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EFFECT OF COMBINED USE OF ORGANIC AND INORGANIC FERTILIZER SOURCES ON GROWTH AND YIELD OF *kharif* MAIZE IN A COARSE LOAMY TYPIC HAPLUSTEPT SOIL

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Abstract

A field experiment was conducted to study the Effect of combined use of organic and inorganic fertilizer sources on growth and yield of *kharif* maize in a coarse loamy Typic Haplustept soil at the Experimental Farm of School of Agriculture, Lovely Professional University, Phagwara, Punjab during *kharif* season of 2015. The experiment was laid out in Randomized Complete Block Design (RCBD) with eight treatments and three replications. The results showed that the highest plant height (193.2cm), stem girth (7.5cm) and maximum number of leaves (12.6) was observed in T_4 (75% RDF + 10t FYM + V.C @ 2t/ha). The highest cob length (21.2cm), number of grains per cob (480.2), grain yield (4096.0 kg/ha), straw yield (6271.0 kg/ha), harvest index (39.4%) and 1000- grain weight (364.4g) was observed in T_6 (50% RDF + 10tFYM + V.C @ 2t/ha + azotobacter/ha). The minimum plant height, stem girth, number of leaves per plant, cob length, number of grains per cob, grain yield, straw yield, harvest index and 1000- grain weight was produced by T_1 (Control) plot. The combination of organic and inorganic fertilizer sources in T_6- 50% RDF + 10t FYM + V.C @ 2t/ha + azotobacter/ha, gave a best result with respect to grain yield, straw yield and harvest index.

***Key words**:* Maize, RDF, Farmyard manure, Vermicompost, Azotobacter.

Introduction

Among cereals maize is the most important crop after wheat and rice. The maize (*Zea mays* L.) belongs to Gramineae family. The origin of maize is Mexico. The maize has a diploid chromosome number 10 (2n=20). Maize is short day plant with shallow root system. It is a cross pollinated crop. The height of maize plant is 250cm. The leaf is about 9cm in width and 120 cm in length generally growing from each internode. It is the most versatile crop with wider adaptability in varied agri-ecologies and has highest genetic yield potential among food grain crops. Maize is called queen of cereals as it is grown throughout the year due to its photo-thermo insensitive characters. Because of high production potential and increasing market price, the maize is become popular crop in India. In India, the total area under maize cultivation is 8.71 million hectares, and production is 22.55 million ton (Anonymous, 2012). It is a rich source of protein (10%), starch (72%), fiber (5.8%), oil (4.87%), sugar (3.07%) and ash (1.7%) (Chaudhry, 1983).

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There are several factors which are responsible for poor growth and yield of maize crop. One of the factor which is responsible for poor yield of crop is low fertility status of soils. At present, the only use of inorganic and organic fertilizer sources are also one of the main reason for slow growth and low yield of maize.

The organic fertilizer sources maintain good soil aeration by improving soil structure and provide nutritious food to plant without any chemical residue. But organic fertilizers are slow releasing, costly and reduce the overall yield of crop. As compare to chemical fertilizers, organic fertilizer source like manure have a residual effect for succeeding crops and check leaching of nutrients, evaporation losses and soil erosion. The nutrients in manures become available to plants very slowly (Malival 2001; 1 FAO 2004; Das, 2005). The inorganic fertilizer sources are cheap, early releasing and require in very small amount as compare to organic fertilizer sources. But they degrade the soil, cause environmental and water pollution and serious health hazards in humans.

To attain the sustainability of agro- ecosystem,

integrated use of organic and inorganic fertilizer sources are desired (Rao *et al*. 2012). The combination of farmyard manure with recommended dose of fertilizers gives higher grain yield. For increasing the grain yield of maize, the application of NPK 20:0:10: at 450kg per hectare and poultry manure at 30 ton per hectare is recommended by (Enjueke, 2013). The root growth of maize can be increased by using poultry manure and cattle dung. The integrated use of vermicompost with inorganic fertilizer sources can meet the nutrient requirement of the crop throughout the growth period, for increasing quality and yield of maize and improve the (physical, chemical and biological) properties of the soil. The combined use of azotobacter with recommended dose of fertilizers results in higher productivity of maize. The combination of organic and inorganic fertilizer sources will help in enhancing the growth and yield of maize. Keeping in view the existing scenario a field experiment has been conduct to study the effect of integrated use of organic and inorganic fertilizer sources on growth and yield of *kharif* grown maize in a coarse loamy Typic Haplustept soil.

