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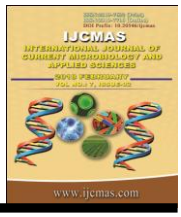

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Effect of Different Levels of NPK and Vermicompost on Physico-Chemical Properties of Maize [*Zea mays* (L.)] Cv. MM2255

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A B S T R A C T

Field experiments was conducted during 2015 on clay loam, sandy loam soil evaluate "to study the Effect of different levels of NPK and Vermicompost on physico-chemical properties of soil" comparison to inorganic fertilizers nitrogen, phosphorous, potassium. Vermicompost had increased the pore space, reduced particle and bulk density, increased water holding capacity, cation exchange capacity, reduced pH and electrical conductivity, increased organic carbon content, available nitrogen, phosphorous, potassium and microbial population and activity in all the soil types, particularly clay loam soil. On the contrary, the application of inorganic fertilizers has resulted in reduced porosity, compaction of soil, reduced organic carbon and reduced microbial activity. As for soil amendment and soil quality improvement, the application of NPK with vermicompost was excellent source to fertilization than fertilizers only in soil.

Introduction

Maize (*Zea mays* L.) belongs to Gramineae family maize is considered as the native to the Central America and Mexico where many diverse types of maize are found Rai (2006). Maize is one of most important cereal crop in the world agriculture Economy both as food for man and feed for animal. It is a miracle crop. It has very high yield potential. There is no cereal on the earth which has so immense potentiality and that is why it is called "queen of cereals" maize is grown in almost all the states of India. Maize grain contains about 10% protein, 4% oil, 70% carbohydrate 2.3% crude fiber, 10.4% aluminizes, 1.4% ash. Maize protein 'Zein' is in tryptophan and lysine two essential amino acids Singh *et al.,* (2007). Excessive use of chemical fertilizers, decline in soil and food quality due to loss of soil organic matter is the main characteristics of the conventional farming systems which are more pronounced in arid and semi-arid areas (Singh *et al.,* 2007; Melero *et al.,* 2008; Liu *et al.,* 2009). Increasing public awareness of the negative environment an impacts, growing consumer demand for healthier products and criticism of high input production systems. Alternate agricultural practices such as organic farming, eco-farming, biodynamic farming and traditional farming practices are considered important alternatives to increase

soil fertility and soil health. Inorganic farming the application of organic manure especially vermicompost is recommended. It is ecofriendly, non-toxic, consumes low energy input for composting and is a recycled biological product (Lourduraj and Yadav, 2005). Vermicomposts are organic materials broken down by interactions between microorganism and earthworms in a mesophilic process (up to 25°C), to produce fully stabilized organic soil amendments with low C: N ratios. They have a high and diverse microbial and enzymatic activity, fine particulate structure, good moisture-holding capacity, and contain nutrients such as N, P, K, Ca and Mg informs readily taken up by plants (Lavelle and Martin, 1992; Prabha *et al.*, 2005; Arancon and Edwards, 2009).

The application of vermicompost helps to improves and conserves the fertility of soil. Vermicompost imparts a dark colour of the soil and thereby help to maintain the temperature of soil. Vermicompost is one of the manure used by the farmer in growing crops because of early availability and presence of almost all the nutrients required by plants. The composition of vermicompost is 0.6-1.2% N, 0.13-0.22% P and 0.40-0.75% K Pawar. (2007). Nitrogen is a most important element for the synthesis of protoplasm, which is responsible for rapid cell division (plant shape and size).

It increased the production of grain yield in maize as well as it is important for the quality of produce like increase proteins in grain. It increases utilization of P and K to an appreciable extent Singh *et al.*, (2003). Phosphorus its plays a *vital* role in photosynthesis, respiration, energy storage transfer cell division, cell elongation and several other processes in living plants. Phosphorus is also a structural component of the cell constituents and metabolically active compound Ahmad *et al.*, (2004). Potassium maintains the cellular organization by regularity the permeability of cellular membrane and keeping the protoplasm in a proper degree of hydration by stabilizing the emulsion of highly colloidal particles. Thus help in maintaining turgor pressure and eliminates water imbalance in plants Singh *et al.*, (2003).

