2023 Trial Reports

UOA2105-013RTX – Development and extension to close the economic yield gap and maximise farming system benefits from grain legume production in South Australia.

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

THE UNIVERSITY of ADELAIDE

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SARDI SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

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Project Investment

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Cover image: Sunset over a lentil crop, north of Brinkworth, 2023. Photo credit: Sarah Day

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HERBICIDE MIXTURES AND ROTATION IN CHICKPEA AND LENTIL (HART, MID NORTH)

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Aim:

(1) Improve herbicide rotation strategy with a focus on reducing selection pressure and dependence on imidazolinone (IMI) herbicides.
(2) Compare the level of weed control achieved with low and high inputs of non-IMI herbicides when used on their own or in combination with IMI herbicides.

Methods:

The trial was established at Hart Field Site, Mid-North as a randomised complete block design with 12 herbicide treatments and 3 replicates (Table 1). The pre-emergent herbicide strategies in chickpea included post-sowing pre-emergent (PSPE) application of Group 27 Balance® and Group 5 simazine with and without Group 14 Herbicide Reflex®. The pre-emergent herbicide strategies in lentil included Reflex® applied as incorporated by sowing (IBS) alone or in combination with Group 5 herbicides diuron/metribuzin as PSPE. Post-emergent (POST) herbicide strategies were comprised of Group 2 Intercept® in chickpea and, Intercept® and metribuzin in lentil applied at 5-6 crop-node stage to a tolerant variety as per permit (PER 92810). The agronomic management details are summarised in Table 2. The seeds of wild radish susceptible to commonly used herbicides, and cultivated vetch seeds (simulated tares) were broadcasted in each plot before pre-emergent treatment application at the Hart trial site. Soil physical and chemical properties of the trial site are summarised in Table 3.

Table 1. Agronomic tactics/herbicide treatments applied to chickpea and lentil at Hart, 2023.

Crop	Herbicide strategy (Dose in terms of commercial product)	Active Ingredients
Chickpea (CBA 2061)	T_1: Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE)	Isoxaflutole (750 g/kg) + Simazine (900 g/kg)
	T_2: Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) + Isoxaflutole (750 g/kg) f.b. Simazine (900 g/kg)
	T_3: Intercept® 750 mL/ha (POST)	Imazamox (33 g/L) + imazapyr (15 g/L)
	T_4: Reflex® 750 mL/ha (PSPE) + Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE)	Isoxaflutole (750 g/kg) f.b. Simazine (900 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
	T_5: Reflex® 750 mL/ha (PSPE) + Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) f.b. Intercept® 750 ml/ha (POST)	Fomesafen (240 g/L) + isoxaflutole (750 g/kg) f.b. Simazine (900 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
	T_6: Unsprayed control	-
Lentil (GIA Metro)	T_7: Metribuzin 380 g/ha (POST)	Metribuzin (750 g/kg)
	T_8: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST$^{\#}$)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)
	T_9: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)
	T_{10}: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
	T_{11}: Unsprayed control	-
Lentil (GIA Thunder)	T_{12}: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b. diuron (900 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)

[#]As per APVMA permit PER92810, expiry 31/12/2025.
*IBS- Incorporated by sowing, PSPE- post-sowing-pre-emergence, POST- post-emergence at 5-6 crop node stage, f.b.- followed by.

Table 2. Trial site details, including sowing date and fertiliser, Hart 2023.

Location	Hart Field Site
Sowing Date	1 June, 2023
Row Spacing (cm)	23
Target plant density	Lentil: 120/m^2 , Chickpea : 50 plants/m^2
Fertiliser (kg MAP/ha)[1]	80
Varieties	Group 2 imidazolinone (IMI) tolerant chickpea germplasm line CBA 2061, IMI and metribuzin dual tolerant lentil GIA Metro and IMI tolerant lentil GIA Thunder
Application date for IBS herbicide treatments	1 June, 2023
Application date for PSPE herbicide treatments	1 June, 2023
Application date for POST herbicide treatments	11 July, 2023
Harvest Date	15 November, 2023

[1]MAP (10.0, 22.0, 0.0, 1.5) + Zn (1.0)

Table 3. The range of soil pH (water), organic carbon (OC) % and soil texture at two depths (0-10 and 10-20 cm) of the experimental sites in 2023.

Soil $pH_{(water)}$		Soil OC %		Soil Texture	
0-10 cm	**10-20 cm**	**0-10 cm**	**10-20 cm**	**0-10 cm**	**10-20 cm**
8.8	8.9	0.98	0.70	Clay loam	Clay loam

Rainfall conditions:

A total of 192 mm growing season rainfall (May–November 2023) was received at Hart. 31 mm of rainfall was received within first two after sowing.

Key Messages:

- Balance® + simazine with or without Reflex® were equally effective for controlling wild radish and common sowthistle in chickpea compared to additional spray of IMI herbicide at trail site in 2023.
- Intercept® (POST) application was found essential to control vetch in IMI tolerant pulses.
- Metribuzin 380 g/ha (POST[#]) in GIA Metro (applied as per PVMA permit PER92810) provided effective control of wild radish, common sowthistle and vetch compared to the unsprayed control.

Results and interpretation

- Chickpea breeding line CBA 2061 did not show any chlorosis, necrosis and stunting symptoms from POST application of Intercept® 750 mL/ha (Table 4).
- In chickpea, low input non-IMI strategy, T_1: Balance® 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) provided effective control of wild radish and common sowthistle (Table 5). Additional application of Reflex® 750 ml/ha (IBS) in high input non-IMI strategy (T_2) provided similar level of weed control compared to low input non-IMI herbicide strategy (Table 5, Figure 1).
- In GIA Metro, strategy of low non-IMI inputs, T_7: Metribuzin 380 g/ha (POST) provided effective control of common sowthistle, wild radish and vetch (Table 5 and Figure 2). The level of broadleaf weed control achieved was similar to that of the high input non-IMI strategy (T_8) with additional Reflex® spray.
- Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE) (T_9) did not provide effective control of vetch and recorded a grain yield penalty as a result.
- IMI tolerance in chickpea and chickpea, with the addition of metribuzin tolerance in lentil, will expand the weed control options in the pulse phase of the cropping rotation.

