Short communication

Indian Journal of Weed Science **47**(2): 211–213, 2015

Bioefficacy of herbicides in blackgram and their residual effect on succeeding mustard

Sandeep Kumar, M.S.Bhatto, S.S. Punia* and Rajni Punia

Department of Agronomy, CCS Haryana Agricultural University, Hisar, Haryana 125 004

Received: 12 April 2015; Revised: 7 May 2015

Key words: Blackgram, Broad-leaf, Crop injury, Mustard, Residual effect, Pre- and post-emergence

Due to limited irrigation facilities, blackgram is the important *Kharif* season in Shivalik foot hills region of Panchkula, Ambala and Yamuna Nagar districts of Haryana state. Weed emergence in blackgram begins almost with the crop emergence leading to crop-weed competition from initial stages and reduce yields to the extent of 78% and sometimes lead to the total failure of crop (Gogoi *et al.* 1992). An initial period of crop-weed completion of 20-40 days is very critical (Saraswat and Mishra 1993) and a season long weed competition has been found to reduce blackgram yield to the extent of 87% depending upon type and intensity of weed flora (Singh *et al.* 2002). Thus, it is necessary to eliminate weeds from crop at proper time and with suitable methods. Chemical method of weed management offers good scope for harvesting a good crop of blackgram.

Imazethapyr and its ready mix combination with imazamox, new herbicides of imidazolinone group have been found promising to control weeds in blackgram. Imazethapyr being highly persistent in soil may cause residual toxicity in succeeding crops (Hollaway *et al.* 2006). Keeping it in view, the present study has been planned to study the bio-efficacy of different herbicides in blackgram and the residual effect of herbicides applied in blackgram on succeeding mustard crop.

Studies on evaluation of herbicides in blackgram and their residual effect on succeeding mustard crop were conducted at Research Area of Department of Agronomy, CCSHAU, Hisar during *Kharif* 2013 and *Rabi* 2013-14. The experimental soil was sandy loam (*Typic Ustochrepts*) with 61% sand, 22.1% silt and 19.1% clay, medium in fertility with 0.29% organic carbon and a pH of 8.2. Blackgram variety '*UH-1*' was drilled on July 16, 2013 in a plot size of 12 x 3.6 m, keeping row to row distance of 30 cm by using seed rate of 15 kg/ha. The study was arranged in randomized block design replicated thrice. To study the residual effect of herbicides applied in blackgram on succeeding crop, mustard var. '*RH-30*' was sown after slight disking the field without disturbing the original layout and crop was raised as per package of practices recommended by CCS HAU, Hisar. Visual injury ratings of weed control and phytoxicity to blackgram were estimated at 15, 30, 45 and 60 DAS on a scale of 0 to 100. Above ground weed biomass was sampled at 30 and 60 DAS using a quadrant of 0.5 x 0.5 m. Plant material was dried at 65^0C for 48 h before determining dry weight and this was used for calculating weed control efficiency (WCE). Data on weed density, per cent weed control, crop injury and seed yield of blackgram were analyzed by analysis of variance, and means were separated with least significant difference at 5% level of probability. To estimate the residual effect of herbicides applied in blackgram on succeeding mustard, data on plant height, number of leaves/plant, fresh weight/plant was recorded at 30 DAS and grain yield of mustard was recorded at maturity.

***Corresponding author:** puniasatbir@gmail.com

Effect of herbicides in blackgram

The major weeds appeared in experimental field comprised of *T. portulacastrum, C. rotundus* and *Convolvulus arvensis*. At 30 DAS, *T. portulacastrum* was the dominant weed with relative density of 83% but at 60 DAS, *C. rotundus* dominated weed flora with relative density of 72%.

