



# **Effect of Organic Manures and Chemical Fertilizers on Growth and Yield of Green Gram (*Vigna radiata* L.)**

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## **Authors' contributions**

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

## **Article Information**

DOI: <https://doi.org/10.9734/arja/2024/v17i4569>

## **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/125294>

**Original Research Article**

**Received: 12/08/2024**  
**Accepted: 17/10/2024**  
**Published: 25/10/2024**

## **ABSTRACT**

A field experiment was conducted at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan) during Rabi season of 2023-24 to effect of organic manures and chemical fertilizers on growth and yield of green gram, variety "SML-832" was used in this study. The required quantities of fertilizers as per treatments were applied. The experiment was laid out in randomized block design with three replications consisting of ten treatments. The data recorded maximum growth parameters like, plant height (51.45 cm), number of branches per plant (4.08) and yield parameters like, number of pods per plant (20.58, number of seeds per pod (8.65), test weight (38.92 g), grain yield (1106.45 kg/ha),

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**Cite as:** Jangid, Kishan, Chandrakanta Jakhar, Om Prakash Gurjar, Bhagwan Suman, and Indra Raj Yadav. 2024. "Effect of Organic Manures and Chemical Fertilizers on Growth and Yield of Green Gram (*Vigna Radiata* L.)". Asian Research Journal of Agriculture 17 (4):629-33. <https://doi.org/10.9734/arja/2024/v17i4569>.

straw yield (2583.85 kg/ha) and maximum net return (48100 Rs/ha) and B:C ratio (1.58) was recorded with T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha. The minimum growth and yield obtained with control treatment. Therefore, concluded that impact of different organic manures and chemical fertilizers on the growth and yield of the green gram. Among different T<sub>9</sub>-75% RDF + Vermicompost @ 1.25 t per ha registered the maximum production with higher net return. So, it was concluded that the treatment 75% RDF + Vermicompost @ 1.25 t per ha superior among all treatments.

**Keywords:** Yield; RDF; vermicompost; growth; economics.

## 1. INTRODUCTION

“Green gram (*Vigna radiata* L.) occupies prime position among pulses by virtue of its short growth period, high tonnage capacity and outstanding nutrient value as food, feed and forage. Unlike other pulses, it does not produce heaviness or flatulence. Green gram is fairly rich in carbohydrate and appreciable amount of riboflavin and thiamine” (Roy et al., 2006).

“The use of fertilizers is essential to increasing crop yields. In terms of crop nutrition, nitrogen is crucial. Even while green grams fix nitrogen from the atmosphere, the crop seemed to benefit most from an initial dose of 15 to 20 kg of nitrogen per hectare, depending on the original fertility of the soil. The degree of response is contingent upon several factors, including temperature, cropping patterns, soil moisture content, and natural fertility” (Roy et al., 2006). “Phosphorus is essential for several physiological functions, including protein synthesis and metabolism, as well as for the growth of roots, the generation of dry matter, nodulation, and nitrogen fixation. The use of chemical fertilizers has been negatively impacted and the issues have been made worse by the recent, unheard-of increase in their cost. The fact that no single source of nutrients could completely satisfy a crop's nutritional needs is becoming more and more apparent. The green gram possesses a special ability to capture atmospheric gaseous nitrogen. Through the process of symbiosis, this is achieved. As a result, the well-modulated crop improves the soil in addition to meeting its own nitrogen needs” (Patil et al., 2011).

“The nutrient density of organic matter is rather low, there are numerous benefits associated with it. By increasing the physical and biological nutrient storage mechanisms in soils, organic manures naturally reduce the danger of overfertilization. Compared to inorganic fertilizers, organic manures such as FYM and Bio compost have a lower nutritional content and a slower rate of nutrient release. By contributing organic matter and nutrients, like nitrogen, that

are held in the soil by bacteria, manures help to make the soil more fertile” (Atik et al., 2014). By enhancing soil fertility and soil structure, FYM and Bio compost contribute to increased agricultural productivity (Pal, et al., 2011). “The productivity of this crop is very low because of its cultivation on marginal and sub marginal lands of low soil fertility where little attention is paying to adequate fertilization. In summer green gram, a high reduction in yield has been reported to occur due to non-use of fertilizers” (Singh et al., 2008). Although, chemical fertilizer is playing a crucial role to meet the nutrients need of the crop, the imbalance and continuous use of chemical fertilizers has adverse effect on soil physical, chemical and biological properties thus affecting the sustainability of crop production, besides causing environmental pollution.

