Original Research Article

INFLUENCE OF VARIOUS ORGANIC AMENDMENTS ON GROWTH AND YIELD ATTRIBUTES OF MUNG BEAN *(Vigna radiata* L.)

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ABSTRACT

A field experiment was conducted during summer season of 2022 to study the influence of various organic amendments on various attributes of growth and yield of mung bean. The experiment was laid out in four replication with 11 treatments in (RBD) Randomized Block design. The results revealed that the highest plant height (52.8 cm), number of leaves plant^{-1} (35.3), number of branches plant^{-1} (11.1), chlorophyll content (58.4), leaf area index (1.85) was recorded from combined application of T11= RDF + Vermicompost + Jeevamrutam + Rhizobium. Similarly for yield attributes the highest number of pods plant^{-1} (31.35), pods length (11.05 cm), number of grins pods^{-1} (12.2), test weight (45.7 g) , grain yield (1242.5 kg ha^{-1}), straw yield (2181.1 kg ha^{-1}), biological yield (3405.3 kg ha^{-1}) and harvest index (36%) was recorded in combined application of same treatment T11. The result showed that combined application of organic manures had positive effects on growth and yield parameters of mung bean.

Keywords: RDF, Vermicompost, Jeevamrutam, Rhizobium and RBD.

1. INTRODUCTION

Mung bean, a member of the Fabaceae family, is an ancient pulse crop that originated from Southeast Asia and has been widely cultivated for human consumption [1]. It can be consumed in various forms including boiled dry beans, stew, flour, sprouts and immature pods as a vegetable. Additionally, the roasted or boiled dry beans can be used for animal food, especially poultry, while its biomass can serve as fodder [2]. Overall, mung bean is a valuable source of cheap protein for human and animal consumption [3].

India is the leading producer of mung bean globally ranks third among important pulse crops grown in India. It covers around 16% of the total pulse area of the country. The crop is cultivated in about 4.5 million hectares with a total production of 2.5 million tonnes, which contributes around 10% to the total pulse production. The third advance estimates by the Government of India in 2020-21 suggest a mung bean production of 2.64 million tonnes (India stat mung bean outlook report, 2021). However, despite the significance of pulses for protein requirements, the availability of pulses in India is only around 40 grams per capita per day, which falls far below under daily intake recommendation of 85 grams of pulses per capita (FAO/WHO recommendations).

Organic amendments refer to natural products that are derived from organic sources such as animal waste, vegetable compost, agricultural residues, and human excreta. Rhizobium, vermicompost, and liquid formulations of jeevamrutam are biological products mix with the soil, providing plant nutrients and increasing soil fertility, organic matter, microbial activity, and aggregate stability. Rhizobium, in particular known for its ability to enhance biological fixation of atmospheric nitrogen into ammonia and improve phosphorus availability to crops [4-5].

Vermicompost is an organic amendment that is rich in nutrients, containing high levels of humus, 3% nitrogen, 1% P2O5, 1.5% K2O, micronutrients, and beneficial soil microbes like nitrogen-fixing bacteria and mycorrhizal fungi. Scientific research has proven that vermicompost is an effective enhancer of plant growth [6]. Vermicomposting involves the biological degradation of organic waste by earthworms to form vermicast by Edwards and Burrows [7]. Studies by Ansari and Ismail [8] have shown that vermicast produced by worms contains 7.37% nitrogen and 19.58% P2O5.

Jeevamrutam is a natural fertilizer made from cow dung, cow urine, pulse flour, jaggery, and a small amount of soil to increase the microbial population. It is a highly effective plant growth stimulant that enhances the biological efficiency of crops. It is used to activate soil and protect plants from diseases and increases the nutritional quality of fruits and vegetables by Devakumar *et al*. [9]. Cow urine is an excellent source of plant nutrients and has anti-fungal properties.

