Biological Forum – An International Journal **15(5): 238-241(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of different Sources of Organic Manures and Jeevamrutha on Yield and Microbial Population of Frenchbean (*Phaseolus vulgaris* L.)

Nath S.[1*], Devakumar N.[1], Rao G.G.E.[1], Murali K.[1], Krishna Naik L.[2] and Kadalli G.G.[3]

[1]Department of Agronomy,
University of Agricultural Sciences, Bangalore (Karnataka), India.
[2]Department of Agricultural Microbiology,
University of Agricultural Sciences, Bangalore (Karnataka), India.
[3]Department of Soil Science & Agricultural Chemistry,
University of Agricultural Sciences, Bangalore (Karnataka), India.

(Corresponding author: Nath S.)*
(Received: 22 February 2023; Revised: 15 April 2023; Accepted: 19 April 2023; Published: 20 May 2023)
(Published by Research Trend)

ABSTRACT: Due to irrational and non-judicious use of synthetic chemical fertilizers without applying organic manures in the crop production process over the years has led to deterioration of physical, chemical and biological properties of soil. To overcome these adverse impacts, a field experiment was carried out to investigate the combined effects of various sources of organic manures and jeevamrutha on yield and microbial population of Frenchbean in the research and demonstration block of the Research Institute on Organic Farming, UAS, Bangalore during *Kharif* - 2021. The experiment was carried out in Factorial RCBD design with 16 treatment combinations that were replicated thrice. Soil of the experimental field was red sandy loam in texture with a pH (6.93), EC (0.27 dS m^{-1}) and medium in available nitrogen (291.5 kg ha^{-1}), phosphorus (28.2 kg ha^{-1}) and potassium (236.4 kg ha^{-1}). The experimental results indicated that application of vermicompost on nitrogen (N) equivalent basis resulted in significantly higher green pod yield (150.48 q ha^{-1}) and haulm yield (38.06 q ha^{-1}) at harvest and microbial population in terms of bacteria, fungi, actinomycetes, N- fixers and P- soulubilizers at 40 DAS compared to other organic manure sources. Among levels of jeevamrutha, application of jeevamrutha at 2000 litre ha^{-1} recorded significantly higher green pod yield (139.14 q ha^{-1}) and haulm yield (35.44 q ha^{-1}) at harvest and microbial population in terms of bacteria, fungi, actinomycetes, N-fixers and P-soulubilizers at 40 DAS compared to other levels of jeevamrutha.

Keywords: Frenchbean, Green pod yield, Jeevamrutha, Organic manures, Vermicompost, Microbial population.

INTRODUCTION

Frenchbean (*Phaseolus vulgaris* L.) is an important vegetable crop belonging to family Fabaceae. In India, it is one of the most popular and commonly farmed vegetable crops. It is also known as snap bean, bush bean, kidney bean or string bean. Whether it be as a tender green pod, vegetable, dried beans, or dal, it is consumed by practically every segment of society. Frenchbean tender pod contains 1.7 g protein, 0.1 g fat, 4.5 g carbohydrate and 1.8 g fiber per 100 g which makes it complete food (Tiwari and Chaubey 2017). Green pods are an important source of vitamin A which is useful for controlling night blindness in human being (Birajdar, 2006).

The physical, chemical, and biological properties of soil have deteriorated over time as a result of the illogical and careless use of synthetic chemical fertilizers during crop cultivation without the application of organic manures (Ramesh, 2014; Masoodi *et al*. 2022). Additionally, there have been more reports of multinutrient deficiencies, particularly those involving different micronutrients like Zn, B, Mn, Fe, and Mo, which have decreased the soil's ability to absorb nutrients. Considering these adverse impacts on crop production along with rapid escalation of fertilizer costs, there is a paradigm shift from inorganic to organic farming. The long-term maintenance of soil health depends on the addition of organic matter as a source of nutrients, and this is why organic farming is so important to the nation's agricultural system. Organic farming mainly focuses on use of on- farm organic resources to sustain soil health. Farmyard manure is the most commonly used organic manure in India. FYM not only supplies nutrient to soil but has been shown to improve physiochemical and biological properties of soil. Vermicompost have been found to have high microbial populations, particularly fungi, bacteria and actinomycetes (Choudhary *et al*., 2022) and have been shown to promote biological activity and improve seed germination, flowering, fruit setting and yield (Makkar *et al*., 2022). Jeevamrutha is a fermented liquid product prepared by mixing cow dung with cow urine, jaggery, pulse flour and handful of soil brought from the bunds of the fields where cultivation is to be taken up. The application of jeevamrutha enhances the microbial activity in soil which helps to improve fertility of soil and also provide adequate supply of nutrient requirement of crop as well as pest management (Rijal *et al*., 2021). Keeping all these points in consideration, the investigation was carried out at University of Agricultural Sciences, Bangalore to study the influence of organic manures and jeevamrutha on yield of frenchbean as well as microbial population in soil.

