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Economics of practicing integrated weed management in blackgram

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Abstract: Field investigation was carried out during *kharif* seasons of 2003 and 2004 at National Pulses Research Centre, Vamban to find out the integrated effect of application of lower dose of pre-emergence herbicide pendimethalin and hand weeding at three seed rates, on the growth, and yield and weed population in blackgram (VBN (Bg)4). The results revealed that integration of chemical, mechanical and cultural methods of weed control markedly influenced the yield and economics of blackgram. The pooled analysis of grain yield data revealed that pre-emergence application of pendimethalin @ 0.75 kg ai/ha + hand weeding on 40 DAS + normal seed rate recorded higher grain yield of 753 kg/ha and highest benefit cost ratio.

Key words: Blackgram, Pre-emergence, Pendimethalin, Integrated weed management.

Introduction

Weed management at early stages of crop growth is essential. Emerging of weeds in pulses begins simultaneously with the crop, leading to severe competition between the crop and weeds (Kandasamy, 2000). When pulses are raised during monsoon season, weeds emerge in succession almost throughout the crop season because of favourable environmental condition and frequent rains (Govindra Singh, 1993). Weeds not only reduce the yield but also act as silent robbers of scare and essential nutrients and moisture. Weeds reduce grain yield of chickpea up to 60 per cent (IIPR, 1997). Weed infestation causes around 50 per cent yield reduction in blackgram (Sumachandrika *et al.*, 2002). Hence, there is a need to study the integrated effect of weed management practice.

Materials and Methods

A field experiment was conducted on integrated weed management in blackgram during *kharif* seasons of 2003 and 2004 at National Pulses Research Centre, Vamban. The experimental soil was paralithic haplustalf, sandy clay loam in texture and had a pH of 6.1, organic carbon 0.3% and low in available N, P and K. The experiment was laid out in randomized block design with three replications. The treatments included were; T1 Weedy check + normal seed rate, T2 Weedy check + 30% higher seed rate, T3 Weedy check + 50% higher seed rate, T4 Hand Weeding (HW) 20 DAS + normal seed rate, T5 HW 20 DAS + 30% higher seed rate, T6 HW 20 DAS + 50% higher seed rate, T7 HW 40 DAS + normal seed rate, T8 HW 40 DAS + 30% higher seed rate, T9 HW 40 DAS + 50% higher seed rate, T10 HW (20 DAS and 40 DAS) + normal seed rate, T11 HW (20 DAS and 40 DAS) + 30% higher seed rate, T12 HW (20 DAS and 40 DAS) + 50% higher seed rate, T13 Pendimethalin 1 kg a.i. /ha + normal seed rate, T14 Pendimethalin 1 kg a.i. / ha+ 30% higher seed rate, T15 Pendimethalin 1 kg a.i. / ha + 50% higher seed rate, T16 Pendimethalin 0.75 kg a.i./ ha + HW (40 DAS) + normal seed rate, T17

Table 1. Yield as affected by integrated weed management in blackgram.

	Treatments	Grain Yield (kg ha^{-1})		
		2003	2004	Pooled
T_1	Weedy check + normal seed rate	88	276	196
T_2	Weedy check + 30% higher seed rate	81	238	161
T_3	Weedy check + 50% higher seed rate	79	226	152
T_4	Hand weeding (HW) 20 DAS + normal seed rate	555	505	532
T_5	HW 20 DAS + 30% higher seed rate	436	458	449
T_6	HW 20 DAS + 50% higher seed rate	394	460	438
T_7	HW 40 DAS normal seed rate	628	497	553
T_8	HW 40 DAS + 30% higher seed rate	436	484	446
T_9	HW 40 DAS + 50% higher seed rate	393	450	414
T_{10}	HW (20 DAS and 40 DAS) + normal seed rate	725	625	653
T_{11}	HW (20 DAS and 40 DAS) + 30% higher seed rate	588	589	567
T_{12}	HW (20 DAS and 40 DAS) + 50% higher seed rate	503	584	553
T_{13}	Pendimethalin 1 kg a.i/ ha + normal seed rate	627	545	563
T_{14}	Pendimethalin 1 kg a.i/ ha + 30% higher seed rate	449	531	455
T_{15}	Pendimethalin 1 kg a.i/ ha + 50% higher seed rate	434	521	476
T_{16}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + normal seed rate	817	693	753
T_{17}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + 30% higher seed rate	611	601	594
T_{18}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + 50% higher seed rate	412	555	496
	SEd	45.2	27.2	22.8
	CD (0.05)	91.8	55.3	46.4

