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Research Article

# EFFECT OF VERMICOMPOST AND P ENRICHED BIOCOMPOST ON YIELD ATTRIBUTES AND YIELD OF FRENCH BEAN

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**Abstract-** An experiment was conducted at the experimental farm of Department of Soil Science, CSKHPKV, Palampur by taking French bean crop during *kharif*, 2009. Biocompost and vermicompost were prepared by using cow dung and weeds and were inoculated with microbial inoculants and rock phosphate. Biocompost and vermicompost were analysed and the best one among nine composts prepared *i.e.*, 50% each of cowdung and substrate+ 2% rock phosphate + inoculants and three vermicomposts *i.e.*, the one prepared by using Eupatorium waste, on the basis of nutrient content, was selected and applied to the crop in combination with fertilizers depending upon the treatment. The yield attributes of the crop were recorded and an increase in emergence, number of pods per plant and height was observed in the treatments where vermicompost was applied @15 t $ha^{-1}$. The highest seed yield was recorded in the treatment 100% P and K + biofertilizer + vermicompost followed by 100% NPK + vermicompost treatment which was significantly higher than the same treatment with replacement of biocompost.

**Keywords**- Cowdung, Biocompost, Biofertilizer

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## Introduction

French bean (*Phaseolus vulgaris L.*), a member of family fabaceae, is one of the most ancient and popular warm season vegetable crop grown worldwide for its green pods. It is an important source of protein, calcium, iron and vitamins in human diet. The crop is known by various names as French bean, common bean, snap bean, kidney bean and navy bean. In India, it is commercially cultivated in Himachal Pradesh, Jammu and Kashmir, hills of Uttrakhand, North-Eastern states and peninsular India, covering an area of about 1,50,000 ha with annual production of 4,20,000 tonnes and ranks 4$^{th}$ in green bean production in the world. Its cultivation in Northern Indian plains is rather restricted in account of limited period of favorable weather conditions. It occupies an area of 3,197 ha with annual production of 33,112 metric tonnes in Himachal Pradesh. Biocompost and vermicompost supplement the nutrient requirements of crops. Concerning the economic sustainability, the low cost of compost is useful to farmer as well to human society. Vermicompost is reported to be rich in nutrient elements [1] and biocompost also contains high amount of nutrients than ordinary compost or FYM. Organic manuring systems fitted effectively in intensive cropping systems are likely to play a decisive role in sustainable agriculture.

## Material and methods

An experiment was conducted at the experimental farm of Department of Soil Science, CSKHPKV, Palampur by taking French bean crop during kharif, 2009. Biocompost and vermicompost were prepared by using cow dung and weeds and were inoculated with microbial inoculants and rock phosphate. Nine biocomposts and three vermicomposts were prepared and analyzed and the best one among nine composts prepared i.e., 50% each of cow dung and substrate+ 2% rock phosphate + inoculants and three vermicomposts i.e., the one prepared by using Eupatorium waste, on the basis of nutrient content, was selected and applied to the crop in combination with fertilizers depending upon the treatment. There were twelve treatments and three replications in randomized block design. The field experiment was conducted on French bean using following treatments: T1: 100% P + N fixer + P solubilizer, $T_2$: 100% P + 100% N, $T_3$: 75% P + N fixer + P solubilizer, $T_4$: 75% P + 100% N, $T_5$: 100% P + N fixer + P solubilizer +biocompost, $T_6$: 75% P + 100% N + biocompost, $T_7$: 100% P + 100% N + biocompost, $T_8$: 75% P + inoculation with N-fixer and P solublizers + biocompost, $T_9$: 100% P + inoculation with N-fixer and P solublizer + vermicompost, $T_{10}$: 100% P + 100% N + vermicompost, $T_{11}$ : 75% P + inoculation with N-fixer and P solublizer + vermicompost, $T_{12}$:75% P + 100% N + vermicompost.