MATERIAL AND METHODS

A field experiment was carried out at research and demonstration block of Research Institute on Organic Farming (RIOF), University of Agricultural Sciences, Bangalore which comes under the agroclimatic zone of Eastern dry zone of Karnataka. The experiment was conducted to study the combined effect of different organic manure sources and jeevamrutha on yield of frenchbean and microbial properties of soil during *Kharif*, 2021under irrigated condition. Experiment was laid out in Randomised Complete Block Design (RCBD) with factorial concept consisting of two factors *viz.*, different organic sources (M_1: No organic manure, M_2: FYM, M_3: Vermicompost and M_4: Poultry Manure - 100 % N equivalent basis) and different levels of jeevamrutha (J_1: No jeevamrutha, J_2: 1000 l ha^{-1}, J_3: 1500 l ha^{-1} and J_4: 2000 l ha^{-1}) replicated thrice. Soils of the experimental field was red sandy loam in texture with a pH (6.93), EC (0.27 dS m^{-1}), medium in available Nitrogen (291.5 kg ha^{-1}), P_2O_5 (28.2 kg ha^{-1}) and K_2O (236.4 kg ha^{-1}). French bean variety Arka Suvidha was sown with a spacing of 30 × 15 cm and recommended agronomic management practices were followed to raise the crop. Recommended dose of nutrients for french bean was 63:100:75 NPK kg ha^{-1} and organic nutrients were supplied on the basis of nitrogen equivalent after analysing the nutrient content. Application of Farm Yard Manure (FYM) at the rate of 25 t ha^{-1} as basal application was common for all the treatments. Three weeks before sowing, organic manures were incorporated into the soil. Jeevamrutha was applied to the soil by diluting with normal water at 15, 30 and 45 DAS according to the treatment. At 20 DAS, hand weeding and earthing up were done in order to keep the plot free of weeds while providing the crop a good anchor. Other crop protection practices were followed as and when required. Observations on yield was recorded at harvest in the net plot. Data was statistical analyzed as per the procedure outlined by Gomez and Gomez (1984). To know the effect of individual factors and to compare treatment combinations with control treatments, statistical procedure of factorial randomized complete block was followed.

RESULTS AND DISCUSSION

Vermicompost application recorded significantly higher green pod yield (141.27 q ha^{-1}) followed by poultry manure, farm yard manure as compared to without manure application (93.68 q ha^{-1}). Among the levels of jeevamrutha, application at 2000 litre ha^{-1} recorded significantly higher green pod yield (133.53 q ha^{-1}) followed by application of jeevamrutha at 1500 litre ha^{-1}, jeevamrutha at 1000 litre ha^{-1} as compared to without jeevamrutha application. Application of vermicompost recorded significantly higher haulm yield (35.57 q ha^{-1}) followed by poultry manure, farm yard manure, as compared to without manure application. Among the levels of jeevamrutha, application rate of 2000 litre ha^{-1} recorded significantly higher haulm yield (33.47 q ha^{-1}) followed by jeevamrutha at 1500 litre ha^{-1}, jeevamrutha at 1000 litre ha^{-1} and without jeevamrutha application. The highest green pod yield of 141.27 q ha^{-1} was recorded in vermicompost applied treatment and it was 9.28, 22.60 and 33.6 per cent higher than application poultry manure, FYM and without manure. The improved photosynthetically active leaf area for longer periods of time during the vegetative and reproductive phases, which led to more efficient absorption and utilisation of radiant energy, may be the cause of the improvement in growth characteristics with vermicompost application. This higher dry matter accumulation and significant increase in plant growth were the end results. As a result, the higher values of the growth parameters under vermicompost may be attributable to the increased availability of plant nutrients and plant growth hormones, such as auxins, cytokinins and gibberellins. Similar findings were reported by Younas *et al.* (2021); Rajput *et al.* (2022). Significantly higher pod yield was reported under vermicompost applied treatment and this might be due to the fact that vermicompost contains humified organic matter characterised by high molecular weight and enzymatically active humic fraction which stimulate seed germination and plant growth and ultimately yield. Similar result was reported by Adhikari *et al.* (2016); Sayfalla *et al.* (2015). There was a lower yield with poultry manure and FYM, which could be attributed to a wider C: N ratio that resulted in less mineralization of nutrients in the soil, which in turn reduced the amount of nutrients available to the crop during the growing season. This is in accordance with Fauzan *et al.* (2022). There were only traces amount of NO_3^- -N is available in these fresh manure which can be taken up by major crop for their metabolic activity. This is in accordance with Stevan *et al.* (1989).

