Indian Journal of Weed Science **47**(1): 34–37, 2015

Integrated weed management in blackgram

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Received: 12 December 2014; Revised: 10 February 2015

ABSTRACT

A field experiment was conducted during *Kharif*, 2005 and 2006 at the Pulses and Oilseeds Research Sub-station, Beldanga, Murshidabad, West Bengal to evolve an integrated weed management (IWM) practice in blackgram. *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Cyperus rotundus*, *Cleome viscosa* and *Physalis minima* were the dominant weeds. Pre-emergence application of pendimethalin either at lower dosage (0.75 kg/ha) along with one hand weeding at 40 days after sowing or at higher dosage (1.0 kg/ha) without any integration with hand weeding proved to record higher seed yield (1.09 and 1.03 t/ha, respectively. In addition, use of 30% higher seed rate than the normal rate of 22.0 kg/ha was found to effectively suppress the weeds and further enhance the yield level. Season-long weed competition caused an average yield reduction of 26.4% as compared to IWM in blackgram.

Key words: Blackgram, Chemical control, Integrated weed management, Pendimethalin, Seed rate, Yield

Weeds pose a serious problem in wet (*Kharif*) season. Losses even up to 50 - 60% (Yadav 1992) have been recorded due to weeds in blackgram (*Vigna mungo* L.). Weeds may mechanically be managed by one hand weeding at 20 days after sowing (DAS) followed by (*fb*) another weeding at about 40 DAS. But manual hand weeding is labour-intensive and tedious and does not ensure weed removal at critical stage of crop-weed competition. Moreover, continuous rainfall during the season makes the manual weeding impracticable (Shweta and Singh 2005). Even non-availability and high wages of labour during critical period warrant an effective and economical weed control practice. Though chemical herbicides become cost-effective, their efficacies are greatly reduced during *Kharif* due to uncertain rainfall (Bhowmick and Gupta 2005). Thus, it is a major challenge to maximize productivity of this important pulse crop. Under this situation, an integrated weed management (IWM) practice involving both chemical and other agronomic manipulation may be an efficient tool, as increasing crop density seems to be an alternative to shift crop-weed competition in favour of crop (Shweta and Singh 2005). Hence, evolving a proper management strategy was felt to avert such yield loss due to weeds in blackgram.

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MATERIALS AND METHODS

A field experiment was conducted during two consecutive *Kharif* seasons of 2005 and 2006 at the Pulses and Oilseeds Research Sub-station, Beldanga, Murshidabad, West Bengal, located at 23^0 55 N latitude and 88^0 15 E longitude with an altitude of 19.0 m above mean sea level. The experimental soil was sandy loam in texture and slightly alkaline in reaction (pH 7.3) besides having a content of 0.20% organic C, 75.0 kg available P_2O_5/ha, 49.0 kg available K_2O/ha, 16.8 kg available S/ha and EC value of 0.39 dS/m. Treatments comprised of five levels of weed management *viz.* weedy check, one hand weeding at 20 DAS, one hand weeding at 40 DAS, pendimethalin 30 EC as pre-emergence (PE) 1.0 kg/ha alone and 0.75 kg/ha in combination with one hand weeding at 40 DAS, and three different seed rates *viz.* normal 22.0 kg/ha, and 30 and 50% higher than normal. Thus, a set of fifteen treatment combinations was replicated three times in a factorial randomized block design, keeping individual plot size of 4 x 3 m. Blackgram variety *'Sarada'* (*'WBU 108'*) was sown on 18th and 9th August in rows 30 cm apart, and harvested on 16th and 2nd November in 2005 and 2006, respectively. The land remained fallow prior to the test crop during both the years of study. A uniform basal dose of 20 kg N, 40 kg P_2O_5 and 20 kg K_2O/ha were applied in all the plots. Endosulfan 35 EC at 1.5 ml/liter of water was sprayed at 30 DAS in all the plots. Other recommended package of practices, except weed management and seed rate treatments, was adopted to grow the experimental

crop. A knapsack sprayer fitted with flat-fan nozzle was used to apply the herbicide on the first day after sowing with a spray volume of 600 litre/ha. Weed data were recorded at 30 and 60 DAS by placing a quadrat of 50 × 50 cm area randomly at five spots in each plot. Observations on height of crop plants were also recorded at 30 and 60 DAS. Data on seed yield along with yield attributes were recorded at harvest.

RESULTS AND DISCUSSION

Weed flora

The experimental field was mainly colonized by *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Cyperus rotundus*, *Cleome viscosa* and *Physalis minima* (Table 1). Similar observation was earlier reported by Bhowmick and Gupta (2005).