2. MATERIALS AND METHODS

The field experiment was conduct at Agriculture research farm of Lovely Professional University, Phagwara, Punjab during *Spring* season of 2022. The experiment was conducted using a randomized block design (RBD) with four replications and each plot measurement covered an area of 3m x 5m. The variety SML-668 was used for sowing green gram. Treatment considering three level of organic manures *viz.* Vermicompost, Rhizobium and Jeevamrutam. in the experiment, which consisted of 11 treatments labelled as T1- control, T2- Rhizobium, T3- Jeevamrutam, T4- Vermicompost, T5- Vermicompost + Rhizobium + Jeevamrutam, T6- Recommended Dose of Fertilizer or RDF, T7- RDF + Rhizobium, T8- RDF + Rhizobium + Jeevamrutam, T9- RDF + Vermicompost, T10- RDF + Vermicompost + Rhizobium and T11- RDF + Vermicompost + Rhizobium + Jeevamrutam.

The growth attributes *viz.* plant height (cm), number of leaves plant^{-1} and number of branches recorded at harvest whereas Leaf area index and Chlorophyll index at 55 DAS. Yield parameters *viz.* number of pods plant^{-1}, Pod length (cm), Number of grains pod^{-1} recorded at harvest whereas test weight (g), grain yield, Straw yield, Biological yield (kg ha-1) and Harvest index (%) recorded after threshing.

2.1 Formula Used

Where, Leaf area index was recorded in cm by formula: $\frac{Leaf\ area\ per\ plant}{Ground\ area}\ X\ 100$

Harvest index was recorded by in % by formula: $\frac{Economic\ yield}{Biological\ \text{yield}}\ X\ 100$

2.2 Statistic Analysis

To determine the impact of different treatments s used in the experiment, statistical analysis of data was performed using the OPSTAT software with a 95% confidence level. This means that the obtained results are considered statistically significant, with a probability of less than 5% that they are due to chance.

3. RESULTS AND DISCUSSION

3.1 Growth attributes

The data presented in Table 1 and Fig. 1 revealed crop growth and development measured in the terms of plant height (cm), number of leaves plant $^{-1}$, number of branches plant^{-1}, chlorophyll content and Leaf area index (%).

Table 1. Influence of organic amendments on growth attributes of mung bean

TREATMENT		GROWTH ATTRIBUTES				
		Plant height (cm)	No of leaves plant $^{-1}$	No of Branches Plant^{-1}	Chlorophyll content	Leaf Area Index
T_c	T1	37.5	21.5	6.5	44.1	1.22
T_R	T2	40.0	26.6	8.2	50.1	1.48
T_J	T3	38.7	22.4	6.8	46.9	1.33
T_V	T4	39.8	25.7	7.9	49.7	1.37
T_{V+R+J}	T5	42.7	29.6	9.2	50.5	1.50
T_{RDF}	T6	44.5	30.8	9.6	54.8	1.54
T_{RDF+R}	T7	47.2	31.7	9.9	55.4	1.63
$T_{RDF+R+J}$	T8	49.5	32.3	10.1	56.0	1.69
T_{RDF+V}	T9	46.4	30.5	9.5	51.9	1.58
$T_{RDF+V+R}$	T10	49.9	34.1	10.7	57.1	1.76
$T_{RDF+V+R+J}$	T11	52.8	35.3	11.1	58.4	1.85
LSD (0.05)		**3.52**	**2.15**	**0.90**	**3.19**	**0.13**

T_c = Control, T_R = Rhizobium, T_J = Jeevamrutam, T_V = Vermicompost, T_{V+R+J} =Vermicompost + Rhizobium + Jeevamrutam, T_{RDF} = Recommended dose of fertilizers, T_{RDF+R} = Recommended dose of fertilizers + Rhizobium, $T_{RDF+R+J}$ = Recommended dose of fertilizers + Rhizobium + Jeevamrutam, T_{RDF+V} = Recommended dose of fertilizers + Vermicompost, $T_{RDF+V+R}$ = Recommended dose of fertilizers + Vermicompost + Rhizobium, $T_{RDF+V+R+J}$ = Recommended dose of fertilizers + Vermicompost + Rhizobium + Jeevamrutam.

