Effect of Weed Management on Weeds, Growth and Yield of Summer Mungbean [*Vigna radiata* (L.) R. Wilczek]

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Mungbean [*Vigna radiata* (L.) Wilczek], also known as greengram, is the third most widely cultivated pulse crop in India. Pulse crops have been the mainstay of Indian agriculture for providing protein-rich diet to vegetarian masses of the country. Being leguminous crops they have beneficial effect on improving soil fertility through fixation of atmospheric nitrogen. Summer mungbean often suffers from severe crop-weed competition because it is grown under irrigated conditions. Infestation of weeds is a major constraint in achieving higher yield of summer mungbean (Singh and Sekhon, 2002), as these compete with crop plants for nutrients, moisture, light and space. The magnitude of reduction in yield depends upon the weed flora present, quantum of weed flora and duration of crop-weed competition. Critical period for crop-weed competition in summer mungbean is from 15 to 30 days after sowing (DAS) (Singh *et al.*, 1996). Thus, it is imperative to eliminate weeds from the crop at proper time and with suitable methods. Though weeds can be controlled by hoeing yet due to shortage of labour it becomes difficult to do hoeing at appropriate time and delayed hoeing may cause economic loss.

A field experiment was conducted at the Punjab Agricultural University, Ludhiana, India during summer 2003 to study the effect of weed control in summer mungbean. The soil of the experimental field was loamy sand in texture, having pH 8.2, low in organic carbon (0.33%), low in available nitrogen and medium in available phosphorus and potassium content.

Twelve treatments, viz. unweeded check, one and two hoeings (25 and 45 DAS), two hoeings with wheel hoe (25 and 40 DAS), fluchloralin 0.625 kg/ha, trifluralin 0.96 kg/ha, pendimethalin 0.45 and 0.75 kg/ha, quizalofop-ethyl 35 and 50 g/ha and chlorimuron-ethyl 9 and 15 g/ha were tested in a randomized complete block design with four replications and net plot size was 4.5 × 2.025 m. The crop was sown on 28 March, 2003 in row spacing of 22.5 cm using a recommended seed rate of 37.5 kg/ha of variety SML 668. The pre-plant incorporation of fluchloralin and trifluralin and pre-emergence application of pendimethalin was done on the same day at the time of sowing and after sowing of the crop, respectively. The post-emergence application of quizalofop-ethyl and chlorimuron-ethyl was done 20 DAS using knapsack sprayer fitted with a flat-fan nozzle. Two hand hoeings were done at 25 and 40 DAS using *khurpa* (a small hand operated tool) and wheel hoe in respective treatments. Data on weed count and weeds dry matter were recorded 25 and 40 DAS and at harvest, using a quadrat measuring 50 × 50 cm. Data on yield and yield attributes were recorded at harvest. The data were analyzed and treatments having a significant F value, critical difference (CD) values were calculated at 5% probability level.

Cyperus spp. were the predominant weed in the experimental field (Table 1). These were not controlled very effectively by any of the herbicides. *Cyperus* spp. was not controlled effectively by pendimethalin, fluchloralin and trifluralin (Singh *et al.*, 1999; Kumar and Kundra, 2001). *Trianthema portulacastrum* and *Eragrostis tenella* were the other prominent weeds. *T. portulacastrum* was effectively controlled by hoeing, pre-emergence application of trifluralin 0.96 kg/ha or by both the doses of pendimethalin i. e. 0.45 and 0.75 kg/ha. Pre-plant application of fluchloralin at 0.625 kg/ha also showed good control of *T. portulacastrum*, while the other herbicides had little effect. Balyan *et al.* (1995) also observed that pre-plant incorporation of trifluralin at 1.5 kg/ha was the most effective in minimizing the density of *T. portulacastrum*. *E. tenella* was effectively controlled by mechanical treatments like two hand hoeings or two hoeings with wheel hoe both at 25 and 40 DAS or by herbicides, namely, fluchloralin 0.625 kg/ha, trifluralin 0.96 kg/ha and pendimethalin 0.45 and 0.75 kg/ha. The post-emergence application of chlorimuron-ethyl failed to control *T. portulacastrum* and *E. tenella*. In some treatments, reduction in the number of weeds

