Original Research Article

Effect of Graded Levels of Fertilisers with FYM on Yield and NPK Uptake by Hybrid Maize in Vertic ustropept

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Abstract

The field experiment was conducted to evaluate yield and N, P and K uptake for hybrid maize on Inceptisol. The soil of experimental field was sandy clay loam with alkaline pH and non-saline in nature. The soil was low in organic carbon and available N, medium in available P and high in available K. The available Zn, Cu, Fe, and Mn were in sufficient status. Among the STCR-IPNS treatments, the highest and significant grain and stover yield of 12,032 kg ha⁻¹ and 13125 kg ha⁻¹ respectively was recorded in STCR-IPNS-200% of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹ (T10). The highest N, P and K uptake of 241.82 kg ha⁻¹, 33.57 kg ha⁻¹ and 149.36 kg ha⁻¹ was recorded in STCR-IPNS-200% of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹ (T10).

Keywords
Fertilisers, Hybrid maize, Vertic ustropept

Introduction

Maize (Zea mays L.) is a dominant crop in the farming system belongs to family Poaceae and is an annual, determinate crop ranks third most important cereal crop after rice and wheat in India. Hybrids play a vital role in successful maize husbandry.

Among the various factors of crop production, improved hybrids play key role in boosting production of maize. Achieving high maize yield requires adequate and balanced supply of plant nutrients (Barbieri *et al.*, 2008) as declining soil fertility is a prominent constraint for maize production (Okoko and Makworo, 2012). So, that integrated use of organic manure and chemical fertilizers is beneficial in improving crop yield and uptake by maize hybrid.

Materials and Methods

The experiment was conducted during *Rabi* season in Allapalayam village, Annur block, Coimbatore District, Western Zone of Tamil Nadu, Southern India during in the year 2015 to 2016. The experimental soil was Periyanaickenpalayam soil series - *Vertic Ustropept* (mixed black calcareous soil). The
Maize Hybrid TNAU CO 6 was sown in experimental plot having thirteen treatments with three replications. The experiment was laid out in Randomized block design with the treatments are T1-STCR-NPK alone- 100 % of FD for 5 t ha⁻¹, T2-STCR-NPK alone- 125 % of FD for 5 t ha⁻¹, T3-STCR-NPK alone- 150 % of FD for 5 t ha⁻¹, T4-STCR-NPK alone- 175 % of FD for 5 t ha⁻¹, T5-STCR-NPK alone- 200 % of FD for 5 t ha⁻¹, T6-STCR-IPNS - 100 % of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹, T7-STCR-IPNS - 125 % of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹, T8-STCR-IPNS - 150 % of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹, T9-STCR-IPNS - 175 % of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹, T10-STCR-IPNS - 200 % of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹, T11-FYM @ 6.25 t ha⁻¹ alone, T12-FYM @ 12.5 t ha⁻¹ alone, T13-Absolute control.

Uptake of nutrients (N, P and K) was calculated by multiplying the dry matter production (kg ha⁻¹) with the corresponding nutrient content of the plant parts at harvest stage. The sum of nutrient uptake of straw and grain was expressed as the total nutrients uptake (kg ha⁻¹) at harvest stage of the crop.

Results and Discussion

Grain and stover yield

Maize yield with complementary alliance of inorganic and organic manures and with sole inorganic fertilizer treatment in the present study is comparable with the organic fertilizer because nutrients are readily released from the inorganic fertilizer and maize, being an exhaustive crop, is able to utilize it for its growth and yield. The purpose of all cultural operations is to manipulate these parameters there by to attain maximum yield. The highest mean grain weight (12032 Kg ha⁻¹) (Table 1) was recorded in the plot treated 200% STCR NPK recommended fertiliser dose along with 5 t ha⁻¹ of FYM. Among the treatments, STCR-IPNS – 200% FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹ (T10) recorded significantly higher grain yield followed by STCR-IPNS – 175% FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹ (T9). Similar results were also recorded by Sanjivkumar (2014); Endris and David (2015). An increase in the grain yield with FYM and vermicompost application along with NPK fertilizers may be due to the fact that added FYM and vermicompost served as store house of several macro and micro-nutrients which are released during the process of mineralization Shilpa shree et al., (2012). Application of organic manures either alone or integrated with chemical amendments for maize, performed better than all amendments tested in laboratory trails studied by Mujeeb et al., (2010). Recommendation of organic matter alone with synthetic fertilizers could be helpful for enhancing stagnant wheat grain yield was reported by Tahir et al., (2011). The lowest (5313 Kg ha⁻¹) was recorded in absolute control plot.

