EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTIVITY OF MAIZE

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Abstract: The field experimentwas conducted during *kharif*, 2014 at the Instructional Farm of the Rajasthan College of Agriculture, Udaipur. The soil of the experimental site was sandy clay loam in texture slightly alkaline in reaction, medium in available nitrogen and phosphorus and high in potassium, sulphur and zinc. The experiment consisted of 12 treatments comprising chemical fertilizers, organic manure, and their combinations, *viz*., , 100 % RDF + FYM at 10t ha^{-1}, 75 % RDF + FYM at 10t ha^{-1}, 50 % RDF + FYM at 10t ha^{-1}, 100 % RDF + vermicompost at 4t ha^{-1},75 % RDF + vermicompost at 4t ha^{-1}, 50 % RDF + vermicompost at 4t ha^{-1} , FYM at 20t ha^{-1}, vermicompost at 8t ha^{-1}, 100 % RDF, 75 % RDF, 50 % RDF, and control These treatments were evaluated under randomized block design (RBD) with three replications. Maize cultivar (pratapmakka- 5) was taken as test crop. The results revealed that the yield of maize crop in terms of grain, stover and biological yield (2766, 7796, 10562 kg ha^{-1}) were maximum by applying 100% RDF + Vermicompost 4 t ha^{-1} though the results were at par with those obtained by applying 100% RDF + FYM 10 t ha^{-1}.

Keywords: Vermicompost, FYM, Maize, RDF, biological yield

INTRODUCTION

In India, effective nutrient management has played a major role in accomplishing the enormous increase in food grain production from 52 million tonnes in 1951-52 to 264.38 million tonnes during 2014. However, application of imbalanced and excessive nutrients lead to declining nutrient-use efficiency making fertilizer consumption uneconomical and producing adverse effects on atmosphere (Aulakh and Adhya, 2005) and ground water quality (Aulakh*et al.*, 2009) causing health hazards and climate change. Integrated nutrient management(INM), which entails the maintenance/adjustment of soil fertility to an optimum level for crop productivity to obtain the maximum benefit from all possible sources of plant nutrients organics as well as inorganics in an integrated manner (Aulakh and Grant, 2008), is an essential step to address the twin concerns of nutrient excess and nutrient depletion. Integrated nutrient management is also important for marginal farmers who cannot afford to supply crop nutrients through costly chemical fertilizers. FYM is one of the components of INM as it a cheap and easily available source of organic nutrients. Integrating FYM with inorganic fertilizer, scientists are getting very good response of the crop. Application of this source of organic improves physical, chemical and biological condition of the soils. FYM can supply all the nutrients required by the plant, however with low quantity.Vermicompost is a nutrient rich compost which helps better plant growth and crop yield, improves physical structure of soil, enriches soil with micro-organisms, attracts deep-burrowing earthworms already present in the soil which indirectly improves fertility of soil, increase water holding capacity of soil, enhances germination, plant growth, and crop yield, improves root growth of plants, enriches soil with plant hormones such as auxins and gibberellic acid. It is helpful in elimination of biowastes.

MATERIAL AND METHOD

The experiment consisted of 12 treatments comprising chemical fertilizers, organic manure, and their combinations, *viz*., , 100 % RDF + FYM at 10t ha^{-1}, 75 % RDF + FYM at 10t ha^{-1}, 50 % RDF + FYM at 10t ha^{-1}, 100 % RDF + vermicompost at 4t ha^{-1},75 % RDF + vermicompost at 4t ha^{-1}, 50 % RDF + vermicompost at 4t ha^{-1} , FYM at 20t ha^{-1}, vermicompost at 8t ha^{-1}, 100 % RDF, 75 % RDF, 50 % RDF, and control.The dose of the NPK for maize was worked out from IPNS equations developed for maize crop for 2.5 t/ha yield target. The NPK dose in kg ha^{-1} worked out was 90: 40: 40 for maize crop. The doses for farm yard manure and vermicompost is 10 t ha^{-1}and 8 t ha^{-1}, respectively. The FYM and Vermicompost were applied before sowing of the maize crop (content of FYM and Vermicompost given below Table 1).

