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Residual herbicides applied in wheat crops to reduce the incidence of fleabane and other weeds in subsequent summer fallows.

Grain Orana Alliance

2024-07-10

Trial Code:	GGWE07723-3
GRDC Project Code:	GOA2302-001SAX
Season/Year:	Winter-Summer 2023-24
Location:	'Allwood', Peak Hill
Trial Partners:	Geoff Hutcheson
Trial Establishment Date:	26/05/2021

Keywords

GGWE077, fleabane, cat head, sowthistle, black bind weed, summer fallows, resistance, in-crop herbicides, residual activity, application timing, Tomingley

Take home messages

Targeting problem fallow weeds with in-crop residual herbicides can be unreliable, as fallow weeds don't germinate if conditions are unfavourable.

The choice of in-crop residuals should primarily target expected in-crop weeds and its fallow effectiveness should be a secondary consideration.

If 100% control of the weeds was not achieved, follow up control would still be required, reducing potential costs savings in fallow management.

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Background

At the 2022 Narromine GRDC National Grower Network (NGN) forum, growers identified summer fallow weed control as a significant and escalating input cost.

Increasing herbicide costs, herbicide resistance and the increasing prevalence of harder to kill weeds have all contributed to this. Several specific weeds in ST, FB and windmill grass have arguably had the greatest impact on these rising costs of managing summer fallows.

Fleabane (*Conzya bonariensis*) often germinates during the spring period. Often not controlled by earlier in crop applications. Following crop harvest FB is already established and coupled with increased tolerances and/or resistances to a range of typically used fallow management herbicides, reliable control is often difficult and expensive. As such contributing significantly to the costs of managing summer fallows.

Given the timing of the weeds germination and establishment it is hypothesised that being able to apply residual herbicides within the winter crop may prevent FB establishing and being present post-harvest, and if possible, indirectly reducing the higher fallow management costs associated with the weed.

This approach has been previously identified utilising Lontrel Advance (Clopyralid) and has been widely adopted by industry. However, an improved understanding of how to finesse the use of this product, including the timing of application, could be very beneficial. There is also suite of other products that could also be utilised in this approach but have not been benchmarked to inform practices but also offer some alternate herbicide mode of action choice to growers.

To test the validity of this management approach and compare products to reduce costs in managing fallows a series of herbicide trials were established under an NGN project over the period of 2023 and 2024.

Aims

- To investigate a range of residual herbicides that could be applied in wheat crops during the growing season for their impact on:
    - on FB germinations, establishment and growth in the subsequent fallow period
    - any other weeds over the summer fallow period.
- Assess if any of these residual herbicides may impacts on the establishment of the subsequent crop.

Methodology

- The trials were established as, randomised and replicated small plot trials.
- Potential herbicide treatments were applied to a commercially sown barley crop, in a paddock predicted to have a high FB seed bank.
- Barley was grown at this site, at the early application the crop was around 5-10% canopy closure (full spray and crop details are available in the Appendix), 15-20% closure at the mid timing and ~25% closure at the late timing (though was moisture stressed). It was very dry at the last application timing.
- Herbicides were applied at predetermined growth stages of the crop. This was done as:
    - some herbicides are only labelled to be applied within certain crop growth stages

- increasing crop canopies may intercept herbicide spray, preventing the product reaching the ground or resulting in uneven coverage of the ground thus potentially limiting the residual effectiveness to control emerging weeds.

- At the timing of each herbicide timing, plots receiving residual treatments at that time were also treated with non-residual knockdown herbicides to control any preexisting germinations of FB as detailed below.
- Following each assessment during the fallow period all plots were sprayed out with a non-residual knockdown so that any subsequent count was a function of any ongoing residual effectiveness of the original treatments applied.
- Specific herbicides timing and the non-residual knockdowns used are detailed below-
    - Early-timing applied 20/7/2023:
        - Crop at Z14-20 growth stage
        - MCPA amine or Amicide® Advance applied to remove plants present so residual effectiveness can be assessed.
    - Mid-timing 24/8/2023:
        - Crop at Z25-27 growth stage
        - Amicide® Advance was applied to remove plants present so residual effectiveness can be assessed.
    - Late-timing 11/9/2023:
        - Crop >Z32 stage
        - Amicide® Advance applied to remove plants present, so residual effectiveness can be assessed.

