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Feathertop Rhodes Grass Residual Management Strategies

Trial ID: LB2110

Location: Nandi

Trial Year: 2021

Investigator: Linda Bailey

Residual herbicides play a vital role in feathertop Rhodes grass (FTR) management as effective, economic knockdown herbicide options are not generally available or pose crop safety risks when applied prior to planting sorghum. In addition, FTR, appears less temperature sensitive than other summer grasses so often germinates in the winter months and after small rainfall events. This project was designed to evaluate the impact of a range of residual herbicides for FTR management in sorghum. The main aim was to evaluate whether split or sequential applications of Dual Gold (metolachlor) could broaden the period of effective residual summer grass control compared to a single application at planting or early in-crop. Alternative residual herbicides with registration prior to, or in sorghum, Valor (flumioxazin) and Gesaprim (atrazine), were included as alternative stand-alone options applied in the fallow and also when 'topped up' with Dual Gold at planting or early in-crop. In addition, three treatments of sequential herbicides prior to planting were evaluated.

Objective:	To evaluate the impact of split application of herbicides for grass control pre-plant and in-crop			
Crop (hybrid):	Sorghum (MR Buster)			
Planting Date:	17/10/2021			
Planter:	Double disc planter on 1 m rows			
Application:	A	B	C	D
Application Date:	30/07/2021	31/08/2021	21/10/2021 (4 days after planting)	05/11/2021 (19 days after planting)
Crop Stage at Application:	Pre-emergent	Pre-emergent	Pre-emergent	GS15 (5 leaf)
Nozzles:	AIXR110015			
Volume:	100 L/ha			
Weeds:	Feathertop Rhodes grass and flaxleaf fleabane			
Trial Design:	Randomised complete block of 23 treatments x 4 replicates with embedded factorial of 18 treatments (3 herbicides x 6 timings/use patterns)			
Plot Size:	4 m x 12 m			
Keywords:	Sorghum, feathertop Rhodes grass, flaxleaf fleabane, residual			

Glufosinate was applied at an OSS rate across the entire trial on the 17th September to effectively control trace populations of other weed species that were present at trial initiation. Glyphosate was applied commercially at planting and only provided suppression of weeds that were emerged at planting.

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NB Applications C and D were NOT applied at the 21/10/2021 assessment. Application C was applied immediately after this assessment. Application D was not applied at the 5/11/2021 assessment. Application D was applied immediately after this assessment.

