

Original Research Article

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## Weed Flora Dynamics and Growth Response of Green Gram (*Vigna radiata* L.) to Weed Management Practices

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### ABSTRACT

#### Keywords

Chemical control, Green gram, Hand weeding, Plastic mulch, Weed flora

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A field experiment was conducted during *Kharif* 2017 to study the effect of different weed management practices on diverse weed flora and yield of green gram at College of Agriculture, Gwalior, India. An experiment was replicated thrice in a randomized complete block design and consisted of 10 treatments as white plastic mulch, black plastic mulch, straw mulching 5 days after sowing (DAS) @ 5 t/ha, one hand weeding at 20 DAS + straw mulching at 25 DAS, two hand hoeing at 20 & 40 DAS, two hand weeding at 20 & 40 DAS, hand weeding at 20 DAS + hoeing at 40 DAS, recommended herbicide (Imazethapyr @ 80 g/ha) + one hand weeding at 40 DAS and weedy check. The highest mortality of weeds, weed control efficiency (94.1%) and maximum grain yield (824 kg/ha) with 104.0% increase in grain yield over weedy check were recorded with one hand weeding at 20 DAS conjointly with straw mulching at 25 DAS. Whereas, the highest B:C ratio of (2.52) was obtained with Imazethapyr 80g/ha as PE followed by application of Imazethapyr 80g/ha with one hand weeding at 40 DAS (2.08).

### Introduction

Green gram is considered as the important pulse crop and accounts for about 10-12% of total pulse production in the country. Green gram is not a very good competitor against weeds, particularly during early growth period and results in serious yield losses in green gram due to luxuriant weed growth. The loss of green gram yield due to weeds ranges from 65.4 to 79.0% (Das *et al.*,

2012; Yadav *et al.*, 2019). Besides causing crop losses, weeds are also responsible for reducing crop quality, nutrient status of soil etc.

Hence weed management assumes utmost importance. Weeds may mechanically be managed by hand weeding at 20 and 40 days after sowing (DAS). But manual hand weeding is labour intensive and tedious and does not ensure weed removal at critical stage

of crop-weed competition. Though chemical herbicides become cost-effective, their efficacies are greatly reduced during *Kharif* due to uncertain rainfall (Sasode *et al.*, 2017). On the other hand, continuous use of herbicides causes environmental pollution and weeds may also develop resistance to the chemicals.

Thus, it is a major challenge to maximize productivity of this important pulse crop and integrated weed management seems an important consideration for obtaining higher and sustainable yield as well as shift crop-weed competition in favour of crop. Hence, the current study was made to determine the effect of weed management practices on weed flora dynamics and growth of green gram to avert such yield loss due to weeds.

### **Materials and Methods**

A field experiment was carried out at the research farm of Department of Agronomy, RVSKVV, College of Agriculture, Gwalior during *Kharif* season (July to November) 2017. The soil contained 0.51% organic carbon with *pH* of 7.8 and electrical conductivity (EC) 0.34 dS/m in the top 15 cm.

The initial N (234 kg/ha) content of soil was low, while P (14 kg/ha) and K (240 kg/ha) content were medium with sandy clay loam in texture. Field was well prepared by one deep ploughing by disc plough followed by two cross disc harrowing and it was leveled with the help of, "Pata (Planker)".

The experiment was laid out in a randomized complete block design, replicated three times, and consisted of 10 treatments as application of white and black plastic mulch, straw mulching at 5 DAS 5 t/ha, cultural practices of weed control as one hand weeding at 20 DAS with straw mulching at 25 DAS, two hand hoeings at 20 & 40 DAS, two hand

weeding at 20 & 40 DAS, hand weeding at 20 DAS + hoeing at 40 DAS, Imazethapyr 80g/ha as PE used individually, Imazethapyr 80g/ha as PE in combination with one hand weeding at 40 DAS and one kept weedy check for comparison.

Green gram variety 'TJM-3' was sown using seed rate 18 kg/ha in rows 40 cm apart on 16<sup>th</sup> July 2017 and harvested on 4<sup>th</sup> October 2017. Both FYM and vermicompost @ 10 t/ha were applied at the time of field preparation and neem cake @ 250 kg/ha was applied in the soil to control termites.

Seeds were treated with NPK culture (35 ml/kg seed) for 30 minutes to control soil and seed born diseases. Mulching materials were placed as per the treatments and irrigation was applied at all the critical stages of crop growth during the experimentation. Imazethapyr 80g/ha as PE was applied with the help of knapsack sprayer with flat fan nozzle at spray volume of 600 liters water/ha.

The growth and yield attributes were recorded from five selected plants in each plot. Observations were recorded with the help of a quadrant 0.5 m x 0.5 m weeds placed randomly at two spots in each plot at 40 DAS and harvest. Weeds were cut at ground level, washed with tap water, sun dried for a few days and then oven drying at 65°C for 48 hours and then weighted. Total dry matter was determined by the summing up the dry weight of each plant.