Materials and Methods

A field Experiment was conducted on research farm of department of Soil Science, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture**,** Technology and Sciences (Deemed-to-be-University) Allahabad, (U.P.) India. The soil of experimental area falls in order Inceptisol and the experimental field is alluvial in nature.

The design applied for statistical analysis was carried out with 3^2 factorial randomized block design having three factors with three levels of NPK @ 0, 50, and 100% ha^{-1}, three levels of Vermicompost@ 0, 50 and 100% ha^{-1}respectively. Treatments were T_0 – (L_0 V_0) @0 % NPK ha^{-1} + 0% Vermicompost ha^{-1}, T_1 – (L_0V_1) @ 0% NPK ha^{-1} + 50% Vermicompost ha^{-1}, T_2 – (L_0 V_2) @ 0% NPK ha^{-1} + 100% Vermicompost ha^{-1}, T_3 – (L_1V_0) @ 50% NPK ha^{-1} + 0% Vermicompost ha^{-1}, T_4- (L_1 V_1) @ 50% NPK ha^{-1} + 50% Vermicompost ha^{-1}, T_5- (L_1 V_2) @50%NPK ha^{-1} +100%Vermicompost ha^{-1}, T_6 – (L_2 $V_{0)}$ @ 100% NPK ha^{-1} + 0% Vermicompost ha^{-1}, T_7 – (L_2 V_1) @ 100% NPK ha^{-1} + 50% Vermicompost ha^{-1}, T_8- (L_2 V_2) @ 100%NPK ha^{-1}+ 100% Vermicompost ha^{-1} having the treatments was replicated thrice. The source of inorganic nutrients sources as Urea, SSP, MOP, and organic nutrients sources as Vermicompost respectively. Basal dose of fertilizer was applied in respective plots according to treatment allocation unifurrows opened by about 5cm. depth before sowing seeds in soil at the same time sowing of seeds was sown on

well prepared beds in shallow furrows, at the depth of 5cm,.

The soil analysis was done in the laboratory of Soil Science, SHIATS.-DU, and Allahabad with following standard methods,

Results and Discussions

Physical properties of soil at 0-15 cm depth

Particle density (g/cm^3)

The maximum particle density (2.75 g/cm^{-3}) was found in treatment T_5-[NPK 50% RDF + Vermicompost 100 %] on followed by T_1-[NPK 0% RDF + Vermicompost 50 %] with (2.64 g/cm^{-3}) and the minimum value (2.43 g/cm^{-3}) particle density was found in treatment T_8 [NPK 0% RDF + Vermicompost 0 %] similar results have also been recorded by Bhattacharya *et al.,* (2004) (Table 1).

Bulk density (g/cm^3)

The maximum bulk density (1.46 g/cm^2) in depth 0 - 15 found with T_5-[NPK 50% RDF + Vermicompost 100 %] on followed by T_8-[NPK 100% RDF + Vermicompost 100%] with (1.43g/cm^2) and the minimum value (1. 16g/cm^2) bulk density was found in treatment T_1- [NPK 0% RDF + Vermicompost 50 %] similar results have also been recorded by Bhattacharya *et al.,* (2004).

Pore space (%)

The maximum pore space (48.75 %) in depth 0 - 15 was foundT_8-[NPK 100% RDF +Vermicompost 100 %] on followed by T_7-[NPK 100% RDF + Vermicompost 50%] with (47.50 %) and the minimum value (42.31 %) pore space was found in treatment T_0 (Control) similar results have also been recorded by Bhattacharya *et al.,* (2004).

Chemical properties of soil at 0-15 cm depth

pH

The maximum pH (7.67) was found in T_0-(control)on followed by T_5- [NPK @ 50% RDF + Vermicompost100%] with (7.56) and the minimum value (7.12) pH was found in treatment T_8 (NPK @ 100% RD+- NPK @ 100% RDF). Similar results have also been recorded by Bhattacharya *et al.,* (2004), Laxminarayan (2006) (Table 2).

