**Effect of Inorganic Fertilizer, Vermicompost and Biofertilizer on Growth, Yield and Nutrient uptake by Mung bean (*Vigna radiata*** **L.)**

# Abstract

 A field experiment was conducted at experimental farm, Department of Agronomy, 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 study evaluated the effects of inorganic fertilizer, vermicompost, and biofertilizer on growth, yield, and nutrient uptake of the Mung bean variety 'SML-832'. The result revealed that the maximum plant height (52.96 cm), number of branches per plant (8.62), leaf area index (4.15) and yield parameter such as number of pods per plant (19.22), number of seed per pod (9.45), grain yield (13.25 q/ha), straw yield (29.12 q/ha) with application of T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer. The maximum nitrogen content in grain and straw (3.70 and 1.53%), phosphorus (0.66 and 0.43%), potassium content (1.05 and 1.60%) and nitrogen uptake in grain and straw (49.03 and 44.55 kg/ha), phosphorus (8.75 and 12.52 kg/ha) and potassium uptake (13.91 and 46.59 kg/ha) were recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer. It was concluded that the treatment T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer found significantly higher growth, yield and nutrient uptake by Mung bean.

**Key words:** Foliar application; Macro & Micro nutrients; Yield, Nutrient uptake, vermicompost, biofertilizer

# 1. Introduction

“Mung bean (*Vigna radiata* L.) is one of the most ancient and extensively grown leguminous crops of India. It supplies protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse, which is an essential supplement of cereal based diet. It is particularly rich in leucine, phenylalanine, lysine, valine, isoleucine, etc. India is one of the important mung bean growing countries in Asia with an area 8.7 million hectares and production of 8.83 million tonnes with a productivity of 1014 kg ha-1” (Anonymous., 2020).

“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. However, yield potential of summer green gram is quite high yet at farmers’ field, its yield is low. In summer green gram, a high reduction in yield has been reported to occur due to non-use of fertilizers. Application of organic amendments may increase supply of macro and micronutrients to plants and could mobilize unavailable nutrients to available forms and as a cumulative effect, nutrient uptake is higher than synthetic fertilizers” (Sharma *et al.* 2008). In judicious use of only inorganic fertilizers resulted in soil health as well as plant quality problem. Now a days it is need to utilize organic sources like farm yard manure (FYM), compost, bio compost, vermicompost, and biofertilizers to get quality production without adhering the soil health. “In spite of being widely adapted crop in India, its productivity is very low. Maximum productivity of crop could be achieved with the maximum use of agrochemicals. The impressive gains in food production achieved due to green revolution but due to intensive use of agro-chemicals soil health is being affected. There is now tremendous scope on growers to use integrated nutrient management approach to increase productivity and sustain soil health. Organic amendment offers an alternative or supplementing control tactic to increase production” (Meena 2015).

“Integration of organic manures and inorganic fertilizer materials has been found to be promising not only in maintaining higher productivity of crops and for providing stability in crop production, besides improving soil physical conditions” (Verma *et al.* 2012). “Farmyard manure and vermicompost have been advocated as good organic manure for use in integrated nutrient management programme in field crops. Biofertilizers are also one of the important components in integrated nutrient management system. They are low cost and eco-friendly inputs, which have tremendous potential of fixing atmospheric nitrogen and can reduce the chemical fertilizer dose by 25–50%” (Pattanayak *et al.* 2007).

# 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 (0.32%), 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 nine treatments *viz.* The experiment was laid out in randomized block design with three replications and ten treatments *i.e.* T1-Control, T2-50% RDF (Recommended dose of fertilizer) (10:20:00 kg/ha), T3-100% RDF (20:40:00 kg/ha), T4-100% RDF + Vermicompost 2.5 t/ha, T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer, T6-75% RDF (15:30:00 kg/ha), T7-75% RDF + Vermicompost 2.5 t/ha, T8-75% RDF + Vermicompost 2.5 t/ha + Biofertilizer and T9-Vermicompost 5 t/ha + Biofertilizer. 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 potassium at basal dose and phosphorus doses giving according to treatments.

