

# Herbicide tolerance of Desi chickpea varieties - Merredin

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## Key messages

Desi chickpea varieties CBA Captain, Neelam and PBA Striker showed good tolerance to a range of chickpea herbicides or herbicide mixtures at registered rates and timings with good crop safety margin.

IBS application of simazine + Balance<sup>®</sup> appears safer than PSPE application especially on PBA Striker.

A new herbicide Ultro<sup>®</sup> 900 WG at 1.1 kg/ha IBS was tolerated well by all the varieties.

Note: Always follow label recommendations. The Department Primary Industries and Regional Development, does not endorse the use of herbicides above the registered rate or off-label use of herbicides or off-label tank mixes. Crop tolerance and yield responses to herbicides are strongly influenced by seasonal conditions.

## Aims

To identify herbicide sensitivities of new or potential new chickpea varieties with the view to reduce their yield losses due to herbicide damage.

## Method

Trial Year and Location	2019 (2019ME48) and DPIRD Merredin Research Facility (Paddock 3A)
Soil Type, pH (CaCl <sub>2</sub> ) and OC (%)	0-10 cm: Clay, 4.8 and 0.96 10-30 cm: Loam, 4.8 and 0.98
Trial design	Criss-cross with every 5 <sup>th</sup> plot as untreated control plot to check spatial variability. The trial was carried out under weed free conditions.
Plot size (net) and replications	8 m x 1.1 m (5 rows at 22 cm row spacing) and 3 reps. To convert plot yield to kg/ha, 1.8 m plot width was used (plot to plot centre).
Varieties and herbicide treatments	CBA Captain (tested as CICA 1521), Neelam and PBA Striker. See Table 1 for herbicide treatments details.
Seeding date and rate	Sown on 17 June with seeding rate of 105 to 132 kg/ha across varieties to target 45 plants/m <sup>2</sup> .
Seed treatment before sowing	P-Pickle T <sup>®</sup> 200 mL per 100 kg seed.
Seeding machinery and depth	Coneseeder with knife points and press-wheels and 5 cm deep.
Fertilizers and rhizobium Inoculum	K-Start 100 kg/ha and Alosca group N granular 10 kg/ha applied with seed at seeding.

Soil moisture on 13 June 2019	0-5 cm: 22.7% (average of 5 samples) 5-10 cm: 23.7% (average of 5 samples)
Method used	Volumetric method
Cumulative rainfall:	
1 week before sowing	15 mm
1 week after sowing	23 mm
2 weeks after sowing	37 mm
4 weeks after sowing	63 mm
Treatment application date:	Please see Table 1 for treatment details.
Incorporated by sowing (IBS)	16 and 17 June 2019 (Trifluralin treatments were applied on 17 June)
Post-sowing pre-emergent (PSPE)	20 and 21 June 2019
3-5 node stage	23 July 2019
Herbicide application machinery	Spray rig with shields on boom at a width of 1.5 m. Air induction nozzles and 100 L/ha water volume used.
Visual observations scale:	0 to 100 %, where 0 = no visible injury & 100 = complete plant death.
Visual observation dates:	15 July, 23 August and 4 November 2019.
Chickpea plant count	4 November, two counts per plot using a quadrat size of 100 cm x 46 cm (2 rows at 23 cm row spacing) and presented as plants/m <sup>2</sup> .
Blanket Sprays	Select <sup>®</sup> 500 mL+ Factor <sup>®</sup> 180 g/ha + Bonza <sup>®</sup> 1% on 18-07-2019.
Harvesting date	13 November 2019
Data analysis	Seed yield and plant population - ANOVA using GenStat prog.
Rainfall (mm) :	2019
	May     June     July     Aug     Sept     Oct     Total
	6        76        38        51        3        22        196

**Crop safety margins:** Higher than label rates of the herbicides were included in the trial to determine the crop safety margin of the herbicides at the maximum label rates. Good crop safety margin means that a herbicide at its maximum label rate and at the higher rate(s) was tolerated well by a crop variety. Whereas, low crop safety margin for a herbicide indicates that the variety tolerated the maximum label rate well, but at higher than the label rate(s) there was significant yield loss. A low crop safety margin implies that when spraying under less than optimal conditions, herbicide damage and yield loss may occur even at the label rate. For example, when overlapping herbicide; spraying under wet conditions (for soil active and residual herbicides) and /or there are stressed plants due to abiotic/biotic factors.

