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# Effect of organic manures and inorganic fertilizers on growth, yield and quality of French bean (*Phaseolus vulgaris* L.)

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**Abstract**
French beans also known as green beans or snap beans, are annual herbaceous plants cultivated for their edible green pods. Therefore, during*Rabi* season 2022, an investigation was conducted at the Central Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh. The investigation aimed to identify the influence of different combinations of organic manures and inorganic fertilizers on the growth, yield, and quality of French bean variety Anusha. The study was carried out using a randomized block design with seven treatments and three replications. The findings of the investigation suggest that treatment $T_3$ (75% RDF + 25% VC) was the most effective in terms of growth, yield, and quality of French bean.

**Keywords:** FYM, vermicompost, poultry manure, inorganic fertilizers, growth, yield and quality, French bean

## Introduction
French beans (*Phaseolus vulgaris* L.) are annual herbaceous plants cultivated worldwide for their green pods or dry seeds. They are members of the legume family, Fabaceae, and form a symbiotic relationship with nitrogen-fixing rhizobia bacteria. While wild species are climbers, cultivated varieties can be bush or climbing beans, including kidney beans, navy beans, pinto beans, and wax beans. Runner beans (*Phaseolus coccineus*) and broad beans (*Vicia faba*) are also commercially grown. In 2016, global production reached 27 million tonnes of dried beans and 24 million tonnes of green beans. French beans have significant nutritional value, containing carbohydrates, proteins, fats, vitamins, and minerals. India is a major producer, accounting for 37.52% of the global production, with Gujarat being the leading state followed by Bihar, Jharkhand, and Karnataka. French beans are grown on approximately 4.62 lakh hectares in India, yielding 21.18 million metric tonnes in the 2021-22 season. It is essential for farmers to develop a well-defined fertilizer strategy that complies with legal, environmental, and economic considerations. Organic and inorganic fertilizers should be used together to promote sustainable agriculture, maximizing yield, quality, and adaptability to stress conditions, ultimately increasing market value.

## Material and Methods
The present investigation was done to understand the effect of organic manures and inorganic fertilizer at different doses combination on growth, yield and quality of French bean variety Anusha. The experiment was carried out at Horticultural Research Farm (HRF), Department of Horticulture, Naini Agricultural Institute SHUATS, Prayagraj, U.P., during the *Rabi* season of 2022-23.Thedifferent combination doses of organic manuresand inorganic fertilizers mentioned in table 1 and replicated thrice. Observations were recorded at different stages of growth periods. The data were statistically analysed by the method suggested by Fisher and Yates, 1963.

**Table 1:** Details of different doses of organic manure and inorganic fertilizers

| Notation | Treatment details |
|---|---|
| $T_1$ | 100% RDF (60:50:70 Kg NPK) + 25t Farmyard Manure (FYM) |
| $T_2$ | 75% RDF + 25% Farmyard Manure (FYM) |
| $T_3$ | 75% RDF + 25% Vermicompost (VC) |
| $T_4$ | 75% RDF + 25% Poultry Manure (PM) |
| $T_5$ | 50% RDF + 50% Farmyard Manure (FYM) |
| $T_6$ | 50% RDF + 50% Vermicompost (VC) |
| $T_7$ | 50% RDF + 50% Poultry Manure (PM) |

## Results and Discussion

### Growth Parameters

#### Days to germination and Days to 50% germination

The days to germination significantly varied among different treatment combinations. The minimum days to germination (2.67 days) was observed with treatment $T_3$ (75% RDF + 25% Vermicompost (VC) followed by $T_1$ (100% RDF (60:50:70 Kg NPK) + 25t Farmyard Manure (FYM) with 3.33 days. Maximum days to germination (4.67) was observed in $T_7$ (50% RDF + 50% Poultry Manure (PM).

#### Plant height (cm) and Number of primary branches per plant

Plant height varied significantly across different treatment combinations. Treatment $T_3$ (75% RDF + 25% Vermicompost) had the tallest plants at harvest, measuring 113.85 cm, followed by $T_2$ (75% RDF + 25% Farmyard Manure) with 107.59 cm. $T_7$ (50% RDF + 50% Poultry Manure) had the shortest plants, measuring 65.54 cm, while the other treatments displayed moderate growth. The number of primary branches was also influenced by the treatments throughout the growth stages. $T_5$ (50% RDF + 50% Farmyard Manure) had the highest number of branches per plant, with 6.27 branches, followed by $T_7$ with 5.27 branches. The lowest number of branches was observed in $T_2$ with 2.27 branches. These findings indicate that different treatments significantly affected plant height and branch development. The application of organic nutrients inorganic fertilizers might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have promoted the maximum vegetative growth leading to increase in plant height and number of primary branches per plant. Similar findings were reported by Prabhakar *et al.*, (2011) [10]; Singh *et al.*, (2011) [15]; Kumar *et al.*, (2019) [7]; Jena *et al.*, (2020) [6]; Parry *et al.*, (2021) [9]; Sachan and Krishna (2021) [13] in French Bean.

