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Pre- and post-emergence herbicides for weed control in blackgram

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ABSTRACT

Application of imazethapyr at all the rates of application (60, 75, 100 and 150 g/ha) significantly reduced the weed density and biomass as compared to quizalofop-ethyl followed by pendimethalin, alachlor and hand hoeing. Hand weeding superseded over all the treatments with the highest weed control efficiency of 96.5% followed by imazethapyr at 150 g/ha (71.9%), 100 g/ha (70.2%) and quizalofop-ethyl (70.3%). The post-emergence application of imazethapyr at 60, 75, 100 and 150 g/ha recorded significantly higher seed yield than pre emergence application of pendimethalin and alachlor and post emergence grass weed killer quizalofop-ethyl. The net monetary returns was maximum with hand weeding twice followed by imazethapyr at 150 g, 100 g and 75 g/ha. However, the benefit:cast ratio was the highest under imazethapyr at 75 g/ha followed by 100 g/ha

Blackgram (*Vigna mungo* L.) is an important crop among *Kharif* pulses of India and is usually grown in rainfed conditions on marginal and sub marginal lands. The crop contains about 25-26% proteins, carbohydrates 60%, Fat 1.5%, minerals, amino acids, and essential vitamins. In India, blackgram is grown in an area of 32.48 lakh hectares with the production and productivity of 21.99 lakh tonnes and 604 kg/ha, respectively during 2014-15 (Economic Survey 2014-15). In Madhya Pradesh, the crop covers an area of 8.62 lakh hectares with total production of 4.28 lakh tonnes and productivity of 496 kg/ha (Anonymous 2014-15). Weeds reduce the yield of blackgram to the extent of 78 % (Gogoi *et al*. 1992). Hand weeding is the common practice to control weeds in this crop (Chand *et al*. 2004). However, it is laborious, time consuming, costly and tedious. Furthermore, weather conditions do not permit timely hand weeding due to wet field conditions in rainy season. Thus, use of herbicides offer an alternative for effective control of weeds. The present experiment was undertaken to find out the efficacy of pre- and post-emergence herbicides for weed control in blackgram.

A field experiment was conducted at Research Farm, College of Agriculture, Tikamgarh, Madhya Pradesh, India during 2015 to evaluate the efficacy of pre- and post-emergence herbicides on weeds, yield attributes and yield of blackgram. The soil of the experimental area was clay loam in texture, medium in available N (290 kg/ha), medium in P_2O_5 (19 kg/ha) and K_2O (331 kg/ha) with pH 7.3. The experiment was laid out in a randomized block design and replicated thrice. Ten treatments consisted of pre-emergence application (PE) of pendimethalin at 1 kg/ha and alachlor at 1 kg/ha, post-emergence application (PoE) of imazethapyr at 60, 75, 100, 150 g/ha at 14 days after seeding (DAS), quizalofop-ethyl at 75 g/ha at 14 DAS, hand hoeing at 30 DAS, hand weeding at 20 and 40 DAS and weedy check. These treatments were replicated thrice in randomized block design.A uniform dose of fertilizer (20 kg N + 60 kg P_2O_5 + 20 kg K_2O/ha) was applied through urea, single super phosphate and muriate of potash, respectively, in all the plots. Variety AZAD-1 was sown with seed rate of 30 kg/ha at uniform row distance of 30 cm. Herbicides were applied using knapsack sprayer fitted with a flat-fan nozzle with water at 500 liter/ha. The data on weed density and biomass was recorded at 30 days after herbicide spray, and were were subjected to square root transformation “x+0.5 before analysis.

