

L9 Herbicide Tolerance, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of new herbicide tolerant lentil varieties to a range of Group B herbicides.

Treatments

- Varieties: PBA HeraldXT, CIPAL1101, CIPAL1208, CIPAL1209 (all tolerant), PBA Flash (Control, Intolerant).
- Herbicides: Nineteen herbicide treatments (Group B; ALS inhibitors) encompassing a range of imidazolinones, triazolopyrimidines and sulfonylureas were applied at various application rates in comparison with an untreated control (Table L11.1).

Other Details

- Sowing date: 4 May.
- Row Spacings/Stubble: 30 cm row spacing, inter-row, standing stubble (ST30).
- Fertiliser: MAP + Zn @ 40 kg/ha at sowing.
- Plant Density: 120 plants/m².
- Soil Type: Alkaline Sandy Loam over a heavy clay at about 40-60cm (pH_{H2O} (0-10cm): 7.8; pH_{H2O} (40-60cm): 9.1)

Results and Interpretation

- Key Message: PBA HeraldXT and CIPAL1101 have good tolerance to imidazolinone chemicals, but may not be as tolerant to Imi-3 as the lines CIPAL1208 and CIPAL1209. Conversely, PBA HeraldXT and CIPAL1101 have improved tolerance to the Sulfonylurea herbicides relative to the control and CIPAL 1208 and CIPAL 1209, indicating potential benefits where residues may be an issue in cropping systems.
- Herbicide Damage - Visual herbicide damage symptoms were observed for all treatments applied to the intolerant genotype PBA Flash (Table 1). Varying levels of damage were observed among the four tolerant lines. CIPAL1101 showed no significant damage symptoms from all imidazolinone herbicide treatments except 'imi-3' applied at the highest rate. It also showed no damage from flumetsulam 800 within the Triazolopyrimidine group and SU-3 within the Sulfonylurea group. PBAHerdXT, which is a sister line with similar genetic background, but less vigour, showed similar trends, however it also showed slightly great symptoms for imi-3 applied at the x2 rate and SU-3 (Table 1). The line CIPAL1208 appeared to have slight significant damage from imazethapyr and Imi-4 at the highest rates, while the line CIPAL1209 was damaged by Imi-2 at the highest rates. In addition CIPAL1209 showed significant damage from flumetsulam 800 at the highest rate and was completely killed by most Sulfylurea treatments. Both of the lines, CIPAL1208 and CIPAL1209, were significantly more damaged by the Sulfonylurea treatments than CIPAL1101 and PBA HeraldXT (Table 1).

Table 1. The effect of various Group B herbicide treatments on visual damage score (1 – no damage, 9 – complete plant death) recorded August 22 of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Curyo, 2012. Significant damage scores have been shaded.

Chemical ¹	Rate	CIPAL1101	CIPAL1208	CIPAL1209	PBA Flash	PBA HeraldXT
Nil		1.0	1.0	1.0	1.0	1.0
<i>Imidazolinones</i>						
Imazethapyr 700	100g/ha	1.0	1.0	1.3	7.0	1.0
Imazethapyr 700	200g/ha	1.0	1.0	1.0	7.0	1.3
Imazethapyr 700	400g/ha	1.0	2.0	1.7	8.7	1.0
Imi-2	x1	1.0	1.0	1.0	8.0	1.0
Imi-2	x2	1.0	1.3	1.3	7.3	1.3
Imi-2	x4	1.0	1.7	2.3	8.7	1.3
Imi-3	x1	1.0	1.3	1.0	9.0	1.0
Imi-3	x2	1.0	1.7	1.0	9.0	2.7
Imi-3	x4	4.3	1.3	1.3	9.0	4.0
Imi-4	x1	1.0	1.3	1.3	9.0	1.3
Imi-4	x2	1.0	1.3	1.0	9.0	1.3
Imi-4	x4	1.0	2.3	1.7	9.0	1.7
<i>Triazolopyrimidines</i>						
Flumetsulam 800	25g/ha	1.0	1.7	1.0	2.3	1.0
Flumetsulam 800	50g/ha	1.0	3.0	1.3	4.3	1.0
Tri-1	x1	6.7	9.0	8.0	8.7	6.7
<i>Sulfonylureas</i>						
SU-1	x1	8.0	9.0	9.0	9.0	8.7
SU-2	x1	6.7	9.0	9.0	9.0	7.0
SU-3	x1	1.7	7.3	6.0	8.0	3.3
SU-4	x1	7.3	9.0	9.0	9.0	8.0

1. Herbicide active ingredient or code for unregistered products.

- Biomass - Similar to visual damage symptoms biomass production varied among the genotypes that were compared in this trial (Table 2). For the intolerant genotype PBA Flash, all herbicide treatments, including that which is registered (Flumetsulam 800 applied at 25g/ha), caused significant reduction in biomass, with many treatments resulting in death. Within the tolerant lines, only minor significant reductions in yield in the imidazolinone chemical group were recorded for CIPAL1208 at the highest rate of Imazethapyr and the mid and low rate of Imi-2 and Imi-4 for PBA HeraldXT, respectively. CIPAL1208 showed significant biomass decline with the application of Flumetsulam, while no other lines were affected. Within the Sulfoylureas the only unaffected treatment was SU-3 applied to PBA HeraldXT and CIPAL1101.