Table 4. Crop growth and yield in response to different herbicide strategies in chickpea and lentil at Hart, 2023.

Crop/variety	Herbicide treatment	Crop emergence/m^2 4 WAS*	Chlorosis (10 WAS*)	Necrosis (10 WAS*)	Stunting (10 WAS*)	Yield (t/ha)
Chickpea (CBA 2061)	T_1: Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE)	48 ^{d}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	1.36 ^{de}
	T_2: Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	54 ^{d}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	1.88 ^{b}
	T_3: Intercept® 750 mL/ha (POST)	54 ^{d}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	1.53 ^{cd}
	T_4: Reflex® 750 mL/ha (PSPE) + Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE)	51 ^{d}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	1.04 ^{e}
	T_5: Reflex® 750 mL/ha (PSPE) + Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) f.b. Intercept® 750 ml/ha (POST)	50 ^{d}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	1.65 ^{bcd}
	T_6: Unsprayed control	53 ^{d}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	0.31 ^{f}
Lentil (GIA Metro)	T_7: Metribuzin 380 g/ha (POST$^{\#}$)	114 ^{bc}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	1.89 ^{b}
	T_8: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST$^{\#}$)	121 ^{ab}	1.0 ^{a}	1.0 ^{a}	1.8 ^{b}	1.73 ^{bc}
	T_9: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$)	128 ^{a}	1.0 ^{a}	1.0 ^{a}	2.2 ^{a}	1.05 ^{e}
	T_{10}: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$) f.b. Intercept® 750 mL/ha (POST)	116 ^{ab}	1.0 ^{a}	1.0 ^{a}	2.3 ^{a}	1.67 ^{bcd}
	T_{11}: Unsprayed control	126 ^{ab}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	0.52 ^{f}
Lentil (GIA Thunder)	T_{12}: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	101 ^{c}	1.0 ^{a}	1.0 ^{a}	1.0 ^{c}	2.57 ^{a}
LSD 5%		14	NS	NS	0.3	0.34

$^{\#}$As per APVMA permit PER92810, expiry 31/12/2025.

*weeks after sowing, IBS- Incorporated by sowing, PSPE- post-sowing-pre-emergence, POST- post-emergence at 5-6 crop node stage, f.b.- followed by

Data labelled with the same letters within a column are not significantly different (P<0.05). NS = not significant (P>0.05).

Plant stunting score (1 = no stunting, 9 = plant death), chlorosis score (1 = no chlorosis, 9 = plant death), necrosis score (1= no plant tissue burn, 9 = plant death)

Table 5. Weeds' pod set in response to different herbicide strategies in chickpea and lentil at Hart, 2023.

Crop/variety	Herbicide treatment	Vetch pods/m^2	Common sowthistle pods/m^2	Wild radish pods/m^2
Chickpea (CBA 2061)	T_1: Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE)	16.2* ^{ab} (262)**	0* ^{b} (0)**	0* ^{b} (0)**
	T_2: Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	2.8 ^{d} (8)	0 ^{b} (0)	0 ^{b} (0)
	T_3: Intercept® 750 mL/ha (POST)	6.7 ^{cd} (45)	0 ^{b} (0)	0 ^{b} (0)
	T_4: Reflex® 750 mL/ha (PSPE) + Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE)	15.7 ^{b} (246)	0 ^{b} (0)	0 ^{b} (0)
	T_5: Reflex® 750 mL/ha (PSPE) + Balance 100 g/ha (PSPE) + Simazine 800 g/ha (PSPE) f.b. Intercept® 750 ml/ha (POST)	6.5 ^{cd} (42)	0 ^{b} (0)	0 ^{b} (0)
	T_6: Unsprayed control	20.1 ^{a} (404)	3.9 ^{a} (15)	28.5 ^{a} (812)
Lentil (GIA Metro)	T_7: Metribuzin 380 g/ha (POST$^{\#}$)	5.9 ^{cd} (35)	0 ^{b} (0)	0 ^{b} (0)
	T_8: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST$^{\#}$)	7.0 ^{c} (49)	0 ^{b} (0)	0 ^{b} (0)
	T_9: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$)	15.1 ^{b} (228)	0 ^{b} (0)	0 ^{b} (0)
	T_{10}: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$) f.b. Intercept® 750 mL/ha (POST)	8.3 ^{c} (69)	0 ^{b} (0)	0 ^{b} (0)
	T_{11}: Unsprayed control	19.9 ^{b} (396)	4.2 ^{a} (18)	30.4 ^{a} (924)
Lentil (GIA Thunder)	T_{12}: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	5.7 ^{cd} (32)	0 ^{b} (0)	0 ^{b} (0)
LSD 5%		4	0.9	1.6

$^{\#}$As per APVMA permit PER92810, expiry 31/12/2025.
IBS- Incorporated by sowing, PSPE- post-sowing-pre-emergence, POST- post-emergence at 5-6 crop node stage, f.b.- followed by
*data after square-root transformation, **values in parentheses are original means
Data labelled with the same letters within a column are not significantly different (P<0.05).

