Indian Journal of Weed Science **47**(2): 136–138, 2015

Weed management effects on yield and economics of blackgram

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Received: 7 April 2015; Revised: 18 May 2015

ABSTRACT

A field experiment was conducted during the *Kharif* season of 2012 and 2013 to evaluate the effect of weed management practices on weed dry weight, yield attributes, yield and economics of blackgram (*Vigna mungo* L.). All the weed species were controlled effectively by pre-mix herbicides as compared to alone application of pendimethalin as pre-emergance and imazethapyr as post-emergence. The reduction in total dry weight of weeds (6.13g/m^2) and maximum weed control efficiency 95.74% was found significantly higher with weed free treatment over all the weed control treatments except pre-mix herbicide imazethapyr + imazamox at 0.05 kg/ha PoE having 12.20g/m^2 weed dry weight and 91.53% weed control efficiency at 60 DAS stage of crop growth. The significantly higher seed (0.89t/ha) and straw (2.91t/ha) yield was recorded in weed free plot over all the treatments, which was followed by imazethapyr + imazamox (pre-mix) at 0.05 kg/ha as (0.84 and 2.89t/ha) and pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha (0.80 and 2.82 t/ha) treatments. However, the maximum net return of ` 17,135/ha and benefit:cost ratio (2.35) was found with imazethapyr + imazamox (pre-mix) at 0.05 kg/ha followed by pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha (` 16,410 and 2.30) treatment.

Key words: Blackgram, Economics, Pre-mix herbicides, Weed dry weight, Yield

Blackgram is one of the most important pulse crops, which can be grown in tropical and subtropical countries. It is grown during *Kharif* season in India where weed infestation causes considerable loss in yield. The weed causes maximum damage initially 25 to 35 days after sowing (Randhawa *et al*. 2002). The weed infestation during early stages of crop growth ends up in yield reduction up to 43.2-64.1% in blackgram (Rathi *et al*. 2004). Therefore, removal of weeds at appropriate time using a suitable method is essential to obtain high yields of blackgram. In blackgram, weeds could be controlled by hand weeding (Chand *et al*. 2004). However, hand weeding is laborious, time consuming, costly and tedious. Moreover, many times labour is not available at the critical period of weed removal. Furthermore, weather conditions do not permit timely hand weeding due to wet field conditions. Use of herbicides offers an alternative for possible effective control of weeds. Therefore, in the present study, effect of various herbicides was compared with hand weeding and untreated check for evaluating the reduction in weed dry weight and obtaining high yields of blackgram grown during *Kharif* season.

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MATERIALS AND METHODS

The climate of experimental area was dry hot during summer and dry cool in winter season. The temperature varies from 5^0 C during winter to 47^0 C in summer season. The soil of the experimental field was sandy-loam in texture, neutral in reaction (pH 7.6) with 0.45% organic carbon content and analyzing low in available N (179 kg/ha), medium P (18.6 kg/ha) and K (298 kg/ha) contents. The topography of experimental field was uniform. Fertility status of experimental site was homogenous. Variations in the growth and yield of crop were mainly due to effect of the treatments tested. The experiment was laid out in randomized block design with three replications having ten treatments, *viz.* pendimethalin at 1.0 kg/ha PE, imazethapyr at 0.050 kg/ha PoE, , imazethapyr at 0.070 kg/ha PoE, pendimethalin + imazethapyr (pre-mix) at 0.80 kg/ha PE, pendimethalin + imazethapyr (pre-mix) at 0.90 kg/ha PE, pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha PE, imazethapyr + imazamox (pre-mix) at 0.04 kg/ha PoE, imazethapyr + imazamox (pre-mix) at 0.05 kg/haPoE, weed free (two hand weedings at 20 and 40 DAS) and weedy check. The quantities of herbicides as per treatments were sprayed by knap-sack sprayer with flat fan nozzle with 600 litre of water. The blackgram variety *'T-9'* was sown at 30

cm apart rows with a seed rate of 18 kg/ha on first fortnight of July and harvested on first week of October during both the experimental years. The crop was fertilized with 20 kg N, 50 kg P_2O_5 and 20 kg K_2O/ha through urea, single super phosphate and murate of potash, respectively.

