Vegetable Science (2022) 49(1):62-68

# Influence of integrated nutrient management and sowing dates on growth, yield and quality of broad bean (*Vicia faba* L.)

**Tsering Lanzes, Manoj Kumar*, Anil Bhushan, Satesh Kumar, Sandeep Chopra, Sanjeev Kumar and R K Samnotra**

Received: March 2022/ Accepted: May 2022

## Abstract

The present field investigation was carried out at Vegetable Experimental Farm, Division of Vegetable Science and Floriculture, SKUAST-J, Chatha during Rabi season 2018-2019. The experiment comprised of three levels of inorganic fertilizers i.e. 50%, 75%, 100% of recommended dose (50:60:50 kg/ha NPK) combined with two organic sources of plant nutrients (FYM and Vermicompost) under two dates of sowing (2nd fortnight of October and 1st fortnight of November). The experiment comprised of 12 treatments laid out in a Randomized Block Design with three replications. The result revealed that vegetative growth and yield parameters were significantly influenced by the application of different sources of nutrients under different dates of sowing. Application of 75% N through inorganic fertilizers in combination with 25% through vermicompost sown at 2nd fortnight of October yielded maximum number of pods/plant (78.33), pod weight/plant (95.07 g), plant height (156.27 cm), pod length (5.69 cm), pod width (0.88 cm), number of branches/plant (10.27), number of nodes/stem (19.00) and pod yield (149.47 q/ha) whereas, days to 50% flowering, days to 50% pod setting, 100 seed weight (g) and number of seeds/pod were found non-significant. Total soluble solids (10.27°B) and protein content (30.79%) were significantly highest in treatment combination of 75% N through inorganic fertilizers + 25% through vermicompost. Economically, this treatment recorded maximum cost benefit ratio (3.96) as compared to other treatment combinations, thus, replacement of 25% of chemical fertilizers with vermicompost in October sown broad beans.

**Keywords**: *Vicia faba,* integrated nutrient management, sowing dates, growth, yield

Sher-e-Kashmir University of Agricultural Sciences and Technology, Chatha, Jammu, J&K
*Corresponding author, Email: manojrajouri@yahoo.com

## Introduction

Broad bean (*Vicia faba* L.) belongs to family Fabaceae and is popularly known as *Kala matar* and *Bakla* in various parts of India. It has been reported to be originated in Egypt, however, the evidences given by Cubero (1974) suggests that the most acceptable centre of origin is either West or Central Asia. It is an excellent source of protein which ranges from 27-34% (Haciseferogullari et al. 2003). Faba bean has been cultivated as a green manure crop, human food and stock feed for several thousands of years; and it is currently being used as a high protein food for humans and as a stock feed mostly in Europe, China, the Middle East and northern Africa (Singh et al. 2012). In Europe and Mediterranean region, the traditional use of Vicia faba is as horse feed (small and medium size). Large seeded varieties are often used for human consumption as a green vegetable.Faba bean has received relatively little attention in the past but recently it has been gaining in popularity, possibly due to its high protein content, tolerance to various biotic and abiotic stresses and high yields leading to availability at reasonable prices (Pala et al. 2000). Being a legume vegetable crop, it plays a critical role in enhanced level of biological nitrogen fixation in agricultural systems by symbiosis with *Rhizobium* in the root system. This substantially reduces the need for nitrogen fertilizers and reduction in pollution. The crop plays a beneficial role in the crop rotation, due to its fixation ability of atmospheric nitrogen. It has multipurpose uses as seed vegetables (green or dried), fresh or canned. There is a worldwide consensus that sole dependence on chemical input based agriculture is not suitable in long run and only integrated plant nutrient systems (IPNS) involving a combination of fertilizer, organic manure and bio-fertilizers are essential to sustain crop nutrients in integrated nutrient management has been proved superior to the use of each component separately. Excessive use of inorganic fertilizers not only

increased the cost of production but also decreased over all soil fertility causing environmental pollution (Ramana et al. 2010). The combined uses of organic and chemical fertilizers not only increase the yield of crop but improve the physical, chemical and biological properties of soil. Use of organic manure with optimum rate of fertilizer under intensive farming system increased the turnover of nutrients in the soil plant system (Metkari and Dhok 2011).

It has been clearly established that time of planting, is a major factor affecting faba bean yield and its components. A judicious combination strategy of using organic and inorganic fertilizer coupled with sowing dates could be helpful in increasing broad bean population. These conditions thus make it necessary to investigate the effect of organic and inorganic fertilizers with particular date of sowing for getting yield and better quality with improved soil health under agro-climatic conditions of Jammu region.

