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Effect of Optimization Use of Nutrient on Yield and Productivity of Mung Bean (*Vigna radiata* L.)

Hitesh Menaria [a*], Bhagwan Suman [a], Om Prakash Gurjar [a] and Brijesh Kumar Meena [a]

[a] Department of Agriculture, Faculty of Agriculture and Veterinary Science, Mewar University, Gangrar, Chittorgarh, Rajasthan, 312901, India.

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

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 optimization use of nutrient on yield and productivity of mung bean, 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 yield attributes such as number of pods per plant (13.35), number of seed per pod (8.52), grain yield (1170.55 kg/ha), stover yield (3260.47 kg/ha) and maximum net return (67329.45 Rs/ha) and B:C ratio (2.28) was recorded with T_8-100% RDF (Refuse-Derived Fuel) + Vermicompost @ 1.0 t ha^{-1} + Rhizobium. The

**Corresponding author: E-mail: hiteshmenariya9057@gmail.com;*

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minimum yield and profitability obtained with control treatment. Therefore, conclude be application of 100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium are indigenous sources of nutrient to enhance yield and productivity of mung bean.

Keywords: Productivity; FYM; vermicompost; yield; mung bean.

1. INTRODUCTION

"Green gram [*Vigna radiata* (L.) Wilczek] is one of the most ancient and extensively grown leguminous crops of India. It is a native of India and Central Asia and commonly known as mung bean. Green gram protein is deficient in methionine and cysteine but rich in lysine making it an excellent complement to rice. It is a good source of mineral, pro-vitamin A, B complex and ascorbic acid. 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}" [1,2].

"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. 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" [3].

"Consumption of chemical fertilizers will also be quite a limiting factor of agricultural production in future. Because of escalating energy cost, chemical fertilizers are not available at affordable price to the farmers. Therefore, there is an urgent need to reduce the usage of chemical fertilizers and in turn increase in the usage of organics is needed to check the yield and quality levels. On the other hand, use of organics alone does not result in spectacular increase in crop yields, due to their low nutrient status. Therefore, the aforesaid consequences have paved way to grow green gram by integration of organic and inorganic fertilizers along with biofertilizers" [4].

"Vermicompost has a higher nitrogen, phosphorus, and potassium content than typical heap manure, making it an excellent alternative to commercial fertilizers. Vermicompost typically contains 0.40–0.75%, 0.13–0.22% P, and 0.6–1.2% N. It also contains significant amounts of nutrients, a sizable population of beneficial microorganisms, and biologically active metabolites, in particular gibberellins, cytokinins, auxins, and group B vitamins" [5].

"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" [6]. "Farmyard manure and vermicompost have been advocated as good organic manure for use in integrated nutrient management programme in field crops. 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%" [7].

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 tan treatments *viz.* T_1-Control, T_2-RDF + Rhizobium, T_3-FYM @ 4 t ha^{-1} + Rhizobium, T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium, T_5-75% RDF + FYM @ 2 t ha^{-1} + Rhizobium, T_6-50% RDF + FYM @ 2 t ha^{-1} + Rhizobium, T_7-Vermicompost @ 2 t ha^{-1} + Rhizobium, T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium, T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium and T_{10}-50% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium. 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 pot from straw yield and grain yield as per market rate.

3. RESULTS AND DISCUSSION

3.1 Yield Attributes and Yield

Data pertaining to effect of different organic and inorganic sources of nutrient on yield attributes and yield are presented in Table 1 and Fig. 1. The organic and inorganic sources of nutrient were showed significant effect on yield attributes and yield of mung bean. The showed that maximum number of pods per plant with T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (13.35), it was at par with T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium and T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (13.25 and 12.76). The minimum number of pods per plant recorded with control treatment (68.58). Singh and Singh [8] Hamza et al. [9] and Yadav et al. [10] reported similar findings. The maximum number of seed per pod with T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (8.52), it was at par with T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium and T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (8.30 and 8.00). The minimum number of seed per pod recorded with control treatment (6.75). The maximum grain yield with T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (1170.55 kg/ha), it was at par with T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium and T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (1145.25 and 1128.45 kg/ha). The minimum grain yield recorded with control treatment (775.25 kg/ha). Solanki et al. [11], Sudipta et al. (2019), Tyagi and Singh [2] and Sachan et al. (2020) stat that same conclusion. The maximum straw yield with T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium (3260.47 kg/ha), it was at par with T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium and T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (3185.45 and 3110.58 kg/ha). The minimum straw yield recorded with control treatment (2536.45 kg/ha). Similar results were reported by Rajkhowa et al. [12], Kinkar [13], Vadgave [14], Kushwaha [15] and Somalraju et al. [16].

