



# Effect of Integrated Nutrient Management on Growth and Yield of Irrigated Blackgram (*Vigna mungo* 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.

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## ABSTRACT

The aim of this study was to examine the effect of integrated nutrient management on the growth and yield of irrigated black gram. Pulses are also known as food legumes and they are second only to cereals in terms of production and consumption in India. A field experiment was carried out at Research Farm of Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu during *rabi* season, (2022-2023) to Effect of Integrated Nutrient Management on growth and yield of irrigated blackgram crop with seven treatments and three replications under Randomized block design (RBD). The results indicated that the treatment with 50% RDF + 25% farmyard manure (FYM) + 25% Vermicompost (T<sub>7</sub>) performed well among all the treatments and recorded higher

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plant height (36.73cm), total dry matter production (2325 kg ha<sup>-1</sup>), grain yield (930 kg ha<sup>-1</sup>), stover yield ( 1395 kg ha<sup>-1</sup>), number of pods (20.65). The net return (25892 Rs ha<sup>-1</sup>) and B:C ratio (1.88) was recorded higher in 100% RDF.

**Keywords:** Blackgram; RDF; farmyard manure; vermicompost; growth; yield; economics.

## 1. INTRODUCTION

“Pulses are also known as food legumes and they are second only to cereals in terms of production and consumption in India. Black gram (*Vigna mungo* L.) 2n=24 is a self-pollinated crop that grows up to 30-50 cm tall with yellow flowers and a side inflorescence. It is one of the oldest and most important pulse crops of Asia” [1]. It later spread throughout Asia during trade and became a staple food grain legume in other parts of the world. According to FAOSTAT [2], the world’s pulse crops occupy 93.54 million hectares of land and produce 92.13 million tonnes of yield at an average rate of 985 kg per hectare. “India is one of the major producers of pulses, with an area of 287.83 lakh hectares, a production of 254.63 lakh tonnes and a productivity of 885 kg per hectare” [3]. “Tamil Nadu, a state in India, has a pulse cultivation area of 8.03 lakh hectares, a production of 4.72 lakh tonnes and a productivity of 588 kg per hectare” [3].

“Integrated Nutrient Management (INM) is a key component of sustainable agriculture that requires managing resources in a way that meets the changing human needs without degrading the quality of the environment and conserving vital natural resources. INM involves maintaining soil fertility at an optimal level for crop productivity by obtaining maximum benefits from all possible sources of plant nutrients, both organic and inorganic, in an integrated manner” [4]. INM includes the smart use of organic, inorganic, and biological resources to achieve optimal yields, improve or maintain soil physical and chemical properties, and provide crop nutrition packages that are technically sound, economically attractive, practically feasible and environmentally safe.

Among the organic manures, Farmyard manure (FYM) is one of the most traditional sources, most readily available and widely used by farmers since ancient times. Adding organic material to the soil such as FYM helps maintain soil fertility and productivity. Vermicompost is rich in all essential plant nutrients and it has excellent effects on overall plant growth. It encourages the

growth of new leaves and improves the quality and shelf life of the produce. It improves soil structure, texture, aeration and water holding capacity and prevents soil erosion. Integrating farmyard manure or vermicompost with reduced doses of inorganic fertilizers resulted in improved soil fertility, growth and yield of crops

To improve the yield of black gram, it is beneficial to combine the recommended dose of fertilizers with farmyard manure and vermicompost. These sources of nutrients provide a balanced and sustained supply of nutrients for the crop, enhancing photosynthesis and yield components. Farmyard manure and vermicompost also improve the soil quality by increasing the availability of essential plant nutrients and improving the physical and chemical properties of the soil. However, organic sources alone may not meet the immediate nutrient demand of the crop, as they release nutrients slowly through mineralization. Therefore, using both organic (farmyard manure and vermicompost) and inorganic (fertilizers) sources of nutrients can ensure optimal nutrient delivery throughout the growth period. The aim of this study was to examine the effect of integrated nutrient management on the growth and yield of irrigated black gram.

