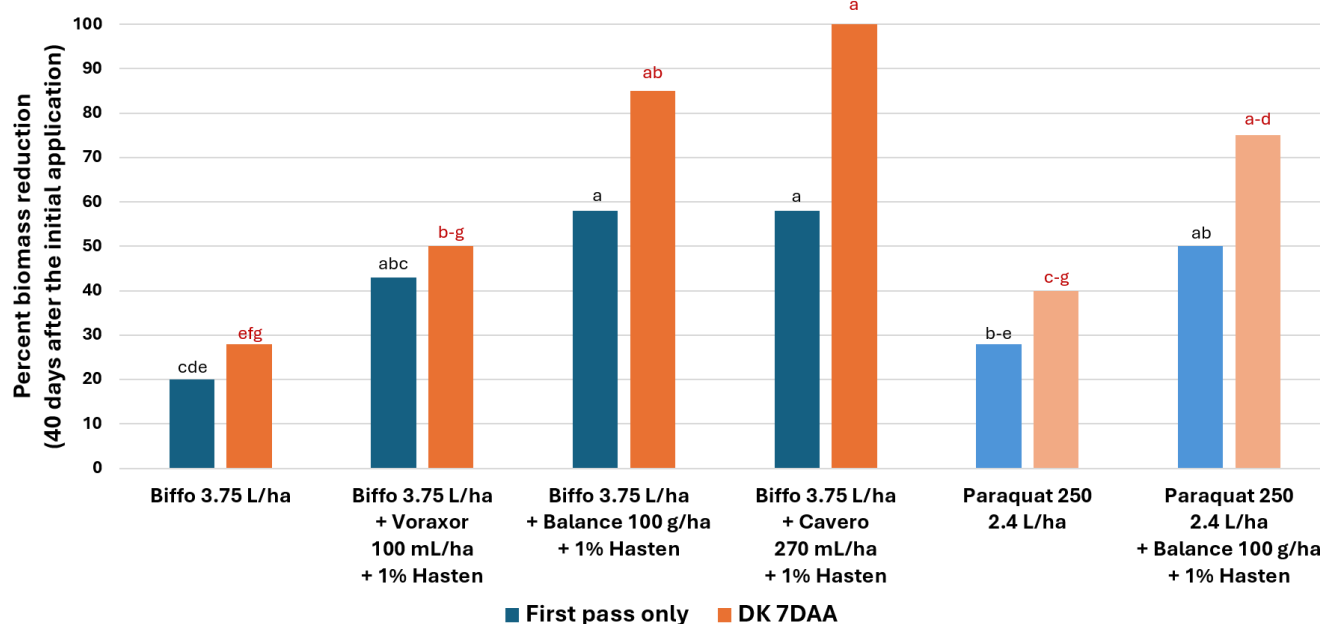
In previous studies, paraquat + Balance® has often provided improved control over paraquat alone on these weeds (either as a stand-alone application or when the paraquat + Balance® is used as the double knock). For this reason, paraquat + Balance® was added to this trial, along with a Biffo® + Balance® treatment to test if the same enhancement in control could be achieved with glufosinate. Adding Balance® to both Biffo® and paraquat noticeably improved control over both contact herbicides in both weed species, either when applied alone or as a double knock. This was statistically significant for Biffo® on FTR (both as a single application and a double knock) and for paraquat on BYG (as a single first pass application).

Biffo® (glufosinate) was also mixed with the Group 14 herbicides Voraxor® and Cavero®. The addition of Voraxor® improved control over glufosinate alone on both species, but this was not significant. Cavero® mixtures with glufosinate also improved control of both weed species. This was significant for FTR (both as a single application and a double knock), while the mixture also gave statistically improved control of BYG when applied in the double knock program. (Paraquat + Group 14 herbicides were not tested in this trial).

