

### **L3 Lentil Group B Herbicide Tolerance, Yorke Peninsula (Arthurton) and Mid North (Pinery), South Australia**

This report was published in the Yorke Peninsula Alkaline Soils Group trial results book.

#### **Aim**

To identify levels of tolerance to a range of Group B herbicides in lentil cultivars which have been selected from the Pulse Breeding Australia (PBA) program for improved tolerance to Group B herbicides.

#### **Treatments**

- Varieties: Nipper, PBA Herald XT, CIPAL1101, CIPAL1208 and CIPAL1209  
Sowing date: 7 June (Arthurton), 27 May (Pinery)  
Treatments: See Table 1. Twenty one herbicide treatments (Group B; ALS inhibitors) including a range of imidazolinones, sulfonylureas and triazolopyrimides were applied at various application rates in comparison with an untreated control. There were some differences in treatments applied between the two sites.  
Rates of off-label herbicides are experimental rates only, and product identification has been with-held.  
Timing: All herbicides were applied at the 4-5 node stage of crop growth except for imazethapyr which was also applied at the post-sowing pre-emergent (PSPE) stage (Table 1).  
Fertiliser: MAP + Zn @ 90kg/ha (Arthurton); MAP + Zn @ 75kg/ha (Pinery)

#### **Results and Interpretation**

- Plant Mortality - mortality was observed in Nipper at Arthurton in all herbicide treatments except Flumetsulam and Imazethapyr applied PSPE (Table 1). Single rate applications of Imazethapyr and Imi-2 generated lower levels of plant mortality than the other imidazolinone chemistries.

There were fewer incidences of plant mortality in the tolerant lentil lines compared to the intolerant check line Nipper at Arthurton. Imi-4 applied at the x4 rate (4 times experimental rate) was the only imidazolinone treatment to cause significant plant mortality in the herbicide tolerant lines. However the herbicide tolerant lines CIPAL1208 and CIPAL1209 showed no plant mortality from this treatment. CIPAL1208 was the only tolerant line to show significant plant mortality from application of SU-1, which was applied at a rate to simulate carryover residues. Applications of SU-2 caused significant plant mortality in all lines, but lower levels were recorded in PBA Herald XT and CIPAL1101 while Tri-1 led to mortality in all lines except CIPAL1101.

Nipper at Pinery showed high plant mortality from most herbicide chemistries, similarly to Arthurton. The only Group B chemistry which showed no plant mortality in this variety was Flumetsulam. Imazethapyr and Imi-2 were again less damaging than the other imidazolinone chemistries, Imi-3 and Imi-4. The sulfonyl-urea treatment SU-2 was the only treatment to generate plant mortality in PBA Herald XT and CIPAL1101 at Pinery.

Table 1: The effect of various Group B herbicide treatments on plant survival (% of untreated) of selected Group B tolerant lentil lines and PBA Herald XT in comparison with Nipper, Arthurton and Pinery 2012.

Chemical	Rate*	Arthurton					Pinery		
		Nipper	PBA Herald XT	CIPAL11 01	CIPAL12 08	CIPAL12 09	Nipper	PBA Herald XT	CIPAL11 01
Nil (plants/m <sup>2</sup> )		110	112	106	110	108	103	112	114
<i>Triazolopyrimidines</i>									
Flumetsulam 800	25g/ha	92	93	104	90	96	106	97	95
Flumetsulam 800	50g/ha	95	87	103	93	102	109	103	94
Tri-1	x	3	68	90	10	48	83	100	100
<i>Imidazolinones</i>									
Imazethapyr 700	100g/ha	71	96	99	102	101	83	96	92
Imazethapyr 700	200g/ha	10	92	98	100	109	68	97	99
Imazethapyr 700	400g/ha	0	95	99	101	91	13	97	95
Imazethapyr 700	100g/ha PSPE	95	96	104	97	96	-	-	-
Imazethapyr 700	200g/ha PSPE	89	99	104	91	95	-	-	-
Imi-2	x	68	97	97	102	93	92	93	99
Imi-2	x2	10	95	106	97	99	72	105	98
Imi-2	x4	0	92	103	93	100	21	97	93
Imi-3	x	3	98	103	102	101	102	101	97
Imi-3	x2	0	99	97	100	91	7	96	98
Imi-3	x4	0	99	103	95	95	0	106	99
Imi-4	x	4	99	99	101	106	14	97	93
Imi-4	x2	0	96	99	100	98	0	99	95
Imi-4	x4	0	41	40	96	96	0	85	88
<i>Sulfonylureas</i>									
SU-1	Res	24	97	97	49	99	83	96	97
SU-2	x	0	74	74	0	7	3	89	90
SU-3	x	-	-	-	-	-	98	100	103
SU-4	x	-	-	-	-	-	4	91	91

