Herbicide tolerance of chickpea varieties - Dongara

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Key messages

Desi chickpea varieties CBA Captain, Neelam and PBA Striker, and Kabuli chickpea variety Genesis 079 showed good tolerance to a range of chickpea herbicides or herbicide mixtures at the label rates and timings with good crop safety margin.

A new herbicide Ultro® 900 WG at 1.1 kg/ha applied before seeding reduced seed yield of PBA Striker (9%) significantly.

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 (2019GE38) and Dongara (29°13'26.8"S 114°56'00.74"E)
Soil Type, pH ($CaCl_2$) and Organic carbon (%)	0-10 cm : Red sandy loam, 6.1 and 2.42% 10-20 cm: Red sandy loam, 6.2 and 1.53%
Trial design	Criss-cross with every 5th 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 1.15 m (5 rows at 23 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, PBA Striker and Genesis 079. Genesis 07 is a Kabuli chickpea variety all other are Desi chickpea varieties. See Table 1 for herbicide treatments details.
Seeding date and rate	Sown on 15 June with seeding rate of 105 to132 kg/ha for Desi chickpeas and 174 kg/ha for Kabuli chickpea to target 45 plants/m^2
Seed treatment before sowing	P-Pickle T® 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	AgNP 80 kg/ha and Alosca group N granular 10 kg/ha applied with seed at seeding.

Soil moisture on 17 June 2019 Method used Cumulative rainfall: 8 days before sowing 1 week after seeding 2 weeks after seeding 4 weeks after sowing	0-10 cm: 24.1 % (average of 5 samples) 10-20 cm: 30.7 % (average of 5 samples) Volumetric method 69 mm 0 mm 76 mm 106 mm
Treatment application date: Incorporated by sowing (IBS) Post-sowing pre-emergent (PSPE) 3-4 node stage	Please see Table 1 for treatment details. 14 and 15 June 2019 15 June 2019 16 July 2019
Herbicide application machinery	Spray rig with shields on boom at a width of 1.5 m. Air induction nozzles (AIXR 11002, TeeJet Yellow) and 80 L/ha water volume used.
Visual observations scale:	0 to 100 %, where 0 = no visible injury & 100 = complete plant death.
Visual observation dates:	12 July, 19 August and 21 & 22 Oct 2019.
Chickpea plant count	22 October, 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^2.
Blanket Sprays	Bravo® 1.5 L/ha on 19 July, 13 and 28 August. Select® 500 mL/ha + 1% Hasten® on 23 July. Dominex® 300 mL/ha on 13 and 28 August, and 10 September.
Harvesting date	14 November 2019
Data analysis	Seed yield and plant population - ANOVA using GenStat prog.
Rainfall (mm) : 2019	May 4 / June 145 / July 35 / Aug 39 / Sept 13 / Oct 7 / Total 243

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	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 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 Pamero® TX fb Broadstrike® X1	1.3 L fb 1 kg fb 25 g	BS fb PSPE fb 3-5 nodes
19	Trifluralin 480 fb Pamero® 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, around flowering stage, on plant population (Table 2) and seed yield (Table 3) of chickpea varieties was as follows:

A new variety CBA Captain was the highest yielding at 1.68 t/ha seed yield, followed by PBA Striker at 1.64 t/ha, Neelam at 1.6 t/ha and Genesis 079 at 1.59t/ha with a plant population of 48-50 plants/m^2 (untreated control plots).

Correlation co-efficient between chickpea plant population and seed yield was 0.37, 0.25, 0.16 and -0.04 in CBA Captain, Neelam, PBA Striker, and Genesis 079, respectively.

Simazine + Balance® and Palmero® TX at label rates applied both IBS and PSPE were tolerated well by all the varieties with good crop safety margin except Palmero® TX at higher rate reduced plant population of PBA Striker significantly (no significant effect on seed yield).

Application of Edge® (propyzamide) IBS at the label rate alone and Edge® and Sakura® IBS followed by Palmero® TX PSPE at the label rates were safe to all the chickpea varieties.

At label rates, Jetti Duo® and trifluralin + Terrain® applied IBS and followed by Palmero® TX PSPE reduced plant population of PBA Striker significantly, whereas IBS application of trifluralin + Terrain® alone and followed by Balance® PSPE reduced plant population of Neelam and PBA Striker

significantly. However, these treatments had no significant negative effect on seed yield of these varieties.

A new pre-emergent herbicide Ultro® 900 WG (carbetamide) reduced plant population and seed yield of PBA Striker significantly. All other varieties tolerated it very well (Photo 1). It needs further testing to confirm the results. Ultro® 900 WG (Group E) is registered in chickpea at 1.1 kg/ha as IBS or PSPE application for suppression of ryegrass, brome grass and barley grass.

Combination of a well suited chickpea growing soil type and good seasonal conditions at this site could have reduced early season negative affect of some of the herbicides.

Key words

Herbicides, tolerance, chickpea varieties, seed yield.

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Plate 1: (L –R). Edge® 900 at 1.1 kg/ha, Ultro® 900 WG 1.1kg/ha (Centre) and Untreated Control. CBA Captain in the front followed by PBA Striker, Neelam and Genesis 079. The photo was taken on 19-8-2019.

Table 2: Effect of herbicide treatments on plant population (% of untreated control) of chickpea varieties on 22-10-19 at crop maturity (2019GE38).

