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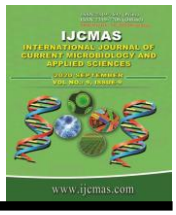

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Response of Different Levels of Fertilizers, Organic Manure and Bio-fertilizers on Soil Properties and Yield Attributes of White Seeded Maize (*Zea mays* L.)

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A B S T R A C T

Organic and bio-fertilizers are important for crop productivity and soil health. Present study investigated the response of different levels of fertilizers, organic manure and bio-fertilizers on soil properties and yield attributes of white seeded maize (*Zea mays* L.). The experiment consisted of 12 treatments combinations which were replicated thrice and laid out in a factorial RBD of three Levels of NPK (Without NPK, N60 + P30 + K30 and N120P60K60), two level of FYM (Without FYM, FYM@10 t) and two Levels of PSB (Without PSB, PSB@100 G/10 kg of seeds). The results showed that progressive increase the growth on (Plant height (cm), Dry matter accumulation, No. of leaves per plant) and yield (No. of cobs/plant, Cob yield and Stover yield) in application of T11 (N120:P60:K60+FYM 10 t/ ha + PSB @100 g/10 kg seeds) of maize (*Zea mays* L.) were found to be the best treatment combinations.

Introduction

Maize is one of the important most important cereal crops in the world agriculture economy both as food grains for humans and fodder and feed for the cattle and poultry. Crop has been developed into a multi dollar business in countries viz. Thailand, Tiwan, Singapore, Malaysia, USA Canada and Germany because of its potential as a value added product for export and a good food substitute. Maize is gaining importance on account of its potential uses in manufacturing starch, plastics, rayon, adhesive, dye, resins, boot polish etc., and due to this large uses it is rightly called a miracle crop and also known as queen of cereals due to its high potential yield.

In India maize is grown in an area of 9.76 million hectares with production of 26.1 for million tonnes and productivity of 26 29.8 kg per hectare Government of India, 2017. Is generally higher in high solar intensities, lower night temperature and low pest infestation optimum plant insta leads to better utilisation of solar radiation resulting in took

on dry matter accumulation and biomass production.

Maize is one of the world's leading crops cultivated over an area of 177 million tonnes with production of about 872 million tonnes of grain. USA leads the largest area, followed by Brazil, China and India. Maize is grown in almost all states of India occupying an area of 8.4 million hectares in the production and productivity of 21 million tonnes and 3.0 tonnes per hectare (2012 World data 2012). Uttar Pradesh is a major producing state contributes 60% area *Zea mays* L. growth, Yield, Azad Uttam, FYM, Grain, Stalk and 70% of maize production in India.

Organic manure significantly increased the soil pH and the concentrations of nitrogen, available phosphorus, exchangeable potassium, calcium, and magnesium. In contrast, the NPK chemical fertilizer decreased the soil pH and exchangeable calcium concentration, did not affect the soil concentrations of nitrogen and magnesium, and increased the concentrations of available phosphorus and exchangeable potassium.

Fertilization treatments increased the seedling height and root collar diameter by 21% and 29%, respectively, and the mean dry weight of the stems and leaves by 72% and 123%, respectively; but a synergistic effect of the organic manure and NPK fertilizer was not observed. Compared to the effects of the fertilization treatments on the soil properties, the effects on nutrient concentrations in the leaves, stems, and roots were relatively small. These findings indicate that organic manure derived from livestock by-products and sawdust can be utilized in seedling production systems.

Farm yard manure occupies an important position among bulky organic manures. The FYM seems to act directly by increasing crop yield either by acceleration of respiratory process by cell permeability or by hormone growth action. It supplies N, P and K in available forms to plants through biological decomposition

Biofertilizers are low cost, renewable sources of plant nutrients which supplement chemical fertilizers. These are nothing but selected strains of beneficial soil microorganisms cultured in the laboratory and packed in a suitable carrier.

They can be used either for seed treatment or soil application. Biofertilizers generate plant nutrients like nitrogen and phosphorous through their activities in the soil or rhizosphere and make available to plants in a gradual manner.

Biofertilizers are gaining momentum recently due to the increasing emphasis on maintenance of soil health, minimize environmental pollution and cut down on the use of chemicals in agriculture. In rainfed agriculture, these inputs gain added importance in view of their low cost, as most of the farmers are small and marginal and can not afford to buy expensive chemical fertilizers. Biofertilizers are also ideal input for reducing the cost of cultivation and for practising organic farming.

Materials and Methods

Soil sampling

The soil of experimental area falls in order of Inceptisol and in experimental plots is alluvial soil in nature. The soil samples randomly collect from five different sites in the experiment plot prior to tillage operation from a depth of 0-15 cm.

