GOA trial site report

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

Grain Orana Alliance

2024-07-09

Trial code:	GGWE07723-1
GRDC project code:	GOA2302-001SAX
Season/year:	Winter 2023
Location:	Narromine Station, Narromine
Trial partners:	Billy Browning
Trial establishment date:	20/07/2023

Keywords

GGWE077, fleabane, sow thistle, caltrop, weed control, summer fallows, resistance, in-crop, herbicides, residual, application timing, Narromine

Take home messages

- All the in-crop the treatments reduced the incidence of fleabane (*Conzya bonariensis*) in the following fallow.
- Only 4 of the treatments tested resulted in sow thistle (*Sonchus oleraceus)* (ST) populations less than the UTC.
- Only treatments applied at the mid-crop timing resulted in less ST and had the greatest reduction of FB of all the timings.
- Some options tested resulted in no fleabane (FB) or sow thistle (ST) at the time of the first assessment.
- Unless 100% control of the weeds is achieved, follow up weed control would still be required, reducing any potential costs savings in fallow management.

- The use of residual herbicides can help reduce FB and ST populations.
- It is likely that the greatest contributor to a reduction in FB and ST populations following herbicide applications is their knockdown effect rather than any residual control.
- No treatments affected on caltrop populations.

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 generally germinates during the spring period and is not present to be controlled by earlier, in-crop applications. Following 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. This contributes significantly to the costs of managing summer fallows.
- Given the weed germination timing 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. This may reduce the higher fallow management costs associated with the weed.
- This approach has been previously identified utilising Lontrel® Advanced (clopyralid) and has been widely adopted by the industry. An improved understanding how to finesse the product usage, including application timing could be very beneficial. There are many other products that could fit this approach but have not been benchmarked to inform practices. They may also offer an alternate herbicide mode of action for growers.
- To test the validity of this approach and compare products to reduce fallow costs, 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:
    - FB germination: establishment and growth in the subsequent fallow period
    - Other weeds over the summer fallow period.
- Assess if any of these residual herbicides impacted crop establishment of the following crop.

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Methodology

- Randomised, replicated small plot trials.
- Potential herbicide treatments were applied to a commercially wheat crop in a paddock predicted to have a high FB seed bank.
- Herbicides were applied at predetermined crop growth stages. This was done as:
    - some herbicides are only labelled to be applied at 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 each herbicide timing, plots receiving residual treatments were also treated with non-residual knockdown herbicides to control any pre-existing FB germinations, detailed below.
- Following each assessment during the fallow period all plots were sprayed out with a non-residual knockdown so that subsequent counts were a function of the residual herbicides originally applied.
- Specific herbicides timing and the non-residual knockdowns used are detailed below
    - Early-timing: 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® 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 wheat the following year. The trial treatments were observed for crop establishment and early growth as measured by Normalised Difference Vegetation Index (NDVI)

Table 1 Treatment table

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® Advance @ 150	Mid	Z25-Z27
Amicide Advance® @ 400 + Lontrel® Advance @ 75	Mid	Z25-Z27
Amicide Advance®@1400 + Picoflex™ (picloram) @ 110	Mid	Z25-Z27
Amicide Advance® @1400 + Trezac® @ 200	Mid	Z25-Z27
Amicide Advance® @1400	Very late	>Z32
Amicide Advance® @1400 + Lontrel® Advance @150	Very late	>Z32
Lontrel® Advanced @ 150	Very late	>Z32
UTC		

Results

Weed control:

When assessed on the 5/12/2023, three key weeds were observed- FB, ST and caltrop.

Fleabane (Figure 1**)**

- Untreated plots (UTC) had ~ 2 FB plants/m^2
- All treatments * timings resulted in reduction of FB.
- Early timed applications resulted in FB populations between 0.17 and 0.45 plants/m^2.
- Mid-timed applications resulted in no FB present where Lontrel® Advanced at both rates, Picoflex™ and Trezac® was applied.
- FB numbers were reduced to less than 0.5 plants/m^2 in all treatments at both the early and late timings.