## Materials and Methods

The field experiment was carried out during Rabi season of the year 2018-19 in the Vegetable Research Farm, Department of Vegetable Science and Floriculture, Main Campus Chatha, SKUAST-Jammu (J&K) India. The trial was conducted in Randomized Block Design replicated thrice with following twelve treatment combinations such as $D_1T_1$- Recommended NPK through inorganic fertilizers + 20 tonnes FYM/ha (Control); $D_1T_2$-100% NPK through inorganic fertilizers(50: 60: 50 kg/ha); $D_1T_3$- 75% N through inorganic fertilizers + 25% through FYM; $D_1T_4$- 50% N through inorganic fertilizer + 50% through FYM; $D_1T_5$- 75% N through inorganic fertilizers + 25% through Vermicompost; $D_1T_6$- 50% N through inorganic fertilizer + 50% through Vermicompost; $D_2T_1$- Recommended NPK through inorganic fertilizers + 20 tonnes FYM/ha; $D_2T_2$- 100% NPK through inorganic fertilizers(50: 60: 50 kg/ha); $D_2T_3$- 75% N through inorganic fertilizers + 25% through FYM; $D_2T_4$- 50% N through inorganic fertilizer + 50% through FYM; $D_2T_5$- 75% N through inorganic fertilizers + 25% through Vermicompost; and $D_2T_6$- 50% N through inorganic fertilizer + 50 % through Vermicompost.

The broad bean variety 'RK-01' released by SKUAST-Jammu was used in the experiment. Seed sowing was done at a spacing of 40 x 10 cm in each plot sized at 2.0×1.8 m. Decomposed compost, well sieved vermicompost were applied on time as per the treatments. FYM and vermicompost were applied before sowing of seeds. The recommended dose of fertilizer is 50:60:50 kg NPK/ha was applied through Urea, DAP (Di-ammonium phosphate), and MOP (Muriate of Potash). The total amount of phosphorous and half of nitrogen as well as half of potash were applied as basal dressing before sowing the seeds in the rows. Thirty days after sowing, half of nitrogen and half of potash were applied as top dressing during hoeing, as per the treatment schedule. All other recommended package of practices was followed throughout the experiment. From each treatment, ten number plants selected randomly were tagged for recording various observations. The mean of the ten plants per treatment combination was considered for further analysis. Analysis of variance (ANOVA) was carried out on mean values separately for each character adopting standard analysis of variance technique for RBD design. The analysis of variance for each of the character was carried out with the mean value of data collected from sample plants from each plot and the mean average data was used for the total variance into components due to replications, treatments and error.

## Results and Discussion

**Plant height:** Maximum plant height (156.27cm) was recorded in $D_1T_5$ treatment containing (75% N through inorganic fertilizers + 25% through vermicompost) in early sowing of second fortnight of October as compared to other treatment combinations, whereas, minimum plant height (147.73 cm) was recorded in $D_2T_4$ (50% N through inorganic fertilizer along with 50% through FYM) when the crop was sown during 1st fortnight of November (Table 1). Bardan and Ahmed (2010) also reported an increase in plant height of broad bean due to the photoperiod and light intensity that prevailed during growth period of early planting which might resulted in an increase in both number and length of plant internodes. Increase in plant height due to proper combination of RDF + organic sources of plant nutrients were also reported by Metkari and Dhok (2011) in French bean and Jat et al. (2013) in cowpea.

**Number of branches per plant:** Significant differences were observed amongst different treatment combinations under different sowing dates (Table 1). Maximum number of branches/plant (10.27) was recorded in $D_1T_5$ (75% N through inorganic fertilizers + 25% through vermicompost) sown during 2nd fortnight of October whereas, minimum number of branches/plant (4.73) were recorded in treatment $D_2T_4$containing 50% N through inorganic fertilizers in combination with 50 % through FYM which was sown during 1st fortnight of November. Increase in number of branches due to vermicompost application was reported by Sharma et al. (2015) and Das et al. (2011) in cowpea with 75%