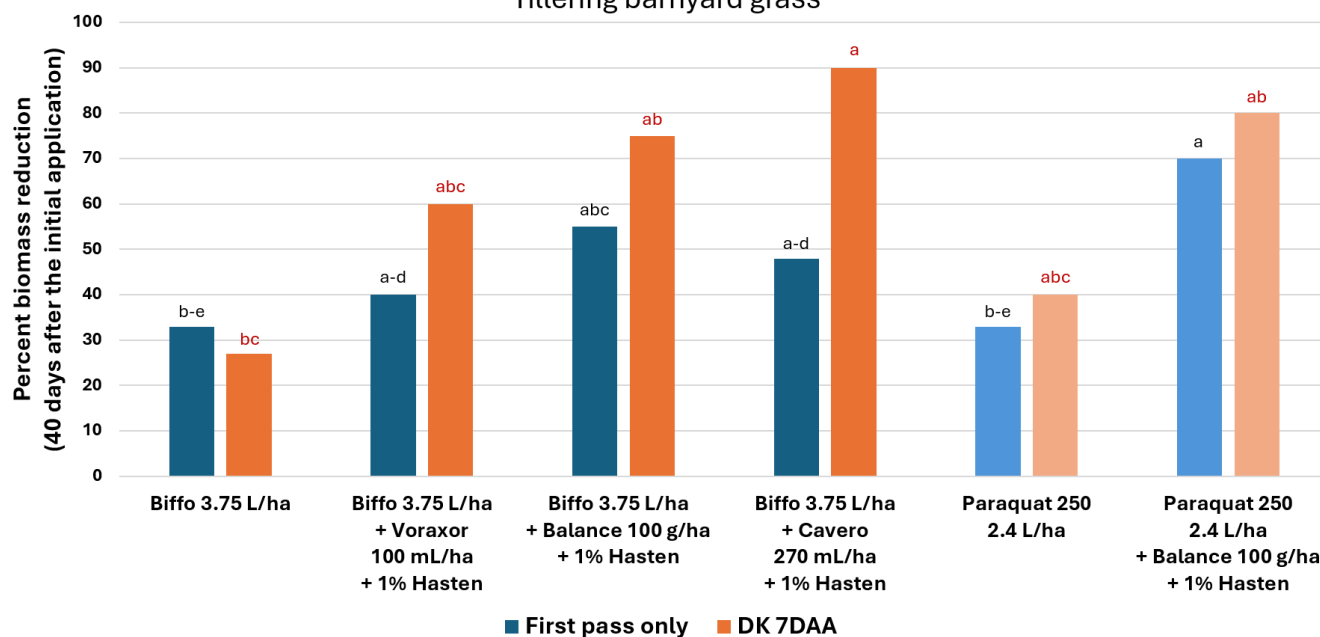
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Tillering feathertop Rhodes grass



Tillering barnyard grass



Cavero®

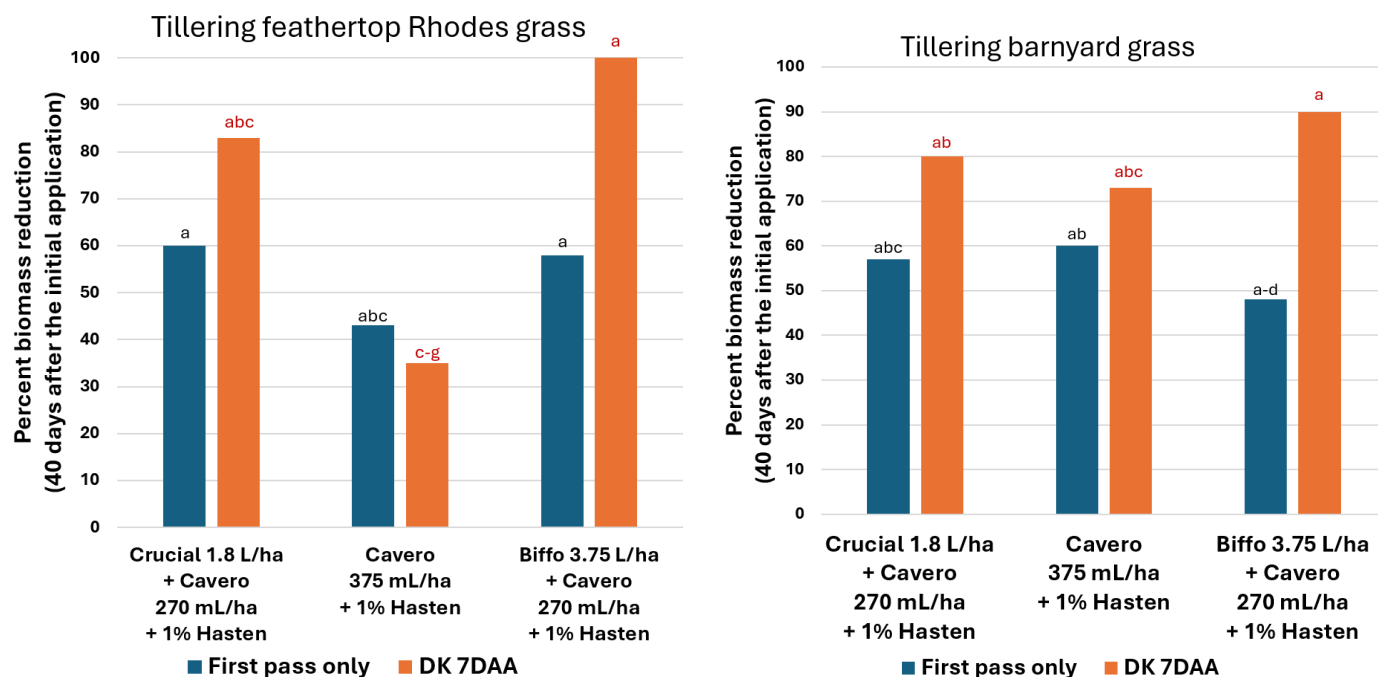
Cavero® (epyrifenacil) is a new Group 14 herbicide in development. While not yet commercially available, it is expected to be registered for control of a range of broadleaf and grass weeds at approximately 20 gai/ha as a solo application, or approximately 15 gai/ha when applied in mixture with another knockdown herbicide (such as glyphosate or paraquat).

