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Influence of Different Weed Management Practices on Weed Dynamics, Growth and Yield of Green Gram (*Vigna radiata* L.)

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Abstract

A field experiment was conducted during kharif 2025–2026 at Agronomy Farm, College of Agriculture, Nagpur, to study the effect of pre and post-emergence herbicides on yield attributes and yield of green gram (*Vigna radiata* L.). The experiment was laid out in Randomized Block Design with three replications. Among the different treatments, weed-free treatment (T_8) recorded the highest number of pods plant⁻¹ (30.07), seeds pod⁻¹ (9.63), grain weight plant⁻¹ (7.06 g), grain yield (9.15 q ha⁻¹) and straw yield (12.66 q ha⁻¹). Among herbicidal treatments, Fomesafen 16.8% + Propaquizafop 5.2% ME @ 275 g ha⁻¹ applied at 15–20 DAS (T_4) recorded superior yield performance with 28.00 pods plant⁻¹, 9.23 seeds pod⁻¹, 6.67 g grain weight plant⁻¹, 8.44 q ha⁻¹ grain yield and 11.92 q ha⁻¹ straw yield. Treatment T_4 also recorded the highest gross monetary returns (₹76,981 ha⁻¹), net monetary returns (₹50,543 ha⁻¹) and benefit:cost ratio (2.91) among the herbicidal treatments. Thus, Fomesafen 16.8% + Propaquizafop 5.2% ME @ 275 g ha⁻¹ proved effective for improving yield performance and profitability of green gram under the experimental conditions.

Keywords: Green gram, herbicides, pre-emergence, post-emergence, yield attributes, grain yield

Introduction

Green gram (*Vigna radiata* L.) is one of the important short-duration pulse crops belonging to the family Leguminosae and is widely cultivated in tropical and subtropical regions. It is an important source of dietary protein and is valued for its good digestibility and nutritional quality. The grains contain approximately 25–28 per cent protein, 3.5–4.5 per cent fibre, 4.5–5.5 per cent ash and 60–65 per cent carbohydrates on dry weight basis. Green gram also contributes to soil fertility through biological nitrogen fixation and can add about 30–40 kg N ha⁻¹ to the soil during a single season. In India, green gram is an important pulse crop cultivated during kharif and summer seasons because of its short duration, adaptability and increasing demand. During 2024–25, green gram occupied about 32.34 lakh ha⁻¹ with an estimated production of 3.81 million tonnes and productivity of approximately 1146 kg ha⁻¹. In Maharashtra, green gram is an important kharif pulse crop; however, its productivity remains below the potential level owing to several biotic and abiotic constraints. Weed infestation is one of the major constraints affecting green gram productivity under field conditions. Weeds are considered one of the major factors responsible for reduced growth and yield of green gram. Being a short-duration and relatively short-statured crop, green gram is highly sensitive to weed competition during the early stages of crop growth. Grasses, sedges and broad-leaved weeds compete with the crop for moisture, nutrients, light and space, thereby adversely affecting crop growth and yield attributes. Uncontrolled weed infestation may cause substantial yield losses depending upon weed density, species composition, environmental conditions and duration of competition. Studies have reported yield reductions of up to 50–90 per cent under severe weed infestation in green gram. Manual weeding and intercultural operations are effective methods of weed management, but they are labour-intensive, time-consuming and often difficult to perform at the appropriate stage because of labour scarcity and unfavourable weather conditions. Herbicides provide an effective and timely alternative for managing weeds during critical stages of crop growth. Pre-emergence herbicides suppress early emerging weeds,

whereas post-emergence herbicides provide effective control of emerged weed flora. Proper selection and application of herbicides can reduce crop–weed competition and improve crop growth, yield attributes and final grain yield. Uncontrolled weed infestation may cause substantial yield losses depending upon weed density, species composition, environmental conditions and duration of competition (Singh *et al.*, 2022)^[11]. Several herbicidal molecules such as Pendimethalin, Imazethapyr, Quizalofop-ethyl, Propaquizafop, Fomesafen and Acifluorfen sodium have been reported to provide effective weed control in green gram. Their appropriate use can reduce weed density and dry matter, improve nutrient availability to the crop and consequently enhance yield attributes and productivity. Integrated and sequential approaches involving pre- and post-emergence herbicides may provide better control of diverse weed flora and improve the economic returns from green gram cultivation. Proper selection and application of herbicides can reduce crop–weed competition and improve crop growth, yield attributes and final grain yield (Poornima *et al.*, 2017)^[9]. Therefore, evaluation of suitable pre- and post-emergence herbicides is essential for effective weed management and improvement of yield performance of green gram. Hence, the present investigation was undertaken to study the effect of pre and post-emergence herbicides on yield attributes and yield of green gram (*Vigna radiata* L.) under the agro-climatic conditions of Nagpur. Different herbicide combinations have also shown promise in achieving broader-spectrum weed control and improving crop performance (Kumar *et al.*, 2019; Javaid *et al.*, 2024)^[3, 7].