**Table 1:** Effect of integrated nutrient management under different sowing dates on growth parameters in broad bean

| Treatment combinations | Plant height (cm) | No. of branches plant$^{-1}$ | No. of nodes stem$^{-1}$ | Days to 50 % flowering | Days to 50% pod setting |
|---|---|---|---|---|---|
| $D_1T_1$- Recommended NPK through inorganic fertilizers + 20 tonnes FYM/ha (Control) | 155.1 | 8.3 | 16.5 | 71.7 | 130.7 |
| $D_1T_2$-100% NPK through inorganic fertilizers(50: 60: 50 kg/ha) | 153.5 | 6.5 | 14.5 | 72.6 | 130.9 |
| $D_1T_3$- 75% N through inorganic fertilizers + 25% through FYM | 154.0 | 7.9 | 15.0 | 72.0 | 130.7 |
| $D_1T_4$- 50% N through inorganic fertilizer + 50% through FYM | 150.9 | 5.7 | 12.8 | 73.8 | 131.0 |
| $D_1T_5$- 75% N through inorganic fertilizers + 25% through Vermicompost | 156.3 | 10.3 | 19.0 | 70.0 | 129.5 |
| $D_1T_6$- 50% N through inorganic fertilizer + 50% through Vermicompost | 156.0 | 9.4 | 18.0 | 70.7 | 129.7 |
| $D_2T_1$- Recommended NPK through inorganic fertilizers + 20 tonnes FYM/ha | 152.0 | 6.3 | 14.3 | 68.5 | 126.8 |
| $D_2T_2$- 100% NPK through inorganic fertilizers(50: 60: 50 kg/ha) | 150.1 | 5.1 | 12.9 | 69.4 | 128.3 |
| $D_2T_3$- 75% N through inorganic fertilizers + 25% through FYM | 150.5 | 5.9 | 13.3 | 69.3 | 126.8 |
| $D_2T_4$- 50% N through inorganic fertilizer + 50% through FYM | 147.7 | 4.7 | 11.8 | 69.6 | 127.2 |
| $D_2T_5$- 75% N through inorganic fertilizers + 25% through Vermicompost | 153.5 | 8.0 | 17.3 | 67.0 | 126.2 |
| $D_2T_6$- 50% N through inorganic fertilizer + 50 % through Vermicompost | 153.0 | 7.1 | 15.1 | 67.9 | 126.4 |
| SEm (±) | 1.4 | 0.6 | 0.9 | 1.8 | 2.2 |
| $CD_{(0.05)}$ | 4.3 | 1.7 | 2.7 | N.S | N.S |

RDF (Recommended dose of fertilizer) with other organic manure combination. Vermicompost treatments compensated the reduced level of recommended dose of inorganic fertilizers and even excelled 100 percent RDF. Similar results were reported by Ali and El- Shaikh (2008) and Bardan and Ahmed (2010) in broad bean.

**Number of nodes/ stem:** Maximum number of nodes /stem (19.00) was observed in early sowing of broadbean (Second fortnight of October) with treatment $D_1T_5$ (75% N through inorganic fertilizers + 25% through vermicompost) and the lowest numbers of nodes/ stem (11.80) were recorded in $D_2T_4$ (50% N through inorganic fertilizer + 50% through FYM) which was sown during 1st fortnight of November (Table 1). This increase in pods per plant is because of increase in nodes that provided more fruit bearing space on the plant (Getachew et al. 2014).

**Days to 50 % flowering and pod setting:** Non significant differences were recorded in various treatment combinations comprising of different nutrient management practices and dates of sowing in respect of days to 50 % flowering and pod setting (Table 1). However, minimum number of days to 50% flowering and pod setting (67.00 days, 126.20 days) were recorded in $D_2T_5$ (75% N through inorganic fertilizers +25% through vermicompost) sown in 1st fortnight of November whereas, maximum number of days to 50 % flowering and pod setting (73.83 days, 131.00 days) were recorded in $D_1T_4$ (50% N through inorganic fertilizers + 50 % through FYM) sown during 2nd fortnight of October. Similar results were obtained by Tiwari and Singh (2000) in cowpea crop.

**Number of pods/plant:** Highest number of pods /plant (78.33) was achieved on early sowing of broadbean (Second fortnight of October) with treatment $D_1T_5$ containing 75% N through inorganic fertilizers + 25% N through vermicompost, whereas, the lowest number of pods/ plant (37.13) were recorded in $D_2T_4$ i.e. 50% N through inorganic fertilizer alongwith 50% through FYM when crop was sown during 1st fortnight of November (Table 2). The variation in pod number might be due to variation in climatic factors owing to different sowing times. These results are in conformity with the findings of Vishwanath et al. (2004) in French bean and Prasad et al. (2012) in cowpea.

