



Pre- and post-emergence herbicides for integrated weed management in summer greengram

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Weed infestation is one of the major constraints in greengram cultivation. In view of severe infestation of annual and perennial weeds in summer greengram, the potential yield is generally not realized. The available pre- and post-emergence herbicide, pendimethalin, oxyfluorfen, fenaxaprop-p-ethyl and quizalofop-ethyl are able to check the emergence and growth of annual grasses and broad-leaved weeds. This study was done to find out the relative efficiency of different herbicide when applied alone or in combination with cultural operation in summer greengram.

The experiment was carried out during summer season of 2011 at Junagadh Agricultural University, Junagadh (Gujarat). The soil of the experimental field was medium black soil having pH 8.10 and EC 0.49 dS/m. It was medium, low and high in available N, P and K, respectively. Summer greengram variety 'Greengram-4' was drilled at 20 kg/ha at 45 cm row spacing on February 18, 2011. The crop was grown with recommended package of practices except weed management. Ten treatment comprising inter-culture with weeding once (30 DAS), two inter-culture with weeding (20 DAS, 30 DAS, 40 DAS), pendimethalin 0.900 kg/ha, oxyfluorfen 0.180 kg/ha, fenaxaprop-p-ethyl 0.075 kg/ha and quizalofop-ethyl 0.040 kg/ha and integration each of pendimethalin 0.900 kg/ha and oxyfluorfen 0.180 kg/ha with an inter-cultural and weeding (30 DAS), weed free (weeding at 15, 30, 45 and 55 DAS) and unweeded control were tried in randomized block design with three replication. Inter-culturing operation was carried out in inter row space through bullock drawn implement and simultaneous removal of weeds manually in intra row space. All the herbicide were applied with manually operate knapsack sprayer fitted with flood jet nozzle at a spray volume of 500 l/ha. Weed count were recorded at 30 DAS, 60 DAS and at harvest and were subjected to $\sqrt{x + 0.5}$ transformation, while dry weight of weeds was recorded at harvest.

Experimental field was infested with *Panicum colonum* L., *Cynodon dactylon* L., *Cyperus rotundus* L., *Digera arvensis* Forsk, *Euphorbia hirta* L., *Leucas aspera* Spreng., *Phyllanthus niruri* L., *Portulaca oleracea* L. and *Indigofera glandulosa* L.

All the herbicidal and integrated treatments significantly reduced the weed density and their biomass over weedy check. At 30, 60 DAS and harvest, least weed density and dry matter were observed in monocot, dicot and sedges at two hand weeding and two inter-culturing at 20 and 40 DAS which was at par with oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS and pendimethalin 0.900 kg/ha + 1 hand weeding + inter-culturing at 30 DAS. Two hand weeding and two inter-culturing at 20 DAS and 40 DAS showed its superiority by recording least weed density and their dry matter (Fig. 1). Although oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS was found equally good but their effectiveness could not match with two hand weeding and two inter-culturing at 20 DAS and 40 DAS which may be due to the escape of some weed species. The excellent performance of two hand weeding and two inter-culturing at 20 DAS and 40 DAS were due to better control of weeds which constituted more than 70% of the total weed flora.

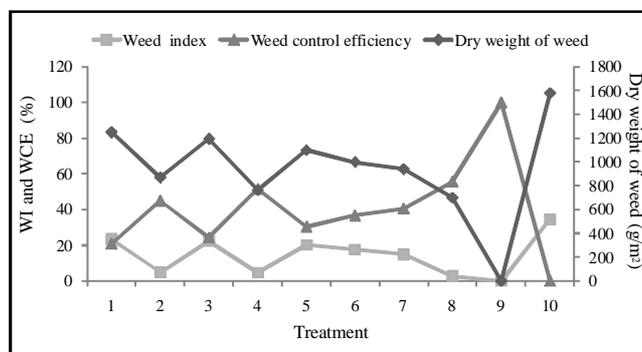


Fig. 1 Effect of different treatments on dry weight of weed, weed index and weed control efficiency