The trial site was sown to barley the following year by the grower. The trial treatments were observed for crop establishment and early growth as measured by Normalised Difference Vegetation Index (NDVI)

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Table 1 Herbicides tested and rates/ha

Product and rates (mL/ha)	Application timing	Target Zadok stage
Amicide® Advance @ 1400	Early	Z14-Z20
Aptitude® @ 200 + MCPA amine 750 @ 300	Early	Z14-Z20
Diuron WDG @ 280 + MCPA amine 750 @ 330	Early	Z14-Z20
Mateno® Complete @ 1000	Early	Z14-Z20
Rexade® @ 100 + MCPA LVE 570 @ 400	Early	Z14-Z20
Amicide® Advance @ 1400 + Grindstone® @ 32	Mid	Z25-Z27
Amicide® Advance @ 1400 + Lontrel® Advanced @ 150	Mid	Z25-Z27
Amicide® Advance @ 1400 + Lontrel® Advanced @ 75	Mid	Z25-Z27
Amicide® Advance @1400 + Picoflex® @110	Mid	Z25-Z27
Amicide® Advance @ 1400 + Trezac® @ 200	Mid	Z25-Z27
Amicide® Advance @1400	Very late	>Z32
Amicide® Advance @1400 + Lontrel® Advanced @ 150	Very late	>Z32
Lontrel® Advanced @ 150	Very late	>Z32
UTC		

Results

Weed control:

Weeds present at the first assessment at 5/12/2023 included Australian bind weed, low numbers of fleabane, and melons. Sow thistle was not observed ().

- Individual species were not assessed
- Total weed populations was ~ 1.6 weeds/m^2 in the untreated plots
- No treatment applied at any timing achieved complete control of the weeds present
- Rexade® and Lontrel® Advanced (with Amicide Advance) applied early and late timing respectively, reduced the weed population at to very low levels.
- Lontrel® Advanced at the late timing was not different to the untreated.

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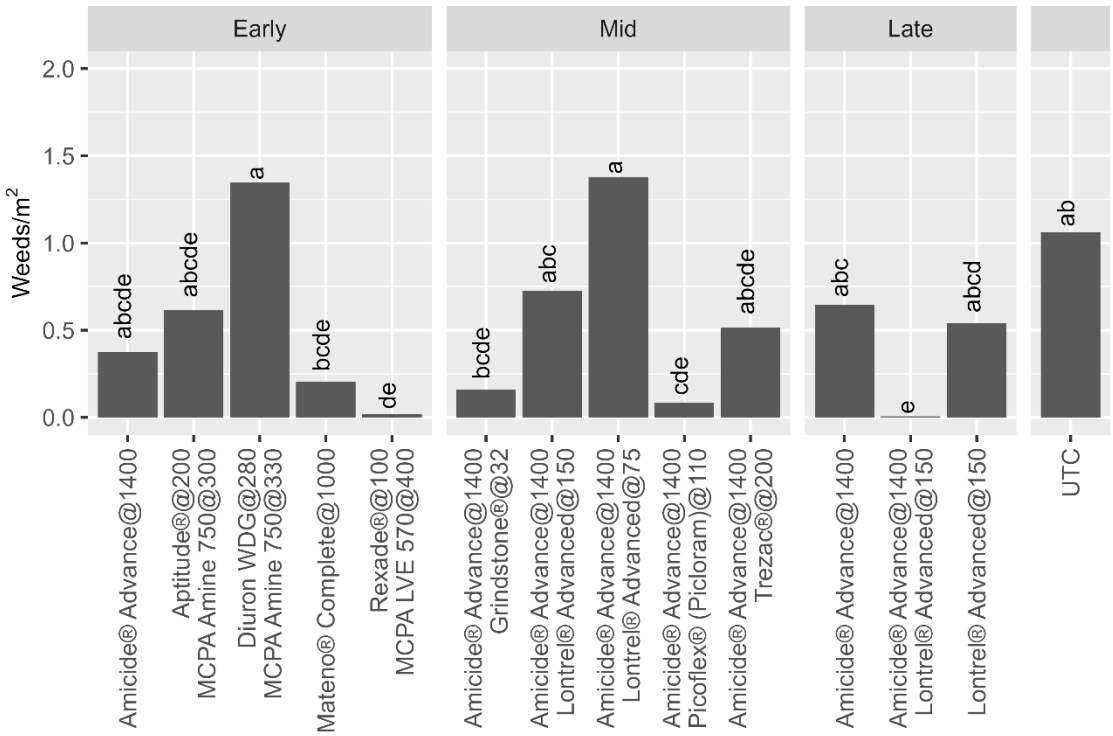

Figure 1: Number of surviving weeds assessed early in the fallow period (5/12/2023). Treatments with the same letter are not significantly different.