Table 1. Composition of FYM and Vermicompost

Nutrient	FYM (%)	Vermicompost (%)
N	0.48	2.94
P_2O_5	0.18	0.96
K_2O	0.45	1.42

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Treatment application

FYM and vermicompost incorporated in soil before month of sowing while,Fertilizer application was made as per the treatment. Full dose of phosphorus and potash and half dose of nitrogen were applied at sowing by drilling in crop rows. The remaining dose of nitrogen was top dressed in two split doses at 30 DAS and 50 DA

Yield parameters viz., grain yield and stover yield observed in following manner

a) **Grain yield:** Cobs of harvested plants of net plot area after proper sun drying were separated from plants, dehusked and shelled with the help of cob sheller. The produce was cleaned, weighed and expressed in terms of grains kg ha^{-1}.

b) **Stover yield:** Stover yield was obtained by subtracting the grain yield per plot from the respectively biological yield per plot and finally expressed in terms of stover yield kg ha^{-1}.

RESULT AND DISCUSSION

Grain yield

An examination of data (Table 2. and Fig.1) revealed that the variation in grain yield of maize varied from 1475.56 to 2766.13 kg ha^{-1}. Significant enhancement in grain yield of maize was recorded by applying various treatments to supply nutrients. The highest grain yield (2766.13 kg ha^{-1}) was recorded by application of 100 % RDF + Vermicompost 4 t ha^{-1} and which was followed by 100% RDF + FYM 10 t ha^{-1} which represents 88 and 79 per cent increase yield over control.

Stover yield

Based on measured data (Table 2 and Fig.1) it can be inferred that stover yield was significantly increased by enriching the soil with various treatments over no fertilization. The increase in yield varied from 4127.81 to 7796.69 kg ha^{-1}. The application of 100% RDF + Vermicompost 4 t ha^{-1} produced highest stover yield (7796.69 kg ha^{-1}) and which was followed by 100% RDF + FYM 10 t ha^{-1} which represents 89 and 82 per cent increase yield over control.

Biological yield

A perusal of data presented in Table 2and Fig 1. show that biological yield varied from 5603.37 to 10562.82 kg ha^{-1} during study by applying various treatments to supply nutrients. An application of 100% RDF + Vermicompost 4 t ha^{-1} recorded significantly highest yield (10562.82 kg ha^{-1}) and which was followed by 100% RDF + FYM 10 t ha^{-1} which represents 89 and 81 per cent increase yield over control.

Table 2. Effect of treatments on yield and harvest index in maize

Treatment	Yield (kg ha^{-1})			Harvest Index (%)
	Grain	Stover	Biological	
T_1 - Control	1475	4127	5603	26.34
T_2 - 50% RDF	1676	4705	6381	26.38
T_3 - 75% RDF	1840	5131	6971	26.58
T_4 - 100% RDF	1918	5202	7120	30.79
T_5 - Vermicompost at 8 tha^{-1}	1845	5140	6985	26.42
T_6 - FYM at 20 tha^{-1}	1795	5062	6857	26.18
T_7 - 50% RDF + vermicompost at 4t ha^{-1}	1801	4980	6781	26.67
T_8 - 75% RDF+ vermicompost at 4t ha^{-1}	1964	5406	7370	26.77
T_9 - 100% RDF+ vermicompost at 4t ha^{-1}	2766	7796	10562	26.21
T_{10} - 50% RDF + FYM at 10 t ha^{-1}	1750	4830	6580	26.59
T_{11} - 75% RDF+ FYM at 10 t ha^{-1}	1920	5294	7214	26.62
T_{12} -100% RDF+ FYM at 10 t ha^{-1}	2643	7510	10153	26.02
SEm±	67.031	233.196	253.904	1.022
CD (p=0.05)	194.181	675.542	735.531	2.961
C.V.%	5.81	7.38	5.88	6.61