Effect of weed management

There was significant impact of weed management treatments on the reduction of density and biomass of weeds during both the years of study (Table 2). Shweta and Singh (2005) reported similar kinds of results. Integration of reduced dose of pendimethalin at 0.75 kg/ha (PE) with one hand weeding at 40 DAS caused remarkable reduction in weed growth at 60 DAS over remaining treatments (Table 2) and resulted in the highest mean seed yield of 1.09 t/ha. Bhowmick and Gupta (2005) reported similar findings. Such increase in crop yield (Table 3) was due to improvement in the values of yield attributes *viz*. number of branches/plant (13.6), number of productive pods/plant (33.0), number of seeds/pod (6.45) and 1000-seed weight (40.3 g), besides lesser crop-weed competition through better control of weeds (mean of two years). Rathi *et al*. (2004) were of similar opinion. Excellent performance of pendimethalin 0.75 kg/ha (PE) + one hand weeding (40 DAS) might be due to initial control of weeds through the chemical herbicide followed by subsequent hand weeding at 40 DAS, which prevented further emergence of weeds. This finding might also be substantiated with the results of Pazahanivelan and Kandasamy (1996) who reported that application of pendimethalin at 1.0 kg/ha as pre-emergence followed by either fluazifop-p-butyl at 0.25 kg/ha as post-emergence or late hand weeding at 40 DAS gave effective weed control and recorded higher seed yield in rainfed pigeonpea. Sole application of pendimethalin (PE) at higher dose (1.0 kg/ha) was also found effective to record significantly higher seed yield (1.03 t/ha) by imparting a sound weed management, especially at 30 DAS during both the years. Bhandari *et al*. (2004) also reported significant reduction in weed growth with the higher doses of alachlor, pendimethalin or fluchloralin. The treatment pendimethalin at 1.0 kg/ha (PE), however, yielded at par with the application of same herbicide at 0.75 kg/ha (PE) along with one hand weeding at 40 DAS (IWM) in both the years. Compared with the plots receiving IWM treatment, the seed yield losses amounted to an average of 26.4% due to uncontrolled weed growth (Table 3). Kumar and Angiras (2005) also recorded significantly lower seed yield in unweeded plots when combined with conventional planting.

Effect of seed rate

Increasing seed rate from normal to 30% higher resulted in numerical increase in seed yield from 0.97 to 1.02 t/ha and subsequently the yield level declined at 50% higher seed rate (0.94 t/ha), though such increase or decrease in seed yield did not occur in significant proportion during both the years (Table 3). No significant yield differences among varying seed rates were earlier recorded at Pantnagar (IIPR 2002). Similar trend was also observed for weed biomass and density although Shweta and Singh (2005)

Table 1. Common weed flora prevalent in the experimental field of blackgram

Scientific name	Family	Common name	Local name
Grass			
Cynodon dactylon (L.) Pers.	Poaceae	Bermuda grass	Durba
Dactyloctenium aegyptium (L.) P. Beauv. Willd.	Poaceae	Star grass	Makra
Digitaria sanguinalis (L.) Scop.	Poaceae	Large crabgrass	Keoai
Echinochloa colona (L.) Link.	Poaceae	Jungle rice	Shyama
Sedge			
Cyperus rotundus L.	Cyperaceae	Purple nut sedge	Motha
Broad-leaved			
Cleome viscosa L.	Capparidaceae	Spider flower	Jungli hurhur
Commelina benghalensis L.	Commelinaceae	Tropical spiderwort	Kansira
Euphorbia hirta L.	Euphorbiaceae	Garden spurge	Bandudhi
Parthenium hysterophorus L.	Asteraceae	Wild carrot weed	Parthenium
Physalis minima L.	Solanaceae	Ground cherry	Bantepari

