Herbicide tolerance of PBA Jurien: a new narrow leafed lupin variety

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Key messages

PBA Jurien tolerated a range of commonly used lupin herbicides and herbicide mixtures at the recommended rates.

PBA Jurien possesses metribuzin tolerance similar to or better than Coromup.

PBA Jurien registered a low crop safety margin for diuron 1000g/ha, diflufenican 50g + metribuzin 112.5g/ha and diflufenican 50g + metosulam 5g/ha in 2 out of 3 trials.

Aims

PBA Jurien is a new high yielding, early maturing, anthracnose, phomopsis and grey spot resistant variety of narrow leafed lupin, released during 2015. It is suitable for growing in most lupin growing areas of Australia with a significant yield improvement over current varieties in most regions.

Three trials under weed free conditions were conducted to identify herbicide sensitivities of PBA Jurien with the view to reduce its yield losses due to herbicide damage. Coromup was included as a standard variety for comparison in the trials.

Method

A total of three field trials, one each during 2012, 2013 and 2014 were conducted on sandy to sandy loam soil (pH Calcl2 5.9 - 6.2 and OC 0.47 - 1.05%) at Valentine road research annex, Eradu. The trials were laid out in criss-cross design with three replications. PBA Jurien and Coromup were sown in 13 - 20 m long and 1.1 m wide plots at 100 kg/ha seed rate, 3-5 cm deep using knife points followed by press wheels on 8 June, 16 May and 20 May during 2012, 2013 and 2014, respectively. Alosca® group S granular inoculum at 10 kg/ha and Super Mn 100 kg/ha (2012) and Bigphos + Mn 100 kg/ha (2013 and 2014) were applied at seeding. The seed was treated with Rovral® 100 mL and Thiroflo® 150 mL/100 kg seed before trial seeding. The soil moisture content at planting (0-10 cm) was 2.4, 3.7 and 3.5% during 2012, 2013 and 2014 respectively. The moisture content of the trial sites was determined by following the gravimetric method (on dry weight basis).

The herbicide treatments (Table1) were applied in 1.5 m wide strips across the varieties, using a spray rig fitted with air induction nozzles and shields on boom, and calibrated to deliver 80 L/ha water volume. The herbicide treatments were applied on the following dates:

Treatment timing	2012	2013	2014
Before seeding	7 and 8 June	16 May	20 May
2 leaf stage	22 June	31 May	4 June
4 leaf stage	28 June	7 June	12 June
8 leaf stage	12 July	21 June	18 June

The varieties and herbicide treatments were randomised within each replicate. The herbicide plot centre to centre was 1.8 m and there was a 70 cm buffer between any two herbicide treatment plots. Every 5th herbicide plot was kept as an untreated control plot to check the spatial variability. The lupin varieties were evaluated for visual injury at 2-4 weeks after treatment application and again at flowering using a 0 to 100 % scale, where 0= no visible injury and 100 = complete plant death.

The trials were harvested on 31 October, 6 November and 20 October during 2012, 2013 and 2014, respectively. The net plot size ranged from 10 -19 m x 1.1 m. However, to convert plot yield to hectare basis 1.8 m plot width was used. Lupin grain yield data was subjected to REML analysis (spatial) using the Genstat program, and the least significant differences (l.s.d. P = 0.05) was calculated.

The total rainfall from May to October at Eradu was 243, 301 and 257 mm during 2012, 2013 and 2014, respectively. During 2012, 53 mm rain fell within 2 days of seeding and another 12 and 15 mm rain fell within next 5 days. During 2013, 31 mm of rainfall was recorded within 4 weeks of sowing. The highest rainfall events of this period were 10 and 11 mm recorded on the 5 and 6 days after seeding. During 2014, 20 mm rainfall was recorded within 4 weeks of the trial seeding and highest rainfall events in this period were 7, 11 and 12 mm recorded on 3, 22 and 29 days after seeding, respectively.

Crop safety margins: Higher than label rates of the herbicides were included in the trials 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. 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 and on grain yield (Table 1) of lupin varieties was as follows:

PBA Jurien yielded 1.8, 3.4 and 2.6t/ha (untreated control plots), and it was 6, 16 and 11% higher than Coromup grain yield during 2012, 2013 and 2014, respectively.

The pre-emergent herbicides simazine, diuron, and dimethenamid-P (eg Outlook®) at the label rates were tolerated well by both the varieties except that diuron 1000g/ha and dimethenamid-P 720g/ha caused significant yield loss in Coromup during 2014.

The pre-emergent herbicides at higher than the label rates caused visual necrosis (10-15%) across all the varieties and diuron also suppressed biomass of all the varieties by around 15 % during 2012 and 2014. As a result, diuron at the higher rate resulted in significant yield loss in PBA Jurien and Coromup during these years. Simazine at the higher rate caused significant yield loss in PBA Jurien during 2012 and in Caromup both during 2012 and 2014. Dimethenamid-P at the higher than label rate reduced grain yield only of Coromup significantly during 2012 and 2014.

A mix of s-metolachlor 300g + prosulfocarb 2000 g/ha (Boxer® Gold at 2.5 L/ha) as a pre-emergent herbicide is now registered to use on lupins. During 2012, s-metolachlor 300g + prosulfocarb 2000g/ha reduced grain yield of PBA Jurien significantly (5%, marginally significant), whereas it was safe on Coromup.

During 2012, a heavy rainfall event of 53 mm within 2 days of the trial's seeding might have contributed in significant yield loss in lupin varieties from the soil active and/or residual pre-emergent herbicides. The heavy rainfall event might have washed the herbicide treated soil in the seeding furrows and thus increasing herbicide concentration in the furrows.

