

Herbicide tolerance of lupin varieties - Wongan Hills

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Key messages

All the lupin varieties tolerated the registered pre and post-emergent herbicides at the label rates and timings with good safety margin.

A new herbicide Ultro® 900 WG at 2.3 kg/ha applied before seeding was tolerated by all the lupin varieties.

For blue lupin control/suppression, Garlon® 600 (triclopyr) at 30 mL/ha applied at 8-leaf stage of narrow leafed lupins was tolerated well by all the varieties, whereas its application at pod setting on main stem of narrow leafed lupins caused statistically significant yield loss across all the lupin varieties (18-24%). **Triclopyr use on narrow leafed lupins is not registered.**

Note: Always follow label recommendations. The Department Primary Industries and Regional Development, does not endorse the use of herbicides above the registered rate or off-label use of herbicides or off-label tank mixes. Crop tolerance and yield responses to herbicides are strongly influenced by seasonal conditions.

Aims

To identify herbicide sensitivities of new lupin varieties with the view to reduce their yield losses due to herbicide damage. Mandelup was included as a standard variety for comparison in the trial.

Blue lupins are problematic in narrow leave lupin production, especially in the Northern Agriculture Region of WA Wheatbelt and no herbicide is registered for their control in this crop. There were earlier reports that blue lupins could be controlled/suppressed with triclopyr (e.g. Garlon®) safely applied at pod setting on main stem of narrow leave lupins (Quinlan and Fleay, 2016). Two timing of application of Garlon® at 30 mL/ha were included in the trial to determine their safety on new narrow leafed lupin varieties.

Method

Trial Year and Location	2019 (2019WH44) and Research Facility (2EA), Wongan Hills
Soil Type, pH (CaCl ₂) and OC (%)	Loamy sand, 0-10 cm: 5.8 and 0.73, 10-20 cm: 4.5 and 0.32
Paddock history	2018 – Wheat, 2017 – Pasture, 2016 – Wheat, 2015 - Lupin
Trial design	Criss-cross with every 5th plot as untreated control plot to check spatial variability.
Plot size (net) and replications	8 m x 1.1 m (5 rows at 22 cm row spacing) and 3 reps. To convert plot yield to kg/ha, 1.8 m plot width was used (plot to plot centre).
Varieties and herbicide treatments	Coyote (tested as WALAN 2546), Mandelup, PBA Jurien and PBA Leeman, and see Table 1 for herbicide treatments details.
Seeding date and rate	Sown on 13 June with seeding rate of 84 to 104 kg/ha across varieties to achieve 45 plants/m ² .

Seed treatment before sowing	Rovral® 100 mL and Thiraflo® 600 170 mL/100 kg seed.
Seeding machinery and depth	Coneseeder fitted with coulters, knife points and press-wheels and 4-5 cm deep. The trial was sown at around 3.5 to 4 km/hr speed.
Fertilizer and rhizobium Inoculum	Landmark MES10 80 kg/ha and Alosca group GS granular 10 kg/ha applied with seed at seeding.
Soil moisture at sowing	0-5 cm: 6% (average of 6 samples) 15-10 cm: 6% (average of 6 samples)
Method used	Volumetric method
Cumulative rainfall:	
1 week before sowing	53.2 mm
1 week after sowing	0 mm
2 weeks after sowing	14 mm
Treatment application date:	Please see Table 1 for treatment details.
Incorporated by sowing (IBS)	12 June 2019
2 leaf stage	10 July 2019
4 leaf stage	16 July 2019
8 leaf stage	01 August 2019
Pod setting on main stem stage	23 September 2019
Herbicide application machinery	Spray rig with shields on boom at a width of 1.5 m. Air induction nozzles and 100 L/ha water volume used.
Visual observations scale:	0 to 100 %, where 0 = no visible injury & 100 = complete plant death.
Visual observation dates:	11 July, 22 August and 28 Oct 2019.
Lupin plant count	28 October, two counts per plot using a quadrat size of 100 cm x 44 cm (2 rows at 22 cm row spacing) and presented as plants/m ² .
Blanket Sprays	Roundup Ultra® Max 2.5 L/ha on 12 June, Spray.Seed® 250 2 L/ha on 13 June, Alpha-Scud® 200 mL + chlorpyrifos® 200 mL/ha on 17 June, Factor® 100 g + Select® 500 mL + Liberate® 1% on 22 August 2019 and Alpha-Scud® 300 mL/ha on 20 September 2019.
Harvesting date	25 November 2019
Data analysis	ANOVA using GenStat programme.
Rainfall (mm) :	2019
	May June July Aug Sept Oct Total
	14.4 82.4 60 45.4 5.6 21.2 229

