L7 Herbicide Tolerance (Gp B), MRZ Mid North (Pinery), South Australia

Aim

To characterize the Sulfonylureas and Group B tolerance in elite breeding lines of Group B tolerant lentils

Treatments

Two commercial lentil varieties; PBA Jumbo 2 (conventional) and PBA Hurricane XT (mutation event at AHAS 197) and four advanced breeding lines; CIPAL1422, CIPAL1521, CIPAL1522 and CIPAL1621 were tested in the tolerance trial.

Table 1 presents the list of experimental Group B herbicides used in the trial.

Table 1: Experimental Group B herbicides, simulated and in-crop, application timings and rates in a lentil herbicide tolerance trial at Pinery SA, 2016.

Group B herbicides	Chemical	Application timing	Application rate (gai/ha)
	Nil	Nil	-
Sulfonylurea	SU-1	Simulated residuals	R1
	SU-1	Simulated residuals	R2
Imidazolinone	Imi-2	Post emergent (4 to 5 leaf)	R1
	Imi-2	Post emergent (4 to 5 leaf)	R2
	Imazethapyr	Post emergent (4 to 5 leaf)	70
	Imazethapyr	Post emergent (4 to 5 leaf)	R2
Sulfonamide	Flumetsulam	Post emergent (4 to 5 leaf)	20
	Flumetsulam	Post emergent (4 to 5 leaf)	R2

***Some of the herbicide treatments in this research contain unregistered herbicide, application rates and timings and were undertaken for experimental purposes only. The results within this document do not constitute a recommendation for that particular use by the author or author's organization.*

Table 2: Site details

	Trial site
	Pinery
Sowing date	21 May (Early); 31 May (Late)
Soil type	Sandy loam/limestone clay
Inoculant	Nil
Seed dressing	P-Pickel T (200 ml/100 kg seed)
Row spacing	22.5 cm
Plot size	10 m x 1.75 m
Plant density	120 plants/m^2
Fertiliser	MAP + Zn (2%) @ 90 kg/ha at sowing
Foliar fungicides	Early vegetative growth (8 weeks after sowing) – Chlorothalonil @ 2 L/ha Canopy closure-Carbendazim @500 ml/ha & Chlorothalonil @ 2L/ha Mid flowering to Early podding - Carbendazim @500 ml/ha & Chlorothalonil @ 2L/ha

Results and discussion

- Good rainfall conditions immediately post sowing provided favourable conditions for good herbicide incorporation in the soil and plant uptake providing maximum herbicide damage expression from treatment application.
- Plant damage was assessed visually, 2 weeks after treatment application (WAT) (Data not presented) and again at commencement of flowering. The most symptomatic expression from herbicide damage was chlorosis (crop yellowing) on leaf foliage. The damage was scored on a 0 to 100 % scale (0 - no visible chlorosis on the leaf foliage, 50 – half plant showing chlorotic symptoms and 100 % - complete chlorotic). Herbicide damage >15 % was considered to be agronomically unacceptable. Notably, the damage observed across all the varieties was up to 10 %.
- A significant (*P<0.001*) treatment by variety interaction was found for plant herbicide damage assessed at commencement of flowering which indicated a genotypic variation in the level of herbicide damage however this was dependent on chemistry.

- A large genetic variation in herbicide tolerance was observed between PBA Jumbo 2 and the advanced breeding lines as well as PBA Hurricane XT where the latter generally showed similarities in reduced but variable levels of sensitivity to most of the Group B chemistries compared with PBA Jumbo 2 which showed more crop yellowing from the application of all the Group B chemistries tested when compared to their respective Nil treatments (Table 3).
- Application of SU chemistry, SU-1 at low rates did not cause any visual damage in PBA Hurricane XT and the advanced breeding lines, high rates of this chemistry however caused low (20%) but significant sensitivities in three of the advanced breeding lines (CIPAL1422, CIPAL1521, and CIPAL1621) but not in PBA Hurricane XT and CIPAL1522. The two application rates of this chemistry caused more yellowing (9 %) in PBA Jumbo 2 (Table 3).
- All the lentil varieties/lines showed sensitivities with visual damage effects of yellowing (up to 10%) from the application of high rates of Imidazolinone chemistry, Imi-2.
- PBA Hurricane XT and two advanced breeding lines CIPAL1422 and CIPAL1522 were unaffected by the application of Imidazolinone chemistries, Imi-2 (low rate) and Imazethapyr (low and high rate) applied at 4 to 5 leaf growth stage. Advanced breeding lines CIPAL1521 and CIPAL1621 however showed low but significant visual yellowing from application of Imazethapyr (high rates) and Imi-2 (low rates) respectively when applied at a similar growth stage.
- Sulfonamide chemistry applied at 4 to 5 leaf stage, had no effect on CIPAL1422, CIPAL1521, CIPAL1522, CIPAL1621 (low rate) and commercial variety PBA Hurricane XT but not on PBA Jumbo 2 and CIPAL1621 (high rate) where more crop yellowing was observed.
- Compared to the other variety/lines, PBA Jumbo 2 had the highest yield penalty of between 17 and 97 %, as a result of herbicide damage effects from the application of Group B chemistries compared to their respective Nil treatments. This is indicative of lack of tolerance to this chemistry and as such plant back periods will require to be adhered to and in-crop Group B weed control is unsuitable for this variety.
- SU chemistry, SU-1 (high rates) resulted in yield penalty of at least 15 % on CIPAL1521, CIPAL1621 and PBA Hurricane XT. The yield penalty from this chemistry was higher in CIPAL1422 at the two application rates (Table 4).
- Application of high rates of Imi-2 caused on average a 20 % yield penalty on PBA Hurricane XT and all the advanced breeding lines apart from CIPAL1522 whose yield remained unaffected from application of all Group B chemistries tested.