The highest and significant stover yield of 13125 kg ha⁻¹ was recorded in STCR-IPNS-200% of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹ (T10) followed by STCR-IPNS -175% of FD for 5 t ha⁻¹ + FYM @ 12.5 t ha⁻¹(T9) (12705 kg ha⁻¹). Dry matter production by maize in response to fertlisers and manure could be attributed to the fact that maize depends on fertiliser P at its early stages of growth; this might have stimulated root proliferation and acquisition of nutrients for growth (Ademba et al., 2014).

The beneficial effects of farm yard manure in increasing the stover yield might be due to its contribution in supplying additional plant nutrients, improvement of favourable soil conditions and biological process in soil, Joshi et al., (2013) also reported the enhancement of maize productivity with combined application of nutrients through organic and inorganic sources.
Table.1 Effect of varying fertiliser doses of NPK and IPNS on yield (kg ha$^{-1}$) of maize

| Treatments                              | Grain yield | Stover yield |
|-----------------------------------------|-------------|--------------|
| $T_1$ STCR-NPK alone- 100 % of FD for 5 t ha$^{-1}$ | 8148        | 9030         |
| $T_2$ STCR-NPK alone-125 % of FD for 5 t ha$^{-1}$ | 8704        | 10137        |
| $T_3$ STCR-NPK alone-150 % of FD for 5 t ha$^{-1}$ | 9683        | 10713        |
| $T_4$ STCR-NPK alone -175 % of FD for 5 t ha$^{-1}$ | 10278       | 11040        |
| $T_5$ STCR-NPK alone- 200 % of FD for 5 t ha$^{-1}$ | 10486       | 11144        |
| $T_6$ STCR-IPNS - 100 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 9245        | 10381        |
| $T_7$ STCR-IPNS -125 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 10203       | 11377        |
| $T_8$ STCR-IPNS -150 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 10992       | 12317        |
| $T_9$ STCR-IPNS -175 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 11393       | 12705        |
| $T_{10}$ STCR-IPNS -200 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 12032       | 13125        |
| $T_{11}$ FYM @ 6.25 t ha$^{-1}$ alone | 6234        | 7193         |
| $T_{12}$ FYM @ 12.5 t ha$^{-1}$ alone | 6625        | 7525         |
| $T_{13}$ Absolute Control. | 5313        | 6507         |

Mean 9180 10245  
SEd 174.40 93.57  
CD (P=0.05) 359.95 193.13

Table.2 Effect of varying fertiliser doses of NPK and IPNS on total N, P and K uptake (kg ha$^{-1}$) by maize at harvest stage

| Treatments                              | N       | P       | K       |
|-----------------------------------------|---------|---------|---------|
| $T_1$ STCR-NPK alone- 100 % of FD for 5 t ha$^{-1}$ | 142.63  | 20.90   | 115.76  |
| $T_2$ STCR-NPK alone-125 % of FD for 5 t ha$^{-1}$ | 164.04  | 24.09   | 128.48  |
| $T_3$ STCR-NPK alone-150 % of FD for 5 t ha$^{-1}$ | 185.85  | 27.49   | 138.27  |
| $T_4$ STCR-NPK alone -175 % of FD for 5 t ha$^{-1}$ | 197.57  | 28.88   | 147.65  |
| $T_5$ STCR-NPK alone- 200 % of FD for 5 t ha$^{-1}$ | 204.34  | 30.20   | 151.52  |
| $T_6$ STCR-IPNS - 100 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 170.29  | 25.54   | 113.79  |
| $T_7$ STCR-IPNS -125 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 190.31  | 28.20   | 125.68  |
| $T_8$ STCR-IPNS -150 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 210.20  | 30.82   | 135.85  |
| $T_9$ STCR-IPNS -175 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 226.50  | 32.35   | 143.63  |
| $T_{10}$ STCR-IPNS -200 % of FD for 5 t ha$^{-1}$ + FYM @ 12.5 t ha$^{-1}$ | 241.82  | 33.57   | 149.36  |
| $T_{11}$ FYM @ 6.25 t ha$^{-1}$ alone | 64.03    | 7.84    | 81.05   |
| $T_{12}$ FYM @ 12.5 t ha$^{-1}$ alone | 71.20    | 8.63    | 90.39   |
| $T_{13}$ Absolute Control. | 54.39    | 6.30    | 71.10   |

