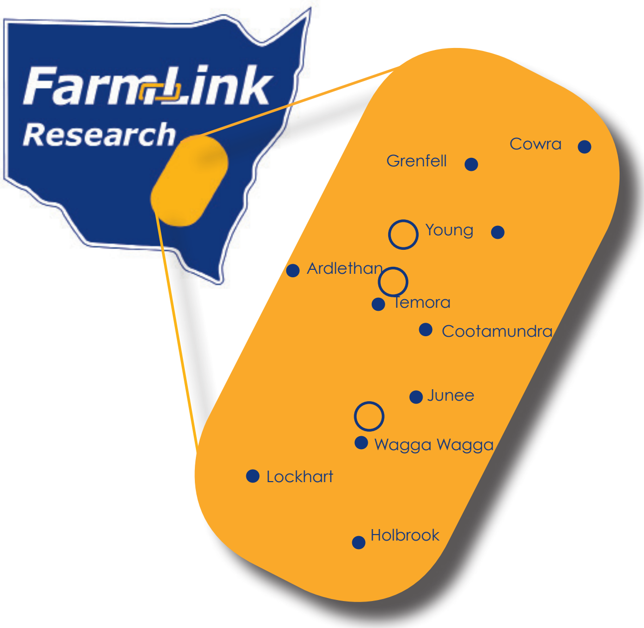
FarmLink
Research Report 2013

03

Improving IWM practice in the Southern Region: Emerging weeds issues

2013 Trial Sites



Project Partners

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Improving IWM practice in the Southern Region: Emerging weeds issues

Introduction

Changes in farming systems, farm practices and climate result in a changing weed spectrum. Weed species that were not of concern can become problematic to manage. The widespread adoption of no-till agriculture has decreased dependence on soil disturbance and let to an increase in weed species suited to low disturbance systems.

This project will address emerging weed issues in the Southern Region, identifying why these issues are arising through targeted biological and ecological studies on emerging weed species and providing practical recommendations where possible. This project will also develop a standard protocol for determining soil disturbance by disc seeders for use by industry. The benefits of this work will primarity be delivered in the Southern Region.

Measurement - Biological Data

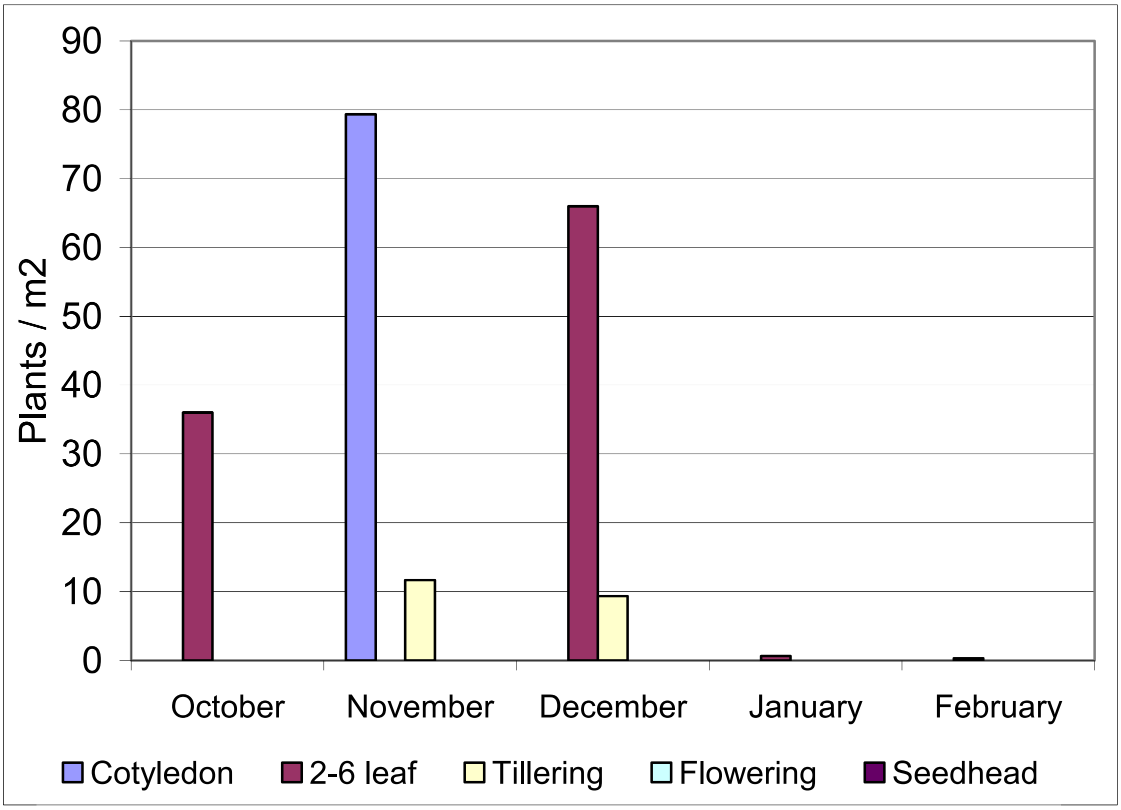
In order to monitor the real-time fleabane emergence in the field, permanent quadrats (1 x 1 m2) were randomly placed in fields with a known history of fleabane, witchgrass or windmill grass last summer (2011-2012). Quadrats were established in Wagga Wagga, Temora and Condobolin for fleabane, Wagga Wagga for witchgrass and Condobolin for windmill grass.

Seedlings in three quadrants of each permanent quadrat were counted and removed by spraying with glyphosate on fortnightly or monthly intervals, dependent upon rainfall events. Plant numbers were determined for five growth stage categories to allow growth stage and development to be assessed over time. Monitoring will continue for a minimum of twelve months.

Preliminary data indicate that witchgrass at Site 1 mainly germinated October-December, with these plants capable of producing tillers within a month. A few continued to emerge in January and February. Where plants were not removed, flowering was noted in December, and mature seed heads were present by January. At Site 2, a large germination flush occurred in November following a rainfall event. The majority of these plants failed to survive, and those that did remain did not continue to develop. Some germination was noted in December, however no plants were alive in February.

Flaxleaf fleabane was present in October when quadrats were established at Wagga Wagga. Where plants were treated with glyphosate, a small amount of monthly regrowth was noted, possibly from existing root stock. Where plants were not removed, flowering and seedhead production occurred late January/ early February. Similarly, flaxleaf fleabane was present when quadrats were established in November at Condobolin. However, dry summer conditions resulted in the number of live plants decrease over time, with little phenological development. No new plants were noted.

