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# Effect of organic manures and bio-fertilizers on growth and quality of Indian bean [*Lablab purpureus* (L.) var. *typicus*]

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Indian bean (*Lablab purpureus* L. var. *typicus*) also known as Sem or Dolichos bean belongs to the family Fabaceae and originated from India. There are two types of cultivated species. *viz*, *Lablab purpureus* var. *typicus is a vegetable type* cultivated for its soft and edible pods and *Lablab purpureus* var. *lignosus* is the field bean cultivated for dry seeds as pulse. It is a multipurpose crop grown for pulse, vegetables and forage. This crop is mostly grown throughout tropical regions of Asia, Africa and America. In India, it is grown as a field crop in Tamil Nadu, Andhra Pradesh, Karnataka, Madhya Pradesh, Kerala and Maharashtra. In India, it is grown in 230 thousand hectares area with an average production of 2278 thousand metric pods. In Rajasthan, it is grown in 0.75 thousand hectares area with an average production of 1.0 thousand metric tonnes pods and is cultivated in Jaipur, Bundi, Kota and Bharatpur districts (Anonymous 2017). The nutritive value of Indian bean is very high, having high percentage of digestible proteins and good content of vitamins and minerals. It contains moisture 85.4%, protein 4.5%, fiber 2.0%, carbohydrates 7.2%, calcium 50.0 mg, phosphorous 63 mg, iron 1.40 mg, vitamin A 16.0 IU, vitamin B1 0.08 mg, vitamin C 12.0 mg and nicotinic acid 0.8 mg. Hence, Indian bean is considered a valuable vegetable for vegetarians (Basu *et al.* 2002).

The effect of organic manures and bio-fertilizers on the growth and quality of Indian bean was conducted during *Kharif*, 2019 at Horticulture Farm, SKN College of Agriculture, Jobner, Rajasthan which is situated at 45 km west of Jaipur at 260 05' North latitude, 750 8' East longitude and at an altitude of 427 meters above mean sea level. In Rajasthan, this area falls in Agro-Climatic Zone-IIIA (Semi-arid Eastern Plain Zone). The experiment was arranged in a randomized complete block design with four levels of organic manures (control, FYM, poultry manure and vermicompost) and four levels of bio-fertilizers (control, *Rhizobium*, PSB and VAM)

and replicated three times. Seeds of Indian bean var. Pairy were sown on 1 August 2019 on flat bed measuring 1.8×1.8 m at a spacing of 60×30 cm and irrigated timely according to the need of crop. To keep the crop free from insect pest (sucking pests) one insecticidal sprays of methyl parathion @ 25 kg/ha at the flowering stage was given. The observations like plant height (cm), leaf area ($cm^2$), number of branches per plant, dry matter accumulation (g), total chlorophyll content in leaves (mg/100g), crop growth rate ($g/m^2$/day), protein content (%) and phosphorus content (%) in green pod of Indian bean were taken manually. The data obtained from the trial were subjected to statistical analyses which are presented in tabular form. Crop growth rate was calculated with following formula (Radford 1967) from periodic dry matter recorded at different stages.

$$\text{CGR } (g/m^2/day) = \frac{W_2 - W_1}{t_2 - t_1} \times 1 / P$$

Where,

$W_1$= total dry weight of plant at time $T_1$, $W_2$= total dry weight of plant at time $T_2$

$T_1$ = time at first observation, $T_2$ = time at second observation, P = row to plant spacing

Chlorophyll content is measured by Arnon, 1949 method

$$\text{Total chlorophyll content (mg/g)} = \frac{A\ (652)\ X\ 29\ X\ \text{Total volume (ml)}}{\alpha\ X\ 1000\ X\ \text{Weight of sample (g)}}$$

Where,

A= Absorbance specific wavelengths; α is the path length = 1 cm

moreover, protein content in the pods was calculated by multiplying nitrogen concentration (%) by the factor 6.25 (AOAC 1960) and estimation of phosphorus on Spectronic-20 was done by Jackson (1967).