Shaded figures denote significant difference to the corresponding Nil treatment

PSPE = post-sowing pre-emergent. PE = post-emergent (4-5 node stage)

\* x = Off label product and rate – experimental rate only. Res = very low rate simulating soil residuals.

- Grain Yield – Nipper incurred higher yield losses from herbicide treatments than other varieties at Arthurton (Table 2). Nipper showed yield loss from all herbicide chemistries except Flumetsulam, which caused no yield loss in any variety. All other herbicide treatments led to yield loss in Nipper except the single rate of Imi-2, and the single rate of Imazethapyr at both pre and post emergent timings. Imi-3 and Imi-4 were the most damaging imidazolinone chemistries, causing over 90% yield loss at the single rate. Tri-1 and SU-2 treatments also resulted in over 90% yield loss in this trial.

As was observed in the plant mortality findings, Imi-4 applied at the quadruple rate was the only imidazolinone treatment to cause significant yield loss in the tolerant lentil lines, and again this only occurred in PBA Herald XT and CIPAL1101. SU-1, SU-2 and Tri-1 caused yield loss in the tolerant lines CIPAL1208 and CIPAL1209, but caused no yield loss in PBA Herald XT and CIPAL1101.

All herbicide treatments generated high yield losses in Nipper at Pinery in 2012. Flumetsulam caused the lowest yield loss, followed by single rates of Imazethapyr, Imi-2 and SU-3. As at Arthurton, higher plant mortalities in Imi-3 and Imi-4 resulted in higher yield losses in these treatments than in the Imazethapyr and Imi-2 treatments.

A low number of incidences of yield loss were observed in the tolerant lines PBA Herald XT and CIPAL1101 at Pinery, but in all of these cases they were significantly lower than the yield loss caused in Nipper. Imi-4 generated a 24% yield loss in CIPAL1101 while SU-2 and Tri-1 generated yield losses in both varieties.

Table 2: The effect of various Group B herbicide treatments on grain yield (% of untreated) of selected Group B herbicide tolerant lentil lines and PBA Herald XT, in comparison with Nipper, Arthurton and Pinery 2012.