Quadrats were also established at Condobolin to monitor windmill grass. Unfortunately, no windmill grass emerged on the sites selected. Quadrats have been relocated in February 2013 to areas where existing windmill grass butts are present, and monitoring will commence at these new sites and continue for at least twelve months.



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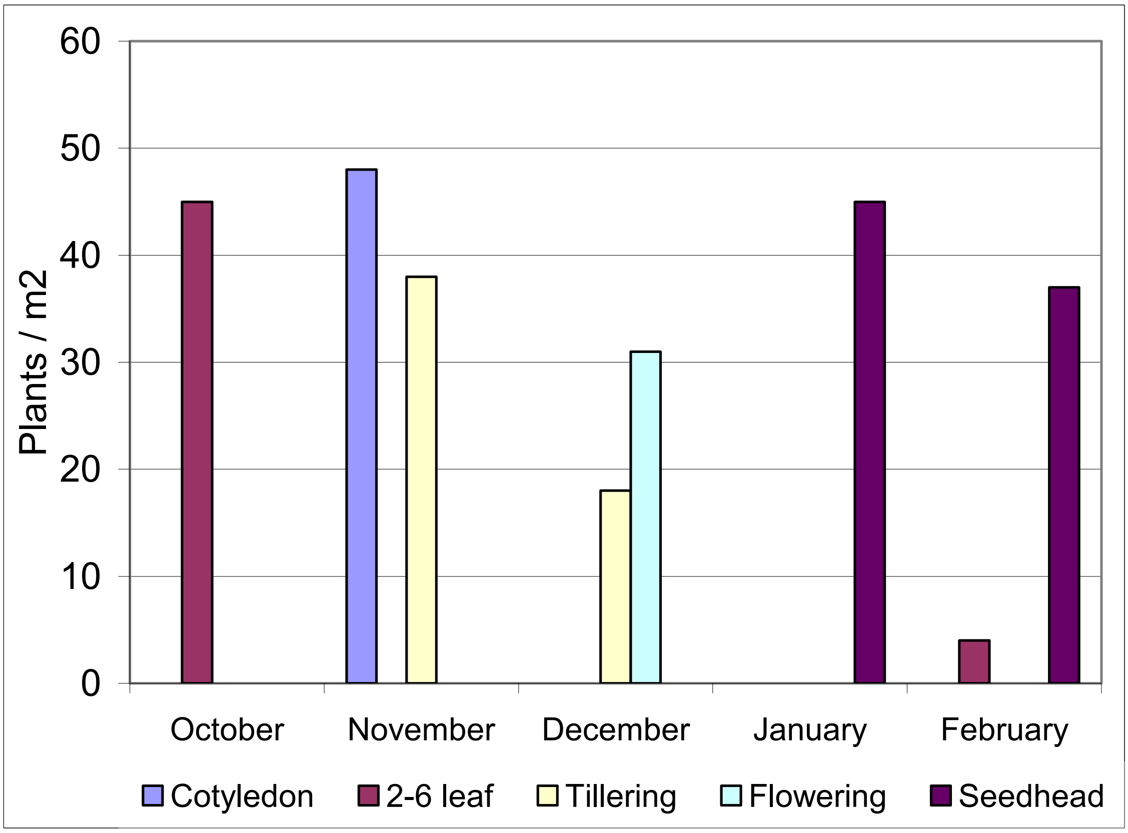
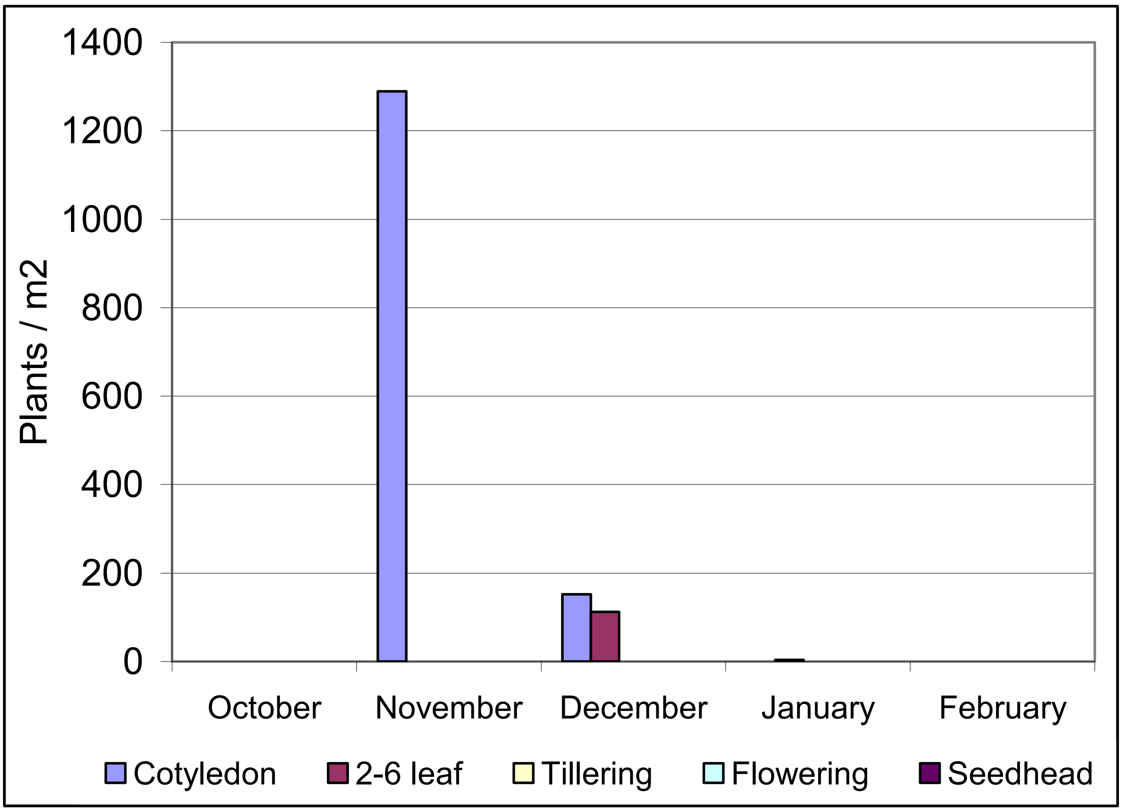


(b)

Figure 1. Witchgrass emergence and phenology over time at EH Graham Centre site 1; (a) plants counted and removed, (b) plants not removed.



