

Herbicide tolerance of lentil varieties - Dongara

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Key messages

Lentil varieties PBA Bolt, PBA Hallmark XT and PBA Jumbo2 showed good tolerance to a range of lentil herbicides or herbicide mixtures at registered rates and timings with good crop safety margin.

Unregistered use pattern of Brodal[®] (diflufenican) at 200 mL/ha as PSPE and of Metribuzin 750 at 100 g/ha in mixture with Brodal[®] 100 mL/ha as post-emergent application reduced seed yield of PBA Bolt and PBA Jumbo2 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 lentil varieties with the view to reduce their yield losses due to herbicide damage.

Method

Trial Year and Location	2019 (2019GE39) 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 5 th 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, 1.35 m plot width was used, even though plot to plot centre was 1.8 m.
Varieties and herbicide treatments	PBA Bolt, PBA Hallmark XT and PBA Jumbo2 and. See Table 1 for herbicide treatments details.
Seeding date and rate	Sown on 15 June with seeding rate of 53 to 73 kg/ha across varieties to target 110 plants/m ² .
Seed treatment before sowing	Gaucho [®] 2.4 mL and P-Pickle T [®] 2 mL per kg seed.
Seeding machinery and depth	Coneseeder with knife points and press-wheels and 4-5 cm deep. The site was not rolled.
Fertilizers and rhizobium Inoculum	AgNP 80 kg/ha and Alosca group EF granular 10 kg/ha applied with seed at seeding.

Soil moisture on 17 June 2019	0-10 cm: 24.1 % (average of 5 samples) 10-20 cm: 30.7 % (average of 5 samples)
Method used	Volumetric method
Cumulative rainfall:	
8 days before sowing	69 mm
1 week after seeding	0 mm
2 week after seeding	76 mm
4 weeks after sowing	106 mm
Treatment application date:	Please see Table 1 for treatment details.
Incorporated by sowing (IBS)	14 and 15 June 2019
Post-sowing pre-emergent (PSPE)	15 June 2019
4 node/leaf stage	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 Oct 2019.
Blanket Sprays	Bravo® 1.5 L/ha on 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	24 October 2019
Data analysis	Seed yield - ANOVA using GenStat prog.
Rainfall (mm) :	2019
	May June July Aug Sept Oct Total
	4 145 35 39 13 7 243

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	Terbyne [®] Xt [®] X1	0.86 kg	IBS
2	Terbyne [®] Xt [®] X2	1.72 kg	IBS
3	Edge [®] 900 WG X1	1.11 kg	IBS
4	Edge [®] 900 WG X2	2.22 kg	IBS
5	Terbyne [®] Xt [®] + Edge 900 X1	0.86 kg + 1.1 kg	IBS
6	Terbyne [®] Xt [®] + Edge 900 X2	1.72 kg + 2.2 kg	IBS
7	Terbyne [®] Xt + Sakura	0.86 kg + 118 g	IBS
8	Terbyne [®] Xt [®] + Trifluralin 480 (*)	0.86 kg + 1.25 L	IBS
9	Terbyne [®] Xt [®] + Trifluralin 480 + Boxer Gold [®]	0.86 kg + 1.25 L + 2.5 L	IBS
10	Trifluralin 480 + Diuron 500	1.25 L + 1.8 L	IBS
11	Terbyne [®] Xt [®] + Trifluralin 480 fb Spinnaker [®]	0.86 kg + 1.25 L fb 35 g	IBS fb PSPE
12	Terbyne [®] Xt [®] + Trifluralin 480 fb Brodal [®]	0.86 kg + 1.25 L fb 200 mL	IBS fb PSPE
13	Edge [®] 900 + Diuron 500 fb Metribuzin 750	1.1 kg + 1.8 L fb 150 g	IBS fb PSPE
14	(*) Brodal [®] X1	200 mL	4 leaf stage
15	(*) Brodal [®] X2	400 mL	4 leaf stage
16	(*) Brodal [®] + Metribuzin 750 X1	100 mL + 100 g	4 leaf stage
17	(*) Brodal [®] + Metribuzin 750 X2	200 mL + 200 g	4 leaf stage
18	(*) Broadstrike [®] X1	25 g	4-8 leaves (fully expanded)
19	(*) Broadstrike [®] X2	50 g	4-8 leaves (fully expanded)
0	Untreated Control		