Application of vermicompost recorded significantly higher population of bacteria (44.18 × 10^6 CFU g^{-1} soil) followed by poultry manure (40.20 × 10^6 CFU g^{-1} soil), FYM (36.75 × 10^6 CFU g^{-1} soil). Significantly lesser bacterial population was recorded in without manure treatment (33.76 × 10^6 CFU g^{-1} soil). Application of jeevamrutha at 2000 litre ha^{-1} application recorded significantly higher populations of bacteria (48.59 × 10^6 CFU g^{-1} soil) followed by jeevamrutha at 1500 litre ha^{-1} application (42.79 × 10^6 CFU g^{-1} soil), jeevamrutha at 1000 litre ha^{-1} application (38.86 × 10^6 CFU g^{-1} soil). Whereas, significantly lower bacterial population was recorded in without jeevamrutha application (24.66 × 10^6 CFU g^{-1} soil). Applcation of vermicompost recorded significantly higher fungal population (26.84 × 10^4 CFU g^{-1} soil) followed by poultry manure (24.43 × 10^4 CFU g^{-1} soil), FYM (21.68 × 10^4 CFU g^{-1} soil). Significantly lower fungal population was recorded in without manure application treatment (16.92 × 10^4 CFU g^{-1} soil). Application ofjeevamrutha at 2000 litre ha^{-1} application recorded significantly higher fungal population (27.75 × 10^4 CFU g^{-1} soil) followed by jeevamrutha at 1500 litre ha^{-1} application (24.68 × 10^4 CFU g^{-1} soil), jeevamrutha at 1000 litre ha^{-1} application (21.93 × 10^4 CFU g^{-1} soil). Whereas, significantly lower fungal population was recorded in without jeevamrutha (15.50 × 10^4 CFU g^{-1} soil). Application of vermicompost recorded significantly higher population of actinomycetes (34.75 × 10^3 CFU g^{-1} soil) followed by poultry manure (32.92 × 10^3 CFU g^{-1} soil), FYM (27.92 × 10^3 CFU g^{-1} soil). Significantly lower population of actinomycetes was recorded in without manure application treatment (25.18 × 10^3 CFU g^{-1} soil). Application of jeevamrutha at 2000 litre ha^{-1} recorded significantly higher population of actinomycetes (37.42 × 10^3 CFU g^{-1} soil) followed by jeevamrutha at 1500 litre ha^{-1} (33.68 × 10^3 CFU g^{-1} soil), jeevamrutha at 1000 litre ha^{-1} (30.25 × 10^3 CFU g^{-1} soil). Whereas, significantly lower population of actinomycetes was recorded in without jeevamrutha (19.42 × 10^3 CFU g^{-1} soil). Application of vermicompost recorded significantly higher population of N-fixers (30.00 × 10^5 CFU g^{-1} soil) followed by poultry manure (27.09 × 10^5 CFU g^{-1} soil), FYM (24.34 × 10^5 CFU g^{-1} soil). Significantly lower population of N-fixers was recorded in without manure application (20.17 × 10^5 CFU g^{-1} soil). Application of jeevamrutha at 2000 litre ha^{-1} recorded significantly higher population of N-fixers (32.33 × 10^5 CFU g^{-1} soil) followed by jeevamrutha at 1500 litre ha^{-1} (28.68 × 10^5 CFU g^{-1} soil), jeevamrutha at 1000 litre ha^{-1} (25.34 × 10^5 CFU g^{-1} soil). Whereas, significantly lower population of N-fixers was recorded in without jeevamrutha (15.24 × 10^5 CFU g^{-1} soil). Application of vermicompost recorded significantly higher population of P-solubalizers (34.08 × 10^5 CFU g^{-1} soil) followed by poultry manure (30.92 × 10^5 CFU g^{-1} soil), FYM (28.92 × 10^5 CFU g^{-1} soil). Significantly lower population of P-solubalizers was recorded in without manure treatment (25.59 × 10^5 CFU g^{-1} soil). Application of jeevamrutha at 2000 litre ha^{-1} recorded significantly higher population of P-solubalizers (36.58 × 10^5 CFU g^{-1} soil) followed by jeevamrutha at 1500 litre ha^{-1} (33.33 × 10^5 CFU g^{-1} soil), jeevamrutha at 1000 litre ha^{-1} (29.84 × 10^5 CFU g^{-1} soil). Whereas, significantly lower population of P-solubalizers was recorded in without jeevamrutha (19.75 × 10^5 CFU g^{-1} soil). Application of different manures and jeevamrutha significantly influenced the bacteria, fungi, actinomycetes, P- solubilizer and N-fixer population in the soil at 40 DAS. In present investigation, application of vermicompost recorded significantly higher microbial population *viz.*, bacteria, fungi, actinomycetes, N- fixers and P- solubilizers followed by poultry manure and FYM. This might be due to more availability of substrates to the microorganisms which acted as source of carbon and energy for the microorganisms. Along with this, narrow C: N ratio as well as readily available nitrogen in vermicompost encouraged microbial proliferation. These results are in line with Karale Gangadhar (2019). Solid manures in combination with jeevamrutha resulted in higher microbial population compared to application of manures alone. Among the treatment combinations, application of vermicompost in combination with jeevamrutha at 2000 l ha^{-1} recorded the higher bacterial, fungal, actinomycetes, N fixers and P- solubilizers population compared to other treatment combinations. This might be due to the beneficial effect of solid organic manures which serves as a source of carbon and energy for soil microorganisms and also application of jeevamrutha at regular intervals might have supplied higher microbial population as fresh inoculums to the soil. This is in conformity with Devakumar *et al.* (2008 and 2014) who have reported higher microbial load in jeevamrutha.