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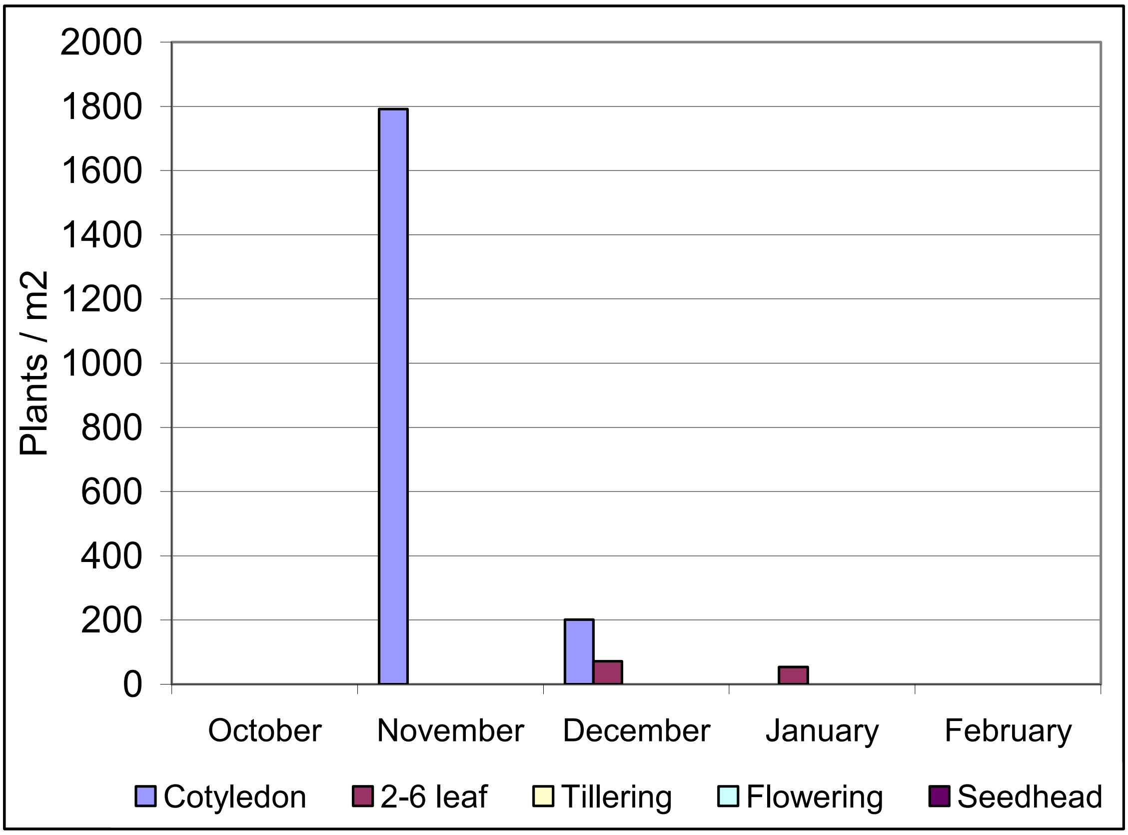

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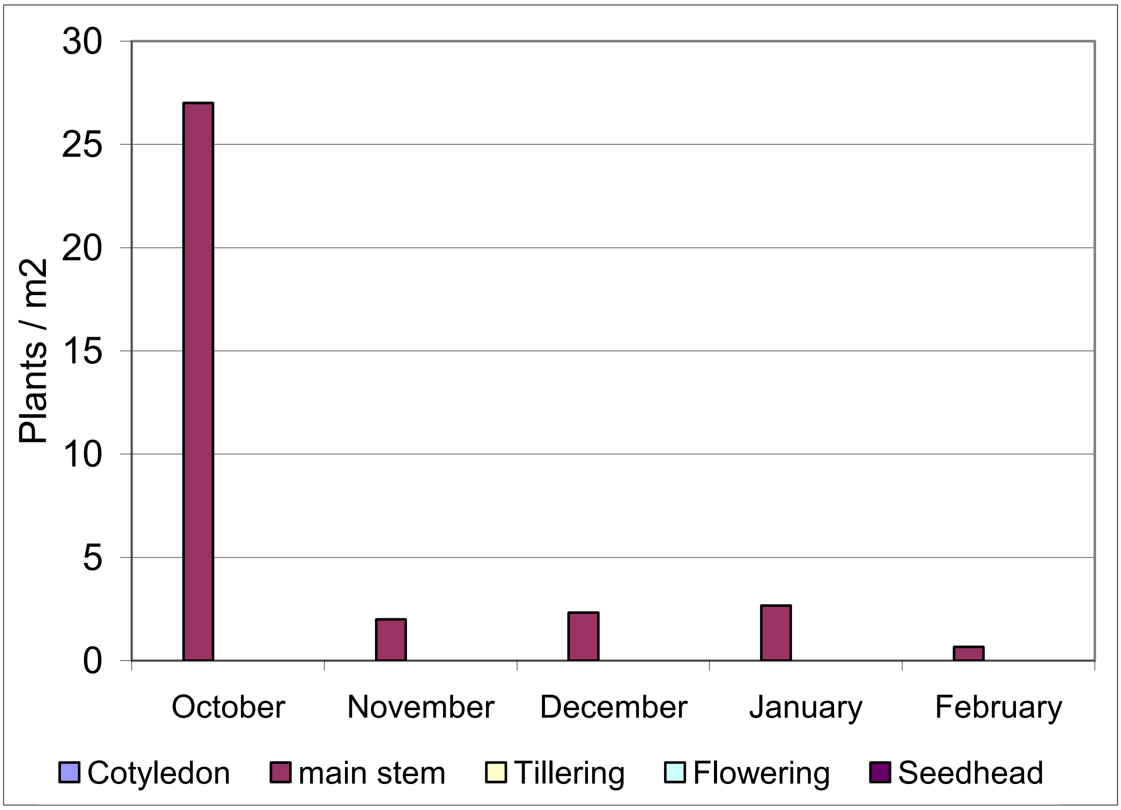
Figure 2. Witchgrass emergence and phenology over time at EH Graham Centre site 2; (a) plants counted and removed, (b) plants not removed.