RESULTS AND DISCUSSION

Effect on weeds

The major weed flora of the experimental field consisted of *Cyperus rotundus, Echinochloa crusgalli, Commelina benghalensis, Phyllanthus niruri* and *Digera arvensis*. All the weed species were effectively controlled by pre-mix herbicides *i.e.*, imazethapyr + imazamox and pendimethalin+ imazethapyr as compared to alone application of pendimethalin as PE and imazethapyr as PoE. Both doses of pre-mix herbicide imazethapyr + imazamox and pendimethalin+ imazethapyr were equally effective as two hand weedings at 20 and 40 days after sowing and they were statistically at par with each other whereas all the weed control treatments were significantly superior to weedy check in respect to reduce the weed population and dry weight of weeds at 60 DAS stage of crop growth. The reduction in total dry weight of weeds was found significantly higher with weed free treatment (6.13 g/m^2) over all the weed control treatments except imazethapyr + imazamox (pre-mix) at 0.05 kg/ha PoE (12.20 g/m^2). The findings were in close agreement with previously reported by Bhandari *et al*. (2004). The maximum weed control efficiency 95.74% was recorded under weed free treatment, which was followed by imazethapyr + imazamox (pre-mix) at 0.05 kg/ha PoE (91.53%) at 60 DAS stage of crop growth.

Effect on crop

All the growth and yield attributes were significantly higher under pre-mix herbicides as PE and PoE application as compared to alone application of these herbicides and at par with weed free plot. The weed free plot was recorded significantly superior in respect of growth and yield attributes as compared to all other treatments. However, among the herbicidal treatments, highest plant height (96.6 cm and 96.2 cm), number of leaves (35.7 and 35.2), Pod length (4.42 and 4.41 cm), number of branches (16.9 and 16.9/plant) and number of pods (65.69 and 57.7/plant) were recorded with imazethapyr + imazamox (pre-mix) at 0.05 kg/ha and pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha, respectively. This was due to better control of both grassy as well as broad leaved weeds during early crop growth period. The minimum values were recorded under

Table 1. Effect of different treatments on weed population, dry weight of weeds and WCE at 60 DAS in blackgram (pooled data of two years)

Treatment	Weed population/m^2					Weed dry weight (g/m^2)			Weed control efficiency (%)
	E. crusgalli	*C. rotundus*	*D. arvensis*	*C. benghal-ensis*	*P. niruri*	Narrow -leaf weed	Broad -leaf weed	Total	
Pendimethalin at 1.0 kg/ha PE	2.44 (5.67)	2.16 (8.66)	2.15 (3.66)	2.41 (5.17)	2.33 (4.67)	35.1	27.3	62.39	56.7
Imazethapyr at 0.050 kg/ha PoE	2.37 (5.16)	2.22 (8.33)	1.89 (2.67)	2.14 (3.66)	1.80 (2.33)	28.4	19.1	47.50	67.1
Imazethapyr at 0.070 kg/ha PoE	1.99 (3.17)	1.99 (7.00)	1.67 (2.00)	1.69 (2.16)	1.64 (1.83)	20.3	15.3	35.64	75.3
Pendimethalin + imazethapyr (pre-mix) at 0.80 kg/ha PE	1.88 (2.67)	1.84 (5.67)	1.71 (2.00)	2.01 (3.17)	1.55 (1.50)	20.7	17.8	38.56	73.3
Pendimethalin + imazethapyr (pre-mix) at 0.90 kg/ha PE	1.70 (2.00)	1.73 (4.83)	1.52 (1.50)	1.87 (2.67)	1.43 (1.17)	14.70	13.3	28.01	80.6
Pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha PE	1.50 (0.83)	1.50 (3.83)	1.31 (0.83)	1.55 (1.50)	1.33 (0.83)	.41	2.1	1.51	5.1
Imazethapyr + imazamox (pre-mix) at 0.04 kg/ha PoE	1.71 (2.00)	1.57 (4.00)	1.41 (1.16)	1.95 (1.50)	1.38 (1.00)	6.2	.94	5.15	2.5
Imazethapyr + imazamox (pre-mix) at 0.05 kg/ha PoE	1.28 (0.67)	1.04 (2.00)	0.71 (0.50)	1.43 (1.17)	1.21 (0.50)	.02	.18	2.20	1.5
Weed free (two hand weeding at 20 and 40 DAS)	1.18 (0.50)	0.87 (1.50)	1.14 (0.33)	1.07 (0.16)	1.07 (0.16)	.55	.58	.13	5.7
Weedy check	4.53 (20.2)	3.46 (31.3)	3.75 (13.8)	3.63 (12.3)	3.19 (6.54)	8.15	15.9	44.2	.00
LSD (P=0.05)	0.47	0.38	0.33	0.79	0.44	2.56	4.41	6.97	-
Transformation	Log x	$\sqrt{x+0.5}$	$\sqrt{x+0.5}$	$\sqrt{x+0.5}$	$\sqrt{x+0.5}$				