**Pod length:** The pod length was significantly influenced by application of organic and chemical fertilizer under different dates of sowing (Table 2). The highest value (5.69 cm) was recorded in $D_1T_5$ (75% N through inorganic fertilizers + 25% through vermicompost) in early sowing of second fortnight of October whereas, the minimum pod length (5.17 cm) was recorded in $D_2T_4$ (50% N through inorganic fertilizer +50% through FYM) when the crop was sown during 1st fortnight of November. This might be due to the fact that higher vegetative growth had helped in the synthesis of greater amount of food material which was later translocated into developing pods resulting in increasing pod length and diameter (Kamble et al. 2016). Similar results were also observed by Rafaat et al. (2016) in broad bean.

**Pod width:** Maximum pod width (0.88 cm) was observed in treatment $D_1T_5$ (75% N through inorganic fertilizers + 25% through vermicompost) in early sowing of broad bean (Second fortnight of October) and the minimum pod length (0.81 cm) was recorded in 1st fortnight of November with treatment $D_2T_4$ (50 % N through inorganic fertilizers + 50 % through FYM) (Table 2). The pod width was found more in early sowing as compared to late sowing. The reason might be the effect of low temperatures which retarded the plant growth as well as pod growth. Similar results have been reported by Kumar et al. (2014) in French bean.

**Pod weight/plant:** Maximum pod weight/ plant (95.07 g) was observed in 2nd fortnight of October with treatment containing $D_1T_5$ (75% N through inorganic fertilizers + 25% N through vermicompost) and the minimum pod weight/plant (37.87 g) was recorded in 1st fortnight of November with treatment $D_2T_4$ (50% N through inorganic fertilizers + 50 % through FYM) (Table 2). Due to better assimilation of photosynthates and better partitioning into developing pod might have taken place and improved yield attributing characters like pods weight and ultimately increased pod yield (Reddy et al. 2014).

**Number of seeds/pod:** Data presented in Table 2 revealed non-significant effects on number of seeds per pod across all treatment combinations. However, maximum number of seeds / pod (3.76) were observed in treatment $D_1T_3$ (75% N through inorganic fertilizers + 25% through FYM) sown during 2nd fortnight of October whereas, minimum number of seeds/pod (3.38) were recorded in1st fortnight of November with treatment $D_2T_2$ (100% through inorganic fertilizers (50: 60: 50 kg/ha NPK). Kubure et al. (2015) stated that the higher number of seeds $pod^{-1}$ treatment could be due to production of more number of pods/ plant and better adaptation to the environment. Our findings are in close association with the findings of Gemechu et al. (2006), and Bardan and Ahmed (2010) in broad bean.

**100 Seed weight:** Non significant differences were recorded in various treatment combinations comprising of different nutrient management practices and dates of sowing in respect of 100 seed weight (Table 2). However, maximum 100 seed weight (19.07 g) was recorded in 2nd fortnight of October with treatment containing $D_1T_6$ (50% N through inorganic fertilizer in combination with 50% through vermicompost) whereas, the minimum 100 seed weight (17.20 g) was recorded in 1st fortnight of November with treatment $D_2T_3$ (75% N through inorganic fertilizer in combination with 25% through FYM). Mohanty et al. (2017) also reported that 100 seed weight of French bean were not much influenced by different treatments and was mostly a varietal character somewhat less influenced by different

**Table 2:** Effect of integrated nutrient management under different sowing dates on yield, economics and quality parameters in broad bean