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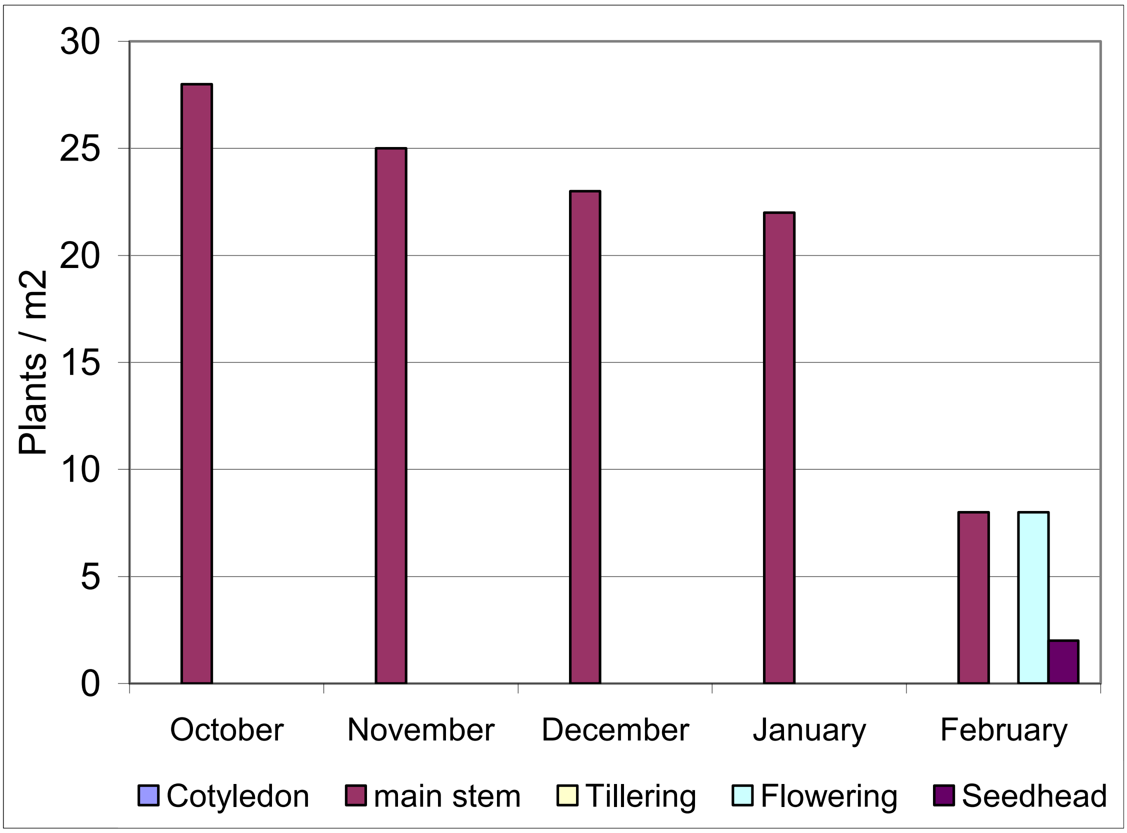
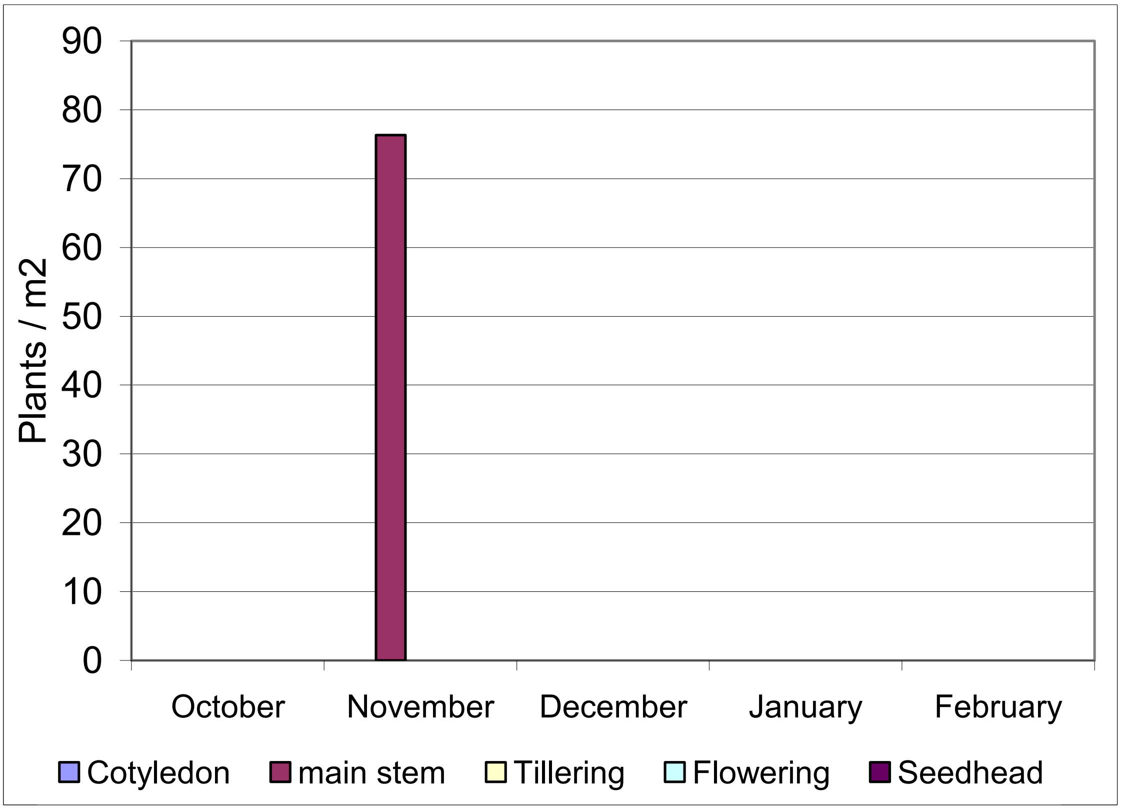


(b)

Figure 3. Flaxleaf fleabane emergence and phenology over time at EH Graham Centre site 2; (a) plants counted and removed, (b) plants not removed.