Materials and methods

The field experiment was conducted during *kharif* 2015 at Lovely Professional University. The experiment was laid out in a randomised block design with 8 treatments and 3 replications. The variety PMH- 2255 was during month of June 2015. The treatments were T_1- Control, T_2 – Recommended dose of fertilizer (125:60:30) kg/ha, T_3- Recommended dose of fertilizer +10 ton farmyard manure/ha, T_4- 75% Recommended dose of fertilizer + 10 ton farm yard manure/ha + Vermicompost @2 ton/ha, T_5-75% Recommended dose of fertilizer +10 ton farmyard manure/ha, T_6- 50% recommended dose of fertilizer +10 ton farm yard manure + vermicompost@2 ton/ha + azotobacter/ha, T_7-50% Recommended dose of fertilizer +15 ton of farmyard manure +azotobacter/ha, T_8-25 % Recommended dose of fertilizer +azotobacter + vermicompost@ 2 ton/ha . The size of the each plot was 20m^2. The seeds were sown at the spacing of 60×20cm between row to row and plant to plant. The half dose of N along with full dose of P_2O_5, K_2O, FYM, V.C. and Azotobacter was applied at the sowing time during land preparation. The ¼ dose of nitrogen was applied at knee high stage and the remaining dose of nitrogen was applied at tasselling stage. The different growth parameters like (plant height, stem girth, number of leaves per plant, cob length and number of grains per cob) were recorded at 25, 50 DAS and at harvesting stage. 0.25 square meters quadrate (0.5 × 0.5m) was placed randomly in each plot at different five places and then the growth parameters and yield parameters were recorded. The analysis of variance (ANOVA) was used to obtain the data of various observations which were subjected and tabulated to their analysis. The F test was used to test the treatments (Gomez and Gomez, 1984).

Result and discussion

1. Effect of fertilizers on growth parameters-

The present study indicated that the integrated nutrient management recorded maximum plant height at different durations (25, 50 days of sowing and at harvesting stage) in T_4 and lowest in T_1. The main reason for increasing plant height in T_4 was that, the farmyard manure and vermicompost increased the soil aeration, which was resulted in maximum plant growth and gave highest plant height. The lowest plant height was observed in control plot because there was no application of any organic and inorganic fertilizer sources. The combined application of organic and inorganic fertilizer sources gave better result in stem girth at different durations (25, 50 days of sowing and at harvesting stage) in T_4 and lowest in T_1. At the time of harvesting there was a small reduction in stem girth as compare to 50 DAS, because due to evapotranspiration the water content might be lost from the leaves and stem of the plant.

The combined application of organic and inorganic fertilizer sources gave better result in number of leaves per plant (25,50 days of sowing and at harvesting stage) .The highest number of leaves at 25 days were recorded in T_3 and lowest was in T_1. At 50 days, the highest number of leaves were recorded in T_4 lowest was in T_1. At harvesting the highest numbers of leaves were recorded in T_4 and the lowest was in T_8. Due to the negligible amount of organic and inorganic fertilizer sources the numbers of leaves were recorded lowest in T_8 at harvesting time. The number of leaves per plant is an important parameter because it promotes the photosynthetic activity of maize plant. The integrated nutrient management resulted in higher length, which was obtained in T_6 and lowest cob length was obtained in T_1. The highest cob length in T_6 was due to combined application of organic sources along with 50% RDF of inorganic fertilizer sources. It might be due to, when organic sources combined with 50% RDF, it was improved nutrient uptake of maize plant due to improved soil properties. The lowest cob length in T_1 (Control), because in this treatment, there was no application of any organic and inorganic fertilizer sources.

