Faba Bean, Herbicide Tolerance (Group B & C), MRZ Wimmera (Horsham), Victoria
Faba Bean, Herbicide Tolerance (Group B & C), HRZ Southern Wimmera (Gymbowen), Victoria

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Aim
To evaluate the response of the new 'imi' tolerant varieties, to novel herbicide strategies involving Group B and C herbicide products.

Treatments

Varieties:	Horsham: PBA Amberley, PBA Bendoc (imidazoline tolerant) Gymbowen: PBA Samira, PBA Bendoc (imidazoline tolerant)
Herbicide Treatments:	Two products were used 'imazamox & imazapyr' (Group B) and 'GpC' (Group C). They were applied at either individually, in sequence or combined at two application timings 'Post Sowing, Pre-emergent' (PSPE) and 4 Node crop growth stage (4N). *Note: The combination treatment was applied at half rates due to a mixing calculation error.* See Table 1 in results for details.

***Some of the herbicide treatments in this research contain unregistered herbicides, 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.*

Other Site Details

	Horsham	Gymbowen
Sowing date	14 May	30 April
Planting density (pl/m^2)	20	20
Stubble height (cm)	Standing (20)	Standing (30)
Row spacing (cm)	36	25.4
Fertiliser (kg/ha)[1]	80	100

[1]MAP (9.2, 20.2, 0, 2.7) + Zn (2.5)

Results and Interpretation

- Key Messages**:** PBA Bendoc, PBA Amberley and PBA Samira showed similar relative tolerance to GpC in terms of crop damage, but slightly higher biomass reduction in PBA Bendoc, could indicate greater sensitivity. PBA Bendoc showed excellent tolerance to 'imazamox & imazapyr', even with GpC applied PSPE. Results also highlighted the base level tolerance that many conventional faba bean varieties have against imidazolinone products with PBA Amberley and PBA Samira showing almost no damage with the PSPE application of 'imazamox & imazapyr'.

- Establishment, Plant Growth and Herbicide Damage: Crop establishment was excellent at both sites, averaging 20 plants/m^2 (data not shown), due good soil moisture and rainfall following sowing. Similar to lentils, initial crop damage symptoms from the PSPE application of herbicide treatments was slow to develop, with few symptoms noted at the 3N crop growth stage. Following application of the 4N treatments and significant rainfall during July, a high level of damage was observed. Herbicide damage scores recorded earlier and later in crop growth showed similar trends (Tables 1 and 2). Both varieties showed significant damage from treatments with GpC applied 4N (leaf blackening and necrosis), but not when applied PSPE. PBA Bendoc showed no damage from 'imazamox & imazapyr' applied PSPE or 4N, when the conventional varieties, PBA Amberley and PBA Samira showed significant damage when applied 4N, but not PSPE. These results indicate similarity in relative tolerance to GpC in these varieties and continue to demonstrate the tolerance of PBA Bendoc to 'imazamox & imazapyr'. It also highlights the base level tolerance that many faba bean varieties have against imidazolinone products with PBA Amberley and PBA Samira showing almost no damage with the PSPE application of 'imazamox & imazapyr'.

Table 1. Visual herbicide damage scores (0 – no damage, 100 – complete plant death) in response to application of 'imazamox & imazapyr' and 'GpC' post sowing pre-emergent and or 4N and individually, in sequence or in combination, recorded A. July 19 (90 days after application (DOA) of the PSPE treatments and 30 DOA of the 4N treatments) and B. October 8 (161 DOA PSPE & 101 DOA 4N) on PBA Amberley and PBA Bendoc at Horsham, Victoria in 2019. *Significant differences from the untreated control within each variety are highlighted.*

A. July 30

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Amberley	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	6	1	*4*
Imazamox & Imazapyr	24.75 & 11.25	4N	66	1	*34*
GpC	X1	PSPE	2	0	*1*
GpC	X1	4N	50	50	*50*
Nil			0	0	*0*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	3	0	*2*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	80	22	*51*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	60	53	*57*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	67	3	*35*
Ave			*37*	*15*	*26*
LSD $_{Herb}$ (P<0.05)				*7*	
LSD $_{Var}$ (P<0.05)				*2*	
LSD $_{Herb*Var}$ (P<0.05)				*8*	

B. August 29

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Amberley	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	3	1	*2*
Imazamox & Imazapyr	24.75 & 11.25	4N	93	1	*47*
GpC	X1	PSPE	0	0	*0*
GpC	X1	4N	53	57	*55*
Nil			0	0	*0*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	2	0	*1*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	82	17	*49*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	67	63	*65*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	93	0	*47*
Ave			*44*	*15*	*30*
LSD $_{Herb}$ (P<0.05)				*6*	
LSD $_{Var}$ (P<0.05)				*3*	
LSD $_{Herb*Var}$ (P<0.05)				*8*	