At the final assessment timing of 22/03/2024, untreated plots had 1.5 plants/m^{2}of Australian bind weed

- the late application of Lontrel® Advanced and Amicide® Advance reduced the population by just over 50%
- Grindstone® and Diuron mixed with a knockdown also reduced the population
- No treatment resulted in sow thistle populations lower than the UTC

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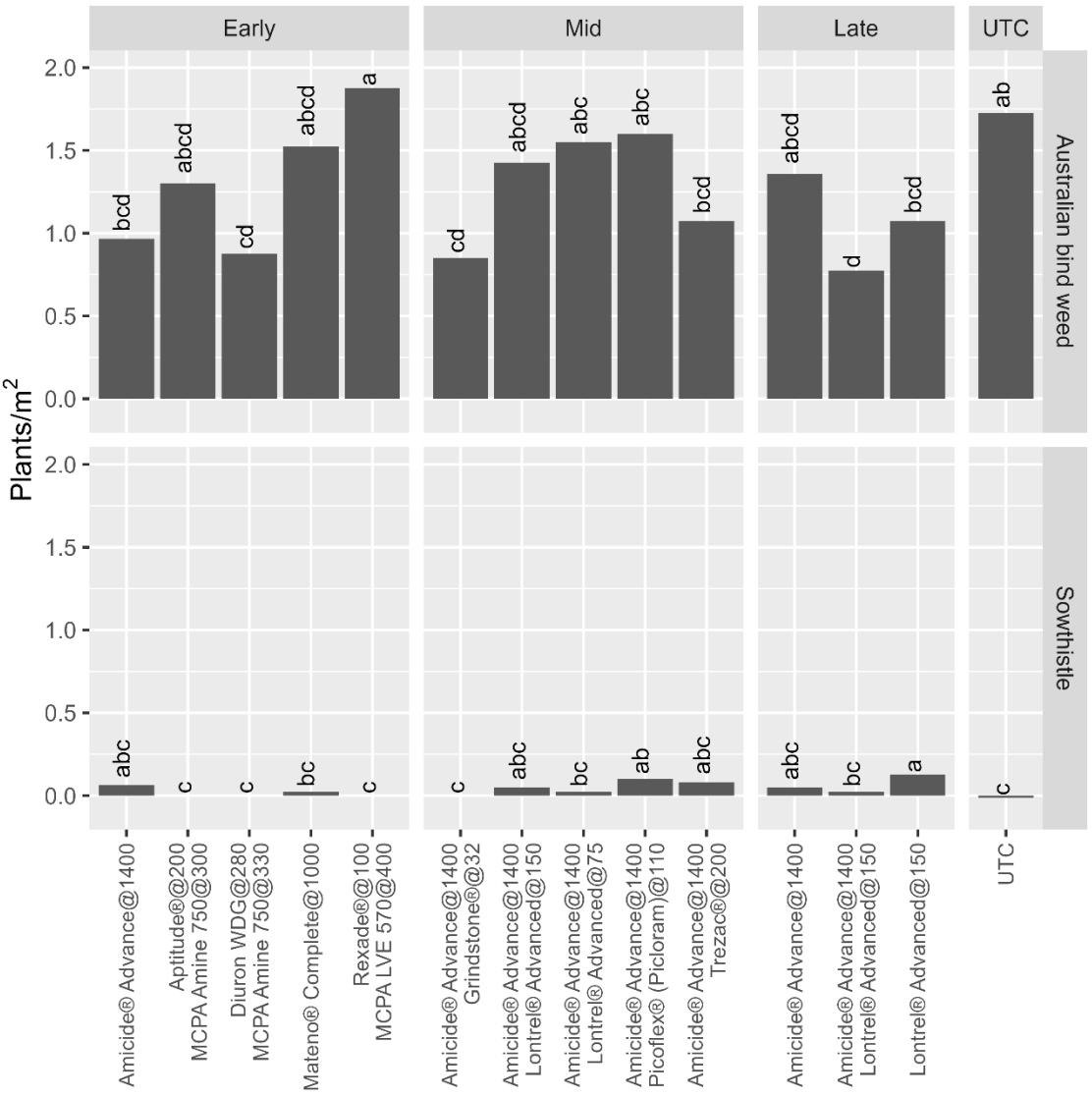

Figure 2: Number of surviving Australian bind weed and sow thistle assessed late in the fallow period (22/03/2024). Treatments with the same letter are not significantly different.

