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Influence of Integrated Supply of Bio Fertilizers, Chemical Fertilizers and Vermicompost on Soil Nutrient Status

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Abstract The aims of this work were to evaluate the changes in soil properties with the application of bio fertilizers, chemical fertilizers, vermicompost and their combinations. The experiment was conducted in a randomized block design (RBD) with 8 treatments i.e. T_1-NT, T_2- VC, T_3-BF, T_4-CF, T_5-BF+VC, T_6-BF+CF, T_7 - CF + VC, T_8 - BF+CF+VC. The increased value in N, P, K, OC, pH and EC was 281 kg/ha, 20.2 kg/ha, 296 kg/ha, 0.69%, 7.7 (T_7 plot), 0.21 dsm^{-1} respectively, in T_8 plot compared to non-treated soil. However, before sowing, soil N, P, K, OC, pH and EC was 260 kg/ha, 18.80 kg/ha, 281 kg/ha, 0.52 %, 6.8, 0.48 dsm^{-1} which was far less than the nutrients obtained in the soil after harvest. After the analysis of nutrient status in post harvest soil it can be concluded that INM in soil by combined application of BF+CF+VC (T_8 plot) are best for soil fertility for longer periods. Based on the results of the current study, it is clear that by use of INM we can minimize the quantity of fertilizer and recycle the farm waste, thus make safe environment and sustainable soil fertility.

Keywords Soil Properties, NPK, OC, EC, INM

1. Introduction

Soils are the natural medium for growth of the plants. Plants obtain mineral and nutrients from the soil. Long-term field experiments on nutrient management in different cropping system indicated decline in factor productivity with soil organic matter as well as available N, P and K status of the soil. Besides, the physico- biochemical properties of the soil damaged significantly. Presently, Indian soils are 70 % deficient in N, 50% in P, 13% in K, 4.7% in Zn, 4.8% in Cu, 11.5 % in Fe and 4.0 % in Mn [M. S. Pal, 2007]. The chemical fertilizers are becoming costlier day by day due to escalating costs and scarce availability of commodities. The use of organic farming with organic amendments to soil as nutrient inputs is increasing and it is an alternative agricultural practice for sustaining economically viable crop production with minimal environmental pollution (Padel, S.,2009). The productivity of a soil depends on such things as its chemical composition and porosity, its content of air and water, and its temperature. It is bridge between the inorganic, organic and living worlds.

2. Material and Methods

The experiment was conducted in a randomized block design (RBD) with 8 treatment using chemical fertilizers (NPK), vemicompost, and biofertilizers (*Azotobacter*, phosphate solubilizing bacteria) in different combinations including one control treatment. The treatments were T_1 - control (no treatment), T_2 -Vermicompost 5t ha^{-1}, T_3 – Biofertlizers (250g *Azotobacter* ha^{-1} + 250g PSB ha^{-1}), T_4 - Chemical fertilizers (60:30:30kg NPK ha^{-1}), T_5 – BF + VC (125g *Azotobacter* + 125g PSB + 5t vermicompost ha^{-1}), T_6 - BF + CF [125g *Azotobacter* + 125g PSB + 50% NPK (RDF) ha^{-1}], T_7 - CF + VC (50% NPK + 5t vermicompost ha^{-1}) and T_8 - BF + CF + VC [250g biofertilizers (125g *Azotobacter* + 125g PSB) + 50% NPK (RDF) + 5t VC.

The pH of soil was determined using Equiptronics pH meter as described by Jackson (1967). The EC of the soil samples was determined on an Equiptronic's digital EC Bridge. The available nitrogen was estimated by Microkjeldahl method (Mishra, 1968). Available phosphorus, available potassium and organic carbon of the soil were estimated by the method of Jackson (1967).

3. Statistical Analysis

Analysis of observation taken on different variable was carried out to know the degree of variation among all the treatments. The results were obtained through analysis of variance (ANOVA) and SPSS software, version 20, 2011.

