Effect of Organic Manures and Biofertilizers on Crop Phenology, GrowthParametersand Yield of Mung Bean (*Vigna radiata*)

ABSTRACT

To assess the fertility level of organic nutrient management practices and biofertilizers on growth parameters, phenology studies and yields of mung bean the present study was carried out during *summer* season of 2024 at Research Farm, School of Agriculture, OM Sterling Global University, Hisar. Seven treatment combinations comprising organic manures and bio fertilizer were tested in randomized block design in three replications.The results revealed that the phenology studies viz., days taken to emergence (6.67), flowering (43.67), pod initiation (52.00) and maturity (65.67), growth parameters *viz.*,plant height (21.07; 48.82; 58.67; 59.00 cm), dry matter accumulation (4.93; 13.83; 19.32; 21.41 g) root shoot ratio on the length (0.58; 0.65; 0.70; 0.75),root shoot ratio on the weight basis (0.29; 0.35; 0.35; 0.36) and number of branches per plant (3.67; 5.00; 5.67; 5.83) at 30, 45, 60 and at harvest stages, respectively andseed yield (1,197 kg ha^{-1}) were significantly higher in the treatment of Jeevamrutha@ 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, Biofertilizers, Phenology, Growth Parameters and Yield

1. INTRODUCTION

Mungbean [*Vigna radiata* (L.)] is one of the excellent sources of high quality protein. It contains about 25 % of protein. It ranks third among important pulse crops, coming after chickpea and pigeon pea. Mungbean is more nutritive, palatable, digestible and non-flatulent than other pulses grown in different parts of the world. Although it is a rainy season crop, but it has also proved to be an ideal crop for spring and summer season. In India mungbeancultivated in an area of 4.75 million hectares, contributing 2.46 million tonnes of production with productivity of 516 kg/ha in the country (DES, 2019). The total area under mungbean in Haryana was 1.06 million hectares with the production of 0.42 million tonnes and productivity of 396 kg/ha (Anonymous, 2019). Chemical fertilizers play an important role to meet the nutritional requirements of mungbean crop, but the imbalanced and continuous use of chemical fertilizers has adverse effect on physical, chemical and biological properties of the soil thus affecting the sustainable crop production, besides causing a huge environment and soil pollution. However, recently the non-judicious use of chemical fertilizers is posing both economic and ecological problems, which are often difficult to face, particularly in developing countries (Sutton et al., 2011). Therefore, it is an immediate need to reduce the use of chemical fertilizers and in turn there is need to increase the usage of organic sources of nutrients for maintaining soil fertility.Organic manure is easily available and low cost. Therefore, smallholder farmers have shifted their attention from chemical alone agriculture to organic nutrient management strategy which utilizes organic nutrients forms (Singh et al., 2017). In Agriculture, manures such as farmyard manure, vermicompost, poultry manure, *etc*. are used as source 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 help 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.

Vermicompost serves as an excellent organic manure in the integrated nutrient management of field crops as well as many other crops. Vermicompost is a sustainable manure formed from organic residue using earthworms. Because of these microbes working on the organic matter, decomposition of the organic matter takes place and there is release of CO_2 gas and formation of organic and carbonic acids from the decomposition and respiration process. It also enhances the fertilizer use efficiency of the crop which in turn lowers down the further requirement of fertilizers. Vermicompost is nutritionally rich organic natural manure. It contains a good proportion of exchangeable Ca, Mg, Na and many micronutrients. It also helps in increasing organic carbon in the soil and releases the nutrients slowly which fulfils the nutritional requirement of crop for a long time. Poultry manure (PM) has gained attention as a potential source of organic fertilizer because 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 which is a microbial culture prepared from the on-farm inputs like cow dung, urine, jaggery 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. Besides increasing the fixation of atmospheric nitrogen, biofertilizers play an important role in increasing the availability of nitrogen and phosphorus. Therefore, introducing an efficient strain of *Rhizobium* in soil increases quality of the crop by providing more nitrogen which may boost up the production. Inoculation of seeds with *Rhizobium* culture is a very low cost method of nitrogen fertilization in legume and also found beneficial in increasing the yield. Therefore, to reduce the losses and indiscriminate use of inorganic fertilizers, substitution with available organic sources of organic nutrients and biofertilizers is inevitable. The present need is to investigate an efficient integrated plant nutrient management system comprising of balanced use of chemical fertilizers with organic manures and biofertilizers which might increase crop production along with preservation of ecosystem.

