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Influence of Microbial Consortium Inoculation on Soil Health of French Bean (*Phaseolus vulgaris* L.)

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ABSTRACT

A field experiment was carried out during 2014-2015 at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat to investigate the influence of microbial consortium inoculation on soil physico-chemical and biological properties with seven treatments and three replications in Randomized Block Design (RBD). The treatments were T_1: FYM 20 t/ha + NPK @ 30:40:20 kg/ha (RDF), T_2: Enriched compost @ 3 t/ha, T_3: Enriched compost @ 3 t/ha + Consortium, T_4: Vermicompost @ 3 t/ha, T_5: Vermicompost @ 5 t/ha, T_6: Vermicompost @ 2.5 t/ha + Consortium and T_7: Consortium (Rhizobium + Azotobacter + Azospirillum + PSB). The results showed that inoculation of microbial consortium on french bean seed was significantly influenced by different treatments. The T_3 recorded the best for all the soil parameters viz., soil moisture (18.72%), bulk density (0.83 g/cm^3), p^H (5.33) and P_2O_5 (47.40 kg/ha); T_5 recorded highest organic carbon (0.68%); while T_1 revealed maximum N and K (220.56 and 119.31kg/ha) content. In accordance with soil physico-chemical characters as found in T_3 soil biological characters also found to be statistically superior in respect of microbial biomass carbon (630.33 µg/g/24h), dehydrogenase activity (711.50 µg TPF/g/24h), phosphomonoesterase activity (442.43 µg p-nitrophenol/g/h), fluorescein di-acetate hydrolysis activity (9.35 µg fluorescein/g/h). Similarly, T_3 treatment was obtained with significantly higher bacterial population (8.55× 10^7 cfu g^{-1}) and fungi population (5.03× 10^3 cfu g^{-1}).

Key words: *Microbial consortium, Soil, Physical, Chemical, Biological.*

INTRODUCTION

Leguminous crops are unique in the high protein content of their seeds and their ability to fix atmospheric nitrogen. French bean (*Phaseolus vulgaris* L.) is known as common bean or kidney bean. Among all the beans, it is the most extensively grown bean because of its short duration and nutritive values. It is an important vegetable for its high quality, nutritional properties and as a grain legume for its major protein source and economic value[4].

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As a legume, it is a cheap and good source of protein and supplies nitrogen to the soil by forming a symbiotic or mutually beneficial partnership with rhizobia through the biological nitrogen fixation process. Use of biofertilizers can provide quality produce for human consumption by way of reduction of the chemical residues and also reduces the risk of environmental pollution. However, due to increase in the prices of chemical fertilizers and also with a view to maintain the ecosystem of soil, it has become necessary to minimize the use of chemical fertilizers by adding organic ones to the soil more particularly biofertilizers of microbial origin.

METHOD AND MATERIALS

Investigation on the influence of microbial consortium with different organic and inorganic fertilizers on soil health of french bean (*Phaseolus vulgaris* L.) of variety Pant Anupama was carried out at Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2014-2015. The experiment was laid out in randomized block design with seven treatments and three replications. The treatments were T_1: FYM 20 t/ha+ NPK @ 30:40:20 kg/ha, T_2: Enriched compost @ 3 t/ha, T_3: Enriched compost @ 3 t/ha + Consortium, T_4: Vermicompost @ 3 t/ha, T_5: Vermicompost @ 5 t/ha, T_6: Vermicompost @ 2.5 t/ha + Consortium and T_7: Consortium @ 20 g/kg seeds. One week prior to sowing FYM, recommended dose of fertilizer, enriched compost and vermicompost were applied to the experimental area. Microbial consortium was applied as seed treatment to the concerned treatments. Cultures of consortium (*Rhizobium* + *Azotobacter* + *Azospirillum* + PSB) @ 20 g/kg seeds were used to pre-treat the seed before sowing. This treated seeds were sown in 5 cm deep by following line sowing at a spacing of 30 cm (raw) and 20 cm (plant). Observations on soil moisture, bulk density, chemical reaction (pH), organic carbon, available N, P, K, microbial biomass carbon, dehydrogenase activity, phosphomonoesterase activity, fluorescein di-acetate hydrolysis activity, bacterial and fungal population of soil were recorded.