3.1.1 Plant height

The data recorded at harvest revealed that the plant height in the treatment T2, T3 and T4 failed to cause any significant increase in plant height as compared to control (T1), while plant height in the treatment T5, T6, T7, T8, T9, T10 and T11 were significantly higher than control. The highest plant height was observed in the treatment T11 that was significantly higher than T5, T6, T7 and T9 whereas T8 and T10 were statistically similar with T11. The findings reported are in agreement with the results obtained by [10-13].

3.1.2 Number of leaves plant^{-1}

The data recorded at harvest revealed that the number of leaves plant^{-1} in the treatment T3 failed to cause any significant increase in the number of leaves plant^{-1} as compared to control, while number of leaves plant^{-1} in the treatment T2, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than control. The highest number of leaves plant^{-1} was observed in the treatment T11 that was significantly higher than T5, T6, T7, T8 and T9 whereas T10 was statistically similar with T11. Similar findings reported were consistent with the results obtained by [11-13].

3.1.3 Number of branches plant^{-1}

The data recorded at harvest revealed that the number of branches plant^{-1} in the treatment T3 failed to cause any significant increase in the number of branches plant^{-1} as compared to control, while number of branches plant^{-1} in the treatment T2, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than control. The highest number of branches plant^{-1} was observed in the treatment T11 that was significantly higher than T5, T6, T7 and

T9 whereas T10 and T8 was statistically similar with T11. [11-13 and 14] also reported similar results.

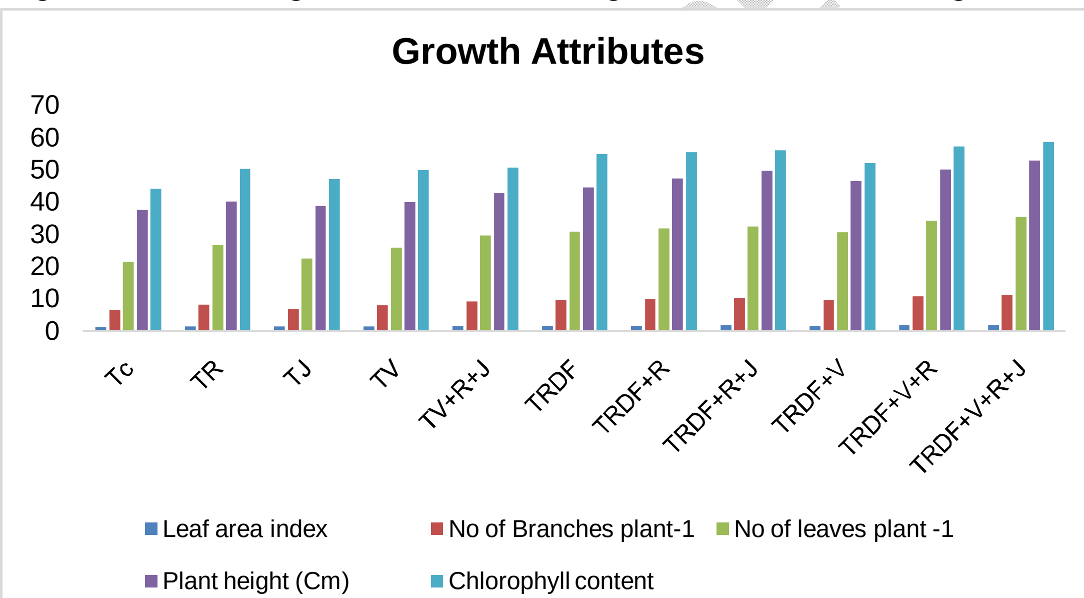
3.1.4 Chlorophyll content

The data recorded at 55 DAS revealed that the chlorophyll content in the treatment T3 failed to cause any significant increase in the chlorophyll content as compared to control, while chlorophyll content in the treatment T2, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than control. The highest chlorophyll content was observed in T11 that was significantly higher than T5 and T9 whereas T6, T7, T8 and T10 were statistically similar with T11. [12] also reported similar results.