## 2. MATERIALS AND METHODS

A field experiment was conducted during Rabi season of 2023-24 at experimental farm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam in texture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient in available zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) and phosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment was laid out in randomized block design with three replications consisting of ten treatments *viz.* T<sub>1</sub>-Control, T<sub>2</sub>-100% RDF, T<sub>3</sub>-75% RDF, T<sub>4</sub>-50% RDF, T<sub>5</sub>-FYM @ 2 t/ha, T<sub>6</sub>-75% RDF + FYM @ 2 t/ha, T<sub>7</sub>-50% RDF + FYM @ 2 t/ha, T<sub>8</sub>-Vermicompost @ 1.25 t per ha, T<sub>9</sub>-75% RDF + Vermicompost @ 1.25 t per ha and T<sub>10</sub>-50% RDF + Vermicompost @ 1.25 t per ha. The required quantities of fertilizers as per treatments were applied. The doses of NPK were applied in the form of urea, diammonium phosphate, murate of potash respectively. The half dose of nitrogen gives basal dose and remain two split doses after irrigation and full dose of phosphorus and potassium at basal dose. Vermicompost and

FYM apply in field at field preparation before sowing. The seed treatment with Rhizobium culture. The yield parameters were calculated from output from the field. The profitability and productivity of mung bean was calculated from cost of field preparation to harvesting and threshing cost and out put from straw yield and grain yield as per market rate.

### 3. RESULTS AND DISCUSSION

#### 3.1 Growth Attributes

Data presenting to effect of organic manures and chemical fertilizers on growth attributes are presented in Table 1. The organic manures and chemical fertilizers were showed significant effect on growth attributes of green gram. The data did not show significant difference at 40 DAS but at 60 DAS and at harvest show significant effect of the treatments. The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher plant height (50.70 and 51.45 cm). The lowest plant height was obtained with control treatment (43.10 and 44.02 cm) at both stages. The data show significant difference at 25 DAS and 50 DAS. The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher number of branches per plant (2.85 and 4.08). The lowest number of branches per plant was obtained with control treatment (2.05 and 2.65) at both stages.

#### 3.2 Yield Attributes and Yield

Data presenting to effect of organic manures and chemical fertilizers on yield attributes are

presented in Table 2. The organic manures and chemical fertilizers were showed significant effect on yield attributes of green gram. The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher number of pods per plant (18.58). The lowest number of pods per plant was obtained with control treatment (15.33). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher number of seed per pod (8.65). The lowest number of seed per pod was obtained with control treatment (6.72). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher test weight (38.92). The lowest test weight was obtained with control treatment (32.95). These findings also supported by Patil et al. (2011) and Mehta et al. (2015). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher grain yield (1106.45 kg/ha), it was found at par with treatment T<sub>6</sub>-75% RDF + FYM @ 2 t/ha (1087.25 kg/ha), T<sub>2</sub>-100% RDF (1053.55 kg/ha) and T<sub>10</sub>-50% Vermicompost @ 1.25 t per ha (966.66 kg/ha). The lowest grain yield was obtained with control treatment (810.53 kg/ha). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher straw yield (2583.85 kg/ha), it was found at par with treatment T<sub>6</sub>-75% RDF + FYM @ 2 t/ha (2561.44 kg/ha), T<sub>2</sub>-100% RDF (2550.14 kg/ha) and T<sub>10</sub>-50% Vermicompost @ 1.25 t per ha (2435.45 kg/ha). The lowest straw yield was obtained with control treatment (1985.36 kg/ha). Similar result also concluded by Tanwar et al. (2010), Singh et al. (2008) and Sahu et al. (2023).

**Table 1. Effect of organic manures and chemical fertilizers on plant height and number of branches per plant on green gram**

Treatments	Plant height (cm)			Number of branches per plant	
	40 DAS	25 DAS	25 DAS	25 DAS	50 DAS
T <sub>1</sub> -Control	24.63	43.10	44.02	2.05	2.65
T <sub>2</sub> -100% RDF	28.10	48.65	49.98	2.56	3.68
T <sub>3</sub> -75% RDF	27.20	45.48	46.25	2.30	3.16
T <sub>4</sub> -50% RDF	26.72	43.62	44.05	2.10	2.95
T <sub>5</sub> -FYM @ 2 t/ha	27.00	44.12	44.75	2.11	3.00
T <sub>6</sub> -75% RDF + FYM @ 2 t/ha	28.42	50.28	50.98	2.84	3.80
T <sub>7</sub> -50% RDF + FYM @ 2 t/ha	27.62	45.90	46.68	2.35	3.20
T <sub>8</sub> -Vermicompost @ 1.25 t per ha	27.15	45.42	46.25	2.25	3.15
T <sub>9</sub> -75% RDF + Vermicompost @ 1.25 t per ha	28.68	50.70	51.45	2.85	4.08
T <sub>10</sub> -50% RDF + Vermicompost @ 1.25 t per ha	28.02	47.80	48.88	2.38	3.20
S. Em. ±	0.60	1.62	1.60	0.10	0.14
CD @ 5%	NS	4.85	4.79	0.29	0.41
CV%	8.32	8.02	7.85	7.25	7.85