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The lowest dry weight of weed was found by the application of two hand weeding and two inter-culturing at 20 DAS and 40 DAS and highest dry weight of weeds by pendimethalin 0.900 kg/ha. The lowest weed index (2.68%) and highest weed control efficiency (55.69%) was observed when two hand weeding and two inter-culturing at 20 DAS and 40 DAS followed by oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS (4.68%, 51.58%, respectively). Among herbicides, quizalofop-ethyl (WCE 36.70%) was most effective in controlling weeds followed by fenoxaprop-p-ethyl (WCE 36.70%). The finding confirms the results of Bhandari *et al.* (2004) and Idapuganti *et al.* (2005).

There was vigorous growth of weed in unweeded check treatments resulted higher uptake of N, P and K nutrients. While treatment two hand weeding and two inter-culturing at 20 and 40 DAS recorded the least loss of nutrients by weeds followed by the oxyfluorfen 0.180 kg/ha (Table 1). It can be explained in the light of the facts that these treatments controlled the weeds effectively, might have made more nutrients available to crop and consequently encouraged higher concentration of nutrients and more yield and there by higher uptake of nutrients by the crop. Two hand weeding and two inter-culturing at 20 DAS and 40 DAS significantly increase protein content (22.2%) followed by oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS (21.87 percent). This can be ascribed to better control of weeds by manual weeding and integration with herbicidal method as compared to unweeded condition, which might have increased uptake of nutrients and water.

The effect of integrated weed management was found significantly on yield attributed and seed yield significantly. Two hand weeding and two inter-culturing at 20 DAS and 40 DAS and oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS applied for the depressed weed growth and promoted yield parameters and seed yield (Table 2). Plant height, branches/plant, no. of pods/plant, length of pod (cm), no. of grain/pod, grain weight/plant (g), test weight (g), grain yield (t/ha), stover yield (t/ha) increased significantly due to application of two hand weeding and two inter-culturing at 20 DAS and 40 DAS and oxyfluorfen 0.180 kg/ha+ 1 hand weeding at 30 DAS supplemented with post-emergence herbicide. Among herbicides, application of quizalofop-ethyl resulted in significantly higher grain yield over fenoxaprop-p-ethyl, oxyfluorfen and pendimethalin. The results are in close conformity with those reported by Kohli *et al.* (2006). Among the treatment, application of two hand weeding and two inter-culturing at 20 DAS and 40 DAS produced highest grain and stover yield of 0.97 and 1.37 t/ha, respectively, and closely followed by oxyfluorfen 0.180 kg/ha+ 1 HW at 30 DAS with seed and stover yield of 0.95 t/ha and 1.36 t/ha. However, both these treatments were at par with weed free treatment. Higher grain yield under integrated weed control treatments (herbicide + hand weeding + inter-culturing) may be attributed mainly to the better control of weeds during different stages, manual removal of weeds emerging, weeding and inter-culturing at subsequent stages, resulting in reduced crop-weed competition and thereby providing better yield attributes (Vivek *et al.* 2008).

Table 1. Effect of weed-control treatments on protein content and nutrient uptake by greengram and weeds

Treatment	Dose (kg/ha)	Protein content (%)	Nutrient uptake (kg/ha)					
			Crop			Weeds		
			N	P	K	N	P	K
T ₁ - Pendimethalin	0.900	19.3	29.1	5.5	30.9	25.0	1.6	13.4
T ₂ - Pendimethalin +1 HW + IC at 30 DAS	0.900	21.2	36.1	6.6	35.7	19.9	1.1	10.3
T ₃ - Oxyfluorfen	0.180	19.6	30.2	5.5	32.4	24.0	1.5	12.7
T ₄ - Oxyfluorfen + 1 HW at 30 DAS	0.180	21.8	37.7	7.0	36.2	19.1	1.0	10.0
T ₅ - Fenoxaprop-p-ethyl at 20 DAS	0.075	20.2	31.7	5.8	33.0	23.6	1.4	11.8
T ₆ - Quizalofop-ethyl at 20 DAS	0.040	20.5	32.7	6.0	33.9	23.0	1.3	11.5
T ₇ - One hand weeding + and one inter-culturing at 30 DAS		20.7	34.3	6.3	35.0	20.5	1.2	10.6
T ₈ - Two hand weeding + two inter-culturing at 20 and 40 DAS		22.1	38.0	7.4	37.6	16.9	0.9	9.4
T ₉ - Weed free		23.0	40.5	7.8	38.4	0.0	0.0	0.0
T ₁₀ - Unweeded check		18.2	24.9	4.7	31.0	28.7	1.9	15.1
LSD (P=0.05)		2.6	3.8	0.2	2.2	3.85	0.27	2.20

