

Herbicidal Weed Control in Green Gram

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ABSTRACT

Field experiment was carried out on the medium black soil of Junagadh Agricultural University, Junagadh (Gujarat) during summer seasons of 2011. The relative efficacy of pendimethalin, oxyfluorfen, fenoxaprop-P-ethyl, quizalofop-ethyl applied alone or in combination with hand weeding and interculturing 30 days after sowing (DAS) to control weeds in summer green gram. The results that two hand weeding with two interculturing 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.

Keywords: *Herbicide efficacy, Weed index, Weed Control Efficiency, Yield attributes*

Weed infestation is one of the major constraints in green gram cultivation. In view of severe infestation of annual and perennial weeds in summer green gram, the potential yield is generally not realized. The available pre- post emergence herbicide i.e. pendimethalin, oxyfluorfen, fenoxaprop-P-ethyl and quizalofop-ethyl are able to check the emergence and growth of annual grasses and broad leaved weeds. In general, find out the relative efficiency of different herbicide when applied alone or in combination with cultural operation to provide weed free environment during entire growing period of green gram and timely, easy, efficient and economically weed management in summer green gram.

1. MATERIALS AND METHODS

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⁻¹. It was medium, low and high in available N, P and K, respectively. Summer green gram variety “Green gram-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 interculture with weeding once (30 DAS) two interculture with weeding (20 DAS, 30 DAS, 40 DAS) pendimethalin @ 0.900 kg ha⁻¹, oxyfluorfen @ 0.180 kg/ha, fenoxaprop-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 intercultural 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. Interculturing operation was carried out in inter row space through bullock drawn implement 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.

2. RESULTS AND DISCUSSION

Weed flora

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., *Indigoflora glandulosa* L., *Phyllanthus niruri* L.

Effect on weeds

All the herbicidal and integrated treatments significantly reduced the weed density and their biomass over weedy check during the year. At 30 DAS, 60 DAS and harvest, least of monocot, dicot and sedges weed density and their dry matter were observed two hand weeding and two interculturing at 20 DAS and 40 DAS at par with oxyfluorfen @ 0.180 kg/ha+ 1 hand weeding at 30 DAS and pendimethalin @ 0.900kg/ha+1 hand weeding + Interculturing at 30 DAS. Two hand weeding and two interculturing at 20 DAS & 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 interculturing 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 interculturing at 20 DAS & 40 DAS in the present study appeared to be due to better control of weeds which constituted more than 70 percent of the total weed flora. The lowest dry weight of weed found that the two hand weeding and two interculturing at 20 DAS & 40 DAS and highest dry weight of weeds that pendimethalin@ 0.900kg/ha. The lowest weed index (2.68 percent) and highest weed control efficiency (55.69 percent) was observed when two hand weeding and two interculturing at 20 DAS & 40 DAS followed by oxyfluorfen @ 0.180 kg/ha+ 1 hand weeding at 30 DAS (4.68 percent, 51.58 percent respectively). Among the herbicides, quizalofop-ethyl (WCE 36.70 percent) was most effective in controlling weeds followed by fenoxaprop-p-ethyl (WCE 36.70 percent). The finding confirms the results of Bhandari *et al.* (2004) and Idapuganti *et al.* (2005).

Effect on crop

The effect of integrated weed management was found significantly on yield attributed and seed yield significantly. Two hand weeding and two interculturing at 20 DAS & 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 (kg/ha), stover yield (kg/ha) increased significantly created due to application of two hand weeding and two interculturing at 20 DAS & 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 interculturing at 20 DAS & 40 DAS produced highest grain and stover yield of 977 and 1376 kg/ha respectively, and closely followed by oxyfluorfen @ 0.180 kg/ha+ 1 HW at 30 DAS with seed and stover yield of 957 kg/ha and 1365 kg/ha. However, both these treatments were at par with weed free. Higher grain yield under integrated weed control treatments (herbicide + hand weeding + interculturing) may be attributed mainly to the better control of weeds during different stages, manual removal of weeds emerging, weeding and interculturing at subsequent stages, resulting in reduced crop-weed competition and thereby providing better yield attributes Vivek *et al.* (2008).

Effect on uptake of nutrients and Quality parameter

There was vigorous growth of weed in unweeded check treatments resulted higher uptake of N, P and K nutrients *i.e* N, P₂O₅ and K₂O respectively. While treatments two hand weeding and two interculturing at 20 & 40 DAS recorded the least loss of nutrients by weeds followed by the oxyfluorfen @ 0.180 kg/ha. 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 interculturing at 20 DAS & 40 DAS significantly increase protein content (22.15 percent) and 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.