Table 2. The effect of various Group B herbicide treatments on biomass production (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Curyo, 2012. Significant yield loss has been shaded

Chemical ¹	Rate	CIPAL1101	CIPAL1208	CIPAL1209	PBA Flash	PBA HeraldXT
Nil		5.37	5.36	5.08	4.92	5.28
<i>Imidazolinones</i>						
Imazethapyr 700	100g/ha	5.42	4.58	4.85	2.07	4.71
Imazethapyr 700	200g/ha	5.37	4.49	4.39	0.95	4.58
Imazethapyr 700	400g/ha	5.10	4.26	4.89	0.50	5.33
Imi-2	x1	5.70	4.63	4.80	1.25	5.04
Imi-2	x2	4.40	4.75	4.73	2.33	3.90
Imi-2	x4	4.99	5.41	5.12	0.29	5.11
Imi-3	x1	4.77	4.56	5.42	0.20	4.76
Imi-3	x2	4.50	5.16	5.60	0.00	5.03
Imi-3	x4	4.45	4.46	4.35	0.00	4.33
Imi-4	x1	5.14	4.49	4.88	0.47	4.03
Imi-4	x2	5.59	4.62	5.20	0.08	4.66
Imi-4	x4	4.56	4.83	5.20	0.00	4.55
<i>Triazolopyrimidines</i>						
Flumetsulam 800	25g/ha	5.23	3.87	4.82	3.18	4.49
Flumetsulam 800	50g/ha	4.50	1.93	4.19	1.87	5.25
Tri-1	x1	4.55	1.46	3.26	2.11	3.33
<i>Sulfonylureas</i>						
SU-1	x1	1.93	0.00	0.54	0.00	1.58
SU-2	x1	3.79	0.00	0.18	0.00	3.56
SU-3	x1	5.11	3.77	4.10	2.80	4.84
SU-4	x1	2.20	0.00	0.56	0.00	2.08

1. Herbicide active ingredient or code for unregistered products.

- Grain Yield - Similar to visual damage symptoms and biomass production, grain yields varied among the genotypes that were compared in this trial (Table 2). For the intolerant genotype PBA Flash, all herbicide treatments, including that which is registered (Flumetsulam 800 applied at 25g/ha), caused significant yield loss, with many treatments resulting in death. Within the tolerant lines, only imi-3 and imi-4 at the highest rates caused significant yield loss in the lines, CIPAL1101 and CIPAL1208, respectively within the imidizolinone chemical group. CIPAL1208 showed significant yield loss with the application of Flumetsulam, while no other lines were affected. Within the Sulfoylureas the only unaffected treatment was SU-3 applied to PBA HeraldXT and CIPAL1101.

Table 3. The effect of various Group B herbicide treatments on grain yield (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Curyo, 2012. Significant yield loss has been shaded

Chemical ¹	Rate	CIPAL1101	CIPAL1208	CIPAL1209	PBA Flash	PBA HeraldXT
Nil		2.40	1.99	2.19	2.52	1.78
<u>Imidazolinones</u>						
Imazethapyr 700	100g/ha	2.07	1.93	2.10	0.80	1.81
Imazethapyr 700	200g/ha	2.31	1.69	2.16	0.00	1.69
Imazethapyr 700	400g/ha	2.10	1.81	2.22	0.00	1.57
Imi-2	x1	2.46	1.81	1.90	0.00	1.84
Imi-2	x2	2.07	1.96	2.13	0.74	1.57
Imi-2	x4	2.19	1.84	2.19	0.00	1.78
Imi-3	x1	2.25	1.90	2.31	0.00	1.69
Imi-3	x2	2.34	1.78	2.04	0.00	1.66
Imi-3	x4	1.48	1.87	2.28	0.00	1.42
Imi-4	x1	2.37	1.87	2.16	0.00	1.51
Imi-4	x2	2.13	1.93	2.28	0.00	1.87
Imi-4	x4	2.25	1.54	2.25	0.00	1.69
<u>Triazolopyrimidines</u>						
Flumetsulam 800	25g/ha	2.40	1.48	2.02	1.33	1.81
Flumetsulam 800	50g/ha	2.34	0.86	1.99	0.89	1.84
Tri-1	x1	1.99	0.42	1.51	0.83	1.69
<u>Sulfonylureas</u>						
SU-1	x1	0.65	0.00	0.00	0.00	0.33
SU-2	x1	1.27	0.00	0.00	0.00	1.24
SU-3	x1	2.04	1.69	1.63	1.07	1.63
SU-4	x1	0.92	0.00	0.00	0.00	0.42

1. Herbicide active ingredient or code for unregistered products.

- Grain Weight and Germination – Within the tolerant lines there were no major impacts of the various herbicide treatments on grain weight or germinability of that grain (data not shown).

Key Findings and Comments

This data highlights the importance of testing across a range of chemicals within a herbicide group and not assuming that tolerance will be consistent within a herbicide group. This data highlighted that PBA HeraldXT has good tolerance to imidazolinone chemicals, but may not be as tolerant to Imi-3 as the lines CIPAL1208 and CIPAL1209. Combining lines like CIPAL1101 and CIPAL1209 could lead to new genotypes with tolerance to the full range of imidazolinone chemicals. Pulse Breeding Australia will be utilising this information to define future breeding directions for herbicide tolerant varieties, following PBA HeraldXT.

The ongoing introduction and improvement of these herbicide tolerant lentils could result in significant farming system benefits through improved weed control, increased control options in lentil crops and in the previous rotation phase, and decreased pressure on herbicides currently employed for broadleaf weed control in lentil. However, we need to continuously monitor weed resistance levels and discuss defining the optimum methods for maximising the benefits of this herbicide tolerance technology for the whole farming system.