**3. Results and Discussion**

**3.1 Growth attributes**

The data revealed (Table 1) that the maximum plant height at 30 DAS was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (19.25 cm). The minimum plant height was found in control treatment (14.25 cm). The data revealed that the maximum plant height at harvest was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (52.96 cm). The minimum plant height was found in control treatment (46.12 cm). The data revealed that the maximum number of branches per plant at 30 DAS was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (2.65). The minimum number of branches per plant was found in control treatment (2.12). The data revealed that the maximum number of branches per plant at harvest was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (8.62). The minimum number of branches per plant was found in control treatment (6.58). The data revealed that the maximum leaf area index was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (4.15). The minimum leaf area index was found in control treatment (3.40). The findings also similar with Patel *et al.* (2013), Gohil *et al*. (2017), Singh *et al.* (2017) and Ruheentaj *et al*. (2020).

**3.2 Yield and yield attributes**

The data revealed (Table 2) that the maximum number of pods per plant was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (19.22). The minimum number of pods per plant was found in control treatment (15.25). The data revealed that the maximum number of seed per pod was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (9.45). The minimum number of seed per pod was found in control treatment (7.25). The data revealed that the maximum grain yield was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (13.25 q/ha). The minimum grain yield was found in control treatment (8.95 q/ha). The minimum straw yield was found in control treatment (19.36 q/ha). Similar concluded by Meena *et al*. (2015), Gohil *et al*. (2017), Verma *et al*. (2017), Patel *et al*. (2020), Dutta *et al.* (2021) and Rabari (2022).

**3.3 Nutrient content and uptake**

The data revealed (Table 3) that the maximum nitrogen content in grain was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (3.70 %). The minimum nitrogen content in grain was found in control treatment (3.30 %). The data revealed that the maximum nitrogen content in straw was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (1.53 %). The minimum nitrogen content in straw was found in control treatment (1.20 %). The data revealed that the maximum phosphorus content in grain was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (0.66 %). The minimum phosphorus content in grain was found in control treatment (0.44 %). The data revealed that the maximum phosphorus content in straw was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (0.43 %). The minimum phosphorus content in straw was found in control treatment (0.20 %). The data revealed that the maximum potassium content in grain was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (1.05 %). The minimum potassium content in grain was found in control treatment (0.82 %). The data revealed that the maximum potassium content in straw was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (1.60 %). The minimum potassium content in straw was found in control treatment (1.28 %). Similar results also reported by Singh *et al.* (2019), Sudipta *et al*. (2019), Katiyar *et al.* (2020), Makwana *et al*. (2020) and Ruheentaj *et al*., (2020).

The data revealed (Table 4) that the maximum nitrogen uptake in grain was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (3.70 %). The minimum nitrogen uptake in grain was found in control treatment (3.30 %). The data revealed that the maximum nitrogen uptake in straw was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (1.53 %). The minimum nitrogen uptake in straw was found in control treatment (1.20 %). The data revealed that the maximum phosphorus uptake in grain was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (0.66 %). The minimum phosphorus uptake in grain was found in control treatment (0.44 %). The data revealed that the maximum phosphorus uptake in straw was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (0.43 %). The minimum phosphorus uptake in straw was found in control treatment (0.20 %). The data revealed that the maximum potassium uptake in grain was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (1.05 %). The minimum potassium uptake in grain was found in control treatment (0.82 %). The data revealed that the maximum potassium uptake in straw was recorded with T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer (1.60 %). The minimum potassium uptake in straw was found in control treatment (1.28 %). These findings also supported by Katiyar *et al.* (2020), Sachan *et al*. (2020), Somalraju *et al*. (2021) and Marimuthu *et al.* (2023).

