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Effect of herbicidal weed control on growth and yield of Green gram (*Vigna radiata* L. Wilczek)

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Abstract

A field experiment entitled “Effect of Herbicidal Weed Control on Growth and Yield of Green gram (*Vigna radiata* L. Wilczek)” was conducted during *kharif* 2024 at the Agronomy Research Farm, Suresh Gyan Vihar University, Jaipur, Rajasthan. The experiment was laid out in a Randomized Block Design with ten treatments and three replications. The results revealed that weed management practices significantly influenced growth and yield parameters of green gram. Among all treatments, the weed-free condition recorded the highest plant height (56.22 cm), dry matter accumulation (17.02 g plant⁻¹), number of branches (6.17) at harvest and leaf area index (1.88) at 40 DAS, along with superior yield attributes and yields. Among herbicidal treatments, application of Imazethapyr + Pendimethalin @ 900 g ha⁻¹ as pre-emergence (T₄) proved most effective, recording higher plant height, dry matter accumulation, number of branches, and LAI. It also resulted in higher yield attributes, including pods per plant (40.32) and seeds per pod (8.74). In contrast, the weedy check treatment recorded the lowest values for all growth and yield parameters due to severe weed competition. The study clearly indicates that effective early weed control through suitable herbicidal application significantly enhances crop growth and productivity. Therefore, the application of Imazethapyr + Pendimethalin @ 900 g ha⁻¹ as pre-emergence can be recommended as an efficient and practical weed management strategy for green gram under *kharif* conditions.

Keywords: Green gram, herbicide, Imazethapyr, Pendimethalin, weed management, yield, growth parameters

1. Introduction

India is a leading pulse-producing country, contributing about 33% of the global area and nearly 25% of total production. Pulses serve as an important source of dietary protein, particularly for the predominantly vegetarian population, and are often referred to as the “poor man’s meat.” Among pulse crops, green gram (*Vigna radiata* L. Wilczek) is an important short- duration legume widely cultivated in India and other regions such as Southeast Asia, Africa, and Australia. India accounts for about 65% of global acreage and 54% of production of green gram (Anonymous, 2024). In India, it is cultivated over 51.13 lakh hectares with a production of 31.5 lakh tonnes and productivity of 783 kg/ha, while Rajasthan is one of the major producing states (Anonymous, 2024). Weeds compete with crops for nutrients, moisture, light, and space, causing yield losses ranging from 40 to 80% (AICRP-WC, 2023–24) ^[1]. Major weeds such as *Trianthema portulacastrum* and *Echinochloa colona* are highly competitive and can significantly reduce crop yield if not controlled timely (Balyan, 1985) ^[3]. Manual and mechanical weed control methods are often limited due to high labour cost, non-availability of labour, and unfavorable climatic conditions during the rainy season. Chemical weed management offers an effective and economical alternative for controlling weeds in green gram. Herbicides such as pendimethalin, trifluralin, and imazethapyr have shown promising results in managing both grassy and broad-leaved weeds (Malik *et al.*, 2000) ^[4]. However, their efficiency varies with soil type, organic matter content, and climatic conditions. Blanket herbicide recommendations may result in sub-lethal doses or crop toxicity due to variations in soil properties, leading to herbicide resistance or environmental concerns (Hance, 2015) ^[5]. Therefore, there is a need to evaluate newer herbicide molecules and optimize their application

for effective weed control, higher productivity, and environmental safety (Buttar *et al.*, 2008) [6]. Keeping these aspects in view, the present investigation was undertaken to study the “Herbicide efficacy for managing weeds in green gram (*Vigna radiata* L. Wilczek).”

2. Materials and Methods

A field experiment entitled “Effect of Herbicidal Weed Control on Growth and Yield of Green gram (*Vigna radiata* L. Wilczek)” was carried out during the *kharif* season of 2024 at the Agronomy Research Farm, School of Agriculture, Suresh GyanVihar University, Jaipur, Rajasthan. The experiment was laid out in a Randomized Block Design with 10 treatments and three replications to minimize experimental error (Panse and Sukhatme, 1985) [7]. The green gram variety used for the study was ‘RMG-492, sown at a spacing of 30 cm × 10 cm using a seed rate of 20 kg ha⁻¹. Biometric observations were recorded from five randomly selected and permanently tagged plants in each plot. Growth parameters such as plant population per metre row length at 20 DAS and at harvest was assessed. Plant height (cm) and dry matter accumulation (g plant⁻¹) were recorded at 25 DAS, 50 DAS and harvest. Total number of branches per plant at harvest and Leaf area index were recorded at 40 DAS. For yield estimation, seed yield was recorded from the net plot and converted to kg ha⁻¹. Straw yield was calculated by subtracting the seed yield from the biological yield. All collected data were subjected to appropriate statistical analysis to interpret treatment effects.