Material and Methods

The present experiment was conducted during the kharif season of 2025-26 at the Agronomy Farm, College of Agriculture, and Nagpur. The experiment was laid out in Randomized Block Design (RBD) consisting of nine treatments viz., (T₁)

Pendimethalin 38.7% CS @ 678 g ha⁻¹ as pre-emergence, (T₂) Pendimethalin 30% + Imazethapyr 2% EC (ready mix) @ 800 g ha⁻¹ as pre-emergence, (T₃) Imazethapyr 10% SL @ 75 g ha⁻¹ at 7–14 DAS, (T₄) Fomesafen 16.8% + Propaquizafop 5.2% ME @ 275 g ha⁻¹ at 15–20 DAS, (T₅) Sodium acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 245 g ha⁻¹ at 15–20 DAS, (T₆) Propaquizafop 2.5% + Imazethapyr 3.75% ME (ready mix) @ 125 g ha⁻¹ at 15–20 DAS, (T₇) Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (ready mix) @ 98.435 g ha⁻¹ at 15–20 DAS, (T₈) weed free and (T₉) Weedy check. The treatments were replicated three times. The PKV Green Gold variety of green gram was used for the experiment. The crop was sown by line sowing at 30 cm × 10 cm spacing with a seed rate of 12 kg ha⁻¹. The gross plot size was 3.0 m × 4.0 m and the net plot size was 2.4 m × 3.8 m. Sowing was carried out on 28 June 2025 under optimum soil moisture conditions. Necessary cultural practices were followed uniformly for all the treatments. Pre-emergence herbicides were applied within 24 hours after sowing, while post-emergence herbicides were applied at the 2–3 leaf stage of weeds using a knapsack sprayer fitted with a flat-fan nozzle. For assessing the effect of different weed management treatments on yield and yield attributes of green gram, observations on number of pods plant⁻¹, number of seeds pod⁻¹, grain weight plant⁻¹, test weight, grain yield, straw yield and harvest index were recorded at harvest. Grain yield from each net plot was recorded after threshing and winnowing and expressed in q ha⁻¹. Harvest index was calculated as the ratio of grain yield to biological yield and expressed as percentage. The experimental data were statistically analysed using Analysis of Variance (ANOVA) appropriate for RBD. The treatment means were compared using critical difference (CD) at 5 per cent level of significance.

Results and Discussion

Effect on weed population / count

Table 1: Effect on total weed count

Tr. no.	Treatment Details	Total weed count (m ⁻²) at				
		15 DAS	30 DAS	45 DAS	60DAS	Harvest
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	5.79 (33.00)	6.82 (46.00)	7.43 (54.66)	8.75 (76.0)	8.77 (76.33)
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	5.46 (29.33)	6.20 (38.00)	6.67 (44.00)	7.69 (58.66)	7.63 (57.66)
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	5.18 (26.33)	5.73 (32.33)	6.42 (40.66)	7.24 (51.99)	7.34 (53.33)
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	7.49 (55.66)	4.53 (20.00)	4.78 (22.33)	5.28 (27.33)	5.34 (27.99)
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	7.74 (59.34)	5.08 (25.33)	5.61 (30.99)	6.65 (43.66)	6.79 (45.66)
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	7.49 (55.66)	4.78 (22.33)	5.15 (25.99)	5.55 (30.33)	5.82 (33.33)
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	7.65 (58.00)	5.49 (29.66)	6.04 (36.00)	6.87 (46.66)	6.82 (45.99)
T ₈	Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
T ₉	Weedy Check	7.56 (56.66)	9.94 (98.33)	11.13 (123.33)	12.37 (152.5)	11.84 (139.67)
	SE(m) ±	0.4	0.37	0.4	0.46	0.46
	CD at 5%	1.21	1.1	1.21	1.37	1.4
	GM	6.11 (41.59)	5.52 (35.10)	6.00 (43.62)	6.78 (55.38)	6.92 (57.18)

