Effects of Vermiwash on the Growth and Yield of Green Gram (*Vigna radiata*) MI6

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ABSTRACT

Green gram (*Vigna radiata*) cultivation in Sri Lanka heavily relies on inorganic fertilizers, leading to environmental and health issues. Thus, alternatives are necessary. A field experiment was conducted at the Adaptive Research Centre in Vavuniya, Sri Lanka, to evaluate the effects of vermiwash on the growth and yield of the green gram variety MI6. Vermiwash was prepared using cow dung, banana fruit waste, mold leaves, and red worms (*Eisenia fetida*). Six treatments were established in a Randomized Complete Block Design (RCBD), including controls such as no fertilizer (T1) and 100% recommended inorganic fertilizer (T2). The remaining treatments combined half-doses of inorganic fertilizer with varying concentrations of vermiwash as a foliar spray: 25% (T3), 50% (T4), 75% (T5), and 100% (T6). The prepared vermiwash had a pH of 7.63 and contained total available nitrogen, phosphorus, and potassium at 0.014%, 0.355%, and 1.500%, respectively. The highest plant height, leaf area index, and number of branches were recorded in T5 (42.13±0.21 cm, 10.48±0.28, and 3.67±0.31, respectively), showing no significant difference ($P>0.05$) from T2. The lowest days for 50% of flowering were observed in T5 (42±0). The highest number of pods per plant, pod length, pod girth, seeds per pod, 100 seeds weight, and total yield (27.17±0.78, 11.27±0.17, 2.29±0.02, 12±0.22, 7.18±0.10 g, and 212±1.49 g) were observed in T5, significantly different ($P<0.05$) from T2. This study suggests reducing inorganic fertilizer by half and combining it with 75% vermiwash (T5) for optimal growth and yield.

Keywords: Green gram, Growth, Inorganic fertilizer, Vermiwash, Yield

1. INTRODUCTION

The green gram (*Vigna radiata*) is a crucial pulse crop in Sri Lanka, providing essential protein for its vegetarian population [1]. It contains antioxidants that may lower the risk of chronic diseases, such as diabetes and heart disease [2]. In 2016, 2017, and 2018, Sri Lanka produced 14,546, 9,392, and 9,856 metric tons of green gram, respectively [3]. The Department of Agriculture (DoA) recommends the MI6 variety for cultivation in dry and intermediate zones (Department of Agriculture Sri Lanka, 2023).

However, excessive use of inorganic fertilizers threatens the sustainability of agroecosystems [4]. For the MI6 variety, the DoA advises applying, per hectare: 35 kg of urea (46% N), 100 kg of triple super phosphate (TSP) (46% P_2O_5), and 75 kg of muriate of potash (MOP) (60% K_2O) (Department of Agriculture Sri Lanka, 2023). Solutions are needed to mitigate the environmental harm caused by inorganic fertilizers, which can degrade soil structure and lead to nutrient loss through leaching and gas emissions [5]. Overusing these fertilizers can harm soil organisms, disrupt ecosystems, and hinder mycorrhizal colonization [6]. Additionally, salt buildup from chemical fertilizers can impair water absorption, resulting in stunted plant growth [7]. Excessive fertilizer use may cause nutrient imbalances, low yields, and increased soil acidity [7]. Increased nitrogen levels can cause crop browning, yellowing leaves, and lodging, while root burn may occur due to salt accumulation. Furthermore, biodiversity declines due to ammonia buildup from over-fertilization [5]. Thus, effective, eco-friendly alternatives are essential.

Alternatives to chemical fertilizers include organic, slow-release, and bio-fertilizers [8]. Vermiwash, an organic liquid fertilizer produced with earthworms, contains growth-promoting hormones and nutrients [9]. Foliar application of vermiwash is preferred for achieving sustainable yields [10]. Studies show that a 75% concentration of vermiwash increases leaf count in cowpeas, and boosts yieldin okraand black gram[11, 12, 13].While vermiwash is widely used in developed countries, it should also be accessible to developing nations [10].