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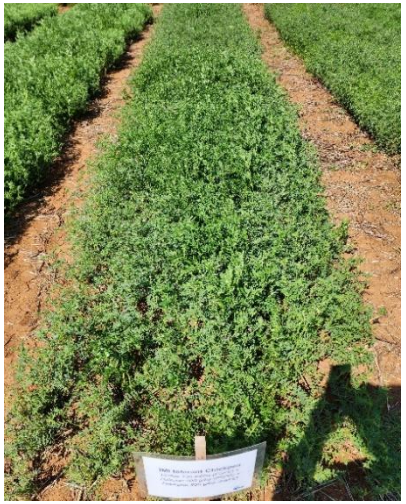
CBA 2061: Unsprayed control

CBA 2061: Balance® 100 (PSPE) + simazine 800 (PSPE)



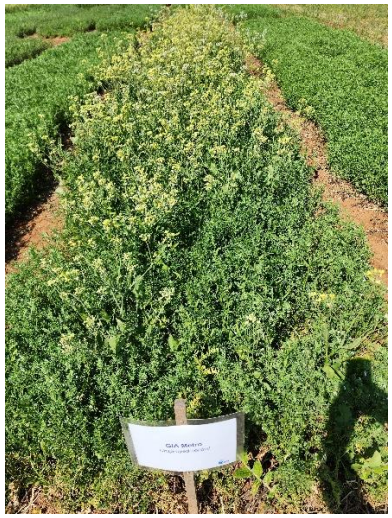
CBA 2061: Reflex® 750 (PSPE) + Balance® 100 (PSPE) simazine 800 (PSPE)

CBA 2061: Intercept® 750 ml/ha (POST)

CBA2061: Reflex® 750 (PSPE) + Balance® 100 (PSPE) simazine 800 (PSPE) fb Intercept® 750 (POST)

CBA2061: Balance® 100 (PSPE) + simazine 800 (PSPE) fb Intercept® 750 (POST)

Figure 1. Efficacy of different herbicide strategies in IMI-tolerant chickpea germplasm line CBA 2061

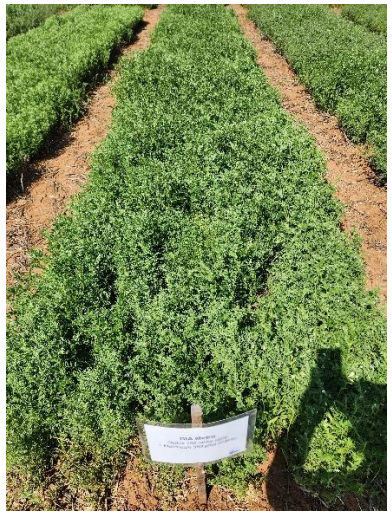


GIA Metro: Unsprayed control

GIA Metro: Reflex® 750 (IBS) fb metribuzin 380 (PSPE) fb Intercept® 750 (POST

GIA Metro: Metribuzin 380 (POST)

GIA Metro: Reflex® 750 (IBS) fb metribuzin 380 (POST



GIA Metro: Reflex® 750 (IBS) fb metribuzin 380 (PSPE)

XT lentil: Reflex® 750 (IBS) fb diuron 550 (PSPE) fb Intercept® 750 (POST)

Figure 2. Efficacy of different herbicide strategies in lentil

BROADLEAF WEED MANAGEMENT IN LENTIL (KIMBA, EYRE PENINSULA, SOUTH AUSTRALIA)

Authors: *Navneet Aggarwal, Amy Keeley and Brianna Guidera*

Aim:

- Evaluation of pre-emergent herbicides for crop safety and weed efficacy in alkaline medium textured soils.
- Benefits from alternate usage patterns of metribuzin in new IMI and metribuzin dual-tolerant lentil technology- can we exclude IMI application and get same level of broadleaf weed control in lentil?
- Better understand yield comparisons of IMI tolerant lentil and metribuzin tolerant lentil under different sets of weed management scenarios.

Methods

The trial was established as a randomised complete block design with 18 herbicide treatments applied to IMI-tolerant lentil GIA Thunder, and IMI and metribuzin dual-tolerant lentil GIA Metro (Table 6) at Kimba. The pre-emergent herbicide strategies included Reflex® applied IBS alone or in combination with diuron/metribuzin PSPE. Post-emergent (POST) herbicide strategies were comprised of Intercept® and diflufenican in GIA Thunder, and metribuzin in GIA Metro applied at 5-6 crop-node stage (as per permit PER92810). All the herbicide treatments were replicated three times. The agronomic management details are summarised in Table 7. The soil physical and chemical properties of the trial site are summarised in Table 8. There was background population of common sowthistle, wild turnip, and Indian hedge mustard at the experimental site.

Treatment details

Table 6. Agronomic tactics/herbicide treatments applied to lentil at Kimba, 2023

Treatment (Dose in terms of commercial product (g or mL/ha)		**Active Ingredients**
T_1	GIA Metro: Metribuzin 380 g/ha (PSPE[#])	Metribuzin (750 g/kg)
T_2	GIA Metro: Metribuzin 380 g/ha (POST[#])	Metribuzin (750 g/kg)
T_3	GIA Metro: Metribuzin 380 g/ha (PSPE[#]) f.b. Intercept® 750 mL/ha (POST)	Metribuzin (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_4	GIA Metro: Reflex® 750 mL/ha (IBS)	Fomesafen (240 g/L)
T_5	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE[#])	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)
T_6	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE[#]) f.b. diflufenican 200 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. diflufenican (500g/L)
T_7	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE[#]) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_8	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST[#])	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)
T_9	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST[#]) + Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_{12}	GIA Metro: Unsprayed control	-
T_{13}	GIA Thunder: Reflex® 500 mL/ha (IBS)	Fomesafen (240 g/L)
T_{14}	GIA Thunder: Reflex® 750 mL/ha (IBS)	Fomesafen (240 g/L)
T_{15}	GIA Thunder: Reflex® 1000 mL/ha (IBS)	Fomesafen (240 g/L)
T_{16}	GIA Thunder: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. diflufenican 200 mL/ha (POST)	Fomesafen (240 g/L) f.b. diuron (900 g/kg) f.b. diflufenican (500g/L)
T_{17}	GIA Thunder: Reflex® 750 (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b diuron (900 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_{18}	GIA Thunder: Unsprayed control	-

[#]As per APVMA permit PER92810, expiry 31/12/2025.