## Results

### Composts

The vermicompost exhibited higher values of total nitrogen, phosphorus, potassium and microbial biomass nitrogen whereas P enriched biocompost exhibited higher values of organic carbon, C : N ratio, microbial population and biomass sulphur. The values of biomass nitrogen were same in both the composts. The soil sample before sowing of crop was taken and was analyzed for physical, chemical and microbiological properties. The soil was having texture silty clay loam, pH 5.2, cation exchange capacity 11.0 cmol (p+) $kg^{-1}$, organic carbon 10.5 g $kg^{-1}$, available N, P and K 390 kg $ha^{-1}$, 11.5 kg $ha^{-1}$ and 169.12 kg $ha^{-1}$ respectively, microbial biomass carbon 65.80 µg $g^{-1}$ and microbial count as $3.2\times10^7$ cfu $g^{-1}$ bacteria, $2.9\times10^5$ cfu $g^{-1}$ fungi and $19\times10^4$ cfu $g^{-1}$ actinomycetes. Similar results were reported by Jambhekar (1992), Saxsena *et al*. (1998), Vasanthi and Kumaraswamy (1999), Sarangthen and Singh (2005), Manna *et al*. (1997), Thakur and Sharma (1998) and Manna and Ganguly (1999) [2-7].

### Yield attributes

The emergence in the first week ranged between 2.7 to 8.0 plants per metre square and the highest emergence *i.e.*, 8.0 plants per metre square, was recorded in the treatment 100% P and K + biofertilizer + vermicompost followed by 100% P and K+ biofertilizer+ P enriched biocompost and 75% P + biofertilizer + P enriched biocompost + 100% K and 75% P + biofertilizer + 100% K. The emergence in the second week ranged between 6 and 17 plants per metre square and highest

emergence *i.e.*, 17 plants per metre square was recorded in treatment 75% P + biofertilizer + vermicompost + 100% K followed by treatment 75% P + biofertilizer + P enriched biocompost + 100% K and 75% P + biofertilizer+100% K. The emergence in the first week was highest in the treatment 100% P and K + biofertilizers + vermicompost which was almost double than that of the emergence in 100% recommended dose of fertilizer. Whereas the emergence in second week was higher in the treatment 75% P + biofertilizers + vermicompost + 100% K over recommended dose of fertilizer. The lowest emergence in both the weeks *i.e.*, 3.00 and 5.67 plants respectively was recorded in the treatment 75% P + 100% N and K.

**Plant height**

The data presented in Table 4.3 revealed that the maximum plant height 155.3 cm was recorded in the treatment 100% NPK + vermicompost @15t ha-1 followed by 75% P + 100% N and K + vermicompost @15t ha$^{-1}$ and 75% P + biofertilizer + vermicompost @15t ha-1+100% K over the recommended dose of fertilizers which was 113 cm. An increase of 0.21 per cent, 37.46 per cent and 24.59 per cent was recorded in case of 100% NPK + vermicompost treatment over 75% P+100% N and K + vermicompost, 100% NPK and 100% NPK + PEB treatments respectively. The plant height in the treatment 100% NPK + vermicompost was significantly higher than the 100% NPK treatment and was at par with the 75% P + 100% N and K + vermicompost treatment. Minimum height *i.e.*, 102.7 cm was recorded in the treatment 100% P and K + biofertilizers.

**Number of pods per plant**

Maximum number of pods per plant was observed in the treatment 100% NPK + vermicompost followed by treatment 100% NPK + P enriched biocompost. An increase of 8.5 per cent and 18.5 per cent was recorded in case of number of pods per plant in the treatment 100% NPK + vermicompost over 100% NPK + PEB and 100% NPK treatment respectively. Maximum number of pods per plant found in the treatment 100% NPK + vermicompost were significantly higher than 100% NPK treatment and was at par with the treatment 100% NPK + PEB. The treatment 75% P + biofertilizer + 100% K recorded minimum number of pods per plant *i.e.*, 18.7. Reason for increased height and number of pods in the treatment recommended dose + vermicompost /PEB might be attributed to the balanced nutrition provided to the plants and also vermicompost /biocompost would have improved the soil physical properties so better root proliferation resulting in better plant height and number of pods per plant. Similar results were recorded by Kumarjitsingh *et al.* (2005) in rice and in groundnut-finger millet cropping system by Varalakshmi *et al.* (2005) [8,9].