**Conclusion: -**

The findings of present investigation revealed that significant impact of different organic and inorganic nutrient sources on the growth, yield and nutrient uptake by the mung bean. Among all treatment T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer registered the maximum production with higher productivity. So, it was concluded that the treatment 100% RDF + Vermicompost 2.5 t/ha + Biofertilizer superior among all treatments.

**Table 1: Effect of different nutrient combination on growth attributes of mung bean**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **Plant height (cm)** | **Number of branches per plant** | **Leaf area index** |
| **30 DAS** | **At harvest** | **30 DAS** | **At harvest** |
| T1-Control | 14.25 | 46.12 | 2.12 | 6.58 | 3.40 |
| T2-50% RDF (10:20:00 kg/ha) | 16.25 | 48.75 | 2.25 | 7.85 | 3.52 |
| T3-100% RDF (20:40:00 kg/ha) | 17.12 | 49.52 | 2.38 | 8.12 | 3.65 |
| T4-100% RDF + Vermicompost 2.5 t/ha | 18.75 | 52.15 | 2.58 | 8.50 | 3.92 |
| T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer  | 19.25 | 52.96 | 2.65 | 8.62 | 4.15 |
| T6-75% RDF (15:30:00 kg/ha) | 16.85 | 49.25 | 2.32 | 7.94 | 3.60 |
| T7-75% RDF + Vermicompost 2.5 t/ha | 17.75 | 50.10 | 2.42 | 8.24 | 3.85 |
| T8-75% RDF + Vermicompost 2.5 t/ha + Biofertilizer | 18.50 | 51.75 | 2.51 | 8.44 | 3.98 |
| T9-Vermicompost 5 t/ha + Biofertilizer | 18.20 | 51.36 | 2.48 | 8.36 | 4.25 |
| S. Em. ± | 0.27 | 0.42 | 0.05 | 0.06 | 0.09 |
| CD at 5% | 0.82 | 1.25 | 0.13 | 0.19 | 0.28 |

**Table 2: Effect of different nutrient combination on yield attributes and yield of mung bean**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Number of pods per plant** | **Number of seed per pod** | **Grain yield** **(q/ha)** | **Grain yield** **(q/ha)** | **Straw yield** **(q/ha)** |
| T1-Control | 15.25 | 7.25 | 8.95 | 8.95 | 11.30 |
| T2-50% RDF (10:20:00 kg/ha) | 17.63 | 7.85 | 9.45 | 9.45 | 12.52 |
| T3-100% RDF (20:40:00 kg/ha) | 18.12 | 8.32 | 10.25 | 10.25 | 12.68 |
| T4-100% RDF + Vermicompost 2.5 t/ha | 18.95 | 9.05 | 12.48 | 12.48 | 13.20 |
| T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer  | 19.22 | 9.45 | 13.25 | 13.25 | 13.70 |
| T6-75% RDF (15:30:00 kg/ha) | 17.85 | 8.16 | 9.82 | 9.82 | 12.82 |
| T7-75% RDF + Vermicompost 2.5 t/ha | 18.32 | 8.45 | 10.62 | 10.62 | 14.70 |
| T8-75% RDF + Vermicompost 2.5 t/ha + Biofertilizer | 18.74 | 8.85 | 11.88 | 11.88 | 12.75 |
| T9-Vermicompost 5 t/ha + Biofertilizer | 18.44 | 8.70 | 11.02 | 11.02 | 15.62 |
| S. Em. ± | 0.17 | 0.21 | 0.47 | 0.47 | 0.65 |
| CD at 5% | 0.51 | 0.60 | 1.39 | 1.39 | 1.97 |