Table 3: Visual herbicide damage (% chlorosis) at commencement of flowering of lentil varieties/lines applied with selected Group B herbicides either as simulated residuals and post emergence at Pinery, South Australia, 2016.

		Chlorosis (% crop yellowing) at commencement of flowering					
Group B Herbicides	**Active Chemical & Application rate**	**CIPAL1422**	**CIPAL1521**	**CIPAL1522**	**CIPAL1621**	**PBA Hurricane XT**	**PBA Jumbo 2**
	Nil	0	0	0	0	0	0
Sulfonylurea	SU-1_R1	0	0	0	10	0	90
	SU-1_R2	20	20	0	20	10	90
Imidazolinone	Imi-2_R1	0	10	0	20	0	90
	Imi-2_R2	80	80	80	80	80	100
	Imazethapyr_70	0	10	0	10	0	80
	Imazethapyr_R2	10	20	0	10	10	90
Sulfonamide	Flumetsulam_20	10	0	0	10	0	50
	Flumetsulam_R2	20	20	10	40	20	70
	LSD (P =0.05)			**13**			

Table 4: Grain yield (t/ha) of lentil varieties/lines applied with selected Group B herbicides either as simulated residuals and post emergence at Pinery, South Australia, 2016.

		Grain yield (t/ha)

Group B Herbicides	Active Chemical & Application rate (gai/ha)	CIPAL1422	CIPAL1521	CIPAL1522	CIPAL1621	PBA Hurricane XT	PBA Jumbo 2
	Nil	3.71	4.00	3.28	3.63	3.66	4.39
Sulfonylurea	SU-1_R1	3.20	3.66	3.36	3.76	3.63	0.35
	SU-1_R2	2.62	3.34	2.91	3.11	3.09	0.10
Imidazolinone	Imi-2_R1	3.70	3.74	3.20	3.49	3.88	1.65
	Imi-2_R2	3.00	3.19	3.15	2.9	3.01	0.11
	Imazethapyr_70	3.41	3.90	3.45	3.93	3.85	3.09
	Imazethapyr_R2	3.33	3.55	3.55	3.62	3.8	1.32
Sulfonamide	Flumetsulam_20	3.59	3.71	3.41	3.66	3.65	3.61
	Flumetsulam_R2	3.71	3.88	3.51	3.52	3.63	2.25
	LSD (P =0.05)			**0.42**			

Conclusion

- Genetic similarities were observed between all the elite breeding lines and PBA Hurricane XT which showed reduced, albeit variable levels of herbicide damage from application of Group B chemistry compared with PBA Jumbo 2 which showed significant damage than the respective Nil treatments.
- PBA Jumbo 2 had significant visual damage (mainly chlorosis) from the application of all Group B chemistries, including Sulfonamide product (Flumetsulam) applied at label rates.
- PBA Jumbo 2 suffered a significant reduction in grain yield from the application of Group B chemistries compared the Nil treatment indicating the high level of sensitivities to this chemistries.
- Grain yield of elite breeding lines and PBA Hurricane XT was generally similar to their respective Nil treatments, although application of some chemistries, caused a significant yield reduction.
- Application of Sulfonylurea chemistry, SU-1 (high rate) as a simulated residual caused a yield penalty in two elite lines CIPAL1521, CIPAL1621 and PBA Hurricane XT. Sound agronomic principles of adherence to plant back periods and careful planning of crop rotations will be required in managing these lines and variety.
- Post emergence application of Imi-2 at high rate also led to a significant yield loss in PBA Hurricane XT and all elite breeding lines apart from CIPAL1522 which was not affected by application of Group B chemistries. This is indicative of genetic variation between CIPAL1522 and other lines/variety and this trait may be important for in-crop broadleaf weed control using this chemistry.
- The improved tolerance to Group B herbicide chemistries in elite breeding lines similar to PBA Hurricane XT could allow for more alternative in-crop weed control options to be developed in lentils. This will also lessen the overreliance of one variety, PBA Hurricane XT which is currently the only variety with improved herbicide tolerance trait for in-crop broadleaf weed control.
- Generally, grain yields of some elite breeding lines were comparable with those of PBA Jumbo 2 in the absence of herbicide, indicating improved agronomic traits of high yielding potential.
- Further agronomic evaluation of the elite breeding lines alongside commercial varieties will continue over the coming seasons to characterize tolerance levels to other groups of herbicide chemistries across seasons and soil types.