This study aimed to assess the effects of various vermiwash application rates on the growth and yield of the green gram MI6. The research involved analyzing the composition of produced vermiwash and investigating its combined effects with half the recommended inorganic fertilizer on MI6 growth. The experiment was conducted as a field study, identifying the best combined treatment based on growth and yield outcomes.

2. MATERIAL AND METHODS

2.1Study location

The study was conducted at the Adaptive Research Centre in Vavuniya, Northern Province, Sri Lanka, during the 2022 Maha season. This dry zone district (rainfall < 1750 mm) has a tropical climate with an average temperature of 28 °C [14].

2.2 Production of vermiwash

A vermiwash production unit was created using a barrel with one open side and a tap at the bottom. A 25 cm layer of broken bricks was placed at the bottom, with the tap open. This was followed by 25 cm of coarse sand and another layer of bricks. Afterward, a 30 cm layer of loam soil was added and moistened. Finally, Red earthworms (*Eisenia fetida*) were introduced, and organic materials like cow dung, leaf litter, and rotten banana waste were added, keeping the contents moist daily. The tap was open for the first week to allow vermiwash to flow out. On the 8th day, the tap was closed, and the collected vermiwash was poured back in. This process continued for two weeks, with the tap opened on alternate days to collect vermiwash. After two weeks, the mature vermiwash was collected through the tap [10].

2.3 Analysis of the chemical composition of vermiwash

Composition analysis was conducted on 100% raw vermiwash samples. Electrical conductivity (EC) and pH were measured using conductivity and pH meters (Model:S-610L). Total nitrogen (N) was estimated using the Kjeldahl method [15]. Total phosphorus (P) was determined using the colorimetric method of Olsen et al. (1954) [40]. Total potassium (K) was measured with a flame photometer. Total organic carbon was assessed using the Walkley-Black method described in Sri Lanka Standard 1702:2021.

2.4 Research design and layout

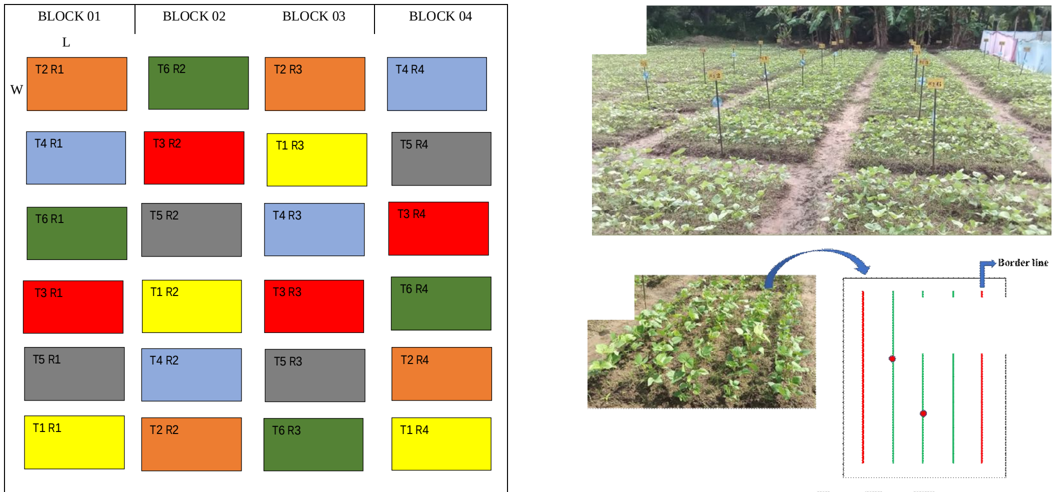

Fig. 1. Field layout of six treatments and replicates in RCBD. A: Experimental field; B, Single plot.

