

Pre-emergent herbicides and mixtures for annual ryegrass control in wheat and barley

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Key findings

- Sakura, Mateno Complete and EPE treatments provided the most effective control in wheat (89-98% control) and barley (76-91%).
- Minimal damage was observed in 2022. Luximax caused a reduction in grain yield (17%) in wheat, although weed control was excellent.
- Using any pre-emergent herbicide in 2022 increased grain yield in wheat (24-52%). Mateno Complete, Overwatch and EPE treatments resulted in grain yield increases (17-40%) in barley when compared to no pre-emergent herbicide.
- Mateno Complete and IBS treatments with EPE applications performed well in wheat and barley. Good winter rainfall suited the solubility and soil binding attributes of pyroxasulfone, resulting in good weed control.

Introduction

Pre-emergent herbicides have become a vital tactic for controlling weed populations in broadacre crops. There are many different pre-emergent herbicide options available to growers, providing varying levels of weed control when applied IBS (incorporated by sowing). Pre-emergent herbicides also act differently in response to soil properties and soil moisture, which can have an impact on herbicide performance. The availability of early post emergent (EPE) herbicides targeting in-crop weeds at early growth stages has increased flexibility for growers.

Annual ryegrass (ARG) is the most challenging grass weed in the Mid-North region, across all broadacre crops including wheat and barley. The recent introduction of new herbicides, such as Overwatch[®] (bixlozone), Luximax[®] (cinmethylin) and Mateno[®] Complete (pyroxasulfone, diflufenican and aclonifen) offer new options for paddocks with resistance to older chemistries across South Australian and Victorian cropping regions (Preston 2021) including Group 15 (formerly Group J, K) and Group 3 (formerly Group D).

This trial assessed the performance of new pre-emergent herbicides applied IBS and EPE, standalone or in mixtures, for the control of annual ryegrass in wheat and barley.

Methodology

Plot size	1.75 m x 10.0 m	Fertiliser	DAP (18:20) + 1% Zn + Impact @ 80 kg/ha
Seeding date	May 13, 2022		Easy N (42.5:0) 70 L/ha on July 22, 2022
Crop history	Mulgara Oaten Hay		Easy N (42.5:0) 60 L/ha on August 17, 2022
Harvest date	November 25, 2022		
Location	Hart, SA		



Two trials were set up as a randomised complete block design with three replicates, 14 herbicide treatments for wheat and 13 herbicide treatments for barley. Both trials were managed with the application of other pesticides to ensure an insect and disease-free canopy.

All plots were assessed for crop establishment (%), ARG weed counts (plants/m²), ARG head counts (heads/m²) and grain yield (t/ha). Data was analysed using a one-way ANOVA model in Genstat 22nd edition.

Annual ryegrass seed with known susceptibility to all herbicide groups was broadcast to trial plots and lightly incorporated on May 13, prior to the application of herbicide treatments. Scepter wheat and Spartacus CL barley was sown after IBS treatments were applied using a standard knife-point press wheel system on 22.5 cm (9") spacings. Early post emergent treatments were applied on June 29 when ryegrass was at GS 12 (two leaves emerged). Ryegrass populations at EPE application were very low, however, due to good winter rainfall, grass weed populations were high during the late winter months.

Herbicides and rates trialed on wheat and barley are listed in Table 1 and Table 2, respectively.

Table 1. IBS and EPE herbicide treatments applied to wheat at Hart in 2022.

Herbicide treatment	IBS Product rate (/ha)	EPE Product rate (/ha)
1 Nil		
2 Sakura®	118 g	
3 Sakura + Avadex® Xtra	118 g + 2 L	
4 Mateno Complete	1 L	
5 Luximax	500 mL	
6 Luximax + Avadex Xtra	500 mL + 2 L	
7 Villain	1.5 L	
8 Overwatch	1.25 L	
9 Overwatch + Avadex Xtra	1.25 L + 2 L	
10 Overwatch + Sakura	1.25 L + 118 g	
11 Trifluralin + Avadex Xtra	1.5 L + 2 L	
12 Boxer Gold® + Avadex Xtra	2.5 L + 2 L	
13 Trifluralin + Mateno Complete (EPE)	1.5 L	1 L
14 Trifluralin + Avadex Xtra + Boxer Gold (EPE)	1.5 L + 2 L	2.5 L

Table 2. IBS and EPE herbicide treatments applied to Barley at Hart in 2022.