The integrated nutrient management resulted in highest or maximum number of grains per cob in T_6 and minimum number of grains per cob in T_1. There were

Table 1: Effect of fertilizers on growth parameters

Treatments	Plant height (cm)	Stem girth (cm)	No. of leaves per plant	Cob length (cm)	No. of grains per cob
T_1-Control	133.7	8.8	11.6	17.9	248.3
T_2-RDF(125:60:30) kg/ha	191.8	10.5	12.0	20.8	429.8
T_3- RDF(125:60:30)+10tFYm/ha	170.0	9.9	11.3	18.8	451.4
T_4-75% RDF+10tFYM+V.C@2t/ha	193.2	11.0	12.6	19.7	409.3
T_5-75% RDF+10tFYM/ha	174.4	10.4	11.6	19.2	419.4
T_6-50%RDF+10tFYM+V.C@2t/ha+ azotobacter/ha	191.4	10.4	12.3	21.2	480.2
T_7-50% RDF+15tFYM+azotobacter/ha	191.4	10.9	12.3	19.1	454.7
T_8-25% RDF+azotobacter+V.C@ 2t/ha	173.1	10.8	10.0	18.9	370.1
$S.E_m$	±134.19	±0.89	±0.83	±1.30	±492.93
CD(P=0.05)	20.28	1.66	NS	NS	38.88
C.V(%)	6.53	14.23	7.80	5.87	5.44

Table 2: Effect of fertilizers on yield parameters

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)	1000-grain weight (gm)
T_1-Control	1671.6	3480.0	31.9	241.6
T_2-RDF(125:60:30) kg/ha	3192.6	5374.6	37.2	349.0
T_3- RDF(125:60:30)+10tFYm/ha	2137.6	4240.0	33.5	308.3
T_4-75% RDF+10tFYM+V.C@2t/ha	1960.0	4125.0	32.0	288.4
T_5-75% RDF+10tFYM/ha	2211.0	4404.6	33.4	300.1
T_6-50%RDF+10tFYM+V.C@2t/ha+ azotobacter/ha	4096.0	6271.0	39.4	364.4
T_7-50% RDF+15tFYM+azotobacter/ha	3363.3	5436.3	38.1	351.2
T_8-25% RDF+azotobacter+V.C@ 2t/ha	1991.3	3855.3	34.0	289.6
$S.E_m$	±3324.92	±11405.00	±0.18	±848.48
CD(P=0.05)	100.97	187.01	0.75	51.01
C.V(%)	2.24	2.30	1.23	9.35

might be higher nutrient uptake in T_6 plot, so the maximum grains per cob were obtained. Whereas due to no application of organic and inorganic fertilizer sources the number of grains per cob was lowest in T_1 (table 1).

2. Effect of fertilizers on yield parameters

The integrated nutrient management resulted in highest grain yield in T_6 and lowest in T_1. With the increased uptake of nutrients, the number of grain per cob increased which was resulted in higher grain yield at maturity. The lowest grain yield was due to no application of organic and inorganic fertilizer in T_1 plot. The integrated nutrient management gave maximum straw yield in T_6 and minimum straw yield was recorded in T_1.

The integrated nutrient management resulted in highest harvest index which was observed in T_6 and lowest harvest index was found in T_1. The integrated nutrient management resulted in highest 1000-grain weight was observed in T_6 and the lowest was obtained in T_1 (table 2).

Conclusion

The present study concluded that, all the organic and inorganic fertilizer sources affect the growth and yield of maize. The T_6 (50% RDF+10tFYM+V.C@2t/ha+ azotobacter/ha) showed the best result. It is not possible to sustain the fertility and productivity level of soil by the single use of organic and inorganic fertilizer sources. Results of this experiment clearly points towards the positive role of organic manure and biofertilizers when used in combination with inorganic fertilizers. Thus, to sustain the soil fertility and productivity on long term basis, the integrated use of organic and inorganic fertilizers is recommended for getting the optimum yield of crop.

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