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Study of Different Sources of Organic Manures in Comparison with RDF on Growth and Yield of Greengram [*Vigna radiata* (L.) Wilczek]

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

The field experiment was conducted to evaluate the different sources of organic manures in comparison with recommended dose fertilizer (RDF) on greengram at South farm, Karunya Institute of Technology and Science, Coimbatore, India. The field experiment was laid out in Randomized Block Design and replicated thrice during *kharif* and *rabi* seasons of 2022. The field study comprised of nine treatments, two organic treatments with sole organic manures at 100% on N equivalent basis (vermicompost, farmyard manure) another three treatments consisted of 25%, 50% and 75% combination of each manure. These two organic manures (vermicompost, farmyard manure) were combined with 50% RDF through inorganic fertilizers (12.5:25:12.5 of N, P_2O_5 and

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K_2O kg ha^{-1}) as a combination of organic and inorganic treatments and one sole 100% inorganic treatment through inorganic fertilizer (25:50:25 of N, P_2O_5 and K_2O kg ha^{-1}). A control treatment was maintained in the layout to compare the performance of all the treatments. The results showed that among the different combinations of organic and inorganic treatments, 100% recommended dose of fertilizer through inorganic (25:50:25 of N, P_2O_5 and K_2O kg ha^{-1}) (T_7) fertilizer significantly enhanced the growth and yield of greengram which was closely followed by vermicompost 100% on N equivalent basis.

Keywords: Vermicompost; farmyard manure; greengram; Recommended Dose of Fertilizer (RDF); growth; yield.

1. INTRODUCTION

In India, Greengram (*Vigna radiata* (L.) Wilczek) is a significant pulse crop. Because of its high protein content, dietary fiber, and other vital minerals and vitamins, green gram is considered as a nutritious pulse crop. This versatile crop can be cultivated in a variety of agroclimatic conditions, from tropical to subtropical areas. It is well-known for its capacity to withstand drought conditions and it is an important crop for small-scale farmers because of its relatively short duration from sowing to harvest and an excellent option for farmers in areas with restricted water resources.

Farmers generally have the false belief that because greengram is a legume crop, it does not require fertilizer and is typically grown in marginal areas without it [1]. Pulse crop yields are low due to a lack of understanding about adopting improved technology [2]. Nutrient balancing is an essential factor in increasing crop yields. Excessive and unbalanced fertilizer usage has resulted in nutrient mining from the soil, reduced crop production and ultimately decreased soil health. Regenerating these nutrients through organic and inorganic combinations has a direct influence on soil health and crop output [3]. Hence, the objective of the study was to compare different organic manures and inorganic fertilizers effects on growth and yield of greengram. Additionally, the study aims to demonstrate the viability and sustainability of nutrient management practices for farmers in greengram cultivation.

2. MATERIALS AND METHODS

The experiment was carried out at South farm of Karunya Institute of Technology and Science, Coimbatore, India during *kharif* (July-October) and *rabi* (November-February) seasons of 2022. Greengram CO 8 variety seeds are sown with a spacing of 30 x 15 cm and irrigation was given thrice. The farm was located at the Western Agro-Climatic zone of Tamil Nadu at 10^0 56' N latitude and 76^0 44' E longitude at an elevation of 474 m above mean sea level. The experiment was laid out in Randomized Block Design, replicated thrice and the experiment consisted of nine treatments namely T_1 - Control, T_2 - Vermicompost 100% on N equivalent basis (4 t/ha), T_3 - Farmyard manure 100% on N equivalent basis (2 t/ha), T_4 - Vermicompost 50% (2 t/ha) + Farmyard manure 50% (6.25 t/ha), T_5 - Vermicompost 75% (3 t/ha) + Farmyard manure 25% (3.125 t/ha), T_6 - Vermicompost 25% (1 t/ha) + Farmyard manure 75% (9.375 t/ha), T_7- RDF 100% (inorganic) (25:50:25 of N, P_2O_5 and K_2O kg/ha), T_8 - RDF 50% (inorganic) (12.5:25:12.5 of N, P_2O_5 and K_2O kg/ha) + Vermicompost 50% (4 t/ha), T_9 - RDF 50% (inorganic) (12.5:25:12.5 of N, P_2O_5 and K_2O kg/ha) + Farmyard manure 50% (6.25 t/ha). Fertilizers and manures were applied basally. Growth attributes viz., the plant height (cm), trifoliate leaves $plant^{-1}$, root length (cm), dry matter production (kg ha^{-1}) and yield parameters viz., haulm yield (kg ha^{-1}) and grain yield (kg ha^{-1}) observations were recorded at harvest stage and statistically analyzed for Randomized Block Design [4]. The significance of the difference was tested by the "F" test at a 5 percent level.