Table 1: Yield of French bean as affected by different manures and levels of jeevamrutha.

Treatments	Yield (q ha^{-1})				
	No jeevamrutha	**Jeevamrutha 1000 l ha^{-1}**	**Jeevamrutha 1500 l ha^{-1}**	**Jeevamrutha 2000 l ha^{-1}**	**Mean**
No organic manure	84.65	89.65	97.98	102.43	93.68
Farm yard Manure	93.56	103.75	115.56	124.48	109.34
Vermicompost	115.40	138.68	150.56	160.45	141.27
Poultry manure	102.65	125.75	137.43	146.75	128.15
Mean	99.07	114.46	125.38	133.53	
	S.Em ±	**C.D. (P= 0.05)**			
M	2.47	7.14			
J	2.47	7.14			
M × J	4.95	NS			

Table 2: Soil microbial population as influenced by different organic manures and levels of jeevamrutha application in french bean at 40 DAS.

Treatments	Bacteria (No. × 10^6 CFU g^{-1} soil)	Fungi (No. × 10^4 CFU g^{-1} soil)	Actinomycetes (No. × 10^3 CFU g^{-1} soil)	N-fixers (No. × 10^5 cfu g^{-1} soil)	P-Solubiliser (No. × 10^5 cfu g^{-1} soil)
Manure sources (M)					
No organic manure	33.76	20.33	25.18	20.17	25.59
Farm yard Manure	36.75	24.92	27.92	24.34	28.92
Vermicompost	44.18	29.84	34.75	30.00	34.08
Poultry manure	40.20	27.51	32.92	27.09	30.92
S.Em ±	0.79	0.49	0.57	0.56	0.56
C.D. (P= 0.05)	2.30	1.40	1.65	1.61	1.62
Levels of jeevamrutha (J)					
No jeevamrutha	24.66	18.50	19.42	15.24	19.75
Jeevamrutha 1000 l ha^{-1}	38.86	24.58	30.25	25.34	29.84
Jeevamrutha 1500 l ha^{-1}	42.79	27.58	33.68	28.68	33.33
Jeevamrutha 2000 l ha^{-1}	48.59	31.67	37.42	32.33	36.58
S.Em ±	0.79	0.49	0.57	0.56	0.56
C.D. (P= 0.05)	2.30	1.40	1.65	1.61	1.62
M × J					
S.Em ±	1.59	0.97	1.14	1.12	1.13
C.D. (P= 0.05)	NS	NS	NS	NS	NS

CONCLUSIONS

Application of vermicompost recorded significantly higher yield of french bean as well as microbial population in soil followed by poultry manure, farm yard manure as compared to without manure treatments. Among different levels of jeevamrutha, application of jeevamrutha at 2000 l ha^{-1} recorded significantly higher yield of french bean as well as microbial population in soil followed by jeevamrutha at 1500 l ha^{-1}, jeevamrutha at 1000 l ha^{-1} and without jeevamrutha application.

FUTURE SCOPE

There is a need to study the residual effect of added nutrients over a period of time. Studies on nitrogen fixation by microbes in organic soils to be conducted.

