Effect of Organic Manures and Biofertlizer on Yield Attributes, Yieldand Economic of Mung Bean (*Vigna radiata*)

ABSTRACT

Background: Pulses are significant in India's agricultural economy not only for their worth as human food, but also for animals because of their high protein content. Due to pulses deep roots and great ground cover, pulses are drought tolerant and minimize soil erosion and are known as a "Marvel of Nature" because of these positive qualities. Mung bean, also known as green gram (*Vigna radiata*) is a small green, and cylindrical-shaped legume that is widely cultivated in various parts of the world, including India, China, and Southeast Asia.

Methods: The present study was carried out during the *summer* season of 2024 at Research Farm, School of Agriculture, OM Sterling Global University, Hisar. Seven treatment combinations comprising organic manures and biofertilizer were tested in randomized block design in three replications.

Result: The results revealed that the Yield and yield attributes*viz.*,Number of pods per plant (15.90), Length of pod per plant (10.76cm), Number of seed per pod (11.05), 1000 grain weight per plant (37.00 g) andgrain yield (1197kgha^{-1}). Were significantly maximum in the treatment of Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB. Whereas, significantly minimum for all above parameters were recorded under control.

Key Words: Mung bean, organic manures, bio fertilizer, Yield and yield attributesand economics

INTRODUCTION

Pulses referred to as food legumes, and are secondary to cereals in production and consumption in India. These are drought resistant and prevent soil erosion due to their deep root system and good ground cover hence; pulses are called as “Marvel of Nature”. The World Health Organization (WHO) recommends per capita consumption of pulses @ 80 g day^{-1} and the Indian Council of Medical Research (ICMR) has recommended a minimum consumption of 47 g per day. The protein hunger is the major problem in the country, were majority of population adopt cereals and millet based dietary habits (Anonymous, 2020). Green gram is known as the "Queen of Pulses" because of its superior nutritional value.

Green gram is native to East Asia, Southeast Asia and the Indian Subcontinent. Green gram grains contain 22-28% protein, 60-65% carbohydrates, 1.0-1.5% fat, minerals 3.5%, 3.5-4.5% fibre and 4.5-5.5% ash. These seeds are more flavorful, nutritious, digestible, and non-flatulent than other pulses growing in the nation. It is a good source of protein with high quality lysine (460 mg g^{-1} N), tryptophan (60 mg g^{-1} N) and low anti-nutritional components. It also has a high concentration of ascorbic acid and riboflavin with a value of 0.21 mg 100^{-1} g (Azadi *et al.*, 2013). It is India's third most significant pulse crop, accounting for 16 and 10% of total pulse acreage and production, respectively. Green gram is grown on 4.5 million hectares in India, with a production of 2.5 million tonnes and a productivity of 548 kg per hectare (Anonymous, 2020). Green gram is mainly cultivated in the states of Rajasthan, Madhya Pradesh, Punjab, Haryana, U.P., Maharashtra, Karnataka Andhra Pradesh and Tamil Nadu.

Improper application of synthetic fertilizers in agricultural field will leads to various health risks and environmental challenges. Save our environment and our crops we have to follow eco-friendly and sustainable agriculture. Reducing the use of harmful chemicals and fertilizers decrease the ratio of this type of problems.In current era of rapidly growing population is exerting significant pressure on agriculture to meet their nutritional food requirement throughout the world and to achieve the current demand of food requirement, farmers are depending more on chemical fertilizers to achieve maximum productivity per unit area. However, the efficiency of the chemical fertilizers already reached a plateau due to their unsystematically use and resulted in poor soil fertility status of the agriculture fields, In addition to accumulation of toxic substances in the harvested produces and the cost of inorganic fertilizers is increasing enormously to an extent that they are not affordable by the small and marginal farmers. In this context, there is a need to identify the suitable substitute in place of chemical fertilizers which are economically cheaper and eco-friendly. At present, the use of organic fertilizers either bulky or liquid organic manures plays an important role to sustain the soil health as well as productivity of the crops (Verma *et al.*, 2018).