Table 2. Visual herbicide damage scores (0 – no damage, 100 – complete plant death) in response to application of 'imazamox & imazapyr' and 'GpC' post sowing pre-emergent and or 4N and individually, in sequence or in combination, recorded A. July 19 (90 days after application (DOA) of the PSPE treatments 30 DOA of the 4N treatments) and B. October 8 (161 DOA PSPE & 101 DOA 4N) on PBA Samira and PBA Bendoc at Gymbowen, Victoria in 2019. *Significant differences from the untreated control withing each variety are highlighted.*

A. July 19

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Samira	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	3	0	*4*
Imazamox & Imazapyr	24.75 & 11.25	4N	73	0	*34*
GpC	X1	PSPE	3	3	*1*
GpC	X1	4N	28	30	*50*
Nil			0	0	*0*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	0	1	*2*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	73	25	*51*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	35	34	*57*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	71	4	*35*
Ave			*32*	*11*	*26*
LSD $_{Herb}$ (P<0.05)				*8*	
LSD $_{Var}$ (P<0.05)				*4*	
LSD $_{Herb*Var}$ (P<0.05)				*9*	

B. October 8

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Samira	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	0	0	*0*
Imazamox & Imazapyr	24.75 & 11.25	4N	70	0	*35*
GpC	X1	PSPE	0	1	*1*
GpC	X1	4N	18	28	*23*
Nil			0	0	*0*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	0	3	*1*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	45	13	*29*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	23	23	*23*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	83	3	*43*
Ave			*26*	*8*	*17*
LSD $_{Herb}$ (P<0.05)				*6*	
LSD $_{Var}$ (P<0.05)				*3*	
LSD $_{Herb*Var}$ (P<0.05)				*8*	

- Biomass: At flowering and maturity, biomass generally correlated with herbicide damage. At both sites, only the treatments with GpC applied 4N significantly reduced biomass (20-40%) in PBA Bendoc at flowering and maturity (Table 3 and 4). Both the 'imazamox & imazapyr' PSPE and 4N and GpC PSPE treatments had no effect. In PBA Amberley at Horsham and PBA Samira at Gymbowen, responses were more variable. At flowering, for both PBA Amberley at Horsham and PBA Samira at Gymbowen treatments with 'imazamox & imazapyr' at 4N resulted in biomass reductions of 65-90%. In comparison, GpC applied 4N reduced biomass by 35-50%. At maturity, trends were relatively similar to those observed at flowering with 'imazamox & imazapyr' at 4N resulting in biomass reductions of 35-70%. In comparison, GpC applied 4N had recovered sufficiently to show no significant difference to the untreated plots.

- Grain Yield: Grain yield showed a slightly different trend to biomass. At Horsham, PBA Bendoc and PBA Amberley both showed significant grain yield loss in all treatments where GpC had been applied 4N, in addition to the sequential treatment of GpC PSPE followed by with 'imazamox & imazapyr' at 4N. Although 'imazamox & imazapyr', did not result in a significant grain yield loss in PBA Amberley, its relatively yield loss compared with PBA Bendoc was much greater. At Gymbowen, the only treatment to cause grain yield loss (15%) in PBA Bendoc was the sequential treatment with 'imazamox & imazapyr' PSPE followed by GpC at 4N. In contrast, grain yields were reduced in PBA Samira by more than 50% when 'imazamox & imazapyr' was applied 4N and by 20% when it was applied at half the rate in combination with GpC at 4N. There were no yield significant yield losses from PSPE application of herbicides.

  These results highlight the importance of developing improved group C herbicide tolerance and combining with the 'imidazolinone' tolerance of varieties like PBA Bendoc. The traits combined will provide a more complete herbicide management package for lentils into the future. The results also highlighted the base level tolerance that many conventional faba bean varieties have for imidazolinone products with PBA Amberley and PBA Samira showing almost no damage with the PSPE application of 'imazamox & imazapyr'.

Table 3. Biomass (t/ha) at A. flowering and B. maturity of PBA Amberley and PBA Bendoc in response to application of 'imazamox & imazapyr' and 'GpC' post sowing pre-emergent and or 4N and individually, in sequence or in combination, at Horsham, Victoria in 2019. *Significant differences from the untreated control withing each variety are highlighted.*

A. Flowering

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Amberley	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	1.60	2.71	*2.16*
Imazamox & Imazapyr	24.75 & 11.25	4N	0.24	2.61	*1.43*
GpC	X1	PSPE	2.12	2.58	*2.35*
GpC	X1	4N	1.10	1.22	*1.16*
Nil			2.07	1.71	*1.89*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	1.84	2.34	*2.09*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	0.74	1.26	*1.00*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	0.76	0.95	*0.86*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	0.41	1.88	*1.15*
Ave			*1.21*	*1.92*	*1.56*
LSD $_{Herb}$ (P<0.05)				*0.63*	
LSD $_{Var}$ (P<0.05)				*0.23*	
LSD $_{Herb*Var}$ (P<0.05)				*0.77*	