RESULT AND DISCUSSION

Soil physico-chemical parameters

Data on soil physico-chemical parameters presented in Table 1. showed significant difference among the treatments. The T_3 (Enriched compost 3 t/ha + Consortium) recorded minimum bulk density and maximum pH, moisture content and available phosphorus; while T_7 (Consortium) recorded maximum bulk density with minimum pH, organic carbon and available NPK. Similar type of findings was observed by Manthan and Thilagavathi[5] who reported that application of organic manures to the soil decreases bulk density and increases per cent pore space and water holding capacity. However, T_1 recorded maximum for soil available nitrogen and potassium but T_1 failed to maintain the soil health for the proceeding crops. This result was might be due to combined application of FYM and inorganic fertilizer that release K and solubilised the mineral based K or native K. These results are similar to the findings by Bahadur *et al*[1]. The highest organic carbon was recorded in T_5 (Vermicompost 5 t/ha). An organic soil amendment increases the water holding capacity of soil that can foster by beneficial micro-organisms. In comparison with mineral fertilizers compost produces significantly greater increase in soil organic carbon and some plant nutrients reported by Nardi *et al*[6]. Organic carbon content of soil increases in the trend of increasing amount of organic matter added to the soil. Data clearly revealed that soil organic carbon decreased from initial levels in T_7 (Bio-fertilizer consortium) might be due to lack of organic matter in the treatment.

Soil biological parameters

Data on soil microbiological parameters were significantly influenced by different treatments and results are presented in Table 2. Results indicated that use of enriched compost along with consortium improves the microbial and enzymatic activities in soil. Dehydrogenase activities increased with increasing microbial population following amendments of soils with nutrients. The application of organic materials, which contain crop residues, animal faeces and their compost etc. to soil usually, increases the soil biomass and microbial activities[7]. Enriched compost also increases the PMEase activity of soil. It may due to the release of more organically bound P, as synthesis of the enzyme is stimulated by the presence of organic substrate[2]. Rock phosphate carrying enriched compost could have augmented the available phosphate in the treatments. The DH plays an important role in the initial stages of the oxidation of soil organic matter and is one of the reliable criteria that signify microbial activity in a given situation. Chaoui *et al*.[3], reported that organic manure application is known to stimulate and improve soil structure, fungal and bacterial population and also biological activities of the soil.

Table 1: Moisture (%), bulk density (g/cm^3), chemical reaction (pH), organic carbon (%), available N (kg/ha), Available P_2O_5 (kg/ha) and available K_2O (kg/ha) of soil as influenced by different treatments

Treatments	Moisture (%)	Bulk density (g/cm^3)	Chemical reaction (pH)	Organic carbon (%)	Available N (kg/ha)	Available P_2O_5 (kg/ha)	Available K_2O (kg/ha)
T_1 (FYM 20 t/ha+ NPK @ 30:40:20 kg/ha)	15.40	1.07	5.21	0.58	220.19	46.79	119.31
T_2 (Enriched compost 3 t/ha)	17.53	1.05	5.28	0.65	216.01	42.25	114.52
T_3 (Enriched compost 3 t/ha + Consortium)	18.72	0.83	5.33	0.61	218.00	47.40	118.49
T_4 (Vermicompost 3 t/ha)	17.46	1.08	5.23	0.57	214.15	41.29	113.66
T_5 (Vermicompost 5 t/ha)	18.43	0.96	5.29	0.68	215.00	42.51	116.45
T_6 (Vermicompost 2.5 t/ha + Consortium)	18.66	0.87	5.31	0.64	217.48	44.06	117.47
T_7 (Consortium)	14.31	1.17	5.00	0.51	211.00	37.96	108.39
S.Ed	0.06	0.01	0.01	0.01	0.80	0.42	0.28
C.D $_{(5\%)}$	0.20	0.05	0.04	0.04	2.40	1.27	0.85