Herbicide treatment	IBS Product rate (/ha)	EPE Product rate (/ha)
1 Nil		
2 Sakura	88 g	
3 Mateno Complete	750 mL	
4 Mateno Complete + Avadex Xtra	0.75 L + 2 L	
5 Voraxor®	200 mL	
6 Overwatch	1.25 L	
7 Overwatch + Avadex Xtra	1.25 L + 2 L	
8 Trifluralin + Avadex Xtra	1.5 L + 2 L	
9 Boxer Gold + Avadex Xtra	2.5 L + 2 L	
10 Trifluralin + Avadex Xtra + Mateno Complete (EPE)	1.5 L + 2 L	750 mL
11 Trifluralin + Avadex Xtra + Boxer Gold (EPE)	1.5 L + 2 L	2.5 L
12 Trifluralin + Avadex Xtra + Intervix® (EPE)	1.5 L + 2 L	750 mL
13 Voraxor + Boxer Gold (EPE)	200 mL	2.5 L

Sakura, although not registered, was applied to barley, as it shares an active ingredient (pyroxasulfone) with the new Mateno Complete, registered for use in barley (IBS and EPE), to compare efficacy. Sakura was applied at 88 g/ha to match the rate of pyroxasulfone in Mateno Complete applied at 0.75 L/ha.

Results and discussion

Seasonal conditions

Early growing season conditions at Hart were dry. The season's first significant rainfall event came on May 30 (26 mm), two weeks after seeding, with crop emergence occurring on June 8. After a dry start, the trial received average rainfall for June (47 mm) and below average rainfall of 15 mm for July (Figure 1).

Wet conditions in early June allowed ARG to germinate and the pre-emergent herbicides to move into the soil. Limited rainfall from late June onwards reduced the potential for crop damage from pre-emergent herbicides (Preston et al 2022). There were no visual symptoms of phytotoxicity or other herbicide damage in 2022 for barley or wheat.

A wet August and September encouraged further ARG and other grass weeds to emerge in the two trials.

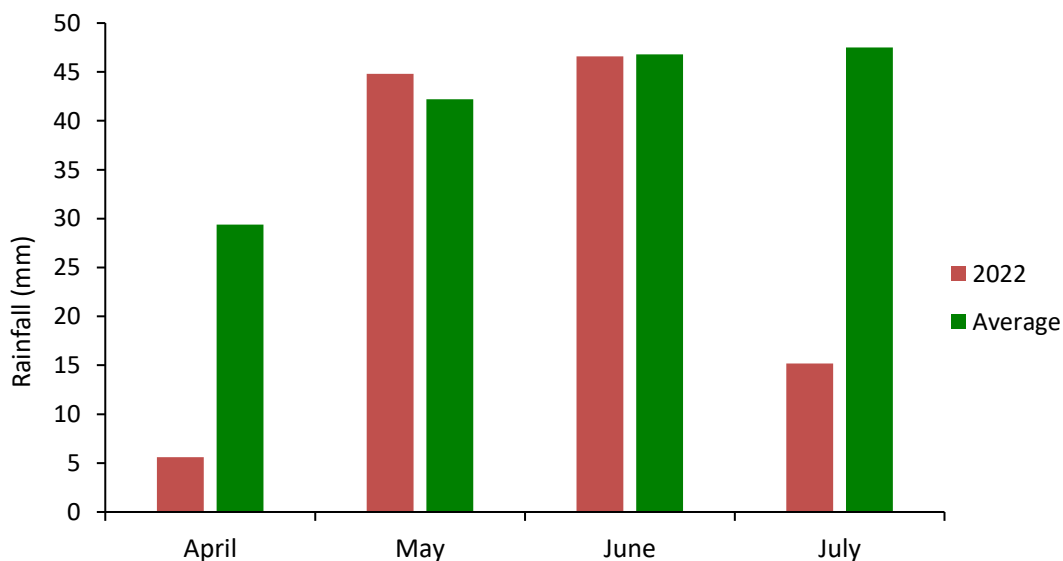


Figure 1. Total monthly rainfall and the 100-year average rainfall for April – July for Hart in 2022.