Scientific Pest Name Pest Name Crop Name Assessment Date Assessment Type Assessment Unit Assessed Area Crop Stage Majority Pest Stage Majority Plant-Evaluation Interval ARM Action Codes				Sorghum 27/10/2021 EMERGENCE /m ² 4 m of row GS 13 10 DAP	Chloris virgata Feathertop Rhodes Grass			Conyza bonariensis Flaxleaf Fleabane
Trt No.	Treatment	Product Rate	Appln. Code		21/10/2021 COUNT /m ² 4 x 0.25 m ² GS 11-13 83 DAA/ 51 DAB	5/11/2021 COUNT /m ² 4 x 0.25 m ² GS 11 -21 98 DAA/ 66 DAB/ 15 DAC AL	14/12/2021 COUNT /m ² 10 m x 1 m GS 39 (GS21-59) 137 DAA/ 105 DAB/ 54 DAC/ 39 DAD AA	14/12/2021 COUNT /m ² 10 m x 1 m 137 DAA/ 105 DAB/ 54 DAC/ 39 DAD AA
19	Untreated	-	-	6.4-	154.3ab	79.2ab	13.4a-d	0.2c-f
1	Dual Gold	1000ml/ha	A	5.9-	4.8c	8.6d-g	3.5e-h	0.2c-f
2	Dual Gold	1000ml/ha	A	5.8-	0.0c	1.3gh	1.1gh	0.3a-f
	Dual Gold	1000ml/ha	C					
3	Dual Gold	1000ml/ha	A	5.4-	4.3c	10.0c-g	4.2e-h	0.5a-d
	Dual Gold	1000ml/ha	D					
4	Dual Gold	1000ml/ha	B	6.8-	0.3c	2.3fgh	1.5gh	1.1a
5	Dual Gold	1000ml/ha	B	5.8-	0.0c	0.7h	1.1gh	0.4a-f
	Dual Gold	1000ml/ha	C					
6	Dual Gold	1000ml/ha	B	6.3-	2.0c	3.9e-h	3.6e-h	0.4a-f
	Dual Gold	1000ml/ha	D					
7	Atragranz	2000g/ha	A	5.4-	136.7abc	56.0abc	17.0ab	0.0ef
8	Atragranz	2000g/ha	A	5.9-	146.5ab	42.7a-d	15.6abc	0.0f
	Dual Gold	1000ml/ha	C					
9	Atragranz	2000g/ha	A	6.5-	24.8bc	23.7b-e	6.2c-g	0.0def
	Dual Gold	1000ml/ha	D					
10	Atragranz	2000g/ha	B	6.2-	69.8abc	28.0bcd	13.8a-d	0.2c-f
11	Atragranz	2000g/ha	B	5.7-	81.0abc	57.0abc	18.0ab	0.2c-f
	Dual Gold	1000ml/ha	C					
12	Atragranz	2000g/ha	B	6.5-	20.3bc	16.7b-f	4.9d-h	0.9ab
	Dual Gold	1000ml/ha	D					
13	Valor	210g/ha	A	5.7-	0.0c	1.9gh	3.9e-h	0.6abc
14	Valor	210g/ha	A	5.5-	0.0c	2.1gh	1.5gh	0.8abc
	Dual Gold	1000ml/ha	C					
15	Valor	210g/ha	A	5.9-	0.0c	0.7h	0.7h	0.4a-f
	Dual Gold	1000ml/ha	D					
16	Valor	210g/ha	B	5.8-	0.0c	2.1gh	2.7e-h	0.5a-e
17	Valor	210g/ha	B	5.7-	0.3c	1.2gh	1.9fgh	0.3a-f
	Dual Gold	1000ml/ha	C					
18	Valor	210g/ha	B	6.2-	0.3c	1.7gh	1.0gh	0.3a-f
	Dual Gold	1000ml/ha	D					
20	Dual Gold	1000ml/ha	C	6.0-	172.5a	48.9a-d	17.5ab	0.4a-f
21	Dual Gold	2000ml/ha	C	5.9-	144.0ab	26.7bcd	8.1b-f	0.8abc
22	Dual Gold	1000ml/ha	D	6.0-	122.3abc	26.4bcd	8.8b-e	0.2b-f
23	Dual Gold	2000ml/ha	D	5.9-	201.5a	160.5a	23.4a	0.1def
LSD P=.05				nsd	137.05	0.73t	9.07t	3.05t
Treatment Prob.(F)=				0.4623	0.0100	0.0001	0.0001	0.0378

Means followed by same letter do not significantly differ (P=.05, LSD)

t=Mean descriptions are reported in transformed data units, and are not de-transformed.

Mean comparisons performed only when AOV Treatment P (F) is significant at mean comparison OSL.

nsd = no significant difference

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The trial was designed with a factorial series of treatments (treatments 1-18) and 5 check treatments (treatments 19-23). The analysis below highlights the performance of the fallow herbicides applied alone or with a following 'top up' treatment of Dual Gold.

Key points when data analysed as a factorial

	In Simple Terms
Table of A Means:	Mean of 'Herbicide' performance with ALL 'Timing' treatments
Table of B Means:	Mean of 'Timing' performance with ALL 'Herbicide' treatments
Table of A x B Means:	'Herbicide' performance with EACH 'Timing' treatment

Is there a significant difference for A x B Means ?