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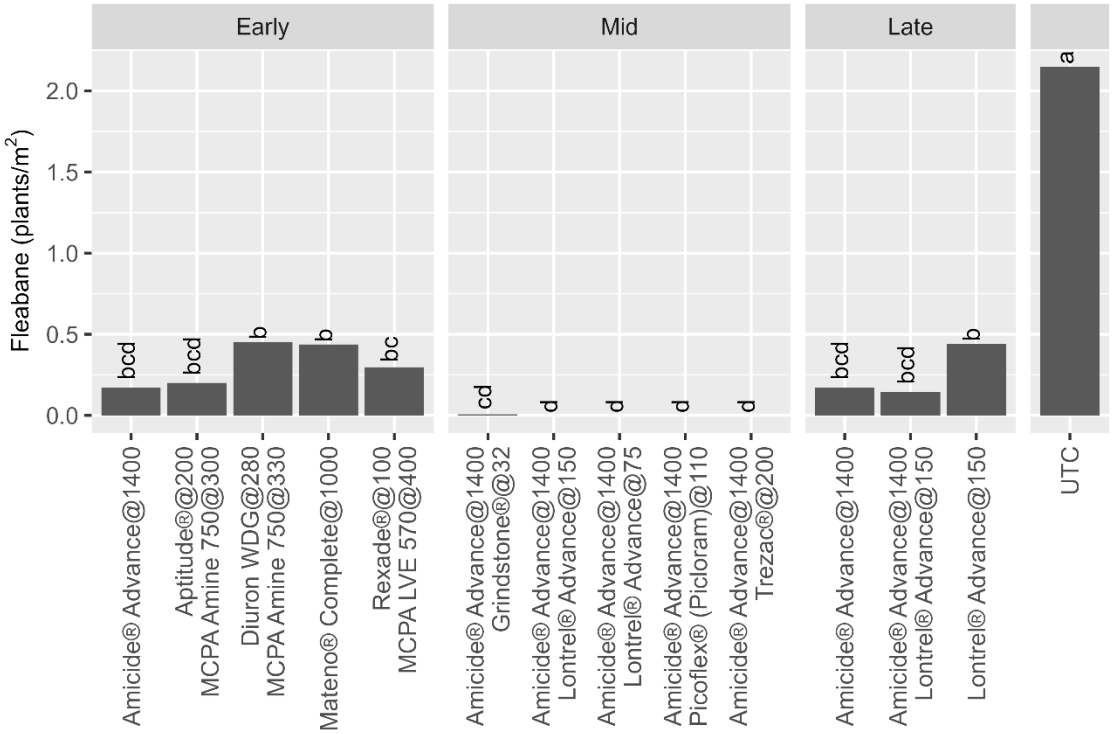

Figure 1 Number of surviving fleabane at the early fallow assessment, 5/12/2023. Treatments with the same letter are not significantly different.

Later assessments showed very few FB had germinated since the first assessments with nil FB recorded at the final assessment.

Sow thistle

- UTC plots had 0.3 sow thistle plants/m^2.
- There were no treatments applied at either the early or late timings that reduced the population below that present in the UTC.
- Only 4 treatments tested resulted in sow thistle populations any different to the UTC.
  - At the mid timing only the Lontrel® Advanced at the high rate and Picoflex™ had no sow thistle
  - At the mid timing, Lontrel® Advanced at the lower rate and Trezac® had very low numbers of sow thistle

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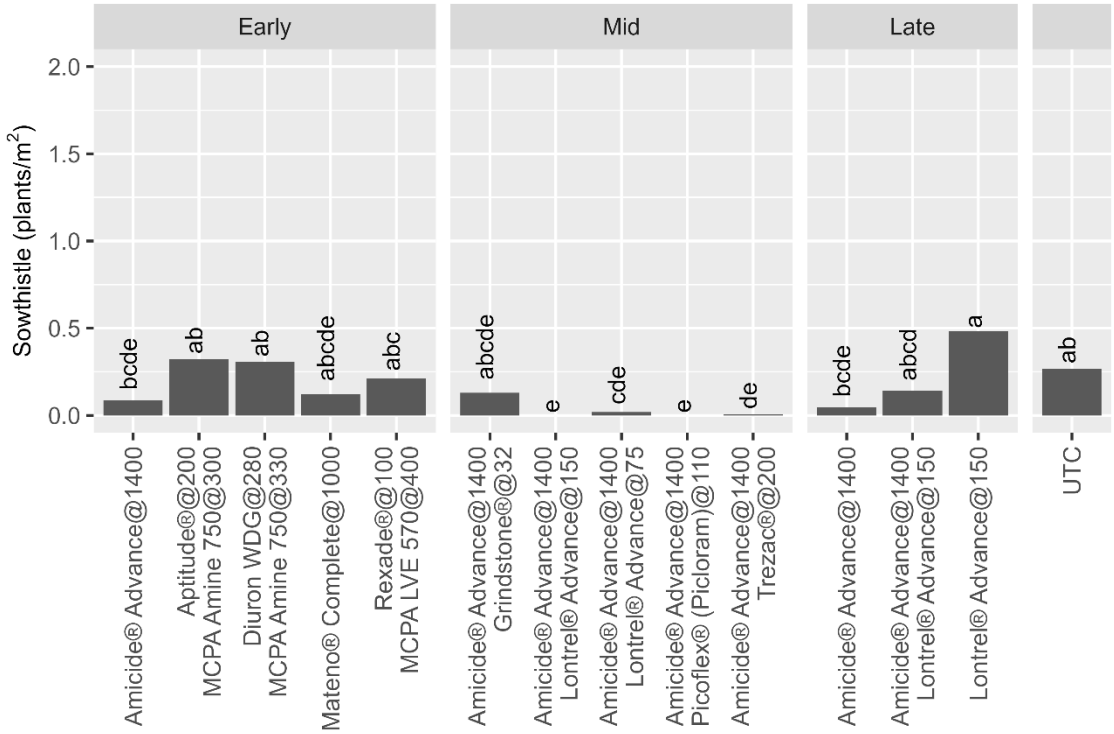