Pre-emergent herbicide performance in wheat

Varying levels of ARG control were observed for pre-emergent and EPE treatments at Hart in 2022. Sakura, Mateno Complete, Luximax, and the two IBS treatments followed by an EPE application showed excellent control, providing > 85% control for ARG populations (< 11 weeds/m²) and an 80% reduction in seed production (< 80 heads/m²) when compared to the nil treatment (Table 3). Villain, a new product undergoing commercialisation by Sipcam, containing terbuthylazine and pyroxasulfone (active ingredients currently in Terbyne[®] Xtreme and Sakura), performed similarly. This product is likely to be registered on wheat (not durum) as an IBS herbicide, targeting grass and broadleaf weeds.

Pyroxasulfone is an active ingredient in Sakura, Mateno Complete and Villain. Good rainfall in May and June (91 mm) provided ideal conditions for pyroxasulfone to move into the soil profile, resulting in good ARG control.

Crop establishment (%) was not affected by any herbicide treatment.

The good growing conditions through spring allowed surviving annual ryegrass to set more seed. Some of the herbicides with shorter persistence, such as Boxer Gold + Avadex Xtra, resulted in more seed heads than other treatments. However, all treatments containing pyroxasulfone (Sakura, Mateno Complete and Villain) had less than 70 seed heads/m². This demonstrates the ability of this herbicide to provide more control through the season.

Table 3. The effect of pre-emergent herbicides on ARG weed counts (8 weeks after sowing) and ARG head counts in wheat. Shaded values show the highest performing treatments.

Herbicide Treatment	Annual Ryegrass (plants/m ²)	% control	Annual Ryegrass (heads/m ²)	% control
Nil	70	0	436	0
Sakura	4	94	28	94
Sakura + Avadex Xtra	2	98	25	94
Mateno Complete	3	96	36	92
Luximax	11	84	80	82
Luximax + Avadex Xtra	4	95	58	87
Villain	6	91	70	84
Overwatch	24	66	172	61
Overwatch + Avadex Xtra	17	76	106	76
Overwatch + Sakura	7	90	58	87
Trifluralin + Avadex Xtra	18	74	75	83
Boxer Gold + Avadex Xtra	17	75	150	66
Trifluralin + Mateno Complete (EPE)	5	92	32	93
Trifluralin + Avadex Xtra + Boxer Gold (EPE)	8	89	22	95
LSD (P≤0.05)	13.3		70.4	

Yields were high in 2022 following the good winter and spring rainfall. The nil treatment was the lowest yielding (3.4 t/ha) due to high weed pressure providing crop competition. Treatments that included pyroxasulfone (Sakura, Mateno Complete and Villain) resulted in the highest yields alongside the two IBS treatments with an EPE application, ranging from 4.79 – 5.18 t/ha (Table 4). Some older chemistries applied IBS, including trifluralin and Boxer Gold, did not perform as well and had significantly higher weed pressure reducing crop yield potential. This shows that pyroxasulfone was highly effective under 2022 conditions due to the wet seasonal conditions suiting pyroxasulfone better than some other products.

Although Luximax treatments provided good weed control, a yield penalty was observed. Luximax is more soluble than pyroxasulfone, meaning it moved further into the soil with the good winter rainfall in 2022, producing crop damage. Across the Mid-North region in recent years, Luximax has been observed to provide good ARG control, but at the expense of crop damage when there is high rainfall after sowing, particularly where soil is dry at application.

Applying a pre-emergent herbicide or mixture resulted in a yield increase by 24 – 53% in 2022, highlighting the importance of pre-emergent herbicides for annual ryegrass control.

Table 4. Grain yield (t/ha) of all herbicide treatments applied to wheat at Hart in 2022. Shaded values show the highest performing treatments.

Herbicide Treatment	Grain yield (t/ha)
Nil	3.40
Sakura	5.08
Sakura + Avadex Xtra	4.95
Mateno Complete	5.01
Luximax	4.28
Luximax + Avadex Xtra	4.42
Villain	4.79
Overwatch	4.55
Overwatch + Avadex Xtra	4.69
Overwatch + Sakura	5.18
Trifluralin + Avadex Xtra	4.21
Boxer Gold + Avadex Xtra	4.56
Trifluralin + Mateno Complete (EPE)	5.00
Trifluralin + Avadex Xtra + Boxer Gold (EPE)	4.83
LSD (P≤0.05)	0.45

Pre-emergent herbicide performance in barley

All treatments applied in 2022 reduced ARG populations and ARG seed set (heads/m²). Many treatments provided high levels of control, including Sakura, Mateno Complete (IBS), Overwatch, Trifluralin + Avadex Xtra, Boxer Gold + Avadex Xtra, and the EPE treatments including Boxer Gold or Intervix ranging from 76 – 91% control (9 – 24 plants/m²) (Table 5).