Pre-emergence application of imazethapyr + pendimethalin at 1000 g/ha provided excellent control (90%) of *T. portulacastrum* up to 30 DAS. At 60 DAS, per cent control with this treatment decreased to 73% which was at par with two hoeings employed at 20 and 40 DAS and pendimethalin at 1000 g/ha used pre-emergence. Post-emergence use of imazethapyr + imazamox at 60-80 g/ha exhibited 78-83% control of weeds with slight crop suppression in form of chlorosis, leaf crinkling and stunting, which mitigated within 15 days after spray resulting adverse effect on crop growth and yield. Early post-emergence application of imazethapyr at 50, 60 and

70 g/ha also caused mild injury to blackgram up to 30 DAS (Table 1), This is in agreement with results of Chandakar *et al.* (2014) who reported effectiveness of early post-emergence application (15-20 DAS) of imazethapyr at 40 g/ha and pendimethalin + imazethapyr at 1.0 kg/ha as pre-emergence against weeds in blackgram in clay textures soils of Raipur. Studies conducted by Patel *et al.* (2014) under Gujarat conditions are also in conformity with above results. The yield and yield attributing characters of blackgram were adversely affected in unweeded plots due to severe weed competition up to harvest. Seed yield of blackgram in the presence weeds through out crop season was reduced by 78%. Similar results were reported by Gogoi *et al.* (1992). Maximum seed yield (0.90 t/ha) of blackgram was obtained with two hoeings at 20 and 40 DAS which was at par with imazethapyr + pendimethalin at 1000 g/ha and pendimethalin at 1000 g/ha applied as pre-emergence.

Economics: The comparative economics showed that PRE application of pendimethalin at 1000 g/ha was most economical weed control treatment with net returns of ` 22,765/ha with benefit : cost ratio of 2.30 which was closely followed by pre-emergence application of imazethapyr + pendimethalin at 1000 g/ha (` 22,390/ha) and B:C of 2.24. Chaudhary *et al.* (2012) reported that in blackgram pre-emergence application of pendimethalin at 1.5 kg/ha + one HW on 25 DAS was at par with 2 HW at 15 and 25 DAS in respect of seed yield, net returns and B:C ratio (Table 2).

Residual effect of herbicides applied in blackgram on succeeding mustard crop

No residual carry over effect of these herbicides applied in blackgram was visible on succeeding mustard crop as no. of plants/m.r.l., number of leaves/ plant and seed yield of mustard in untreated and herbicide applied treatments was same(Table 2). This may be due to enhanced microbial degradation of these herbicides with 477 mm of rainfall occurred between time of herbicide application and planting of mustard. Earlier findings of Tomar *et al.* (2014) and Patel *et al.* (2014) support above results where no residual effect of imazethapyr at 70 g/ha and its ready

Table 1. Effect of different herbicides on visual weed control, crop phytotoxicity and seed yield of blackgram (2013)