Key: IBS- Incorporated by sowing, PSPE- post-sowing-pre-emergence, POST- post-emergence at 5-6 crop node stage, f.b.- followed by

Table 7. Trial site details, including sowing date and fertiliser, Kimba 2023.

Sowing Date	10 May, 2023
Row Spacing (cm)	25
Fertiliser (kg MAP/ha)[1]	80
Application date for IBS herbicide treatments	10 May, 2023
Application date for PSPE herbicide treatments	10 May, 2023
Application date for POST herbicide treatments	19 June, 2023
Harvest date	02 November, 2023

[1]MAP (10.0, 22.0, 0.0, 1.5) + Zn (1.0)

Table 8. The range of soil pH (water), organic carbon (OC) % and soil texture at two depths (0-10 and 10-20 cm) of the Kimba experimental site in 2023.

Soil $pH_{(water)}$		Soil OC %		Soil Texture	
0-10 cm	**10-30 cm**	**0-10 cm**	**10-30 cm**	**0-10 cm**	**10-30 cm**
7.7	9.5	0.65	0.24	Loam/clay	Clay

Rainfall conditions:

A total of 223 mm growing season rainfall (May–November 2023) was received at Kimba trial site. out of this, only 2 mm of rainfall was received within first two weeks after sowing.

Key messages

- GIA Metro did not show any chlorosis, necrosis or stunting when applied with metribuzin at 380 g/ha PSPE, and post-emergent at 5-6 node stage (POST) in alkaline medium textured soils (permit PER92810).
- Reflex® (IBS) applied in combination with metribuzin showed higher stunting compared to Reflex alone® in GIA Metro. The crop recovered from this stunting and did not record any yield penalty.
- Reflex® alone or in combinations with metribuzin/diuron did not result in any loss of plant numbers of both GIA Thunder and GIA Metro.
- Reflex® (IBS) proved effective in controlling common sowthistle, wild turnip and Indian hedge mustard. Additional Group 5 herbicides applied PSPE, and Group 2 and 12 herbicides applied POST improved broadleaf weed control compared to IBS herbicides only.
- Metribuzin applied POST in GIA Metro (permit PER92810) gave more flexibility and improved common sowthistle control compared to its PSPE application.
- GIA Metro was lower yielding compared to GIA Thunder where weeds were effectively controlled due to fitness penalty associated with metribuzin tolerance. However, this yield gap was reduced in scenarios when unsatisfactory weed control occurred in IMI lentils.

Results and interpretation

Broadleaf weed control

- Reflex® (IBS) proved equally effective at 750 ml/ha (T_{14}) and 1000 ml/ha (T_{15}) in controlling common sowthistle, wild turnip and Indian hedge mustard in 2023 season at Kimba trial site (Table 9 and Figure 3).
- Surviving common sowthistle plants in plots sprayed with Reflex® 750 mL/ha were mainly growing in the crop rows and still could set significant number of pods. A follow-up application of diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST) (T_{17}) effectively controlled these surviving weed plants in crop rows (Table 9 and Figure 4).

- Metribuzin 380 g/ha applied alone PSPE (T_1), and POST (T_2) provided effective control of wild turnip and Indian hedge mustard in 2023 season at the trial site.
- However, metribuzin 380 g/ha applied POST (T_2) proved more effective than its PSPE timing (T_1) for controlling common sowthistle (permit PER92810). Additional application of Reflex® 750 mL/ha (IBS) to metribuzin 380 g/ha (PSPE) (T_5) was needed for controlling common sowthistle effectively.
- Strategy of non-IMI herbicides alone using Reflex® 750 ml/ha (IBS) f.b. metribuzin 380 g/ha applied either as PSPE (T_5) or POST (T_8) proved equally effective in controlling common sowthistle, wild turnip and Indian hedge mustard (permit PER92810), as was achieved with additional application of IMI herbicide Intercept® 750 ml/ha (POST) in GIA Metro (T_7 and T_9).

Lentil growth and yield

- There were no adverse effects of herbicide treatments on emergence and plant establishment.
- Plant height measurements indicated no difference between Reflex® (IBS) treated plots of both GIA Metro (T_{12}) and GIA Thunder (T_{18}) as compared to unsprayed control in 2023 season. However, the plant height of GIA Metro was generally lesser in Reflex® + metribuzin treatments as compared to unsprayed control plots.
- No herbicide treatment caused chlorosis or necrosis in GIA Metro or GIA Thunder.
- The average lentil yield at Kimba was 2.02 t/ha in 2023. Overall, the yield of GIA Metro averaged 35% lower in untreated plots than the best herbicide strategy (Table 10). GIA Thunder yielded 15% less in untreated plots than the best herbicide strategy.
- Grain yields of GIA Metro (regardless of herbicide treatment) were lower than GIA Thunder, despite similar weed control. NVT evaluation of GIA Metro in SA, Victoria, Western Australia and New South Wales in 2021 and 2022 suggested it is 20 to 30% lower yielding than PBA Hurricane XT where weeds are controlled effectively and in the absence of herbicide damage (Fact sheet GIA Metro, Grains Innovation Australia, 2023).

Table 9. Weeds' pod set in response to different herbicide strategies in lentil at Kimba, 2023.