The experiment was carried out under RCBD design with four replicated plots in four blocks (Fig 1; Table 1). The Length (L) and the width (W) of each plot were 2 m and 1.5 m respectively. The total area was 208 m², with 1 m between blocks and treatments. Field preparation, planting, and watering followed DoA (Department of Agriculture Sri Lanka, 2023) recommendations.

2.5 Field preparation and planting

The experimental site was plowed and harrowed, and flatbeds were made manually based on the water supply. Two seeds per hill were planted 2 cm deep, and weaker plants were thinned after 10-12 days. Planting space was 30 cm × 10 cm (Department of Agriculture Sri Lanka, 2023).

2.6 Implementation of treatments

Table 1. Different combinations of inorganic fertilizer and vermiwashwere used in the study.

Treatments	Basal dressing	Top dressing (after 30	Top dressing

				days)	
	Inorganic fertilizer (kg/ha)			Inorganic fertilizer (kg/ha)	Vermiwash concentration (%)
	Urea	TSP	MOP		
T1	No	No	No	No	No
T2	35	100	75	30	No
T3	17.5	50	37.5	15	25%
T4	17.5	50	37.5	15	50%
T5	17.5	50	37.5	15	75%
T6	17.5	50	37.5	15	100%

T-Treatment; TSP -Triple Super Phosphate; MOP-Muriate of Potash

Basal dressings included inorganic fertilizers like urea, TSP, and MOP applied before sowing, with urea top dressing 4 weeks after planting. Vermiwash concentrations (25%, 50%, 75%, 100%) indicated dilution rates. The experiment featured six treatments with four combinations of inorganic fertilizers and vermiwash (Table 1). Controls included no fertilizer (T1) and 100% inorganic application (T2). Vermiwash was applied as a foliar spray at the 1st, 3rd, 5th, and 7th weeks after planting (WAP), Vermiwash solution sprayed per plant in each treatment at each application was 10 ml.

Harvesting occurred 60 days after planting when pods turned brown [1]. Three randomly chosen plants from the middle lines in a plot (one from each line) were used to measure plant height, Leaf Area Index (LAI), and number of branches per plant. LAI was calculated using the following formula.

$$\text{LAI} = \frac{\text{L x [illegible]aves x N of leaves on the plant}}{\text{Area covered (m}^2\text{)}}$$

Where; L = Length (m), W = Width of leaves (m), N = Number of leaves

[39]

Five plants were randomly uprooted from each plot at flowering, and the average tap root length was measured. The days to 50% flowering were counted by noting flowered plants. Yield parameters included number of pods per plant, pod length, pod girth, seeds per pod, 100 seeds weight, and total yield.

2.7 Data analysis

The data were analyzed using a SAS 9.4 version. One-way ANOVA was used to find out the significant differences among the treatments for each parameter.

3. RESULTS AND DISCUSSION

3.1 VermiwashComposition Analysis

The vermiwash used in the experiment had the following composition: pH 7.63, EC 9.66 mS/cm, total organic carbon 0.239%, nitrogen 0.014%, phosphorus 0.355%, and potassium

1.5%.Macronutrients are essential for plant growth. Nitrogen aids leaf and stem development. Phosphorus promotes growth, flower formation, and maturity. Potassium enhances vigor, disease resistance, and water efficiency [16].

3.2The effects of vermiwash and recommended inorganic fertilizer on the growth of Green Gram MI6.