| Treatments | 1st week emergence | 2nd week emergence | Plant height (cm) | Number of pods plant$^{-1}$ | Seed yield (kg ha $^{-1}$) |
|---|---|---|---|---|---|
| $T_1$ | 6.3 | 13.7 | 102.7 | 20.3 | 774 |
| $T_2$ | 4.0 | 7.3 | 113.0 | 21.6 | 929 |
| $T_3$ | 6.3 | 13.7 | 134.0 | 18.7 | 651 |
| $T_4$ | 3.0 | 5.7 | 143.7 | 20.3 | 880 |
| $T_5$ | 6.7 | 12.3 | 110.3 | 19.4 | 1113 |
| $T_6$ | 4.0 | 6.0 | 123.0 | 21.4 | 973 |
| $T_7$ | 3.3 | 7.0 | 124.7 | 23.6 | 1023 |
| $T_8$ | 6.3 | 14.3 | 105.0 | 19.5 | 982 |
| $T_9$ | 8.0 | 12.3 | 125.3 | 20.3 | 1488 |
| $T_{10}$ | 2.7 | 9.0 | 155.3 | 25.6 | 1402 |
| $T_{11}$ | 5.3 | 17.0 | 150.0 | 20.4 | 1203 |
| $T_{12}$ | 4.0 | 10.3 | 155.0 | 22.4 | 1331 |
| CD (P=0.05) | 2.24 | 3.02 | 16.88 | 3.13 | 24.4 |

**Seed Yield**

The seed yield varied between 651 and 1488 kg ha$^{-1}$. The highest seed yield was recorded in the treatment 100% P and K + biofertilizer + vermicompost followed by 100% NPK + vermicompost. The yield increase in the treatment 100% P and K + biofertilizer + vermicompost was found to be 6.13 per cent higher than the treatment 100% NPK + vermicompost and 60.2 per cent increase over 100% NPK treatment. Significant increase in seed yield in the treatment 100% P and K + biofertilizers + vermicompost was recorded over 100% recommended dose of fertilizers. Lowest seed yield (651 kg ha$^{-1}$) was recorded in the treatment 75% P + biofertilizers + 100% K. The highest seed yield was observed in the treatment where combined use of chemicals, organics and inoculants was done. It may be attributed to the fact that the organics, inorganics and microbial inoculants sustain optimum yields, maintain soil physical, chemical and microbiological properties which in turn make soil a better medium for plant growth. Similar reports are presented by Yadav and Kumar (2000), Janaki and Hari (1997), Jagdale *et al.* (2005), Singh and Chauhan (2009), Aziz and Eliot (2010), Otieno *et al.* (2009), Smith *et al.* (2001), Arancon (2006), Kanwar and Paliyal (2004), Kushwaha (1994) and Rajkhowa *et al.* (2003). The yield attributes and green pod yield data shows that the application of 100% $P_2O_5$ significantly increased the pod yield [10-20]. The increase in yield attributes may be due to the fact that phosphorus is an important constituent of nucleic acids, phytin and phospholipids in plants which are high energy compounds for the transfer of energy in metabolic processes. The increase in green pod yield was due to the active role of P as a major nutrient in plant nutrition. Addition of P stimulates the rate of symbiotic nitrogen fixation and in turn increased the growth of plant, thereby having beneficial effect in giving higher yield.

**Conclusion**

The emergence in the first and second week was recorded highest in the treatments 100% P and K + biofertilizer + vermicompost @ 15t ha$^{-1}$ and 75% P+ biofertilizers + vermicompost @ 15 t ha$^{-1}$ respectively. Maximum height and number of pods per plant were recorded in the treatment 100% NPK along with vermicompost @ 15t ha$^{-1}$. Seed yield was recorded maximum in the treatment 100% P and K + biofertilizer + vermicompost @ 15t ha$^{-1}$ treatment.

**Application of research**: An integrated nutrient management system can be a much better approach in sustaining soil health

**Research Category**: Vermicompost

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