Effect on weeds

There was prevalence of monocot weeds in experimental field as these weeds constituted the

higher relative density (77.2%) as compared to dicot weeds (22.7%). The dominant monocot weeds in the field were *Cyperus rotundus* (28.6%), *Echinochloa colona* (28.1%), *Cynodon dactylon* (12.7%) and *Commelina benghalensis* (7.7%) whereas among the dicot weeds,the intensity of *Digera arvensis* (L) was the highest (12.6%) followed by *Phyllanthus niruri* (L.) (11.1%) and *Corchorus olitorious* (L.) (10.6%). All the herbicidal treatments and hand weeding reduced the weed intensity as compared to weedy check (**Table 1**). Hand weeding twice was the most effective and recorded minimum weed density among all the treatments. Application of imazethapyr at all the rates of application (60, 75, 100 and 150 g/ha) significantly reduced the weed density and biomass and registered higher weed control efficiency as compared to quizalofop-ethyl followed by pendimethalin, alachlor and hand hoeing. Effective control of weeds with the application of imazethapyr was also reported by Rajput *et al.* (2014). Quizalofop-ethyl significantly reduced the density of grassy weeds, *viz. Cyperus rotundus, Echinocloa colonum* and *Cynodon dactylon* but was found ineffective against broad-leaved weeds, *viz. Commelina benghalensis, Digera arvensis, Phyllanthus niruri* and *Corchorus olitorius.* The herbicidal treatments and hand weeding significantly reduced the weed biomass compared to weedy check. Hand weeding superseded over all the treatments and attained minimum weed biomass (3.12 g/m^2) with the highest weed control efficiency of 96.5% followed by imazethapyr at 150 g/ha (71.9%), 100 g/ha (70.2%) and quizalofop-ethyl (70.3%).

Yield attributes and economics

Yield attributing characters, *viz.* number of pods/plant, number of seeds/pod and test weight attained significantly higher values under herbicidal treatments and hand weeding than weedy check (**Table 2**). Two hand weedings gave significantly higher number of pods/plant (36.33) and number of seeds/pod (8.13). The increase in yield attributes under hand weeding twice (20 and 40 DAS) was due to weed management from early crop growth and higher dry matter accumulation which resulted in

Table 1. Effect of pre- and post-emergence herbicides on weed density, biomass and weed control efficiency

Treatment	Time of application	Weed density (no./m^2)							Total weed density (no./m^2)	Total weed dry weight (g/m^2)	Weed control efficiency (%)
		Cyperus rotundus	*Echinocloa colona*	*Cynodon dactylon*	*Commelina benghalensis*	*Corchorus olitorius*	*Phyllanthus niruri*	*Euphorbia hirta*			
Imazethapyr at 60 g/ha	PoE at 14 DAS	4.63(21)	4.41(19)	4.59(21)	2.65(6.5)	1.6(2.1)	1.71(2.7)	0.73(0.0)	8.63(74)	5.08(25)	63.5
Imazethapyr at 75 g/ha	PoE at 14 DAS	4.49(20)	4.34(18)	4.45(19)	2.53(6.4)	1.22(1.0)	1.64(2.2)	0.71(0.0)	8.25(68)	4.98(24)	65.6
Imazethapyr at 100 g/ha	PoE at 14 DAS	4.30(18)	4.23(17)	4.38(19)	2.47(5.7)	1.10(0.7)	1.54(1.9)	0.71(0.0)	7.93(62)	4.75(22)	70.2
Imazethapyr at 150 g/ha	PoE at 14 DAS	4.24(17)	4.21(17)	4.26(18)	2.38(5.2)	0.92(0.4)	1.50(1.8)	0.71(0.0)	7.77(60)	4.69(22)	71.9
Pendimethalin at 1 kg/ha	PE	4.76(22)	4.83(23)	4.52(20)	3.25(10.1)	2.71(7.0)	2.95(8.2)	0.76(0.1)	9.62(92)	5.72(32)	32.3
Alachlor at 1 kg/ha	PE	5.20(27)	5.25(27)	4.77(22)	3.36(10.9)	3.15(9.4)	3.05(8.9)	0.71(0.0)	10.4(107)	6.32(39)	23.3
Quizalofop-ethyl at 75 g/ha	PoE at 14 DAS	3.24(11)	3.08(9)	2.30(5)	3.80(14.0)	3.13(9.3)	3.61(12.7)	2.09(3.9)	8.79(77)	4.72(22)	70.3
Hand hoeing	30 DAS	7.77(60)	8.49(72)	5.24(27)	4.23(17.4)	3.29(10.3)	3.73(13.4)	2.17(4.2)	14.8(219)	8.63(75)	29.3
Hand weeding	20 and 40 DAS	2.29(5)	1.58(2)	1.97(3)	1.44(1.7)	0.98(0.5)	0.88(0.3)	0.71(0.0)	3.63(13)	1.97(3)	96.5
Weedy check		7.83(61)	8.27(73)	5.27(27)	4.36(18.7)	3.13(9.5)	3.42(11.3)	2.34(5.0)	15.0(225)	8.25(68)	0
LSD (p=0.05)		0.83	1.73	0.53	0.7	0.56	0.59	0.17	1.03	1.08	