Organic matter acts as a reservoir of plant nutrients, chiefly N, P and S and it improves cation exchange capacity of soil (Brady and Weil, 2008).In Agriculture manures such as farmyard manure, vermicompost, poultry manure, etc. are used as sources of nutrients. These manures assist in maximizing crop output and desired quality while also ensuring balanced nutrient proportions, closing the current large gap between nutrient removal and supply, and improving response efficiency. Among the organic manures, FYM is rich in organic matter, and it is a good source of plant nutrients. It helps to buffer soils against rapid chemical changes. FYM can potentially be used as a source of energy for soil microorganisms, improvement in physical properties of soil, organic carbon and available nitrogen, phosphorus and potassium were found due to long term application of FYM and fertilizer (Babulkar et al., 2000). Vermicompost is created by vermicomposting of organic material through interactions between earthworms and microorganisms. The continued use of chemical fertilizers causes health and environmental hazards such as ground and surface water pollution by nitrate leaching (Eswaran and Mariselvi, 2016). Stimulation of plant growth mainly depends on the biological characteristics of vermicompost, the plant species used and the conditions of cultivation. Poultry manure (PM) has gained attention as a potential source of organic fertilizerbecause of its high nutrient content and relatively low cost. PM, which is rich in nitrogen, phosphorus, potassium, and other essential nutrients, has been shown to improve soil fertility, increase crop yield and enhance the quality of agricultural products. (Mutale-Joan et al., 2020).

Organic concoctions like Jeevamrutha/Jeevamrutha which is a microbial culture prepared from the on-farm inputs like cow dung, urine, jiggery and pulse flour has been found a suitable formulation in natural farming to meet the nutritional demands of the crops. Jeevamrutha is a traditional fermented liquid organic concoction commonly used as soil microbial enhancer in natural farming. Bio-fertilizers, a component of integrated nutrient management are considered to be cost effective, eco-friendly and renewable source of non-bulky, low cost of plant nutrient supplementing chemical fertilizers in sustainable agriculture system in India. Their role assumes a special significance in the present context of high costs of chemical fertilizers. Considering these above facts, the present study was conducted to assess the effect of organic manures and biofertilizer on yield attributes, grain yield and economic of mung bean (Vigna radiata).

MATERIALS AND METHODS

The present study was carried out during *the summer* season of 2024 at Research Farm, School of Agriculture of OM Sterling Global University, Hisar. Situated in the subtropics at 29°10′ N latitude and 75°46′ E longitudes at an elevation of 215.2 meters above mean sea level in Haryana, India. The place has a typical semi-arid climate with severe cold during winter and hot, dry desiccating winds during summer. During crop growing period the weekly highest and lowest maximum mean temperature were recorded 37.1 ºC and 14.2 in 3rd and 17th and highest and lowest minimum mean temperature were recorded 4.9 ºC and 18.8 in 3rd and 17th meteorological standard weeks, respectively. The weekly mean lowest and highest wind velocity was 1.6 km hr^{-1} and 5.5 km hr^{-1} in 7th and 8th standard weeks, respectively. The weekly mean minimum and maximum relative humidity was recorded 55.5 % and 99.6% in morning during 3rd and 15th standard weeks and 18.1 % and 79 % in evening during 15th and 5th standard weeks, respectively. Weekly mean maximum and minimum sunshine of 9.1 hrs and 1.7 hrs per day were recorded on 17th and 5th weeks, respectively. The data show that the total amount of rainfall received during the crop growing period was 9.0 mm.The soil of the experimental field was sandy loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experimentconsisting of seven treatment combinations comprising of organic manures and biofertilizer were tested in randomized block design in three replications.

During the experiment, the standard package of practices was considered for mung bean crop.The plot size maintained was 3.6 m*2.0 m high yielding MH 1142 variety was taken for the study. The plant to plant spacing was 10 cm and row to row spacing was 30 cm. The farmyard manure, poultry manure and vermicompost doses were calculated according to the treatment for each plot. FYM, poultry manure and vermicompost were applied 15 days before sowing and incorporated five days before sowing in respective plots as per treatment specification.Rhizobium and PSB inoculation: 25 g of jaggery was boiled in one half liter water and then cooled, 50 g of culture was mixed in jaggery solution. The required quantity of seed was thoroughly mixed with the paste of culture to inoculate them with Rhizobium/PSB, then the seeds were allowed to dry in shade and after dried applied as per treatments.Weeding, hoeing and plant protection measures were carried out as per recommendations at appropriate times.

Data were recorded on yield attributesand yield*i.e.*,number of pods per plant, length of pod per plant (cm), number of seed per pod, 1000 grain weight per plant, grainyield and economics *i.e.*,cost of cultivation, gross returns, net returns and benefit-cost ratio as per standard procedure. Data collected during the study were statistically analyzed by using the technique of analysis of variance (ANOVA) described by (Cochran and Cox, 1959).