**Table 1: Herbicide treatments**

No	Herbicides	Rate/ha	Timing
1	Simazine 900 + Balance® X1	835 g + 100 g	IBS
2	Simazine 900 + Balance® X2	1.67 kg + 200 g	IBS
3	Palmero® TX X1	1 kg	IBS
4	Palmero® TX X2	2 kg	IBS
5	Edge® 900 WG	1.1 kg	IBS
6	Ultro® 900 WG	1.1 kg	IBS
7	Simazine 900 + Balance® X1 PS	835 g + 100 g	PSPE
8	Simazine 900 + Balance® X2 PS	1.67 kg + 200 g	PSPE
9	Palmero® TX X1 PS	1 kg	PSPE
10	Palmero® TX X2 PS	2 kg	PSPE
11	Edge® 900 WG fb Palmero® TX	1.1 kg fb 1 kg	IBS fb PSPE
12	Jetti Duo® fb Palmero® TX	1.8 L fb 1 Kg	IBS fb PSPE
13	Jetti Duo® fb Balance® + Metribuzin 750	1.8 L fb 100 g + 180 g	IBS fb PSPE
14	Sakura® fb Palmero® TX	118 g fb 1 kg	IBS fb PSPE
15	Trifluralin 480 + Terrain®	1.3 L + 180 g	IBS
16	Trifluralin 480 + Terrain® fb Balance®	1.3 L + 180 g fb 100 g	IBS fb PSPE
17	Trifluralin 480 + Terrain® fb Palmero® TX	1.3 L + 180 g fb 1 Kg	IBS fb PSPE
18	Trifluralin 480 fb Pameror® TX fb Broadstrike® X1	1.3 L fb 1 kg fb 25 g	BS fb PSPE fb 3-5 nodes
19	Trifluralin 480 fb Pameror® TX fb Broadstrike® X2	1.3 L fb 1 kg fb 50 g	BS fb PSPE fb 3-5 nodes
0	Untreated Control		

- IBS = incorporated by sowing, PSPE = post-sowing pre-emergent, fb = followed by
- Balance® = Isoxaflutole 750 g/kg, Broadstrike® = flumetsulam 800 g/kg, Edge® = propyzamide 900 g/kg, Jetti Duo® = trifluralin 350 g + triallate 550 g /L, Palmero® TX = isoxaflutole 75 g + terbuthylazine 750 g/kg, Sakura® = pyroxasulfone 850 g/kg, Terrain® = flumioxazin 500 g/kg and Ultro® = carbetamide 900 g/kg.
- Simazine rate is equivalent to terbuthylazine at active ingredient basis (750 g a.i./ha)
- Simazine 900 is registered on chickpeas at 550g - 1.1 kg/ha
- Jetti Duo® 1.8 L = 1.3 L Trifluralin 480 + 2 L Avadex Xtra 500
- PSPE treatments were aimed to apply on the same day of seeding or within two days of seeding.

## Results and discussion

The effect of herbicides during early crop growth stages (Table 2), around flowering stage (Table 3), on plant population (Table 4) and seed yield (Table 5) of chickpea varieties was as follows:

Merredin was a low yielding site with average seed yield of 0.73 t/ha (across varieties in untreated control plots) compared to Dongara that had 1.6 t/ha average seed yield. PBA Striker was the highest yielding variety at 0.8 t/ha seed yield, followed by CBA Captain at 0.7 t/ha, and Neelam at 0.68 t/ha with a plant population of 57-61 plants/m<sup>2</sup> (untreated control plots).

Correlation co-efficient between chickpea plant population and seed yield (across treatments) was - 0.17, -0.10 and 0.33 in CBA Captain, Neelam, and PBA Striker, respectively.

Simazine + Balance® and Palmero® TX at label rates applied IBS did not produce any visual symptoms and were tolerated well by all the varieties with good crop safety margin. However, Simazine + Balance® at both rates and Palmero® TX at higher rate applied PSPE reduced plant population significantly of PBA Striker and CBA Captain, respectively, without transferring this negative effect on seed yield. The PSPE application of these treatments in combination of 23 mm rainfall within a week or 37 mm within a two weeks of sowing might have caused movement of the herbicides in furrows resulting in some of the chickpea seeds coming in contact with herbicides and thus reducing plant stand. The reduced plant population could have been compensated with more pods per plant and/or higher seed weight, and thus no effect on seed yield.