3.1.5 Leaf Area Index

The data recorded at 55 DAS revealed that the leaf area index in the treatment T3 and T4 failed to cause any significant increase in leaf area index as compared to control while, leaf area index in the treatment T2, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than control. The highest LAI was observed in T11 that was significantly higher than T5, T6, T7, T8 and T9 whereas T10 were statistically similar with T11. [12-13] also reported similar results.

Fig.1 Influence of organic amendments on growth attributes of mung bean



3.2 Yield attributes

The data presented in Table 2 and Fig.2. yield and yield attributes on mung bean was measured in the terms of number of pods plant^{-1}, pods length, number of grains pod $^{-1}$, test weight, grain yield, straw yield, biological yield and harvest index.

3.2.1 Number of pods plant^{-1}

The data recorded at harvest revealed that the highest number of pods plant^{-1} of mung bean was recorded by treatment T11and the lowest number of pods plant^{-1} was recorded by treatment T1. Number of pods plant^{-1} in the treatment T2, T3, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than T1. The number of pods plant^{-1} in T2 was significantly higher than T3 and T4 whereas T5 was statistically similar with T6. The number of pods plant^{-1}in T11 was significantly higher than T7, T8 and T9 while T11 was statistically similar with T10. Similar findings reported were consistent with the results obtained by [14-15].

3.2.2 Pods length (cm)

The data recorded at harvest revealed that the highest pods length of mung bean was recorded by treatment T11 and the lowest pods length was recorded by treatment T1. The pods length in treatment T3 failed to cause significant increase as compared to T1 while, pods length in T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than control. The pods length in T5 was significantly higher than T3 and T4 but statistically similar with T2. The pod length in the treatment T11 was significantly higher than T6, T7, T8, and T9 while T11 was statistically similar with T10. The outcomes reported are consistent with the results obtained by [16-17].

3.2.3 Number of grains pod^{-1}

The data recorded at harvest revealed that the highest number of grains pod^{-1} of mung bean was recorded by treatment T11and the lowest number of grains pod^{-1} was recorded by treatment T1. The number of grains pod^{-1} in the treatment T3 failed to cause any significant increase as compared to T1while, number of grains pod^{-1} in T2, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than T1. The number of grains pod^{-1} in T5 was significantly higher than T3 and T4 but statistically similar with T2. The number of grains pod^{-1} in T11 was significantly higher than T6, T7, T8, T9 and T11. [14-15 and 17] also reported similar results.

3.2.4 Test weight

The data recorded after threshing revealed that the highest test weight of mung bean was recorded by treatment T11 and the lowest test weight was recorded by treatment T1. The test weight in the treatment T3 failed to caused any significant increase as compared to T1 while treatment T4 was statistically similar with T1. The test weight in T2, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than T1 however, test weight in T5 was significantly higher than T2, T3 and T4. The test weight in T11 was significantly higher than T6, T7 and T9 while T11 was statistically similar with T8 and T10. [14 and 16] also reported similar results.

3.2.5 Grain yield (kg ha^{-1})

The data recorded after threshing revealed that the highest grain yield of mung bean was recorded by treatment T11 and the lowest grain yield was recorded by treatment T1. The grain yield in the treatment T3 failed to cause any significant increase as compared to T1 while, grain yield in T2, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than T1. However, grain yield in T5 was significantly higher than T2, T3 and T4. The grain yield in T11 was significantly higher than T6, T7, T8, T9 and T10. The outcomes reported are consistent with the results obtained by [14-15, 17-18].