RESULTS AND DISCUSSION

1.Yield attributes and Yield

Data on various yield attributing characters and yield*viz.*, number of pods per plant, pod length (cm), number of seeds per pod and 1000 grain weight per plant (g) by various organic manures and biofertilizer treatments are presented in Table 1and depicted in Fig. 1.

Significantly higher number of pods per plant (15.90),pod length (10.76 cm), number of seeds per pod (11.05) and 1000 grain weight per plant (37.00 g)was recorded under application treatment of Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB (T_7) as compared to other treatments. Significantly lower number of pods per plant (10.67), pod length (6.40 cm), number of seeds per pod (8.13), and 1000 grain weight per plant (29.67 g) was recorded under treatment control (T_1).Grain yield was significantly influenced by different organic manures and biofertilizer. Among the treatments, treatment T_7 recorded significantly higher grain yield (1,197 kg ha^{-1}) as compared to other treatments. Whereas, significantly lower grain yield (824 kg ha^{-1}) was recorded under control (T_1).The larger number of pods $plant^{-1}$ and seeds pod^{-1} could be due to the maximal nutritional enrichment, as well as good vegetative development and photosynthate translocation. Organic treatments may have provided the crop with micro and macro nutrients as well as growth-promoting chemicals, resulting in an increase in the number of pods $plant^{-1}$ and seeds pod^{-1}. Due to the cumulative effect of yield attributes, like number of pods $plant^{-1}$, number of seeds pod^{-1} and slight improvement in test weight which were the important yield attributes having significant positive correlation with seed yield. Crop yield is the result of a complex interaction of physiological and biochemical processes that alter the anatomy and morphology of growing plants. According to Natarajan (2002) foliar spraying jivamrut was beneficial in the majority of crops. The present trend of increase in seed yield with application of organics and bio fertilizers were also observed by (Patel *et al.*, 2013; Shariff *et al.*, 2017). The improvement in yield attributes and yields with panchagavya and jeevamrut treatment could be attributed to the fact that cow excrement in panchagavya acts as a medium for the growth of beneficial bacteria, and cow urine offers nitrogen, which is necessary for crop growth (De Britto and Girija, 2006). These findings were in line with the finding of Patil *et al.* (2012). Combined application of panchagavya at 4% as foliar spray and jeevamrutha at 500 L ha^{-1} as soil application recorded significantly higher pod yield and haulm yield of soybean as against the yield under recommended dose of fertilizers (Patel *et al.*, 2018).Application of jeevamrutha at 1000 L ha^{-1} and panchagavya at 7.5% recorded significantly higher yield attributes like number of pods $plant^{-1}$, number of seeds pod^{-1}, seed weight g $plant^{-1}$and ultimately higher grain yield and haulm yield of cowpea as compared to control (Sutar *et al.*, 2019). Similar results was also observed by Shwetha (2008) who reported 25–35% increase in seed yield of soybean with the application of beejamrut, jeevamrut and panchagavya along with different organic manures. Palekar (2006), and Devakumar *et al.* (2008) reported the beneficial effects of jeevamrut which was attributed to high microbial population and enzymes which in turn might have availability and uptake of nutrients and growth hormones which ultimately have resulted in better yield of crops. Due to the beneficial effect of jeevamrut cause more vigorous and extensive root system of crops leading to increased vegetative growth means for more efficient sink formation and greater sink size, greater carbohydrate translocation from vegetative plant parts to the grains and higher dry matter accumulation during grain filling period. It also increased biological efficiency of crop plants and enhanced the level of soil enzymes activities and promoted the recycling of soil nutrients in the ecosystem, improve the absorptive power of cations and anions present on soil particle and that may be released slowly during the crop growth and improvement in soil structure to existence of favourable nutritional environment under the influence of organic liquid manures which had a positive effect on vegetative and reproductive growth which ultimately led to realization of higher values for growth attributes leading to higher yield of crop. Similar findings were also reported by (Balakumbahan *et al*., 2010 and Kumar *et al*., 2011).