3. Results and Discussion

3.1 Growth Parameters

3.1.1 Plant Height

At 25 DAS, the highest plant height was recorded under T₉ (Weed-free) (30.15 cm), which was significantly superior to all treatments. Among herbicides, T₄ (Imazethapyr + Pendimethalin @ 900 g ha⁻¹ PE) (29.74 cm) and T₃ (800 g ha⁻¹ PE) (29.44 cm) performed best, followed by T₈ (Imazethapyr + Imazamox @ 80 g ha⁻¹) (29.00 cm). The lowest height was observed in T₁₀ (Weedy check) (25.12 cm). At 50 DAS, a similar trend was observed with maximum height in T₉ (55.48 cm), followed by T₄ (54.72 cm), T₃ (54.17 cm), T₈ (53.36 cm), and T₇ (52.90 cm), while T₁₀ recorded the minimum (46.22 cm). At harvest, T₉ again showed the highest plant height (56.22 cm). Among herbicidal treatments, T₄ (55.46 cm) and T₃ (55.58 cm) remained superior, followed by T₈ (54.10 cm) and T₇ (53.64 cm). The lowest plant height was consistently recorded in T₁₀ (46.29 cm), indicating the adverse effect of weed competition on crop growth.

3.1.2 Dry Matter Accumulation

At 25 days after sowing, the maximum dry matter accumulation was recorded in T₉ Weed-free (1.35 g/plant), which was significantly superior to all other treatments (Table 4.7). Among herbicidal treatments, T₄ Imazethapyr + Pendimethalin (900 g ha⁻¹) PE (1.25 g plant⁻¹) registered the highest dry matter accumulation, followed by T₃ Imazethapyr + Pendimethalin (800 g ha⁻¹) PE (1.18 g plant⁻¹) and T₈ Imazethapyr + Imazamox (80 g ha⁻¹) at 3–4 leaf stage (1.12 g plant⁻¹). While, the lowest dry matter accumulation at this stage was recorded in T₁₀ Weedy check (0.75 g plant⁻¹). At 50 DAS, T₉ Weed-free maintained its superiority with the maximum dry matter accumulation (11.99 g plant⁻¹). Among the herbicidal treatments, T₄ (11.10 g plant⁻¹) recorded higher dry matter accumulation, followed by T₃ (10.48 g plant⁻¹), T₈ (9.95 g plant⁻¹) and T₇ (9.32 g plant⁻¹). While, the minimum dry matter (6.66 g plant⁻¹) was recorded in T₁₀ Weedy

check. A similar trend was observed at harvest, where the highest dry matter accumulation was recorded under T₉ Weed-free (17.02 g plant⁻¹). Among the herbicidal treatments, T₄ (15.76 g plant⁻¹) continued to outperform other treatments, followed by T₃ (14.88 g/plant), T₈ (14.12 g plant⁻¹) and T₇ (13.24 g plant⁻¹). While, the lowest dry matter accumulation (9.46 g plant⁻¹) was noted in T₁₀ Weedy check during the experimentation.

3.1.3 Number of Branches per Plant

Among all treatments, the highest number of branches per plant was recorded in T₉ Weed-free (6.17), which was statistically superior to the remaining treatments. This was closely followed by T₄ Imazethapyr + Pendimethalin (900 g ha⁻¹) PE (5.96) and T₃ Imazethapyr + Pendimethalin (800 g ha⁻¹) PE (5.71). While, the lowest number of branches per plant was observed in T₁₀ Weedy check (3.40), attributed to intense weed competition.

3.1.4 Leaf area index (LAI)

The data revealed that herbicidal weed control exerted a significant positive effect on LAI of mung bean (Table 1). The maximum LAI was recorded under T₉ Weed-free (1.88), followed closely by T₄ Imazethapyr + Pendimethalin (900 g ha⁻¹) PE (1.84) and T₃ Imazethapyr + Pendimethalin (800 g ha⁻¹) PE (1.82). While, the lowest LAI was observed in T₁₀ Weedy check (1.50), reflecting severe weed competition for nutrients, moisture and light.

The present findings align with earlier research on green gram and other pulse crops. the effectiveness of pendimethalin followed by imazethapyr has been documented by Yadav *et al.* (2015) [11], Punia *et al.* (2017) [10] and Kumar *et al.* (2018) [12], who found that sequential herbicide application provides broad-spectrum and sustained weed control, resulting in improved crop growth and biomass production. This result is in close conformity with the findings of Veeraputhiran and Chinnusamy (2023) [8], Mirjha *et al.* (2020) [9] and Punia *et al.* (2017) [10] in legume crops.

3.2 Yield attributes and Yield

3.2.1 Number of pods per plant

The maximum number of pods per plant was recorded under T₉ Weed-free (41.25), which was closely followed by T₄ Imazethapyr + Pendimethalin (900 g ha⁻¹) PE (40.32) and T₃ Imazethapyr + Pendimethalin (800 g ha⁻¹) PE (39.35) (Table 4.9). While, the lowest number of pods per plant was observed in T₁₀ Weedy check (25.25), which suffered severe weed competition.