Keeping all these facts in view, the present study was conducted to assess the effect of organic manures and biofertilizers on crop phenology, growth parameters and yield of mung bean (*Vigna radiata*).

2. MATERIALS AND METHODS

The present study was carried out during *summer* season of 2024 at Research Farm, School of Agriculture, 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. The meteorological data recorded during crop season of 2024 indicated that 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 sun shine 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 experiment consisting of seven treatment combinations *viz.*,T_1 (control), T_2. (Farmyard Manure (FYM) @ 10 t/ ha), T_3 [Vermicompost (VC) @ 5 t/ ha], T_4 [Poultry Manure (PM) @ 5 t/ha], T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rizobium+PSB), T_6 (50% FYM @ 5 t/ ha + 50% PM @ 2.5 t/ha + Rizobium+PSB) and T_7 (Jeevaamrtha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS+ Rizobium+PSB) comprising of organic manures and biofertilizers 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 and 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.

Jeevamruthasolution was prepared by thoroughly mixing cow dung (fresh) (10 kg) + cow urine (10 liters) + jaggery (2 kg)+ pulse flour (cow pea) (2 kg) + sajiv soil (1 kg) + water (200 liters) in a container and stirred well. Allowed the mixture to ferment for 7 days under tree shade. The mixture was stirred twice (morning and evening) every day in a clockwise direction. The container was kept under a well-ventilated open shed. The mouth of container was tied with thin cotton cloth to enable proper aeration in the container and after preparation applied as per treatments.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 phenology studies *viz.,* days taken to emergence, flowering, pod initiation and maturity, growth parameters *viz.,* plant height, dry matter accumulation, root shoot ratio on the length and weight basis, number of branches per plant and yield as per the 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).

3. RESULTS AND DISCUSSION

3. 1. Crop Phenology

The perusal of data are presented in Table 1 and depicted in Fig.1 showed that the treatments did not influenced crop emergence during of study. However, treatments T_1, T_3, T_5 and T_7 had taken numerically more days for emergence, the crop took 6.67 days for emergence while in the other treatments *viz.,* T_2, T_4 and T_6 crop took 6.33 days for emergence. Among the treatments, T_7(Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS+ Rhizobium +PSB) (43.67), (52.00); T_6(50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (43.00), (51.67); T_5(50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (42.33), (64.33); T_4(Poultry Manure (PM) @ 5 t/ ha) (42.33), (50.00), respectively significantly took more days for the flowering and pod initiation stage as compared to treatments *viz.*, T_3 (Vermicompost (VC) @ 5 t/ ha) (41.33), (49.00); T_2(Farmyard Manure (FYM) @ 10 t/ ha) (40.67), (48.67); T_1(control) (40.33), (47.67), respectively during the year of study. Among the treatments, T_7 (65.67); T_6 (65.33); T_5 (50.00), respectively significantly took more days for the maturity stage as compared to treatments T_3 (63.33); T_2 (63.00); T_1 (62.33), respectively during the year of study. The longer number of days taken to 50% flowering and pod initiation might be due to continuous supply of liquid manures throughout the crop growth. This result is in line with the findings of Rahman et al. (2009) and Singh et al. (2019).This increase might be due higher availability of nitrogen in adequate proportion which delayed the senescence of leaves and succulence of plants and made the plant to stay green. This result is line with findings of Shrestha (2007). Mondal et al. (2015) also reported that organic and liquid manures has taken more number of days for flowering and maturity of crop.