**Table 2. Effect of organic manures and chemical fertilizers on yield attributes and yield of green gram**

Treatment	Number of pod per plant	Number of seed per pod	Test weight (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
T <sub>1</sub> -Absolute control	15.33	6.72	32.95	810.53	1985.36
T <sub>2</sub> -RDF + Rhizobium	19.20	7.90	36.62	1053.55	2550.14
T <sub>3</sub> -FYM @ 4 t ha <sup>-1</sup> + Rhizobium	17.95	7.16	34.70	948.45	2309.85
T <sub>4</sub> -100% RDF + FYM @ 2 t ha <sup>-1</sup> + Rhizobium	15.25	6.90	33.00	818.36	2325.39
T <sub>5</sub> -75% RDF + FYM @ 2 t ha <sup>-1</sup> + Rhizobium	16.60	6.93	33.98	876.12	2043.66
T <sub>6</sub> -50% RDF + FYM @ 2 t ha <sup>-1</sup> + Rhizobium	19.92	8.18	37.68	1087.25	2561.44
T <sub>7</sub> -Vermicompost @ 2 t ha <sup>-1</sup> + Rhizobium	18.25	7.22	35.76	964.85	2353.36
T <sub>8</sub> -100% RDF + Vermicompost @ 1.0 t ha <sup>-1</sup> + Rhizobium	16.75	7.18	34.53	928.78	2238.52
T <sub>9</sub> -75% RDF + Vermicompost @ 1.0 t ha <sup>-1</sup> + Rhizobium	20.58	8.65	38.92	1106.45	2583.85
T <sub>10</sub> -50% RDF + Vermicompost @ 1.0 t ha <sup>-1</sup> + Rhizobium	19.15	7.30	36.22	966.66	2435.45
S. Em. ±	0.49	0.46	0.90	48.25	50.25
CD @ 5%	1.48	1.36	2.72	144.85	151.02
CV%	8.12	9.36	7.45	7.02	8.17

**Table 3. Effect of organic manures and chemical fertilizers on economics**

Treatments	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T <sub>1</sub> -Control	22000	48500	26500	1.20
T <sub>2</sub> -100% RDF	26000	65500	39500	1.52
T <sub>3</sub> -75% RDF	25000	60500	35500	1.42
T <sub>4</sub> -50% RDF	24000	56500	32500	1.35
T <sub>5</sub> -FYM @ 2 t/ha	24500	54900	29400	1.24
T <sub>6</sub> -75% RDF + FYM @ 2 t/ha	28500	72500	44000	1.54
T <sub>7</sub> -50% RDF + FYM @ 2 t/ha	26500	64200	37700	1.42
T <sub>8</sub> -Vermicompost @ 1.25 t per ha	25000	57400	32400	1.30
T <sub>9</sub> -75% Vermicompost @ 1.25 t per ha	30500	78600	48100	1.58
T <sub>10</sub> -50% Vermicompost @ 1.25 t per ha	29500	70800	41300	1.40

### 3.3 Economics

Data pertaining to effect of different organic and chemical fertilizers of nutrient on economics presented in Table 3. The organic manures and inorganic were showed significant effect on economic variability of green gram. The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher cost of cultivation (30500 Rs/ha). The lowest cost of cultivation was obtained with control treatment (22000 Rs/ha). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher gross return (78600 Rs/ha). The lowest gross return was obtained with control treatment

(48500 Rs/ha). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher net return (48100 Rs/ha). The lowest net return was obtained with control treatment (26500 Rs/ha). The treatment T<sub>9</sub>-75% Vermicompost @ 1.25 t per ha recorded higher net return (1.58). The lowest net return was obtained with control treatment (1.20). This result also collaborated with Patil et al. (2011), Mehta et al. (2015), Phinehas et al. (2022) and Sahu et al. (2023).

### 4. CONCLUSION

The investigation the present experimentation that significant response of organic manures and

chemical fertilizers on the growth and yield of the green gram. Among all treatment T<sub>9</sub>-75% RDF + Vermicompost @ 1.25 t per ha registered the maximum production with higher net return. So, it was concluded that the treatment 100% RDF + Vermicompost @ 1.25 t per ha superior among all treatments.

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:  
The peer review history for this paper can be accessed here:  
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