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Effect of Different Levels of Bulky Organic Manures with Chemical Fertilizers on Soil Properties of French Bean (*Phaseolus vulgaris L.*) Variety Arka Komal

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A B S T R A C T

A field experiment was conducted during the Rabi season 2019-2020 on sandy loam soil to -study the effect of different levels of bulky organic manures with chemical fertilizers on soil properties of French bean. Organic and inorganic nutrients are important for crop productivity and soil health. The trial was conducted at Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Prayagraj – 211007. The experimental layout was done in a Randomized block design with 9 treatments replicated three times. The results shown that application of 100% vermicompost significantly enhanced the physical parameters., viz. % pore space, water retaining capacity (%), specific gravity., organic carbon (%) and there was reduced bulk density (Mg m^{-3}) along with particle density (Mg m^{-3}) and application of 50% RDF + 25% FYM + 25% vermicompost gave good results in terms of chemical parameters viz. pH, electrical conductivity (dSm^{-1}), available N, P and K (kg ha^{-1}). The present study reveals that combined application of organic manures and inorganic fertilizers gave best results in terms of soil chemical parameters. Whereas, application of 100% vermicompost without any chemical fertilizer as given the positive outcome in terms of soil physical parameters including organic carbon.

Introduction

French bean (*Phaseolus vulgaris* L.) is considered as one of the most important vegetable crop in the world which is grown for its tender pods with high protein, calcium and iron content. French bean is one of the most important leguminous vegetable grown in a commercial scale in all types of soils ranging from sandy loam to clay soils with pH 5.5 – 6.

The long term utilization of inorganic fertilizers will damage the soil physical, chemical and biological properties and causes environmental pollution. Organic manures act as a source of nutrients, organic matter and also improve the microbial population along with physical, chemical and biological parameters of the soil (Manivannan *et al.*, 2009). Organic manures are eco-friendly, cheap source of nutrients and are potentially sound for Supplying nutrients which can

reduce dependence on chemical fertilizers (Datt *et al.,* 2013). Inadequate use of the organic manures has rendered Indian soils deficient in macro and micro nutrients (Acharya and mandal, 2002).

Vermicompost is the microbial composting of organic wastes through earthworm activity to form organic fertilizers which contain higher level of organic matter, organic carbon, total and available N, P, K and micronutrients, microbial and enzyme activities (Ranganathan, 2006; Parthasarathi *et al.,* 2007). FYM, the most commonly and widely used organic nutrient is a rich source of primary, secondary and micronutrient to the plant growth. It is the constant source of energy for heterotrophic microorganisms that helps in increasing the availability of nutrients, and thereby improves the quantity and quality of crop production (Dixit and Gupta, 2000)

Judicious use of manures with chemical fertilizers improves soil physical, chemical and biological properties and improves crop productivity (Singh and Singh, 2012). Due to excess and in judicial use of inorganic fertilizers alone, the soil physical parameters will be damaged, soil micro fauna population will be disturbed and accumulation of soil pollutants will shoot up.

This problem can be mitigated with the use of organic manures along with recommended dosage of inorganic fertilizers. Considering these problems, the present study was conducted with the combination of bulky organic manures along with the different doses of inorganic fertilizers.

Materials and Methods

Experimental site

The experiment was conducted during Rabi season 2019-2020 in the research farm of Department of Soil Science and agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj which situated six km away from Prayagraj city on the right bank of Yamuna river, the experimental site is located in the sub-tropical region with 25^0N latitude 81.50^0E longitude and 95m mean sea level. Prayagraj district represents the subtropical belt of the South East of Uttar Pradesh, and is endowed with extremely hot summer and fairly cold winter.

The maximum temperature of the location ranges between 46°C - 48°C and seldom falls below 4°C - 5°C. The relative humidity ranges between 20-94%. The average rainfall of this area is around 1100mm annually.

Soil sampling

The soil samples were randomly collected from 0-15cm depths prior to tillage operations, the size of the soil sample was reduced to required quantity by conning and quartering method.

The composites soil sample was air dried and passed through 2 mm sieve. The composite sample was utilized for physical and chemical analysis.