In this trial we compared Cavero® alone at 375 mL/ha (20.625 gai/ha), versus Cavero® at 270 mL/ha (14.85 gai/ha) in mixtures with either Crucial® or Biffo®. Cavero® (especially in mixtures) was amongst the best

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performing herbicides in this trial. When double knocked, the Cavero® mixtures were able to achieve at least 80% final control, with Biffo® + Cavero® followed by a paraquat double knock being the only treatment in this trial to achieve 100% control of the tillering feathertop Rhodes grass.



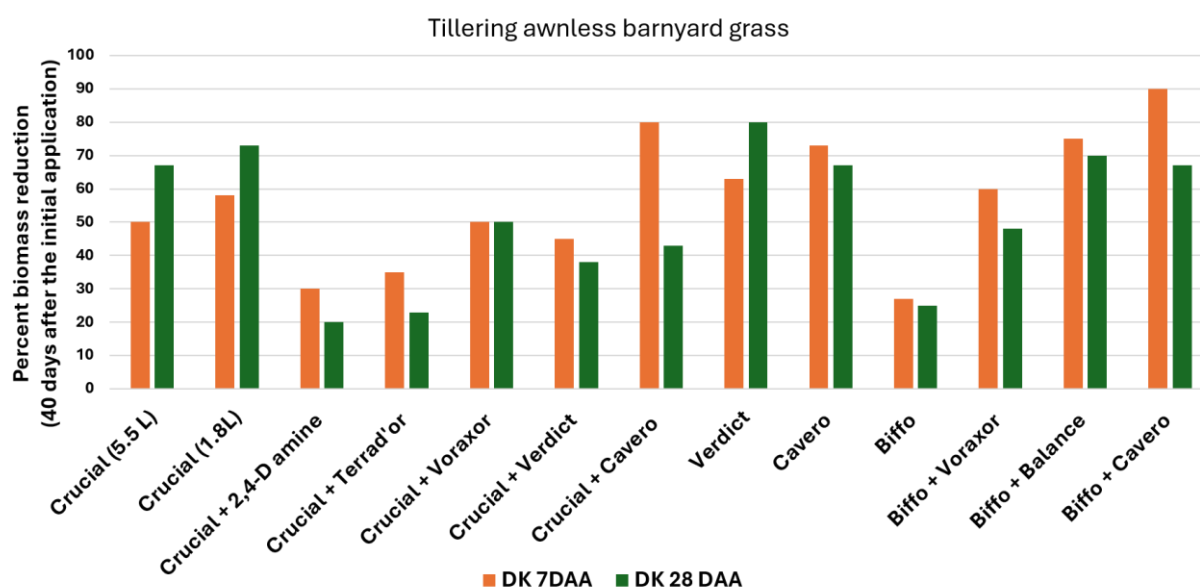
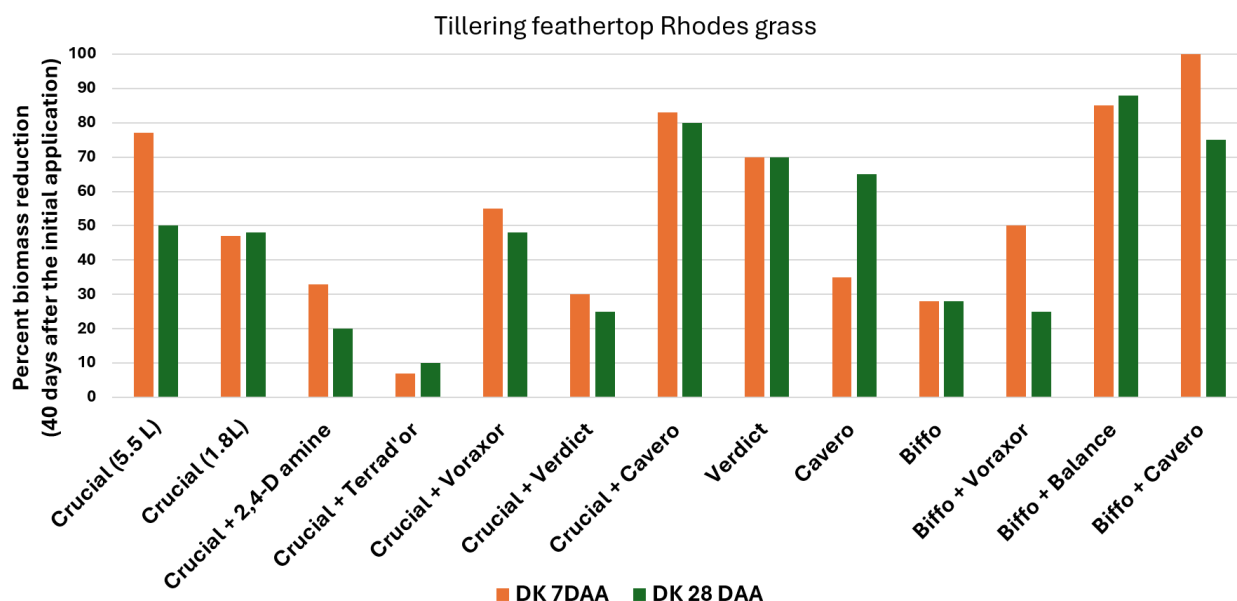
Double knock timing

Trial design included a double knock of paraquat applied at 7 or 28 days after the initial treatments. Often growers and agronomists ask about the value of applying the double knock later than the 'ideal' timing in situations where the preferred double knock timing could not be applied. Previous research has sometimes identified a trend for reduced control where the double knock timing is extended beyond about 10 days.

Graphs below show control for the 7-day and 28-day double knock intervals. The statistical analysis completed on this trial evaluated results within each application timing and not across different application timings, hence statistical analysis is not available for this timing comparison. However, a visual comparison of means appears to show that there was very little difference between the different double knock timings in this trial.

It should be noted that both assessments were done 40 days after the initial application, so the later double knock timing had only been applied 12 days prior to the final assessment. Additionally, the trial site was rapidly drying by the final assessment. It may be possible that the delayed double knock timing may have performed differently in a situation of ongoing rainfall and plants attempt to regrow.

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Disclaimer: This document is based on the results from individual trials. Variability in product performance is expected across trials and environments. Different outcomes are possible under different trial situations; brand of herbicide applied; environmental conditions before, at and following application; sprayer setup; adjuvant choice; water quality and spray volume; weed size and weed stress; and herbicide resistance status of the population. Trials seek to build on current knowledge – therefore this summary may contain experimental use patterns that are currently not specifically labelled for all of the weed(s) targeted in the trial, or treatments applied at a weed growth stage or application timing that may differ to the product label. In some circumstances, inclusion of a particular treatment is included to demonstrate why this product should not be used in that particular situation. Any research with unregistered agricultural chemicals or of unregistered products, rates or use patterns reported in this document does not constitute a recommendation for that particular use by the authors or the authors' organisations. All agricultural chemical applications must accord with the currently registered label for that particular agricultural chemical, crop and region.