Mean 163.31 23.44 122.50  
SEd 4.54 0.90 3.40  
CD (P=0.05) 9.37 1.86 7.01
The amount of fertiliser applied is responsible for the amount of nitrogen, phosphorus and potassium uptake in maize. The increase in P and K uptake was due to the fact that nitrogen promotes phosphorus and potassium uptake by increasing top and root growth, altering plant metabolism and increasing P and K solubility and availability Kafle et al., (2016). Among the treatments, STCR-IPNS treatment with STCR-IPNS- 200 % FD for 5 t ha-1 +FYM @ 12.5 t ha-1 (T10) recorded significant and the highest total uptake of N 241.82 kg ha-1 (Table 2). Whereas, the total uptake of P (33.57 kg ha-1) and K (149.36 kg ha-1) (Table 2) was found to be the highest in STCR-IPNS- 200 % FD for 5 t ha-1 +FYM @ 12.5 t ha-1 (T10) followed by STCR-IPNS-175 % FD for 5 t ha-1 +FYM @ 12.5 t ha-1 (T9) which were on par with each other. The uptake of N, P and K found to have significant and positive correlation with grain yield of maize (R² = 0.9734**, 0.9523**, 0.8458**), respectively. Among the treatments imposed, STCR-IPNS treatments found to enhance uptake of nutrients when compared to STCR-NPK treatments due to the combined effect of FYM and NPK fertilisers. Numerous studies have shown that addition of organic manures exerts multiple benefits of crop productivity and soil fertility (Zhang, 2016) and sustainable cropping (Fig. 1).

The present study concluded that FYM along with inorganic fertilizers were efficiently used by maize crop for their growth and development and also maintained soil fertility and increased yield of the crop. The uptake of N, P and K found to have significant and positive correlation with grain and stover yield of maize. Addition of organic manures
plays multiple roles in crop productivity and maintaining soil fertility which sustains cropping and enhances profitability of farmers.

References

Ademba S. J., Johnson K Kwach, Silas M. Ngari, Anothony S. Esilaba and Nelson L. Kidula. 2014. Effect of organic and inorganic amendments on nutrient uptake, Phosphorous use efficiency and yield of maize in Kisii Country, Kenya. Afr. J. Agri. Res., 9(20): 1571-1578.

Barbieri, P.A., H.E. Echeverria, H. R.S. Rozas and F.H. Andrade. 2008. Nitrogen use efficiency in maize as affected by nitrogen availability and row spacing. Agron. J., 100: 1094-1100.

Endris Solomon and Jafer David. 2015. Yield Response of Maize to Integrated Soil Fertility Management on Acidic Nitosol of Southwestern Ethiopia. J. Agron., 14 (3): 152-157.

Joshi E., V. Nepalia, Arvind Verma and Dilip Singh. 2013. Effect of integrated nutrient management on growth, productivity and economics of maize (Zea mays). Indian J. Agron., 58 (3): 434- 436.

Kafle S. and P. K. Sharma. 2016. Effect of integration of organic and inorganic sources of nitrogen on growth, yield and nutrient uptake by maize (Zea mays L.). Int. J. Appl. Sci. Biotechnol., 3(1): 31-37.

Mujeeb, F., Rahmatullah, J., Akhtar and Ahmad, R. 2010. Integration of organic and inorganic P sources for improving P use efficiency in different soils. Soil and Environment, 29:122-127.

Okoko, E.N.K. and S. Makworo. 2012. Evaluation of the effect of compost and inorganic fertiliser on maize yield in Nyamira District. Southwest Kenya. Kenya Agricultural Research Institute (KARI), Kenya. http://www.kari.org/fileadmin/publications/legume_project/Legume2Conf_2000/3.pdf.

Sanjivkumar. V. 2014. Effect of integrated nutrient management on soil fertility and yield of maize crop (Zea mays L.) in Entic Haplustart in Tamil Nadu, India. J. Appl. & Nat. Sci. 6 (1): 294-297.

Shilpashree V.M, Chidanandappa H.M. Jayaparaksh R and Punitha B.C. 2012. Influence of integrated nutrient management practices on productivity of maize crop Indian J. Fundamental and Applied Life Sci., 2 (1):45-50.

Tahir, M., Ayub, M., Javeed, H.M.R., Naeem, M., Rehman, H., Waseem, M. and Ali, M. 2011. Effect of different organic matter on growth ad yield of wheat (Triticum aestivum L). Pakistan Journal of life and Social Sciences, 9: 63-66.

Zhang, Y., Caihua Li, Yanwei Wang, Yinmin Hu, Peter Christie, Junling Zhang and Xiaolin Li. 2016. Maize yield and soil fertility with combined use of compost use of compost and inorganic fertilizers on a calcareous soil on the North China Plain. Soil & Tillage Res., 155: 85-94.

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