3.2.1Plant height

The study evaluated the effects of varying rates of vermiwash with 50% of the recommended inorganic fertilizer by DoA (Table 1). T2 was maintained as the full dose of inorganic fertilizer recommendation and T1 without any sort of fertilizer application. At the 2nd and 3rd WAP, there was no significant difference in average plant height among all treatments ($p>0.05$) (Table 2). From the fourth week onwards T1 started giving significantly the lowest plant height of all the other treatments. However, a significant difference in plant height was not observed among T2 or other treatments. From the 5th WAP to the 8th WAP, the T2 and T5 had the maximum plant heights in the range of 31.38±0.70 cm and 56.08±0.72 cm. At the 7th and 8th WAP, T5 had the significantly highest plant height even compared to T2, the full dose of inorganic fertilizer recommendation (Table 2). T5 included 75% vermiwash and 50% inorganic fertilizer. Similar results were reported in tomato studies [17]. Undiluted vermiwash can significantly reduce plant height, causing phytotoxicity to *Vigna radiata* [18]. In this study, T6 was treated with undiluted vermiwash every two weeks, possibly explaining the reduced height in T6. According to these findings, reducing inorganic fertilizer by 50% and substituting by 75% vermiwash increased the height of green gram plants.

Table 2. Average plant heights (cm) of green gram MI6

	Average Plant Height (cm)						
Treatments	**At 2nd WAP**	**At 3rd WAP**	**At 4th WAP**	**At 5th WAP**	**At 6th WAP**	**At 7th WAP**	**At 8th WAP**
T_1	12.76±0.28^{a*}	17.13±0.80^{a}	21.46±0.81^{b}	27.14±0.48^{c}	36.79±0.29^{c}	44.77±0.51^{c}	46.48±0.44^{d}
T_2	14.58±0.16^{a}	19.42±0.56^{a}	26.33±0.30^{a}	31.38±0.70^{a}	41.92±0.63^{a}	49.75±1.17^{b}	50.58±0.57^{bc}
T_3	12.92±0.76^{a}	17.46±0.80^{a}	23.21±0.92^{ab}	29.13±0.53^{ab}	37.79±0.36^{bc}	46.36±0.55^{c}	49.47±0.61^{bcd}
T_4	13.21±0.95^{a}	17.67±1.03^{a}	23.50±1.00^{ab}	30.21±0.97^{ab}	38.54±0.21^{b}	47.13±0.35^{bc}	52.33±0.83^{b}
T_5	13.54±0.35^{a}	18.77±0.91^{a}	25.96±0.65^{a}	32.00±1.12^{a}	42.13±0.21^{a}	54.30±0.69^{a}	56.08±0.72^{a}
T_6	13.33±1.19^{a}	17.93±1.19^{a}	23.42±0.73^{ab}	30.58±1.27^{ab}	38.54±0.26^{b}	46.15±0.81^{c}	49.08±0.93^{cd}

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments. T1 - No vermiwash or inorganic fertilizers applications, T2 - full doses of recommended inorganic fertilizer–Control, T3 - ½ doses of recommended inorganic fertilizer + 25% vermiwash, T4 - ½ doses of recommended inorganic fertilizer + 50% vermiwash, T5 - ½ doses of recommended inorganic fertilizer + 75% vermiwash, T6 - ½ doses of recommended inorganic fertilizer + 100% vermiwash.*

3.2.2 Leaf area index

The Leaf Area Index (LAI) represents the total leaf surface area per unit ground area, reflecting plant canopy structure [19]. Key material and energy exchanges in plants stem from the canopy's surface area, mainly leaves. In this study, LAI remained consistent among treatments until the 4th WAP. Green gram leaves responded better to 100% vermiwash for development, but regular use of undiluted vermiwash resulted in stunted growth of the leaves. The highest LAI values such as 5.28±0.46, 10.48±0.28, 12.94±0.43, and 13.11±0.43 were observed in T5 at the 5th, 6th, 7th, and 8th WAPs, respectively (Table 3). At 7th WAP, T2 and T5 had the highest LAI values (49.75±1.17 and 54.30±0.69), which were not significantly different (Table 3).Higher leaf area correlates with a crop's ability to accumulate dry matter [20]. Similar results showed that 75% of vermiwash increased leaf count in cowpeas [11]. Comparable findings were reported for tomato, Ber seeds, okra, and Black gram [21, 22, 23, 24]. Our results indicate that reducing inorganic fertilizer by 50% and substituting with 75% vermiwash enhanced the LAI of green gram.