Application of Edge® (propryzamide) IBS at the label rate alone and Edge® and Sakura® IBS followed by Palmero® TX PSPE at the label rates had no significant negative effect on seed yield, despite Sakura® treatment reduced plant population of PBA Striker significantly.

At label rates, trifluralin + Terrain® applied IBS alone and followed by Balance® or Palmero® TX PSPE reduced plant population and biomass (visual) during early growth stages. However, these treatments also had no significant negative effect on seed yield.

A new pre-emergent herbicide Ultro® 900 WG (carbetamide) was tolerated well by all the varieties (Photo 1). Ultro® 900 WG (Group E) is registered on chickpea at 1.1 kg/ha as IBS or PSPE application for suppression of ryegrass, brome grass and barley grass.

### **Key words**

Herbicides, tolerance, chickpea varieties, seed yield.

### **Acknowledgments**

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Plate 1: (L –R). Edge® 900 WG at 1.1 kg/ha, Ultro® 900 WG 1.1kg/ha (Centre) and Untreated Control. CBA Captain in the front followed by PBA Striker and Neelam. The photo was taken on 23-8-2019.

**Table 2: Visual bleaching (BI) and population reduction (PR) observed on 15 -7-19 at Merredin (2019ME48)**

No	Herbicides	Rate/ha	Timing	CBA Captain	Neelam	PBA Striker
0	Untreated Control			0	0	0
15	Trifluralin 480 + Terrain®	1.3 L + 180 g	IBS	15% PR	10% PR	15% PR
16	Trifluralin 480 + Terrain® fb Balance®	1.3 L + 180 g fb 100 g	IBS fb PSPE	10% PR	10% PR	10% PR
17	Trifluralin 480 + Terrain® fb Palmero® TX	1.3 L + 180 g fb 1 Kg	IBS fb PSPE	10% PR	10% PR	10% PR

IBS = incorporated by sowing, PSPE = Post-sowing pre-emergent, fb = followed by

**Table 3: Visual biomass reduction (%) observed on 23-8-19 at Merredin (2019ME48)**

No	Herbicides	Rate/ha	Timing	CBA Captain	Neelam	PBA Striker
0	Untreated Control			0	0	0
13	Jetti Duo® fb Balance® + Metribuzin 750	1.8 L fb 100 g + 180 g	IBS fb PSPE	15	5	5
14	Sakura® fb Palmero® TX	118 g fb 1 kg	IBS fb PSPE	0	0	5
15	Trifluralin 480 + Terrain®	1.3 L + 180 g	IBS	10	10	5

IBS = incorporated by sowing, PSPE = Post-sowing pre-emergent, fb = followed by

**Table 4: Effect of herbicide treatments on plants/m<sup>2</sup> (% of untreated control) of chickpea varieties at crop maturity (2019ME48).**

No	Herbicides	Rate/ha	Timing	CBA Captain	Neelam	PBA Striker
0	Untreated Control >>>>> Plants/m <sup>2</sup>			100 59	100 57	100 61
1	Simazine 900 + Balance <sup>®</sup> X1	835 g + 100 g	IBS	99	98	106
2	Simazine 900 + Balance <sup>®</sup> X2	1.67 kg + 200 g	IBS	93	105	94
3	Palmero <sup>®</sup> TX X1	1 kg	IBS	110	101	109
4	Palmero <sup>®</sup> TX X2	2 kg	IBS	107	107	93
5	Edge <sup>®</sup> 900 WG	1.1 kg	IBS	94	99	94
6	Ulro <sup>®</sup> 900 WG	1.1 kg	IBS	96	111	96
7	Simazine 900 + Balance <sup>®</sup> X1	835 g + 100 g	PSPE	100	103	<b>88</b>
8	Simazine 900 + Balance <sup>®</sup> X2	1.67 kg + 200 g	PSPE	97	97	<b>88</b>
9	Palmero <sup>®</sup> TX X1	1 kg	PSPE	94	100	96
10	Palmero <sup>®</sup> TX X2	2 kg	PSPE	<b>87</b>	101	93
11	Edge <sup>®</sup> 900 WG fb Palmero <sup>®</sup> TX	1.1 kg fb 1 kg	IBS fb PSPE	108	95	90
12	Jetti Duo <sup>®</sup> fb Palmero XT	1.8 L fb 1 Kg	IBS fb PSPE	93	100	<b>87</b>
13	Jetti Duo <sup>®</sup> fb Balance <sup>®</sup> + Metribuzin 750	1.8 L fb 100 g + 180 g	IBS fb PSPE	103	90	95
14	Sakura <sup>®</sup> fb Palmero <sup>®</sup> TX	118 g fb 1 kg	IBS fb PSPE	99	107	<b>86</b>
15	Trifluralin 480 + Terrain <sup>®</sup>	1.3 L + 180 g	IBS	<b>84</b>	93	<b>79</b>
16	Trifluralin 480 + Terrain <sup>®</sup> fb Balance <sup>®</sup>	1.3 L + 180 g fb 100 g	IBS fb PSPE	100	93	91
17	Trifluralin 480 + Terrain <sup>®</sup> fb Palmero <sup>®</sup> TX	1.3 L + 180 g fb 1 Kg	IBS fb PSPE	89	97	<b>82</b>
18	Trifluralin 480 fb Pamer <sup>®</sup> TX fb Broadstrike <sup>®</sup> X1	1.3 L fb 1 kg fb 25 g	BS fb PSPE fb 3-5 nodes	113	96	<b>88</b>
19	Trifluralin 480 fb Pamer <sup>®</sup> TX fb Broadstrike <sup>®</sup> X2	1.3 L fb 1 kg fb 50 g	BS fb PSPE fb 3-5 nodes	94	96	<b>88</b>
Isd (0.05) Control vs Herbicides (1-tail)				11	13	10
Isd (0.05) Herbicides vs Herbicides (1-tail)				14	17	14
CV (%)				11	13	10