The total weed population was significantly influenced by different weed management treatments at all stages of crop growth. The weedy check (T₉) recorded the highest weed population, which increased from 56.66 m⁻² at 15 DAS to 152.50 m⁻² at 60 DAS, followed by a slight reduction at harvest (139.67 m⁻²). In contrast, the weed-free treatment (T₈) recorded no weed infestation throughout the crop season. Among the herbicidal

treatments, fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) and propaquizafop 2.5% + imazethapyr 3.75% ME @ 125 g ha⁻¹ (T₆) were highly effective in reducing total weed population from 30 DAS onwards. T₆ recorded 4.78, 5.15, 5.55 and 5.82 at 30, 45, 60 DAS and harvest, respectively, while T₄ recorded 4.53, 5.28 and 5.34 at 30, 45 DAS and harvest, respectively. These treatments were followed by sodium

acifluorfen 16.5% + clodinafop-propargyl 8% EC (T₅). The lower weed population under these herbicide combinations may be attributed to their complementary activity against different groups of weeds. Similar results have been reported in greengram, where combinations involving fomesafen, propaquizafop, imazethapyr and sodium-acifluorfen effectively reduced total weed density and biomass compared with the weedy

check. Overall, weed-free treatment (T₈) was most effective, while among herbicidal treatments T₄ and T₆ were the most effective in suppressing total weed population throughout the crop season. The present results are in agreement with Chhodavadia *et al.* (2013) and Khairnar *et al.* (2014)^[2, 5], who reported significant reduction in weed density through pre- and post-emergence herbicide application in green gram.

Table 2: Effect of weed dry weight (g m⁻²)

Tr. No.	Treatment Details	Weed dry matter accumulation (g m ⁻²) at				
		15 DAS	30 DAS	45 DAS	60 DAS	harvest
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	4.08 (16.18)	4.45 (19.29)	5.04 (24.91)	5.47 (29.40)	5.88 (34.10)
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	3.90 (14.72)	4.08 (16.18)	4.48 (19.53)	4.85 (23.00)	5.24 (27.00)
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	3.52 (11.86)	3.84 (14.22)	4.11 (16.42)	4.53 (20.00)	4.98 (24.30)
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	5.40 (28.68)	3.11 (9.16)	3.52 (11.90)	3.85 (14.30)	4.30 (18.00)
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	5.45 (29.22)	3.47 (11.56)	4.04 (15.81)	4.41 (18.95)	4.90 (23.50)
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	5.28 (27.41)	3.34 (10.67)	3.73 (13.42)	4.06 (16.00)	4.47 (19.50)
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	5.39 (28.52)	3.71 (13.23)	4.19 (17.08)	4.67 (21.35)	5.00 (24.50)
T ₈	Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
T ₉	Weedy Check	5.45 (29.18)	6.66 (43.92)	7.21 (51.43)	7.78 (60.00)	8.32 (68.7)
	SE(m) ±	1.36	1.05	1.28	1.52	1.79
	CDat 5%	4.09	3.14	3.84	4.56	5.36
	GM	4.60 (20.640)	3.98 (15.36)	4.41 (18.94)	4.80 (22.55)	5.21 (26.62)

Weed dry matter generally increased with advancement of crop growth, with the maximum accumulation under weedy check (T₉), indicating unrestricted weed growth throughout the crop season. The weed-free treatment (T₈) recorded negligible weed dry matter at all stages. Among the herbicidal treatments, fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) recorded the lowest weed dry matter from 30 DAS onwards, followed by propaquizafop 2.5% + imazethapyr 3.75% ME (T₆) and sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC (T₅). At harvest, T₄ recorded only 18.00 g m⁻², compared with 34.10 g m⁻² under pendimethalin (T₁) and about 68.7 g m⁻² under

the weedy check (T₉). The lower weed dry matter under T₄, T₆ and T₅ may be attributed to effective suppression of weed emergence and growth, resulting in reduced accumulation of weed biomass. Similar findings have been reported in greengram, where fomesafen- and propaquizafop-based combinations effectively reduced weed biomass compared with the weedy check.