3.2.6 Straw yield (kg ha^{-1})

The data recorded after threshing revealed that the highest straw yield of mung bean was recorded by treatment T11 and the lowest straw yield was recorded by treatment T1. The straw yield in the treatment T3 and T4 failed to cause any significant increase as compared to T1 while, straw yield in T2, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than T1. However, straw yield in T5 was significantly higher than T3 and T4 while statistically similar with T2. The straw yield in T11 was significantly higher than T6, T7, T8 and T9 and T11 was statistically similar with T10. These results are in accordance with [15 and 17].

3.2.7 Biological yield (kg ha^{-1})

The data recorded after threshing revealed that the highest biological yield of mung bean was recorded by treatment T11 and the lowest biological yield was recorded by treatment T1. The biological yield in T2, T3, T4, T5, T6, T7, T8, T9, T10 and T11 were significantly higher than T1. However, biological yield in T5 was significantly higher than T2, T3 and T4. The biological yield in T11 was significantly higher than T6, T7, T8, T9, and T10. [16] also reported similar results.

3.2.8 Harvest index (%)

The harvest index is the proportionality of grain yield to the biological yield multiplied by 100. The data recorded after threshing revealed that the highest harvest index of mung bean was recorded by treatment T11 and the lowest harvest index was recorded by treatment T3. The harvest index in T2, T4 and T9 were statistically similar with T1 while treatment T11 was significantly higher than T7, T8 and T10. However, harvest index in T5 was statistically similar with T6. The biological yield in T11 was significantly higher than T6, T7, T8, T9, and T10. [16 and 18] also reported similar results.