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Appendix – treatments applied at trial site timing 1 & 3

DK = Double knock of 2.4 L/ha paraquat 250 applied 7 or 28 days after the initial application.

Results highlighted in blue had less than 3 replicates included in the average, due to no plants available to be assessed in the remaining replicate(s). These results should be viewed with caution.

Tillering feathertop Rhodes grass

All herbicide rates per hectare 2% liquid AMS added to all treatments		Brownout 16 DAA		Biomass reduction 40DAA1					
				Alone		DK @7DAA		DK @28DAA	
1	Crucial (5.5 L)	48	cd	20	cde	77	a-d	50	b-f
2	Untreated	0	h	0	e	0	efg	0	efg
3	Crucial (1.8L)	10	gh	15	de	47	b-g	48	b-g
4	Crucial (1.8 L) + 2,4-D amine 625 (1.7 L)	10	gh	18	cde	33	d-g	20	efg
5	Crucial (1.8 L) + Terrad'or (40 g) + 1% Hasten	40	de	10	e	7	g	10	g
6	Crucial (1.8 L) + Voraxor (100 mL) + 1% Hasten	23	efg	15	de	55	b-e	48	b-g
7	Crucial (1.8 L) + Verdict (150 mL) + 1% Hasten	40	def	25	b-e	30	efg	25	efg
8	Crucial (1.8 L) + Cavero (270 mL) + 1% Hasten	75	ab	60	a	83	abc	80	ab
9	Verdict (150 mL) + 1% Hasten	50	cd	43	abc	70	a-d	70	a-d
10	Cavero (375 mL) + 1% Hasten	80	ab	43	abc	35	c-g	65	a-e
11	Biffo (3.75 L)	73	ab	20	cde	28	efg	28	d-g
12	Biffo (3.75 L) + Voraxor (100 mL) + 1% Hasten	83	a	43	abc	50	b-g	25	d-g
13	Biffo (3.75 L) + Balance (100 g) + 1% Hasten	80	a	58	a	85	ab	88	a
14	Biffo (3.75 L) + Cavero (270 mL) + 1% Hasten	87	a	58	a	100	a	75	abc
15	Paraquat 250 (2.4 L)	20	gh	28	b-e	40	c-g	30	d-g
16	Paraquat 250 (2.4L) + Balance (100g) + 1% Hasten	73	ab	50	ab	75	a-d	40	c-g

Tillering barnyard grass

All herbicide rates per hectare 2% liquid AMS added to all treatments		Brownout 16 DAA		Biomass reduction 40DAA1					
				Alone		DK @7DAA		DK @28DAA	
1	Crucial (5.5 L)	20	hi	33	b-e	50	abc	67	a-d
2	Untreated	0	i	0	e	0	bc	0	a-e
3	Crucial (1.8L)	10	i	30	b-e	58	abc	73	ab
4	Crucial (1.8 L) + 2,4-D amine 625 (1.7 L)	20	ghi	33	b-e	30	bc	20	ef
5	Crucial (1.8 L) + Terrad'or (40 g) + 1% Hasten	43	efg	35	b-e	35	bc	23	def
6	Crucial (1.8 L) + Voraxor (100 mL) + 1% Hasten	33	fgh	28	de	50	abc	50	a-f
7	Crucial (1.8 L) + Verdict (150 mL) + 1% Hasten	50	def	30	b-e	45	abc	38	b-f
8	Crucial (1.8 L) + Cavero (270 mL) + 1% Hasten	78	abc	57	abc	80	ab	43	a-f
9	Verdict (150 mL) + 1% Hasten	80	ab	43	a-d	63	abc	80	a
10	Cavero (375 mL) + 1% Hasten	80	ab	60	ab	73	abc	67	a-d
11	Biffo (3.75 L)	58	cde	33	b-e	27	bc	25	c-f
12	Biffo (3.75 L) + Voraxor (100 mL) + 1% Hasten	80	ab	40	a-d	60	abc	48	a-f
13	Biffo (3.75 L) + Balance (100 g) + 1% Hasten	80	ab	55	abc	75	ab	70	abc
14	Biffo (3.75 L) + Cavero (270 mL) + 1% Hasten	90	a	48	a-d	90	a	67	a-d
15	Paraquat 250 (2.4 L)	63	b-e	33	b-e	40	abc	33	b-f
16	Paraquat 250 (2.4L) + Balance (100g) + 1% Hasten	73	a-d	70	a	80	ab	63	a-e