IBS = incorporated by sowing, PSPE = Post-sowing pre-emergent, fb = followed by. Figures in **RED** are significantly lower than untreated control.

**Table 5: Effect of herbicide treatments on seed yield (% of untreated control) of chickpea varieties at Merredin during 2019 (2019ME48).**

No	Herbicides	Rate/ha	Timing	CBA Captain	Neelam	PBA Striker
0	Untreated Control >>>>> Seed yield (kg/ha)			100 697	100 678	100 814
1	Simazine 900 + Balance® X1	835 g + 100 g	IBS	113	102	118
2	Simazine 900 + Balance® X2	1.67 kg + 200 g	IBS	108	116	107
3	Palmero® TX X1	1 kg	IBS	111	109	110
4	Palmero® TX X2	2 kg	IBS	106	99	99
5	Edge® 900 WG	1.1 kg	IBS	98	104	104
6	Ulro® 900 WG	1.1 kg	IBS	97	104	108
7	Simazine 900 + Balance® X1	835 g + 100 g	PSPE	129	113	122
8	Simazine 900 + Balance® X2	1.67 kg + 200 g	PSPE	116	105	111
9	Palmero® TX X1	1 kg	PSPE	126	133	120
10	Palmero® TX X2	2 kg	PSPE	122	104	102
11	Edge® 900 WG fb Palmero® TX	1.1 kg fb 1 kg	IBS fb PSPE	108	104	107
12	Jetti Duo® fb Palmero XT	1.8 L fb 1 Kg	IBS fb PSPE	116	108	106
13	Jetti Duo® fb Balance® + Metribuzin 750	1.8 L fb 100 g + 180 g	IBS fb PSPE	136	111	100
14	Sakura® fb Palmero® TX	118 g fb 1 kg	IBS fb PSPE	113	112	105
15	Trifluralin 480 + Terrain®	1.3 L + 180 g	IBS	119	91	97
16	Trifluralin 480 + Terrain® fb Balance®	1.3 L + 180 g fb 100 g	IBS fb PSPE	125	122	116
17	Trifluralin 480 + Terrain® fb Palmero® TX	1.3 L + 180 g fb 1 Kg	IBS fb PSPE	112	111	106
18	Trifluralin 480 fb Pameror® TX fb Broadstrike® X1	1.3 L fb 1 kg fb 25 g	BS fb PSPE fb 3-5 nodes	102	95	90
19	Trifluralin 480 fb Pameror® TX fb Broadstrike® X2	1.3 L fb 1 kg fb 50 g	BS fb PSPE fb 3-5 nodes	103	103	88
	Isd (0.05) Control vs Herbicides (1-tail)			19	21	18
	Isd (0.05) Herbicides vs Herbicides (1-tail)			25	29	23
	CV (%)			19	21	17

IBS = incorporated by sowing, PSPE = Post-sowing pre-emergent, fb = followed by. Figures in **RED** are lower values, but are at par with untreated control.