

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 effect of inorganic fertilizer, vermicompost and biofertilizer on growth, yield and nutrient uptake by Mung bean variety “SML-832” was used in this study. 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

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. The moong dal Khichdi is recommended to the ill or aged person

as it is easily digestible and considered as complete diet. Roti with Moong dal and Moong dal chawal is an important ingredient in the average Indian diet. The biological value improves greatly, when wheat or rice is combined with green gram because of the complementary relationship of the essential amino acids. 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 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 intexture, 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 (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 1.0) 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 2.0) 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 3.0) 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 4.0) 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 1.0 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	
T ₁ -Control	14.25	46.12	2.12	6.58	3.40
T ₂ -50% RDF (10:20:00 kg/ha)	16.25	48.75	2.25	7.85	3.52
T ₃ -100% RDF (20:40:00 kg/ha)	17.12	49.52	2.38	8.12	3.65
T ₄ -100% RDF + Vermicompost 2.5 t/ha	18.75	52.15	2.58	8.50	3.92
T ₅ -100% RDF + Vermicompost 2.5 t/ha + Biofertilizer	19.25	52.96	2.65	8.62	4.15
T ₆ -75% RDF (15:30:00 kg/ha)	16.85	49.25	2.32	7.94	3.60
T ₇ -75% RDF + Vermicompost 2.5 t/ha	17.75	50.10	2.42	8.24	3.85
T ₈ -75% RDF + Vermicompost 2.5 t/ha + Biofertilizer	18.50	51.75	2.51	8.44	3.98
T ₉ -Vermicompost 5 t/ha + Biofertilizer	18.20	51.36	2.48	8.36	4.25
S. Em. \pm	0.27	0.42	0.05	0.06	0.09
CD at 5%	0.82	1.25	0.13	0.19	0.28

Table 2.0 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)
T ₁ -Control	15.25	7.25	8.95	8.95	11.30
T ₂ -50% RDF (10:20:00 kg/ha)	17.63	7.85	9.45	9.45	12.52
T ₃ -100% RDF (20:40:00 kg/ha)	18.12	8.32	10.25	10.25	12.68
T ₄ -100% RDF + Vermicompost 2.5 t/ha	18.95	9.05	12.48	12.48	13.20
T ₅ -100% RDF + Vermicompost 2.5 t/ha + Biofertilizer	19.22	9.45	13.25	13.25	13.70
T ₆ -75% RDF (15:30:00 kg/ha)	17.85	8.16	9.82	9.82	12.82
T ₇ -75% RDF + Vermicompost 2.5 t/ha	18.32	8.45	10.62	10.62	14.70
T ₈ -75% RDF + Vermicompost 2.5 t/ha + Biofertilizer	18.74	8.85	11.88	11.88	12.75
T ₉ -Vermicompost 5 t/ha + Biofertilizer	18.44	8.70	11.02	11.02	15.62
S. Em. \pm	0.17	0.21	0.47	0.47	0.65
CD at 5%	0.51	0.60	1.39	1.39	1.97

Table 3.0 Effect of different nutrient combination on nutrient content in mung bean

Treatments	N content %		P content %		K content %	
	Grain	Straw	Grain	Straw	Grain	Straw
T ₁ -Control	3.30	1.20	0.44	0.20	0.82	1.28
T ₂ -50% RDF (10:20:00 kg/ha)	3.35	1.28	0.48	0.24	0.85	1.34
T ₃ -100% RDF (20:40:00 kg/ha)	3.45	1.38	0.50	0.26	0.92	1.44
T ₄ -100% RDF + Vermicompost 2.5 t/ha	3.64	1.50	0.62	0.39	1.01	1.56
T ₅ -100% RDF + Vermicompost 2.5 t/ha + Biofertilizer	3.70	1.53	0.66	0.43	1.05	1.60
T ₆ -75% RDF (15:30:00 kg/ha)	3.40	1.32	0.52	0.28	0.89	1.39
T ₇ -75% RDF + Vermicompost 2.5 t/ha	3.48	1.42	0.53	0.30	0.94	1.47
T ₈ -75% RDF + Vermicompost 2.5 t/ha + Biofertilizer	3.60	1.48	0.59	0.36	0.99	1.53
T ₉ -Vermicompost 5 t/ha + Biofertilizer	3.55	1.45	0.55	0.33	0.96	1.50
S. Em. \pm	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 4.0 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
T ₁ -Control	29.54	23.23	3.94	3.87	7.34	24.78
T ₂ -50% RDF (10:20:00 kg/ha)	31.66	27.20	4.54	5.10	8.03	28.48
T ₃ -100% RDF (20:40:00 kg/ha)	35.36	32.36	5.13	6.10	9.43	33.77
T ₄ -100% RDF + Vermicompost 2.5 t/ha	45.43	41.48	7.74	10.78	12.60	43.13
T ₅ -100% RDF + Vermicompost 2.5 t/ha + Biofertilizer	49.03	44.55	8.75	12.52	13.91	46.59
T ₆ -75% RDF (15:30:00 kg/ha)	33.39	28.88	5.11	6.13	8.74	30.41
T ₇ -75% RDF + Vermicompost 2.5 t/ha	36.96	34.02	5.63	7.19	9.98	35.22
T ₈ -75% RDF + Vermicompost 2.5 t/ha + Biofertilizer	42.17	38.06	6.53	8.66	11.40	39.38
T ₉ -Vermicompost 5 t/ha + Biofertilizer	39.67	37.22	6.50	9.05	10.91	38.48
S. Em. \pm	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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