Table 3. Average plant LAIs of green gram MI6

	Plant Leaf Area Index (LAI)						
Treatments	**At 2nd WAP**	**At 3rd WAP**	**At 4th WAP**	**At 5th WAP**	**At 6th WAP**	**At 7th WAP**	**At 8th WAP**
T_1	0.11±0.01[a*]	0.64±0.05[a]	1.33±0.27[a]	2.89±0.46[b]	5.49±0.77[c]	6.52±0.81[b]	6.57±0.82[b]
T_2	0.18±0.04[a]	0.91±0.10[a]	2.73±0.43[a]	4.78±0.63[ab]	8.76±1.09[ab]	9.99±1.10[ab]	10.11±1.10[ab]
T_3	0.12±0.02[a]	0.70±0.11[a]	1.78±0.45[a]	4.18±0.55[ab]	6.56±0.47[bc]	8.06±0.56[b]	8.14±0.55[b]
T_4	0.14±0.01[a]	0.77±0.08[a]	2.15±0.33[a]	4.24±0.38[ab]	7.87±1.02[abc]	9.01±1.31[b]	9.00±1.22[b]
T_5	0.17±0.02[a]	0.88±0.08[a]	2.71±0.28[a]	5.28±0.46[a]	10.48±0.28[a]	12.94±0.43[a]	13.11±0.43[a]
T_6	0.14±0.02[a]	0.82±0.09[a]	2.23±0.32[a]	4.59±0.65[ab]	7.38±0.49[abc]	8.56±0.93[b]	8.66±0.92[b]

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments.T1 - No vermiwash or inorganic fertilizers applications, T2 - full doses of recommended inorganic fertilizer–Control, T3 - ½ doses of recommended inorganic fertilizer + 25% vermiwash, T4 - ½ doses of recommended inorganic fertilizer + 50% vermiwash, T5 - ½ doses of recommended inorganic fertilizer + 75% vermiwash, T6 - ½ doses of recommended inorganic fertilizer + 100% vermiwash.*

3.2.3 Number of branches

In this study, the highest number of branches was in T5 (3.67±0.31), followed by T2 (3.58±0.18), T4 (3.42±0.18), T6 (3.33±0.54), T3 (2.75±0.10), and T1 (2.67±0.27) at 6th WAP (Table 4). Ranjan and Murugesan (2012) found that 75% of vermiwash yielded the most branches in cowpea (*Vigna unguiculata*). At all-time points, T2 and T5 had significantly more branches than other treatments. There was no significant difference between T5 and T2 in the number of branches.

Table 4. Average plant number of branches of green gram MI6

	Average Number of Branches		
Treatments	**At 6th WAP**	**At 7th WAP**	**At 8th WAP**
T_1	2.67±0.27^{c*}	2.83±0.25^{c}	3.17±0.19^{d}
T_2	3.58±0.18^{a}	4.50±0.11^{a}	5.25±0.33^{ab}
T_3	2.75±0.10^{bc}	3.20±0.16^{bc}	4.17±0.11^{cd}
T_4	3.42±0.18^{bc}	3.67±0.16^{abc}	4.50±0.19^{bc}
T_5	3.67±0.31^{a}	4.58±0.29^{a}	5.75±0.18^{a}
T_6	3.33±0.54^{bc}	4.17±0.40^{ab}	5.25±0.40^{ab}

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.2.4Tap root length

Plant growth depends on root system design, facilitating nutrient and water absorption [25]. Foliar application of vermiwash increased taproot length at 50% flowering: T6 (16.06±0.11 cm), T5 (15.17±0.14 cm), T4 (14.25±0.23 cm), T3 (13.93±0.30 cm), T2 (14.04±0.27 cm), and T1 (13.78±0.21 cm) (Table 5). Applying 100% vermiwash at two-week intervals with 50% inorganic fertilizer produced the longest taproot in T6, not significantly different from T5. Ranjan and Murugesan (2012) also found the longest cowpea root with 100% vermiwash, aligning with this result. Vermiwash contains high levels of macro- and micronutrients, and plant growth regulators, enhancing crop development [26]. It was noted that vermiwash extracts can increase root tip length [27].