| Treatment combinations | No. of pod $plant^{-1}$ | Pod length (cm) | Pod width (cm) | Pod weight $plant^{-1}$ | No. of seeds $pod^{-1}$ | 100 seed weight | Pod yield (q /ha) | B : C Ratio | Protein (%) | TSS (°B) |
|---|---|---|---|---|---|---|---|---|---|---|
| $D_1T_1$- Recommended NPK through inorganic fertilizers + 20 tonnes FYM/ha (Control) | 61.8 | 5.5 | 0.9 | 78.4 | 3.6 | 18.9 | 115.4 | 2.41 | 26.6 | 9.5 |
| $D_1T_2$-100% NPK through inorganic fertilizers(50: 60: 50 kg/ha) | 52.1 | 5.4 | 0.8 | 72.1 | 3.7 | 18.4 | 112.4 | 3.11 | 28.6 | 9.7 |
| $D_1T_3$- 75% N through inorganic fertilizers + 25% through FYM | 57.5 | 5.5 | 0.9 | 76.4 | 3.8 | 18.7 | 114.4 | 3.06 | 29.3 | 10.0 |
| $D_1T_4$- 50% N through inorganic fertilizer + 50% through FYM | 41.5 | 5.3 | 0.8 | 63.1 | 3.7 | 17.7 | 93.1 | 2.22 | 28.33 | 9.8 |
| $D_1T_5$- 75% N through inorganic fertilizers + 25% through Vermicompost | 78.3 | 5.7 | 0.9 | 95.1 | 3.6 | 18.9 | 149.5 | 3.96 | 30.8 | 10.3 |
| $D_1T_6$- 50% N through inorganic fertilizer + 50% through Vermicompost | 69.7 | 5.6 | 0.9 | 84.7 | 3.7 | 19.1 | 131.3 | 3.00 | 29.1 | 10.1 |
| $D_2T_1$- Recommended NPK through inorganic fertilizers + 20 tonnes FYM/ha | 50.3 | 5.3 | 0.8 | 50.4 | 3.4 | 17.5 | 110.8 | 2.27 | 27.7 | 9.7 |
| $D_2T_2$- 100% NPK through inorganic fertilizers(50: 60: 50 kg/ha) | 40.5 | 5.2 | 0.8 | 44.2 | 3.4 | 18.1 | 103.7 | 2.78 | 28.4 | 10.3 |
| $D_2T_3$- 75% N through inorganic fertilizers + 25% through FYM | 45.5 | 5.2 | 0.8 | 45.2 | 3.7 | 17.2 | 105.0 | 2.74 | 26.2 | 9.6 |
| $D_2T_4$- 50% N through inorganic fertilizer + 50% through FYM | 37.1 | 5.2 | 0.8 | 37.9 | 3.6 | 17.7 | 87.0 | 2.01 | 27.7 | 9.5 |
| $D_2T_5$- 75% N through inorganic fertilizers + 25% through Vermicompost | 68.6 | 5.6 | 0.9 | 68.7 | 3.7 | 18.5 | 132.5 | 3.39 | 30.0 | 10.2 |
| $D_2T_6$- 50% N through inorganic fertilizer + 50 % through Vermicompost | 57.0 | 5.3 | 0.9 | 57.1 | 3.6 | 18.4 | 125.0 | 2.75 | 27.9 | 10.0 |
| SEm (±) | 6.9 | 0.1 | 0.02 | 7.5 | 0.1 | 0.5 | 6.9 | - | 1.2 | 0.3 |
| $CD_{(0.05)}$ | 20.5 | 0.3 | 0.05 | 22.3 | N.S. | N.S | 20.3 | - | N.S | N.S. |

combination of treatments. Similar findings were also observed in French bean (Ramana et al. 2011); mung bean (Haque et al. 2014) and faba bean (El Hag 2017).

**Pod yield:** Maximum pod yield (149.47 q/ ha) was recorded in treatment combination $D_1T_5$ containing 75% N through inorganic fertilizers along with 25% through vermicompost sown during 2nd fortnight of October and minimum pod yield (87.03 q/ ha) was recorded in $D_2T_4$ containing 50% N through inorganic fertilizers along with 50 % through FYM sown during 1st fortnight of November. Sowing during second fortnight of October resulted in maximum green pod yield as compared to first fortnight of November. Higher green pod yield per hectare was obtained with early sowings, whereas, lower green pod yield per hectare was obtained with late sowings in broad bean. These results are in conformity with the finding of Pandey et al. (2012) in French bean and Ananth and Kumar (2018) in dolichos bean.

**Protein:** Non significant differences were recorded in various treatment combinations comprising of different nutrient management practices and dates of sowing in respect of protein content (Table 2). Maximum protein (30.79 %) was recorded in treatment combination $D_1T_5$ containing 75% N through inorganic fertilizers along with 25% through vermicompost sown during 2nd fortnight of October whereas, the minimum protein (26.18 %) was recorded in $D_2T_3$ 75% N through inorganic fertilizers along with 25% through FYM sown during 1st fortnight of November. Sugiyama et al. (1984) stated that the soluble proteins were increased with better N supply and favorable growth condition. Greef (1994) also reported that high values of the reduced N fraction (protein fraction) were found in photo synthetic active leaf tissue. The results are also in agreement with the finding of Chavan et al. (2015) in faba bean and Fouda et al. (2017) in French bean.

