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RESEARCH NOTE

Non-chemical weed management evaluation in greengram

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ABSTRACT

A field experiment was conducted during *Kharif* season of 2022 at agricultural research block, School of Agricultural Sciences, Shri Guru Ram Rai University (SAS-SGRRU), Dehradun, Uttarakhand to study the effect of non-chemical weed management methods on weed growth and greengram (*Vigna radiata* L.) yield. The experiment was laid out in factorial randomized RBD comprising 2 factors replicated thrice. First factor, crop geometry comprised of 20 × 15 cm, 25 × 12 cm 30 × 10 cm spacing maintained between row to row and plant to plant, respectively. The second factor was non-chemical weed management treatments including: weedy check, hand weeding (HW) once at 20 days after seeding (DAS) + mulching, and hand weeding twice at 30 and 45 DAS. Crop geometry and weed management treatments significantly influenced all the growth parameters, yield attributes and yield of greengram, weed density and biomass. To improve the productivity of greengram by managing weeds effectively in the Doon valley area of Uttarakhand, hand weeding once at 20 DAS + mulching along with crop geometry of 30 cm × 10 cm may be recommended, as they recorded a significant improvement in growth and yield parameters and greengram yield, compared to other treatments.

Keywords*:* Doon valley, Greengram, Non-chemical weeding, Mulching, Crop geometry

Greengram (*Vigna radiata* L.) locally known as "mung", a *Kharif* season pulse crop widely grown in arid and semi-arid parts of India, is one of the most significant pulse crops. It contains around 25% protein, 1.3% fat, 3.5% mineral, 4.1% fiber, and 56.7% carbohydrates. When sprouted, it also contains a notable amount of ascorbic acid and riboflavin. Despite being a staple of our daily diet, this crop's average yield is quite poor in India. Tamang *et al*. (2015) noted that because of their short stature, weeds severely reduce greengram's yield. Weeds constitute a severe concern since they compete for resources such as space, light, nutrients, water, and other growth inputs and lower the productivity of *Kharif* greengram by up to 65.4 to 96.5 %, depending on the species of weed and the level of crop weed competition (Verma *et al*. 2015, Dungarwal *et al.* 2003, Tamang *et al*. 2015). In addition to having low crop yields, they also harbor pests and insects that raise agricultural costs. Therefore, managing weeds at critical period is essential to improve productivity of the greengram.

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The low population will also result in a lower yield. Hence, in order to get a higher yield, the ideal plant population of greengram is required (Mansoor *et al*. 2010) and higher plant population was also reported to help in suppressing weed growth**.** Herbicides were evaluated for their efficacy in managing weeds in greengram (Tamang *et al.* 2015, Bajiya *et al.* 2025). But studies on non-chemical weed management are limited. Hence, current study was conducted at SGRR University, Dehradun with an objective to evaluate the efficacy of non-chemical weed management methods viz. crop geometry, hand weeding and mulching in managing weeds and enhancing yield of greengram in the Western Himalayan areas of Dehradun.

A field experiment was conducted at Agriculture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Pathribagh, Dehradun, Uttarakhand in the *Kharif* season of 2022. The sandy loam soil of the experimental field had a pH of 7.26, was rather neutral, had a low amount of available nitrogen (225.3 kg/ha) and organic carbon (0.42%), a medium amount of available phosphorus (16.1 kg/ha) and available potassium (236.3 kg/ha). The study used a factorial randomized complete block design, with two factors at various levels and three replications.

First factor crop geometry comprised of three crop rows to row and plant to plant spacings viz. 20 cm × 15 cm, 25 cm × 12 cm and 30 cm × 10 cm and second factor of different non- chemical weed control treatments comprising: weedy check (control), hand weeding once at 20 days after seeding (DAS) + mulching, and hand weeding twice at 30 and 45 DAS. After the experimental area was ploughed and the optimal soil moisture condition was reached, the plot was leveled with the aid of a tractor-drawn leveller and two cross harrowing operations. The sowing of greengram variety "*Shikha*" was done on June 20, 2022 and was harvested on September 16, 2022. Line sowing method for sowing was adopted while plant geometry varied according on the treatments. N, P and K 20:40:40 kg/ha. The wheat straw 5 t/ha was used as mulch in the experimental plot. Greengram harvesting was done manually, and after threshing, washing, and sun-drying, plot-wise weight measurements were made.