Electrical conductivity (dSm^{-1})

The maximum electrical conductivity (0.25) in depth 0 - 15 was found with T_8-[NPK 100% RDF + Vermicompost 100%] on followed by T_7- [NPK 100% RDF + Vermicompost 50%] with (0.24) and the minimum value (0.20) electrical conductivity was found in treatment T4 [NPK 50% RDF + Vermicompost 50 %] similar results have also been recorded by Aphale *et al.,* (2005).

Organic carbon (%)

The maximum Carbon (0.84%) in depth 0 - 15 was found withT_8-[NPK 100% RDF + Vermicompost 100%] on followed by T_7-[NPK 100% RDF + Vermicompost 50 %] with (0.75 %) and the minimum value (0.60 %) Carbon was found in treatment T_0 (Control). Similar results have also been recorded by Bhattacharya *et al.,* (2004).

Available nitrogen

The maximum available nitrogen (kg/ah) (222.15 kg/ha) in depth 0 - 15 was found with T_8-[NPK 100% RDF + Vrmicompost100%] on followed by T_7- [NPK 100% RDF + Vermicompost 50 %] with (215.90kg ha^{-1}) and the minimum value (201.19 kg ha^{-1}) available nitrogen was found in treatment T_0 (Control).

Table.1 Mechanical analysis of the post–harvest soil

S. No.	Soil separates	Age (%)	Method followed
1.	Sand	60.0	Bouyoucous hydrometer (1927)
2.	Silt	20.12	
3.	Clay	11.51	
4.	Texture of soil	Sandy loam	

Table.2 Physical and chemical analysis of pre-harvest soil

Particulars	Rating	Method
1.Soil pH, Soil water Suspension	7.19	Digital pH meter **(Jackon 1958)**
2. EC (dS m^{-1})	0.23	Digital Conductivity meter **(Wilcox 1950)**
3. Bulk density (Mgm^{-3})	1.35	Graduated measuring cylinder**(Black 1965)**
4. Particle density (Mgm^{-3})	2.56	Graduated measuring cylinder **(Black 1965)**
5. Pore space (%)	47.51	Graduated measuring cylinder **(Black 1965)**
6. Organic carbon (%)	0.70	Walkley and Black **(1947)**
7. Available N ($Kgha^{-1}$)	209.25	Alkaline Permanganate Method**(Subbiah and Asija. 1956)**
8. Available P ($Kgha^{-1}$)	19.61	Calorimetric Method **(Olsen *et al.*, 1954)**
9. Available K ($Kgha^{-1}$)	132.45	Flame photometric Method **(Toth and Price. 1949)**

Similar results have also been recorded by Iqbal *et al.*, (2013) and Singh (2003).

Available phosphorus

The maximum available phosphorus kg ha^{-1} (24.03kg ha^{-1}) in depth 0 - 15 was found with T_8-[NPK 100% RDF + Vermicompost 100%] on followed by T_7- [NPK 100% RDF + Vermicompost 50 %] with (22.87 kg ha^{-1}) and the minimum value (16 kg ha^{-1}) available phosphorus was found in treatment T_0 (Control). Similar results have also been recorded by Iqbal *et al.*, (2013).

Available Potassium (kg/ha)

The maximum available potassium kg ha^{-1} (147.87 kg ha^{-1}) in depth 0 - 15 was found in T_8-[NPK 100% RDF + Vermicompost100%] on followed by T_7- [NPK 100% RDF + Vermicompost 50%] with (144.27 kg ha^{-1}) and the minimum value (115.98 kg ha^{-1}) available potassium was found in treatment T_0 (Control.) similar results have also been recorded by Khatkar *et al.*, (2009).

It was concluded from trial that the various levels of different sources in the experiment, the treatment T_8-L_2 V_2-**[**@ 100%NPK+100%Vermicompost.] was found to be the best in increasing Physical and Chemical properties of Soil Bulk density (1.35 Mgm^{-3}), Particle density (2.56 Mgm^{-3}), Pore Space (47.51 %), pH (7.19), EC (0.23 dSm^{-1}), Organic carbon (0.70%), N (209.25 Kg ha^{-1}), P (19.61 Kg ha^{-1}), K (132.45 Kg ha^{-1}), were found to be at par than any other treatment combinations.

Since the result is based on one year experimental data. Further research may be initiated for the establishment of the above findings.

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