Treatment	Dose (g/ha)	Time of application	Weed density at 60 DAS (no./m^2)			WCE (%)	Visual weed control (%) *Trianthema*			Crop phytotoxicity (%)		
			T. portulacastrum	*C. rotundus*	*C. arvensis*		30 DAS	45 DAS	60 DAS	15 DAS	30 DAS	45 DAS
Pendimethalin	1000	PRE	3.0 (8.0)	10.2 (104.0)	3.9 (14.3)	40.3 (42.0)	65.9 (83.3)	55.7 (68.3)	51.7 (61.7)	0	0	0
Imazethapyr	50	3-4 leaf stage	3.0 (8.0)	7.8 (60.7)	3.8 (13.7)	44.2 (48.7)	27.7 (21.7)	49.8 (58.3)	46.8 (53.3)	0	0	0
Imazethapyr	60	3-4 leaf stage	2.5 (5.3)	7.6 (58.0)	3.8 (13.7)	47.7 (54.7)	29.9 (25.0)	52.7 (63.3)	49.7 (58.3)	0	12.2	0
Imazethapyr	70	3-4 leaf stage	2.5 (5.3)	7.5 (56.7)	3.8 (13.7)	51.8 (61.7)	34.2 (31.7)	55.7 (68.3)	50.7 (60.0)	0	19.8	0
Imazethapyr + pendimethalin	800	PRE	2.9 (7.3)	11.2 (124.0)	3.9 (14.7)	46.0 (51.7)	68.8 (86.7)	55.0 (66.7)	52.7 (63.3)	0	0	0
Imazethapyr + pendimethalin	900	PRE	1.5 (2.0)	10.5 (109.3)	3.9 (14.0)	48.1 (55.3)	70.1 (88.3)	57.8 (71.7)	54.7 (66.7)	0	0	0
Imazethapyr + pendimethalin	1000	PRE	1.0 (0)	9.6 (92.0)	3.7 (13.0)	54.1 (65.7)	71.5 (90.0)	62.3 (78.3)	58.9 (73.3)	0	0	0
Imazethapyr + imazamox	50	3-4 leaf stage	1.0 (0)	8.7 (74.0)	3.9 (15.3)	55.5 (68.0)	31.0 (26.7)	65.9 (83.3)	61.1 (76.7)	0	18.4	0
Imazethapyr + imazamox	60	3-4 leaf stage	1.0 (0)	8.7 (74.7)	3.9 (14.7)	58.3 (72.3)	32.0 (28.3)	68.8 (86.7)	62.2 (78.3)	0	21.3	0
Imazethapyr + imazamox	70	3-4 leaf stage	1.0 (0)	8.6 (72.7)	3.9 (14.0)	59.4 (74.0)	33.2 (30.0)	70.1 (88.3)	64.6 (81.7)	0	24.0	0
Imazethapyr + imazamox	80	3-4 leaf stage	1.0 (0)	7.9 (61.3)	3.9 (14.3)	60.4 (75.3)	34.2 (31.7)	71.5 (90.0)	65.9 (83.3)	0	25.3	0
Two hoeings		20 & 40 DAS	1.7 (2.0)	6.2 (38.0)	3.0 (6.7)	70.6 (89.0)	68.8 (86.7)	73.4 (91.7)	67.3 (85.0)	0	0	0
One hoeing	-	20 DAS	2.8 (6.7)	8.3 (68.7)	3.6 (12.3)	62.8 (79.0)	67.4 (85.0)	64.7 (81.7)	61.1 (76.7)	0	0	0
Weed free	-	-	1.0 (0)	1.0 (0)	1.0 (0)	90.0 (100.0)	90.0 (100.0)	90.0 (100.0)	90.0 (100)	0	0	0
Weedy check	-	-	5.2 (26.0)	10.5 (108.7)	4.2 (16.7)	0 (0)	0 (0)	0 (0)	0 (0)	0	0	0
LSD (P=0.05)			0.6	1.1	0.7	3.5	5.0	4.8	3.47	-	5.2	-

Table 2. Grass returns and residual carry over effect of different herbicides applied in blackgram on succeeding mustard crop (2013-14)

Treatment	Dose (g/ha)	Time of application	Blackgram			Mustard			
			Seed yield (t/ha)	Gross returns (x10^3 `)	B:C ratio	No. of plants/ m. r. l.	Plant height (60 DAS)	No. of pods/ Plant	Seed yield (t/ha)
Pendimethalin	1000	PRE	0.86	40.16	2.30	11	20.5	299	2.48
Imazethapyr	50	3-4 leaf stage	0.69	32.03	1.88	10	20.1	306	2.47
Imazethapyr	60	3-4 leaf stage	0.70	32.83	1.91	11	20.3	306	2.50
Imazethapyr	70	3-4 leaf stage	0.75	34.95	2.01	11	19.8	303	2.52
Imazethapyr + pendimethalin	800	PRE	0.69	32.57	1.85	11	20.9	301	2.47
Imazethapyr + pendimethalin	900	PRE	0.85	39.32	2.12	11	20.2	298	2.50
Imazethapyr + pendimethalin	1000	PRE	0.87	40.34	2.24	11	19.8	306	2.50
Imazethapyr + imazamox	50	3-4 leaf stage	0.72	33.11	1.93	11	19.9	306	2.45
Imazethapyr + imazamox	60	3-4 leaf stage	0.78	36.34	2.11	11	19.8	306	2.48
Imazethapyr + imazamox	70	3-4 leaf stage	0.81	37.75	2.16	11	20.6	310	2.47
Imazethapyr + imazamox	80	3-4 leaf stage	0.82	38.01	2.16	12	20.6	323	2.45
Two hoeings		20 & 40 DAS	0.90	41.54	1.60	12	20.3	313	2.48
One hoeing	-	20 DAS	0.82	38.15	1.83	11	20.8	313	2.50
Weed free	-	-	1.02	47.31	2.38	12	21.2	306	2.52
Weedy check	-	-	0.23	10.76	0.68	11	19.9	303	2.47
LSD (P=0.05)			0.05			NS	NS	NS	NS