Table 2. Effect of treatments on weed growth and plant height of blackgram

Treatment	Weed biomass (g/m²)				Weed density (no./m²)				Plant height (cm)			
	30 DAS		60 DAS		30 DAS		60 DAS		30 DAS		60 DAS	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Weed management												
Hand weeding at 20 DAS	80.9	60.4	112.4	99.3	396.0	302.2	424.0	497.2	25.1	26.3	49.8	53.9
Hand weeding at 40 DAS	112.7	92.4	104.4	86.8	537.3	411.1	408.9	401.2	22.8	24.7	49.3	50.4
Pendimethalin at 1.0 kg/ha PE	38.4	45.9	102.4	76.1	377.8	258.2	350.0	357.0	25.9	27.1	51.8	54.1
Pendimethalin at 0.75 kg/ha PE + Hand weeding at 40 DAS	67.6	48.7	70.7	67.8	392.9	297.6	320.9	308.0	25.4	26.8	52.0	54.2
Weedy check	103.1	94.5	140.0	143.5	523.6	432.7	812.4	720.2	23.6	24.4	42.3	44.4
LSD (P=0.05)	15.5	13.1	26.1	12.9	32.6	22.6	52.4	16.3	NS	NS	3.6	7.3
Seed rate												
Normal	78.8	74.6	105.1	96.9	453.3	344.8	466.5	461.3	23.5	25.2	48.9	51.9
30 % higher	74.3	64.2	100.0	89.4	433.9	334.9	447.7	447.3	24.9	26.9	55.8	55.5
50 % higher	88.5	66.4	112.9	97.7	449.3	341.3	477.5	461.6	25.2	25.4	42.4	46.8
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	12.7	NS	NS	2.8	5.6
Interaction												
LSD (P=0.05)	26.9	NS	NS	22.4	56.5	NS	NS	NS	NS	NS	NS	NS

DAS: Days after sowing; NS: Not significant; PE: Pre-emergence.

Table 3. Effect of treatments on yield attributes and seed yield of blackgram

Treatment	Branches/plant		Productive pods/plant		Seeds/pod		1000-seed weight (g)		Seed yield (t/ha)	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Weed management										
Hand weeding at 20 DAS	11.7	12.7	28.2	25.5	6.3	6.2	36.2	38.6	0.94	1.00
Hand weeding at 40 DAS	11.4	12.5	25.4	25.2	6.2	5.8	35.4	38.0	0.93	0.99
Pendimethalin at 1.0 kg/ ha PE	11.9	13.1	29.1	33.2	6.3	6.2	37.9	40.3	0.99	1.07
Pendimethalin at 0.75 kg/ ha PE + hand weeding at 40 DAS	13.1	14.0	30.2	35.8	6.5	6.4	38.3	42.3	1.05	1.15
Weedy check	10.8	11.8	23.1	21.9	5.9	5.7	34.9	36.1	0.81	0.81
LSD (P=0.05)	NS	1.34	2.06	2.89	0.25	0.42	1.31	3.25	0.08	0.12
Seed rate										
Normal	12.3	13.3	27.4	27.7	6.3	6.2	36.9	39.0	0.94	1.01
30 % higher	12.8	13.8	28.4	33.1	6.5	6.7	37.8	40.5	0.97	1.06
50 % higher	10.3	11.4	25.8	24.1	5.8	5.3	34.9	37.6	0.93	0.94
LSD (P=0.05)	1.19	1.04	1.60	2.24	0.20	0.33	1.02	NS	NS	NS
Interaction										
LSD (P=0.05)	NS	NS	NS	5.01	0.44	0.73	NS	NS	NS	NS

DAS: Days after sowing; NS: Not significant; PE: Pre-emergence

recorded significantly lower weed density and dry matter up to 50% higher seed rate as compared to the normal recommendation. They also reported that use of 50% higher seed rate yielded significantly higher than normal seed rate but was at par with 30% higher seed rate. Higher values of seed yield and yield attributes were recorded under normal and 30% higher seed rates in both the years. The highest seed yield with the use of 30% increased seed rate might be due to significant improvement of crop growth and yield attributes as well as effective suppression of weed growth at 60 DAS (Table 2) over that of 50% higher seed rate. Conversely, poor yield might be due to greater competition among the crop plants for growth resources when 50% higher seed rate was followed. According to Davies and Ballingall (2008), grain legumes grown at higher seed rates would tend to compete more effectively with weeds, but this must be balanced with optimum seed rates for matching economic yield benefits.

Effect of interaction

There was no significant interaction between weed management and seed rate in respect of seed yield in both the years (Table 3), indicating that different seed rates might not significantly be affected by weed management practices and that the effect of weed management might not differ significantly with the differential rates of seeding. The effect of interaction was not significant for almost all the

growth and yield attributes of the crop. However, Das (2008) advocated good crop husbandry along with pre-emergence herbicide application and one hand weeding to control late emerging annuals as well as perennial weeds.

On the basis of two-year study, it might be suggested that pre-emergence application of pendimethalin either at lower dosage of 0.75 kg/ha along with one hand weeding at 40 DAS or at higher dosage (1.0 kg/ha) alone, besides using normal seed rate (22.0 kg/ha) may be a good weed management practice for maximizing productivity of *Kharif* blackgram in West Bengal.

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