Treatment (Dose in terms of commercial product (g or mL/ha)		Common sowthistle pods/m²	Wild turnip pods/m²	Indian hedge mustard pods/m²
T_1	GIA Metro: Metribuzin 380 g/ha (PSPE#)	5.3 ^{b} * (27.6)**	0.7 ^{c} * (0.5)**	0 ^{b} * (0)**
T_2	GIA Metro: Metribuzin 380 g/ha (POST#)	0.5 ^{def} (0.3)	0 ^{c} (0)	0 ^{b} (0)
T_3	GIA Metro: Metribuzin 380 g/ha (PSPE#) f.b. Intercept® 750 mL/ha (POST)	2.7 ^{cd} (7.3)	0 ^{c} (0)	0 ^{b} (0)
T_4	GIA Metro : Reflex® 750 mL/ha (IBS)	2.5 ^{cde} (6.3)	0 ^{c} (0)	1.0 ^{b} (1.0)
T_5	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE#)	0.8 ^{def} (0.6)	0 ^{c} (0)	0 ^{b} (0)
T_6	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE#) f.b. diflufenican 200 mL/ha (POST)	0.8 ^{def} (0.6)	0 ^{c} (0)	0 ^{b} (0)
T_7	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE#) f.b. Intercept® 750 mL/ha (POST)	0.4 ^{ef} (0.1)	0 ^{c} (0)	0 ^{b} (0)
T_8	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. Metribuzin 380 g/ha (POST#)	0.2 ^{f} (0)	0 ^{c} (0)	0 ^{b} (0)
T_9	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST#) + Intercept® 750 mL/ha (POST)	0 ^{f} (0)	0 ^{c} (0)	0 ^{b} (0)
T_{12}	GIA Metro: Unsprayed control	11.2 ^{a} (124.3)	6.1 ^{b} (37.2)	3.4 ^{a} (11.8)
T_{13}	GIA Thunder: Reflex® 500 mL/ha (IBS)	5.2 ^{b} (26.8)	0.5 ^{c} (0.3)	0.9 ^{b} (0.8)
T_{14}	GIA Thunder: Reflex® 750 mL/ha (IBS)	4.1 ^{bc} (17.0)	0 ^{c} (0)	0 ^{b} (0)
T_{15}	GIA Thunder: Reflex® 1000 mL/ha (IBS)	2.7 ^{cd} (7.5)	0.2 ^{c} (0)	0 ^{b} (0)
T_{16}	GIA Thunder: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. diflufenican 200 mL/ha (POST)	1.7 ^{def} (2.7)	0.8 ^{c} (0.6)	0 ^{b} (0)
T_{17}	GIA Thunder: Reflex® 750 (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	0.3 ^{ef} (0.1)	0 ^{c} (0)	0 ^{b} (0)
T_{18}	GIA Thunder: Unsprayed control	11.4 ^{a} (130.0)	7.6 ^{a} (57.8)	3.1 ^{a} (11.5)
	LSD 5%	2.3	1.2	1.0

#As per APVMA permit PER92810, expiry 31/12/2025.

IBS= Incorporated by sowing, PSPE= post-sowing-pre-emergence, POST= post-emergence at 5-6 crop node stage, f.b. = followed by.

*data after square-root transformation, **values in parentheses are original means.

Data labelled with the same letters within a column are not significantly different (P<0.05).

Table 10. Crop growth and yield in response to different herbicide strategies in lentil at Kimba, 2023.

Treatment (Dose in terms of commercial product (g or mL/ha)		Emergence/m^2	Chlorosis (10 WAS*)	Necrosis (10 WAS*)	Plant height (cm) 10 WAS*	Yield (t/ha)
T_1	GIA Metro^P : Metribuzin 380 g/ha (PSPE$^\#$)	104 ^{a}	1.0 ^{a}	1.0 ^{a}	8.7 ^{de}	1.75 ^{c}
T_2	GIA Metro^P : Metribuzin 380 g/ha (POST$^\#$)	105 ^{a}	1.0 ^{a}	1.0 ^{a}	9.3 ^{cde}	1.87 ^{c}
T_3	GIA Metro^P : Metribuzin 380 g/ha (PSPE$^\#$) f.b. Intercept® 750 (POST)	119 ^{a}	1.0 ^{a}	1.0 ^{a}	9.8 ^{bcde}	1.64 ^{c}
T_4	GIA Metro^P : Reflex® 750 mL/ha (IBS)	112 ^{a}	1.0 ^{a}	1.0 ^{a}	10.0 ^{bcde}	1.76 ^{c}
T_5	GIA Metro^P : Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^\#$)	108 ^{a}	1.0 ^{a}	1.0 ^{a}	8.7 ^{de}	1.94 ^{c}
T_6	GIA Metro^P : Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^\#$) f.b. diflufenican 200 mL/ha (POST)	102 ^{a}	1.0 ^{a}	1.0 ^{a}	9.3 ^{cde}	1.84 ^{c}
T_7	GIA Metro^P : Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^\#$) f.b. Intercept® 750 mL/ha (POST)	111 ^{a}	1.0 ^{a}	1.0 ^{a}	8.0 ^{e}	1.80 ^{c}
T_8	GIA Metro^P : Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST$^\#$)	110 ^{a}	1.0 ^{a}	1.0 ^{a}	8.5 ^{de}	1.87 ^{c}
T_9	GIA Metro^P : Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST$^\#$) + Intercept® 750 mL/ha (POST)	101 ^{a}	1.0 ^{a}	1.0 ^{a}	8.8 ^{de}	1.92 ^{c}
T_{12}	GIA Metro^P : Unsprayed control	119 ^{a}	1.0 ^{a}	1.0 ^{a}	10.7 ^{abcde}	1.26 ^{d}
T_{13}	GIA Thunder^P : Reflex® 500 mL/ha (IBS)	102 ^{a}	1.0 ^{a}	1.0 ^{a}	11.7 ^{abc}	2.45 ^{ab}
T_{14}	GIA Thunder^P : Reflex® 750 mL/ha (IBS)	103 ^{a}	1.0 ^{a}	1.0 ^{a}	11.0 ^{abcd}	2.32 ^{b}
T_{15}	GIA Thunder^P : Reflex® 1000 mL/ha (IBS)	107 ^{a}	1.0 ^{a}	1.0 ^{a}	11.7 ^{abc}	2.68 ^{a}
T_{16}	GIA Thunder^P : Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. diflufenican 200 mL/ha (POST)	108 ^{a}	1.0 ^{a}	1.0 ^{a}	13.0 ^{a}	2.69 ^{a}
T_{17}	GIA Thunder^P : Reflex® 750 (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	98 ^{a}	1.0 ^{a}	1.0 ^{a}	12.2 ^{ab}	2.66 ^{a}
T_{18}	GIA Thunder^P : Unsprayed control	104 ^{a}	1.0 ^{a}	1.0 ^{a}	11.7 ^{abc}	2.30 ^{b}
	LSD 5%	NS	NS	NS	2.7	0.31

