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Effect of different dose of NPK and vermicompost on growth and yield attributes of maize [*Zea Mays* (L.)] Cv. MM2255

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Abstract
The field experiment was carried out at soil science research farm of Sam Higginbottom institute of Agriculture, Technology and Sciences (deemed- to- be university) Allahabad, during *Kharif* season 2015-16. The design applied was 3x3 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. The result obtained with treatment T_8-[NPK@ 100% + Vermicompost@ 100%] that showed the highest yield regarding, gave the best results with respect to plant height 158.22 cm, number of leaves per plant 11.00, cob length 17.50 cm leaf length per plant 48.50 cm, and dry weight 163.46 g, it gave highest yield, 42.77 q ha^{-1}, test weight 209.03 g. the maximum cost benefit ratio was recorded 1:2.55 and net profit. ₹ 44,624.96ha^{-1}in treatment combinationT_6-L_2V_0 [@ 100%NPK ha^{-1}+0% Vermicompost ha^{-1}] was found to be significant among other treatments in maize cultivation and soil quality improvement. It was also revealed that the application of NPK with Vermicompost were excellent source for fertilization than fertilizers.

Keywords: yield attributes, growth parameters, maize, Nitrogen, Phosphorus, Potassium and Vermicompost content, *etc*

Introduction
Maize (*Zea mays* L.) belongs to Gramineae family maize is considered as the native to the Central America & Mexico where many diverse types of maize are found Rai (2006) [7]. 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.*, (2008) [2]. Maize (*Zea mays* L.) rank third after wheat and rice and is grown all over the world in a wide range of climatic conditions. Being highly cross pollinated, maize has become highly polymorphic through the course of natural and domesticated evolution and thus contains enormous variability in which salinity tolerance may exist Paterniani (2009). In addition to meeting the food requirement of human and livestock, maize is put to many industrial uses. It is a well known fact that the yield potential of a crop is mainly dependent upon its genetic makeup as well as the environment in which it is grown. The genetic potential however, can be exploited to the maximum by providing favorable growth environments. The climatic conditions and existing varieties in our country are highly favorable for increasing production of maize. Fertilizer play an important role in increasing the maize yield and their contribution is 40-45 percent. Balanced and optimum use of nitrogen, phosphorus & potassium and Vermicompost fertilizers play pivotal role in increasing the yields of cereals. Though the yield potential of our present varieties is high enough, but it has not been explored fully due to some production constraints. Among the limiting factors; proper level and ratio of nitrogen, phosphorus & potassium and Vermicompost are of prime importance. Moreover the nutritional requirements of approved varieties must also be investigated. Keeping in view the above facts the present study was undertaken to determine the effect of nitrogen, phosphorus & potassium and Vermicompost on growth and yield parameters of maize grown under central Punjab conditions. 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) [6]. Vermicompost are organic materials broken down by interactions between micro-organism and earthworms in a hemophilic process, to produce fully stabilize organic soil amendments with low C: N ratios Ramasamy *et al.* (2011) [8]. The growth of crop depend mainly on the soil fertility, macro and micro nutrients, like all other crops maize plants, also require at least 17 essential nutrients to grow and produce grain among these nitrogen (N) phosphorus (P) potassium & (K) are the major nutrient. 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. (*2008) [2]. Phosphorus 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) [1]. 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) [9].

Material 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 & 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 shown on well prepared beds in shallow furrows, at the depth of 5cm, row to row distance was maintained at 20cm and plant to plant distance was 25cm, during the course of experiment, observations were recorded as mean values of the data.

Table 1: Effect different levels of NPK and Vermicompost on Attribute and yield of Maize. (90 DAS)

Treatment Combination	Plant Height (cm)	No. of Leaves Per plant	Leaf length (cm)	Lenth of cob (cm)	Dry weight (g)	Test weight (g)	Seed yield (q ha^{-1})	Cost Benefit ratio (C:B)
T_0=L_0V_0	113.18	10.73	40.63	10.17	135.41	185.37	25.11	1:1.86
T_1=L_0V_1	130.52	11.11	41.60	11.33	139.01	191.40	28.13	1:1.72
T_2=L_0V_2	135.98	11.00	42.60	12.17	138.93	197.30	28.16	1:1.54
T_3=L_1V_0	140.32	11.55	43.43	13.23	145.50	196.00	32.15	1:2.27
T_4=L_1V_1	145.65	11.55	43.97	14.13	147.82	199.83	33.84	1:2.00
T_5=L_1 V_2	150.36	11.11	44.37	15.17	151.21	201.47	36.17	1:2.31
T_6=L_2V_0	150.84	11.44	45.60	16.27	156.31	203.80	39.15	1:2.55
T_7=L_2V_1	155.22	11.44	46.50	16.83	158.68	205.93	41.83	1:2.31
T_8=L_2V_2	158.22	11.64	48.50	17.50	163.46	209.03	42.77	1:2.07
Mean	142.25	11.28	44.13	15.74	148.47	198.90	20.59	
F- test	S	S	S	S	S	S	S	
S. Em (±)	0.95	0.016	0.23	0.047	0.318	0138	0.138	
C. D. at 5%	2.022	0.033	0.50	0.100	0.674	0.292	0.292	