3. 2. Growth Parameters

The data on plant height at different growth stages are presented in Table 2. Perusal of data revealed that the plant height increased up to maturity. The increase in plant height was rapid up to 60 DAS and thereafter, it increased at a slower rate and almost stationary after physiological maturity. Among the treatments, treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS+ Rhizobium +PSB) recorded significantly taller plants height (21.07 cm), (48.82 cm), (58.67 cm) and (59.00) as compared to other treatments *viz.*, T_6 (50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (19.77 cm), (46.77 cm), (55.82 cm), (56.66 cm); T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (18.89 cm), (46.53 cm), (54.82 cm), (55.84 cm); T_4 (Poultry Manure (PM) @ 5 t/ ha) (18.05 cm), (45.60 cm), (54.52 cm), (55.71 cm); T_3 (Vermicompost (VC) @ 5 t/ ha) (7.06 cm), (45.33 cm), (53.75 cm), (55.45 cm); T_2 (Farmyard Manure (FYM) @ 10 t/ ha) (16.37 cm), (44.47 cm), (53.03 cm), (54.41 cm); T_1 (control) (15.54 cm), (39.93 cm), (46.31 cm), (47.30 cm) at 30, 45, 60 DAS and at harvest respectively. The significantly lower plant height was recorded in treatment T_1 (control) at all growth stages of mung bean crop. The data on dry matter accumulation per plant at different stages of crop growth are presented in Table 3. In general, dry matter accumulation increased with the age of the crop. Initially, the increase in dry matter accumulation was at a slower rate but after 30 DAS, there was a rapid increase in the dry matter accumulation. The data revealed that the dry matter accumulation was significantly influenced by the treatments at all stages of crop growth. Among the treatments, treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) produced significantly maximum dry matter accumulation (4.93 g), (13.83 g), (19.32 g) and (21.41g) as compared to others treatments *viz.*, T_6 (50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (4.20 g), (12.04 g), (16.81g), (18.63 g); T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (4.12 g), (11.50 g), (16.08 g), (17.80 g); T_4 (Poultry Manure (PM) @ 5 t/ ha) (4.00 g), (11.20 g), (15.63 g), (17.31g); T_3 (Vermicompost (VC) @ 5 t/ ha) (3.91g), (10.93 g), (15.34 g), (16.97g); T_2 (Farmyard Manure (FYM) @ 10 t/ ha) (3.76 g), (10.56 g), (14.72 g), (16.31 g); T_1 (control) (2.50 g), (6.96 g), (9.69 g), (10.71 g) at 30, 45, 60 DAS and at harvest respectively. The significantly minimum dry matter accumulation was recorded in treatment T_1 (control) at all growth stages of mung bean crop.The data pertaining to root shoot ratio on length basis at different stages of crop growth are presented in Table 4. At 30 DAS observed that there was non-significant difference in the root shoot ratio on length basis among all the treatments. However, maximum root shoot ratio on length basis (0.58) was recorded in treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) and minimum root shoot ratio on length basis (0.32) was recorded in control. The data revealed that the root shoot ratio on length basis was significantly influenced by the treatments at 45, 60 DAS and at harvest. Among the treatments, treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) produced significantly maximum root shoot ratio on length basis (0.65), (0.70) and (0.75) as compared to others treatments *viz.*, T_6 (50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (0.60), (0.66), (0.68); T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (0.56), (0.62), (0.64); T_4 (Poultry Manure (PM) @ 5 t/ ha) (0.53), (0.60), (0.62); T_3 (Vermicompost (VC) @ 5 t/ ha) (0.49), (0.55), (0.57); T_2 (Farmyard Manure (FYM) @ 10 t/ ha) (0.46), (0.52), (0.54); T_1 (control) (0.33), (0.39), (0.42) at 45, 60 DAS and at harvest respectively. The significantly minimum root shoot ratio on length basis was recorded in treatment T_1 (control) at all growth stages of mung bean crop. The data pertaining on root shoot ratio on weight basis per plant at different stages of crop growth are presented in Table 5. The data revealed that the root shoot ratio on weight basis was significantly influenced by the treatments at 30, 45, 60 DAS and at harvest. Among the treatments, treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) produced significantly maximum root shoot ratio on weight basis (0.65), (0.65), (0.70) and (0.75) as compared to others treatments *viz.*, T_6 (50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (0.23), (0.28), (0.30), (0.31); T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (0.21), (0.25), (0.27), (0.28); T_4 (Poultry Manure (PM) @ 5 t/ ha) (0.20), (0.24), (0.25), (0.26); T_3 (Vermicompost (VC) @ 5 t/ ha) (0.18), (0.22), (0.23), (0.24); T_2 (Farmyard Manure (FYM) @ 10 t/ ha) (0.17), (0.18), (0.20), (0.21); T_1 (control) (0.14), (0.15), (0.16), (0.18) at 30, 45, 60 DAS and at harvest respectively. The significantly minimum root shoot ratio on weight basis was recorded in treatment T_1 (control) at all growth stages of mung bean crop.The data pertaining on number of branches per plant at different stages of crop growth are presented in Table 6. The data revealed that the number of branches per plant was significantly influenced by the treatments at all the stages of crop growth. Among the treatments, treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) produced significantly maximum number of branches per plant (3.67), (5.00), (5.67), (5.83) as compared to others treatments. *viz.*, T_6 (50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (3.33), (4.33), (5.33), (5.00); T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (3.17), (4.03), (4.83), (5.00); T_4 (Poultry Manure (PM) @ 5 t/ ha) (3.00), (3.67), (4.33), (4.83); T_3(Vermicompost (VC) @ 5 t/ ha) (2.67), (3.33), (4.00), (4.33); T_2 (Farmyard Manure (FYM) @ 10 t/ ha) (2.50), (3.50), (4.00), (4.17); T_1 (control) (2.17), (2.83), (3.67), (3.83) at 30, 45, 60 DAS and at harvest respectively. The significantly minimum number of branches per plant was recorded in treatment T_1 (control) at all growth stages of mung bean crop.Significant increase in plant height, dry matter accumulation, root shoot ratio on length and weight basis and number of branches per plant of mung bean might be due to the availability of small quantities of macronutrients, micronutrients and growth promoting substances in addition to huge beneficial microbial population in Jeevamrutha, thus when applied to the crop as foliar spray andthrough soil they trigger the necessary plant growth. Moreover, liquid bio enhancer avail favorable influence of nitrogen to produce larger cells with thinner cell walls and its contribution in cell division and cell elongation, which promoted vegetative growth and ultimately increased growth parameters and improved the metabolic and photosynthetic activity for enhancing biological efficiency of plant which helps the roots to spread into deeper layer of soil so that it can uptake more nutrients from soil cause there by accumulation of more carbohydrates and higher dry matter (Upperi et al., 2009; Patel et al., 2023). These results corroborate with the findings (Ramesh et al., 2015; Siddappa et al., 2016; Gowda et al., 2018). Foliar sprays enhanced the availability of nutrients at the site of photosynthesis leading to improved growth of mung plant. Liquid organics like Jeevamruthat, possessed good amount of nutrients enriched with beneficial microorganism and growth promoting substances along with other enzymes (Nileema et al., 2011). Similar result was also reported by (Gunasekar et al., 2018).