Table 1. Effect of different organic and inorganic sources of nutrient on yield attributes and yield of mung bean

Treatments	Number of pods per plant	Number of seeds per plant	Grain yield (kg/ha)	Straw yield (kg/ha)
T_1-Absolute control	10.02	6.75	775.25	2536.45
T_2-RDF + Rhizobium	11.32	8.15	1080.45	3085.45
T_3-FYM @ 4 t ha^{-1} + Rhizobium	10.95	7.82	1018.65	2862.45
T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium	13.25	8.30	1145.25	3260.47
T_5-75% RDF + FYM @ 2 t ha^{-1} + Rhizobium	12.70	7.89	1100.36	3012.45
T_6-50% RDF + FYM @ 2 t ha^{-1} + Rhizobium	11.28	7.75	1052.25	2905.78
T_7-Vermicompost @ 2 t ha^{-1} + Rhizobium	11.00	7.89	1022.47	2935.45
T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium	13.35	8.52	1170.55	3185.45
T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium	12.76	8.00	1128.45	3110.58
T_{10}-50% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium	11.35	7.78	1070.65	3028.85
S. Em. (±)	**0.20**	**0.18**	**15.25**	**50.12**
C.D. at 5%	**0.59**	**0.53**	**45.85**	**151.02**