Design and treatments

The experiment was carried out in randomized block design with 9 treatments replicated three times. The treatment combinations laid out as, T_1– Absolute control, T_2– 100% N.P.K.,T_3– 100% Vermicompost, T_4– 100% Farm yard manure, T_5– 50% N.P.K.+ 50% Vermicompost, T_6– 75% N.P.K. + 25% Vermicompost, T_7– 50% N.P.K. + 50% Farm yard manure, T_8– 75% N.P.K. + 25% Farm yard manure, T_9– 50% N.P.K. + 25% vermicompost + 25% Farm yard manure

Fertilizer application

The fertilizers were weighed and applied in the plots and mixed thoroughly with soil. The recommended dose of NPK was 120 kg N, 80 kg $P_2O_5$and 50 kg K_2O, was given through different sources i.e. Urea, DAP, MOP, FYM and vermicompost as per design of the experiment. Full dose of P & K was applied through DAP and muriate of potash (MOP) as a basal dose. Organic manures such as FYM (20t ha^{-1}) and vermicompost (10t ha^{-1}) were applied 5 days before sowing. Nitrogen through urea was applied in two equal splits doses i.e. first at the time of sowing and second dose at 20 DAS.

Results and Discussion

Soil quality can be monitored by a set of measurable attributes termed indicators. These indicators can be broadly grouped as physical and chemical indicators and one can assess overall soil quality by measuring changes in these indicators (Sahrawat and Narteh 2002; Tripathi *et al.*, 2012). In the present study the fallowing results of different physic chemical characters which were influenced by application of bulky organic manures and chemical fertilizers have been recorded (Fig. 1–4 and Table 1).

Physical properties of soil

The application of different manures with Chemical fertilizer produced remarkable effect on soil physical properties is presented in Table 2. Application of 100% Vermicompost significantly increased the pore space (54.56%), water retaining capacity (65%) and specific gravity (2.26) respectively compared to absolute control and this application reduced the bulk density (1.01 Mg m^{-3}) and particle density (2.51 Mg m^{-3}) of soil and particle density have non-significant effect on different treatments. Similar findings were also obtained by Hossein *et al.*, 2007, Rasool Azarmi *et al.*, 2008, Chenping Xu *et al*., 2016 and Aysha *et al.*, 2017.

Table.1 Physio-chemical analysis of soil prior to sowing of French bean

Particulars	Method employed	Result
Bulk density (Mg m^{-3})	Copper core (Muthuaval *et al.*, 1992)	**1.24**
Particle density (Mg m^{-3})	Graduated measuring cylinder (Muthuaval *et al.*, 1992)	**2.66**
Pore space (%)	Graduated measuring cylinder (Muthuaval *et al.*, 1992)	**56**
Water holding capacity (%)	Graduated measuring cylinder (Muthuaval *et al.*, 1992)	**58**
Specific gravity	Graduated measuring cylinder (Muthuaval *et al.*, 1992)	**2.21**
Soil color	Munsell colour chart (Albert henry munsell 1971)	**10YR6/4**
Soil texture Sand Silt Clay	Bouyoucos hydrometer (Bouyoucos 1927)	**Sandy loam 65.41 21.12 13.74**
pH (1:2)	Glass Electrode pH Meter (Jackson, 1958)	**7.6(slightly saline)**
EC (dS m^{-1}at 25°C)	Conductivity Bridge Meter (Wilcox, 1950)	**0.16**
Organic Carbon (%)	Wet oxidation (Walkley and Black (1947)	**0.60 (medium)**
Available N (kg ha^{-1})	Alkaline Permanganate (Subbiah and Asija, 1956)	**288 (medium)**
Available P (kg ha^{-1})	Calorimetric method (Olsen *et al.*, 1954)	**22.6 (medium)**
Available K (kg ha^{-1})	**Flame Photometer method (Toth and prince 1949)**	**196 (medium)**

Table.2 Effect of different levels of bulky organic manures with chemical fertilizers on physical properties of soil