2. Economics

The data pertaining to economic assessment in terms of cost of cultivation, gross returns, net returns and benefit-cost ratio are presented in Table 2 and and depicted in Fig. 2. Gross income was calculated using mung bean minimum support price of ₹ 10000/q. for grain and ₹ 1.5/kg of straw as per prevailing market price.The maximum gross returns (128212 ₹ ha^{-1}) was incurred under application treatment of Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB (T_7) followed by poultry manure (PM) @ 5 t/ ha (122528 ₹ ha^{-1}) (T_4) while the minimum gross returns (88837 ₹ ha^{-1}) was recorded under control (T_1). The maximum cost of cultivation (43823 ₹ ha^{-1}) was incurred under application of vermicompost (VC) @ 5 t/ ha (T_3) followed by 50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rhizobium+PSB (T_5) (43773 ₹ ha^{-1}) while the minimum cost of cultivation (38623 ₹ ha^{-1}) was recorded under control (T_1).The higher net returns (86189 ₹ ha^{-1}) was incurred under application treatment of Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB (T_7) followed by treatment of poultry manure (PM) @ 5 t/ ha (T_4) (50214 ₹ ha^{-1}) while the lower net returns(88837 ₹ ha^{-1}) was recorded under control (T_1).Benefit cost ration was calculated to find out income per unit of amount invested. Higher cost return and lower cost of cultivation lead to better B:C ratio. The higher benefit-cost ratio (3.05) was incurred under application treatment of Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB (T_7) followed by treatment of poultry manure (PM) @ 5 t/ ha (T_4) (2.86) while the lowest benefit-cost ratio

(2.30)was recorded under control (T_1).The increased net returns and B:C ratio(2.30) could be explained on the basis of increased seed and straw yield under these treatments. These findings were in line with those reported by (Singhal *et al*., 2015; Panchal *et al*., 2017; Zinzala *et a*l., 2018).The reason for increasing the gross returns, net returns and B:C ratio may be through organic sources. Provided vital role in attaining economical harvests that emphasize the need to adopt nutrient management this results into increasing farmer's premium as well as maintain soil nutrition (Aslam *et al*., 2010). It was also observed that application of jeevamrut is one of the cheap and efficient organic supplements to organic cultivation for high crop yield and profitability (Kasbe *et al*., 2009). These results were in conformity with the findings of Boraiah (2013).

CONCLUSION

Treatment T_7 (Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) was found most suitable in terms of yield attributes *viz*., number of pods per plant, pod length (cm), number of seeds per pod and 1000 grain weight per plant (g); Economics *viz*., cost of cultivation, gross returns, net returns and benefit-cost ratio; grain yield among all treatments, it can be concluded that among the treatment tested, treatment T_7 (Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) may be grown for better yield attributes, grain yield and maximum economic returns.

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Table 1:Effect of organic manures and biofertlizer on yield attributes and grain yield of mung bean crop

Treatments	Yield attributes studies	Grain

	Number of pods per plant	Pod length (cm)	Number of seeds per pod	1000 grain weight per plant (g)	yield (kg ha^{-1})
T_1: Control	10.67	6.40	8.13	29.67	824
T_2: Farmyard Manure (FYM) @ 10 t/ ha	13.00	8.20	9.33	30.67	1101
T_3: Vermicompost (VC) @ 5 t/ ha	13.67	8.80	9.40	32.00	1114
T_4: Poultry Manure (PM) @ 5 t/ ha	14.00	8.93	9.73	32.67	1141
T_5: 50 % FYM @ 5 t/ha + 50 % VC @ 2.5 t/ha +Rizobium+PSB	14.13	9.61	9.87	34.33	1135
T_6: 50 % FYM @ 5 t/ha+50 % PM @ 2.5 t/ha + Rhizobium +PSB	14.53	9.50	10.40	35.00	1136
T_7: Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	15.90	10.76	11.05	37.00	1197
SE (m) ±	**0.17**	**0.22**	**0.10**	**0.41**	**6.69**
CD at 5 %	**0.54**	**0.68**	**0.30**	**1.27**	**20.85**

Table 2:Effect of organic manures and biofertlizer on economics of mung bean crop

Treatments	**Economics (₹ ha^{-1})**			
	Gross returns (₹ ha^{-1})	**Cost of cultivation (₹ ha^{-1})**	**Net returns (₹ ha^{-1})**	**B:C**
T_1: Control	88837	38623	50214	2.30
T_2: Farmyard Manure (FYM) @ 10 t/ ha	118470	43323	75147	2.73
T_3: Vermicompost (VC) @ 5 t/ ha	119690	43823	75867	2.73
T_4: Poultry Manure (PM) @ 5 t/ ha	122528	42823	79705	2.86
T_5: 50 % FYM @ 5 t/ha + 50 % VC @ 2.5 t/ha +Rhizobium+PSB	121841	43773	78068	2.78
T_6: 50 % FYM @ 5 t/ha+50 % PM @ 2.5 t/ha + Rhizobium +PSB	121977	43273	78704	2.82
T_7: Jeevamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	128212	42023	86189	3.05