*values in parentheses are original values; PoE - Post-emergence; PE- Pre-emergence

Table 2. Effect of pre and post emergence herbicides on yield attributes, seed yield and economics of blackgram

Treatment	Time of application	No. of pods/ plant	No. of seeds/ pod	Seed weight/ pod	Test weight (g)	Seed yield (kg/ha)	Weed index (%)	Net monetary return (x10^3 `/ha)	B:C ratio
Imazethapyr at 60 g/ha	Post-emergence at 14 DAS	31.0	7.00	0.26	36.8	1042	26.0	32.52	3.24
Imazethapyr at 75 g/ha	Post-emergence at 14 DAS	31.5	7.07	0.27	37.0	1104	21.5	34.84	3.41
Imazethapyr at 100 g/ha	Post-emergence at 14 DAS	31.5	7.27	0.28	37.3	1118	20.6	35.09	3.33
Imazethapyr at 150 g/ha	Post-emergence at 14 DAS	32.3	7.35	0.28	37.5	1136	19.3	35.22	3.16
Pendimethalin at 1 kg/ha	Pre-emergence	28.1	6.40	0.24	36.3	845	40.0	24.04	2.29
Alachlor at 1 kg/ha	Pre-emergence	26.3	5.93	0.23	35.8	818	41.9	23.70	2.43
Quizalofop-ethyl at 75 g/ha	Post-emergence at 14 DAS	28.7	6.07	0.23	36.0	913	35.2	26.75	2.53
Hand hoeing	30 DAS	23.8	5.80	0.22	34.0	772	45.1	20.69	1.90
Two hand weeding	20 and 40 DAS	36.3	8.13	0.31	38.5	1410	0	42.65	2.90
Weedy check		21.3	4.93	0.19	33.3	656	53.3	17.89	1.99
LSD (p=0.05)		4.29	0.88	0.04	0.76	94.5			

greater translocation of food materials to the reproductive parts and reflected in superiority of yield attributing characters and ultimately to higher yield (Nirala *et al*. 2016). Among the herbicidal treatments, imazethapyr as post-emergence recorded significantly higher number of pods/plant and number of seeds/ pod than pre-emergence application of alachlor, post-emergence application of quizalofop-ethyl and hand hoeing at 30 DAS. All the herbicidal treatments were significantly superior over weedy check.

Seed yield was significantly higher under all the weed control treatments over weedy check. Two hand weeding at 20 and 40 DAS recorded the highest seed yield (1410 kg/ha) followed by imazethapyr at all the rates of application. Post-emergence application of imazethapyr at 75, 100 and 150 g/ha (1104, 1118 and 1154, respectively) was found at par with respect to seed yield. All the rates of application of imazethapyr recorded significantly higher seed yield over pre-emergence application of pendimethalin (799 kg/ha), alachlor (818 kg/ha) and post-emergence grass weed killer quizalofop-ethyl (913 kg/ha). Application of quizalofop-ethyl proved significantly effective in producing higher seed yield over one hand hoeing (722 kg/ha), pre-emergence application of pendimethalin (799 kg/ha) and alachlor (818 kg/ha). Aggarwal *et al*. (2014) also reported the effectiveness of imazethapyr for controlling weeds in blackgram.

The highest gross and net monetary returns was obtained with two hand weeding followed by imazethapyr at 150, 100 and 75 g/ha but the benefit: cost ratio was the highest with imazethapyr at 75 g/ha followed by 100 g/ha.

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