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Establishment:

- There was no treatment effect on the various herbicides on establishment or growth of the subsequent crop (figure 3)

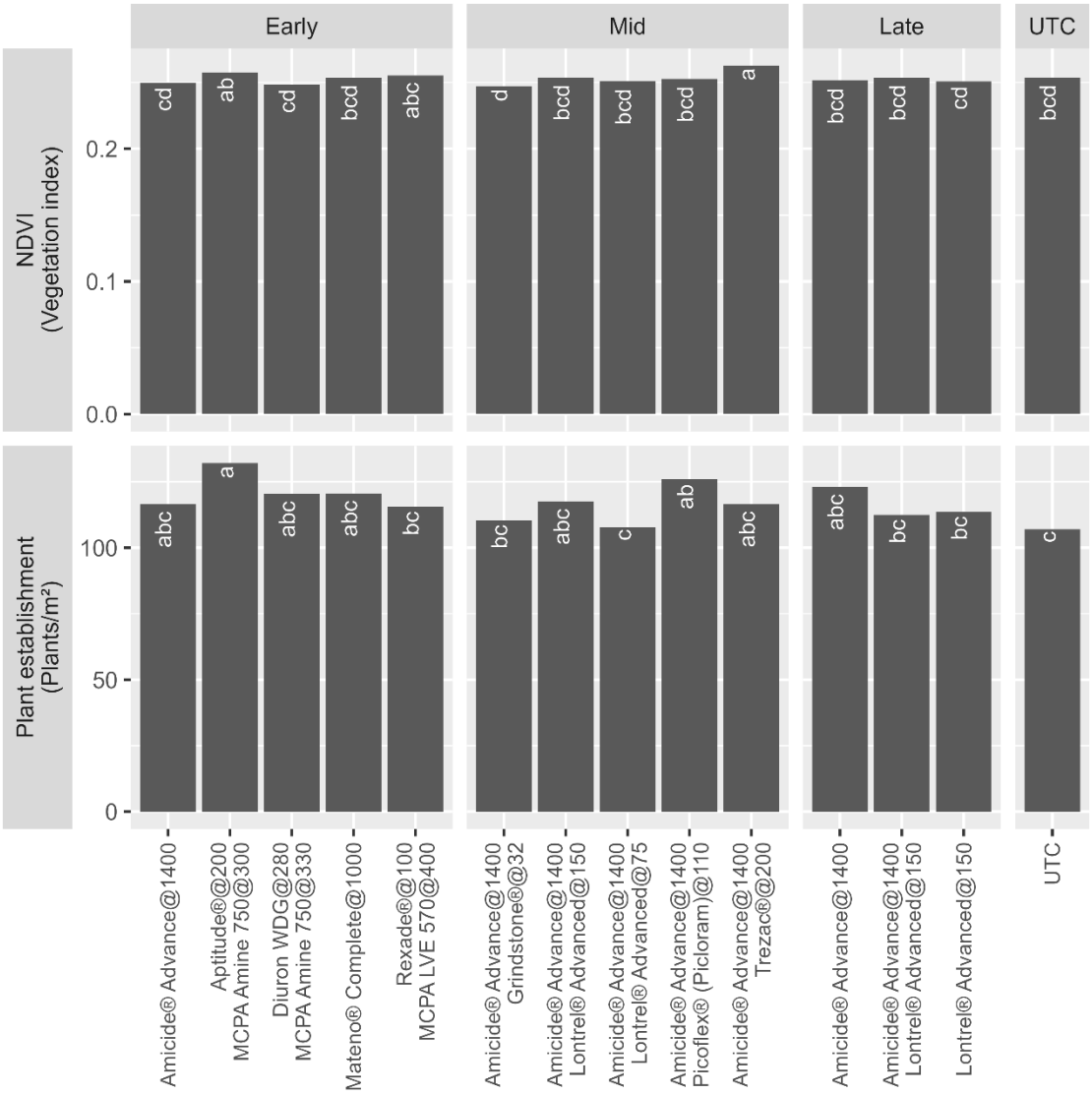

Figure 3: Number of surviving Australian bind weed and sow thistle assessed late in the fallow period (22/03/2024). Treatments with the same letter are not significantly different.

Discussion

This site was selected because of a large population of fleabane established and set seed in the previous summer (2022/23). Spring 2023 was dry and not conducive with fleabane establishment, and very few germinated and established over the summer period. This demonstrates that to justify the use of in-crop residuals they need to be targeting more than just weeds that may occur in the subsequent fallow.