**Table 3: Effect of different nutrient combination on nutrient content in mung bean**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **N content %** | **P content %** | **K content %** |
| **Grain** | **Straw** | **Grain** | **Straw** | **Grain** | **Straw** |
| T1-Control | 3.30 | 1.20 | 0.44 | 0.20 | 0.82 | 1.28 |
| T2-50% RDF (10:20:00 kg/ha) | 3.35 | 1.28 | 0.48 | 0.24 | 0.85 | 1.34 |
| T3-100% RDF (20:40:00 kg/ha) | 3.45 | 1.38 | 0.50 | 0.26 | 0.92 | 1.44 |
| T4-100% RDF + Vermicompost 2.5 t/ha | 3.64 | 1.50 | 0.62 | 0.39 | 1.01 | 1.56 |
| T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer  | 3.70 | 1.53 | 0.66 | 0.43 | 1.05 | 1.60 |
| T6-75% RDF (15:30:00 kg/ha) | 3.40 | 1.32 | 0.52 | 0.28 | 0.89 | 1.39 |
| T7-75% RDF + Vermicompost 2.5 t/ha | 3.48 | 1.42 | 0.53 | 0.30 | 0.94 | 1.47 |
| T8-75% RDF + Vermicompost 2.5 t/ha + Biofertilizer | 3.60 | 1.48 | 0.59 | 0.36 | 0.99 | 1.53 |
| T9-Vermicompost 5 t/ha + Biofertilizer | 3.55 | 1.45 | 0.55 | 0.33 | 0.96 | 1.50 |
| S. Em. ± | 0.04 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 |
| CD at 5% | 0.10 | 0.09 | 0.09 | 0.07 | 0.06 | 0.07 |

**Table 4: Effect of different nutrient combination on nutrient uptake by mung bean**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **N uptake (kg/ha)** | **P uptake (kg/ha)** | **K uptake (kg/ha)** |
| **Grain** | **Straw** | **Grain** | **Straw** | **Grain** | **Straw** |
| T1-Control | 29.54 | 23.23 | 3.94 | 3.87 | 7.34 | 24.78 |
| T2-50% RDF (10:20:00 kg/ha) | 31.66 | 27.20 | 4.54 | 5.10 | 8.03 | 28.48 |
| T3-100% RDF (20:40:00 kg/ha) | 35.36 | 32.36 | 5.13 | 6.10 | 9.43 | 33.77 |
| T4-100% RDF + Vermicompost 2.5 t/ha | 45.43 | 41.48 | 7.74 | 10.78 | 12.60 | 43.13 |
| T5-100% RDF + Vermicompost 2.5 t/ha + Biofertilizer  | 49.03 | 44.55 | 8.75 | 12.52 | 13.91 | 46.59 |
| T6-75% RDF (15:30:00 kg/ha) | 33.39 | 28.88 | 5.11 | 6.13 | 8.74 | 30.41 |
| T7-75% RDF + Vermicompost 2.5 t/ha | 36.96 | 34.02 | 5.63 | 7.19 | 9.98 | 35.22 |
| T8-75% RDF + Vermicompost 2.5 t/ha + Biofertilizer | 42.17 | 38.06 | 6.53 | 8.66 | 11.40 | 39.38 |
| T9-Vermicompost 5 t/ha + Biofertilizer | 39.67 | 37.22 | 6.50 | 9.05 | 10.91 | 38.48 |
| S. Em. ± | 2.30 | 2.20 | 0.75 | 1.30 | 0.85 | 2.10 |
| CD at 5% | 6.92 | 6.62 | 2.24 | 3.89 | 2.55 | 6.28 |

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**References**

Anonymous, 2020*,* Agricultural Statistics at a Glance. Govt of India, New Delhi, *www. Indiastat.org.*

Dutta, S., Singh, M., Meena, R. K., Onte, S., Basak, N., Kumar, S., & Meena, V. K. (2021). Effect of organic and inorganic nutrient sources on growth, yield, nutrient uptake and economics of fodder cowpea [*Vigna unguiculata* (L.) Walp.]. *Legume Research-An International Journal*, **44**(9), 1046-1052.

Gohil, K.O., Kumar, S. and Jat, A. L. (2017). Effect of plant geometry, seed priming and nutrient management on growth, yield and economics of summer greengram [*Vigna radiata* (L.) Wilczek]. *International Journal of Current Microbiology and Applied Sciences*, **6**(9): 2386-2390.