## 2. MATERIALS AND METHODS

The experiment was conducted to examine the effect of Integrated Nutrient Management on growth and yield of irrigated blackgram. The investigation was performed at Research Farm, Department of Agronomy, Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu. The experimental site is geographically located in the western agro climatic zone of Tamil Nadu at 10° 56'N latitude and 76° 44'E longitude at an elevation of 474 m above mean sea level. The soil of the experimental site was silty clay loam with a pH of 7.2, EC (0.23 dS m<sup>-1</sup>), OC (1.03 %), nitrogen (197 kg ha<sup>-1</sup>), phosphorus (19.7 kg ha<sup>-1</sup>) and potassium (281 kg ha<sup>-1</sup>). The experiment was performed during *Rabi* season of 2022. The design used to analyze and perform experiment was Randomized Block Design with Seven treatments and Three replications.

Treatments used are following: T<sub>1</sub>- Control (No fertilizer); T<sub>2</sub>- 100% RDF; T<sub>3</sub>- 100% Farm yard manure; T<sub>4</sub>- 100% Vermicompost; T<sub>5</sub>- 50% RDF + 50% Vermicompost; T<sub>6</sub>- 50% RDF + 50% Farm yard manure; T<sub>7</sub>- 50% RDF + 25% Farm yard manure + 25% Vermicompost. The recommended fertilizer doses (RDF) for blackgram were 20:40:20 kg NPK ha<sup>-1</sup>. The blackgram VBN-8 variety, which has a duration of 65-75 days, was sown in the first week of November with a spacing of 30 cm x 10 cm and a seed rate of 20 kg ha<sup>-1</sup>. All growth and yield characteristics were calculated using established procedures.

### 2.1 Statistical Analysis

The experimental data were analyzed statistically by applying the technique of analysis of variance (ANOVA) prescribed for the design to test the significance of overall difference among treatments by the F test and conclusions were drawn at 5% probability level. Economics of treatments was also worked out [5].

## 3. RESULTS AND DISCUSSION

### 3.1 Effect of Integrated Nutrient Management on Growth Attributes of Blackgram

The data presented in Table 1 revealed that the plant height of blackgram at different growth stages showed significance difference among the treatments. The treatment T<sub>7</sub>- 50% RDF + 25% Farm yard manure + 25% vermicompost recorded the higher plant height (36.73 cm) among all the treatments, which is statistically at par with T<sub>5</sub>- 50% RDF + 50% Vermicompost (36.15 cm) and T<sub>2</sub>- 100% RDF (35.47 cm) treatments. "The combined application of 50% recommended dose of fertilizer + 50% vermicompost to the blackgram improved accessibility of major and minor nutrient to plant might have enhanced early root growth and cell multiplication leading to more absorption of other nutrients from deeper layers of soil ultimately resulting in increased plant growth attributes and finally increase plant growth rate" [6].

The higher dry matter production (2325 kg ha<sup>-1</sup>) was recorded in the T<sub>7</sub>-50% RDF + 25% Farm yard manure + 25% vermicompost which is statistically at par with T<sub>5</sub>- 50% RDF + 50%

Vermicompost (2069 kg ha<sup>-1</sup>). The largest yield attributes from the highest N level with FYM + VC may be attributed to the greatest rise in dry matter production and its successful partitioning to the economic sink. This observation is consistent with Uma Shankar Bagri [7].

### 3.2 Effect of Integrated Nutrient Management on Yield Attributes of Blackgram

The higher grain yield (930 kg ha<sup>-1</sup>) of black gram was recorded in T<sub>7</sub>-50% RDF + 25% Farm yard manure + 25% vermicompost followed by T<sub>5</sub>- 50% RDF + 50% Vermicompost (862 kg ha<sup>-1</sup>) which is significantly differed from other treatments. The combined application of organic and inorganic fertilizers has a favourable influence on yield because organic fertilizers help to reduce the danger of nutrient leaching even after inorganic fertilizers are applied to the soil. Furthermore, vermicompost is one of the finest cures for maintaining soil health as well as crop plant productivity, especially when used in conjunction with chemical fertilizers. These findings are consistent with Parthasarathi et al. [8], Dhyani [9], and Sunil Kumar and Yadav [10].