Weed density was recorded in each plot at 25DAS, 40 DAS and at harvest, using quadrat of 50 × 50 cm (0.25 m^2) from the area marked for observations. For recording weed dry matter (weed biomass), all the weed species within the area of quadrat were cut close to the ground surface separately and air dried first (4-5 days) and then dried in the hot air oven maintained at of 70 ±1 ^{0}C temperature. Weed biomass at 25 DAS, 40 DAS and at greengram harvest was recorded and expressed as gram per square meter during crop season. Weed control efficiency was calculated in relation to total weed dry weight by using the recommended formula and expressed in per cent during crop season:

Effect on greengram

Growth characteristics such as crop height, number of branches, number of nodules, and dry matter production per plant were significantly impacted by varying row spacing. It was noted that the 30 ×10 cm recorded the highest greengram plant height (51.46 cm), largest number of branches (21.09 cm), maximum number of nodules (29.39 cm), and maximum dry matter accumulation (54.17 g/plant) at 75 DAS, which was substantially better than the other treatments. The elimination of intra-plant competition and having better access to ground area and sunlight and nutrients may have allowed

Table 1. Effect of crop geometry and non-chemical weed management treatments on growth attributes of greengram

Treatment	Crop height (cm)			No. of branches/plant			No. of nodules/plant		Dry matter production (g/plant)		
	25 DAS*	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	25 DAS	50 DAS	75 DAS
Crop geometry											
20 cm × 15 cm	17.35	38.12	49.18	4.45	12.15	18.48	20.33	27.88	6.23	25.11	53.04
25 cm × 12 cm	18.07	41.00	50.23	5.33	13.59	19.44	22.44	28.38	7.28	25.99	53.52
30 cm × 10 cm	21.00	46.48	53.46	6.69	16.40	22.09	24.98	31.39	9.61	30.88	57.17
LSD (p=0.05)	1.564	2.312	2.011	1.291	2.664	2.111	2.192	1.987	2.643	3.614	3.381
Non-chemical weed management treatment											
Weedy check	16.78	35.92	47.81	3.84	10.72	17.73	17.02	26.67	5.32	24.42	52.43
Hand weeding once at 20 days after seeding (DAS) + mulching	21.09	46.23	51.15	6.51	16.47	22.79	25.94	31.61	9.13	29.65	56.50
Hand weeding twice at 30 and 45 DAS	18.55	43.44	47.81	5.52	13.95	20.49	24.40	29.38	7.67	26.51	53.80
LSD (p=0.05)	2.161	2.312	2.518	1.134	2.131	1.987	1.869	2.100	1.984	3.100	2.541

Table 2. Effect of crop geometry and non-chemical weed management treatments on yield and yield contributing characters of greengram

Treatment	No. of pods/plant	No. of grains/pod	Thousand grain weight (g)	Grain yield kg/ha	Stover yield kg/ha	Harvest index
Crop geometry						
20 cm × 15 cm	12.52	9.99	35.40	824.11	1874.7	31.79
25 cm × 12 cm	13.54	11.70	35.83	836.45	1890.8	32.07
30 cm × 10 cm	16.60	13.58	36.41	865.44	1924.7	33.32
LSD (p=0.05)	2.171	1.211	0.451	10.51	21.34	1.011
Non-chemical weed management treatment						
Weedy check	11.74	9.32	34.39	801.32	1864.1	31.61
Hand weeding once at 20 days after seeding + Mulching	14.83	12.59	36.88	897.67	1937.1	32.67
Hand weeding twice at 30 and 45 DAS	12.10	10.35	35.36	828.33	1903.1	32.11
LSD (p=0.05)	1.637	1.371	1.192	12.36	20.98	0.511

greengram to thrive well with maximum crop height, no. of pods/plant, grains/pod, thousand grain weight, grain yield (kg/ha) and stover yield (kg/ha) at the spacing of 30 cm × 10 cm as compared to 20 cm × 15 cm and 25 cm × 12 cm. The above finding is in complete agreement with Mansoor *et al*. (2010); Yadav (2004) and Rasul (2012) Foysalkabir *et al*. (2016).