While treatments containing Voraxor provided better control when compared to the nil treatment, there were higher ARG weed counts (52 – 70%) and head counts (heads/m²) compared to most other treatments. When measuring seed set potential, treatments containing Voraxor had the highest number of ARG heads when compared to other treatments. This was expected as Voraxor is only registered for suppression of ARG in lighter soils.

When applied EPE, the residual properties of Mateno Complete were able to suppress ryegrass seed set later in the season. With the exception of Voraxor, all herbicide treatments performed well at reducing ARG seed set with reductions between 82-96% (Table 5).

Table 5. The effect of pre-emergent herbicides on ARG plant counts (8 weeks after sowing) and ARG head counts in barley at Hart in 2022. Shaded values show the highest performing treatments.

Herbicide Treatment	Annual Ryegrass (plants/m ²)	% control	Annual Ryegrass (heads/m ²)	% control
Nil	101 ^e	0	692 ^d	0
Sakura	16 ^{ab}	84	64 ^{ab}	91
Mateno Complete	9 ^a	91	24 ^a	96
Mateno Complete + Avadex Xtra	24 ^{ab}	76	84 ^{ab}	88
Voraxor	70 ^d	31	268 ^c	61
Overwatch	21 ^{ab}	79	105 ^{ab}	85
Overwatch + Avadex Xtra	19 ^{ab}	81	80 ^{ab}	88
Trifluralin + Avadex Xtra	21 ^{ab}	79	126 ^{abc}	82
Boxer Gold + Avadex Xtra	19 ^{ab}	81	79 ^{ab}	89
Trifluralin + Avadex Xtra + Mateno Complete (EPE)	39 ^{bc}	62	104 ^{ab}	85
Trifluralin + Avadex Xtra + Boxer Gold (EPE)	17 ^{ab}	83	96 ^{ab}	86
Trifluralin + Avadex Xtra + Intervix (EPE)	12 ^{ab}	88	45 ^a	94
Voraxor + Boxer Gold (EPE)	52 ^{cd}	49	196 ^{bc}	72
LSD (P≤0.05)	27.6		20.7	

Values with the same letter are not significantly different.

Barley yields were high at Hart in 2022 following good winter and spring rainfall, ranging from 4.01 – 5.68 t/ha (Table 6). Treatments containing Mateno Complete and Intervix had the best yields with an average of 5.35 t/ha.

Clearfield technology is still useful in farming systems with populations of ARG susceptible to Group 2 herbicides (formerly Group B), as shown through the good control of ARG with Intervix applied EPE.

Table 6. Grain yield (t/ha) of all herbicide treatments applied to barley at Hart in 2022. Shaded values show the highest performing treatments.

Herbicide Treatment	Grain yield (t/ha)
Nil	4.01
Sakura	4.86
Mateno Complete	5.68
Mateno Complete + Avadex Xtra	5.17
Voraxor	4.64
Overwatch	4.49
Overwatch + Avadex Xtra	4.98
Trifluralin + Avadex Xtra	4.43
Boxer Gold + Avadex Xtra	4.37
Trifluralin + Avadex Xtra + Mateno Complete (EPE)	5.24
Trifluralin + Avadex Xtra + Boxer Gold (EPE)	4.83
Trifluralin + Avadex Xtra + Intervix (EPE)	5.30
Voraxor + Boxer Gold (EPE)	4.70
LSD (P≤0.05)	0.63

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References

- Anderson D & Allen R 2022, 'Pre-emergent herbicides and mixtures for annual ryegrass control' <https://www.hartfieldsite.org.au/pages/resources/trials-results/2021-trial-results.php>
- Preston C, Fleet B & Gill G 2022, 'Getting pre-emergent herbicides choices correct', 2022 Hart Field Day Guide.
- Preston C, Condon G 2021, 'Fitting new pre-emergent chemistries in the farming system and managing them for longevity', 2021 Dubbo Grains Research Update.

Useful resource

Pre-emergent herbicides Fact Sheet, GRDC
<https://grdc.com.au/resources-and-publications/all-publications/factsheets/2022/pre-emergent-herbicides-fact-sheet>