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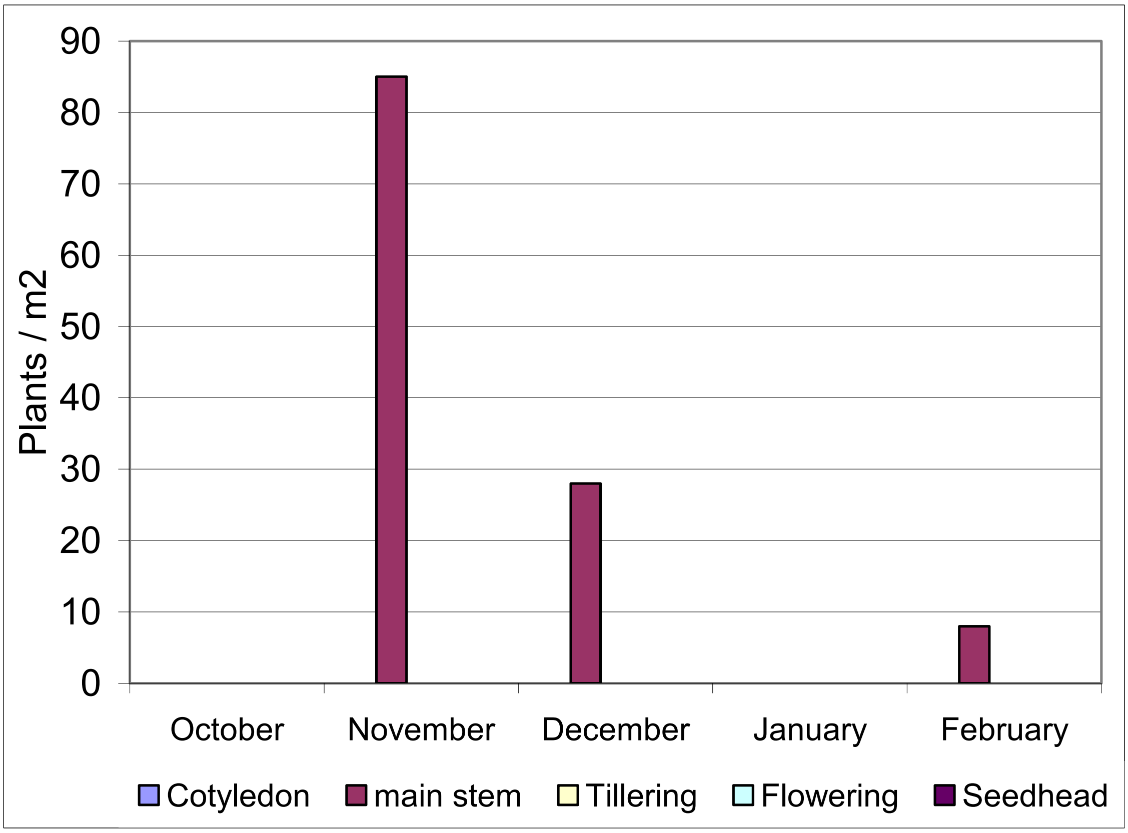

(b)

Figure 4. Flaxleaf fleabane emergence and phenology over time at Condobolin; (a) plants counted and removed, (b) plants not removed.

2 - Management Strategies

As it is often difficult to control mature fleabane plants after harvest, it is critical to manage fleabane seedlings in winter crops. Autumn germinations of fleabane provides opportunity for seedlings to develop extensive root systems over winter, creating plants that will be more difficult to control in late spring or early summer.

Question: Are there any suitable post emergent herbicides to control fleabane in wheat or canola, with sufficient residual activity to suppress emergence and growth in summer?

Herbicides in wheat

A series of trials were established at Wagga Wagga, Temora and Condobolin to investigate the impact of herbicide choice and application timing on fleabane control.

All sites were bulk sown to wheat in May or June. Details on wheat variety and pre-emergent herbicide for general winter weed control are provided below.

Table 1. Site details.

Site	Wheat Variety	Pre-emergent herbicide
Wagga Wagga	EGA Gregory	Boxer Gold
Temora	Wheat	Trifluralin
Condobolin	Livingston	Trifluralin

Plots were established in a randomised complete block design with three replicates, with plot size 2 x 10 m.

Herbicides were applied using a 2 m hand operated boom fitted with Teejet 11002 nozzles, delivering 100L/Ha spray volume at 2 Bar pressure. Early post emergent herbicides were applied 24th-31st July. Late post emergent herbicides were applied 28th August – 3rd September.

The number of fleabane plants was recorded in a 0.5 x 10 m strip in the centre of each plot from November 2012 through to January 2013.

Early post-emergent herbicide treatments.

1. Lontrel (300) 300mL
2. Lontrel + MCPA LVE (200mL + 625mL)
3. Metsulfuron 7g
4. MCPA LVE + Metsulfuron (625mL + 5g)
5. Glean 20g
6. Glean 15g + Lontrel 200 ml
7. Glean 20g + Starane Advance 250ml + MCPA LVE 250 ml
8. Terbutryne (Igran 850ml)+ Lontrel 200 ml
9. Bromoxynil 1.4L + Lontrel 200 ml
10. Control

Assessment of plots in Condobolin found no fleabane plants present during summer. For trials in both Wagga Wagga and Temora, no significant control of fleabane was observed with the use of 20g Glean alone or 7g metsulfuron alone. Variable results were observed between sites for treatments 6 (glean+lontrel), 7 (Glean+starane+MCPA) and 8 (terbutryne + Lontrel). All other treatments provided significant control compared to the untreated control.

Table 2. Fleabane density in January following early post-emergent winter wheat herbicide applications.				
Treatment	Wagga Wagga		Temora	
	Plants/m^2	s.e	Plants/m^2	s.e
1	0.0	0.0	0.2	0.1
2	0.0	0.0	0.0	0.0
3	1.0	0.4	0.6	0.2
4	0.3	0.1	0.2	0.2
5	1.0	0.5	1.6	1.1
6	0.0	0.0	0.6	0.4
7	0.1	0.1	0.7	0.5
8	2.1	0.9	0.0	0.0
9	0.0	0.0	0.0	0.0
10	1.6	0.6	3.0	1.3

Late post-emergent herbicide treatments

1. Starane (200) 600mL
2. Amicide Advance 700 1-1.5L
3. MCPA LVE 750ml 1L
4. Tordon 75-D 300mL
5. Tordon 242 1L
6. Lontrel Advance + MCPA LVE (100mL + 625mL)
7. Amicide Advance 700 + Metsulfuron (800mL + 5g)
8. Amicide Advance 700 + Velocity (800mL + 600mL)
9. Amicide Advance 700 + Lontrel Advance (1L + 150mL)
10. Starane + Metsulfuron (600mL + 5g)
11. Starane + Lontrel Advance (600 mL + 150mL)
12. Untreated control

Assessment of plots in Condobolin found no fleabane plants present during summer. For trials in both Wagga Wagga and Temora, the use of starane + metsulfuron provided the least level of fleabane control.

Table 3. Fleabane density in January following early post-emergent winter wheat herbicide applications.				
Treatment	Wagga Wagga		Temora	
	Plants/m^2	s.e	Plants/m^2	s.e
1	0.0	0.0	0.4	0.4
2	0.0	0.0	0.0	0.0
3	0.3	0.1	0.1	0.1
4	0.0	0.0	0.1	0.1
5	1.4	0.8	0.0	0.0
6	0.0	0.0	1.0	1.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	1.1	0.7
9	0.0	0.0	0.0	0.0
10	2.5	1.0	3.0	1.6
11	0.0	0.0	1.1	1.0
12	1.4	0.5	0.0	0.0

Herbicides in canola

Trials were established at Wagga Wagga to investigate the impact of herbicide choice and canola type on weed control. In both trials, herbicides were applied using a 2 m hand operated boom fitted with Teejet 11002 nozzles, delivering 100L/Ha spray volume at 2 Bar pressure.