The size of the soil sample reduce by conning and quartering the composites soil sample is

air dry and pass through a 2 mm sieve by way of preparing the sample for physical and chemical analysis. The experimental details are given below under different heading:

Design and treatment

The experiment consisted of 12 treatments combinations which were replicated thrice and laid out in a factorial RBD of three Levels of NPK (Without NPK, N60 + P30 + K30 and N120P60K60), two level of FYM (Without FYM, FYM@10 t) and two Levels of PSB (Without PSB, PSB @ 100 G/10 kg of seeds).

Experimental sites

The experiment was conducted on the research farm of department of Soil Science and agricultural chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj which situated six km away from Prayagraj city on the right bank of yamuna river, the experimental site is located in the sub – tropical region with 250 N *latitude* 81.500 E longitude and *95 MS Laltitude.*

Fertilizer application

The fertilizers were applied in each plot according to treatment combinations. T0-Control, T1-N0:P0:K0 + +FYM0+PSB@100 g/10 kg seeds, T2- N0:P0: K0 + FYM 10 t / ha + PSB0, T3-N0: P0: K0 + FYM @10 t/ha + PSB @ 100 g/10 kg of seeds, T4-N60:P30:K30 + FYM0 + PSB0, T5-N60: P30: K30 + FYM0 + PSB @ 100 g/10 kg seeds, T6-N60: P30:K30 + FYM 10 t/ha + PSB0, T7-N60: P30:K30 + FYM 10 t/ha + PSB @100 g/10 kg seeds, T8- N120: P60:K60 + FYM0 + PSB0, T9-N120: P60: K60 + FYM0 + PSB + @100 g/10 kg seeds, T10-N120: P60: K60 + FYM 10 t/ha + PSB0, T11-N120: P60: K60 + FYM 10 t/ ha + PSB @100 g/10 kg seeds was given in equal quantity to each plot which was calculated on the basis of general recommendation for maize as 0 kg, 80 kg, 100 kg ha was supplied.

Results and Discussion

Data presented in table 1 showed that the application of T11 (N120:P60:K60 + FYM 10 t/ha + PSB @100 g/10 kg seeds) recorded maximum bulk density (Mgm-3), Particle density, % pore space and Water retaining capacity (%) was (1.47, 2.55, 50.98, 56.19) respectively, however pH (1:2) w/v (7.57) was recorded in T0-Control. In case of EC (dSm-1 at 25ºC), Specific gravity, % of solid space Organic carbon, Available nitrogen (kg ha-1), Phosphorus (Kg ha-1) and Phosphorus (Kg ha-1) Available Potassium (kg ha-1)was (0.36, 0.72, 2.53, 48.27, 328.26, 31.95 and 213.88) in T11(N120:P60:K60+FYM 10 t/ha + PSB @100 g/10 kg seeds), respectively. Increasing the bulk density, Particle density (Mgm^{-3}), % pore space and Water retaining capacity (%) due to increasing NPK, FYM and PSB fertilizer. It is found that the crop plants as nutrients absorbed a considerable amount of salts from the soil, which results in decrease of soil water suspension. Similar findings had also been reported by Kahlepure *et al.,* (2013). It is found that the crop plants as nutrients absorbed a considerable amount of salts from the soil, which results in decrease of soil water suspension. Similar findings had also been reported by Shinde *et al.,* (2011). It is found that the crop plants as nutrients absorbed a considerable amount of salts from the soil, which results in decrease of soil water suspension. Similar findings had also been reported by Verma (2011). Increasing the available nitrogen, Phosphorus (Kg ha-1) and available potassium due to increasing NPK, FYM and PSB fertilizer. It is found that the crop plants as nutrients absorbed a considerable amount of salts from the soil. Similar findings had also been reported by Umesha *et al.,* (2013) (Fig. 1–3).