### Earliness parameter

#### Days to first flowering, Days to 50% flowering and days to first pod picking

$T_3$ (75% RDF + 25% Vermicompost) exhibited the shortest duration to first flowering, with 31.00 days, followed by $T_4$ (75% RDF + 25% Poultry Manure) with 32.33 days. On the other hand, $T_7$ (50% RDF + 50% Poultry Manure) had the longest duration to first flowering, recorded at 39.00 days. Regarding 50% flowering, $T_3$ had the shortest duration with 36.00 days, followed by $T_4$ with 37.33 days, while $T_7$ took the longest time with 44.00 days. In terms of pod picking, $T_3$ had the shortest duration with 48.00 days, followed by $T_4$ with 49.33 days, and $T_7$ had the longest duration at 56.00 days. These findings demonstrate the impact of different organic manure and inorganic fertilizer applications on the flowering and pod development stages. Similar findings were reported by Prabhakar *et al.*, (2011) [10]; Singh *et al.*, (2011) [11]; Dash *et al.*, (2019) [2]; Kumar *et al.*, (2019) [7]; Jena *et al.*, (2020) [6]; Parry *et al.*, (2021) [9]; Sachan and Krishna (2021) [13] in French Bean.

**Table 2:** Performance of different treatment combinations of organic manure and inorganic fertilizer on growth and yield parameters studied for French bean

| Treatment Notation | Treatment details | Days to germination | Plant height (cm) | Number of primary Branches per plant | Days to first flowering | Days to 50% flowering | Days to first Pod picking | No of pods/plant | Weight of single pod (g) | Pod yield per plant (g/plant) | Pod yield per hectare (t/ha) | TSS [°Brix] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | 100% RDF (60:50:70 Kg NPK) + 25t Farmyard Manure (FYM) | 3.33 | 80.09 | 4.27 | 36.00 | 41.00 | 53.00 | 22.83 | 10.43 | 229.45 | 76.01 | 3.69 |
| $T_2$ | 75% RDF + 25% Farmyard Manure (FYM) | 4.00 | 107.59 | 2.27 | 32.67 | 37.67 | 49.67 | 22.01 | 10.33 | 219.16 | 75.19 | 5.51 |
| $T_3$ | 75% RDF + 25% Vermicompost (VC) | 2.67 | 113.85 | 4.27 | 31.00 | 36.00 | 48.00 | 28.73 | 12.46 | 347.23 | 85.44 | 5.70 |
| $T_4$ | 75% RDF + 25% Poultry Manure (PM) | 3.67 | 97.69 | 3.27 | 32.33 | 37.33 | 49.33 | 22.64 | 11.61 | 254.31 | 78.00 | 4.98 |
| $T_5$ | 50% RDF + 50% Farmyard Manure (FYM) | 4.00 | 84.92 | 6.27 | 35.33 | 40.33 | 52.33 | 23.19 | 11.71 | 262.86 | 78.70 | 5.50 |
| $T_6$ | 50% RDF + 50% Vermicompost (VC) | 3.67 | 76.36 | 4.27 | 38.67 | 43.67 | 55.67 | 20.33 | 8.93 | 174.07 | 71.59 | 3.33 |
| $T_7$ | 50% RDF + 50% Poultry Manure (PM) | 4.67 | 65.54 | 5.27 | 39.00 | 44.00 | 56.00 | 21.01 | 9.98 | 201.84 | 73.80 | 4.82 |
| S.E. (m) ± | | 0.32 | 0.01 | 0.01 | 0.62 | 0.62 | 0.61 | 0.51 | 0.03 | 0.64 | 0.51 | 0.57 |
| C.V. | | 14.79 | 0.03 | 0.06 | 3.07 | 2.68 | 2.06 | 3.84 | 0.03 | 4.63 | 1.15 | 2.05 |

**Yield Parameter**

**Number of pods per plant, pod weight (g) and pod diameter (cm)**

Treatment $T_3$ (75% RDF + 25% Vermicompost) had the highest number of pods per plant at 28.73, followed by $T_5$ (50% RDF + 50% Farmyard Manure) with 23.19 pods. The lowest number of pods per plant, 20.33, was observed in $T_6$ (50% RDF + 50% Vermicompost). $T_3$ also had the highest pod weight at 12.46 g, followed by T5 at 11.71 g, while the lowest pod weight of 8.93 g was found in $T_6$. The application of fertilizers and organic nutrients significantly influenced the average yield per plant and per plot. $T_3$ had the highest average yield per plant at 347.23 g/plant and the highest average yield per plot at 85.44 t/ha. $T_5$ had the second highest yields, while $T_6$ had the lowest yields. Similar findings were reported by Prabhakar *et al.,* (2011) [10]; Singh *et al.,* (2011) [15]; Dash *et al.,* (2019) [2]; Kumar *et al.,* (2019) [7]; Parween (2019) [8]; Ranee *et al.,* (2019) [12]; Jena *et al*., (2020) [6]; Parry *et al*., (2021) [9]; Sachan and Krishna (2021) [13]; Sharma and Thakur (2022) [14] in French Bean.

**Quality parameter**

**TSS [°Brix]**

The data contained in the table reveals that the TSS was significantly influenced by application of fertilizers and organic nutrients and their interaction. The maximum TSS (5.70 °Brix) were recorded in treatment $T_3$ (75% RDF + 25% Vermicompost (VC) followed by $T_2$ (75% RDF + 25% Farmyard Manure (FYM) i.e., 5.51 °Brix and the lowest TSS (3.33 °Brix) were observed in $T_6$ (50% RDF + 50% Vermicompost (VC).

**Summary and Conclusion**

From the above experimental finding it is concluded that the treatment $T_3$ (75% RDF + 25% Vermicompost) was found to be best in the terms of growth, yield and quality of French bean.

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