Effect of Organic Manures and Biofertilizers on Crop Phenology, GrowthParametersand Yieldof Mung Bean (*Vignaradiata*).

ABSTRACT

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.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, Biofertilizer, Phenology, Growth Parameters and Yield

INTRODUCTION

Mung bean (*Vignaradiata*L. Wilczek) is one of the protein rich pulse crop grown in India. The lack of productivity has contributed to food insecurity throughout the region and widespread malnutrition. Being a short duration crop, it its well in manyintensive crop rotations, prevents soil erosion, fixes atmospheric nitrogen through Rhizobial symbiosis and helps in improving soil fertility (Bansal, 2009).Mungbean is a native Indian crop that is also referred to as green gram or moong. In addition to being an important food and economic crop in the rice-based farming systems of South and Southeast Asia, However, it is also grown in other regions of the world. The average production of mung beans is 721 kg/ha, and there are around 7.3 million hectares planted worldwide. 30% of the 5.3 million tonnes of production produced globally is split between India and Myanmar. China, Indonesia, Thailand, Kenya, and Tanzania are other significant producers (Nair et al., 2020). Mungbean production in India is expected to total 5.5 million hectares in 2022, yielding 3.17 million tonnes at a productivity of 570 kg/ha.It is a highly nutritious and versatile crop that is used for both food and fodder purposes. The mung bean seed is high in copper, phosphorus, potassium, magnesium, important vitamins, contains 20-25% protein, 1.3 % fat, 15.4 % fibre and 3.7 ash % (FAO, 2019).There is no doubt that chemical fertilizers are playing a vital role to meet the nutrient requirement of crops and thereby increasing their production. 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). The cost of chemical fertilizers is high, but the 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). 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 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 (Babulkaret al., 2000). Vermicompost is created by vermicomposting of organic material through interactions between earthworm 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 depend 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 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. 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 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 biofertilizers on crop phenology, growth parameters and yield of mung bean (*Vignaradiata*).

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 7^{th} and 8^{th} standard weeks, respectively. The weekly mean minimum and maximum relative humidity was recorded 55.5 % and 99.6% in morning during 3^{rd} and 15^{th} standard weeks and 18.1 % and 79 % in evening during 15^{th} and 5^{th} standard weeks, respectively. Weekly mean maximum and minimum sun shine of 9.1 hrs and 1.7 hrs per day were recorded on 17^{th} and 5^{th} 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 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 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.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).

RESULTS AND DISCUSSION

1. Crop Phenology

The perusal of data are presented in Table 1 and depicted in Fig.1 showed that the treatments were 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). Mondalet al. (2015) also reported that organic and liquid manures has taken more number of days for flowering and maturity of crop.

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).

CONCLUSION

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 biofertilizer 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 +	6.67	43.67	52.00	65.67

Rhizobium +PSB				
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 biofertilizer 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 biofertilizer 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 biofertilizer 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 biofertilizer 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 biofertilizer 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**

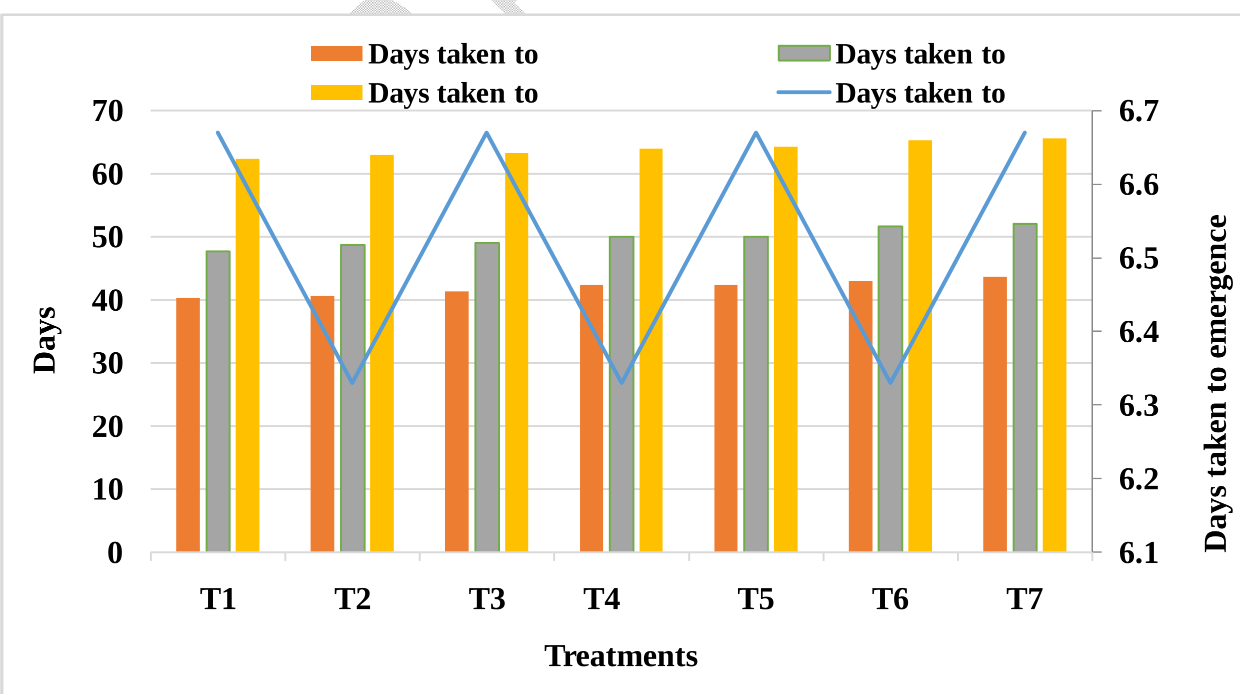

Fig. 1: Effect of organic manures and biofertilizer on phenology stages of mung bean crop