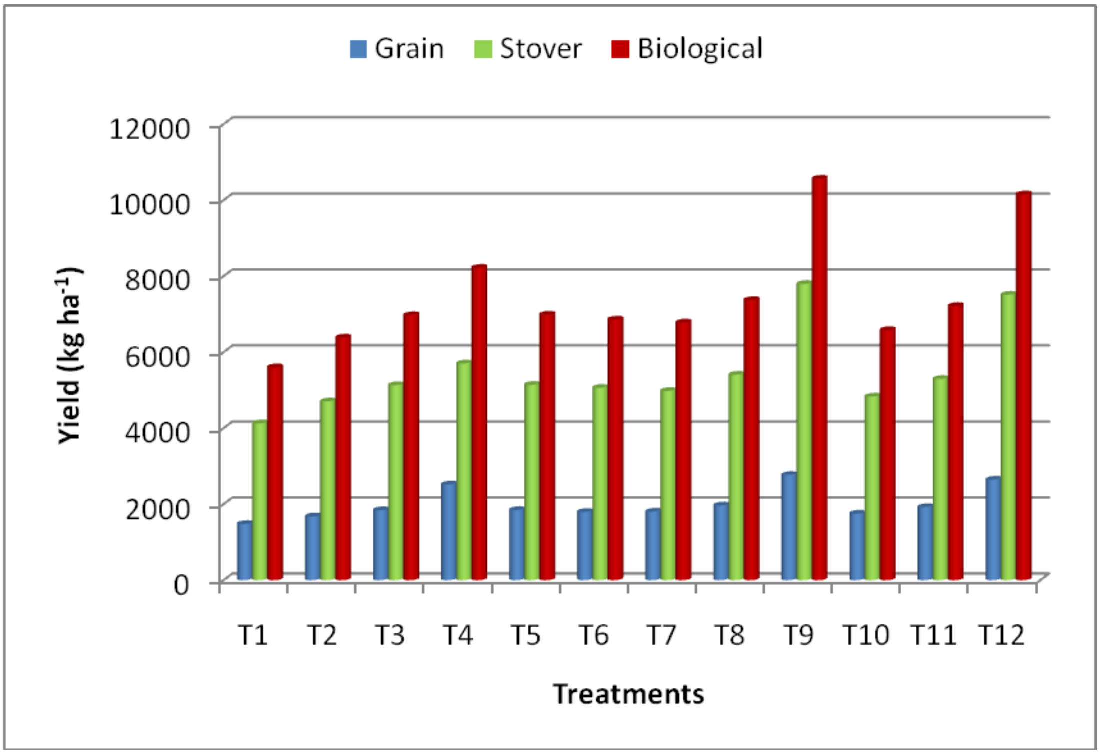

Fig 1. Effect of treatments on yield in maize

The results showed that balanced fertilization of maize crop involving nutrient combinations of N, P and K, with vermicompost and FYM most effectively enhanced various yield components in maize *viz.* grain, stover, biological yield were maximized when crop was fertilized with balanced and increased levels of nutrient combinations.The highest grain yield realized with application of balanced and higher level of plant nutrition could be ascribed due to its profound influence on vegetative and reproductive growth of the crop. Hence, marked increase in grain yield with balanced and higher level of fertilization seems to be due to exploitation of crop genetic potential for vegetative and reproductive growth. The best result on grain yield was obtained with application of 100 % NPK + vermicompost 4 t ha^{-1} which was 88 per cent higher over control. This indicates that maize responds well to integrated nutrient management. The results of the present investigation indicating positive response of maize crop to balanced fertilization are alike to findings of several researchers (Kumpawat, 2004; Kumar, 2008 and Mehta *et al*., 2011).

Application of integrated nutrient as 100 % NPK + vermicompost 4 t ha^{-1} increased yield components of maize crop significantly over control and at par with 100 % NPK + FYM 10 t ha^{-1}(Table 4.1). The significant interactive effect as a consequence of Vermicompost and fertilizer application is attributed to the favorable nutritional status of the soil resulting into increased biomass production of the crop. This may also be attributed to favorable effect of Vermicompost on microbial and root proliferation on soil which caused solubilizing effect on native phosphorus and other nutrients. Integrative chemical fertilizers and organic manures was, however, found to be quite promising not only in maintaining higher productivity but also in providing greater stability in crop production by synergistic effect of Vermicompost on improving efficiency of optimum dose of NPK. The results of the present study that Combined use of organic manure and chemical fertilizer has been found to be providing higher productivity with those reported by Ramesh *et al*. (2008), Dadarwal*et al*. (2009), Kannan*et al*. (2013) Singh *et al.* (2010), Behera and Singh, (2009), Paradkar*et al.* (2010), Sharma and Banik (2011). Data presented in Table 2. show that significant increase in stover yield due to higher fertility levels and balanced fertilization (100 % NPK + vermicompost 4 t ha^{-1}) could be ascribed to their direct influence on dry matter production in leaf and stem at successive stages by virtue of increased photosynthetic efficiency. The profound influence of nutrient application on biological yield seems to be on account of its influence on vegetative (stover) and reproductive growth (grain) with those reported by Singh *et al*., 2006; Kar*et al*., 2006; Choudhary*et al*., 2007; Singh *et al.*, 2012.

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