There were low numbers of weeds observed in the early fallow assessment. Weeds were sporadic, particularly melons, which had patchy populations. The contrast in the effectiveness of both the late applications of Lontrel Advanced (on the early assessed population, and on the Australian bind weed population) demonstrates the site weed variability. It also demonstrates that recommendations regarding products and rates of residual herbicides cannot be derived from this data set.

No treatments had complete control of all the weeds present, as such it is questionable as to whether the use of a residual would have reduced the requirement for summer fallow weed controls. In treatments where weed numbers were lower, some savings may be on offer if the grower had access to real time weed detection systems (such as optical sprayers).

There was no residual effect on the subsequent barley crop.

Conclusions

In this trial there were several treatments that did result in lower numbers of weeds, in particular Australian bind weed. However results are not robust enough to make recommendations to products or timings of applications of in-crop residual herbicide.

Fleabane in this trial germinated in low numbers prior in the spring, with no subsequent germinations over the summer. This highlights that the use of a residual herbicide to target fleabane was not warranted. The other problem weed, sow thistle, did not start germinating till late in the fallow, when the effectiveness of the residual herbicides had worn off.

As weeds were present, such as Australian bind weed, melons, heliotrope and pigweed, that were not as well controlled, these would still need to be sprayed. This would negate any savings unless the remaining weed could have been controlled using spot spraying technologies.

There was no significant impact measured on the emergence or early growth of following barley crop.

Acknowledgements

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Appendix

Results

Timing	Product (rate)	(plants/m2) Weeds 5/12/2023		Sow thistle 22/03/2024		Black bind weed 22/03/2024		Plant establishment 22/03/2024		Vegetation index (ndvi)	
Early	Amicide® Advance@1400	0.37	abcde	0.63	abc	9.67	bcd	116.48	abc	0.25	cd
	Aptitude®@200 + MCPA Amine 750@300	0.61	abcde	0.00	c	13.00	abcd	132.01	a	0.26	ab
	Diuron WDG@280 + MCPA Amine 750@330	1.35	a	0.00	c	8.75	cd	120.45	abc	0.25	cd
	Mateno® Complete@1000	0.21	bcde	0.25	bc	15.25	abcd	120.64	abc	0.25	bcd
	Rexade®@100 + MCPA LVE 570@400	0.02	de	0.00	c	18.75	a	115.53	bc	0.26	abc
Mid	Amicide® Advance@1400 + Grindstone®@32	0.16	bcde	-0.01	c	8.50	cd	110.42	bc	0.25	d
	Amicide® Advance@1400 + Lontrel® Advanced@150	0.72	abc	0.50	abc	14.25	abcd	117.61	abc	0.25	bcd
	Amicide® Advance@1400 + Lontrel® Advanced@75	1.38	a	0.25	bc	15.50	abc	107.77	c	0.25	bcd
	Amicide® Advance@1400 + Picoflex® (Picloram)@110	0.08	cde	1.00	ab	16.00	abc	125.95	ab	0.25	bcd
	Amicide® Advance@1400 + Trezac®@200	0.52	abcde	0.83	abc	10.75	bcd	116.67	abc	0.26	a
Late	Amicide® Advance@1400	0.65	abc	0.50	abc	13.59	abcd	123.11	abc	0.25	bcd
	Amicide® Advance@1400 + Lontrel® Advanced@150	0.01	e	0.25	bc	7.75	d	112.50	bc	0.25	bcd
	Lontrel® Advanced@150	0.54	abcd	1.25	a	10.75	bcd	113.64	bc	0.25	cd
	UTC@ ~	1.06	ab	-0.12	c	17.25	ab	107.01	c	0.25	bcd

Spray application details

Spray Application	Early Z14-Z20	Mid- Z25->Z27	Very Late >Z32
Date applied	20/07/2023	24/08/2023	11/09/2023
Start time	10:30am	11.40am	3:30pm
Finish time	11:00am	12.40pm	3:50pm
Water rate (l/ha)	100	100	100
Speed (km/hr)	5	7	5
Pressure (bar)	3	3	30psi
Equipment	HB	New HB x 6 noz	handboom
Nozzle	Airmix 01	Airmix 01	Airmix 01
Boom height (cm)	50	50	75
Temp (oC)	10	23.4	23.3
Wind velocity (km/hr)	5-7 km	2-8km	0-8
Wind direction	E	N	S
Humidity (%)	60.6	41.5	
Δt	3.8	8.2	
Cloud cover (%)	0	10	