Figure 2 Number of surviving sow thistle at the early fallow assessment, 5/12/2023. Treatments with the same letter are not significantly different.

At the second and last assessment there was no differences between the treatments and the untreated control in sow thistle numbers, however an average of 0.9 sow thistle plants/m^2.

Caltrop:

- treatments had no effects on caltrop numbers compared to the UTC at any of the three assessments (Figure 3).

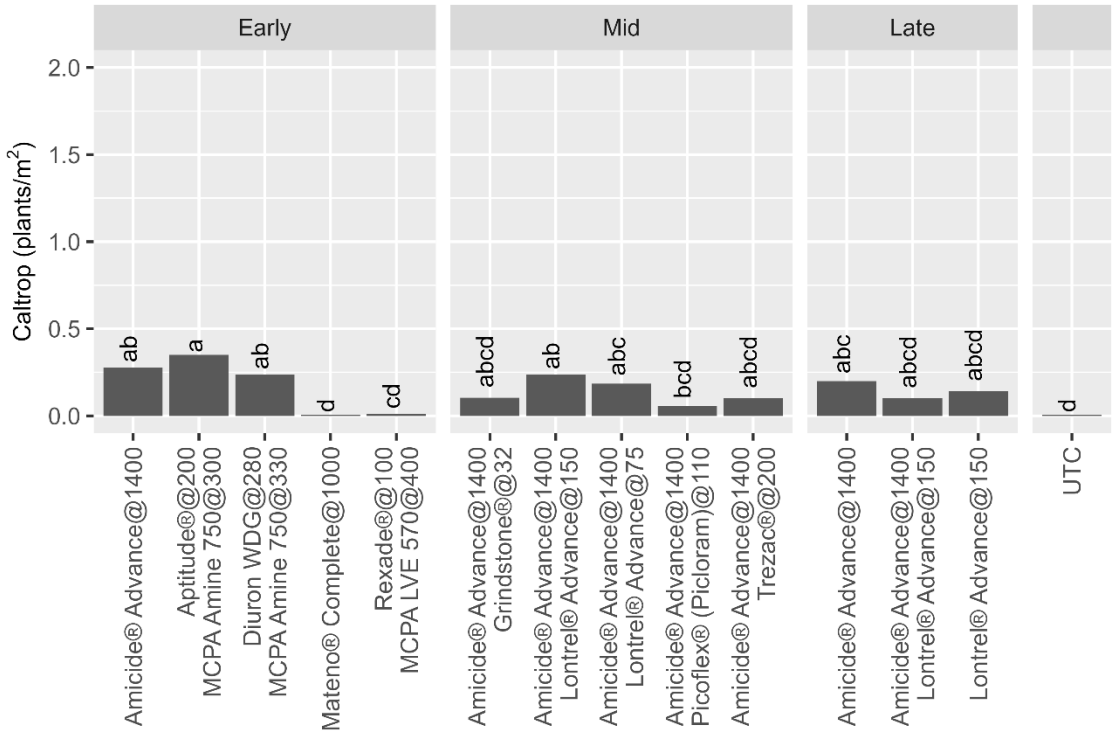

Figure 3 Number of surviving caltrop at the early fallow assessment, 5/12/2023. Treatments with the same letter are not significantly different.

Establishment:

There was no treatment effect on the various herbicides on establishment (Figure 4). Early crop growth as measured by NDVI was not different to the UTC except Lontrel® Advanced applied at 150 ml/ha applied late although the impact was small and possibly agronomically in consequential.