$^\#$As per APVMA permit PER92810, expiry 31/12/2025.

*Weeks after sowing, IBS= Incorporated by sowing, PSPE = post-sowing-pre-emergence, POST = post-emergence at 5-6 crop node stage, f.b. = followed by.

Data labelled with the same letters within a column are not significantly different (P <0.05). Chlorosis score (1 = no chlorosis, 9 = plant death), necrosis score (1= no plant tissue burn, 9 = plant death).

GIA Thunder: Unsprayed control | GIA Thunder: Reflex® 750 mL/ha (IBS) | GIA Thunder: Reflex® 1000 mL/ha (IBS)

Figure 3. Efficacy of different herbicide strategies in lentil at Kimba 2023

GIA Thunder: Reflex® 750 (IBS) + diuron 550 (PSPE) + Intercept® 750 (POST)

GIA Metro: Unsprayed control

GIA Metro: Metribuzin 380 g/ha (POST)

Figure 4. Efficacy of different herbicide strategies in lentil at Kimba 2023

BROADLEAF WEED MANAGEMENT IN LENTIL (TOOLIGIE, EYRE PENINSULA, SOUTH AUSTRALIA)

Authors: *Navneet Aggarwal, Amy Keeley and Brianna Guidera*

Aim:

- Evaluation of pre-emergent herbicides for crop safety and weed efficacy in alkaline medium textured soils.
- Benefits from alternate usage patterns of metribuzin in new IMI and metribuzin dual-tolerant lentil technology- can we exclude IMI application and get same level of broadleaf weed control in lentil?
- Better understand yield comparisons of IMI tolerant lentil and metribuzin tolerant lentil varieties under different sets of weed management scenarios.

Methods

The trial was established as a randomised complete block design with 18 herbicide treatments applied to IMI-tolerant lentil PBA Highland XT, and IMI and metribuzin dual-tolerant lentil GIA Metro (Table 11) at Tooligie. The pre-emergent herbicide strategies included Reflex® (IBS) applied alone or in combination with Group 5 herbicides diuron/Terbyne® (IBS), or diuron/metribuzin (PSPE). Post-emergent (POST) herbicide strategies were comprised of Intercept® in PBA Highland XT, and Intercept®, diflufenican and metribuzin in GIA Metro applied at 5-6 crop-node stage (as per permit PER92810). All the herbicide treatments were replicated three times. The agronomic management details are summarised in Table 12. The soil physical and chemical properties of the trial site are summarised in Table 13. There was background population of common sowthistle and Indian hedge mustard at the trial site.

Treatment details

Table 11. Agronomic tactics/herbicide treatments applied to lentil at Tooligie, 2023.

Treatment (Dose in terms of commercial product (g or mL/ha)		**Active Ingredients**
T_1	GIA Metro: Reflex® 750 mL/ha (IBS)	Fomesafen (240 g/L)
T_2	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE#)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)
T_3	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE#) f.b. diflufenican 200 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. diflufenican (500g/L)
T_4	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE#) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_5	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST#)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)
T_6	GIA Metro: Unsprayed control	-
T_7	PBA Highland XT: Reflex® 500 mL/ha (IBS)	Fomesafen (240 g/L)
T_8	PBA Highland XT: Reflex® 750 mL/ha (IBS)	Fomesafen (240 g/L)
T_9	PBA Highland XT: Reflex® 1000 mL/ha (IBS)	Fomesafen (240 g/L)
T_{10}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + diuron 300 g/ha (IBS) (Industry practice)	Fomesafen (240 g/L) f.b diuron (900 g/kg)
T_{11}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + diuron 300 g/ha (IBS) f.b. Intercept® 750 mL/ha (POST) (Industry practice)	Fomesafen (240 g/L) f.b diuron (900 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_{12}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE)	Fomesafen (240 g/L) f.b diuron (900 g/kg)
T_{13}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b diuron (900 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_{14}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. metribuzin 180 g/ha (PSPE)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg)

T_{15}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. metribuzin 180 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) f.b. metribuzin (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_{16}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS)	Fomesafen (240 g/L) + terbulathyzine (750 g/kg)
T_{17}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS) f.b. Intercept® 750 mL/ha (POST)	Fomesafen (240 g/L) + terbulathyzine (750 g/kg) f.b. imazamox (33 g/L) + imazapyr (15 g/L)
T_{18}	PBA Highland XT: Unsprayed control	-

#As per APVMA permit PER92810, expiry 31/12/2025.
Key: IBS= Incorporated by sowing, PSPE= post-sowing-pre-emergence, POST= post-emergence at 5-6 crop node stage, f.b.= followed by.