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

3.1.1 Plant height (cm)

The greengram plant height was measured at harvest during *rabi* and *kharif* seasons of 2022 and were presented in (Table 1). The application of different combinations of organic manures and recommended RDF exerted marked influence on the plant height.

Table 1. Effect of different organic manures comparison with RDF on plant height, Root length and Dry matter production at harvest

Treatments	*Rabi* 2022			*Kharif* 2022		
	Plant height (cm)	Root length (cm)	Dry matter production (kg ha^{-1})	Plant height (cm)	Root length (cm)	Dry matter production (kg ha^{-1})
T_1 - Absolute control	45.3	17.5	2713	43.3	16.5	2672
T_2 - Vermicompost 100% on N equivalent basis	54.6	22.5	4060	53.7	22.1	4022
T_3 - Farmyard manure 100% on N equivalent basis	47.3	19.3	3350	46.1	19.1	3317
T_4 - Vermicompost 50% + Farmyard manure 50%	51.4	20.7	3914	51.3	20.4	3884
T_5 - Vermicompost 75% + Farmyard manure 25%	51.3	20.6	3877	51.2	20.2	3842
T_6 - Vermicompost 25% + Farmyard manure 75%	48.3	19.8	3802	47.1	19.5	3769
T_7 - RDF 100% inorganic	55.7	24.6	4203	55.1	23.7	4173
T_8 - RDF 50% inorganic + Vermicompost 50%	53.2	21.4	3975	52.6	21.2	3944
T_9 - RDF 50% inorganic + Farmyard manure 50%	49.5	20.2	3839	48.8	20.1	3805
SEd	0.18	0.72	6.4	0.13	0.58	5.2
CD (*p*=0.05)	0.38	1.50	13.3	0.27	1.21	10.8

Among the various combination of organic and inorganic treatments, the highest plant height was recorded at RDF 100% (inorganic) (55.7 cm and 55.1 cm during *rabi* and *kharif* seasons of 2022, respectively) (T_7). This might due to the availability of nutrients from inorganic sources in addition to suitable circumstances for plant nutrient absorption by the crop. The ability of plants to use available nutrients ultimately determines the amount of photosynthetic activity and photosynthate translocation occurs inside the plant. More plant height was achieved after an initial nitrogen rise, which might have helped in better chlorophyll development and subsequently higher photosynthesis [5]. Additionally, nitrogen is known to promote cell elongation. Another probable factor might be the distribution of phosphorus that is already available under the treatment RDF, which may aid in root extension, greater nutrient absorption, and improved soil water extraction. Likewise, phosphorus has been reported to promote cell division, which has led to plants growing taller. These results were reported by [5] and [1]. The next best treatment was Vermicompost 100% on N equivalent basis (54.6 cm and 53.7 cm) (T_2) and the shortest plant height was recorded under absolute control (45.3 cm and 43.3 cm) (T_1) at harvest stage of greengram.