Weeds were recorded in a 0.5 x 10 m strip in the centre of each plot from November 2012 through to January 2013.

In the first trial, Hyola 555TT was sown at 5kg/Ha on 29th May 2012. Plots were established in a randomised complete block design with three replicates, with plot size 3.6 x 10 m. Pre-emergent herbicides were applied in the morning immediately prior to sowing, and post-emergent herbicides were applied 29th August 2012.

Table 4. Fleabane density in January following early post-emergent winter wheat herbicide applications.		
Treatment	**Pre-emergent herbicide**	**Post-emergent herbicides**
1	atrazine 1.1kg	-
2	atrazine 2.2kg	-
3	Terbyne 0.7kg	-
4	Terbyne 1.4kg	-
5	-	Atrazine: 1.1 kg
6	-	Terbyne: 0.7 kg
7	-	Terbyne: 1.4 kg
8	-	Lontrel 120 ml
9	-	Lontrel 120 ml + Terbyne 0.7kg
10	-	Lontrel 120 ml + Terbyne 1.4kg
11	-	Lontrel 120 ml + Atrazine 1.1kg
12	atrazine 1.1kg	Terbyne: 0.7 kg
13	atrazine 1.1kg	Terbyne: 1.4 kg
14	Terbyne 0.7kg	Atrazine: 1.1 kg
15	Atrazine 2.2kg	Lontrel 120 ml
16	Atrazine 2.2kg	Lontrel 120 ml + Atrazine 1.1kg
17	Atrazine 2.2kg	Lontrel 120 ml + Terbyne 0.7kg
18	Untreated control	-

In this experiment, Terbyne was ineffective for fleabane control as a post-emergent herbicide alone. When only a pre-emergent herbicide was used, atrazine was more effective than terbyne for fleabane control. All treatments where both pre-emergent and a post-emergent herbicides were used provided good fleabane control. Improved fleabane control appears to have allowed better establishment of witchgrass.

Table 5. Summer weed density in January following winter herbicide applications in canola.

Treatment	Fleabane		Witchgrass	
	Plants/m^2	s.e	Plants/m^2	s.e
1	0.5	0.3	5.1	3.5
2	0.1	0.1	23.6	7.9
3	4.1	2.5	0.7	0.7
4	2.6	1.3	12.5	6.4
5	1.5	1.5	9.5	2.6
6	16.0	11.5	0.0	0.0
7	10.4	6.8	10.1	6.2
8	0.1	0.1	1.3	0.9
9	0.1	0.1	2.6	1.9
10	0.1	0.1	2.7	2.1
11	0.7	0.7	4.0	1.8
12	1.0	0.3	32.9	8.2
13	0.0	0.0	25.7	11.0
14	0.0	0.0	4.4	1.7
15	0.0	0.0	20.0	2.3
16	0.0	0.0	22.8	5.7
17	0.0	0.0	65.9	11.3
18	16.0	11.5	0.2	0.2

In the second trial, three canola systems were compared. Plots were established in a randomised complete block design with three replicates, with plot size 1.8 x 10 m. Pre-emergent herbicides were applied in the morning immediately prior to sowing, and post-emergent herbicides were applied 29th August 2012. For each treatment, an additional plot was established that was not treated with herbicide as a control.

Table 6. Canola cultivar herbicide treatments.

Treatment	Cultivar	Pre-emergent herbicide	Post-emergent herbicide
1	44Y84 CL	Treflan 2L	Intervix 750 mL
2	Hyola 555TT	Atrazine 4L	Lontrel 300mL
3	Hyola 50	Treflan 2L	Lontrel 300mL
4	AV Garnet	Treflan 2L	Lontrel 300mL
5	cb Jardee TT	Atrazine 4L	Lontrel 300mL
6	ATR Gem TT	Atrazine 4L	Lontrel 300mL

In this experiment, the use of intervix in the Clearfield canola system failed to provide fleabane control compared to the use of lontrel in either the conventional or triazine tolerant systems. The use of trifluralin in either the Clearfield or conventional canola systems provided better suppression of witchgrass emergence than use of atrazine in the triazine tolerant system.

Table 7. Summer weed density in January following canola systems.

Treatment	Untreated Control		With Herbicide	
	Plants/m²	s.e	Plants/m²	s.e
Fleabane				
1	3.1	0.4	4.9	0.1
2	0.7	0.2	0.0	0.0
3	2.9	0.7	0.0	0.0
4	1.8	0.1	0.0	0.0
5	5.3	0.4	0.0	0.0
6	0.8	0.1	0.0	0.0
Witchgrass				
1	0.1	0.0	0.1	0.0
2	0.9	0.2	14.6	0.4
3	0.0	0.0	2.8	0.3
4	0.1	0.0	1.6	0.2
5	0.4	0.1	19.3	2.0
6	0.5	0.1	18.2	0.8

Herbicides in summer

Question: Are there any suitable herbicides to control fleabane, hairy panic or windmill grass in a summer fallow situation that will ultimately reduce the reliance upon glyphosate or paraquat?

Trials were established at Wagga Wagga (fleabane and witchgrass), Condobolin (fleabane) and Ariah Park (windmill grass) to investigate herbicide options for summer control of the three model weeds. Average fleabane density was 3 plants/m2 (Condobolin) to 7 plants/m2 (Wagga Wagga), witchgrass density was 28 plants/m2 and windmill grass density was 22 plants/m2.

In the first trial, plots were established at Wagga Wagga and Condobolin in fallow situations where stands of fleabane were present in a randomised complete block design with three replicates, with plot size 2 x 10 m.

Herbicides were applied using a 2 m hand operated boom fitted with Teejet 11002 nozzles, delivering 100L/Ha spray volume at 2 Bar pressure. Herbicides were applied 30th January (Wagga Wagga) and 6th February (Condobolin) after rain. Double knock herbicide treatments were applied 4th February (Wagga Wagga) and 12th February (Condobolin).

The number of fleabane plants was recorded in a 1 x 10 m strip in the centre of each plot prior to herbicide application. Herbicide efficacy will be monitored post herbicide application.

Table 8. Fleabane summer herbicide treatments.