Economics

The highest net monetary returns of ₹. 18354/ha was obtained with two hand weeding and two interculturing 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 interculturing at 20 DAS & 40 DAS and oxyfluorfen @ 0.180 kg/ha+ 1 hand weeding at 30 DAS closely followed by pendimethalin @ 0.900kg/ha+ 1 hand weeding + interculturing at 30 DAS and one hand weeding and one interculturing 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 interculturing at 20 DAS & 40 DAS were found effective to control weeds and improve the crop yield. These findings are in close vicinity with those reported by Sardana *et al.* (2006). Thus, chemical weed control with oxyfluorfen pre-emergence in summer green gram appear to be economically viable whenever the labor scarcity arises during peak season for obtaining maximum weed control efficiency and seed yield.

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Table 1: Effect of weed-control treatments on protein content, dry weight of weeds, weed index, weed-control efficiency and nutrient uptake by green gram

Treatments	Dose Kg/ha	Protein content (%)	Dry weight of weeds (kg/ha)	Weed index (%)	Weed control efficiency (%)	Nutrient uptake by					
						Crop			Weed		
						N	P	K	N	P	K
Pendimethalin	0.900	19.30	1250	23.50	20.88	29.14	5.50	30.96	25.01	1.69	13.42
Pendimethalin +1 HW + IC at 30 DAS	0.900	21.21	870	4.88	44.93	36.10	6.62	35.70	19.99	1.19	10.32
Oxyfluorfen	0.180	19.61	1195	22.41	24.36	30.21	5.53	32.40	24.05	1.59	12.75
Oxyfluorfen + 1 HW at 30 DAS	0.180	21.87	765	4.68	51.58	37.72	7.03	36.26	19.19	1.08	10.01
Fenoxaprop-P-ethyl at 20 DAS	0.075	20.28	1100	20.21	30.37	31.70	5.83	33.00	23.60	1.45	11.89
Quizalofop-ethyl at 20 DAS	0.040	20.54	1000	17.62	36.70	32.76	6.05	33.90	23.09	1.38	11.53
One hand weeding and one interculturing at 30 DAS		20.74	940	14.94	40.50	34.30	6.31	35.06	20.53	1.27	10.65
Two hand weeding and two interculturing at 20 and 40 DAS		22.15	700	2.68	55.69	38.01	7.46	37.60	16.97	0.92	9.47
Weed free		23.00	0.00	0.00	100	40.55	7.85	38.40	0.00	0.00	0.00
Unweeded check		18.26	1580	34.36	0.00	24.93	4.76	31.00	28.72	1.98	15.18
LSD (P=0.05)		2.61	211.26	-	-	3.85	0.27	2.20	3.85	0.27	2.20

Table 2: Effect of weed-control treatments on growth, yield attributes, yield and economics of green gram

Treatments	Dose (kg/ha)	Plant height	Branches per plant at harvest	No. of Pods per plant	Length of pod (cm)	No. of Grain per pod	Grain wt. per plant (g)	Test weight (g)	Grain yield (kg/ha)	Stover yield (kg/ha)	Net return (₹/ha)	B: C Ratio
Pendimethalin	0.900	26.24	4.86	11.23	5.53	5.78	5.11	30.30	768	1131	12924	2.09
Pendimethalin +1 HW + IC at 30 DAS	0.900	36.65	6.13	14.66	7.46	6.72	6.21	35.33	955	1364	17623	2.35
Oxyfluorfen	0.180	28.20	5.00	12.10	5.96	5.98	5.39	32.10	779	1170	13308	2.12
Oxyfluorfen + 1 HW at 30 DAS	0.180	37.26	6.37	15.00	7.86	6.91	6.81	35.85	957	1365	18040	2.41
Fenoxaprop-P-ethyl at 20 DAS	0.075	31.20	5.33	12.93	6.40	6.25	5.69	32.61	801	1215	14436	2.26
Quizalofop-ethyl at 20 DAS	0.040	33.06	5.47	13.20	6.73	6.21	5.90	33.46	827	1265	15213	2.32
One hand weeding and one interculturing at 30 DAS		35.48	5.80	13.26	6.90	6.53	6.02	34.66	851	1303	15825	2.35
Two hand weeding and two interculturing at 20 and 40 DAS		39.32	6.73	15.40	8.10	7.03	6.99	35.96	977	1376	18354	2.41
Weed free		40.18	7.03	16.16	8.60	7.13	7.58	36.81	1004	1416	18424	2.33
Unweeded check		23.46	4.50	10.26	4.75	5.33	4.95	29.16	659	1068	11072	2.07
LSD (P=0.05)		3.71	1.26	3.05	1.02	NS	1.12	4.78	139.06	211.55	-	-

DAS= Day after sowing