4. Result and Discussion

Abbreviations:- NT- No Treatment, BF-Biofertilizers, CF- Chemical fertilizers, VC- Vermicompost, SD- Standard Deviation, SEm- Standard Error mean, SA-Statistical

Analysis, PSB-Phosphorus Solubilizing Bacteria, N-Nitrogen, P- Phosphorus, K- Potassium, EC- Electrical Conductivity, OC- Organic Carbon, INM- Integrated Nurient Management, df- degree of freedom.

Soil samples were analyzed before sowing and after the harvesting crop to visualize the amount of major and micronutrients remaining in the soil and that all nutrients were significantly affected by different treatments. N, P, K, and OC were maximum under combined application of organic and inorganic nutrients in T_8 plot after harvest. The increased value in N, P, K, OC, pH and EC was 281 kg/ha, 20.2 kg/ha, 296 kg/ha, 0.69%, 7.7 (T_7 plot), 0.21 dsm^{-1} respectively (Table 2.), in T_8 plot compared to non-treated soil. However, before sowing, soil N, P, K, OC, pH and EC was 260 kg/ha, 18.80 kg/ha, 281 kg/ha, 0.52 %, 6.8, 0.48 dsm^{-1} (Table 1.) which was far less than the nutrients obtained in the soil after harvest.

Higher availability of N, P, K, OC, pH after harvesting the crop under combined application of nutrients i.e. (BF, CF, VC) may be due to improved physical, chemical and biological properties on account of organic matter addition, as already observed by Marinari S. *et al.*, (2000); Mahmoud EK and Mahmoud Ebrahim (2012); Anwar *et al.,* (2005); Dauda *et al.*, (2008); Patra *et al.*,(2000); Chand *et al.*, (2011) on Soil.

After the analysis of nutrient status in post harvest soil it can be concluded that INM in soil by combined application of BF+CF+VC (T_8 plot) are best for soil fertility for longer periods. By use of INM we can minimize the quantity of fertilizer and recycle the farm waste, thus make safe environment and sustainable soil fertility and crop quality. INM will increase soil organic matter status, which act as a reservoir for nutrients and hence improve soil physico-chemical attributes of plant growth.

Table 1. Chemistry of Soil before sowing

S. No.	Sample	pH	OC%	EC (dsm^{-1})	Available N in kg/ha	Available P in kg/ha	Available K in kg/ha
1.	Soil	6.8	0.52	0.48	260	18.80	281

Table 2. Effect of INM on Soil Chemistry after harvesting crop

Plot No.	Treatment in soil	pH	OC%	EC (dsm^{1})	N in kg/ha	P in kg/ha	K in kg/ha
T_1	NT	7.5	0.43	0.32	258	14.8	271
T_2	VC	7.2	0.62	0.26	278	19.7	292
T_3	BF	7.4	0.60	0.27	274	18.6	289
T_4	CF	7.6	0.51	0.29	269	17.18	284
T_5	BF+VC	7.1	0.67	0.24	280	20.12	294
T_6	BF+CF	7.4	0.49	0.31	263	16.1	276
T_7	CF+VC	7.7	0.50	0.30	268	16.8	280
T_8	BF+CF+ VC	7.3	0.69	0.21	281	20.2	296

Table 3. Statistical Analysis of Soil Chemistry after harvesting

Parameters		pH	OC	EC	N	P	K
Mean		7.31	0.56	0.2750	271.37	17.9375	285.25
Variation		0.04125	0.008855	0.0014	69.125	4.07365	81.3571
SD		0.203	0.094	0.374	8.314	2.01	9.0198
SEm		0.071	0.03327	0.01323	2.9394	0.71359	3.1889
t-value		101.83	16.944	20.788	92.320	25.13	89.44
df		7	7	7	7	7	7
Sig. (2 tailed)		0.000	0.000	0.000	0.000	0.000	0.000
95% confidence interval of the difference	Lower	7.1427	0.4851	0.2437	264.42	16.2501	277.709
	Upper	7.4823	0.6424	0.3063	278.325	19.624	292.790

5. Recommendation

Plant and crop physiologists, microbiologists and agronomists agree that plant growth and development strictly depends on biological fertility factors. Long term studies on organic fertilizers and manures along with chemical fertilizers need to be initiated to develop integrated nutrient management schedule for obtaining good quality soil which is very important factor for surviving plant life.

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