Table 12. Trial site details, including sowing date and fertiliser, Tooligie 2023.

Sowing Date	23 May, 2023
Row Spacing (cm)	25
Fertiliser (kg MAP/ha)[1]	80
Application date for IBS herbicide treatments	23 May, 2023
Application date for PSPE herbicide treatments	23 May, 2023
Application date for POST herbicide treatments	03 July, 2023
Harvest date	23 November, 2023

[1]MAP (10.0, 22.0, 0.0, 1.5) + Zn (1.0)

Table 13. The range of soil pH (water), organic carbon (OC) % and soil texture at two depths (0-10 and 10-20 cm) of the Tooligie experimental site in 2023.

Soil $pH_{(water)}$		**Soil OC %**		**Soil Texture**	
0-10 cm	**10-30 cm**	**0-10 cm**	**10-30 cm**	**0-10 cm**	**10-30 cm**
8.7	9.0	1.49	0.85	Sandy clay loam	Sandy clay loam

Rainfall conditions

A total of 99 mm growing season rainfall (May–November 2023) was received at the Tooligie trial site. 10 mm of rainfall was received within the first two weeks after sowing.

Key messages

- Pre-emergent herbicides strategies of Reflex® alone or in combination with diuron/Terbyne® in PBA Highland XT, and metribuzin in GIA Metro, did not result in any loss of plant numbers.
- Reflex® (IBS) f.b. metribuzin (POST) caused chlorosis and necrosis in GIA Metro, though the crop recovered from it and did not record a yield penalty.
- Reflex® (IBS) proved effective in controlling common sowthistle and Indian hedge mustard. Adding Group 5 herbicides applied PSPE, as well as Group 2 and 12 herbicides POST provided control of weeds surviving in the crop rows.

Results and interpretation

Broadleaf weed control

- Reflex® (IBS) proved equally effective at 500 mL/ha (T_7), 750 ml/ha (T_8) and 1000 ml/ha (T_9) in controlling common sowthistle and Indian hedge mustard at Tooligie trial site in 2023 (Table 14).
- Surviving common sowthistle and Indian hedge mustard plants in plots sprayed with Reflex® (IBS) alone, or in combination with low rate of diuron IBS (300 g/ha) were mainly growing in the crop rows.
- The weed plants surviving in the crop rows were controlled with a follow up application of diuron 550 g/ha PSPE in PBA Highland XT, and metribuzin 380 g/ha PSPE or POST in GIA Metro.
- Strategy of non-IMI herbicides of Reflex® 750 ml/ha (IBS) f.b. metribuzin at 380 g/ha applied either as PSPE (T_2) or POST (T_5) proved equally effective in controlling common sowthistle and Indian hedge mustard, as was achieved with additional application of IMI herbicide Intercept® 750 ml/ha (POST) (T_4) in GIA Metro.

Lentil growth and yield

- Herbicide treatments did not affect plant establishment.
- No differences in plant height for each variety treated with herbicides compared to the respective untreated control.
- Reflex® 750 ml/ha (IBS) f.b. metribuzin at 380 g/ha (POST) caused chlorosis and necrosis in GIA Metro compared with the untreated control plots, though the crop recovered from it and did not record a yield penalty.
- Combination of Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS) caused chlorosis as compared to Reflex® 750 mL/ha (IBS) alone in PBA Highland XT.
- All PBA Highland XT plots yielded similarly, regardless of herbicide and weed control.
- Applying Reflex® with or without metribuzin (PSPE) to GIA Metro improved this varieties yield compared to the untreated control.

Table 14. Weeds' pod set in response to different herbicide strategies in lentil at Tooligie, 2023.

Treatment (Dose in terms of commercial product (g or mL/ha)		Common sowthistle pods/m^2	Indian hedge mustard pods/m^2
T_1	GIA Metro: Reflex® 750 mL/ha (IBS)	0 ^{c} (0)	0 ^{c} (0)
T_2	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$)	0 ^{c} (0)	0 ^{c} (0)
T_3	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$) f.b. diflufenican 200 mL/ha (POST)	0 ^{c} (0)	0 ^{c} (0)
T_4	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE$^{\#}$) f.b. Intercept® 750 mL/ha (POST)	0 ^{c} (0)	0 ^{c} (0)
T_5	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST$^{\#}$)	0 ^{c} (0)	0 ^{c} (0)
T_6	GIA Metro: Unsprayed control	9.0 ^{a} (81)	17.9 ^{a} (320)
T_7	PBA Highland XT: Reflex® 500 mL/ha (IBS)	1.0 ^{bc} (1)	1.0 ^{c} (1)
T_8	PBA Highland XT: Reflex® 750 mL/ha (IBS)	0 ^{c} (0)	0 ^{c} (0)
T_9	PBA Highland XT: Reflex® 1000 mL/ha (IBS)	2.6 ^{bc} (7)	2.6 ^{c} (7)
T_{10}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + diuron 300 g/ha (IBS) (Industry practice)	3.3 ^{b} (11)	3.3 ^{c} (11)
T_{11}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + diuron 300 g/ha (IBS) f.b. Intercept® 750 mL/ha (POST) (Industry practice)	0 ^{c} (0)	0 ^{c} (0)
T_{12}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE)	0 ^{c} (0)	0 ^{c} (0)
T_{13}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	1.8 ^{bc} (3)	1.8 ^{c} (3)
T_{14}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. metribuzin 180 g/ha (PSPE)	0 ^{c} (0)	0 ^{c} (0)
T_{15}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. metribuzin 180 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	0 ^{c} (0)	0 ^{c} (0)
T_{16}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS)	0 ^{c} (0)	3.4 ^{c} (12)
T_{17}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS) f.b. Intercept® 750 mL/ha (POST)	0 ^{c} (0)	0 ^{c} (0)
T_{18}	PBA Highland XT: Unsprayed control	8.9 ^{a} (79)	9.2 ^{b} (85)
	LSD 5%	3.3	3.6

IBS- Incorporated by sowing, PSPE- post-sowing-pre-emergence, POST- post-emergence at 5-6 crop node stage, f.b.- followed by

$^{\#}$As per APVMA permit PER92810, expiry 31/12/2025.