- IBS = incorporated by sowing, PSPE = post-sowing pre-emergent, fb = followed by,
- Terbyne[®] Xt[®] = Terbyne[®] Xtreme[®] = terbuthylazine 875 g/kg, Boxer Gold[®] = prosulfocarb 800 g + s-metolachlor 120 g/L, Broadstrike[®] = flumetsulam 800 g/kg, Brodal[®] Options = diflufenican 500 g/L, Edge[®] = propyzamide 900 g/kg, Rustler[®] = propyzamide 500 g/L, Sakura[®] = pyroxasulfone 850 g/kg and Spinnaker[®] = imazethapyr 700 g/kg.
- A minor use permit (PER87042) for use of Spinnaker[®] or similar products at 70-100 g/ha as IBS or PSPE or post-emergent application (cotyledon to 3-leaf growth stage) on PBA PBA PBA Hallmark XT XT is valid until 24 February 2024.
- Pre-emergent use pattern of Brodal[®] (diflufenican) and post-emergent use pattern of metribuzin on lentils is not registered.
- 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, at flowering stage (Table 2), and on seed yield (Table 3) of lentil varieties was as follows:

PBA Jumbo2 was the highest yielding variety at 2.5 t/ha seed yield, followed by PBA Bolt at 2.4 t/ha, and PBA Hallmark XT at 2.3 t/ha (untreated control plots).

Terbyne[®] Xtreme[®] at 0.86 kg/ha and Edge[®] 900 at 1.11 kg/ha applied alone and in-mixture before seeding did not produce any visual symptoms and were tolerated well by all lentil varieties with good crop safety margin except Terbyne[®] Xtreme[®] + Edge[®] recorded low crop safety margin in PBA Bolt.

Application of Terbyne[®] Xtreme[®] in mix with trifluralin or diuron before seeding was tolerated well by all the varieties. Sakura[®] applied before seeding in mixture with Terbyne[®] Xtreme[®] and Boxer Gold[®] with Terbyne[®] Xtreme[®] + trifluralin, caused slight visible biomass suppression during early growth stages, but had no significant negative effect on seed yield of lentil varieties.

Terbyne[®] Xtreme[®] 0.85 kg + Trifluralin 480 1.25 L/ha IBS followed by Spinnaker[®] 35 g/ha and Edge[®] 900 1.11 kg + Diuron 500 1.8 L/ha IBS followed by Metribuzin 750 150 g/ha PSPE were tolerated by all the varieties well. Imzethapyr or Spinnaker is permitted (permit no 87042) to use only on XT lentils

such as PBA Hallmark XT. Depending upon soil type, Metribuzin 750 at 180-380 g/ha as PSPE application is registered on lentils.

Terbyne® Xtreme® 0.86 kg + Trifluralin 480 1.25 L/ha BS followed by Brodal® 200 mL/ha PSPE caused visible bleaching of leaves (Photo 1) during early growth stages, reduced biomass by 20-25% around flowering stage (Photo 2) and ultimately reduced seed yield of PBA Jumbo2 and PBA Bolt significantly. The results are in line with Merredin trial site. Pre-emergent use of Brodal® on lentils is not registered.

Registered post-emergent herbicides Brodal® at 200 mL/ha and Broadstrike® at 25 g/ha applied at 4 leaf stage were tolerated well with good crop safety margin by all the lentil varieties.

Post-emergent application of Brodal® 100 mL + Metribuzin 750 100 g/ha at 4 leaf stage reduced biomass by 20% around flowering stage and seed yield of PBA Jumbo2 and PBA Bolt significantly. At higher rate of this mix, the intensity of these symptoms was higher and seed yield of all the varieties was reduced significantly. Post-emergent use of metribuzin on lentils is not registered.

Key words

Herbicides, tolerance, lentil varieties, seed yield.

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Plate 1: Bleaching symptoms caused by PSPE Brodal® on lentils. The photo was taken by Martin Harries on 12-7-19.



Plate 2: (L –R) Terbyne® Xt® + Trifluralin (IBS) followed by Brodal® (PSPE), Edge® 900 WG + Diuron 900 (IBS) followed by Metribuzin 750 (PSPE) in the centre and Untreated control. Brodal® PSPE treatment caused biomass reduction across all varieties. PBA Bolt in the front followed by PBA Jumbo2 and PBA Hallmark XT. The photo was taken on 19-8-2019.



Plate 3: (L –R) Brodal® 100 mL + Metribuzin 750 100 g/ha, Brodal® 200 mL + Metribuzin 750 200 g/ha (in the centre) and Untreated control. Brodal + metribuzin treatments caused biomass reduction across all varieties. PBA Bolt in the front followed by PBA Jumbo2 and PBA Hallmark XT. The photo was taken on 19-8-2019.

Table 2: Visual biomass reduction (%) of lentil varieties (averaged over three reps) as observed on 19-8-2019 at Dongara (2019GE39).