The present findings corroborate with the observations of Patel *et al.* (2004) and Kumar *et al.* (2019)^[7, 8], who reported reduced weed dry matter under effective herbicidal weed management practices in green gram.

Table 3: Weed control efficiency (%)

Tr. No.	Treatment Details	Weed Control Efficiency % at 30 DAS	Weed Control Efficiency % 45 DAS	Weed Control Efficiency % (At harvest)	Weed Index % (At harvest)
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	56.08	51.57	52.36	35.00
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	63.16	62.03	60.70	29.17
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	67.62	68.07	64.63	23.33
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	79.14	76.86	73.80	10.00
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	73.68	69.26	65.79	16.67
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	75.71	73.91	71.62	12.50
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	69.88	66.79	64.34	26.67
T ₈	Weed free	100.00	100.00	100.00	0.00
T ₉	Weedy Check	-	-	-	50.00

Weed control efficiency and weed index were markedly influenced by different weed management treatments. The weed control efficiency at harvest was highest with fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) (72.59%), followed by propaquizafop 2.5% + imazethapyr 3.75% ME @ 125 g ha⁻¹ (T₆) (71.62%). Sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC (T₅) recorded 65.79% WCE, while T₇ and T₃ recorded 64.92 and 64.88%, respectively. The higher weed control efficiency of these treatments may be attributed to effective suppression of both grassy and broad-leaved weeds, resulting in lower weed density and dry matter. Similar effectiveness of fomesafen-, propaquizafop- and sodium acifluorfen-based herbicide combinations in improving weed control efficiency in greengram has been reported earlier. The weed index was lowest in T₄ (10.59%), followed by T₆ (12.59%), T₅ (15.67%) and T₃

(20.28%), indicating comparatively lower yield reduction due to weed competition under these treatments. The highest weed index among the herbicidal treatments was recorded with T₁ (36.00%), followed by T₂ (28.37%). Thus, the lower weed index associated with T₄ and T₆ indicates their better performance in reducing weed competition and maintaining crop productivity. Overall, T₄ (fomesafen 16.8% + propaquizafop 5.2% ME) proved to be the most effective herbicidal treatment, recording the highest WCE and lowest weed index at harvest, followed closely by T₆. These findings are in agreement with earlier studies reporting superior weed suppression and higher WCE from fomesafen + propaquizafop and propaquizafop + imazethapyr combinations in greengram. Similar observations were also reported by Verma and Choudhary (2020).

Growth attributes

Table 4: Plant height

Tr. No.	Treatment Details	Plant height (cm) at				
		15 DAS	30 DAS	45 DAS	60 DAS	harvest
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	15.10	23.70	34.17	40.00	40.16
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	15.10	25.00	36.30	40.30	40.36
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	15.20	26.40	38.50	40.32	40.40
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	13.40	29.13	42.17	42.05	42.19
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	14.20	27.80	40.40	40.35	40.43
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	13.10	28.40	41.10	41.70	41.84
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	13.50	24.40	35.80	40.34	40.42
T ₈	Weed free	16.50	30.27	43.37	43.78	43.92
T ₉	Weedy Check	11.20	22.20	32.50	39.97	40.07
	SE(m) ±	0.28	0.41	0.54	0.56	0.56
	CDat 5%	0.84	1.23	1.62	1.68	1.68
	GM	14.15	26.37	38.32	40.98	41.09

Plant height of green gram was influenced by different weed management treatments at all growth stages. The maximum plant height was recorded under T₈ (weed free) at 15, 30, 45, 60 DAS and at harvest (16.50, 30.27, 43.37, 43.78 and 43.92 cm, respectively). Among herbicidal treatments, T₄ (Fomesafen 16.8% + Propaquizafop 5.2% ME @ 275 g ha⁻¹) recorded higher

plant height, followed by T₆ and T₅. The minimum plant height was observed under T₉ (weedy check). Effective weed control under T₈ and herbicidal treatments reduced crop-weed competition for moisture, nutrients, light and space, resulting in better plant growth. Thus, effective weed management enhanced plant height in green gram.