Treatment	Pre-emergent herbicide	Post-emergent herbicides	% control (Wagga Wagga site)
1	Glyphosate (2L)+ 2,4-D + Hasten 1%		56%
2	Glyphosate + 2,4-D + Hasten 1%	Paraquat (2L)	99%
3	Glyphosate + 2,4-D + Hasten 1%	Sharpen (34g/ha) (700g/kg Saflufenacil) + 1% Bonza oil	97%
4	Glyphosate + 2,4-D + Hasten 1%	Glufosinate (Basta 4-5L/ha)	91%
5	Glufosinate + 2,4-D		55%
6	Glufosinate + 2,4-D	Glyphosate (2L)	76%
7	Glufosinate + 2,4-D	Paraquat (2L)	98%
8	Glufosinate + 2,4-D	Sharpen	92%
9	Sharpen + 2,4-D		8%
10	Sharpen + 2,4-D	Glyphosate (2L)	28%
11	Sharpen + 2,4-D	Glufosinate	78%
12	Sharpen + 2,4-D	Paraquat (2L)	89%
13	Glufosinate + Simazine 4L	Sharpen	60%
14	Glufosinate + Simazine 4L	Paraquat 2L	66%
15	Glyphosate + Simazine 4L	Sharpen	51%
16	Sharpen + Simazine 4L	Paraquat 2L	59%
17	Glufosinate + Sharpen		46%
18	Glyphosate + Glufosinate		43%
19	Glyphosate + Sharpen + Hasten 1%		62%
20	Untreated control		-4%

Treatments at Condobolin are yet to be assessed. For treatments imposed at Wagga Wagga, preliminary data indicates that using a paraquat or Sharpen as a double knock five days after an initial application of either glyphosate or glufosinate provided the best level of control. Use of simazine as a mix partner in the initial herbicide application, or use of only a single herbicide application provided unsatisfactory levels of control. A single herbicide application of Sharpen + 2,4-D provided the least control.

In the second trial, plots were established at Wagga Wagga in a stubble situation where witchgrass was present in a randomised complete block design with three replicates, with plot size 2 x 10 m.

Herbicides were applied using a 2 m hand operated boom fitted with Teejet 11002 nozzles, delivering 100L/Ha spray volume at 2 Bar pressure. Herbicides were applied 30th January.

Plant numbers were recorded in a 1 x 1 m quadrat randomly placed twice in each plot. Herbicide efficacy will be monitored 21 days post herbicide application.

Table 9. Witchgrass herbicide treatments.

Treatment	Herbicide 1	Herbicide 2
1	Untreated control	-
2	Glyphosate 1L	-
3	Glyphosate 2L	-
4	Verdict 0.4L	-
5	Select 0.4L	-
6	Dual Gold 1.2L	-
7	Atrazine 2L	-
8	Glyphosate 1L	Oxyflurofen 80 mL
9	Glyphosate 1L	Ally 20g
10	Glyphosate 1L	Atrazine 2L

Preliminary results indicate that glyphosate at either rate provided good control. Addition of other herbicides with glyphosate did not improve control, therefore would not be recommended unless there is a need to target other weed species. Select, Dual Gold and Atrazine did not provide satisfactory control, possibly due to dry summer conditions and lack of rainfall for incorporation.

Dual Gold and Atrazine appears to have failed to provide any control of flowering or seed set. The two grass selective herbicides, Select and Verdict, reduced the number of plants able to produce flowers.

Table 10. Witchgrass control and flowering following herbicide treatment.			
Treatment	**Herbicide 1**	**Live plants 21DAT**	**Flowering plants 21DAT**
1	Untreated control	28	14
2	Glyphosate 1L	4	1
3	Glyphosate 2L	1	0
4	Verdict 0.4L	13	2
5	Select 0.4L	30	4
6	Dual Gold 1.2L	29	11
7	Atrazine 2L	40	16
8	Glyphosate 1L + Oxyflurofen	13	3
9	Glyphosate 1L + Ally	6	1
10	Glyphosate 1L + Atrazine	5	1

In the third trial, plots were established at Ariah Park in a degraded pasture situation with windmill grass was present in a randomised complete block design with three replicates, with plot size 2 x 10 m. Treatments were identical to those outlined for witchgrass management.

Hot, dry conditions have prevented herbicide application to date. At the last site inspection, very few windmill grass plants showed signs of green.

Stubble management

Certain crop species and cultivars can suppress weeds effectively at standard establishment rates, either due to their ability to compete effectively with weeds for valuable resources, or due to potential allelopathic effects associated with the crop or remaining residues following harvest.

Rotational crops noted for their weed suppressive effects will be evaluated together with key cultural practices, including herbicide application, stubble burning, and tillage for their impacts upon subsequent weed growth and weed seed viability on the soil surface or in upper layer of soil under cultivation.

Treatments include various crops and cultivars established in replicated plots. Crop and weed biomass per plot will be assessed by visual ratings, stand counts and biomass collection. Weeds evaluated will include annual ryegrass, fleabane, witchgrass, windmill grass, heliotrope and other weeds of significance.

Cultivar Trial

Trials were established at Wagga Wagga and Condobolin to investigate the impact of crop stubble type on summer weed emergence.

Plots were established in a randomised complete block design with four replicates, with plot size 2 x 16 m in Wagga Wagga 4 x 12 m in Condobolin. Plots were sown 31st May (Wagga Wagga) and 13th June (Condobolin). Post-emergent herbicides were applied 3rd August in Wagga Wagga for winter weed control. Winter weed control was not required in Condobolin.

Table 11. Wagga Wagga cultivar treatments.			
Treatment	**Crop**	**Variety**	**Sowing Rate (kg/Ha)**
1	grazing wheat	Wedgetail	60
2	wheat	EGA Gregory	60
3	grazing oats	Graza	60
4	oats	Mitika	60
5	grazing barley	Urambie	60
6	barley	Buloke	60
7	triticale	Tobruk	80
8	cereal rye	Ryecorn	60
9	grazing canola	cb Taurus	6.5
10	canola	Hyola 50	3.4

Due to the late sowing date, the two canola cultivars were not sown in Condobolin. Instead, treatments 9 and 10 were replaced with a lucerne/clover mix and black barley, respectively.

Plots were harvested between 19th November and 12th December. Weed numbers were recorded in a 0.5 x 10 m strip in the centre of each plot from November 2012 through to January 2013.

More fleabane emerged in canola plots than in any cereal plots in Wagga Wagga. There were no discernable differences between grain only and grazing cultivars of the three cereals examined in terms of control of either fleabane or witchgrass.

Fleabane was the only weed on interest to emerge in the plots in Condobolin, however fleabane numbers were quite low compared to the fallow buffer areas adjacent to the trial plots. Given that no pre-emergent herbicide was used prior to sowing, this suggests that either the soil disturbance at sowing or the presence of the living crop during winter/spring has suppressed the emergence of fleabane. Notably, fleabane was more common in the 70cm wide space between adjacent plots than within the plots, which were sown on 30cm row spacing.