Weed control efficiency was calculated using weed dry weight data at 40 DAS and economics of different weed control treatments was also worked out by taking the selling price of greengram and existing market prices of the inputs. Statistical analysis of the data was carried out using analysis of variance technique as applicable to RCBD (Gomez and Gomez, 1984).

## Results and Discussion

### Effect on weeds

The major weed flora in the experimental plots were *Setaria glauca*, *Echinochloa crusgalli*, *Celosia argentea*, *Acrachne racemosa*, *Cynodon dactylon*, *Leptochloa panicea*, *Eragrostis pilosa*, and *Phyllanthus niruri*, *Digera arvensis*, *Commelina benghalensis* and *Cyperus rotundus*. All the weed control treatments proved effective in minimizing the population, density and dry weight of weeds over weedy check (Table 1). Total weed population was significantly lowest in one hand weeding at 20 DAS + straw mulching at 25 DAS while lowest total weed population was under two hand weedings at 20 and 40 DAS. This treatment gave best results because weeding was performed during critical period of crop-weed competition (i.e. first 30 days of crop growth) (Yadav *et al.*, 2019), thus cascading effect observed in terms of better crop growth and crop lead suppression of weeds.

The maximum weed dry weight was registered in weedy check plot and minimum in one hand weeding at 20 DAS + straw mulching at 25 DAS. Broad and narrow leaved weed control efficiency of treatments varied from 63.18 to 94.12%. One hand weeding at 20 DAS + straw mulching at 25 DAS resulted in higher weed control efficiency followed by two hand weedings at 20 and 40 DAS, Imazethapyr 80 g/ha as PE + HW at 40 DAS (Table 1).

Application of Imazethapyr 80 g/ha as PE effectively reduced biomass and density of total weeds in general and broad leaf weed (BLW) and grasses in particular. The initial weed growth was ceased due to effect of pre-emergence herbicide and forth coming weed flushes were then suppressed by the hand weeding at 40 DAS, resulting in higher WCE. Similar results of higher WCE of imazethapyr

were also reported by Dubey *et al.*, (2012). Higher weed control due to various treatments may be attributed to reduced growth and number of weeds due to manual removal of weeds by hand weeding or hoeing, smothered weed growth because of good soil coverage by straw mulch application. Similar result was also reported by Mansoori *et al.*, (2015) and Raman and Krishnamoorthy (2005).

### Effect on crop

Due to least competition from weeds for the light, space, as well as above and below ground resources, greengram responded better to all the imposed weed control treatments. Efficient control of weeds by one hand weeding at 20 DAS + straw mulching at 25 DAS led to better values of growth parameters *i.e.* plant height and yield attributes *i.e.* number of pods/plant, pod length, number of seeds/pod in greengram and was followed by two hand weedings at 20 and 40 DAS, application of Imazethapyr 80 g/ha as PE + HW at 40 DAS (Table 2). This may be due to better control of weeds, which reduced the intensity of crop-weed competition in greengram. Higher growth and yield attributes value were observed under one hand weeding at 20 DAS + straw mulching at 25 DAS and two hand weeding at 20 & 40 DAS treatments owing to weeding operations at critical period of crop-weed competition led to better weed suppression and higher weed control efficiency (Table 2), which got reflected in better natural resource allocation to the crops, hence crop exhibited more vegetative growth, enhanced yield attributes and yield.

The highest seed yield was recorded with one hand weeding at 20 DAS + straw mulching at 25 DAS (824 kg/ha) and was comparable with all treatments except two hand hoeing at 20 & 40 DAS, hand weeding at 20 DAS + hoeing at 40 DAS and weedy check (Table 2). One hand weeding at 20 DAS + straw mulching at

25 DAS recorded 51 and 52 % higher seed and stover yield respectively, as compared to weedy check and 15 and 21 % higher seed and stover yield respectively, compared to straw mulching (5 t/ha) at 5 DAS. This increase in yield might be due to effective

control of weeds in early stage, which smothered weed growth and gave higher yield attributes of green gram and ultimately resulted to higher yields. This was in conformity with the findings of Singh and Kumar (2008) and Shivran *et al.*, (2017).