Table 5: Similar findings were reported by Sahoo *et al.*, (2025) ^[10]. Number of branches plant⁻¹

Tr. No.	Treatment Details	Number of branches plant ⁻¹			
		15 DAS	30 DAS	45 DAS	60 DAS
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	2.20	3.40	5.10	6.57
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	2.00	3.80	5.53	7.00
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	2.50	4.30	6.13	7.14
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	3.00	4.93	7.03	7.88
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	2.80	4.60	6.63	7.22
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	2.90	4.70	6.73	7.39
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	2.10	3.90	5.83	7.08
T ₈	Weed free	3.20	5.23	7.33	9.40
T ₉	Weedy Check	1.70	3.00	4.63	5.00
	SE(m) ±	0.07	0.10	0.14	0.18
	CDat 5%	0.21	0.30	0.42	0.54
	GM	2.60	4.21	6.10	7.66

The number of branches plant⁻¹ increased progressively with advancement of crop growth and was significantly influenced by different weed management treatments. The weed-free treatment (T₈) recorded the highest number of branches plant⁻¹ at all stages, with 3.20, 5.23, 7.33 and 9.40 branches plant⁻¹ at 15, 30, 45 and 60 DAS, respectively. Among the herbicidal treatments, fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) recorded the highest number of branches (3.00, 4.93, 7.03 and

7.88 plant⁻¹), followed by propaquizafop 2.5% + imazethapyr 3.75% ME (T₆) and sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC (T₅). The weedy check (T₉) recorded the lowest number of branches throughout the crop period, with only 1.70, 3.00, 4.63 and 5.00 branches plant⁻¹ at respective stages. The higher branching under effective weed management treatments may be attributed to reduced competition from weeds for nutrients, moisture, light and space, resulting in better

vegetative growth and development of secondary branches. Similar improvement in branches plant⁻¹ under effective weed management in greengram has been reported by earlier studies. Overall, T₈ recorded the maximum branching, while among herbicidal treatments T₄ was superior, followed by T₆ and T₅. The

lowest branching was observed under the weedy check due to severe weed competition. The present results are in agreement with the findings of Chaudhari *et al.* (2016) and Junjariya *et al.* (2024) ^[1, 4],

Table 6: Number of leaves plant⁻¹

Tr. No.	Treatment Details	Number of leaves plant ⁻¹ at				
		15 DAS	30 DAS	45 DAS	60 DAS	harvest
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	8.40	12.50	18.80	22.30	23.27
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	8.40	13.00	20.10	23.80	22.80
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	8.50	14.20	21.10	25.70	23.87
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	7.10	16.00	25.50	29.40	25.03
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	7.40	15.20	23.80	27.60	23.87
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	7.10	15.90	24.20	28.40	24.40
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	7.10	12.70	20.80	24.80	23.27
T ₈	Weed free	9.10	18.60	26.20	30.90	25.40
T ₉	Weedy Check	5.80	11.40	17.80	20.50	22.67
	SE(m) ±	0.50	0.91	1.42	1.67	1.53
	CDat 5%	1.50	2.72	4.25	5.00	NS
	GM	7.65	14.14	22.05	25.93	23.84

The number of leaves plant⁻¹ increased progressively with crop growth up to 60 DAS and was influenced by different weed management treatments. The weed-free treatment (T₈) recorded the highest number of leaves at all stages, with 9.10, 18.60, 26.20 and 30.90 leaves plant⁻¹ at 15, 30, 45 and 60 DAS, respectively. Among the herbicidal treatments, fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) recorded higher leaf production, followed by propaquizafop 2.5% + imazethapyr 3.75% ME (T₆) and sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC (T₅). At harvest, T₈ recorded the highest numerical value (26.40 leaves plant⁻¹), followed by T₄ (26.03 leaves plant⁻¹) and T₃ (26.07 leaves plant⁻¹). The weedy check (T₉) recorded the lowest number of leaves at most growth stages,

indicating the adverse effect of weed competition on crop growth. The greater leaf production under effective weed management treatments could be attributed to reduced competition for moisture, nutrients, light and space, which favoured vegetative growth and leaf development. Similar improvement in growth parameters, including number of leaves plant⁻¹, under effective weed management in green gram has been reported by earlier studies. Thus, weed-free conditions promoted maximum leaf production, while among herbicidal treatments T₄ showed better performance. The lower leaf number under the weedy check was associated with severe crop-weed competition. The present results are in agreement with the findings of Chaudhari *et al.* (2016) and Junjariya *et al.* (2024) ^[1, 4],

Table 7: Dry matter accumulation plant⁻¹ (g)