Table 5. Average plant tap root lengths of green gram MI6

	Average Tap Root Length (cm)
Treatments	**At 50% of flowering**
T_1	13.78±0.21^{d*}
T_2	14.06±0.27^{c}
T_3	13.93±0.30^{cd}
T_4	14.25±0.23^{bc}
T_5	15.17±0.14^{ab}
T_6	16.06±0.11^{ab}

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.3 The effects of vermiwash and 1/2 the level of recommended inorganic fertilizer on the yield of Mung bean MI6.

3.3.1 Days for 50% of flowering

Vermiwash application significantly decreased ($p<0.05$) the days to 50% flowering. T5 and T2 had the minimum days (42±0), while T1 had the maximum (48±0). Applying vermiwash at 75% concentration biweekly with half the inorganic fertilizer dose reduced the time to 50% flowering. This may be due to increased auxin and available N and P in the flowering shoots [28]. A study on the foliar application of vermiwash and KNO3 showed significant improvements in flower yield and tuberose quality, affecting floret length and diameter [29].

Table 6. Days for 50% of flowering of green gram MI6

Days for 50% of Flowering	
Treatments	**Days**
T_1	$48±0^{a*}$
T_2	$42±0^{d}$
T_3	$45±0^{b}$
T_4	$43±0^{c}$
T_5	$42±0^{d}$
T_6	$45±0^{b}$

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.3.2 Number of pods per plant

The application of vermiwash significantly increased ($p<0.05$) pods per plant. The highest number was in T5 (27.17±0.78), followed by T2 (22.5±0.25), T4 (21.42±0.29), T3 (19.50±0.25), T1 (16.17±0.60), and T6 (15.75±0.43) (Table 7). A study found that vermiwash enhanced pods and yield of *Abelmoschus esculentus* [12]. These findings suggest reducing inorganic fertilizer by 50% and replacing it with 75% vermiwash can increase green gram pod numbers.

Table 7. The average number of pods per plant of green gram MI6

Average Number of Pods per Plant	
Treatments	**Pods**
T_1	$16.17±0.6^{d*}$
T_2	$22.50±0.25^{b}$
T_3	$19.50±0.25^{c}$
T_4	$21.42±0.29^{bc}$
T_5	$27.17±0.78^{a}$
T_6	$15.75±0.43^{d}$

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.3.3 Pod length and pod girth

The use of vermiwash significantly impacted pod length and girth. The longest pods were in T5, likely due to micronutrients enhancing fruit size [30]. The minimum pod length in T6 was

9.26±0.06 cm, and the minimum girth in T1 was 2.03±0.01 cm (Tables 8 and 9). The high salt content in 100% vermiwash may inhibit growth and lead to malformed pods [31]. This aligns with the finding that 100% vermiwash reduced potato yield [32]. T5 had the highest (P<0.05) pod length and girth at 11.27±0.17 cm and 2.29±0.02 cm, respectively. Applying vermiwash as a foliar spray at 75% with ½ inorganic fertilizer increased pod girth by 1.08 times compared to control T1 (Table 9). Thus, foliar application of vermiwash at this rate biweekly is optimal for greater pod length and girth.