Table 12. Weed density in January following different crops in Wagga Wagga.

Treatment	Variety	Crop Yield t/ha	Witchgrass		Fleabane	
			Plants/m²	s.e	Plants/m²	s.e
1	Wedgetail	2.19	50.7	16.8	0.0	0.0
2	EGA Gregory	2.42	28.2	7.8	0.0	0.0
3	Graza	1.67	36.9	13.3	0.1	0.1
4	Mitika	2.95	50.9	11.2	0.0	0.0
5	Urambie	3.27	33.7	12.4	1.3	1.3
6	Buloke	3.30	26.4	9.1	0.0	0.0
7	Tobruk	2.13	60.5	10.0	0.0	0.0
8	Grazer	1.78	41.5	11.5	0.1	0.1
9	cb Taurus	-	33.8	9.8	12.4	5.5
10	Hyola 50	-	42.8	19.8	9.1	3.2

Table 13. Weed density in January following different crops in Condobolin.					
Treatment	Crop	Variety	Crop Yield t/ha	Fleabane	
				Plants/m²	s.e
1	grazing wheat	Wedgetail	0.93	0.1	0.0
2	wheat	EGA Gregory	1.08	0.1	0.0
3	grazing oats	Graza	0.63	0.0	0.1
4	oats	Mitika	1.10	0.2	0.0
5	grazing barley	Urambie	1.42	0.1	1.3
6	barley	Buloke	1.53	0.1	0.0
7	triticale	Tobruk	1.01	0.0	0.0
8	cereal rye	Grazer	1.13	0.0	0.1
9	pasture	-	-	0.7	5.5
10	black barley	-	0.80	0.1	3.2

Cultural Trial

Trials were established at Wagga Wagga and Condobolin to investigate the impact of crop stubble management techniques on summer weed emergence.

Plots were established in a randomised complete block design with four replicates, with plot size of 4 x 12 m. Plots were sown with EGA Gregory wheat at two rates on 31st May (Wagga Wagga) and 13th June (Condobolin). No herbicides were applied. Short stubble treatments were imposed at sowing to imitate the result of using technology such as a Harrington Seed Destructor. Rolled stubble treatments were imposed within a week of harvest. Tilled stubble and burnt stubble treatments will be imposed later in the season.

Table 14. Wagga Wagga cultural treatments.			
Treatment	Treatment	Sowing Rate (kg/ha)	
		Wagga Wagga	Condobolin
1	Stubble retained	40	30
2	Stubble retained	60	45
3	Stubble burnt	40	30
4	Stubble burnt	60	45
5	Stubble tilled	40	30
6	Stubble tilled	60	45
7	Stubble rolled	40	30
8	Stubble rolled	60	45
9	Stubble short	40	30
10	Stubble short	60	45

Plots were harvested between 19th November and 12th December. Weed numbers were recorded in a 0.5 x 10 m strip in the centre of each plot from November 2012 through to January 2013.

Wheat yield in Wagga Wagga across all plots prior to any treatments being imposed was 0.94 t/ha (s.e. 0.03) for the lower sowing rate and 1.11 t/ha (s.e. 0.03) for the higher sowing rate. Insufficient fleabane was present to allow analysis. However, while witchgrass density was slightly higher in the rolled treatment and the short stubble at high sowing rate, these densities were not significantly higher than for other treatments. Wheat sowing rate did not affect significantly affect witchgrass emergence. The first three treatments are yet to be imposed.

Table 15. Influence of stubble management tactic on witchgrass emergence in Wagga Wagga.

Treatment	Wheat sowing rate 40 kg/ha		Wheat sowing rate 60 kg/ha	
	Plants/m^2	s.e	Plants/m^2	s.e
Stubble retained	7	3.2	17	5.5
Stubble burnt	24	10.0	22	0.9
Stubble tilled	18	4.6	28	5.2
Stubble rolled	33	13.4	40	3.7
Stubble short	28	7.6	33	13.6

Wheat yield in Condobolin across all plots prior to any treatments being imposed was 2.35 t/ha (s.e. 0.18) for the lower sowing rate and 2.60 t/ha (s.e. 0.12) for the higher sowing rate. Fleabane emergence has been lower than anticipated across all plots, particularly compared to emergencein the buffer areas surrounding the trial. While fleabane was less prevalent in the rolled or short stubble treatments, the effect was not statistically significant. The first three treatments are yet to be imposed.

Table 16.Influence of stubble management tactic on fleabane emergence in Condobolin..

Treatment	Wheat sowing rate 40 kg/ha		Wheat sowing rate 60 kg/ha	
	Plants/m^2	s.e	Plants/m^2	s.e
Stubble retained	0.44	0.17	0.06	0.03
Stubble burnt	0.11	0.06	0.10	0.10
Stubble tilled	0.45	0.26	0.37	0.27
Stubble rolled	0.00	0.00	0.03	0.03
Stubble short	0.03	0.03	0.23	0.23

Row spacing

Crop competition is still a proven non-chemical option for weed management and reducing the reliance upon herbicides for weed control. The establishment of poorly competitive weeds can be influenced by crop management practices. Certain crops inherently possess the ability to suppress weeds at standard establishment rates, either due to inherent ability to outcompete the weeds for valuable resources or from potential allelopathic effects associated with remaining crop residues, including root and shoot residues. Crop row spacing can also impact crop establishment, stubble density and potential for subsequent weed infestation. This study will evaluate the impact of row spacing upon stubble load and future weed infestation, up to 12 months following crop establishment.

All treatments were sown with 55kg/ha wheat (EGA Gregory), providing similar plant densities per square metre irrespective of row spacing. Plots were sown on 8" and 16" row spacings. Plots of 4 x 100m were established at Wagga Wagga in three replicates for demonstration purposes.

Crop establishment and tiller counts were taken during the season. Plots were harvested 12th December. Weed presence was counted in eight 0.4 m2 quadrats per plot.

Whilst crop emergence and tiller counts were not statistically different between treatments, the yield from the wide row spacing was significantly lower (P<0.05) than the yield from the narrow row spacing. No fleabane emerged in the plots, however significantly more (P<0.05) witchgrass had emerged in the wide row spacing treatment by mid January.

Table 17. Wagga Wagga cultural treatments.

Character	Units	Row Spacing			
		Narrow (20cm)		Wide (40 cm)	
		Plants/m²	s.e	Plants/m²	s.e
Wheat emergence	Plants/m²	118	11	107	3
Tillers	tillers/m²	390	10	331	22
Yield	t/ha	2.87	0.11	2.40	0.16
Panic	Plants/m²	14	5	36	1