**Table.1** Effect of different weed management practices on total weeds population/m<sup>2</sup>, dry weight of weeds at 40 DAS and weed control efficiency (%) in green gram

Treatments	Total weed population/m <sup>2</sup>				Dry weight of different weeds g/m <sup>2</sup>				WCE (%)
	Narrow	Broad	Sedge	Total	Narrow	Broad	Sedge	Total	
White plastic mulch	2.29 (194.7)	1.97 (94.7)	2.54 (412.0)	2.82 (701.3)	121.3	53.0	34.3	208.7	63.2
Black plastic mulch	2.18 (153.3)	1.86 (86.7)	2.47 (305.3)	2.72 (545.3)	83.3	34.7	29.7	147.6	74.0
Straw mulching 5 t/ha at 5DAS	2.11 (130.7)	1.78 (60.0)	2.42 (266.7)	2.66 (457.3)	73.7	33.0	29.3	136.0	76.0
One HW at 20 DAS + Straw mulching 5 t/ha at 25 DAS	1.48 (33.3)	0.96 (10.7)	1.94 (102.7)	2.12 (146.7)	17.3	2.7	13.3	33.3	94.1
Two hand hoeing at 20 & 40 DAS	2.31 (206.7)	2.10 (128.0)	2.62 (453.3)	2.88 (788.0)	122.3	96.3	35.7	254.3	55.1
Two hand weeding at 20 & 40 DAS	1.77 (61.3)	1.40 (25.3)	2.26 (184.0)	2.43 (270.7)	20.7	7.0	17.0	44.7	92.1
HW at 20 DAS + hoeing at 40 DAS	2.50 (320.0)	2.31 (214.7)	2.69 (490.7)	3.01 (1025.3)	135.0	197.0	45.0	377.0	33.5
Imazethapyr 80g/ha PE	2.03 (108.0)	1.63 (48.0)	2.37 (244.0)	2.59 (400.0)	69.3	30.7	18.3	118.3	79.1
Imazethapyr 80g/ha PE + HW at 40 DAS	1.90 (80.0)	1.52 (34.7)	2.30 (201.3)	2.50 (316.0)	22.7	30.3	17.7	70.7	87.5
Weedy Check	2.83 (686.7)	2.44 (289.3)	2.92 (854.7)	3.26 (1830.7)	200.0	280.0	86.7	566.7	63.2
SEm (±)	<b>0.06</b>	<b>0.10</b>	<b>0.11</b>	<b>0.07</b>	<b>32.06</b>	<b>33.07</b>	<b>10.80</b>	<b>57.90</b>	-
CD (P=0.05%)	<b>0.19</b>	<b>0.30</b>	<b>0.32</b>	<b>0.21</b>	<b>93.87</b>	<b>96.81</b>	<b>31.61</b>	<b>169.51</b>	-
Transformation	Log x	Log x	Log x	Log x	-	-	-	-	-

Figures within parenthesis are original means

**Table.2** Effect of different weed management practices on growth, yield attributes, yield and economics of green gram

Treatments	Plant height (cm)	Pod length (cm)	No. of pods/plant	No. of seeds / pod	Seed yield (kg/ha)	Stover yield (kg/ha)	Net returns (₹*10 <sup>3</sup> /ha)	B:C
White plastic mulch	54.87	6.91	16.00	8.80	676	835	4.1	1.10
Black plastic mulch	56.80	6.93	16.53	9.47	696	873	7.4	1.19
Straw mulching 5 t/ha at 5DAS	57.80	7.05	16.87	9.53	700	880	19.7	1.74
One HW at 20 DAS + Straw mulching 5 t/ha at 25 DAS	64.40	7.30	18.80	11.80	824	1115	23.4	1.75
Two hand hoeing at 20 & 40 DAS	54.00	6.77	15.93	8.67	654	792	21.6	1.99
Two hand weeding at 20 & 40 DAS	61.07	7.25	18.40	11.00	800	1071	25.3	1.91
HW at 20 DAS + hoeing at 40 DAS	53.67	6.73	15.13	8.60	637	760	17.4	1.70
Imazethapyr 80g/ha PE	58.27	7.14	17.73	9.60	775	1023	31.1	2.52
Imazethapyr 80g/ha PE + HW at 40 DAS	58.87	7.20	17.93	10.33	782	1035	26.9	2.08
Weedy Check	51.47	6.69	13.20	8.13	402	537	8.0	1.43
SEm (±)	5.59	0.21	1.76	0.90	57	109	-	-
CD (P=0.05%)	16.37	0.60	5.15	2.63	166	320	-	-

### Economics

Economic analysis of data (Table 2) revealed that the net monetary returns (₹4101/ha) and benefit cost ratio (1.10) were lowest in white plastic mulch plots. It was because of high cost incurred in white plastic mulch, resulted in lower net returns and B C ratio. Imazethapyr 80 g/ha as PE registered highest net returns (₹31055/ha) and B C ratio (2.52) closely followed by Imazethapyr 80 g/ha PE + hand weeding at 40 DAS (₹26929/ha & 2.08) and two hand weeding at 20 and 40 DAS (₹25318/ha & 1.91). The findings confirm the result of Rathi *et al.*, (2004).

It has been concluded that one hand weeding at 20 DAS + straw mulching 5 t/ha at 5 DAS gave the highest weed suppression, crop

growth and yield of green gram, however, where economics is concern, application of Imazethapyr 80 g/ha as PE gave highest gross, net returns and B C ratio.

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