Treatments	Bulk density ($Mg\ m^{-3}$)	Particle Density ($Mg\ m^{-3}$)	Pore space (%)	Water retaining capacity (%)	Specific gravity
T_1	1.21	2.67	44.6	51.66	**2.03**
T_2	1.17	2.61	47.4	54.73	**2.08**
T_3	1.01	2.51	54.56	65	**2.26**
T_4	1.02	2.54	52.96	64.3	**2.22**
T_5	1.04	2.56	51.36	63.91	**2.06**
T_6	1.12	2.59	49.61	59.39	**2.09**
T_7	1.03	2.58	49.75	60.70	**2.07**
T_8	1.15	2.60	49.14	56.98	**2.13**
T_9	1.02	2.57	50.33	63.49	**2.18**
F-test	S	NS	S	S	**S**
S.em (+-)	0.09	0.034	1.13	0.84	**0.03**
CD (P=0.05)	**0.05**	**0.10**	**3.34**	**2.47**	**0.09**

Table.3 Effect of different levels of bulky organic manures with chemical fertilizers on chemical properties of soil

Treatments	pH	EC (dSm-1)	Organic carbon (%)	Available N ($kg\ ha^{-1}$)	Available P ($kg\ ha^{-1}$)	Available K ($kg\ ha^{-1}$)
T_1	7.89	0.17	0.46	225.33	16.23	**112.66**
T_2	7.81	0.22	0.51	238.33	17.24	**161.66**
T_3	7.7	0.18	1.005	259.34	17.36	**142.34**
T_4	7.58	0.19	0.82	278.35	18.2	**144.3**
T_5	7.65	0.21	0.77	281.66	19.26	**166.67**
T_6	7.77	0.2	0.70	278.67	19.4	**165.32**
T_7	7.79	0.19	0.72	297.68	20.3	**168.31**
T_8	7.76	0.21	0.62	277.7	21.33	**174.3**
T_9	7.5	0.23	0.73	307.4	22.16	**189.67**
F-test	S	S	S	S	S	**S**
S.em (+-)	0.03	0.01	0.04	1.55	0.16	**0.84**
CD (P=0.05)	**0.091**	**0.03**	**0.12**	**4.55**	**0.49**	**2.47**

Fig.1 Effect of different levels of bulky organic manures with chemical fertilizers on Bulk density (Mg m^{-3}), Particle density (Mg m^{-3}) and specific gravity

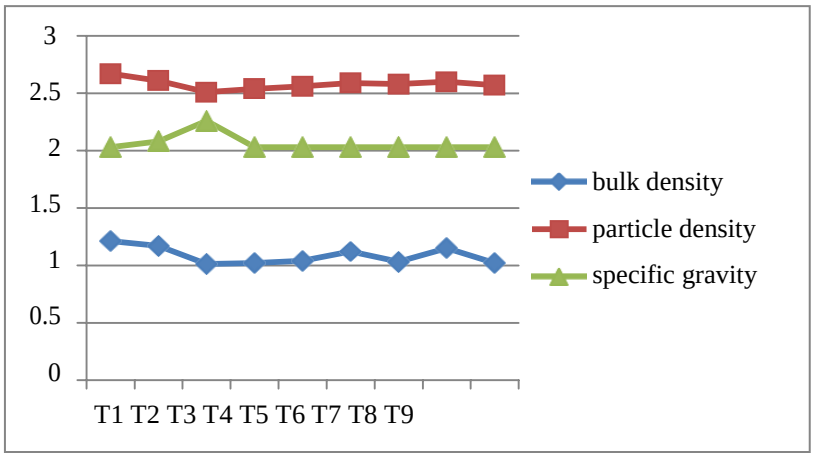


Fig.2 Effect of different levels of bulky organic manures with chemical fertilizers on pore space (%) and water retaining capacity (%)

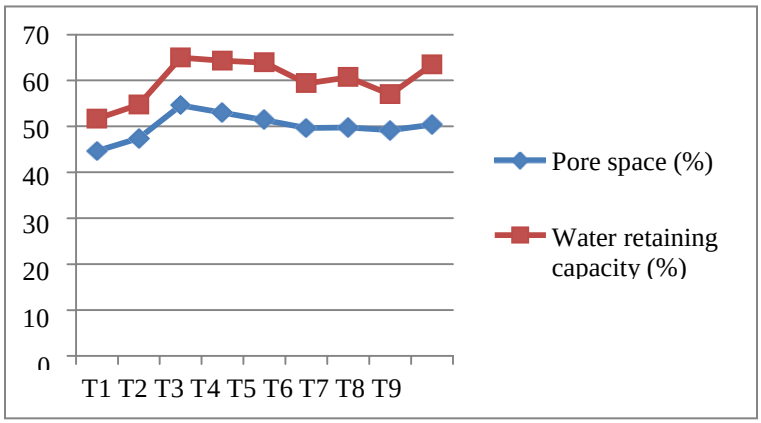


Fig.3 Effect of different levels of bulky organic manures with chemical fertilizers on EC (dSm^{-1}) and organic carbon (%)