Various weed control strategies significantly impacted every growth and yield-related parameter of the greengram. With hand weeding once at 25 DAS + mulching, the maximum crop height; number of branches; number of nodules; and maximum dry matter were observed. In the weedy check, the lowest values of studied parameters were observed due to intense competition by the uncontrolled weeds, which inhibited growth and development. Chaudhari (2016) and Chhodavadia (2014) also reported similar results.

Different weed control treatments had a substantial impact on grain and stover yield and harvest index. Hand weeding once at 20 DAS + mulching recorded the highest grain yield (905.9 kg/ ha), stover yields (1907 kg/ha), and harvest index (32.4). The decrease in weed competitiveness with the crop during the critical crop-weed competition phase that aided in improved growth and development resulting in appreciable yield (Meena et al., 2009; (Chhodavadia *et al*. 2014). In contrast, the weedy check recorded significantly lower values of growth, yield attributes, and yield of greengram. The combined effect of spacing and weed control methods on grain yield of the greengram was also significant (**Table 3**).

Table 3. Interaction effect of crop geometry and non-chemical weed management treatments on grain yield of greengram

Treatment	Weedy check	Hand weeding once at 20 days after seeding (DAS) + Mulching	Hand weeding twice at 30 and 45 DAS
20 cm × 15 cm	795.0	864.3	813.0
25 cm × 12 cm	815.0	892.3	802.0
30 cm × 10 cm	790.0	936.3	870.0
LSD (p=0.05)		18.21	

Effect on weeds

The highest total weed density and biomass was observed in weedy check, at all the dates of observation (**Table 4**). At 25 DAS, 40 DAS and at harvest stage, hand weeding once at 20 DAS + mulching had significantly lesser weeds density and biomass than the other weed control treatments. The results are in line with the findings of Kundra *et al*. (1989) and Nayak *et al*. (2000). However significantly higher weed density and biomass were recorded with the plant geometry of 30 cm × 10 cm as compared to other spacing showed. Significantly higher weed control efficiency was observed with 20 × 15 cm followed by 30 × 10 cm & 25 × 12 cm. Wider plant spacing often leads to higher weed infestation. This is because wider spacing provides more space for weeds to germinate, grow, and compete with the crop for resources like nutrients and sunlight as observed by Mengistu and Mekonnen (2020). While hand weeding once at 20 DAS + mulching has recorded significantly higher WCE due to lesser weed density and biomass, compared to other treatments. Nayak *et al*. (2000) also reported similar results.

Table 4. Effect of crop geometry and non-chemical weed management treatments on weed density and biomass in greengram

Treatment	Total weed density (no./m^2)			Total weed biomass (g/m^2)			Weed control efficiency (%)
	25 DAS	40 DAS	At harvest	25 DAS	40 DAS	At harvest	
Crop geometry							
20 cm × 15 cm	24.1	17.0	9.3	3.65	1.43	0.51	85.8
25 cm × 12 cm	26.3	20.1	11.1	3.76	2.10	0.94	81.2
30 cm × 10 cm	32.0	24.2	14.0	4.11	2.78	1.09	78.3
LSD (p=0.05)	3.24	2.19	2.94	0.61	0.50	0.12	2.36
Non-chemical weed management treatment							
Weedy check	52.0	48.2	32.2	6.67	5.10	4.18	46.2
Hand weeding once at 20 days after seeding (DAS) + mulching	14.1	9.4	7.4	2.14	1.04	0.85	89.5
Hand weeding twice at 30 and 45 DAS	21.5	19.3	13.1	4.08	3.11	0.50	85.7
LSD (p=0.05)	2.31	4.57	4.01	0.53	0.41	0.11	3.01

It may be concluded that hand weeding once at 20 DAS + mulching with greengram sown at the spacing of 30 cm × 10 cm results in significantly higher greengram productivity due to effective weed management in greengram grown in Uttarakhand Doon Valley areas.

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