Table.1 Interaction effect of different treatment combination of NPK, FYM and PSB fertilizers of post harvest soil

Treatment	Bulk density (Mgm^{-3})	Particle density (Mgm^{-3})	% pore space	Water retaining capacity (%)	pH(1:2) w/v	EC (dSm at 25°C)	Organic carbon	Specific gravity	% of solid space	Available nitrogen (kg ha)	Phosphorus (Kg ha)	Available Potassium (kg ha)
T0	1.30	2.04	44.72	47.54	7.57	0.31	0.56	1.75	23.11	289.25	20.93	**153.26**
T1	1.32	2.13	47.78	50.95	7.50	0.32	0.58	2.13	33.66	290.54	25.07	**157.75**
T2	1.35	2.13	47.91	49.46	7.53	0.33	0.57	2.27	35.62	291.59	25.66	**157.75**
T3	1.37	2.23	50.01	50.95	7.50	0.33	0.61	2.30	37.17	296.78	25.96	**159.24**
T4	1.37	2.23	47.78	51.93	7.43	0.33	0.61	2.33	44.36	299.87	26.56	**170.47**
T5	**1.39**	**2.34**	**47.91**	**52.85**	**7.30**	**0.33**	**0.63**	**2.33**	**44.45**	**304.16**	**27.76**	**174.21**
T6	**1.39**	**2.34**	**48.75**	**51.51**	**7.40**	**0.34**	**0.59**	**2.36**	**44.68**	**305.21**	**28.74**	**177.96**
T7	1.42	2.25	46.94	53.28	7.30	0.34	0.64	2.43	44.73	308.35	29.56	**180.20**
T8	1.42	2.25	48.75	52.43	7.30	0.35	0.61	2.44	45.25	313.59	29.56	**191.43**
T9	1.45	2.44	47.91	55.24	7.27	0.35	0.69	2.47	45.30	318.83	31.05	**195.17**
T10	1.45	2.44	48.88	54.20	7.17	0.35	0.66	2.49	47.70	323.02	31.35	**202.66**
T11	1.47	2.55	50.98	56.19	7.20	0.36	0.72	2.53	48.27	328.26	31.95	**213.88**
F - test	NS	NS	S	S	NS	NS	NS	S	S	S	S	**S**
S. Ed. (±)	0.03	0.07	0.42	0.42	0.49	0.01	0.02	0.07	1.40	0.81	0.54	**1.01**
C. D. at 5%	**0.07**	**0.14**	**0.86**	**0.86**	**0.99**	**0.02**	**0.04**	**0.13**	**2.85**	**1.65**	**1.1**	**2.06**

Fig.1 Effect of different treatment combination of NPK, FYM and PSB fertilizers (on bulk and particle density, pore space, water retaining capacity) of post harvest soil

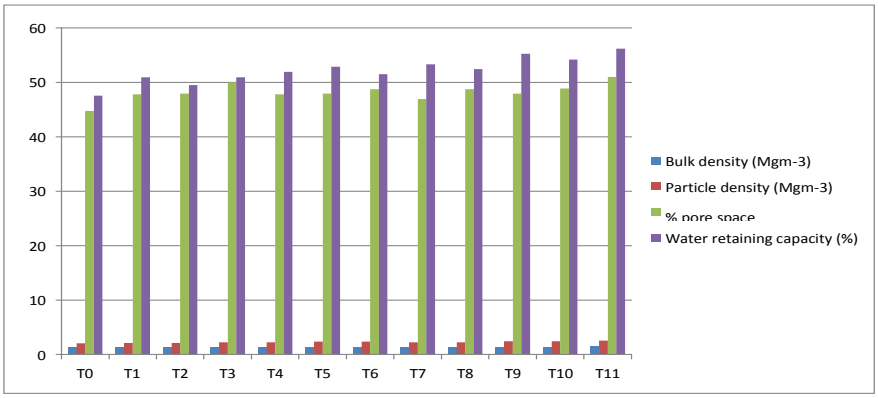


Fig.2 Effect of different treatment combination of NPK, FYM and PSB fertilizers (on pH, EC, organic carbon, specific gravity, solid space) of post harvest soil