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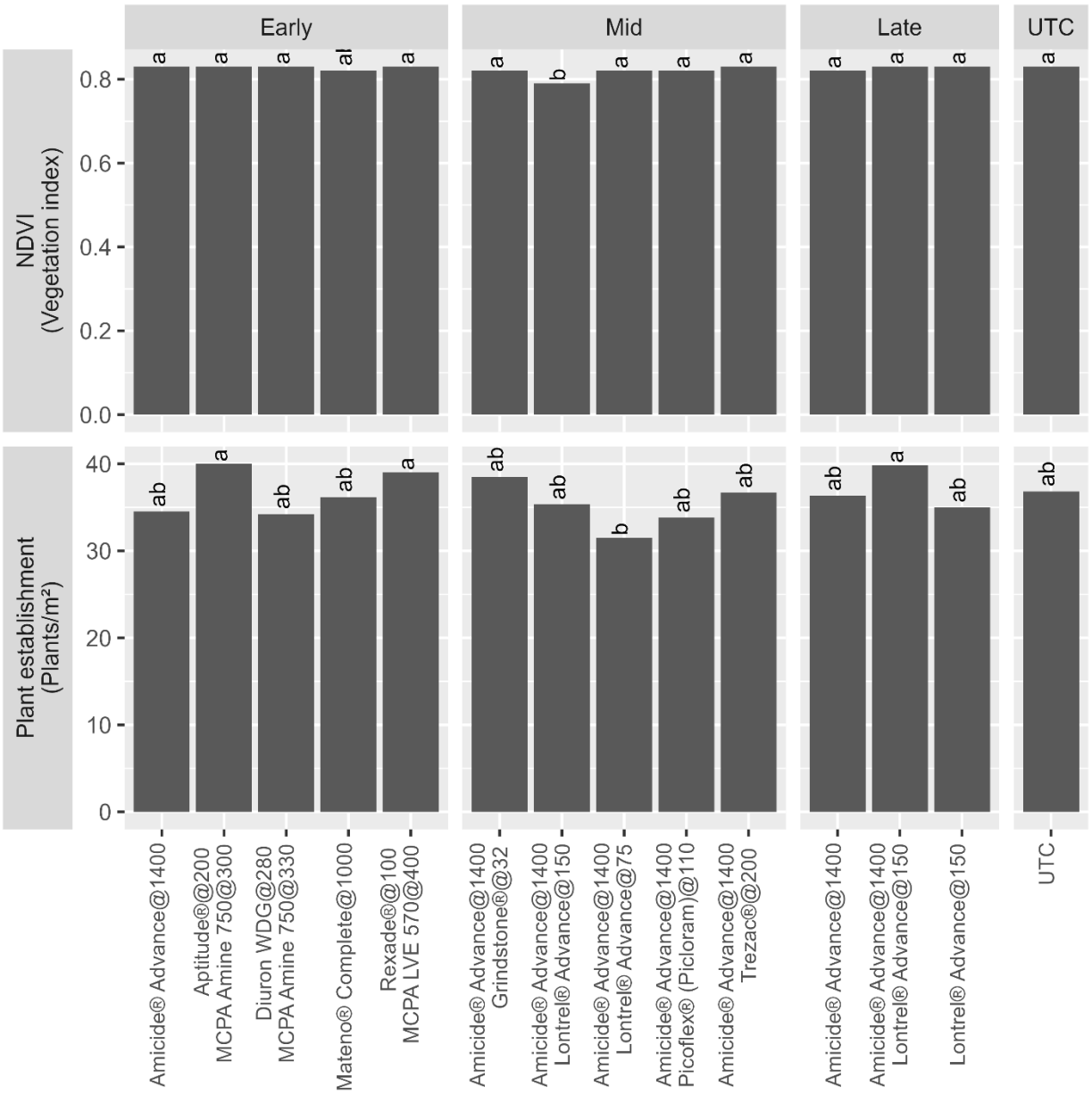

Figure 4: Crop establishment and vegetation index as measured by NDVI in the next winter crop, assessed 12/06/2024. Treatments with the same letter are not significantly different.

Discussion

The caltrop populations were not affected by the by any of the treatments tested and would have needed follow up spraying.

Sow thistle was affected products and timing with several treatments achieving 100% control, however this was only achieved at the mid timing applications. No applications made early or late achieved the same level of control.

The control of FB was similar, several products achieved a 100% reduction plant numbers, but this was only achieved by mid timing applications.

These scenarios support a view that mid timings application may be more efficient in reducing the presence of these key weeds in the fallow. This could be that it is a good balance between weeds having germinated by this time to allow knockdown control, along with canopies not too big to obstruct herbicide penetration to the soil, needed to offer residual control.