3.2.2 Number of seeds per pod

The highest number of seeds per pod was recorded in T₉ Weed-free (8.85), followed by T₄ (8.74) and T₃ (8.50). Whereas, the minimum seeds per pod were observed in T₁₀ Weedy check (7.32), reflecting the suppressive effect of weed competition on seed development.

3.2.3 Test weight (g)

The data related to test weight (100-seed weight) of mung bean as influenced by different herbicidal treatments are presented in Table 2. Although statistically at par, the highest test weight was observed in T₉ Weed-free (38.52 g) followed by T₄ (38.15 g) and T₃ (38.00 g).

Slightly lower test weights were recorded in treatments such as T₁ (37.00 g) and T₁₀ Weedy check (36.74 g).

The results of the present study are supported by earlier findings

in legumes and other kharif crops. Mohankumar *et al.* (2018)^[13], Singh *et al.*, (2015)^[15] and Tiwari *et al.* (2007)^[14] reported

that weed management leads to higher seed and straw yields due to favorable climatic conditions and extended growth duration.

Table 1: Effect of herbicidal weed control on growth attributes of green gram

Treatments	Plant height (cm)			Dry matter accumulation (g/plant)			Number of branches per plant	Leaf area index
	At 25 DAS	At 50 DAS	At harvest	At 25 DAS	At 50 DAS	At harvest	At harvest	At 40 DAS
T ₁ -Imazethapyr (70 g ha ⁻¹) 3 – 4 leaf stage	26.45	49.34	49.41	0.85	7.55	10.72	3.96	1.55
T ₂ -Imazethapyr (80 g ha ⁻¹) 3 – 4 leaf stage	27.00	49.68	50.42	0.92	8.17	11.60	4.21	1.60
T ₃ -Imazethapyr + Pendimethalin (800 g ha ⁻¹) PE	29.44	54.17	55.58	1.18	10.48	14.88	5.71	1.82
T ₄ -Imazethapyr + Pendimethalin (900 g ha ⁻¹) PE	29.74	54.72	55.46	1.25	11.10	15.76	5.96	1.84
T ₅ -Imazethapyr + Imazamox (70 g ha ⁻¹) PE	28.00	51.52	52.26	0.95	8.44	11.98	4.46	1.65
T ₆ -Imazethapyr + Imazamox (80 g ha ⁻¹) PE	28.32	52.11	52.85	1.00	8.88	12.61	4.70	1.70
T ₇ -Imazethapyr + Imazamox (70 g ha ⁻¹) 3-4 leaf stage	28.75	52.90	53.64	1.05	9.32	13.24	4.96	1.75
T ₈ -Imazethapyr + Imazamox (80 g ha ⁻¹) 3-4 leaf stage	29.00	53.36	54.10	1.12	9.95	14.12	5.28	1.80
T ₉ -Weed free	30.15	55.48	56.22	1.35	11.99	17.02	6.17	1.88
T ₁₀ -Weedy check	25.12	46.22	46.29	0.75	6.66	9.46	3.40	1.50
S. Em. ±	1.00	1.79	1.99	0.05	0.45	0.61	0.21	0.08
CD (P = 0.05%)	2.98	5.32	5.91	0.14	1.34	1.81	0.62	0.23
CV%	6.17	7.94	7.30	7.58	7.48	8.02	7.37	7.90

Table 2: Effect of herbicidal weed control on yield attributes of green gram

Treatments	Number of pods per plant	Number of seed per pod	Test weight (g)
T ₁ -Imazethapyr (70 g ha ⁻¹) 3 – 4 leaf stage	32.85	7.52	37.00
T ₂ -Imazethapyr (80 g ha ⁻¹) 3 – 4 leaf stage	33.12	7.74	37.12
T ₃ -Imazethapyr + Pendimethalin (800 g ha ⁻¹) PE	39.35	8.50	38.00
T ₄ -Imazethapyr + Pendimethalin (900 g ha ⁻¹) PE	40.32	8.74	38.15
T ₅ -Imazethapyr + Imazamox (70 g ha ⁻¹) PE	34.62	7.95	37.52
T ₆ -Imazethapyr + Imazamox (80 g ha ⁻¹) PE	36.25	8.05	37.65
T ₇ -Imazethapyr + Imazamox (70 g ha ⁻¹) 3-4 leaf stage	37.55	8.22	37.72
T ₈ -Imazethapyr + Imazamox (80 g ha ⁻¹) 3-4 leaf stage	38.42	8.42	37.85
T ₉ -Weed free	41.25	8.85	38.52
T ₁₀ -Weedy check	25.25	7.32	36.74
S.Em. ±	1.75	0.29	1.61
CD (P = 0.05%)	5.19	0.87	NS
CV%	8.43	7.24	7.43

4. Conclusion

The present investigation conclusively indicate that among the herbicidal treatments, Imazethapyr + Pendimethalin (900 g ha⁻¹) as PE (T₄) proved to be the best, consistently resulting in superior plant height, dry matter accumulation, number of branches, leaf area index, and yield attributes such as pods per plant and seeds per pod. This indicates that efficient early weed control through the combined application of pre-emergence herbicides ensures better crop growth and resource utilization.

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