No	Herbicides	Rate/ha	Timing	CBA Captain	Neelam	PBA Striker	Genesis 079
0	Untreated Control			100	100	100	100
	>>>>Plant population/m^2			50	50	49	48
1	Simazine 900 + Balance® X1	835 g + 100 g	IBS	92	107	90	93
2	Simazine 900 + Balance® X2	1.67 kg + 200 g	IBS	113	99	98	99
3	Palmero® TX X1	1 kg	IBS	104	108	101	108
4	Palmero ®TX X2	2 kg	IBS	94	104	102	110
5	Edge® 900 WG	1.1 kg	IBS	100	103	104	110
6	Ultro® 900 WG	1.1 kg	IBS	104	99	**77**	104
7	Simazine 900 + Balance® X1	835 g + 100 g	PSPE	102	96	98	104
8	Simazine 900 + Balance® X2	1.67 kg + 200 g	PSPE	104	101	102	99
9	Palmero® TX X1	1 kg	PSPE	94	90	104	114
10	Palmero® TX X2	2 kg	PSPE	102	94	**86**	99
11	Edge® 900 WG fb Palmero® TX	1.1 kg fb 1 kg	IBS fb PSPE	95	97	96	102
12	Jetti Duo® fb Palmero® TX	1.8 L fb 1 Kg	IBS fb PSPE	102	102	**86**	101
13	Jetti Duo® fb Balance® + Metribuzin 750	1.8 L fb 100 g + 180 g	IBS fb PSPE	100	94	96	94
14	Sakura® fb Palmero® TX	118 g fb 1 kg	IBS fb PSPE	104	98	94	93
15	Trifluralin 480 + Terrain®	1.3 L + 180 g	IBS	102	**75**	**80**	104
16	Trifluralin 480 + Terrain® fb Balance®	1.3 L + 180 g fb 100 g	IBS fb PSPE	95	**85**	**87**	90
17	Trifluralin 480 + Terrain® fb Palmero® TX	1.3 L + 180 g fb 1 Kg	IBS fb PSPE	98	92	**85**	99
18	Trifluralin 480 fb Pamero® XT fb Broadstrike® X1	1.3 L fb 1 kg fb 25 g	BS fb PSPE fb 3-5 nodes	105	94	94	105
19	Trifluralin 480 fb Pamero® XT fb Broadstrike® X2	1.3 L fb 1 kg fb 50 g	BS fb PSPE fb 3-5 nodes	103	96	**89**	104
lsd (0.05) Control vs Herbicides (1-tail)				10	10	10	11
lsd (0.05) Herbicides vs Herbicides (1-tail)				13	13	13	14
CV (%)				10	10	10	10

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

Table 3: Effect of herbicide treatments on seed yield (% of untreated control) of chickpea varieties at Dongara during 2019 (2019GE38).

No	Herbicides	Rate/ha	Timing	CBA Captain	Neelam	PBA Striker	Genesis 079
0	Untreated Control >>>>Seed yield (kg/ha)			100 1680	100 1602	100 1645	100 1592
1	Simazine 900 + Balance® X1	835 g + 100 g	IBS	95	99	95	103
2	Simazine 900 + Balance® X2	1.67 kg + 200 g	IBS	103	107	100	108
3	Palmero® TX X1	1 kg	IBS	100	100	103	101
4	Palmero® TX X2	2 kg	IBS	99	105	96	104
5	Edge® 900 WG	1.1 kg	IBS	105	105	96	104
6	Ultro® 900 WG	1.1 kg	IBS	95	98	**91**	104
7	Simazine 900 + Balance® X1	835 g + 100 g	PSPE	97	106	98	107
8	Simazine 900 + Balance® X2	1.67 kg + 200 g	PSPE	97	110	95	111
9	Palmero® TX X1	1 kg	PSPE	96	97	101	102
10	Palmero® TX X2	2 kg	PSPE	99	102	94	104
11	Edge® 900 fb Palmero® TX	1.1 kg fb 1 kg	IBS fb PSPE	99	100	97	97
12	Jetti Duo® fb Palmero® TX	1.8 L fb 1 Kg	IBS fb PSPE	98	99	100	103
13	Jetti Duo® fb Balance® + Metribuzin 750	1.8 L fb 100 g + 180 g	IBS fb PSPE	98	106	96	100
14	Sakura® fb Palmero® TX	118 g fb 1 kg	IBS fb PSPE	95	105	101	103
15	Trifluralin 480 + Terrain	1.3 L + 180 g	IBS	101	98	99	96
16	Trifluralin 480 + Terrain® fb Balance®	1.3 L + 180 g fb 100 g	IBS fb PSPE	97	101	106	101
17	Trifluralin 480 + Terrain® fb Palmero® TX	1.3 L + 180 g fb 1 Kg	IBS fb PSPE	100	97	98	102
18	Trifluralin 480 fb Pamero® XT fb Broadstrike® X1	1.3 L fb 1 kg fb 25 g	BS fb PSPE fb 3-5 nodes	101	102	100	100
19	Trifluralin 480 fb Pamero® XT fb Broadstrike® X2	1.3 L fb 1 kg fb 50 g	BS fb PSPE fb 3-5 nodes	102	99	106	105
lsd (0.05) Control vs Herbicides (1-tail)				6	6	6	6
lsd (0.05) Herbicides vs Herbicides (1-tail)				8	8	8	8
CV (%)				6	6	6	6

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