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Efficacy and Economics of Weed Management Practices in Blackgram (*Vigna mungo* L.) under Rainfed Conditions

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ABSTRACT

Pre-plant or pre-emergence application of trifluralin at 0.50 kg ha^{-1} supplemented with one hand hoeing at 30 days stage provided effective control of weeds and significantly increased seed yield of blackgram over weedy check, one hand hoeing or application of herbicides alone. Higher dose of herbicides alone did not improve weed control or seed yield further compared to their lower dose. The highest net return and B : C ratio were registered with pre-emergence application of trifluralin at 0.50 kg ha^{-1}+one HW followed by pre-plant application of trifluralin at 0.50 kg ha^{-1}+one HW. Yield and profit with pendimethalin were less due to lower yield and higher cost of herbicide.

INTRODUCTION

Pulses play an important role in human nutrition, soil fertility build up and in the economy of marginal and sub-marginal farmers due to less investment needed, restoration of soil fertility and low water requirement. Crop cultivation in the Kandi region of Punjab depends entirely on rains due to lack of irrigation facilities. Blackgram (*Vigna mungo* L.) is an important pulse crop of this region which faces severe weed competition due to its slow initial growth and lack of effective weed control measures. An initial period of 20-40 days is very critical (Saraswat and Mishra, 1993) and season long weed competition has been found to reduce blackgram yield to the extent of 87% depending on the type and intensity of weed flora (Singh *et al.*, 2002). Rainfed farmers hesitate to practise manual weeding, which is very expensive, time consuming and frequent rains often do not allow or delay the weeding. Chemical weed management in pulse crops has been found effective and economical (Dungarwal *et al.*, 2003). However, information on chemical weed management in rainfed pulse crops is lacking particularly for the sub-mountaneous region of Punjab. An attempt was, therefore, made to find out an effective weed management strategy based on herbicides applied alone and in combination with hand hoeing.

MATERIALS AND METHODS

A field study was conducted during **kharif** 2003 and 2004 at Punjab Agricultural University Zonal Station for Kandi Area, Ballowal Saunkhri (31°06′ 05″ N, 76°27′ 2″ E and 355 m above mean sea level) on sandy loam soil testing low in organic carbon, available nitrogen and medium in available phosphorus. The 12 treatments of herbicides alone and in combination with hand hoeing (Table 1) were laid out in randomised block design with three replications. Blackgram cultivar Mash 338 was sown on July 11, 2003 and July 15, 2004 by following recommended agronomic practices. The crop was harvested on September 18, 2003 and September 25, 2004. The rainfall received during the crop season was 441 mm in 24 rainy days in 2003 and 506 mm in 20 days in 2004. The herbicides were applied with a manually operated knapsack sprayer using flat jet nozzle with a spray volume of 500 l ha^{-1}. Weed population and dry matter were recorded at 30 days after sowing (DAS) before hand hoeing as per

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Table 1. Effect of treatments on weeds, yield attributes, yield of black gram and their economics (Mean of two seasons)

Treatment	Dose (g ha^{-1})	Weed density (No. m^{-2})		Weeds dry weight 30 DAS (g m^{-2})	Pods/ plant	1000-seed weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Net return (Rs. ha^{-1})	B : C ratio
		30 DAS	At harvest							
Pendimethalin**	560	7.7 (58)	6.9 (47)	59.5	16.8	36.7	0738	2177	3546	1.45
Pendimethalin**	750	5.9 (37)	5.8 (33)	45.1	16.5	37.8	0717	1926	2828	1.34
Pendimethalin** fb HW at 30 DAS	560	7.5 (57)	5.6 (31)	52.0	18.3	38.7	0993	2786	5418	1.54
Trifluralin*	500	8.1 (65)	6.4 (41)	48.3	16.9	37.5	0769	2372	4380	1.57
Trifluralin*	750	6.4 (45)	6.5 (41)	68.7	18.3	38.0	0821	2490	4975	1.63
Trifluralin* fb HW at 30 DAS	500	8.1 (66)	4.8 (23)	46.9	19.9	38.2	1106	2865	7459	1.77
Trifluralin**	500	7.5 (59)	5.4 (29)	44.5	18.7	36.0	0796	2203	4752	1.62
Trifluralin**	750	6.3 (40)	5.2 (27)	57.6	17.6	31.9	0785	2209	4379	1.56
Trifluralin** fb HW at 30 DAS	500	7.5 (57)	4.3 (18)	64.8	18.7	37.9	1129	2887	7808	1.80
HW at 30 DAS	-	11.8 (138)	7.5 (56)	81.9	13.4	36.9	0847	2307	3879	1.42
HW at 25 and 40 DAS	-	1.0 (0)	4.5 (19)	00.0	18.4	37.5	1083	2829	5449	1.48
Weedy	-	12.7 (163)	12.2 (149)	88.3	11.5	35.0	0490	1890	0516	1.07
LSD (P=0.05)		1.3 (22)	0.8 (11)	21.3	03.1	NS	0133	0418	-	-