Pendimethalin 0.75 kg a.i./ha + HW (40 DAS) + 30% higher seed rate and T18 Pendimethalin 0.75 kg a.i/ha + HW (40 DAS) + 50% higher seed rate. The recommended dose of fertilizer *viz.*, 25:50:25 NPK kg/ha was applied as basal application. The weed control treatments were imposed as per the schedule. The crop was irrigated at critical stages. Need based plant protection measures were given as per the Crop Production Guide (1999). The data on grain yield were recorded and analysed. The economic implication of integrated weed management practices was evaluated using absolute benefit-cost ratio and relative benefit-cost ratio. The absolute benefit-cost ratio is calculated by taking ratio of gross return to total cost of cultivation while the relative benefit-cost ratio is taken as a ratio of additional benefit over control (T1) to additional cost over control (T1). It may be noted here that the relative benefit-cost ratio was computed for the pooled data. The relative benefit-cost ratio would enable us to compare the economic benefits arising from weed management treatments.

Results and Discussion

Grain Yield

Pre-emergence application of pendimethalin @ 0.75 kg a.i/ha + hand weeding at 40 DAS + normal seed rate (T16) recorded a grain yield of 817 and 698 kg/ha for the years 2003 and 2004 respectively (Table 1). The pooled analysis also revealed that the same treatment recorded a higher grain yield of 753 kg/ha. This might be due to the combined action of pre-emergence application of herbicide which did suppress the initial weed growth and the hand weeding done at 40 DAS, did remove weeds that emerged at later stage of the crop growth. Further under this treatment, there was better utilization of the available resources such as water, sunlight and essential nutrients by the crop otherwise it would have been utilized by the weeds. The results are in accordance with the findings of Singh *et al.* (2003) in chickpea. The lowest grain yield was recorded with the weedy check treatments. This was mainly due to higher weed population.

Economic parameters

The integrated weed management practices in blackgram were evaluated to identify the best performing practice using both absolute benefit-cost ratio (Table 2) and relative benefit-cost ratio (Table 3). Of the eighteen treatments, hand weeding twice (20 DAS and 40 DAS) + 50% higher seed rate registered higher cost of cultivation (Rs.8255 ha^{-1}) due to higher cost on labour on account of two hand weedings as well as higher seed rate. Data on gross return revealed that treatment pre-emergence application of pendimethalin @ 0.75 kg a.i./ha + hand weeding on 40 DAS + normal seed rate (T16) had higher gross return of Rs.16,340 ha^{-1} in the year 2003 and Rs. 13,860 ha^{-1} in the year 2004 (Table 2). This might be due to higher grain yield obtained on account of effective weed control.

On the other hand, net return was found to be higher for treatment of pre-emergence applciation of pendimethalin @ 0.75 kg a.i./ha + hand weeding on 40 DAS + normal seed rate (T16) while it was negative for all weedy check treatments regardless of seed rate (Table 2). The higher net return recorded by the treatment T16 was mainly due to effective weed management.

With reference to absolute benefit-cost ratio, it may be seen from table 2 that among the treatments, pre-emergence application of pendimethalin @ 0.75 kg a.i./ha + hand weeding on 40 DAS + normal seed rate (T16) turned out to be the best treatment with higher absolute benefit-cost ratio of 2.1 and 1.8 for the years 2003 and 2004 respectively.

Table 2. Economics of operating Integrated Weed Management in blackgram.