B. Maturity

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Amberley	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	6.60	11.95	*9.28*
Imazamox & Imazapyr	24.75 & 11.25	4N	6.66	11.00	*8.83*
GpC	X1	PSPE	8.85	7.05	*7.95*
GpC	X1	4N	7.88	6.54	*7.21*
Nil			9.83	10.07	*9.95*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	10.31	8.62	*9.47*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	5.61	7.30	*6.46*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	6.53	5.91	*6.22*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	3.38	7.76	*5.57*
Ave			*7.29*	*8.47*	*7.88*
LSD $_{Herb}$ (P<0.05)				*1.67*	
LSD $_{Var}$ (P<0.05)				*1.10*	
LSD $_{Herb*Var}$ (P<0.05)				*2.75*	

Table 4. Biomass (t/ha) at A. flowering and B. maturity of PBA Samira and PBA Bendoc in response to application of 'imazamox & imazapyr' and 'GpC' post sowing pre-emergent and or 4N and individually, in sequence or in combination, at Gymbowen, Victoria in 2019. *Significant differences from the untreated control withing each variety are highlighted.*

A. Flowering

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Samira	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	3.64	3.14	*3.39*
Imazamox & Imazapyr	24.75 & 11.25	4N	0.69	3.58	*2.14*
GpC	X1	PSPE	3.85	4.17	*4.01*
GpC	X1	4N	2.16	2.03	*2.10*
Nil			3.30	3.61	*3.46*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	3.09	3.62	*3.36*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	0.96	2.68	*1.82*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	1.86	2.30	*2.08*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	0.63	4.93	*2.78*
Ave			*2.24*	*3.34*	*2.79*
LSD $_{Herb}$ (P<0.05)				*0.77*	
LSD $_{Var}$ (P<0.05)				*0.35*	
LSD $_{Herb*Var}$ (P<0.05)				*1.05*	

B. Maturity

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Samira	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	13.07	12.73	*12.90*
Imazamox & Imazapyr	24.75 & 11.25	4N	5.14	12.86	*9.00*
GpC	X1	PSPE	12.20	14.76	*13.48*
GpC	X1	4N	11.82	10.37	*11.10*
Nil			13.30	13.33	*13.32*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	13.67	13.07	*13.37*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	9.04	10.78	*9.91*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	10.80	10.83	*10.82*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	3.94	13.71	*8.83*
Ave			*10.33*	*12.49*	*11.41*
LSD $_{Herb}$ (P<0.05)				*1.84*	
LSD $_{Var}$ (P<0.05)				*0.77*	
LSD $_{Herb*Var}$ (P<0.05)				*2.40*	

Table 5. Grain Yield (t/ha) of PBA Amberley and PBA Bendoc in response to of 'imazamox & imazapyr' and 'GpC' post sowing pre-emergent and or 4N and individually, in sequence or in combination, at Horsham, Victoria in 2019. *Significant differences from the untreated control withing each variety are highlighted.*

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Amberley	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	3.30	3.96	*3.63*
Imazamox & Imazapyr	24.75 & 11.25	4N	3.17	4.82	*4.00*
GpC	X1	PSPE	3.94	3.94	*3.94*
GpC	X1	4N	3.04	2.70	*2.87*
Nil			3.92	4.16	*4.04*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	4.29	4.90	*4.60*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	2.44	3.36	*2.90*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then GpC @ 4N	2.38	2.48	*2.43*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	GpC @ PSPE then mox & pyr @ 4N	1.34	3.33	*2.34*
Ave			*3.09*	*3.74*	*3.42*
LSD $_{Herb}$ (P<0.05)				*0.74*	
LSD $_{Var}$ (P<0.05)				*0.17*	
LSD $_{Herb*Var}$ (P<0.05)				*0.80*	

Table 6. Grain Yield (t/ha) of PBA Samira and PBA Bendoc in response to of 'imazamox & imazapyr' and 'GpC' post sowing pre-emergent and or 4N and individually, in sequence or in combination, at Gymbowen, Victoria in 2019. *Significant differences from the untreated control withing each variety are highlighted.*

Active ingredient (g/ha)	Application Rate (gai/ha)	Application Timing	PBA Samira	PBA Bendoc	*Ave*
Imazamox & Imazapyr	24.75 & 11.25	PSPE	4.64	4.63	*4.64*
Imazamox & Imazapyr	24.75 & 11.25	4N	2.09	4.40	*3.25*
GpC	X1	PSPE	4.47	4.58	*4.53*
GpC	X1	4N	4.25	4.30	*4.28*
Nil			4.49	4.73	*4.61*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	PSPE	4.49	4.69	*4.59*
GpC + Imazamox & Imazapyr	X0.5 & 5.63	4N	3.72	4.50	*4.11*
Imazamox & Imazapyr then GpC	24.75 & 11.25 then x1	mox & pyr @ PSPE then terb @ 4N	4.65	4.08	*4.37*
GpC then Imazamox & Imazapyr	X1 then 24.75 & 11.25	terb @ PSPE then mox & pyr @ 4N	2.26	4.54	*3.40*
Ave			*3.90*	*4.49*	*4.20*
LSD $_{Herb}$ (P<0.05)				*0.24*	
LSD $_{Var}$ (P<0.05)				*0.19*	
LSD $_{Herb*Var}$ (P<0.05)				*0.46*	

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