Fig. 2. Influence of organic amendments on yield attributes of mung bean

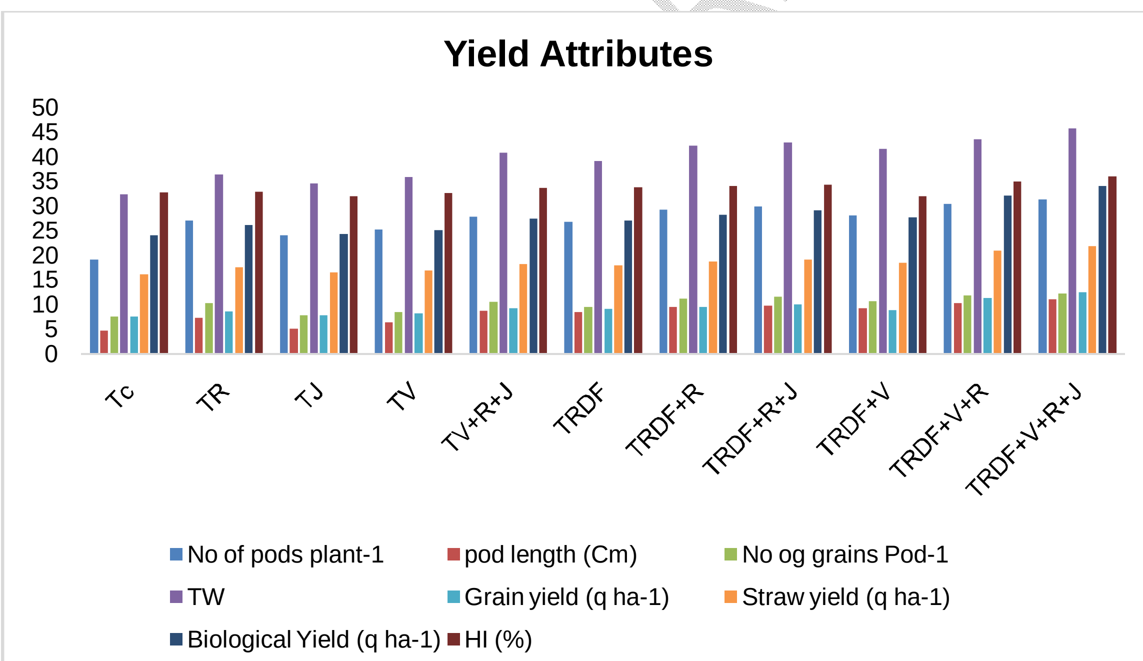


Table 2. Influence of organic amendments on yield attributes of mung bean

YIELD ATTRIBUTES									
TREATMENT		**No of pods plant^{-1}**	**Pods length (cm)**	**No of grains Pod^{-1}**	**Test weight (g)**	**Grain yield (kg ha^{-1})**	**Straw yield (kg ha^{-1})**	**Biologica l yield (kg ha^{-1})**	**Harvest index (%)**
T_c	**T1**	19.10	4.73	7.5	32.4	748.5	1612.5	2397.0	32.7
T_R	**T2**	27.00	7.33	10.3	36.3	855.5	1750.9	2606.8	32.8
T_J	**T3**	24.00	5.03	7.8	34.6	778.0	1654.0	2432.3	31.9
T_V	**T4**	25.20	6.40	8.4	35.8	816.5	1688.0	2504.8	32.6
T_{V+R+J}	**T5**	27.85	8.70	10.5	40.8	926.3	1815.5	2741.3	33.7
T_{RDF}	**T6**	26.80	8.38	9.5	39.1	911.5	1785.8	2696.8	33.8
T_{RDF+R}	**T7**	29.20	9.50	11.2	42.2	952.3	1871.5	2823.5	34.0
$T_{RDF+R+J}$	**T8**	29.85	9.80	11.6	42.8	995.3	1908.0	2903.0	34.3
T_{RDF+V}	**T9**	28.05	9.23	10.7	41.5	883.6	1838.8	2767.3	32.0
$T_{RDF+V+R}$	**T10**	30.40	10.28	11.8	43.5	1127.3	2086.3	3212.5	35.0
$T_{RDF+V+R+J}$	**T11**	31.35	11.05	12.2	45.7	1242.5	2181.1	3405.3	36.0
LSD (0.05)		**1.67**	**1.19**	**0.67**	**3.00**	**38.52**	**128.07**	**31.64**	**0.90**

T_c = Control, T_R = Rhizobium, T_J = Jeevamrutam, T_V = Vermicompost, T_{V+R+J} =Vermicompost + Rhizobium + Jeevamrutam, T_{RDF} = Recommended dose of fertilizers, T_{RDF+R} = Recommended dose of fertilizers + Rhizobium, $T_{RDF+R+J}$ = Recommended dose of fertilizers + Rhizobium + Jeevamrutam, T_{RDF+V} = Recommended dose of fertilizers + Vermicompost, $T_{RDF+V+R}$ = Recommended dose of fertilizers + Vermicompost + Rhizobium, $T_{RDF+V+R+J}$ = Recommended dose of fertilizers + Vermicompost + Rhizobium + Jeevamrutam.

4. CONCLUSION

From the above results it can be concluded that the combination of organic and inorganic fertilizers is more productive compared to sole application of organic as well as inorganic fertilizers. By combining both organic and inorganic fertilizers we got highest growth and yield parameters. The combination of organic and inorganic fertilizers have positive effects on the growth and yield parameters of mung bean. From my research I concluded that the highest plant height (52.8 cm), number of leaves plant^{-1} (35.3), number of branches plant^{-1} (11.1), chlorophyll content (58.4), leaf area index (1.85)was recorded from combined application of RDF + vermicompost + jeevamrutam + Rhizobium similarly for yield parameters the highest number of pods plant^{-1} (31.35), pods length (11.05 cm), number of grins pods^{-1} (12.2), test weight (45.7 g) , grain yield (1242.5 kg ha^{-1}), straw yield (2181.1 kg ha^{-1}), biological yield (3405.3 kg ha^{-1}) and harvest index (36%) was recorded in combined application of RDF + vermicompost + jeevamrutam + Rhizobium. Therefore, I recommended farmers to use combine application of organic and inorganic fertilizers instead of using their sole application.

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