Seed yield was significantly influenced by different organic manures and biofertilizers. Among the treatments, treatment T_7 recorded significantly maximumseed yield (1,197 kg ha^{-1}) as compared to other treatments*viz.*, T_6 (50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB) (1136 kg ha^{-1}); T_5 (50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha + Rhizobium +PSB) (1135 kg ha^{-1}); T_4 (Poultry Manure (PM) @ 5 t/ ha) (1141 kg ha^{-1}); T_3 (Vermicompost (VC) @ 5 t/ ha) (1114 kg ha^{-1}); T_2 (Farmyard Manure (FYM) @ 10 t/ ha) (1101 kg ha^{-1}); T_1 (control) (824 kg ha^{-1}), respectively. Whereas, significantly lower seed yield (824 kg ha^{-1}) was recorded under control (T_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 Jeevamrutha 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).

4. CONCLUSION

Based on one year study, it can be suggested that,Treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) was found most suitable in terms of phenology *viz*., days taken to emergence, 50 per cent flowering, 50 % pod initiation and physiological maturity; growth parameters *viz*., plant height, dry matter accumulation, number of branches per plant, root shoot ratio on length and weight basis of crop; grain yield among all treatments, it can be concluded that among the treatment tested, treatment T_7 (Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB) may be grown for better phenology, growth parameters and yield.

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Table 1: Effect of organic manures and biofertilizers on phenology stages of mung bean crop.

Treatments	**Days taken to**			
	Emergence	**Flowering**	**Pod initiation**	**Maturity**
T_1: Control	6.67	40.33	47.67	62.33
T_2: Farmyard Manure (FYM) @ 10 t/ ha	6.33	40.67	48.67	63.00
T_3: Vermicompost (VC) @ 5 t/ ha	6.67	41.33	49.00	63.33
T_4: Poultry Manure (PM) @ 5 t/ ha	6.33	42.33	50.00	64.00
T_5: 50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rizobium+PSB	6.67	42.33	50.00	64.33
T_6: 50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB	6.33	43.00	51.67	65.33
T_7: Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	6.67	43.67	52.00	65.67
SE (m) ±	**0.35**	**0.61**	**0.71**	**0.44**
CD at 5 %	**NS**	**1.90**	**2.22**	**1.38**

Table 2: Effect of organic manures and biofertilizers on plant height (cm) at all growth stages of mung bean crop.