It is evident from Table 1 that application of organic manures and bio-fertilizers had a significant effect on the growth attributes. Results showed that application of vermicompost @ 5 t/ha significantly increased the plant height (59.98 cm and 81.48 at 45 and 60 DAS, respectively), number of branches per plant (10.50), leaf area (3034.10 $cm^2$), total chlorophyll content in leaves (2.03) and dry matter accumulation (91.08, 160.31 and 211.54 g at 45, 60 and 75 DAS, respectively) and crop growth rate (26.47 and 20.19 g/$m^2$/day at 45-60 and 60-75 DAS, respectively) over control and FYM. This might be because vermicompost contains higher growth-promoting substances, vitamins, enzymes and increases the root biomass production, which resulted in high production of root exudates and increased the useful bacteria, fungi and actinomycetes population in the rhizosphere region. Organic manures have easy release of nitrogen due to its slow mineralization, which induces the availability of nutrients commensurate with the growth and development of the plants and thus results in higher growth parameters. These findings corroborative the results of (Chaurasia and Chaurasia 2008) in chickpeas, (Hassan *et al.* 2017) in green bean, (Ananth and Kumar 2018) in Indian bean (Ullasa *et al.* 2018) in field bean and (Zahida *et al.* 2016) in French bean. Further, There was a significant increase in the plant growth parameters *viz,* plant height (59.66 cm and 80.39 at 45 and 60 DAS, respectively), number of branches per plant (10.19), leaf area (3009.93 $cm^2$), total chlorophyll content in leaves (2.05), dry matter accumulation (88.82, 157.54 and 208.93 g at 45, 60 and 75 DAS, respectively) and crop growth rate (25.71 and 19.65 g/m2/day at 45-60 and 60-75 DAS, respectively) were also observed significantly maximum with the *rhizobium* culture @ 2kg/ha application among different bio-fertilizers. The finding clearly indicated that the application of *rhizobium* significantly increased the growth attributes of Indian bean over control might be due to the biofertilizer was helpful to keep diversity in the

**Table 1:** Effect of organic manures and bio-fertilizers on growth attributes of Indian bean

| *Treatments* | *Plant height (cm)* | | *No. of branches/plant at 60 DAS* | *Leaf area ($cm^2$)* | *Total Chlorophyll at 60 DAS (mg/g)* | *Dry Matter Accumulation (g/ m row length)* | | | *Crop Growth Rate (g/ $m^2$/day)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *45 DAS* | *60 DAS* | | | | *45-60 DAS* | *45-60 DAS* | *90 DAS* | *45-60 DAS* | *60-75 DAS* |
| A. Bio-regulators | | | | | | | | | | |
| $O_1$ – Control | 48.71 | 62.11 | 7.45 | 2600.00 | 1.60 | 74.72 | 133.71 | 176.55 | 19.44 | 16.15 |
| $O_2$ – FYM | 55.54 | 73.25 | 9.30 | 2874.17 | 1.87 | 82.82 | 147.50 | 194.78 | 23.72 | 17.96 |
| $O_3$ –Poultry manure | 59.73 | 80.83 | 10.36 | 3010.63 | 2.02 | 90.18 | 159.03 | 210.58 | 26.29 | 19.38 |
| $O_4$– Vermi-compost | 59.98 | 81.48 | 10.50 | 3034.10 | 2.03 | 91.08 | 160.31 | 211.54 | 26.47 | 20.19 |
| SEm± | 1.18 | 2.10 | 0.24 | 45.69 | 0.05 | 2.46 | 3.71 | 2.46 | 0.50 | 0.45 |
| CD (P=0.05) | 3.40 | 6.05 | 0.71 | 131.94 | 0.13 | 7.11 | 10.71 | 14.17 | 1.44 | 1.30 |
| B. Bio-fertilizers | | | | | | | | | | |
| $B_1$- Control (no inoculation) | 45.86 | 57.10 | 7.24 | 2501.61 | 1.42 | 72.46 | 130.88 | 168.89 | 19.23 | 14.99 |
| $B_2$- Inoculation with *Rhizobium* | 59.66 | 80.39 | 10.19 | 3009.93 | 2.05 | 88.82 | 157.54 | 209.64 | 25.71 | 19.65 |
| $B_3$- Inoculation with PSB | 59.14 | 80.07 | 10.07 | 2999.10 | 2.02 | 88.75 | 155.48 | 207.61 | 25.44 | 19.46 |
| $B_4$– Inoculation with VAM | 59.31 | 80.11 | 10.10 | 3008.26 | 2.03 | 88.78 | 156.65 | 208.93 | 25.55 | 19.57 |
| SEm± | 1.18 | 2.10 | 0.24 | 45.69 | 0.05 | 2.46 | 3.71 | 2.46 | 0.50 | 0.45 |
| CD (P=0.05) | 3.40 | 6.05 | 0.71 | L131.94 | 0.13 | 7.11 | 10.71 | 14.17 | 1.44 | 1.30 |