Table 8. Average pod lengths of green gram MI6

Average Pod Length	
Treatments	**Pod length (cm)**
T_1	9.95±0.08^{c*}
T_2	10.45±0.02^{b}
T_3	10.54±0.02^{b}
T_4	10.77±0.1^{b}
T_5	11.27±0.17^{a}
T_6	9.26±0.06^{d}

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

Table 9. Average pod girths of green gram MI6

Average Pod Girth	
Treatments	**Pod Girth (cm)**
T_1	2.03±0.01^{d*}
T_2	2.13±0.01^{c}
T_3	2.17±0.01^{c}
T_4	2.23±0.02^{b}
T_5	2.29±0.02^{a}
T_6	2.06±0.01^{d}

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.3.4 Number of seeds per pod

There was a significant increase (p<0.05) in seeds per pod. The highest was in T5 (12±0.22), with 75% vermiwash and ½ dose of inorganic fertilizer (Table 10). Jaybhaye and Bhalerao (2015) reported similar findings, noting that vermiwash increased seeds per pod in black gram. Vermiwash from 100% cow dung significantly impacted growth and yield, leading to the highest seed yield [33]. Foliar application of vermiwash at a rate of 75% with half the dose of inorganic fertilizer at two-week intervals would be the best method to obtain a higher number of seeds.

Table 10. Average number of seeds per pod of green gram MI6

Number of Seeds per Pod	
Treatments	**Number of Seeds per Pod**
T_1	$9.78±0.1^{d*}$
T_2	$10.93±0.06^{c}$
T_3	$11.05±0.06^{bc}$
T_4	$11.50±0.09^{b}$
T_5	$12.00±0.22^{a}$
T_6	$9.53±0.09^{d}$

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.3.5 Weight of 100 seeds

There was a significant increase in 100-seed weight in T5 (7.18±0.10 g), 1.2 times higher than control T2 (6.05±0.07 g), which had full inorganic fertilizer (Table 11). However, a 100% vermiwash rate reduced 100-seed weight in green gram. Thus, 75% vermiwash with 50% inorganic fertilizer is optimal. This is likely due to essential and trace nutrients and growth regulators enhancing photosynthesis and bio-physiological conditions. These findings align with Krishnaveni *et al*. (2021), Ansari *et al*. (2024), and Joshi *et al*. (2022) [34, 35, 36]. Kumar and Pandey (2020) noted that nutrition supplementation is crucial for improving pulse seed yield [37].

Table 11. 100 seeds weight of green gram MI6

100 Seeds Weight	
Treatments	**100 Seeds Weight (g)**
T_1	$5.13±0.06^{c*}$
T_2	$6.05±0.07^{b}$
T_3	$6.40±0.11^{b}$
T_4	$6.90±0.09^{a}$
T_5	$7.18±0.10^{a}$
T_6	$5.30±0.18^{c}$

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05 within the treatments*

3.3.6 Total yield

Sun-dried total seed weight of green gram significantly increased (p<0.05) with foliar vermiwash application. The highest weight was in T5 (212±1.49 g) with ½ doses of basal and top dressings plus 75% vermiwash. The lowest was in T6 (94.2±0.82 g) with ½ doses and 100% vermiwash (Table 12). Thus, 75% vermiwash at two-week intervals was the best for maximizing dry weight. This likely resulted from enhanced photo-assimilation and translocation, producing larger, higher-quality seeds [38].

Table 12. Average total yield per treatment of green gram MI6

Average Total Yield per Treatment	
Treatments	**Total Yield (g)**
T_1	99.7±0.9^{d*}
T_2	137.4±0.58^{c}
T_3	106.6±0.38^{d}
T_4	154.9±0.55^{b}
T_5	212±1.49^{a}
T_6	94.2±0.82^{d}

*Values are means ± standard deviation (n = 4). *Means with the same letters are not significantly different at P > .05within the treatments*

4. CONCLUSIONS

This study suggests that the application of 75% vermiwash in combination with a 50% dosage of the recommended inorganic fertilizer enhances both vegetative and yield parameters in the green gram variety MI6. Alternatively, 75% vermiwash as a foliar application, along with half the dosage of inorganic fertilizer, can reduce the DoA-recommended inorganic fertilizer dosage while maintaining the same growth and yield in the green gram variety MI6. Since this is a field trial, the findings can also be recommended for farmers.

6. REFERENCES

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