REFERENCES

Adhikari, P., Khanal, A. and Subedi, R. (2016). Effect of different sources of organic manure on growth and yield of sweet pepper. *Advances in Plants & Agriculture Research, 3*(5), 158-161.

Birajdar, A.M. (2006). Report on French bean in Shetiwadi-News 2006.

Choudhary, R. C., Bairwa, H. L., Kumar, U., Javed, T., Asad, M., Lal, K. and Abdelsalam, N. R. (2022). Influence of organic manures on soil nutrient content, microbial population, yield and quality parameters of pomegranate (*Punica granatum* L.) cv. Bhagwa. *PloS one*, *17*(4), e0266675.

Devakumar, N., Rao, G. G. E., Shubha, S., Khan, I., Nagaraj and Gowda, S. B. (2008). Activities of Organic Farming Research Centre, Navile, Shivmogga, *University of Agricultural Sciences, Bangalore, Karnataka, India.*

Devakumar, N., Shubha, S., Gouder, S. B. and Rao, G. G. E. (2014). Microbial analytical studies of traditional organic preparations beejamrutha and jeevamrutha, Proc. Building Organic Bridges. *4th ISOFAR Scientific Conference, Istanbul*, Turkey, 639-644.

Fauzan, F., Fadhil, M., Irfan, I., Yunita, D., Erika, C. and Lahmer, R. A. (2022). Study of C/N ratio of organic materials and its application in the production of natural fertilizer (bokashi). In *IOP Conference Series: Earth and Environmental Science, 1,* 951-955.

Gomez, K. A. and Gomez, A. A. (1984). Statistical procedures agricultural research, (2/e) an international rice research institute book, *A Willey Inter Science Publication, John Willey and Sons, New York*.

Karale, G. (2019). Effect of different sources of organic manures, decomposers on nutrient release, growth and yield of chilli (*Capsicum annuum* L.). *Ph.D. (Agri.) Thesis*, University of Agricultural Sciences, Bangalore.

Makkar, C., Singh, J., Parkash, C., Singh, S., Vig, A. P. and Dhaliwal, S. S. (2022). Vermicompost acts as bio-modulator for plants under stress and non-stress conditions. *Environmental Development and Sustainability*, 1-52.

Masoodi, U. H., Bashir, K. and Malik, A. A. (2022). Organic Farming in Vegetables- The Indian Scenario. *Biological Forum – An International Journal*, *14*(3), 564-572.

Rajput, M., Singh, B. and Jangre, N. (2022). Impact of Organic, Inorganic and Biofertilizers on Growth and Yield Attributes of cabbage (*Brassica oleracea* var. *capitata* L.) in Bastar, Chhattisgarh. *Biological Forum – An International Journal, 14*(3), 58-61.

Ramesh, P. (2014). Current Status and Relevance of Organic Farming in Indian Agriculture, *Organic Farming and Sustainability*, 3, 29-35.

Rijal, R., Kumar, A., Maity, P., Bisoyi, S. K., Chattarjee, S. and Nelli, R. (2021). Effect of bio-manures on growth and development of tomato (*Solanum lycopersicum* L.): A review, *Plant Cell Biotechnology and Molecular Biology*, *22*(13&14), 119-135.

Sayfalla, A., Ovassi, M. and Fatahinejad, E. (2015). Effect of vermicompost and triple superphosphate on yield of corn (*Zea mays* L.) in Behbahan. *Journal of Experimental Biology and Agricultural Sciences*, *3*(6), 494-499.

Stevan, R. J., Laughline, R. L. and Malone, J. P. (1989). Soil pH affect the process of reducing nitrate to nitrous oxide and di- nitrogen. *Soil Biology and Biochemistry,*30, 1119-1126.

Tiwari, A. K. and Chaubey, T. (2017). Quality seed production of French bean, https://www.researchgate.net/publication/318284847_Quality_seed_production_of_French_bean

Younas, M., Zou, H., Laraib, T., Abbas, W., Akhtar, M. W., Aslam, M. N. and Arif, M. (2021). The influence of vermicomposting on photosynthetic activity and productivity of maize (*Zea mays* L.) crop under semi-arid climate. *Plos one*, *16*(8), 28-36.

How to cite this article: Nath S., Devakumar N., Rao G.G.E., Murali K., Krishnanayak L. and Kadalli G.G. (2023). Effect of Different Sources of Organic Manures and Jeevamrutha on Yield and Microbial Population of Frenchbean (*Phaseolus vulgaris* L.). *Biological Forum – An International Journal, 15*(5): 238-241.