PE - pre-emergence

Table 2. Effect of different treatments on growth, yield attributing characters, yield and economics of blackgram (pooled data of two years)

Treatment	Plant height (cm)	No. of branches /plant	No. of pods/ plant	Seed yield (t/ha)	Stover yield (t/ha)	Cost of cultivation (x10^3 `/ha)	Net returns (x10^3 `/ha)
Pendimethalin at 1.0 kg/ha PE	88.6	13.9	48.8	0.54	2.25	11.65	7.14
Imazethapyr at 0.050 kg/ha PoE	87.8	12.6	49.1	0.33	2.23	11.59	6.86
Imazethapyr at 0.070 kg/ha PoE	90.9	12.9	51.2	0.64	2.34	11.75	10.75
Pendimethalin + imazethapyr (pre-mix) at 0.80 kg/ha PE	93.3	14.3	56.1	0.74	2.62	12.17	13.58
Pendimethalin + imazethapyr (pre-mix) at 0.90 kg/ha PE	95.6	16.1	56.1	0.75	2.69	12.25	14.07
Pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha PE	96.2	16.9	57.7	0.80	2.82	12.34	16.42
Imazethapyr + imazamox (pre-mix) at 0.04 kg/ha PoE	95.3	15.2	59.8	0.82	2.71	11.99	15.06
Imazethapyr + imazamox (pre-mix) at 0.05 kg/ha PoE	96.6	16.9	65.6	0.77	2.89	12.16	17.13
Weed free (two hand weeding at 20 and 40 DAS)	98.1	17.5	68.8	0.89	2.91	14.98	16.31
Weedy check	71.2	8.09	30.2	0.31	1.56	10.92	-0.18
LSD (P=0.05)	4.45	2.46	5.05	0.05	0.12	-	-

weedy check treatment. The significantly higher seed (0.89 t/ha) and straw (2.91 t/ha) yield was recorded in weed free plot over all the treatments, which was followed by imazethapyr + imazamox (pre-mix) at 0.05 kg/ha as (0.84and 2.89t/ha) and pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha (0.80 and 2.82 t/ ha) treatments. In *Kharif* blackgram, two hand weedings done 20 and 40 DAS provided as high grain yield as the weed free treatment (Chand *et al.* 2004). The weed free treatment reduced the crop weeds competition by providing no weed situation in blackgram field. Thus, the crop plants being vigorous by efficiently utilization of nutrients, moisture, sunlight with space and gave better yield. The weedy check plot gave significantly minimum yield due to heavy competition for nutrient, moisture and light between the crop and weeds. Similar grain yield losses due to weeds were reported by Chand *et al*. (2003) in *Kharif* blackgram. On the basis of visual observation on 0-10 point scale, none of the treatments was found phytotoxic on the crop in terms of different phytotoxic effect during the experimentation. The seedlings and plants did not show any abnormality during the crop growth period.

Effect on economics

The maximum net return of ` 17,135/ha and benefit:cost ratio (2.35) were found with imazethapyr + imazamox (pre-mix) at 0.05 kg/ha as which was followed by pendimethalin + imazethapyr (pre-mix) 1.0 kg/ha (` 16,410 and 2.30) treatment, while minimum with weedy check (-180 and 0.98). On the basis of two years experimentation, it was concluded that weed free (two hand weedings at 20 and 40 DAS) treatment recorded maximum seed yield followed by pre-mix herbicides *i.e.* imazethapyr + imazamox (pre-mix) at 0.05 kg/ha and pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha application. The net return and benefit: cost ratio were highest in imazethapyr + imazamox (pre-mix) at 0.05 kg/ha followed by pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha.

On the basis of two years experimentation, it can be concluded that highest net return (` 17135) and benefit: cost ratio (2.35) were obtained with the pre-mix imazethapyr + imazamox at 0.05 kg/ha as PoE followed by pre-mix pendimethalin + imazethapyr at 1.0 kg/ha as PoE. However, yield was found superior in weed free treatment which was closely followed by pre-mix imazethapyr + imazamox 0.05 kg/ha and pre-mix pendimethalin + imazethapyr 1.0 kg/ha.

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