mixture with pendimethalin at 800 g/ha applied pre-emergence in blackgram was not observed on succeeding mustard and wheat crops. But findings of this experiment are not in agreement with earlier finding of Punia *et al.* (2011) who reported poor, stunted growth of mustard grown after imazethapyr used at 80-100 g/ha either PPI, pre- and post-emergence (21 DAS) in preceding clusterbean crop.

SUMMARY

Pre-emergence application of imazethapyr + pendimethalin at 1000 g/ha provided excellent control (90%) of *T. portulacastrum* up to 30 DAS. At 60 DAS, per cent control with this treatment decreased to 73% which was at par with two hoeings employed at 20 and 40 DAS and pendimethalin at 1000 g/ha. Post-emergence use of imazethapyr + imazamox at 60-80 g/ha exhibited 78-83% control of weeds with slight crop suppression which mitigated within 10-15 days after spray but with yield penalty. Early post-emergence application of imazethapyr at 50, 60 and 70 g/ha also caused mild injury to blackgram in terms of yellowing of leaves and stunted crop growth up to 30 DAS, but it diminished within two weeks. Maximum seed yield (0.90 t/ha) of blackgram was obtained with two hoeings at 20 and 40 DAS which was at par with imazethapyr + pendimethalin at 1000 g/ha and pendimethalin at 1000 g/ha applied as pre-emergence. All herbicides, irrespective of their dose and time of application, did not cause any injury to mustard planted as succeeding crop after harvest of blackgram.

REFERENCES

Chandrakar DK, Nagre SK, Chandrakar K, Singh AP and Nair SK. 2014. Chemical weed management in blackgram. p. 93 In: Extended Summary of Biennial Conference of Indian Society of Weed Science, Feb. 15-17, 2014, DSWR, Jabalpur (M.P.).

Choudhary VK, Suresh KP and Bhagawati R. 2012. Integrated weed management in blackgram (*Vigna mungo*) under mid hills of Arunachal Pradesh. *Indian Journal of Agronomy* **57** (4): 382-385.

Gogoi AK, Kalita H, Pathal AK and Deka J. 1992. Crop-weed competition in rainfed blackgram. *Indian Journal of Weed Science* **24:** 81-83.

Hollaway KL, Kookana RS, Noy DM, Smith JGN and Wilhelm C. 2006. Persistence and leaching of imazethapyr and flumetsulam herbicides over a 4-year period in the highly alkaline soils of south-eastern Australia. *Australian Journal of Experimental Agriculture* **46**: 669–674.

Patel RB, Patel BD and Parmar JK. 2014. Combination of imazethapyr with other herbicides against complex weed flora in blackgram. p. 115. In: Extended Summary of Biennial Conference of Indian Society of Weed Science, Feb. 15-17, 2014, DSWR, Jabalpur (M.P.).

Punia SS, Singh S and Yadav D. 2011. Bioefficacy of imazethapyr and chlorimuron-ethyl in clusterbean and their residual effect on succeeding rabi crops. *Indian Journal of Weed Science* **43** (1&2): 48-53.

Sarswat V N and Mishra JS. 1993. Weed management in pulse crops. In: *Proceedings of International Symposium of Indian Society of Weed Science,* CCS HAU, Hisar, November 18-20, Vol. 111. L37-l40 pp.

Tomar J, Tomar SS, Singh R and Vivek. 2014. Effect of imazethapyr on blackgram and residual effect on wheat and mustard crops, p. 192. In: Extended Summary of Biennial Conference of Indian Society of Weed Science, Feb. 15-17, 2014, DSWR, Jabalpur (M.P.).