Katiyar, D., Kumar, S. and Singh, N. (2020). Effect of rhizobium and PSB inoculation on growth, yield attributes and yield of chickpea (*Cicer arietinum* L.). *International Journal of Chemical Studies*, **8**(4): 3729-3734.

Makwana, S. N., Patel, G. G., Patel, H. K., Shiyal, V. N., & Patel, B. K. (2020). Effect of inorganic and organic nutrients on growth and yield of summer green gram (*Vigna radiata* L. Wilczek). *Int. J. Curr. Microbiol. App. Sci*, 11, 730-738.

Marimuthu, S., Gnanachitra, M., Prabu Kumar, G., & Surendran, U. (2023). Effect of organic and inorganic sources of phosphorus for enhancing productivity and phosphorus use efficiency in blackgram under acid soils*. Journal of Plant Nutrition,***46**(9), 1845-1855*.*

Meena, R. S., Dhakal, Y., Bohra, J. S., Singh, S. P., Singh, M. K., Sanodiya, P. and Meena, H. (2015). Influence of bioinorganic combinations on yield, quality and economics of mung bean. *American Journal of Experimental Agriculture*, **8**(3): 159-166.

Meena, S. (2015). Effect of integrated nutrient management on physical and chemical properties of soil. *Agricultural science digest*, **36** (1) 2016: 56-59.

Patel, H. R., Patel, H. F., Maheriya, V. D. and Dodia, I.N. (2013) response of kharif green gram (*vigna radiate* L. wilczek) to sulphur and phosphorus fertilization with and without bio-fertilizer application. *The Bioscan* **8**(1); 149-152.

Patel, V. M., Shah, K. A. and Nayaka, P. (2020). Production potential of summer greengram [*Vigna radiata* (L) wilczek] to different nutrient management practices under south Gujarat condition. *International Journal of Current Microbiology and Applied Sciences*, **9**(4): 1888-1897.

Pattanayak SK, Rao DLN and Mishra KN. 2007. Effect of biofertilizers on yield, nutrient uptake and nitrogen economy of rice–peanut cropping sequence. *Journal of the Indian Society of Soil Science* 55: 184–9.

Rabari, K. V. (2022).Effect of phosphorus and biofertilizers on yield and economics of blackgram*. International Journal of Agriculture Sciences, ISSN, 0975-3710.*

Ruheentaj, Yadahalli, V. G. and Sarawad, I, M. (2020). Effect of integrated nutrient management on yield and uptake of nutrients by mothbean (*Vigna acontifolia*) in northern dry zone of Karnataka. *Journal of Pharmacognosy and Phytochemistry*, **9**(5): 379-383.

Sachan, H. K., Krishna, D., & Prasad, A. (2020). Combined effect of organic and inorganic fertilization on the growth and yield of mung bean (*Vigna radiata*). *Research on Crops*, **21**(4), 676-680.

Singh G, Kumar, P. K. and Sekhon HS. 2019. Effect of various inputs on the growth and yield of summer green gram (Vigna radiata). *Indian Journal of Agricultural Sciences* **78** (1): 87-89.

Somalraju, S., Goyal, G., Singh Gurjar, L., Chaturvedi, M., & Singh, R. (2021). Effect of organic and inorganic fertilizer on the growth and yield of green gram (*Vigna radiata* L.). *The Pharma Innovation Journal*, **10**(12), 1959-1962.

Sudipta Pramanik, S. P., Santanu Das, S. D., & Tarun Paul, T. P. (2019). Influence of organic and inorganic foliar nutrients on green gram (*vigna radiata* L.).

Verma, G., Kumawat, N. and Morya, J. (2017). Nutrient management in mung bean [*Vigna radiate* (L.) Wilczek] for higher production and productivity under semi-arid tract of central India. Int. J. Curr. *Microbial. App. Sci* **6** (7): 488-493.