NS: Non Significant,* significant at 5% and** Significant at 1%

Results and Discussions

Growth Parameters

Plant height (cm)

At 30 DAS, the maximum plant hight 57.47 cm in T_8-[NPK @100% +Vermicompost@ 100%], followed by T_7- [NPK@ 100% + Vermicompost50%] was 52.89 cm and minimum plant height was observed in T_0 (control) that is 39.51 cm. At 60 DAS, the maximum 142.90 cm in T_8-[NPK @100% +Vermicompost@100%], followed by T_7- [NPK@ 100% +Vermicompost@ 0%] was 135.02 cm and minimum plant height was observed in T_0 (control) that is 98.13 cm. At 90 DAS the maximum 158.22 cm in T_8-[NPK@ 100% RDF + Vermicompost@100%], followed by T_7- [NPK@100% + Vermicompost@50%] the plant height was 155.22 cm and minimum plant height was observed in T_0 (control) that is 113.18 cm. Similar findings had also been reported by **Mohammed *et al.* (2014) [4]**

Number of leaves

At 30 DAS, the maximum number of leaves 7.11cm in T_8-[NPK@100% + Vermicompost@100], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the number of leaves was 6.55cm and minimum number of leaves was observed in T_0 (control) that is 5.89cm. At 60 DAS, the maximum 11.11 in T_8-[NPK@100%+Vermicompost@100%], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the number of leaves was 10.66 an minimum number of leaves was observed in T_0 (control) that is 9.89. At 90 DAS the maximum 11.64 in T_8-[NPK@ 100% + Vermicompost@100%], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the number of leaves was 11.44 and minimum number of leaves was observed in T_0 (control) that is 10.73. Similar findings had also been reported by Kumar *et al.* (2008) [2].

Leaf length (cm)

At 30 DAS, the maximum leaf length 22.43cm in T_8-[NPK@100% + Vermicompost@100], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the leaf length was 19.17 and minimum leaf length was observed in T_0 (control) that is 14.77cm. At 60 DAS, the maximum 47.20cm in T_8-[NPK@100% + Vermicompost@100%], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the number of leaves was 44.70 an minimum leaf length was observed in T_0 (control) that is 38.37. At 90 DAS the maximum 48.50 in T_8-[NPK@ 100% + Vermicompost@100%], followed by T_7-[NPK @100% + Vermicompost@ 50%] the leaf length was 45.60cm and minimum leaf length was observed in T_0 (control) that is 40.63cm. Similar findings had also been reported by Kumar *et al.* (2008) [2].

Cob length (cm)

At 90 DAS, the maximum 17.50 cm in T_8-[NPK@100% + Vermicompost@100], followed by T_7- [NPK@ 100% + Vermicompost@ 50%] the number of leaves was 16.63 and minimum cob length was observed in T_0 (control) that is 10.17. Similar findings had also been reported by Kumar *et al.* (2008) [2].

Dry weight (g.)

At 90 DAS, the maximum dry weight 163.46gm in T_8-[NPK@100% + Vermicompost@100], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the dry weight of plant was 158.31gm and minimum dry weight of plant was observed in T_0 (control) that is 135.41gm. Similar findings had also been reported by Lourduraj (2006) [3].

Test weight (g.)

At 95DAS, the maximum 209.03g in T_8-[NPK@100% + Vermicompost@100], followed by T_7- [NPK@ 100% + Vermicompost@ 50%] the number of leaves was 205.93g and minimum number of leaves was observed in T_0 (control) that is 185.37g. Similar findings had also been reported by Kumar *et al.* (2008) [2].

Yield (qha^{-1})

At 90DAS, the maximum grain yield 42.77 in T_8-[NPK@100% + Vermicompost@100%], followed by T_7-[NPK@ 100% + Vermicompost@ 50%] the grain yield was 41.83 and minimum grain yield was observed in T_0 (control) that is 25.11(qha^{-1}). The grains yield of maize were found to be significant, maize cv. MM-2255 grown in sandy loam soil and given no fertilizer or 120 kg N,+ P 60kg+ K 60, 10tha^{-1} Vermicompost) respectively. Similar findings had also been reported by Stulin. (2012) [10].

Conclusion

It was concluded from trial that the to study effect of different levels on NPK and Vermicompost on the growth yield of maize. the various levels of different sources in the experiment, the treatmentT_8-L_2 V_2-**[**@ 100% NPK+100% Vermicompost.] was found to be the best in increasing Plant height per plant (158.22 cm), Number of leaves per plant (11.00), leaf length per plant (46.87cm), cob length (17.50cm),Test weight (209.26 g), Dry weight per plant (163.46g) and Grain yield (42.77 q ha^{-1}) net profit ₹ (44,624.96ha^{-1}) Were found to be at par than any other treatment combinations found. 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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