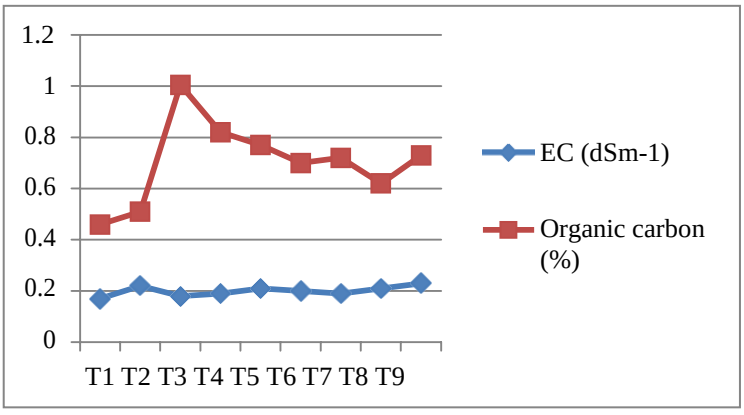
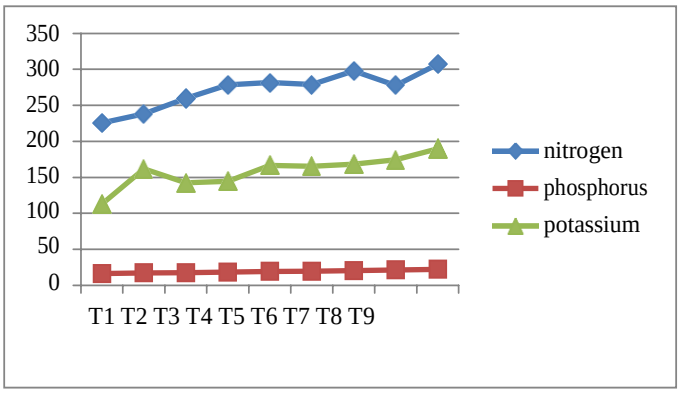


Fig.4 Effect of different levels of bulky organic manures with chemical fertilizers on available N, P and K. (kg ha^{-1})



Chemical properties of soil

Perusal of data in table 3 reveals that, application of 100% Vermicompost significantly improved the percentage of organic carbon (1.005%) compared with control plot Rasool Azarmi *et al.,* 2008, Sruti Karmakar *et al.,* 2013 and Chenping Xu *et al.,* 2016. Application of 50% NPK + 25% FYM + 25% Vermicompost significantly enhanced the EC (0.23dSm^{-1}), available nitrogen (307.4kg ha^{-1}), available phosphorus (22.16kg ha^{-1}) and available potassium (189.67kg ha^{-1}) in soil when it is compared with untreated plot. Similar results were also reported by Aphale *et al.,* 2005, Akash swamy *et al.,* 2017 and Dhaka *et al.,* 2016. The highest pH (7.89) was recorded in untreated plot whereas; the lowest pH (7.5) observed with treatment T_9- 50% N.P.K + 25% FYM +25% Vermicompost. Similar findings were reported by Meena *et al.,* 2016.

Application of organic manures decreases the bulk density of soil, organic manures mainly contributed to higher organic matter content of soil because of higher microbial activities which leads to better aggregation of soil (Pawan kumar *et al.,* 2018). Addition of organic manures will have a positive relationship with pore space, water holding capacity, bulk density and particle density of soil (Manivannan *et al.,* 2009, Albiach *et al.,* 2000).