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Advanced feathertop Rhodes growth

All herbicide rates per hectare 2% liquid AMS added to all treatments		Brownout 16 DAA		Biomass reduction 40DAA1					
				Alone		DK @7DAA		DK @28DAA	
1	Crucial (5.5 L)	40	cde	15	a-f	3	de	28	bc
2	Untreated	0	i	0	f	0	e	0	c
3	Crucial (1.8L)	10	hi	13	b-f	13	de	7	c
4	Crucial (1.8 L) + 2,4-D amine 625 (1.7 L)	10	hi	0	ef	0	e	0	c
5	Crucial (1.8 L) + Terrad'or (40 g) + 1% Hasten	23	fgh	0	ef	0	e	0	c
6	Crucial (1.8 L) + Voraxor (100 mL) + 1% Hasten	13	ghi	0	f	43	b-e	10	c
7	Crucial (1.8 L) + Verdict (150 mL) + 1% Hasten	37	def	10	c-f	10	de	3	c
8	Crucial (1.8 L) + Cavero (270 mL) + 1% Hasten	53	c	30	abc	23	b-e	13	c
9	Verdict (150 mL) + 1% Hasten	27	efg	7	c-f	60	abc	65	ab
10	Cavero (375 mL) + 1% Hasten	20	ghi	0	ef	60	abc	37	abc
11	Biffo (3.75 L)	50	cd	10	c-f	0	e	0	c
12	Biffo (3.75 L) + Voraxor (100 mL) + 1% Hasten	53	bc	3	def	13	de	0	c
13	Biffo (3.75 L) + Balance (100 g) + 1% Hasten	70	a	33	ab	60	ab	73	a
14	Biffo (3.75 L) + Cavero (270 mL) + 1% Hasten	80	a	23	a-e	100	a	73	a
15	Paraquat 250 (2.4 L)	20	ghi	5	def	18	cde	8	c
16	Paraquat 250 (2.4L) + Balance (100g) + 1% Hasten	53	bc	25	a-d	45	bcd	33	bc

Advanced barnyard grass

All herbicide rates per hectare 2% liquid AMS added to all treatments		Brownout 16 DAA		Biomass reduction 40DAA1					
				Alone		DK @7DAA		DK @28DAA	
1	Crucial (5.5 L)	10	hi	7	bc	23	bc	47	ab
2	Untreated	0	i	0	c	0	bc	0	b
3	Crucial (1.8L)	15	ghi	13	abc	30	bc	38	ab
4	Crucial (1.8 L) + 2,4-D amine 625 (1.7 L)	15	ghi	23	abc	0	c	20	b
5	Crucial (1.8 L) + Terrad'or (40 g) + 1% Hasten	45	c-f	10	bc	28	bc	13	b
6	Crucial (1.8 L) + Voraxor (100 mL) + 1% Hasten	23	e-i	0	c	33	bc	28	b
7	Crucial (1.8 L) + Verdict (150 mL) + 1% Hasten	47	b-e	3	c	40	abc	23	b
8	Crucial (1.8 L) + Cavero (270 mL) + 1% Hasten	60	abc	23	abc	33	bc	27	b
9	Verdict (150 mL) + 1% Hasten	57	abc	35	a	57	ab	77	a
10	Cavero (375 mL) + 1% Hasten	50	a-d	10	bc	37	bc	40	ab
11	Biffo (3.75 L)	45	cde	5	c	0	c	7	b
12	Biffo (3.75 L) + Voraxor (100 mL) + 1% Hasten	57	abc	0	c	0	c	15	b
13	Biffo (3.75 L) + Balance (100 g) + 1% Hasten	40	c-f	35	a	35	c	48	ab
14	Biffo (3.75 L) + Cavero (270 mL) + 1% Hasten	73	a	10	bc	93	a	53	ab
15	Paraquat 250 (2.4 L)	30	d-h	13	abc	0	c	10	b
16	Paraquat 250 (2.4L) + Balance (100g) + 1% Hasten	50	a-e	23	abc	50	abc	40	ab

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