The post-emergent herbicides like diflufenican and metosulam both alone or in mixture with other herbicides caused visual chlorosis and yellowing, and metribuzin and simazine resulted in necrosis. With the increase in herbicide or herbicide mixes rates, the intensity of these symptoms also increased. Most of these symptoms were out-grown by the time crop reached the flowering stage.

Diflufenican at the maximum label rate (50g/ha) alone and applied mixed with metribuzin at 112.5g/ha was tolerated well by both the varieties in all the trials. However, diflufenican alone and its mix with metribuzin at higher rates had one or two significant negative results out of 3 trials across both the varieties.

Metribuzin alone at the maximum label (112.5g/ha) and higher rate was tolerated well by PBA Jurien across all the trials. However, metribuzin at both the rates caused significant yield loss in Coromup during 2014.

Metosulam at 7.14g/ha, diflufenican 50g + metosulam 5g/ha, diflufenican 50g + simazine 250g/ha and their higher rates caused significant yield loss in PBA Jurien and Coromup at least once in 3 years.

During, 2014, Coromup had very poor vigour during early crop growth stages as compared to PBA Jurien. Coromup's poor plant health could have contributed to its lower tolerance to most of the post-emergent treatments during 2014. During September 2014, Eradu had 82 mm rainfall which improved Coromup plant vigour/growth and podding significantly.

Conclusion

PBA Jurien tolerated simazine, diuron, dimethenamid-P, diflufenican, metribuzin and diflufenican + metribuzin at the label rates, quite well.

PBA Jurien seems to have metribuzin tolerance similar to or better than Coromup.

PBA Jurien registered low crop safety margin for diuron 1000g/ha in 2 out of 3 years of testing and for simazine 1000g/ha during 2012 only. The standard variety Coromup recorded low crop safety margin for diuron and simazine at these rates during both 2012 and 2014.

PBA Jurien also registered low crop safety margin for diflufenican 50g + metribuzin 112.5g/ha and diflufenican 50g + metosulam 5g/ha in 2 out of 3 trials. However, Coromup registered low crop safety margin for these herbicide mixes only in 1 out of 3 trials (during 2014).

The interaction of pre-emergent herbicide with heavy rainfall after crop seeding could cause crop damage, if the herbicides washed into the crop root zone.

Note: Always follow label recommendations. The Department of Agriculture and Food WA, 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

Key words

Narrow leafed lupin, herbicides, tolerance and grain yield.

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Table 1: Effect of herbicides on grain yield (% of untreated control) of narrow leafed lupin varieties at Eradu (2012-14).

Herbicides (Rate a.i./ha)	Timing	PBA Jurien			Coromup		
Years		2012	2013	2014	2012	2013	2014
Untreated Control >>>>Grain yield (kg/ha)		100 1842	100 3379	100 2572	100 1731	100 2827	100 2299
Simazine 1000g (*)	Pre-seeding	97.5	100.6	102.1	100.4	100	95.3
Simazine Higher rate	Pre-seeding	**90.3**	93.6	101.3	**90.7**	93	**92.4**
Diuron 1000g	Pre-seeding	98.6	93.2	98.4	99.0	93	**90.1**
Diuron Higher rate	Pre-seeding	**85.1**	95.7	**90.5**	**81.6**	97	**67.6**
Dimethenamid-P 720g (Outlook®)	Pre-seeding	102.2	100.9	100.4	102.3	102	**94.0**
Dimethenamid-P Higher rate	Pre-seeding	99.0	99.6	100.2	**92.8**	92	**94.8**
S-metolachlor 300g+ prosulfocarb 2000g (Boxer® Gold)	Pre-seeding	**94.9**	**-**	-	100.1	-	-
(*) Diflufenican 100g (Brodal®)	2 leaves	105.6	100.2	101.1	102.8	95	99.2
(*) Diflufenican Higher rate	2 leaves	**91.7**	101.2	97.9	99.6	96	**92.0**
(*) Metribuzin 112.5g (Lexone®)	2 leaves	102.2	100.4	100.7	100.0	93	**93.0**
(*) Metribuzin Higher rate	2 leaves	99.8	99.0	96.0	94.6	105	**85.2**
(*) Diflufenican 50g + metribuzin 112.5g	4 Leaves	104.1	97.4	98.6	110.8	100	96.5
(*) Diflufenican + metribuzin Higher rate	4 Leaves	100.3	**84.8**	**93.0**	93.8	93	**84.6**
(*) Diflufenican 50g + simazine 250g	4 Leaves	103.4	**90.3**	98.8	108.5	98	**88.9**
(*) Diflufenican + simazine Higher rate	4 Leaves	100.3	**92.5**	101.5	99.8	100	**84.7**
(*) Metosulam 7.14g (Eclipse®)	8 Leaves	102.4	**87.2**	97.4	99.9	**88**	**88.2**
(*) Metosulam Higher rate	8 Leaves	97.9	**82.4**	95.9	98.4	**82**	**88.0**
(*) Diflufenican 50g + metosulam 5 g	8 Leaves	102.2	**86.7**	96.1	99.4	93	**89.6**
(*) Diflufenican + metosulam Higher rate	8 Leaves	**93.8**	**88.3**	97.4	98.2	92	**85.7**
lsd (0.05) Control vs Herbicides (1-tail)		4.7	7.4	4.3	7.0	10	4.8
lsd (0.05) Herbicides vs Herbicides (1-tail)		6.1	9.7	5.5	9.2	13	6.2
CV (%)		4.5	7.2	4.1	6.9	9	4.6

(*) indicates simazine 1000g/ha as a basal treatment. − = Not tested. The names in the parenthesis are the herbicide trade names.
Figures in **BOLD** are significantly lower than untreated control.