Crop safety margins: Higher than label rates of the herbicides were included in the trial to determine the crop safety margin of the herbicides at the maximum label rates. Good crop safety margin means that a herbicide at its maximum label rate and at the higher rate(s) was tolerated well by a crop variety. Whereas, low crop safety margin for a herbicide indicates that the variety tolerated the maximum label rate well, but at higher than the label rate(s) there was significant yield loss. A low crop safety margin implies that when spraying under less than optimal conditions, herbicide damage and yield loss may occur even at the label rate. For example, when overlapping herbicide; spraying under wet conditions (for soil active and residual herbicides) and /or there are stressed plants due to abiotic/biotic factors.

Results

The effect of herbicides during early crop growth stages, at flowering time, on plant population (Table 1) and on seed yield of lupin varieties (Table 2) was as follows:

PBA Jurien was the highest yielding variety at 1.6 t/ha seed yield, whereas all other varieties yielded 1.2 t/ha with a plant population range of 51-54 plants/m² (untreated control plots).

Registered herbicides Simazine 600 and Edge[®] 900 applied before seeding at the label and higher rate had no negative effect on plant growth and yielded at par with untreated control across varieties.

A new herbicide Ultro[®] 900 WG at 2.3 kg/ha before seeding caused slight yellowing of leaf tips at 2-4 leaf stage (11 July) across all the varieties and reduced plant population of Mandelup and PBA Leeman significantly, but these symptoms did not translate into significant yield loss in any of the lupin varieties.

Pre-emergent Simazine 600 at 1.7 L/ha followed by post-emergent Brodal[®] and metribuzin alone, Brodal[®] + metribuzin and Brodal[®] + Eclipse[®] mixes at the label and the higher rates did not produce any visual symptoms and yielded at par with untreated control across the lupin varieties.

Pre-emergent Simazine 600 at 1.7 L/ha followed by Garlon[®] 600 at 30 mL/ha at 8-leaf stage of lupins did not produce any visual symptoms (in contrast to Eradu site) and yielded at par with untreated control across the lupin varieties. Garlon[®] 600 30 mL/ha applied at pod setting on main stem of lupins, even though did not produce any visual symptoms (in contrast to Eradu site), but resulted in significant yield loss of 18-24% across the lupin varieties. The new variety Coyote was the least affected.

Conclusion

All the varieties tolerated the registered pre and post-emergent herbicides at the label rates and timings with good safety margin.

A new pre-emergent herbicide Ultro[®] 900 WG (carbetamide) was tolerated well at the maximum label rate by all the lupin varieties. Ultro[®] 900 WG (Group E) is registered at 1.1 -2.3 kg/ha in lupins for control of ryegrass, brome grass and barley grass.

Pre-seeding Simazine 600 at 1.7 L/ha followed by Garlon[®] 600 (triclopyr) at 30 mL/ha applied at 8-leaf stage was tolerated well by all the varieties, whereas its application at pod setting on main stem of lupins caused statistically significant yield loss across all the lupin varieties. **Triclopyr is not registered on lupins.**

References

Quinlan R. and Fleay K. (2016) Selective Control of Blue Lupins in Mandelup Crops.
<https://agvivo.com.au/wp-content/uploads/2016/04/Richard-Quinlan.pdf>

Key words

Herbicides, tolerance, lupin varieties, seed yield.