It is not possible from the treatment designs to confidently apportion control to either the knockdown effect of this timing or the residual capacity of any herbicides applied. The very low populations of both sow thistle and FB following the non-residual options of just Amicide advance suggests that most of the control was because of the knockdown herbicide, with some additive effect of the residuals.

The addition of products such as Lontrel® Advanced, Picoflex™ or Trezac® did result in high levels of control of FB and ST. If these were the only weeds present, fallow control costs may have been reduced as follow- up spraying was not needed. However, it is worth noting that the same level of control was not achieved on caltrop under the same treatments. In this scenario follow up control of caltrop would have been needed. Negating any savings unless optical spot spraying technology could have been employed. In doing so the overall chemical usage may be reduced as less area would have been sprayed

Conclusions

In this trial there were several treatments that did result in less weeds, in particular FB and sow thistle early in the fallow. In this trial, control of FB and sow thistle appears to be optimal at the mid or Z32 crop timing. It is likely that this is optimal for coverage of already germinated weeds, getting enough residual on the soil surface (i.e. not intercepted by plants), and longevity of the active (ability to persist).

The addition of products such as Lontrel® Advanced, Picoflex™ or Trezac resulted in the best level of control, but it is unclear us to if these treatments gave the level of control as a clear function of their residual nature or primarily as a function of their knockdown capacity.

If these 2 weeds were the only weeds present, the use of these residuals products may result in the no need for follow up applications and savings in management costs being had. If other weeds were present, such as caltrop, that were not as well controlled, these would still need control. 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 wheat crop.

Acknowledgements

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DISCLAIMER — TECHNICAL

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Appendix

Results

Timing	Product (rate)	Fleabane		Sow thistle		Caltrop		Plant establishment		Vegetation index	
		(plants/m²)								(NDVI)	
Early	Amicide® Advance @1400	0.17	bcd	0.09	bcde	0.28	ab	34.50	ab	0.83	a
	Aptitude® @ 200 + MCPA Amine 750 @ 300	0.20	bcd	0.32	ab	0.35	a	40.00	a	0.83	a
	Diuron WDG @ 280 + MCPA Amine 750 @ 330	0.45	b	0.31	ab	0.24	ab	34.22	ab	0.83	a
	Mateno® Complete @1000	0.44	b	0.12	abcde	0.01	d	36.17	ab	0.82	ab
	Rexade® @ 100 + MCPA LVE 570 @ 400	0.30	bc	0.21	abc	0.01	cd	39.00	a	0.83	a
Mid	Amicide® Advance @1400 + Grindstone® @ 32	0.01	cd	0.13	abcde	0.10	abcd	38.50	ab	0.82	a
	Amicide® Advance @1400 + Lontrel® Advance @150	0.00	d	0.00	e	0.24	ab	35.33	ab	0.79	b
	Amicide® Advance @1400 + Lontrel® Advance @ 75	0.00	d	0.02	cde	0.19	abc	31.50	b	0.82	a
	Amicide® Advance @1400 + Picoflex® (Picloram) @ 110	0.00	d	0.00	e	0.06	bcd	33.83	ab	0.82	a
	Amicide® Advance @1400 + Trezac® @ 200	0.00	d	0.01	de	0.10	abcd	36.67	ab	0.83	a
Late	Amicide® Advance @1400	0.17	bcd	0.05	bcde	0.20	abc	36.33	ab	0.82	a
	Amicide® Advance @1400 + Lontrel® Advance @ 150	0.15	bcd	0.14	abcd	0.10	abcd	39.83	a	0.83	a
	Lontrel® Advance @ 150	0.44	b	0.48	a	0.14	abcd	35.00	ab	0.83	a
	UTC	2.15	a	0.27	ab	0.01	d	36.83	ab	0.83	a

Spray application details.

Spray application	Early Z14-20	Mid Z25->Z27	Very late >Z32
Date applied	20/07/2023	24/08/2023	11/09/2023
Start time	2:10 PM	2:15pm	2:00 AM
Finish time	2:40 PM	2:55pm	2:25 AM
Water rate (L/ha)	100	100	100
Speed (km/hr)	5	7	5
Pressure (bar)	3	3	30psi
Equipment	Brolga hand boom	Brolga hand boom	Brolga hand boom
Nozzle	Airmix 01	Airmix 01	Airmix 01
Boom height (cm)	50	50	100
Temp (°C)	19.5	23.3	22.3
Wind velocity (km/hr)	5-8KM	5km	0-10K
Wind direction	NW	E	E
Humidity (%)	38	45.8	32
Δt	8	7.7	9.3
Cloud cover (%)	0	10	0