The higher stover yield (1395 kg ha<sup>-1</sup>) was recorded in T<sub>7</sub>-50% RDF + 25% Farm yard manure + 25% vermicompost followed by T<sub>5</sub>- 50% RDF + 50% Vermicompost (1207 kg ha<sup>-1</sup>). The favourable effect of vermicompost and RDF resulted in a significant improvement in yield attributes and an unexpected increase in seed and stover yield of blackgram. These findings agree with those of Bakthavathsalam and Deivanayaki [11], Geetha and Velayutham [12], Bhattacharya et al. [13], and Hussain et al. [14]. Shashi Kumar et al. [15].

The maximum number of pods per plant was higher in T<sub>7</sub>-50% RDF + 25% Farm yard manure + 25% vermicompost (20.65) which is statistically at par with T<sub>5</sub>- 50% RDF + 50% Vermicompost (20.54). Rajeshwari [16] reported that "the number of pods per plant is another important yield attributing factor which differed significantly with vermicompost @ 1 t ha<sup>-1</sup> + RDF and broadcast method application of FYM @ 5 t ha<sup>-1</sup> + RDF as compared to only RDF This might be attributed to better availability of nutrients". These results are in conformity with Shete et al. [17] in green gram, Singh et al. [18] in blackgram.

**Table 1. Effect of Integrated nutrient management on growth and yield parameters of blackgram**

<b>Treatments</b>	<b>Plant height (cm)</b>	<b>Number of Pods plant<sup>-1</sup></b>	<b>Dry matter Production (kg ha<sup>-1</sup>)</b>	<b>Grain yield (kg ha<sup>-1</sup>)</b>	<b>Stover yield (kg ha<sup>-1</sup>)</b>	<b>Harvest index</b>
T1-Control	31.26	16.74	1323	630	756	45.45
T2- 100% RDF	35.47	20.17	1952	849	1189	41.65
T3- 100% Farmyard manure	33.05	19.65	1756	798	958	45.44
T4-100% Vermicompost	33.14	19.86	1797	817	1062	43.48
T5- 50% RDF + 50% Vermicompost	36.15	20.54	2069	862	1207	41.66
T6- 50% RDF + 50% Farmyard manure	34.15	19.95	1826	830	1079	43.47
T7-50% RDF + 25% Farmyard manure + 25% Vermicompost	36.73	20.65	2325	930	1395	40
Mean	31.3	19.65	1864	817	1092	-
Sed	35.5	0.54	134.8	58.9	80.65	-
CD ( $p=0.05$ )	33.1	1.12	281.7	123	168.49	-

**Table 2. Effect of Integrated nutrient management on Economics of Blackgram**

<b>Treatments</b>	<b>Net return (Rs. ha<sup>-1</sup>)</b>	<b>B:C ratio</b>
T1-Control	17500	1.74
T2-100% RDF	25892	1.88
T3-100% Farmyard manure	2070	1.04
T4-100% Vermicompost	7470	1.16
T5-50% RDF + 50% Vermicompost	18793	1.50
T6-50% RDF + 50% Farmyard manure	14628	1.37
T7-50% RDF + 25% Farmyard manure + 25% Vermicompost	19983	1.49

### 3.3 Economics

The maximum net return was recorded in T<sub>2</sub>-100% RDF (25892 Rs ha<sup>-1</sup>) with the BCR (1.88). Prasad Jha et al. 2015 [19] reported that higher net return and B:C ratio was recorded with 100% RDF + Zn + Fe. Significantly increased net return and benefit cost ratio due to inorganic nutrient sources are consistent with the findings of Gupta et al. [20], Shashikumar et al. [15], and Kumawat et al. [21].

### 4. CONCLUSION

Based on the findings of the aforesaid experiment, it is possible to conclude that growing of blackgram in the southern zone of Coimbatore with an application of T<sub>7</sub> (50% RDF+25% farmyard manure + 25% vermicompost) considerably boosted blackgram grain and stover yields. As a result, it can be recommended to farmers as a superior treatment. T<sub>5</sub> (50% RDF + 50% vermicompost) can also be considered as a second alternative for increasing blackgram production.

### 5. FUTURE SCOPE

1. In order to provide accurate recommendations for farmers, it is essential to conduct studies in various agro-climatic zones.
2. Exploring additional agronomic practices can be beneficial in order to optimize the yield of blackgram.
3. Evaluating different blackgram varieties can be done to enhance yield potential.

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### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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