No	Herbicides	Rate/ha	Timing	PBA Bolt	PBA Hallmark XT	PBA Jumbo2
0	Untreated Control			0	0	0
1	Terbyne® Xt® X1	0.86 kg	IBS	0	0	0
2	Terbyne® Xt® X2	1.72 kg	IBS	0	5	0
3	Edge® 900 WG X1	1.11 kg	IBS	0	0	0
4	Edge® 900 WG X2	2.22 kg	IBS	0	0	0
5	Terbyne® Xt® + Edge® 900 WG X1	0.86 kg + 1.1 kg	IBS	0	0	0
6	Terbyne® Xt® + Edge® 900 WG X2	1.72 kg + 2.2 kg	IBS	5	10	0
7	Terbyne® Xt® + Sakura®	0.86 kg + 118 g	IBS	5	5	5
8	Terbyne® Xt® + Trifluralin 480 (*)	0.86 kg + 1.25 L	IBS	0	0	0
9	Terbyne® Xt® + Trifluralin 480 + Boxer Gold®	0.86 kg + 1.25 L + 2.5 L	IBS	5	10	5
10	Trifluralin 480 + Diuron 500	1.25 L + 1.8 L	IBS	0	0	0
11	Terbyne® Xt® + Trifluralin 480 fb Spinnaker®	0.86 kg + 1.25 L fb 35 g	IBS fb PSPE	0	0	0
12	Terbyne® Xt® + Trifluralin 480 fb Brodal®	0.86 kg + 1.25 L fb 200 mL	IBS fb PSPE	20	20	25
13	Edge® 900 + Diuron 500 fb Metribuzin 750	1.1 kg + 1.8 L fb 150 g	IBS fb PSPE	0	0	0
14	(*) Brodal X1	200 mL	4 leaf stage	0	0	0
15	(*) Brodal X2	400 mL	4 leaf stage	0	0	0
16	(*) Brodal® + Metribuzin 750 X1	100 mL + 100 g	4 leaf stage	20	20	20
17	(*) Brodal® + Metribuzin 750 X2	200 mL + 200 g	4 leaf stage	25	25	25
18	(*) Broadstrike® X1	25 g	4-8 leaves (fully expanded)	0	0	0
19	(*) Broadstrike® X2	50 g	4-8 leaves (fully expanded)	0	0	0

IBS = incorporated by sowing, PSPE = post-sowing pre-emergent, fb = followed by. (*) = Terbyne® Xtreme® 0.86 kg + Trifluralin 480 1.25 L/ha. At the time of observations, plants were at 11-12 node stage and PBA Jumbo2 started to flower.

No	Herbicides	Rate/ha	Timing	PBA Bolt	PBA Hallmark XT	PBA Jumbo2
0	Untreated Control >>> Seed yield kg/ha			100 2449	100 2449	100 2540
1	Terbyne® Xt® X1	0.86 kg	IBS	99	102	104
2	Terbyne® Xt® X2	1.72 kg	IBS	96	98	107
3	Edge® 900 WG X1	1.11 kg	IBS	100	102	103
4	Edge® 900 WG X2	2.22 kg	IBS	96	111	103
5	Terbyne® Xt® + Edge® 900 WG X1	0.86 kg + 1.1 kg	IBS	100	102	104
6	Terbyne® Xt® + Edge® 900 WG X2	1.72 kg + 2.2 kg	IBS	92	96	95
7	Terbyne® Xt® + Sakura®	0.86 kg + 118 g	IBS	97	102	102
8	Terbyne® Xt® + Trifluralin 480 (*)	0.86 kg + 1.25 L	IBS	100	104	103
9	Terbyne® Xt® + Trifluralin 480 + Boxer Gold®	0.86 kg + 1.25 L + 2.5 L	IBS	99	102	101
10	Trifluralin 480 + Diuron 500	1.25 L + 1.8 L	IBS	98	102	99
11	Terbyne® Xt® + Trifluralin 480 fb Spinnaker®	0.86 kg + 1.25 L fb 35 g	IBS fb PSPE	103	100	99
12	Terbyne® Xt® + Trifluralin 480 fb Brodal®	0.86 kg + 1.25 L fb 200 mL	IBS fb PSPE	92	96	77
13	Edge® 900 + Diuron 500 fb Metribuzin 750	1.1 kg + 1.8 L fb 150 g	IBS fb PSPE	107	98	95
14	(*) Brodal X1	200 mL	4 leaf stage	95	99	96
15	(*) Brodal X2	400 mL	4 leaf stage	98	104	97
16	(*) Brodal® + Metribuzin 750 X1	100 mL + 100 g	4 leaf stage	94	96	87
17	(*) Brodal® + Metribuzin 750 X2	200 mL + 200 g	4 leaf stage	78	91	70
18	(*) Broadstrike® X1	25 g	4-8 leaves (fully expanded)	98	97	100
19	(*) Broadstrike® X2	50 g	4-8 leaves (fully expanded)	107	104	105
Isd (0.05) Control vs Herbicides (1-tail)				6	6	6
Isd (0.05) Herbicides vs Herbicides (1-tail)				8	8	8
CV (%)				6	6	6

IBS = incorporated by sowing, PSPE = post-sowing pre-emergent, fb = followed by. (*) = Terbyne® Xtreme® 0.86 kg + Trifluralin 480 1.25 L/ha. Figures in **RED** are significantly lower than untreated control.