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Table 1.Weed count/m^2 under different treatments at various crop stages

Treatments	Growth stages (DAS)	*Cyperus* spp.	*Trianthema portulacastrum*	*Eragrostis tenella*	Total*
Unweeded control	25	28	9	1	40
	40	28	11	10	49
	At harvest	30	14	18	69
One hand hoeing (25 DAS)	25	18	6	8	32
	40	20	1	2	25
	At harvest	11	2	3	17
Two hand hoeings (25 & 40 DAS)	25	11	8	4	23
	40	18	2	2	22
	At harvest	13	4	1	21
Two hoeings with wheel hoe (25 & 40 DAS)	25	20	7	1	28
	40	20	2	1	24
	At harvest	2	3	0	9
Fluchloralin 0.625 kg/ha	25	11	5	0	18
	40	21	4	0	26
	At harvest	12	3	1	16
Trifluralin 0.96 kg/ha	25	18	2	0	22
	40	17	1	0	20
	At harvest	14	2	0	17
Pendimethalin 0.45 kg/ha	25	19	0	0	20
	40	12	1	3	17
	At harvest	13	2	0	15
Pendimethalin 0.75 kg/ha	25	12	0	0	12
	40	11	0	0	11
	At harvest	8	1	0	9
Quizalofop-ethyl 35 g/ha	25	6	4	2	14
	40	10	10	5	29
	At harvest	4	6	6	18
Quizalofop-ethyl 50 g/ha	25	19	5	3	29
	40	20	4	3	30
	At harvest	13	2	3	21
Chlorimuron-ethyl 9 g/ha	25	11	8	2	24
	40	9	8	13	37
	At harvest	10	4	12	31
Chlorimuron-ethyl 15 g/ha	25	10	8	12	31
	40	5	5	9	23
	At harvest	3	2	12	20

*Includes some other weeds also.

was observed after 40 days, which was possibly due to the smothering effect of the crop (Singh *et al.*, 1996). Total weed population decreased with mechanical as well chemical treatments and among the herbicides pendimethalin was the most effective. Nayak *et al.* (2000) also reported that total weed population was decreased with pendimethalin 1.25 kg/ha.

The highest dry matter of weeds was observed in unweeded check, especially at 40 DAS and at harvest stage (Table 2). At 25 DAS, pendimethalin, fluchloralin and trifluralin treatments had significantly lesser amounts of weeds than the other treatments. At 40 DAS, hoeing and herbicide treatments had significantly less dry matter of weeds. At harvest, all the treatments recorded significantly less dry matter production of weeds than the unweeded control. Two hoeings, 25 and 40 DAS and pendimethalin 0.75 kg/ha showed least amount of dry matter of weeds but were at par with trifluralin 0.96 kg/ha. The results are in line with the findings of Kundra *et al.* (1989) and Nayak *et al.* (2000).

Both primary and secondary branches per plant differed significantly by weed control treatments (Table 3).

Table 2. Dry matter of weeds as influenced by different treatments

Treatments	Dry matter of weeds (q/ha)		
	25 DAS	40 DAS	At harvest
Unweeded control	0.93	1.67	27.56
One hand hoeing (25 DAS)	0.97	0.71	8.56
Two hand hoeings (25 & 40 DAS)	0.94	0.69	5.07
Two hoeings with wheel hoe (25 & 40 DAS)	0.94	0.84	9.46
Fluchloralin 0.625 kg/ha	0.11	0.60	10.47
Trifluralin 0.96 kg/ha	0.12	0.65	7.80
Pendimethalin 0.45 kg/ha	0.08	0.59	8.27
Pendimethalin 0.75 kg/ha	0.06	0.48	4.63
Quizalofop-ethyl 35 g/ha	0.96	0.36	12.83
Quizalofop-ethyl 50 g/ha	0.92	0.31	15.67
Chlorimuron-ethyl 9 g/ha	0.96	0.39	18.29
Chlorimuron-ethyl 15 g/ha	0.97	0.32	9.67
LSD (P=0.05)	0.09	0.09	3.95