**Total Soluble Solid (TSS):** Non significant differences were observed in respect of TSS content across all the treatment combinations (Table 2). However, maximum TSS (10.27 °Brix) was recorded in $D_1T_5$ treatment (75% N through inorganic fertilizers + 25% through vermicompost) sown during 2nd fortnight of October whereas, the minimum TSS (9.47°Brix) was recorded in treatment combination $D_2T_4$ containing 50% N through inorganic fertilizer + 50% through FYM when crop was sown during 1st fortnight of November. Koshalendra et al. (1992) reported that total polysaccharides and sugars in crops increased due to application of organic manures, which resulted due to the higher availability of phosphorus which is a constituent of ADP, ATP and other high energy compounds. This increase in TSS with the application of organics may be attributed to increase in sugar phosphates polysaccharides as phosphorus is one of the important constituent. Our findings are in close association with the findings of Sepehya et al. (2015) in garden pea.

**Economics:** Data depicted in Table 2 revealed the detailed economics of different treatment combination used in the present study. The economic analysis revealed among all the treatment combinations significantly highest gross return (Rs 447000/ ha) and net return (Rs 309936.46 /ha) was recorded in treatment combination $D_1T_5$ (75% N through inorganic fertilizers in combination with 25% through Vermicompost) in early sowing of second fortnight of October as compared to other treatments combination. The optimal and sub optimal dose of chemical fertilizer alongwith vermicompost and farm yard manure resulted higher pod yield, thus highest gross return and net return were obtained. Similar results have been reported in broad bean by Kubure et al. (2015).

## Conclusion

From the present study it can be concluded that treatment combination ($D_1T_5$) comprising of 75% N through inorganic fertilizers + 25% through Vermicompost sown during 2nd fortnight of October results in high yield as well as quality parameters in broad bean under subtropical plains of Jammu region thereby reducing the appreciable amount of inorganic fertilizers in soil without compromising yield and quality in broad bean.

## Acknowledgement

The authors are highly thankful to Late Dr. R. K. Gupta, Ex-Professor & Head, Division of Vegetable Science & Floriculture, SKUAST-Jammu for his guidance, supervision and providing logistics for carrying out the field trial.

## Lkkjk'k

वर्तमान परीक्षण वर्ष 2018–19 (रबी मौसम) के दौरान सब्जी विज्ञान और पुष्प कृषि विभाग, शेरे–ई–कश्मीर कृषि एवं प्रौद्योगिकी विश्वविद्यालय, जम्मू (कश्मीर) में सब्जी शोध प्रक्षेत्र में की गयी। प्रयोग में अकार्बनिक उर्वरकों के तीन स्तर अर्थात् 50 प्रतिशत, 75 प्रतिशत अनुशंसित पोषण का 100 प्रतिशत (50:60:50 किग्रा. प्रति हेक्टेयर एन.पी.के.) सम्मिलित किया गया जो बुवाई की विभिन्न तिथियों के तहत् पौधों के पोषक (एफ.वाई.एम. और वर्मीकम्पोस्ट) के दो जैविक स्रोतों के साथ संयुक्त रूप से (अक्टूबर का दूसरा पखवाड़ा और नवम्बर का पहला पखवाड़ा) तीन बार प्रतिकृति कर यादृच्छिक प्रखण्ड विन्यास में निर्धारित 12 उपचारों समाहित किया गया।

परिणाम से पता चला कि वानस्पतिक वृद्धि और उपज घटकों, बुवाई की विभिन्न तिथियों के तहत् पोषक तत्वों के विभिन्न स्रोतों के उपयोग से सार्थक रूप से प्रभावित थे। अक्टूबर के दूसरे पखवाड़े (डी.1 डी. :) में बोये गये वर्मीकम्पोस्ट के माध्यम से 25 प्रतिशत के साथ अकार्बनिक उर्वरकों के माध्यम से 75 प्रतिशत नत्रजन के प्रयोग से अधिकतम फली प्रति पौध (78.33), फल भार प्रति पौध (95.07 ग्राम), पौधे की ऊँचाई (156.25 सेमी.), फल लम्बाई (5.69 सेमी.), फली चौड़ाई (0.88 सेमी.), शाखा प्रति पौध संख्या (10.27), गांठ प्रति तना संख्या (19.00) एवं फल उपज (149.47 कुन्तल प्रति हेक्टेयर) पाया गया जबकि 50 प्रतिशत पुष्पन के दिन से 50 प्रतिशत फली धारण करने, 100 बीज वजन (ग्राम) एवं बीजों की संख्या प्रति फली अलग–अलग बुवाई की तारीखों में विभिन्न उपचार संयोजन गैर–महत्वपूर्ण पाये गये। कुल घुलनशील ठोस (10.27 डिग्री ब्रिक्स) और प्रोटीन की मात्रा (30.79 प्रतिशत) अकार्बनिक उर्वरकों के माध्यम से 75 प्रतिशत नत्रजन + वर्मीकम्पोस्ट के माध्यम से 25 प्रतिशत उपचार संयोजन आर्थिक रूप से अधिकतम पाये गये। अन्य उपचारों की तुलना में अकार्बनिक उर्वरकों के माध्यम से 75 प्रतिशत एन.+ अक्टूबर के दूसरे पखवाड़े के दौरान बोये गये वर्मीकम्पोस्ट के माध्यम से आर्थिक रूप से अधिकतम लागतःलाभ अनुपात (3.96) दर्ज किया गया था। इस प्रकार, 25 प्रतिशत रासायनिक उर्वरकों के स्थान पर वर्मीकम्पोस्ट लगाने से अक्टूबर में बुवाई कर अधिक फलियाँ प्राप्त करने के लिए संस्तुत की जाती है।

