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Research Communication

Effect of weed control measures on weeds, nodulation, growth and yield of mungbean (*Vigna radiata*)

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ABSTRACT

A field experiment was conducted at Varanasi, Uttar Pradesh during the rainy (*kharif*) season of 2009, to study the effect of different weed-control measures on mungbean {*Vigna radiata* (L.) Wilczek}. Weed-control treatments significantly increased the grain yield of mungbean over weedy check. Weedy condition for the entire crop season reduced the grain yield by 40.4% (0.589 tonnes/ha) compared to hand-weeding (HW) twice at 20 and 40 days after sowing (0.989 tonnes/ha). Hand-weeding at 20 and 40 days after sowing (DAS) also recorded maximum number of branches/plant, weed-control efficiency, shoot dry weight/plant, nodules number and dry weight/plant followed by post emergence (PoE) application of fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha. Highest benefit: cost ratio was obtained with the fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha (PoE).

Key words **:** Crop protection, Hand-weeding, Mungbean, Nodulation, Weed control measures

Mungbean is grown throughout Asia, Australia, West Indies, south and north America, tropical and subtropical Africa. India alone accounts for 65% of the world acreage and 54% of the world production. It is the third important pulse crop of India in terms of area cultivated (3.55 mha) and production (1.82 mt) next to chickpea and pigeonpea, (IIPR, 2010). Weeds are one of the major causes for the poor yield of mungbean. Being a short-stature crop, it faces heavy weed competition right from the early crop growth stages. Uncontrolled weeds may reduce mungbean yield by 50–90% dpending upon cultivars, soil type, soil moisture level and other environmental conditions (Kumar *et al.,* 2006).

Increasing labour costs and unavailability of labours particularly during the peak period, has led to the use of herbicides. Chemical control of weed forms an excellent alternative to manual as well as mechanical weeding and provide weed-free environment from emergence up to 30–35 days (Dungarwal *et al.,* 2003). Specific recommendations for herbicides vary in different areas due to local environment and soil conditions, weed populations, cropping patterns and cultural procedure. Keeping these facts in view, weed-control potential and cost effectiveness of some formulations of herbicides and their combinations, viz. quizalofop-p-ethyl, fenoxaprop-p-ethyl and chlorimuron-ethyl, were tested, which were new for the existing agro-climatic condition, along with the other weed-control measures.

A field experiment was conducted at Varanasi (25°18´ N, 83°36´ E and 128.93 m above the msl) during the rainy (*kharif*) 2009 on sandy clay loam soil, having 0.4% organic C, 192.3 kg/ha available N, 23.3 kg/ha available P, 212 kg/ha available K and 7.4 pH. Twelve treatments were laid out in randomized block design with 3 replications.

The recommended dose of nitrogen (20 kg/ha) and phosphorus (50 kg/ha) was applied. 'HUM 12' was sown at 20 kg/ha in 30 cm apart rows. Thinning was done at 10 DAS and 15 DAS to maintain the optimum plant population. Post-emergence herbicides were applied 20 DAS. All agronomic operations except those under study were kept uniform for all the treatments. All the necessary observations were recorded as per the established norms.

Weed-management practices showed profound effect on number of branches, leaf-area index, plant dry matter and nodule characteristics (Table 1). Most of these characters are significantly influenced compared with weedy check at all the crop growth stages. Significantly highest values of all growth parameters were observed with weed

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free. It was closely followed by the hand-weeding at 20 and 40 DAS and fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha. Under high weed infestation, the crop plants are unable to express their genetic potential due to tough weed competition for all the inputs like moisture, light, nutrient and space. Weed-control treatment did not differ significantly in respect of plant height.

Weed-free treatment resulted in significantly higher shoot dry weight at both crop growth stages. Among the herbicidal treatments, fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha resulted in maximum dry matter. Weedy check produced lowest dry matter. Similar findings were also reported by Chattha *et al.,* (2007) and Procopio *et al.* (2009). Maximum nodules number and their fresh weight and dry weight were recorded in the weed free plot, followed by hand-weeding at 20 and 40 DAS and fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha. This result confirm by the work of Patel *et al.* (2007) and Raman and Krishnamurthy (2005), who revealed that hand-weeding carried out at 20 and 40 DAS recorded the highest number of nodules, dry weight of nodules, and grain yield. Two hand-weedings were significantly better in reducing total weed-density (Table 2). Among herbicides, total weed-density was effectively reduced by

Table 1. Effect of different weed-control measures on growth and yield of mungbean