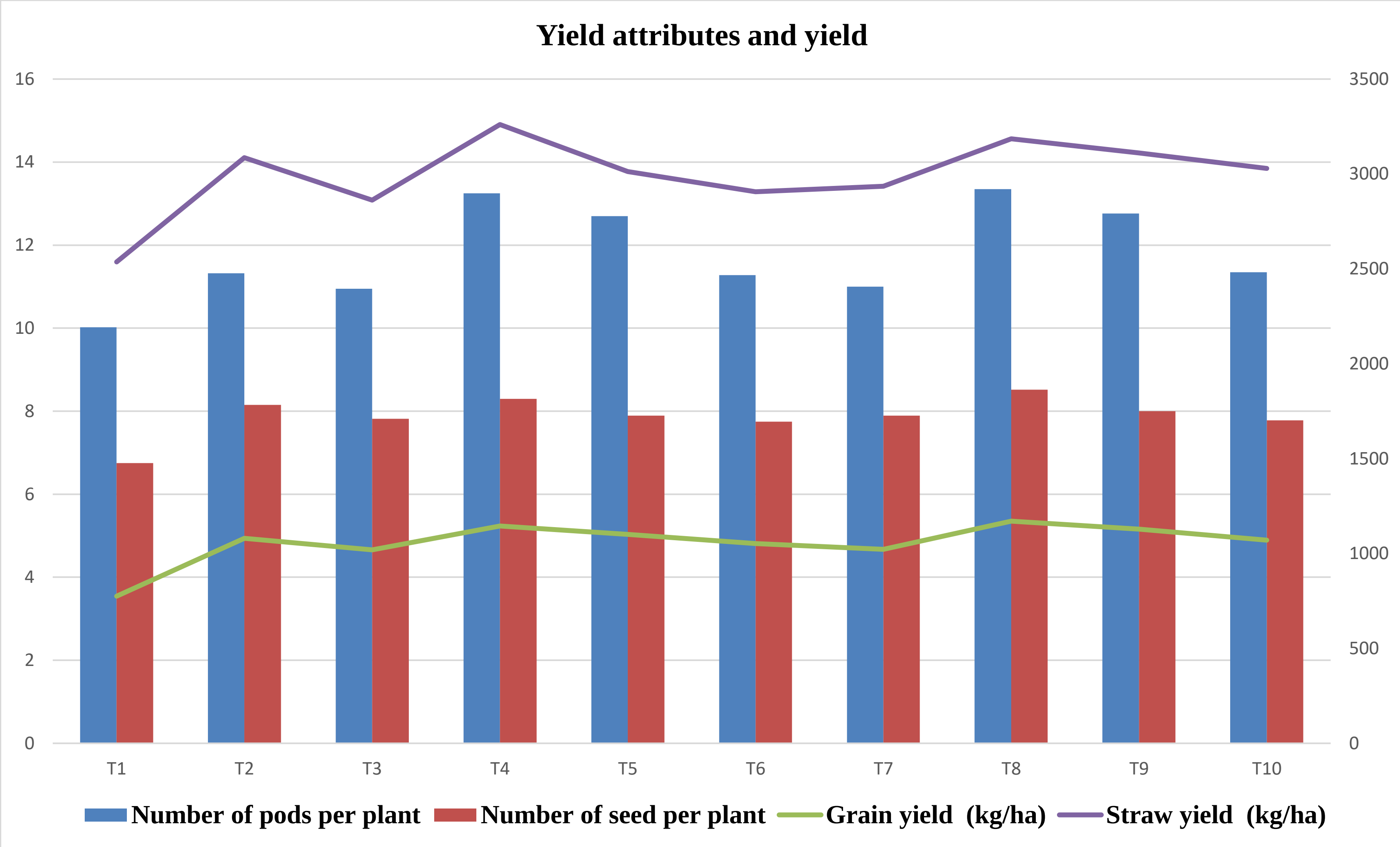

Fig. 1. Effect of vermicompost and zinc application on yield of gram

Table 2. Effect of different organic and inorganic sources of nutrient on economics of mung bean

Treatment	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T_1-Absolute control	24500.00	60500.00	36000.00	1.47
T_2-RDF + Rhizobium	28500.00	76580.00	48080.00	1.69
T_3-FYM @ 4 t ha^{-1} + Rhizobium	27000.00	78250.00	51250.00	1.90
T_4-100% RDF + FYM @ 2 t ha^{-1} + Rhizobium	29500.00	90500.00	61000.00	2.07
T_5-75% RDF + FYM @ 2 t ha^{-1} + Rhizobium	28500.00	85050.00	56550.00	1.98
T_6-50% RDF + FYM @ 2 t ha^{-1} + Rhizobium	26500.00	78500.00	52000.00	1.96
T_7-Vermicompost @ 2 t ha^{-1} + Rhizobium	26300.00	82500.00	56200.00	2.14
T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium	29500.00	96829.45	67329.45	2.28
T_9-75% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium	28500.00	88500.00	60000.00	2.11
T_{10}-50% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium	27500.00	81500.00	54000.00	1.96

3.2 Economics

Data pertaining to effect of different organic and inorganic sources of nutrient on economics presented in Table 2. The organic and inorganic sources of nutrient were showed significant effect on economic variability of mung bean. Data showed that the maximum cost of cultivation was recorded with treatment was recorded T_4 and T_8 (29500 Rs/ha). The minimum cost of cultivation was recorded with control treatment (24500 Rs/ha). The maximum gross return was recorded with treatment was recorded T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (96829.45Rs/ha). The minimum gross return was recorded with control treatment (60500.00 Rs/ha). Patil et al. [17] and Verma et al. [18] supported by similar findings. The maximum net return was recorded with treatment was T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (67329.45Rs/ha). The minimum net return was recorded with control treatment (36000.00 Rs/ha). The maximum B:C ratio was recorded with treatment was recorded T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium (2.28). The minimum B:C ratio was recorded with control treatment (1.47). Similar result also reported by Singh et al*.* [19] and Marimuthu et al*.* [20],[21].

4. CONCLUSION

The findings of present investigation revealed that significant impact of different organic and inorganic nutrient sources on the yield and productivity of the mung bean. Among all treatment T_8-100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium registered the maximum production with higher net return. So, it was concluded that the treatment 100% RDF + Vermicompost @ 1.0 t ha^{-1} + Rhizobium superior among all treatments.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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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