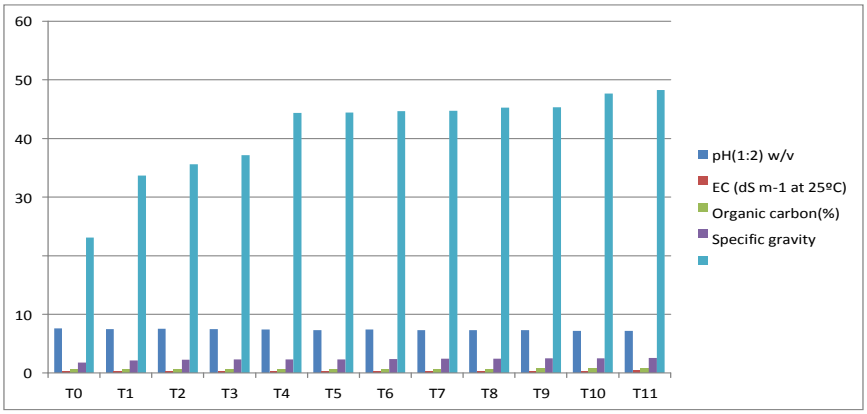
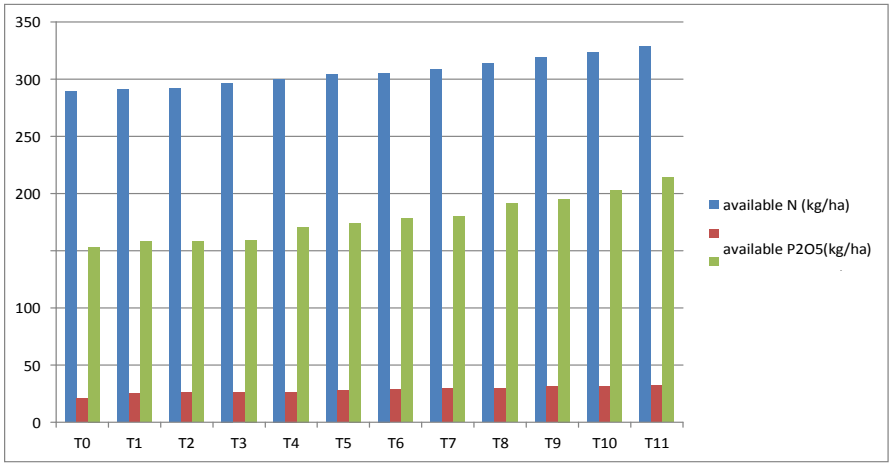


Fig.3 Effect of different treatment combination of NPK, FYM and PSB fertilizers (on available NPK) of post harvest soil



Economics

Economics of all treatments were calculated according to expenditure incurred from the land preparation till harvesting of the crop. Gross return, net return, cost of cultivation were calculated.

As for the economy of different is concerned, the treatment L2 F1P1 provides highest net profit of ₹ 50600 ha^{-1} with benefit cost ratio is 1:3.02 however, the minimum net profit of11.896 ha^{-1} was recorded in the L0F0P0 treatment with benefit cost ratio 1:1.48 respectively**.**

Summary

The experiment was conducted at the Research Farm of Soil Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during kharif season 2019-2020 study the "Response of different levels of fertilizers, organic manure and biofertilizers on soil properties and yield attributes of white seeded maize (*Zea mays* L.)" in Allahabad soil.

The treatments were allocated in a 3 x 2 x 2 factorial design with three replications. The treatments consisted of all combination, 3 levels of NPK fertilizer @ N0P0K0 $kgha^{-1,}$ N60P30K30 kg ha^{-1} and N120P60K60 kg ha^{-1}, 2 level of FYM in level @ FYM 0 t ha^{-1}, FYM@ 10 t ha^{-1}, 2 level of PSB @ 0 kg ha-1, PSB@ 100 G/10 kg of seeds.

The crop was sown on 15th July 2020 with a seed rate of 25 kg ha^{-1} and harvested on 18th October 2020. The observation taken on different plant characters during the crop growth period and at crop harvest.

The general results of the investigation are summarized below:

With increase in the level of NPK fertilizes N120P60K60 kg ha^{-1} to there was significant increase in vegetative growth and yield attributes. At this level there was slight decrease in pH and EC but increase in nutrient status of soil.

With increase in the level of FYM to FYM@ 10 t ha-1 there was significant increase in vegetable growth and yield attributes. At this level there was slight decrease in pH and EC but increase in nutrient status of soil.

With increasing in the level of PSB@100 G/10 kg of seeds there was significant increase in vegetable growth and yield attributes.

The interaction between NPK fertilizer in conjunction with FYM and PSB fertilizer increased all the growth parameters and yield attribute with the treatment T11 (N120:P60:K60 + FYM 10t/ha + PSB @100 g/10 kg seeds) was also highest in this combination.

As for the economy of different is concerned, the treatment L2 F1P1 provide highest net profit of ₹ 50600 ha^{-1} with benefit cost ratio is 1:3.02.

It was concluded from trail that the various levels of integrated nutrients use from different sources in the experiment, The combined application of NPK fertilizers @ N120: P60:K60 + FYM10 t/ha + PSB @100 g/10 kg seeds of seeds found to be the best in increasing plant height, no. of leaves per plant, leaf length, cob length, no. of grain per cob, dry weight, test weight, grain yield and the physical and chemical properties of soil such as bulk density, particle density, % pore space, water retaining capacity, EC, pH, % organic carbon, available N, P, K, PSB, found to that any other treatment combination. The maximum net return (₹ 50600) ha^{-1}. Since the result is based on one season experiment, further trial is needed to substantiate the results.

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