*Applied as pre-plant, **Applied as pre-emergence. NS–Not Significant.
Values in parentheses indicate actual weed population.

treatments and at harvest by randomly placing a quadrat of 0.5 m x 0.5 m at two places in each plot. The data on weed density were subjected to $\sqrt{X+1}$ transformation. The economics of different weed control treatments were also worked out by using the prevailing market prices of the produce and the inputs used.

RESULTS AND DISCUSSION

Effect on Weeds

The field was infested mainly with *Eleusine aegyptiacum* (23%), *Cyperus rotundus* (15%) and *Cynodon dactylon* (4%) among grasses and *Digera arvensis* (40%) and *Commelina benghalensis* (10%) among broadleaf weeds. Different weed control treatments significantly reduced weed population and their dry weight at 30 DAS and weed population recorded at harvest as compared to weedy check (Table 1). Higher dose of each herbicide in general caused greater reduction in number and dry weight of weeds over its respective lower dose. However, integration of one hand weeding (HW) at 30 DAS with pendimethalin at 0.56 kg ha^{-1} and trifluralin at 0.50 kg ha^{-1} proved more effective in reducing the weed density at harvest in comparison to application of both doses of respective herbicides applied alone. Weed population with two HW performed at 25 and 40 DAS was at par with pendimethalin at 0.56 kg ha^{-1} or trifluralin at 0.50 kg ha^{-1} supplemented with one HW at 30 DAS. Pre-emergence application of trifluralin at 0.50 or 0.75 kg ha^{-1} provided better weed control at harvest compared to its application as pre-plant.

Effect on Crop

All the weed control treatments significantly increased the seed and stover yields of blackgram over weedy check (Table 1). In general, seed yield was lower in case of pendimethalin based treatments compared to trifluralin application. The highest seed yield (1129 kg ha^{-1}) was achieved with pre-emergence application of trifluralin at 0.50 kg ha^{-1}+one HW at 30 DAS which was at par with its application as pre-plant at same dose+one HW at 30 DAS (1106 kg ha^{-1}) and also with HW twice at 25 and 40 DAS (1083 kg ha^{-1}). Seed yield with each herbicide at its both doses was statistically similar. However, integration of herbicide with one HW significantly increased the seed yield as compared to lower and higher doses of herbicides applied alone due to better control of weeds and significant increase in number of pods per plant and also improvement in 1000-seed weight. Elsewhere, only pre-plant application of trifluralin was found more effective in controlling weeds in pulses (Malik *et al.*, 2000; Kumar and Kundra, 2001; Dungarwal *et al.*, 2003).

Economics

Pre-emergence application of trifluralin at 0.50 kg ha^{-1}+one HW resulted in highest net returns (Rs. 7808 ha^{-1}) and B : C ratio (1.80) followed by its application as pre-plant+one HW (Rs. 7459 ha^{-1} and 1.77) and both these treatments increased the net return by Rs. 2359 and 2010 and B : C ratio by 0.32 and 0.29, respectively, over two HW inspite of statistically similar yields (Table 1). Lower profit in case of two HW can be ascribed to additional expenditure of about Rs. 1550 ha^{-1} for manual weeding as compared to application of herbicide alongwith only one HW (Rs. 2600 ha^{-1}). All other herbicides applied alone or in integration with hand weeding recorded higher net returns and B : C ratio than HW once at 30 DAS except pendimethalin at 0.75 kg ha^{-1}. Pre-emergence or pre-plant application of trifluralin at 0.50 kg ha^{-1}+one HW at 30 DAS substantially increased the net returns by Rs. 7292/ 6943 ha^{-1} over weedy check (Rs. 516 ha^{-1}). Increase in net returns with pre-emergence application of pendimethalin at 0.56 kg ha^{-1} over weedy check was Rs. 4902 ha^{-1}.

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