The treatments of two hoeings either by hand or wheel hoe had higher number of branches per plant than the unweeded control. Significantly lower number of branches in one hoeing or quizalofop or unweeded control might be due to weed competition. The maximum number of primary branches was recorded in both the doses of chlorimuron-ethyl which was possibly due to phytotoxic effect initially and regeneration of the crop thereafter. The number of secondary branches was significantly higher with two hoeings, fluchloralin and pendimethalin than the chlorimuron. The unweeded check also produced more number of secondary branches than chlorimuron. One and two hoeings, fluchloralin, trifluralin and pendimethalin at both the doses were at par and gave significantly higher number of pods per plant than the unweeded control. The post-emergence spray of quizalofop or chlorimuron at both the doses produced almost equal number of pods per plant as observed in unweeded control. The number of seeds per pod did not vary significantly in different weed control treatments. However, the maximum number of seeds per pod was observed in two hand hoeings and pendimethalin 0.75 kg/ha, followed by two hoeings with wheel hoe. The minimum number of seeds per pod was observed with chlorimuron at 15 g/ha. It was possibly due to poor plant growth as the herbicide caused phytotoxicity. The toxic effect was severe at higher dose. The 100-seed weight was significantly higher in two hoeings either done with hand or wheel hoe or herbicides like pendimethalin, fluchloralin and trifluralin than the unweeded control. The minimum 100-seed weight was recorded with chlorimuron at 15 g/ha.

Table 3. Number of branches (primary and secondary) and yield attributing characters as influenced by different treatments

Treatments	No. of primary branches/plant	No. of secondary branches/plant	No.of pods/ plant	No. of seeds/ pod	100-seed weight (g)	Grain yield (q/ha)
Unweeded control	1.0	5.7	15.0	8.8	5.04	10.47
One hand hoeing (25 DAS)	1.6	5.9	21.0	9.0	5.07	13.85
Two hand hoeings (25 & 40 DAS)	2.6	6.2	21.9	9.2	5.82	15.10
Two hoeings with wheel hoe (25 & 40 DAS)	2.5	6.3	20.2	9.1	5.65	13.54
Fluchloralin 0.625 kg/ha	2.1	6.0	22.2	8.9	5.76	14.37
Trifluralin 0.96 kg/ha	2.1	5.3	21.0	8.6	5.66	14.20
Pendimethalin 0.45 kg/ha	1.7	6.1	22.5	8.6	5.73	13.75
Pendimethalin 0.75 kg/ha	1.7	6.3	23.0	9.2	5.63	14.47
Quizalofop-ethyl 35 g/ha	1.1	5.5	15.3	8.8	5.47	11.25
Quizalofop-ethyl 50 g/ha	1.2	5.5	16.0	8.4	5.15	11.29
Chlorimuron-ethyl 9 g/ha	3.8	4.8	13.7	8.2	5.51	1.58
Chlorimuron-ethyl 15 g/ha	4.5	4.6	13.2	7.8	4.84	2.55
LSD (P=0.05)	0.9	1.0	3.7	NS	0.63	2.99

NS–Not Significant.

The highest grain yield was obtained in two hand hoeings at 25 and 40 DAS (Table 3) followed by pendimethalin 0.75 kg/ha. The treatments of one hoeing at 25 DAS, two hoeings with wheel hoe at 25 and 40 DAS, fluchloralin 0.625 kg/ha, trifluralin 0.96 kg/ha and pendimethalin 0.45 and 0.75 kg/ha were significantly superior to the unweeded control. The high yield was because of reduced weed competition by these weed control treatments. Chlorimuron at 9 and 15 g/ha had phytotoxic effect on the crop. This shows that phytotoxicity reduced the crop growth and ultimately reduced the grain yield. Panwar *et al*. (1999) also reported that pendimethalin at 0.75 kg/ha applied on the day of sowing recorded the highest yield of mungbean, which was at par with fluchloralin 0.7 kg/ha applied on the same day before sowing or with hand hoeing 30 DAS.

In inclusion, all the mechanical and herbicidal weed control treatments except post-emergence herbicides gave a marked reduction in dry matter of weeds and produced significantly more grain yield as compared to unweeded check. Though two hand hoeings at 25 and 40 DAS produced the highest grain yield yet pendimethalin at 0.75 kg/ha was statistically at par with it.

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