Table 2. Effect of weed-control treatments on growth, yield and economics of greengram

Treatment	Plant height (cm)	Branches /plant	No. of pods/plant	Length of pod (cm)	No. of grain/pod	Grain weight/plant (g)	Test weight (g)	Grain yield (t/ha)	Stover yield (t/ha)	Net returns (x10 ³ ₹/ha)	Benefit: cost ratio
T ₁	26.2	4.86	11.2	5.5	5.7	5.1	30.3	0.76	1.13	12.92	2.09
T ₂	36.6	6.13	14.6	7.4	6.7	6.2	35.3	0.95	1.36	17.62	2.35
T ₃	28.2	5.00	12.1	5.9	5.9	5.3	32.1	0.77	1.17	13.30	2.12
T ₄	37.2	6.37	15.0	7.8	6.9	6.8	35.8	0.95	1.36	18.04	2.41
T ₅	31.2	5.33	12.9	6.4	6.2	5.6	32.6	0.80	1.21	14.43	2.26
T ₆	33.0	5.47	13.2	6.7	6.2	5.9	33.4	0.82	1.26	15.21	2.32
T ₇	35.4	5.80	13.2	6.9	6.5	6.0	34.6	0.85	1.30	15.82	2.35
T ₈	39.3	6.73	15.4	8.1	7.0	6.9	35.9	0.97	1.37	18.35	2.41
T ₉	40.1	7.03	16.1	8.6	7.1	7.5	36.8	1.00	1.41	18.42	2.33
T ₁₀	23.4	4.50	10.2	4.7	5.3	4.9	29.1	0.65	1.06	11.07	2.07
LSD (P=0.05)	3.7	1.26	3.0	1.0	NS	1.1	4.7	0.14	0.21	-	-

DAS= Day after sowing: Treatment details are given in Table 1

The highest net monetary returns of ₹18354/ha was obtained with two hand weeding and two inter-culturing at 20 DAS and 40 DAS which was at par with oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS (18040/ha). The highest benefit: cost ratio of 2.41 was obtained with two hand weeding and two inter-culturing at 20 DAS and 40 DAS and oxyfluorfen 0.180 kg/ha + 1 hand weeding at 30 DAS closely followed by pendimethalin 0.900 kg/ha + 1 hand weeding + inter-culturing at 30 DAS and one hand weeding and one inter-culturing at 30 DAS which may be due to lower cost of treatments than other. It was concluded that application of two hand weeding and two inter-culturing at 20 DAS and 40 DAS were found effective to control weeds and to improve crop yield. These findings were in close vicinity with those reported by Sardana *et al.* (2006). Thus, chemical weed control with oxyfluorfen as pre-emergence in summer greengram was found economically viable.

SUMMARY

A field experiment was carried out on the medium black soil of Junagadh Agricultural University, Junagadh (Gujarat) during summer season of 2011. The relative efficacy of pendimethalin, oxyfluorfen, fenoxaprop-p-ethyl, quizalofop-ethyl was tested applied alone or in combination with hand weeding and inter-cultural 30 days after sowing (DAS) to control weeds in summer green-gram.

Two hand weeding with two interculturing at 20 DAS and 40 DAS proved its superiority over rest of the weed management in summer green gram. Among herbicidal treatment, application of quizalofop-ethyl at 20 DAS and fenoxaprop-p-ethyl at 20 DAS was found to be relatively more effective in controlling weeds than their sole application.

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