Table 2: Microbial biomass carbon (µg/g/24h), dehydrogenase activity (µg TPF/g/24h), phosphomonoesterase activity (µg *p*-nitrophenol/g/h), fluoresce in di-acetate hydrolysis activity (µg fluorescein/g/h), bacterial population (×10^7 cfu/g) and fungal population (×10^3 cfu/g) of soil as influenced by different treatments

Treatments	Microbial biomass carbon (µg/g/24h)	Dehydrogenase activity (µg TPF/g/24h)	Phosphomonoesterase activity (µg *p*-nitrophenol/g/h)	Fluorescein di-acetate hydrolysis activity (µg fluorescein/g/h)	Bacterial population (×10^7 cfu/g)	Fungal population (×10^3 cfu/g)
T_1 (FYM 20 t/ha+ NPK @ 30:40:20 kg/ha)	365.80	395.37	315.48	6.66	7.85	3.93
T_2 (Enriched compost 3 t/ha)	512.37	624.43	355.80	8.44	8.00	4.22
T_3 (Enriched compost 3 t/ha + Consortium)	630.33	711.50	442.43	9.35	8.55	5.03
T_4 (Vermicompost 3 t/ha)	485.43	501.56	325.53	8.23	7.84	4.24
T_5 (Vermicompost 5 t/ha)	587.30	664.57	382.47	8.51	8.26	4.26
T_6 (Vermicompost 2.5 t/ha + Consortium)	624.27	710.40	421.47	9.26	8.44	4.96
T_7 (Consortium)	295.37	320.33	295.50	5.24	7.41	3.86
S.Ed	0.25	0.28	0.38	0.10	0.03	0.03
C.D $_{(5\%)}$	0.76	0.86	1.16	0.31	0.11	0.09

CONCLUSION

The present investigation justified that using of microbial consortium along with the organic fertilizers as an alternative to RDF management as it enhances the more growth of soil micro and macro organisms which is more beneficial to maintaining the soil health.

REFERENCES

1. Bahadur, A., Singh, J., Singh, K.P., Upadhyay, A.K. and Rai, M., Effect of organic amendments and bio-fertilizer on growth, yield and quality attributes of Chinese cabbage (*Brassica pekinensis*). *Ind. J. Agric. Sci* **76(10):** 596-98 (2004).

2. Biswas, D.R. and Narayanasamy, G., Rock phosphate enriched compost: An approach to improve low grade Indian rock phosphate. *Biores. Technol* **97:** 2243-51 (2006).
3. Chaoui, I., Zibiliske, M. and Ohno, T., Effects of earthworm casts and compost on soil microbial activity and plant nutrient availability. *Soil Biol. Biochem* **35:** 295-2 (2003).
4. Martins, R.C. and Silva, C.L.M., Frozen green beans (*Phaseolus vulgaris* L.) quality profile evaluation during home storage. *J. Food Eng* **64:** 481-88 (2004).
5. Manthan, K.K. and Thilagavathi, T., Change in physical properties of soil due to application of coir pith, composted for different duration. *Indian Coconut J* **27:** 9-10 (1997).
6. Nardi, S., Morari, F., Berti, A., Tosoni, M. and Giardini, L., Soil organic matter properties after 40 years of different use of organic and mineral fertilisers. *Europ. J. Agron* **21:** 357-67 (2004).
7. Subhani, A., Changyong, H., Zhengmiao, Y., Min, L. and El-ghamry, A., Impact of soil environment and agronomic practices on microbial/ dehydrogenase enzyme activity in soil. *Pakistan J. Biol. Sci* **4:** 333-38 (2001).