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Table 1: Effect of herbicides on plant population (% of untreated control) of lupin varieties at maturity Wongan Hills during 2019 (2019WH44)

No	Herbicides	Rate/ha	Timing	Coyote	Mandelup	PBA Jurien	PBA Leeman
0	Untreated Control >>>> plant population/m ²			100 52	100 51	100 54	100 54
1	Simazine 600 (*) X1	1.7 L	IBS	99	121	118	88
2	Simazine 600 X2	3.4 L	IBS	88	110	109	80
3	Edge® 900 WG X1	1.1 kg	IBS	92	117	100	104
4	Edge® 900 WG X2	2.2 kg	IBS	84	99	104	79
5	Ultron® 900 WG	2.3 kg	IBS	86	76	91	83
6	(*)Brodal® X1	200 mL	2 leaves	77	102	100	94
7	(*)Brodal® X2	400 mL	2 leaves	97	121	95	99
8	(*)Metribuzin 750 X1	150 mL	2 leaves	95	119	95	108
9	(*)Metribuzin 750 X2	300 mL	2 leaves	103	81	97	112
10	(*)Brodal® + Metribuzin X1	100 ml + 150 g	4 leaves	104	121	103	110
11	(*)Brodal® + Metribuzin X2	200 mL + 300 g	4 leaves	106	102	106	107
12	Simazine (Pre) fb Brodal® + Simazine fb Brodal® + Metribuzin	1.2 L fb (200 mL + 415 mL) fb (100 mL + 75g)	IBS fb 4 leaves fb 8 leaves	98	102	103	86
13	(*)Brodal® + Eclipse® X1	100 mL + 10 g	8 leaves	88	99	97	99
14	(*)Brodal® + Eclipse® X2	200 mL + 20 g	8 leaves	103	85	87	97
15	(*) Garlon® 600	30 mL	8 leaves	90	103	106	93
16	(*) Garlon® 600	30 mL	Podding	92	114	93	80
Isd (0.05) Control vs Herbicides (1-tail)				17	17	16	16
Isd (0.05) Herbicides vs Herbicides (1-tail)				22	23	22	22
CV (%)				17	17	16	16

(*) = Simazine 600 1.7 L/ha, IBS = incorporated by sowing, PSPE = Post-sowing pre-emergent, fb = followed by, lf = leaves, and Figures in Red are significantly lower than untreated Control.

Table 2: Effect of herbicides on seed yield (% of untreated control) of lupin varieties at Wongan Hills during 2019 (2019WH44)

No	Herbicides	Rate/ha	Timing	Coyote	Mandelup	PBA Jurien	PBA Leeman
0	Untreated Control >>>>> Grain yield (kg/ha)			100 1219	100 1204	100 1605	100 1230
1	Simazine 600 (*) X1	1.7 L	IBS	99	98	102	105
2	Simazine 600 X2	3.4 L	IBS	106	94	106	102
3	Edge® 900 WG X1	1.1 kg	IBS	108	115	117	109
4	Edge® 900 WG X2	2.2 kg	IBS	97	104	114	101
5	Ultra® 900 WG	2.3 kg	IBS	94	91	100	88
6	(*)Brodal® X1	200 mL	2 leaves	107	100	100	115
7	(*)Brodal® X2	400 mL	2 leaves	123	105	107	112
8	(*)Metribuzin 750 X1	150 mL	2 leaves	102	98	102	114
9	(*)Metribuzin 750 X2	300 mL	2 leaves	101	96	91	101
10	(*)Brodal® + Metribuzin X1	100 ml + 150 g	4 leaves	100	101	95	89
11	(*)Brodal® + Metribuzin X2	200 mL + 300 g	4 leaves	89	80	91	97
12	Simazine (Pre) fb Brodal® + Simazine fb Brodal® + Metribuzin	1.2 L fb (200 mL + 415 mL) fb (100 mL + 75g)	IBS fb 4 leaves fb 8 leaves	115	101	107	106
13	(*)Brodal® + Eclipse® X1	100 mL + 10 g	8 leaves	110	108	106	105
14	(*)Brodal® + Eclipse® X2	200 mL + 20 g	8 leaves	107	94	94	99
15	(*) Garlon® 600	30 mL	8 leaves	105	93	113	105
16	(*) Garlon® 600	30 mL	Podding	82	81	76	76
Isd (0.05) Control vs Herbicides (1-tail)				14	14	10.6	14
Isd (0.05) Herbicides vs Herbicides (1-tail)				19	19	14	18
CV (%)				14	14	10	14
(*) = Simazine 600 1.7 L/ha, IBS = incorporated by sowing, PSPE = Post-sowing pre-emergent, fb = followed by, and Figures in Red are significantly lower than untreated Control.							