3.1.2 Root length

The data on root length (cm) observed at harvest stage furnished in (Table 1). The recorded data showed that a significant maximum root length was recorded in RDF 100% (inorganic) (24.6 cm and 23.7 cm during *rabi* and *kharif* seasons of 2022, respectively) (T_7) it was on par with Vermicompost 100% on N equivalent basis (T_2) (22.5 cm and 22.1 cm). Among the other treatments control (T_1) recorded the lowest root length (17.4 cm and 16.5 cm). Supply of major nutrients by inorganic fertilizers had a significant physiological function by promoting cell multiplication, elongation, expansion, and chlorophyll biosynthesis, which in turn enhanced assimilate production for root growth [6,7].

3.1.3 Dry matter production

The data observed in (Table. 1) showed that the highest dry matter production (4203 and 4173 kg ha^{-1} during *rabi* and *Kharif* seasons of 2022, respectively) was recorded in RDF 100% (inorganic) (T_7) than other treatments. Similar results were reported by Kalsaria et al. [8], Rathod and Gawande [9]. This was closely followed by Vermicompost 100% on N equivalent basis (T_2) (4060 and 4022 kg ha^{-1}). The lowest dry matter production was registered under absolute control (2713 and 2672 kg ha^{-1}) (T_1).

3.2 Yield of Greengram

The yield of green gram as influenced by RDF and different sources of organic sources is given in Table 2. The grain and haulm yield of greengram (1132 and 1089 kg ha^{-1} of grain yield, 2217 and 2196 haulm yield kg ha^{-1} during *rabi* and *Kharif* seasons of 2022, respectively) increased significantly with RDF 100% (inorganic) treatment followed by Vermicompost 100% on N equivalent basis (1074 and 1025 kg ha^{-1} of grain yield, 2171 and 2136 haulm yield kg ha^{-1}). This might be due to the use of 100% RDF, which likely provided enough supplies of N and P to plants for notably greater development of different growth parameters, which eventually led to increased grain and haulm yields. These similar results were supported by Patel et al. [10]. Nitrogen is an important component of chlorophyll and which is essential for various enzyme activities in order for plants to develop properly. The proper quantity of phosphorus can help the crop to produce more pods while simultaneously developing healthier stocks and root systems [11].

Table 2. Effect of different organic manures comparison with RDF on grain and haulm yield

Treatments	*Rabi* 2022		*Kharif* 2022	
	Grain yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Grain yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
T_1 - Absolute control	462	1052	427	1017
T_2 - Vermicompost 100% on N equivalent basis	1074	2171	1025	2136
T_3 - Farmyard manure 100% on N equivalent basis	964	2035	931	2002
T_4 - Vermicompost 50% + Farmyard manure 50%	1008	2137	973	2101
T_5 - Vermicompost 75% + Farmyard manure 25%	1003	2125	968	2087
T_6 - Vermicompost 25% + Farmyard manure 75%	977	2064	946	2029
T_7 - RDF 100% inorganic	1132	2217	1089	2196
T_8 - RDF 50% inorganic + Vermicompost 50%	1027	2157	994	2126
T_9 - RDF 50% inorganic + Farmyard manure 50%	992	2104	959	2067
SEd	16	29	13	28
CD (*p*=0.05)	33	60	26	59

4. CONCLUSION

Based on the field experiment, it was concluded that the application of 100% inorganic fertilizer, specifically through the recommended dose of fertilizer (RDF) with a ratio of 25:50:25 of N, P_2O_5, and K_2O kg/ha, resulted in higher plant height, root length, dry matter production, grain yield and haulm yield of greengram in both seasons of *Kharif* and *rabi* 2022. Adopting a balanced and scientifically proven fertilizer approach in greengram cultivation enhances growth, productivity, profitability, and overall farm income for small landholding farmers. The results of this study can help shifting the mindset of farmers into applying a balanced amount of fertilizers to which unlocks the full potential of greengram crops, ensuring increased productivity and financial success in agriculture.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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