agricultural ecosystem, which are living in a rhizosphere environment and are able to improve plant nutrition and soil fertility through a biological complex of nitrogen fixation, phosphate solubilization, and enhancement of plant growth. These results corroborate the findings of Mathur (2009), Yadav *et al.* (2017) and Ananth *et al.* (2018).

The content of protein content and phosphorus in pods were significantly increased with the application of poultry manure @ 5 t/ha as compared to control and FYM (Table 2). This might be due to poultry manure enhancing the soil physical conditions and increased nutrient availability resulting in superior plant growth. The increased growth characteristics might be due to huge availability of nitrogen which improved the plant growth due to the incident that nitrogen after being taken up by the plant is transformed in to amino acids which are the building blocks of protein which ability have led to an increase in the rate of meristematic activity resulting in well growth characters. Poultry manure which was easily available to the plant more a C:N ratio, abundant supply of accessible nutrients to the soil with comparative lesser retention in roots and more translocation to the aerial parts for protoplasmic proteins and integration of other compounds. The finding is in line with the research of Jain and Trivedi (2005) and Venkata *et al.* (2009). Further, the protein content (3.36) in pods of Indian bean was significantly increased with the application of *rhizobium* as compared to control and phosphorus content in pods of Indian bean as compared to control. The increase in this value due to inoculation of seed with rhizobium was possibly due to more fixation of nitrogen resulting in better nitrogen absorption by plants, which led to more chlorophyll formation, nitrogen and protein content in green pods. A significantly increased in nitrogen concentration of green pod was noticed fixation. These findings are in line with the research of Khandelwal (2012), Salehi and Aminpanah (2015) and Bhadala (2017). Similarly, PSB enhanced phosphorus content (0.49%) in Indian bean pod might be due to greater root development and nodulation, resulting in high nitrogen fixation in the soil by nodules. Thus, increased accessibility of nitrogen and phosphorus might have resulted in greater uptake by the plants for proper improvement and ultimately increased their content in plants.

**Table 2:** Effect of organic manures and bio-fertilizers on protein and phosphorus content in pods

| *Treatments* | *Protein content (%)* | *Crude fibre content (%)* | *Phosphorus content (%)* |
|---|---|---|---|
| A. Bio-regulators | | | |
| $O_1$ – Control | 2.43 | 1.96 | 0.39 |
| $O_2$ - FYM | 3.09 | 1.86 | 0.44 |
| $O_3$ –Poultry manure | 3.40 | 1.85 | 0.47 |
| $O_4$ - Vermi-compost | 3.38 | 1.82 | 0.46 |
| SEm± | 0.06 | 0.05 | 0.01 |
| CD (P=0.05) | 0.16 | NS | 0.02 |
| B. Bio-fertilizers | | | |
| $B_1$- Control (no inoculation) | 2.42 | 1.99 | 0.31 |
| $B_2$- Inoculation with *Rhizobium* | 3.36 | 1.82 | 0.47 |
| $B_3$- Inoculation with PSB | 3.25 | 1.82 | 0.49 |
| $B_4$– Inoculation with VAM | 3.27 | 1.85 | 0.48 |
| SEm± | 0.06 | 0.05 | 0.01 |
| CD (P=0.05) | 0.16 | NS | 0.04 |

It may be concluded that among the bio-regulators, vermicompost @ 5 t/ha recorded higher plant height, number of branches per plant, leaf area, total chlorophyll content in leaves, dry matter accumulation and crop growth rate but the quality attributes *viz.,* protein content and phosphorus content were recorded maximum with the application of poultry manure @ 5 t/ha. Among the bio-fertilizers, *rhizobium* @ 2 kg/ha provided the best performance in terms of growth and quality parameters such as plant height, number of branches per plant, leaf area, total chlorophyll content in leaves, dry matter accumulation, crop growth rate and protein content but phosphorus content increased with PSB @ 2 kg/ha.

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