*data after square-root transformation, **values in parentheses are original means

Data labelled with the same letters within a column are not significantly different (P=<0.05).

Table 15. Crop growth and yield in response to different herbicide strategies in lentil at Tooligie, 2023.

Treatment (Dose in terms of commercial product (g or mL/ha)		Emergence/m²	Chlorosis (10 WAS*)	Necrosis (10 WAS*)	Plant height (cm) 10 WAS*	Yield (t/ha)
T_1	GIA Metro: Reflex® 750 mL/ha (IBS)	130 [a]	1.5 [bcd]	1.5 [bc]	8.7 [bcdef]	1.10 [abcd]
T_2	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE[#])	132 [a]	1.5 [bcd]	1.0 [c]	8.2 [def]	1.10 [abcd]
T_3	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE[#]) f.b. diflufenican 200 mL/ha (POST)	118 [a]	2.2 [ab]	1.2 [bc]	8.3 [cdef]	0.85 [e]
T_4	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (PSPE[#]) f.b. Intercept® 750 mL/ha (POST)	121 [a]	1.8 [abcd]	1.2 [bc]	8.0 [ef]	0.90 [de]
T_5	GIA Metro: Reflex® 750 mL/ha (IBS) f.b. metribuzin 380 g/ha (POST[#])	118 [a]	2.5 [a]	2.3 [a]	8.0 [ef]	0.99 [cde]
T_6	GIA Metro: Unsprayed control	127 [a]	1.0 [d]	1.0 [c]	7.8 [f]	0.87 [e]
T_7	PBA Highland XT: Reflex® 500 mL/ha (IBS)	104 [a]	1.0 [d]	1.0 [c]	9.0 [abcdef]	1.28 [a]
T_8	PBA Highland XT: Reflex® 750 mL/ha (IBS)	123 [a]	1.1 [d]	1.0 [c]	8.8 [bcdef]	1.13 [abc]
T_9	PBA Highland XT: Reflex® 1000 mL/ha (IBS)	125 [a]	1.3 [cd]	1.2 [bc]	10.1 [a]	1.11 [abc]
T_{10}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + diuron 300 g/ha (IBS) (Industry practice)	129 [a]	1.0 [d]	1.0 [c]	8.9 [bcdef]	1.12 [abc]
T_{11}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + diuron 300 g/ha (IBS) f.b. Intercept® 750 mL/ha (POST) (Industry practice)	127 [a]	1.5 [bcd]	1.0 [c]	9.6 [ab]	1.11 [abc]
T_{12}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE)	121 [a]	1.0 [d]	1.0 [c]	9.5 [abc]	1.22 [ab]
T_{13}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. diuron 550 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	133 [a]	1.2 [cd]	1.0 [c]	8.7 [bcdef]	1.20 [ab]
T_{14}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. metribuzin 180 g/ha (PSPE)	131 [a]	1.2 [cd]	1.2 [bc]	9.0 [abcdef]	1.06 [bcde]
T_{15}	PBA Highland XT: Reflex® 750 mL/ha (IBS) f.b. metribuzin 180 g/ha (PSPE) f.b. Intercept® 750 mL/ha (POST)	124 [a]	1.3 [cd]	1.2 [bc]	9.1 [abcde]	1.10 [abcd]
T_{16}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS)	131 [a]	2.0 [abc]	1.7 [bc]	9.4 [abcd]	1.10 [abcd]
T_{17}	PBA Highland XT: Reflex® 750 mL/ha (IBS) + Terbyne® 1000 g/ha (IBS) f.b. Intercept® 750 mL/ha (POST)	116 [a]	1.7 [abcd]	1.2 [bc]	9.1 [abcde]	1.12 [abc]
T_{18}	PBA Highland XT: Unsprayed control	127 [a]	1.0 [d]	1.0 [c]	9.2 [abcde]	1.17 [abc]
	LSD 5%	NS	0.8	0.7	1.2	0.21

[#]As per APVMA permit PER92810, expiry 31/12/2025.

*Weeks after sowing, IBS - Incorporated by sowing, PSPE - post-sowing-pre-emergence, POST - post-emergence at 5-6 crop node stage, f.b. - followed by

Data labelled with the same letters within a column are not significantly different (P = <0.05). Plant stunting score (1 = no stunting, 9 = plant death), chlorosis score (1 = no chlorosis, 9 = plant death).

CONCLUSION

New dual metribuzin and IMI tolerant lentil, GIA Metro has provided new opportunities to control multiple broadleaf weeds, with use of APVMA permit PER92810 (expiry 31/12/2025). Increased adoption of this variety will potentially help to reduce selection pressure and delay resistance build up to the IMI herbicides. Grain yield of GIA Metro is significantly lower than existing lentil varieties in the absence of weeds, or where weeds are controlled effectively without crop damage from Group 5 herbicides due to a fitness penalty associated with the metribuzin tolerance. GIA Metro is an option for lentil growers where weed competition and/or current herbicide options (e.g. IMI-resistant broadleaf weeds) prohibit economical and sustainable lentil production. The strategic use of GIA Metro in some cropping rotations may assist in improved weed control in lentil and reduced weed seed bank burdens of Group 2 resistant weeds allowing for a return to other lentil varieties in subsequent season.