Tr. No.	Treatment Details	Dry matter accumulation (g) plant ⁻¹ at				
		15 DAS	30 DAS	45 DAS	60 DAS	harvest
T ₁	Pendimethalin 38.7 CS@ 580 g a. i. ha ⁻¹ (PE)	2.30	5.02	8.65	11.60	12.24
T ₂	Pendimethalin 30% EC + Imazethapyr 2% EC (RM) 800 g ha ⁻¹ (PE)	2.25	5.21	9.25	12.40	12.88
T ₃	Imazethapyr 10% SL 100 g ha ⁻¹ at 10 DAS	2.40	6.00	10.05	13.50	13.68
T ₄	Fomesafen 16.8% + Propaquizafop 5.2% ME 275 g ha ⁻¹ at 20DAS	1.95	6.80	11.35	15.00	14.16
T ₅	Sodium acifluorfen 16.5% + Clodinafoppropargyl 8% EC 245 g ha ⁻¹ at 20 DAS	2.10	6.55	10.65	14.30	13.80
T ₆	Propaquizafop 2.5% + Imazethapyr 3.75% ME (RM) 125 g ha ⁻¹ at 20 DAS	1.57	6.60	11.00	14.70	14.13
T ₇	Quizalofop-ethyl 7.5% + Imazethapyr 15% EC (RE) 98.435 g ha ⁻¹ at 20 DAS	1.85	5.40	9.45	12.80	13.19
T ₈	Weed free	2.55	7.10	11.80	15.60	15.17
T ₉	Weedy Check	1.55	4.72	7.95	10.80	11.03
	SE(m) ±	0.05	0.08	0.12	0.12	0.03
	CDat 5%	0.15	0.24	0.36	0.36	0.09
	GM	2.08	5.93	10.02	10.02	13.36

Dry matter accumulation in green gram increased progressively with advancement of crop growth and was significantly influenced by different weed management treatments. The weed-free treatment (T₈) recorded the highest dry matter accumulation at all stages, increasing from 2.55 g plant⁻¹ at 15 DAS to 15.17 g plant⁻¹ at harvest. Among the herbicidal treatments, fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) recorded the highest dry matter accumulation at 60 DAS (15.00 g plant⁻¹), while at harvest it recorded 14.16 g plant⁻¹, followed by propaquizafop 2.5% + imazethapyr 3.75% ME (T₆; 14.13 g plant⁻¹) and sodium acifluorfen 16.5% + clodinafop-propargyl 8% EC (T₅; 13.80 g plant⁻¹). The weedy check (T₉) recorded the

lowest dry matter accumulation at all stages, with 11.03 g plant⁻¹ at harvest. The greater dry matter accumulation under effective weed management treatments could be attributed to reduced weed competition for moisture, nutrients, light and space, which promoted better vegetative growth and photosynthetic activity. Effective suppression of weeds allows greater availability of growth resources to the crop, resulting in enhanced biomass production. Similar findings have been reported in greengram, where effective herbicidal weed management resulted in improved crop growth and total dry matter production. Thus, T₈ recorded the maximum dry matter accumulation, while among herbicidal treatments T₄ was superior, followed by T₆ and T₅. The

lowest dry matter accumulation under T₉ clearly indicated the detrimental effect of prolonged weed competition on crop growth, the results corroborate the findings of Sahoo *et al.* (2025)^[10], who attributed increased dry matter accumulation to improved crop growth conditions under reduced competition.

Yield attributes

Number of pods plant⁻¹

The number of pods plant⁻¹ was significantly influenced by different weed control treatments. The maximum number of pods plant⁻¹ was recorded under T₈ (30.07), followed by T₄ (28.50) and T₆ (27.88), while the minimum was recorded under T₉ (19.93). Better weed control reduced crop–weed competition and promoted reproductive growth, resulting in more pods plant⁻¹.

Number of seeds per pod⁻¹

The highest number of seeds pod⁻¹ was recorded in T₈ (11.64), followed by T₄ (10.89) and T₆ (10.63). The lowest number was observed in T₉ (9.55). Effective weed management provided favourable conditions for better pod development and seed formation. Similar improvement in yield attributes of green gram under effective weed management was reported by junjaria *et al.*, (2024) and chaudhari *et al.*, (2016)^[11].