Likewise, significant improvements in fertility status of the soils due to addition of FYM and vermicompost have also been reported by Roy *et al.,* (2001). Anwar *et al.,* (2005) also reported tremendous increase in organic carbon, Available N, P and K may due to combined application of vermicompost, FYM and inorganic fertilizers. Decrease in soil pH may be due to formation of bicarbonates and ammonium nitrate by the application of urea that reacts with hydrogen ions which causes reduction in acidity.

The findings of the experiment concluded that the combined application of organic manures and inorganic fertilizers i.e. 50% NPK + 25% FYM + 25% Vermicompost improves the soil chemical parameters. Whereas, with the application of 100% vermicompost best results obtained in terms of soil physical parameters including organic carbon.

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Conflict of interest

The authors declare that they have no conflict of interest.

References

Akash Swamy., David A.A., Madhu, B.M., and Soman Singh Dhruw., 2017. Response of inorganic fertilizers and FYM on physico chemical properties of soil of yellow mustard (*Brassica campestris* L.) cv. Ulhas. *Journal of Pharmacognosy and Phytochemistry*, 6(5):871-873.

Aysha siddika, M. M., Jeyamangalam, F., 2017. Short term effect of organic manure on the physical and chemical properties of soil. *International journal of trend in research and development.* Page 35-37.

Chenping Xu., and Beiquan Mou., 2016. Vermicompost Affects Soil Properties and Spinach Growth, Physiology, and Nutritional Value. *Horticulture science*. 51(7):847–855.

Datt, N., Dubey, Y. P., and Rohina Chaudhary., 2013. Studies on impact of organic, inorganic and integrated use of nutrients on symbiotic parameters, yield, quality of French-bean (Phaseolus vulgaris L.) vis-à-vis soil properties of an acid alfisol, *Asian journal of agricultural research*, 8(22): 2645-2654.

Hossein Moradi., Mohammad Fahramand., Alireza Sobhkhizi., Mohammad Adibian, Mohsen Noori., Shilaabdollahi., and Khashayar Rigi., 2014. Effect of vermin compost on plant growth and its relationship with soil properties. *International Journal. of Farming and Allied Sciences.* Vol., 3(3): 333-338.

Manivannan S., Balamurugan M., Parthasarathi K., Gunasekaran G. and Ranganathan L.S., 2009. Effect of vermicompost on soil fertility and crop productivity - beans (*Phaseolus vulgaris*) *Journal of Environment Biologty*, 30(2), 275-281

Meena, L. R., Singh, R. K. and Gautam, R. C., (2003)Yield and nutrients uptake of chickpea as influenced by moisture conservation practices, phosphorus levels and bacterial inoculation. *Legume Research*., 26(1): 109-112

Parthasarathi, K., Ranganathan, L.S., Anandi, V., and Zeyer J., 2007. Diversity of microflora in the gut and casts of tropical composting earthworms reared on different substrates. *Journal of Environmental Biology*. 28:87-97.

Pawan kumar pant., and shri ram.,2018. Long term manuring and fertilization effects on soil physical properties after forty two cycles under rice-wheat system in north Indian mollosols, *international journal of current microbiology and applied sciences*, 7(7): 232-240

Rasool Azarmi., Mousa Torabi Giglou., and Rahim Didar Taleshmikail., 2008. Influence of vermicompost on soil chemical and physical properties in tomato (*Lycopersicum esculentum*) field. *African Journal of Biotechnology*. Vol. 7(14), pp. 2397-2401.

Sahrawat, K.L., Narteh, L.T., (2002), A fertility index for submerged ricesoils,

Communications in Soil Science and Plant Analysis, 33: pp 229–236.

Singh, Muneshwar., Mohan Singh., and Kumra Wat., (2008). Influence of nutrient supply systems on productivity of soybean-wheat and soil fertility of Vertisols of Madya Pradesh. *Journal of Indian Society of Soil Science*, 56(4):436-441.

Sruti Karmakar., Koushik Brahmachari., and Aniruddha Gangopadhyay., 2013. Studies on agricultural waste management through preparation and

utilization of organic manures for maintaining soil quality. *African Journal of Agricultural Research.* Vol. 8(48), pp. 6351-6358.

Tripathi A, Misra D. R 2012. A study of physico-chemical properties and heavy metals in contaminated soils of municipal waste dumpsites at Allahabad, India, *International Journal of Environmental Sciences*, Volume 2(4): 2031-2040.

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