	Treatments	Total Cost of cultivation (Rs./ha)	Gross return (Rs./ha)		Net return (Rs./ha)		Absolute BC ratio	
			2003	2004	2003	2004	2003	2004
T_1	Weedy check + normal seed rate	6515	1760	5,520	-4755	-995	0.3	0.8
T_2	Weedy check + 30% higher seed rate	6695	1620	4,760	-5075	-1935	0.2	0.7
T_3	Weedy check + 50% higher seed rate	6815	1580	4520	-5235	-2295	0.2	0.6
T_4	Hand weeding (HW) 20 DAS + normal seed rate	7051	11100	10000	4049	3049	1.6	1.4
T_5	HW 20 DAS + 30% higher seed rate	7231	8720	9160	189	1929	1.2	1.3
T_6	HW 20 DAS + 50% higher seed rate	7351	7880	9200	529	1849	1.1	1.2
T_7	HW 40 DAS + normal seed rate	7339	12560	9940	5221	2601	1.7	1.3
T_8	HW 40 DAS + 30% higher seed rate	7519	8720	9680	1201	2161	1.2	1.2
T_9	HW 40 DAS + 50% higher seed rate	7639	7860	9000	221	1361	1.0.	1.2
T_{10}	HW (20 DAS and 40 DAS) + normal seed rate	7955	14500	12500	6545	4545	1.8	1.6
T_{11}	HW (20 DAS and 40 DAS) + 30% higher seed rate	8135	10560	11780	2425	3645	1.3	1.4
T_{12}	HW (20 DAS and 40 DAS) + 50% higher seed rate	8255	10060	11680	1805	3425	1.2	1.4
T_{13}	Pendimethalin 1 kg a.i/ ha + normal seed rate	6479	12540	10900	5381	4421	1.7	1.5
T_{14}	Pendimethalin 1 kg a.i/ ha + 30% higher seed rate	6679	9000	10620	1661	3941	1.2	1.4
T_{15}	Pendimethalin 1 kg a.i/ ha + 50% higher seed rate	6779	8680	10420	1221	3641	1.2	1.3
T_{16}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + normal seed rate	7754	16340	13860	8586	6106	2.1	1.8
T_{17}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + 30% higher seed rate	7954	12240	12020	4306	5426	1.5	1.5
T_{18}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + 50% higher seed rate	8054	8240	11100	186	5046	1.0	1.3

Table 3. Relative Benefit - Cost Ratio of Integrated Weed Management in blackgram.

	Treatments	Additional cost of inputs over T1 (Rs/ha)	Gross return (Rs./ha)	Net return (Rs/ha)	Additional net return over T1	Relative BC ratio
T_1	Weedy check + normal seed rate	-	3920	-2595	-	-
T_2	Weedy check + 30% higher seed rate	180	3220	-3475	-880	-
T_3	Weedy check + 50% higher seed rate	300	3040	-3775	-1180	-
T_4	Hand weeding (HW) 20 DAS + normal seed rate	536	10640	3589	6184	11.5
T_5	HW 20 DAS + 30% higher seed rate	616	8980	1749	4344	7.1
T_6	HW 20 DAS + 50% higher seed rate	836	8760	1409	4004	4.8
T_7	HW 40 DAS + normal seed rate	824	11060	3721	6316	7.7
T_8	HW 40 DAS + 30% higher seed rate	1004	8920	1401	3996	3.9
T_9	HW 40 DAS + 50% higher seed rate	1124	8280	641	3236	2.9
T_{10}	HW (20 DAS and 40 DAS) + normal seed rate	1440	13060	5105	7700	5.3
T_{11}	HW (20 DAS and 40 DAS) + 30% higher seed rate	1620	11340	3205	5800	3.6
T_{12}	HW (20 DAS and 40 DAS) + 50% higher seed rate	1740	11060	2805	5400	3.1
T_{13}	Pendimethalin 1 kg a.i/ ha + normal seed rate	644	11260	4101	6696	10.4
T_{14}	Pendimethalin 1 kg a.i/ ha + 30% higher seed rate	824	9100	1761	4356	5.3
T_{15}	Pendimethalin 1 kg a.i/ ha + 50% higher seed rate	944	9520	2061	4656	4.9
T_{16}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + normal seed rate	1239	15060	7306	9901	7.9
T_{17}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + 30% higher seed rate	1419	11880	3926	6521	4.5
T_{18}	Pendimethalin 0.75 kg a.i/ ha + HW (40 DAS) + 50% higher seed rate	1539	9920	1866	4461	2.9

The data on relative benefit-cost ratio revealed the extent to which economic benefit could be indeed maximized in relation to different weed management practices involving additional cost at varying levels. Of the treatments, hand weeding at 20 DAS + normal seed rate (T4) registered higher relative benefit-cost ratio of 11.5, which was closely followed by treatment (T13) of pre-emergence application of pendimethalin @ 1 kg a.i./ha + normal seed rate (10.4). However, all treatments with normal seed rate reported comparatively higher relative benefit - cost ratio than other treatments. Similarly, all treatments with 50 per cent higher seed rate recorded comparatively lower relative benefit-cost ratio. The higher relative benefit-cost ratio in the case of hand weeding at 20 DAS + normal seed rate (T4) could be attributed partly to the lower additional cost on account of weed management, when compared to those of other treatments, and partly to reasonably higher additional benefit therein.

The study pointed out that integrated weed management with pre-emergence application of pendimethalin @ 0.75 kg ai/ha + hand weeding on 40 DAS + normal seed rate of 20 g appeared to be effective treatment from the point of grain yield as well as absolute benefit-cost ratio to the *kharif* season of Pudukkottai district.

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