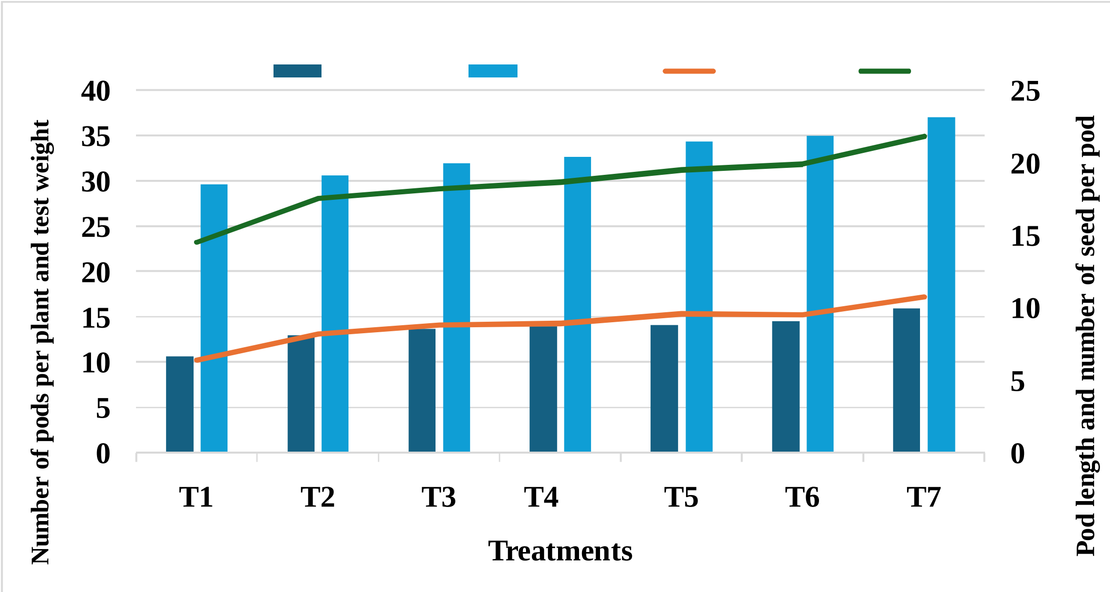

Fig. 1: Effect of organic manures and biofertlizer on yield attributes studiesof mung bean

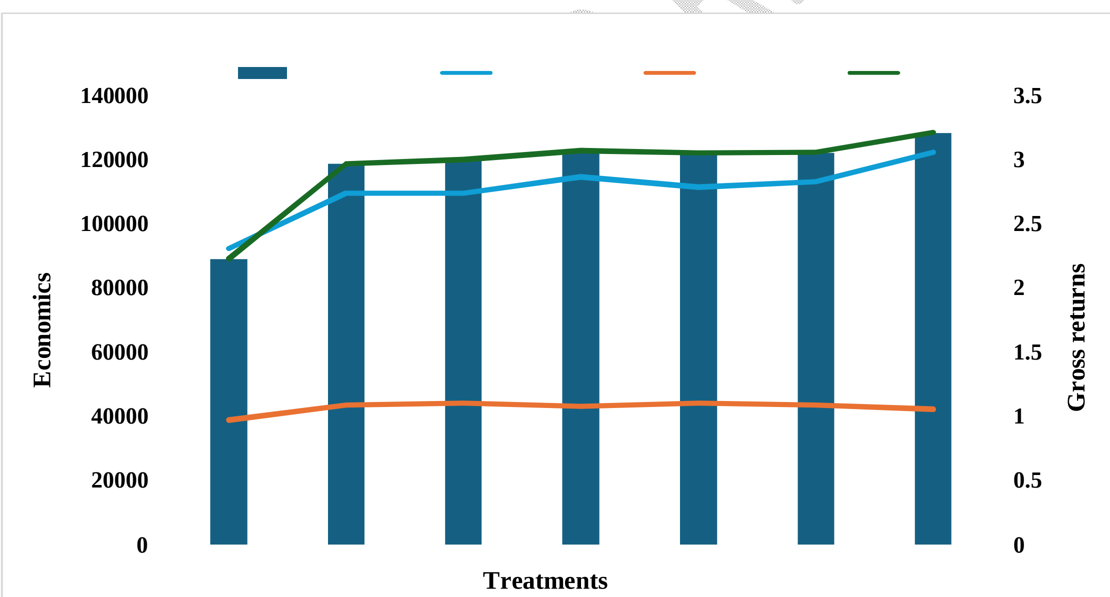

Fig. 2: Effect of organic manures and biofertlizer on economics of mung bean crop