If YES

Table A x B Means analysis is the key information

If NO (ie nsd)

Table A or Table B Means analysis is the key information

Scientific Pest Name				<i>Chloris virgata</i>			<i>Conyza bonariensis</i>
Pest Name				Feathertop Rhodes Grass			Flaxleaf Fleabane
Assessment Date				21/10/2021	5/11/2021	14/12/2021	14/12/2021
Assessment Type				COUNT	COUNT	COUNT	COUNT
Assessment Unit				/m ²	/m ²	/m ²	/m ²
Assessed Area				4 x 0.25 m ²	4 x 0.25 m ²	10 m x 1 m	10 m x 1 m
Treatment-Evaluation Interval				83 DAA/ 51 DAB	98 DAA/ 66 DAB/ 15 DAC	137 DAA/ 105 DAB/ 54 DAC/ 39 DAD	137 DAA/ 105 DAB/ 54 DAC/ 39 DAD
ARM Action Codes					AL	AA	AA
Trt No.	Treatment	Product Rate	Appl. Code				
TABLE OF A MEANS (Herbicide)							
1	Dual Gold	1000ml/ha		1.9b	3.4tb	2.3tb	0.4ta
2	Atragranz	2000g/ha		79.8a	34.0ta	12.0ta	0.2tb
3	Valor	210g/ha		0.1b	1.6b	1.8tb	0.5ta
TABLE OF B MEANS (Timing)							
1	Herbicides alone end-July		A	47.1-	10.6t-	7.2t-	0.2t-
2	Herbicides alone end-July		A	48.8-	5.8t-	4.4t-	0.3t-
	Dual Gold planting	1000ml/ha	C				
3	Herbicides alone end-July		A	9.7-	6.7t-	3.2t-	0.3t-
	Dual Gold in-crop	1000ml/ha	D				
4	Herbicides alone end-August		B	23.3-	5.7t-	4.9t-	0.5t-
5	Herbicides alone end-August		B	27.1-	5.1t-	5.0t-	0.3t-
	Dual Gold planting	1000ml/ha	C				
6	Herbicides alone end-August		B	7.5-	5.2t-	2.9t-	0.5t-
	Dual Gold in-crop	1000ml/ha	D				

Interaction tables not presented as no significant interactions

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FACTORIAL/POOLED ERROR AOV <i>Chloris virgata</i> - Feathertop Rhodes Grass 21/10/2021 COUNT /m² 83 DAA/ 51 DAB						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	67	249440.938272				
R	3	8467.518519	2822.506173	1.580	0.2066	
A	2	99491.151235	49745.575617	27.854	0.0001	24.7
B	5	18912.141975	3782.428395	2.118	0.0797	34.9
AB	10	38629.978395	3862.997840	2.163	0.0374	60.4
ERROR	47	83940.148148	1785.960599			

FACTORIAL/POOLED ERROR AOV <i>Chloris virgata</i> - Feathertop Rhodes Grass 5/11/2021 COUNT /m² 98 DAA/ 66 DAB/ 15 DAC AL						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	66	33.727600				
R	3	2.622271	0.874090	3.792	0.0164	
A	2	17.288673	8.644336	37.501	0.0001	0.3
B	5	0.670365	0.134073	0.582	0.7138	0.4
AB	10	2.542718	0.254272	1.103	0.3802	0.7
ERROR	46	10.603574	0.230512			

FACTORIAL/POOLED ERROR AOV <i>Chloris virgata</i> - Feathertop Rhodes Grass 14/12/2021 COUNT /m² 137 DAA/ 105 DAB/ 54 DAC/ 39 DAD AA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	66	5076.792514				
R	3	443.746783	147.915594	4.606	0.0067	
A	2	2328.528711	1164.264356	36.257	0.0001	3.3
B	5	247.035187	49.407037	1.539	0.1966	4.7
AB	10	580.359699	58.035970	1.807	0.0860	8.1
ERROR	46	1477.122135	32.111351			