Treatment	Dose (g/ha)	Time of application	Plant height at maturity (cm)	LAI 50 DAS	Number of branches/ plant at maturity	Shoot dry weight/plant (g)		Number of nodules/plant	
						25 DAS	50 DAS	25 DAS	50 DAS
Weedy check			78.4	3.16	3.56	6.9	9.3	19.3	50.8
2 hand-weedings		20 and 40 DAS	80.6	4.46	4.56	9.9	14.3	24.7	86.5
Pendimethalin	1,000.0	PE	76.8	4.28	3.67	7.7	11.0	22.3	76.0
Quizalofop	37.5	PoE	79.9	3.92	4.11	8.9	12.8	21.3	63.5
Chlorimuron	4.0	PoE	76.5	3.98	4.11	8.3	12.5	20.0	55.0
Fenoxaprop	50.0	PoE	86.1	3.54	4.11	8.9	12.8	21.2	63.9
Quizalofop+ Chlorimuron	37.5+4.0	PoE	80.4	3.73	4.00	8.2	11.1	21.6	67.1
Fenoxaprop+ Chlorimuron	50.0+4.0	PoE	79.7	4.73	4.33	9.6	13.3	21.6	73.2
Imazethapyr	30.0	PoE	80.2	4.39	4.11	6.9	9.9	20.6	61.9
Imazethapyr	60.0	PoE	79.5	4.39	4.00	8.6	12.7	24.1	83.4
Chlorimuron	4.0	PPI	77.6	3.74	3.78	8.3	11.1	19.6	60.8
Weed free			81.8	4.82	4.67	10.1	14.4	25.0	92.8
SEm±			2.7	0.24	0.17	0.6	0.8	0.9	6.5
CD (P=0.05)			NS	0.70	0.49	1.6	2.2	2.8	18.9

DAS, Days after sowing; PE, Pre-emergence; PoE, Post-emergence; PPI, Pre-plant incorporation; LAI, leaf-area index

Table 2. Effect of different weed-control measures on weeds and growth and yield of mungbean

Treatment	Dose (g/ha)	Time of application	Dry weight of nodules/plant (mg)		Total weed dry weight (g/m^2)[ab]	WCE (%)	Yield (tonnes/ha)		Net returns ($\times 10^3$ ₹/ha)	Benefit : cost ratio
			25 DAS	50 DAS			Grain	Straw		
Weedy check			17.6	28.3	11.3 (127.1)	-	0.589	2.026	11.4	0.85
2 hand-weedings		20 & 40 DAS	44.4	70.3	3.3 (10.1)	92.1	0.989	2.670	22.7	1.23
Pendimethalin	1,000.0	PE	32.9	66.2	5.6 (31.3)	75.4	0.797	2.204	17.8	1.22
Quizalofop	37.5	PoE	27.8	40.0	6.9 (46.5)	63.4	0.677	1.943	13.4	0.90
Chlorimuron	4.0	PoE	23.0	31.6	6.1 (36.7)	71.1	0.749	2.102	17.2	1.23
Fenoxaprop	50.0	PoE	30.2	59.3	5.2 (26.3)	79.3	0.802	2.272	18.9	1.30
Quizalofop+ Chlorimuron	37.5+4.0	PoE	25.4	35.6	6.0 (35.9)	71.8	0.781	2.066	17.3	1.15
Fenoxaprop+ Chlorimuron	50.0+4.0	PoE	30.7	58.1	4.6 (20.2)	84.1	0.895	2.390	22.4	1.52
Imazethapyr	30.0	PoE	25.5	33.1	7.0 (48.2)	62.0	0.739	2.202	16.6	1.16
Imazethapyr	60.0	PoE	32.7	63.2	5.8 (33.5)	73.6	0.835	2.304	19.9	1.34
Chlorimuron	4.0	PPI	25.7	35.4	6.7 (44.3)	65.1	0.708	2.031	15.5	1.11
Weed free			49.2	85.3	0.7 (0.0)	100.0	1.223	2.768	27.1	1.16
SEm±			4.1	9.5	0.22		0.066	0.114	-	-
CD (P=0.05)			11.9	27.9	0.64		0.196	0.335	-	-

[a]Values are square root transformed ($\sqrt{x+0.05}$), original value mentioned in parenthesis; [b]recorded at 50 days after sowing; WCE, Weed control efficiency

fenoxaprop-p-ethyl + chlorimuron-ethyl though at par weed biomass also recorded under fenoxaprop-p-ethyl 50.0 g/ha. Raman (2006) also reported similar findings of significant reduction in weed biomass and highest value of weed control efficiency under 2 hand-weedings at 20 and 40 DAS over herbicides.

The weed control treatment significantly increased the grain and straw yields over weedy check. Unchecked weed growth decreased the grain yield to the extent of 107.49% compared to weed-free plots. Weed-free treatment recorded significantly highest grain yield. It was followed by hand-weeding at 20 and 40 DAS. This might be due to less weed competition for nutrients, moisture, light and space. Weedy check recorded lowest net returns/rupee invested due to lower productivity. Among herbicides, high net returns/hectare were obtained in fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha owing to higher seed yield comparatively at low costs of weed management. Though in terms of benefit: cost ratio fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4.0 g/ha was best treatment, followed by Imazethapyr 60.0 g/ha; because of higher grain yield and low cost of weed control. Similar results were recorded at Behrampur (West Bengal) in urdbean, where hand-weedings at 20 and 40 DAS recorded the highest grain yield (1.262 t/ha) followed by post-emergence application of fenoxaprop-p-ehyl 50 g/ha + chlorimuron-ethyl 4 g/ha (1.240 t/ha) (IIPR, 2008).

It may be concluded that manual weed control gives higher grain yield, though in terms of benefit: cost ratio it is not profitable because of higher cost. Therefore, post emergence application of fenoxaprop-p-ethyl 50 g/ha + chlorimuron-ethyl 4 g/ha may be a better alternative for effective weed control in *kharif* mungbean.

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