Treatments	Plant height (cm)			
	At 30 DAS	**At 45 DAS**	**At 60 DAS**	**At harvest**
T_1: Control	15.54	39.93	46.31	47.30
T_2: Farmyard Manure (FYM) @ 10 t/ ha	16.37	44.47	53.03	54.41
T_3: Vermicompost (VC) @ 5 t/ ha	17.06	45.33	53.75	55.45
T_4: Poultry Manure (PM) @ 5 t/ ha	18.05	45.6	54.52	55.71
T_5: 50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rhizobium+PSB	18.89	46.53	54.82	55.84
T_6: 50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB	19.77	46.77	55.82	56.66
T_7: Jeevamrutha@ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS+ Rhizobium +PSB	21.07	48.82	58.67	59.00
SE (m) ±	**0.35**	**0.48**	**0.71**	**0.59**
CD at 5 %	**1.07**	**1.49**	**2.23**	**1.84**

Table 3: Effect of organic manures and biofertilizers on dry matter accumulation (g) at all growth stages of mung bean crop.

Treatments	Dry matter accumulation (g)			
	At 30 DAS	**At 45 DAS**	**At 60 DAS**	**At harvest**
T_1: Control	2.50	6.96	9.69	10.71
T_2: Farmyard Manure (FYM) @ 10 t/ ha	3.76	10.56	14.72	16.31
T_3: Vermicompost (VC) @ 5 t/ ha	3.91	10.93	15.34	16.97
T_4: Poultry Manure (PM) @ 5 t/ ha	4.00	11.20	15.63	17.31
T_5: 50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rizobium+PSB	4.12	11.50	16.08	17.80
T_6: 50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB	4.20	12.04	16.81	18.63
T_7: Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	4.93	13.83	19.32	21.41
SE (m) ±	**0.16**	**0.49**	**0.72**	**0.81**
CD at 5 %	**0.51**	**1.52**	**2.24**	**2.53**

Table 4: Effect of organic manures and biofertilizers on root shoot ratio on length basis at all growth stages of mung bean crop.

Treatments	Root shoot ratio on length basis			
	At 30 DAS	**At 45 DAS**	**At 60 DAS**	**At harvest**
T_1: Control	0.32	0.33	0.39	0.42
T_2: Farmyard Manure (FYM) @ 10 t/ ha	0.42	0.46	0.52	0.54
T_3: Vermicompost (VC) @ 5 t/ ha	0.47	0.49	0.55	0.57
T_4: Poultry Manure (PM) @ 5 t/ ha	0.48	0.53	0.60	0.62
T_5: 50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rhizobium+PSB	0.52	0.56	0.62	0.64
T_6: 50% FYM @ 5 t/ha + 50% PM @ 2.5 t/ha + Rhizobium +PSB	0.56	0.60	0.66	0.68
T_7: Jeevamrutha@ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	0.58	0.65	0.70	0.75
SE (m) ±	**0.09**	**0.01**	**0.01**	**0.02**
CD at 5 %	**NS**	**0.05**	**0.03**	**0.07**

Table 5: Effect of organic manures and biofertilizers on root shoot ratio on weight basis at all growth stages of mung bean crop.

Treatments	Root shoot ratio on weight basis			
	At 30 DAS	**At 45 DAS**	**At 60 DAS**	**At harvest**
T_1: Control	0.14	0.15	0.16	0.18
T_2: Farmyard Manure (FYM) @ 10 t/ ha	0.17	0.18	0.20	0.21
T_3: Vermicompost (VC) @ 5 t/ ha	0.18	0.22	0.23	0.24
T_4: Poultry Manure (PM) @ 5 t/ ha	0.20	0.24	0.25	0.26
T_5: 50% FYM @ 5 t/ha + 50% VC @ 2.5 t/ha +Rizobium+PSB	0.21	0.25	0.27	0.28
T_6: 50 % FYM @ 5 t/ha+50 % PM @ 2.5 t/ha + Rhizobium +PSB	0.23	0.28	0.31	0.30
T_7: Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	0.29	0.35	0.35	0.36
SE (m) ±	**0.02**	**0.02**	**0.01**	**0.02**
CD at 5 %	**0.05**	**0.05**	**0.02**	**0.05**

Table 6: Effect of organic manures and biofertilizers on number of branches per plant at all growth stages of mung bean crop.