Chemical	Rate*	Arthurton					Pinery		
		Nipper	PBA Herald XT	CIPAL11 01	CIPAL12 08	CIPAL12 09	Nipper	PBA Herald XT	CIPAL11 01
Nil (t/ha)		2.06	1.89	2.23	1.91	2.45	1.25	1.03	1.31
<i>Triazolopyrimidines</i>									
Flumetsulam 800	25g/ha	108	111	101	105	101	79	104	98
Flumetsulam 800	50g/ha	102	95	92	99	102	65	85	94
Tri-1	x	9	93	97	13	55	22	76	71
<i>Imidazolinones</i>									
Imazethapyr 700	100g/ha	94	105	102	119	117	54	112	110
Imazethapyr 700	200g/ha	19	108	114	117	105	30	105	105
Imazethapyr 700	400g/ha	2	105	111	118	112	6	107	110
Imazethapyr 700	100g/ha PSPE	94	111	97	112	108	-	-	-
Imazethapyr 700	200g/ha PSPE	56	104	96	111	98	-	-	-
Imi-2	x	95	98	109	114	101	57	110	99
Imi-2	x2	24	127	115	108	112	26	104	98
Imi-2	x4	0	109	102	118	104	7	90	94
Imi-3	x	5	95	108	124	113	32	104	99
Imi-3	x2	0	111	122	130	103	2	112	96
Imi-3	x4	0	125	110	122	104	1	104	95
Imi-4	x	1	122	105	113	109	4	98	95
Imi-4	x2	0	136	104	118	106	2	88	90
Imi-4	x4	0	44	52	117	105	1	81	76
<i>Sulfonylureas</i>									
SU-1	Res	44	100	104	69	83	38	103	101
SU-2	x	2	95	91	2	12	2	78	88
SU-3	x	-	-	-	-	-	57	105	103
SU-4	x	-	-	-	-	-	2	96	91

Shaded figures denote significant difference to the corresponding Nil treatment

PSPE = post-sowing pre-emergent. PE = post-emergent (4-5 node stage)

\* x = Off label product and rate – experimental rate only. Res = very low rate simulating soil residuals.

### Key Findings and Comments

- A high level of crop safety exists in PBA Herald XT to both post-sowing pre-emergent (PSPE) and post-emergent (PE) applications of imazethapyr. This high level of crop safety was shown to most but not all of the group B herbicides (e.g. Imi-4).
- Nipper showed up to 100% yield loss in some treatments where tolerant lines showed no yield loss. Nipper incurred yield losses from all herbicide treatments at Pinery but not all at Arthurton. Flumetsulam and single rates of Imazethapyr and Imi-2 were less damaging at Arthurton, but other treatments generally caused similar yield losses between the two sites.

These differences are probably due to increased recovery at Arthurton due to the more favourable conditions at this site, eg longer growing season and heavier soil.

- All tolerant lines, PBA Herald XT, CIPAL1101, CIPAL1208 and CIPAL1209, showed improved tolerance to the range of group B herbicides compared to Nipper. However some variability in tolerance between these lines to the different herbicide families within the Group B herbicides trialled was identified. Tolerant lines showed no yield loss from all imidazolinone chemistries in this trial at both sites except for PBA Herald XT and CIPAL1101 at the highest rate of Imi-4. PBA Herald XT and CIPAL1101 showed no yield loss to the varying rates of sulfonyl-urea and the Tri-1 chemistries at Arthurton, demonstrating better tolerance to sulfonylurea chemistries than Nipper and the imazethapyr tolerant lines CIPAL1208 and CIPAL1209. However they did incur yield loss from SU-2 and Tri-1 at Pinery indicating low safety margins with these products. Plant survival measurements showed that plant mortality was higher at Arthurton than Pinery, indicating again that recovery from damage may be better under more favourable growing conditions.
- Yield losses were closely associated with plant mortality levels, where treatments with high plant mortality also generated high yield loss. However in some treatments (eg Imazethapyr PSPE x2 at Arthurton, and Imi-2 and Imi-3 at Pinery) showed no significant plant mortality but incurred a significant yield loss of up to 50%. Biomass cuts (data not shown) showed significant reductions in biomass of Nipper from these treatments, therefore yield loss caused by this treatment is likely due to the inability to recover from the severe biomass reduction due to the dry season finish, and the effect of delayed flowering. This effect, where a herbicide causes yield loss without causing mortality, has been previously observed with high rates of Flumetsulam or Metribuzin in trials and broadacre crops.
- While a range of Group B chemistries may appear safe for post-emergent use on particular herbicide tolerant varieties in this research the current permitted herbicide is Spinnaker on PBA HeraldXT and PBA Hurricane XT (CIPAL1101) only. Future agronomic research in conjunction with Pulse Breeding Australia may be able to develop lines with improved levels of herbicide tolerance to other Group B chemistries.