Grain weight (g) plant⁻¹

Grain weight plant⁻¹ was highest in T₈ (8.26 g), followed by T₄ (7.81 g) and T₆ (7.74 g), whereas the lowest grain weight was recorded in T₉ (3.80 g). Reduced weed competition under effective weed control resulted in better grain development and higher grain weight plant⁻¹. Similar improvement in yield attributes of green gram under effective weed management was reported by junjaria *et al.*, (2024) and chaudhari *et al.*, (2016)^[11].

Test weight (g) (1000 seed weight)

The maximum test weight was recorded under T₈ (33.60 g), followed by T₆ (31.83 g) and T₄ (31.47 g). The minimum test

weight was observed under T₉ (23.31 g). Better weed suppression improved the availability of growth resources, resulting in better seed filling and higher test weight. Similar improvement in yield attributes of green gram under effective weed management was reported by junjaria *et al.*, (2024) and chaudhari *et al.*, (2016)^[11].

Grain yield (q ha⁻¹)

Grain yield was significantly influenced by different weed control treatments. The highest grain yield was recorded under T₈ (9.15 q ha⁻¹), followed by T₄ (8.54 q ha⁻¹) and T₆ (8.16 q ha⁻¹), while the lowest was recorded under T₉ (3.56 q ha⁻¹). The higher grain yield under effective weed management was mainly due to improved yield attributes and reduced crop–weed competition. Similar enhancement in grain yield of green gram through effective weed management was reported by Javaid *et al.*, (2024)^[3], Komal *et al.*, (2015) and Singh *et al.*, (2022)^[6, 11].

Straw yield (q ha⁻¹)

The maximum straw yield was recorded under T₈ (13.73 q ha⁻¹), followed by T₄ (12.81 q ha⁻¹) and T₆ (12.25 q ha⁻¹). The minimum straw yield was observed under T₉ (5.35 q ha⁻¹). Effective weed control promoted better vegetative growth, resulting in higher straw production. Similar findings were reported by udhaya *et al.*, (2023)^[12], who observed higher straw/biological yield under effective weed management practices in green gram.

Harvest index (%)

The highest harvest index was recorded under T₈ (42.74%), followed by T₄ (42.02%) and T₅ (41.49%), whereas the lowest harvest index was observed under T₉ (38.36%). Better weed management enhanced assimilate production and its efficient partitioning towards reproductive parts, resulting in higher harvest index. Similar observations were reported by Junjaria *et al.*, (2024), who reported that effective weed management improved crop productivity and influenced harvest index in green gram

Table 8: Yield parameter of Green gram as influence by different weed control treatments

Tr. No.	No. of pods plant ⁻¹	No. of seeds pod ⁻¹	Grain weight (g) plant ⁻¹	Test weight (1000) (g)	Grain yield (qha ⁻¹)	Straw yield (qha ⁻¹)	Harvest index (%)
T ₁	26.12	9.61	5.82	25.83	7.03	10.55	40.65
T ₂	25.90	9.65	6.06	26.08	7.33	11.00	39.53
T ₃	26.38	9.59	6.46	26.03	7.68	11.52	38.91
T ₄	28.50	10.89	7.81	31.47	8.54	12.81	42.02
T ₅	26.96	9.58	6.57	29.59	7.53	11.29	41.49
T ₆	27.88	10.63	7.74	31.83	8.16	12.25	41.15
T ₇	26.56	9.70	6.39	29.24	7.69	11.54	40.16
T ₈	30.07	11.64	8.26	33.60	9.15	13.73	42.74
T ₉	19.93	9.55	3.80	23.31	3.56	5.35	38.36
SE(m) ±	0.49	0.30	0.42	0.42	.18	0.27	-
CD at 5%	1.48	0.89	1.26	1.27	0.54	0.81	-
GM	26.48	10.09	6.55	28.28	7.14	11.11	-

Conclusion

The study revealed that weed management practices significantly influenced the yield attributes and yield of green gram. Farmer's practice (T₈) recorded the highest grain yield (9.15 q ha⁻¹), followed by fomesafen 16.8% + propaquizafop 5.2% ME @ 275 g ha⁻¹ (T₄) (8.44 q ha⁻¹) and propaquizafop 2.5% + imazethapyr 3.75% ME @ 125 g ha⁻¹ (T₆) (7.81 q ha⁻¹). Among herbicidal treatments, T₄ was found to be the most promising treatment, followed by T₆ and T₅. Test weight was not significantly affected by the weed control treatments.

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