Treatments	Number of branches per	

	plant				Seed yield (kg ha^{-1})
	At 30 DAS	At 45 DAS	At 60 DAS	At harvest	
T_1: Control	2.17	2.83	3.67	3.83	824
T_2: Farmyard Manure (FYM) @ 10 t/ ha	2.50	3.50	4.00	4.17	1101
T_3: Vermicompost (VC) @ 5 t/ ha	2.67	3.33	4.00	4.33	1114
T_4: Poultry Manure (PM) @ 5 t/ ha	3.00	3.67	4.33	4.83	1141
T_5: 50% FYM @ 5t/ha + 50% VC @ 2.5 t/ha +Rizobium+PSB	3.17	4.03	4.83	5.00	1135
T_6: 50% FYM @ 5 t/ha+50% PM @ 2.5 t/ha + Rhizobium +PSB	3.33	4.33	5.33	5.00	1136
T_7: Jeevamrutha @ 3000 l ha^{-1} through three splits at sowing, 30 and 45 DAS + Rhizobium +PSB	3.67	5.00	5.67	5.83	1197
SE (m) ±	**0.32**	**0.17**	**0.20**	**0.26**	**6.69**
CD at 5 %	**NS**	**0.52**	**0.61**	**0.79**	**20.85**

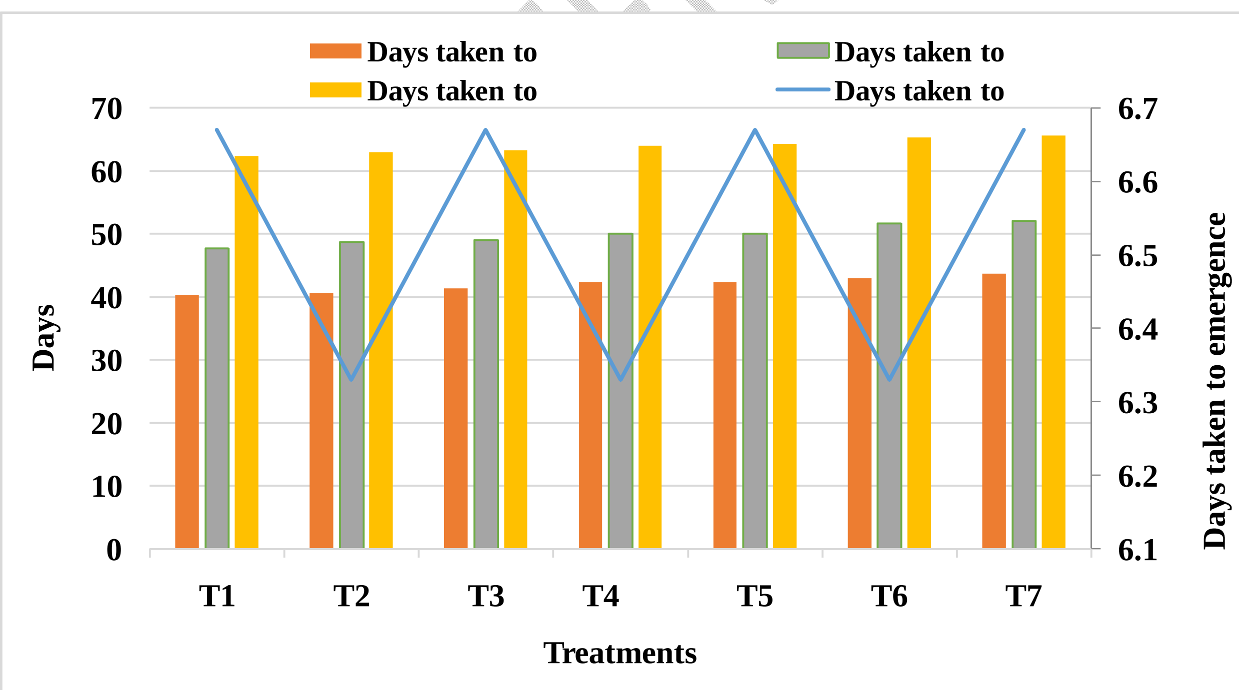

Fig. 1: Effect of organic manures and biofertilizers on phenology stages of mung bean crop