## References


Ali HAO and El-Sheikh KAA (2008) Yield and its components in faba bean genotypes as influenced by cultivation method in reclaimed soil. Minia Journal of Agricultural Research and Development 28 (1): 67-82.

Ananth RA and Kumar SR (2018) Effect of integrated nutrient management on growth and yield of dolichos bean (*Lablab purpureus*). Annals of Plant and Soil Research 20(3): 302–306.

Bardan MSS and Ahmed MZD (2010) Effect of sowing dates and planting methods on growth characters, seed yield and its components of faba bean in newly reclaimed lands. Journal of Agricultural and Environment Science 9(1): 53-66.

Chavan BL, Vedpathak, MM and Pirgonde BR (2015) Effects of organic and chemical fertilizers of cluster bean (*Cyamopsis tetragonolobus*). European Journal of Experimental Biology 5(1):34-38.

Cubero JI (1974) On the evolution of *Vicia faba* L. Theoretical and Applied Genetics 45(2): 47-51.

Das B, Wagh AP, Dod VN, Nagre PK. and Bawkar SO (2011) Effect of integrated nutrient management on cowpea. The Asian Journal of Horticulture 6(2): 402-405.

El Hag. DAA (2017) Impact of plant arrangement and density on yield and its components of two faba bean cultivars (*Vicia faba* L.). Journal of plant production 8(12): 1345-1350.

Fouda KF, El- Ghamry AM, El-Sirafy ZM and Klwet IHA (2017) Integrated effect of fertilizers on beans cultivated in alluvial soil. Egyptian Journal of Soil Science 57(3): 303 – 312.

Gemechu K, Jarso M and Wolabu T (2006) Faba bean (*Vicia faba* L.) genetic and breeding research in Ethopia: A Review. In: Ali Kemal, Kenneni Gemechu, Ahmed Seid, Malhatra Rajendra, Beniwal Surendra, Makkouk Khaled, Halila MH, (eds). Food and forage legumes of Ethopia: Progress and Prospects. Proceeding of the workshop on food and forage legume, pp. 22-26. Addis Ababa, Ethopia.

Getachew E, Tesfaye A and Mulualem T (2014) The effects of sowing date and spacing for yield of green bean (*Phaseolus vulgaris* L.) varieties at Jimma, Southwestern Ethiopia. Sky Journal of Agricultural Research 3(9):174 – 180.

Greef (1994) Comparing vermicomposts and composts. BioCycle 39: 63-66.

Hacýseferogullarý H, Gezer I, Bahtiyarca Y and Menges HO (2003) Determination of some chemical and physical properties of Sakýz faba bean (*Vicia faba* L. var. Major). Journal of Food Engineering, pp. 475–479.

Haque MM, Biswash MK, Rahman MW, Sbermin M and Shamhunnahar (2014) Combination of potassium and vermicompost in different stage on growth and yield of Mung bean (*Vigna radiata* L.) cultivar. Journal of Agricultural and Food Technology 4(8): 8-15.

Jat SR, Patel BJ, Shivran AC, Kuri BR and Jat G (2013) Effect of phosphorus and sulphur levels on growth and yield of cowpea under rainfed conditions. Annals of Plant and Soil Research 15(2): 114-117.

Kamble MY, Kalalbandi BM, Kadam AR and Rohidas SB (2016) Effect of organic and inorganic fertilizers on growth, green pod yield and economics of French bean (*Phaseolus vulgaris* L.) cv. HPR-35. Legume Research 39 (1): 110-113.