FACTORIAL/POOLED ERROR AOV <i>Conyza bonariensis</i> - Flaxleaf Fleabane 14/12/2021 COUNT /m² 137 DAA/ 105 DAB/ 54 DAC/ 39 DAD AA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	66	412.229101				
R	3	12.100496	4.033499	0.737	0.5357	
A	2	41.865669	20.932834	3.822	0.0291	1.4
B	5	22.003741	4.400748	0.804	0.5530	1.9
AB	10	84.337634	8.433763	1.540	0.1560	3.3
ERROR	46	251.921561	5.476556			

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Conclusions:

This was a complex trial to evaluate the impact of split or sequential residual herbicide applications for feathertop Rhodes grass (FTR) management both prior to and in sorghum. Dual Gold, Atragranz or Valor were applied at the end of July or end of August. These treatments either remained as stand-alone or were topped-up with Dual Gold at 1 L/ha, at sorghum planting or early in-crop. Reference treatments were an untreated and Dual Gold rates applied at planting or in-crop.

Levels of rainfall of <5 mm occurred in the week following the application timings at the end of July, end of August or at-planting. Monthly rainfall totals of <10 mm were recorded in both August and September.

The site was sown to MR Buster sorghum on the 17th October. The untreated had a population of ~6.4 plants/m row. All treatments were crop safe with no impact on emergence counts at 10 days after planting or any visual crop effect evident.

Rainfall totalling over 60 mm occurred during the 12th-14th of October with FTR seedlings already apparent at planting. The 1st assessment count was conducted four days later with >150 FTR/m² in the untreated. All Dual Gold or Valor treatments reduced FTR populations to <5/m² with no significant difference between products or application timing. Atragranz provided poor levels of FTR suppression and was not significantly different to the untreated. A 'clean-up' application of glyphosate was applied after this assessment but only resulted in FTR suppression.

A second assessment was conducted ~2 weeks later. Although there was no significant difference between Dual Gold and Valor, there was a trend to improved FTR control from Valor. There was also a trend to improved control where initial applications of Dual Gold were 'topped-up' with Dual Gold 1 L/ha shortly after planting. There was no obvious benefit where Valor was 'topped-up' with the at-planting treatment. Dual Gold applied at the end of July, without the at-planting 'top-up', trended to poorer control than either timing of Valor or where Dual Gold was applied at the end of August. Applications of Dual Gold alone at-planting provided poor FTR control and were not significantly different to the untreated. The at-planting treatment of Dual Gold 2 L/ha was significantly poorer than all Valor or early Dual Gold treatments except where Dual Gold was only applied in July.

A final weed assessment was conducted in mid-December. Rainfall totals of ~300 mm were recorded between the 2nd and final assessment. Similar patterns were apparent to the 2nd assessment. Dual Gold applications alone at planting or in-crop were not significantly different to the untreated and poorer than 11 of the 12 treatments with July or August herbicide application. It is expected that the poor performance of Dual Gold at planting or in-crop was due to the majority of weeds being already emerged at application combined with the poor knockdown efficacy provided by glyphosate.

Low levels of flaxleaf fleabane were present at the final assessment with <0.2/m² in the untreated. Factorial analysis showed Atragranz provided improved control compared to Dual Gold or Valor.

This trial highlights the importance of residual herbicide application prior to FTR emergence. Despite very low levels of incorporating rainfall, applications of either Dual Gold or Valor ~7-11 weeks prior to planting provided very effective levels of control. In contrast, ineffective FTR control was achieved from all Dual Gold treatments applied only at-planting or in-crop. Improved FTR efficacy from sequential application was most apparent from the July application of Dual Gold with the at-planting 'topped-up'.

Useful data on the length of in-crop efficacy from the sequential treatments was not possible as effective knockdown control of emerged seedlings at planting could not be achieved.