Koshalendra T, Solankey BS and Shinde DA (1992) Effect of phosphorus levels and genotypes on quality of soybean seeds. Legume Research 15(2): 76-80.

Kubure TE, Cherukuri R, Arvind C and Hamza I (2015) Effect of faba bean (*Vicia faba* L.) genotypes, plant densities and phosphorous on productivity, nutrient uptake, soil fertility changes and economics in central land of Ethiopia. International Journal of Life Science 3(4):287-305.

Kumar A, Singh PK, Rai N, Bhaskar GP and Datta D (2014) Genetic diversity of French bean (Phaseolus vulgaris L.) genotypes on the basis of morphological traits and molecular marker. Indian Journal of Biotechnology 13: 207-213.

Metkari PM and Dhok SP (2011) Effect of organic and inorganic fertilization on soil fertility and productivity of French bean in vertisol, Asian Journal of Soil Science 6(1): 80-84.

Mohanty S, Sahu GS, Dash SK, Pradhan SR, Mangaraj S and Nahak S (2017) Integrated nutrient management for seed production in French bean (*Phaseolus vulgaris* (L.). International Journal of Current Microbiology and Applied Sciences 6(10): 3295-3303.

Pala M, Armstrong E and Johansenm C (2000) Linking research marketing opportunities for pulses in the 21st century. Marketing Opportunities for Pulses in the 21st Century (Current Plant Science and Biotechnology in Agriculture), Proceedings of the Third International Food Legumes Research Conference pp. 22–26. Dordrecht, the Netherlands: Kluwer Academic Publishers.

Pandey YR, Gautam DM, Thapa RB, Sharma MD and Paudyal KP (2012) Response of pole type French bean (*Phaseolus vulgaris* L.) genotypes to sowing dates in the mid hills of

western Nepal, Nepal Journal of Science and Technology 13(2): 15-20.

Prasad M, Dawson J and Yadav RS (2012) Effect of different Nitrogen sources and Phosphate solubilising bacteria on growth and yield Green Cowpea (*Vigna unguiculata* (L.) Walp.). Crop Research 44(1, 2):59-62.

Rafaat JG, Hussein RA and Ahmad MM (2016) Effect of fertilizer application on vegetative growth characters of broad bean (*Vicia faba* L.). International Journal of plant, animal and environmental sciences 6(1): 103-108.

Ramana V, Ramakrishna M, Purushotham K and Reddy KB (2011) Effect of biofertilizer on growth, yield and quality of French bean. Vegetable Science 38(1): 35-38.

Reddy DS, Nagre PK, Reddaiah K and Reddy BR (2014) Effect of integrated nutrient management on growth,yield, yield attributing characters and quality characters in cluster bean [*Cymopsis tetragonaloba* (L.) Taub.]. International Quarterly Journal of Environmental Sciences 6: 329-332.

Sepehya S, Bhardwaj SK and Dhiman S (2015) Quality attributes of garden pea (*Pisum sativum* L.) as influenced by integrated nutrient management under mid hill conditions. Journal of Krishi Vigyan 3(2) : 78-83.

Sharma SK, Prajapati S and Raghuwanshi O (2015) Effect of organic manures and Inorganic fertilizers on yield and economics of cowpea production (*Vigna unguiculata* L.). Indian Research Journal Genetic & Biotechnology *7*(1):152-155.

Singh BK, Gupta AJ and Singh L (2012) Improvement of faba bean (*Vicia faba* L.). In: Faba bean (*Vicia faba* L.): A potential leguminous crop of India (AK Singh and BP Bhatt eds.). Jain Brother Publishing House, New Delhi, pp 119-140 (ISBN 978-93-5067-773-5).

Sugiyama C, Lourdura A, Rangasamy A, Subbian P and Velayuthan A (1984) Effect of vermicompost application on the soil properties, nutrient availability, uptake and yield of rice – A review. Agriculture Review 23(2):127-133.

Tiwari A and Singh YS (2000) Effect of organic manures and inorganic fertilizers on yield and economics of cowpea production (*Vigna unguiculata* L.*).* Indian Research Journal of Genetics Biotechnology **7**(1): 152-155.

Vishwanath K, Kalappa VP and Lokesh K (2004) Influence of sowing dates on seed yield and quality of French bean (*Phaseolus vulgaris* L.) varieties, Mysore. Journal of Agricultural Science 38(1): 56-59.