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Pest Stage Majority

11 = 1 true leaf, leaf pairs or whorls unfolded
 22 = 2 side shoots visible; G_2 tillers visible
 39 = 9 visibly extended internode; G_9 node stage

ARM Action Codes

AL = Automatic log transformation of X+1
 AA = Automatic arcsine square root % transformation

DAA = Days After Application A
 DAB = Days After Application B
 DAC = Days After Application C
 DAD = Days After Application D
 DAP = Days After Planting

Crop Description	
Crop & Variety:	Sorghum cv. MR Buster
Planting Date:	17/10/2021
Planting Rate:	60,000 seeds/ha
Planting Equipment:	Disc
Row Spacing:	100 cm

Application Description				
	A	B	C	D
Application Date:	30/07/2021	31/08/2021	21/10/2021	5/11/2021
Application Start Time:	9:55 AM	2:55 PM	10:40 AM	12:15 PM
Application Stop Time:	10:45 AM	3:55 PM	11:15 AM	12:35 PM
Application Method:	SPRAY			
Application Timing:	PRE-EMERGENT			POEMCR
Application Placement:	SOIL			
Air Temperature, Unit:	15.5 C	26.7 C	27.3 C	23.4 C
% Relative Humidity:	53.4	46.8	45.4	47.8
Wind Velocity, Unit:	3.6 km/h	6.6 km/h	14.6 km/h	11.2 km/h
Wind Direction:	NE	NW	NW	NE
Soil Moisture:	DRY	DRY	SLIWET	DRY
% Cloud Cover:	0	20	40	80
Next Moisture Occurred On:	4/08/2021	6/09/2021	26/10/2021	8/11/2021

Crop Stage at Each Application				
	A	B	C	D
Crop:	Sorghum MR Buster			
Stage Majority, %:	Pre-plant	Pre-plant	Post-plant, pre-emergent	GS 15 (5 leaf)

Application Equipment				
	A	B	C	D
Application Equipment:	Polaris			
Equipment Type:	BOOM			
Operation Pressure, Unit:	300 kPa			
Nozzle Type:	AIXR			
Nozzle Size:	110015			
Nozzle Spacing, Unit:	50 cm			
Boom Length, Unit:	4 m			
Boom Height, Unit:	50 cm			
Ground Speed, Unit:	7.2 km/h			
Spray Volume, Unit:	100 L/ha			

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Rainfall:

Closest Weather Station:	SILO grid pt -27.30, 151.15
Distance:	~2.4 km

Date	Amount	Unit	
30/07/2021	-		Application A
4/08/2021	1.3	mm	
5/08/2021	0.9	mm	
24/08/2021	7.2	mm	
31/8/2021	-		Application B
6/09/2021	1.2	mm	
21/09/2021	3.2	mm	
28/09/2021	0.3	mm	
29/09/2021	0.8	mm	
30/09/2021	1.2	mm	
1/10/2021	5.5	mm	
2/10/2021	0.5	mm	
12/10/2021	6.8	mm	
13/10/2021	7.9	mm	
14/10/2021	49.6	mm	
15/10/2021	1.1	mm	
17/10/2021	-		Planting
19/10/2021	6.4	mm	
21/10/2021	-		Application C, 1 st Assessment
26/10/2021	2.7	mm	
27/10/2021	0.6	mm	
29/10/2021	2.1	mm	
30/10/2021	3.5	mm	
5/11/2021	-		Application D, 2 nd Assessment
8/11/2021	30.8	mm	
9/11/2021	6.4	mm	
11/11/2021	3.8	mm	
12/11/2021	46.4	mm	
21/11/2021	0.8	mm	
22/11/2021	34.4	mm	
23/11/2021	5.6	mm	
24/11/2021	1.5	mm	
26/11/2021	5.4	mm	
27/11/2021	12.2	mm	
28/11/2021	13.5	mm	
29/11/2021	1.7	mm	
30/11/2021	47.1	mm	
1/12/2021	69.9	mm	
2/12/2021	7.6	mm	
5/12/2021	1.6	mm	
9/12/2021	1.7	mm	
10/12/2021	0.3	mm	
14/12/2021	-		3 rd Assessment

Monthly Rainfall:

Month	Rainfall (mm)
August 2021	9
September	7
October	87
November	210
December	81