The Pharma Innovation Journal 2022; 11(2): 2369-2373

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 2369-2373

www.thepharmajournal.com
Received: 13-11-2021
Accepted: 19-01-2022

Prakash Chand Gurjar
M.Sc. Scholar, Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad, Uttar Pradesh, India

Hukam Singh Kothyari
Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad, Uttar Pradesh, India

Akash Tanwar
Department of Extension Education, MPUAT, Udaipur, Rajasthan, India

Santosh Yadav
Department of Soil Science and Agricultural Chemistry, MPUAT, Udaipur, Rajasthan, India

Jitendra Singh Bamboriya
Department of Soil Science and Agricultural Chemistry, MPUAT, Udaipur, Rajasthan, India

Ajit Kumar Meena
Department of Soil Science and Agricultural Chemistry, MPUAT, Udaipur, Rajasthan, India

Sarita Choudhary
Department of Soil Science and Agricultural Chemistry, MPUAT, Udaipur, Rajasthan, India

Corresponding Author:
Prakash Chand Gurjar
M.Sc. Scholar, Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad, Uttar Pradesh, India

Effect of different levels of NPK, micronutrient, neem cake and PGPR on Plant growth and yield of maize

Prakash Chand Gurjar, Hukam Singh Kothyari, Akash Tanwar, Santosh Yadav, Jitendra Singh Bamboriya, Ajit Kumar Meena and Sarita Choudhary

Abstract
The research study was conducted at experimental farm of Department of Soil science and Agriculture Chemistry, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad during *Kharif* season 2016-17 to evaluate the effect of different levels of NPK, Micronutrient, Neem cake and PGPR on plant growth and yield of maize. The Experiment was carried out in randomized block design with three levels of NPK, Neem cake, micronutrient and plant growth promoting rhizobacteria. The treatments were replicated three times and were allocated at randomly in each replication in which the results showed that increase in plant height 30, 60 and 90 DAS (@86.52,168.68, 175.64 cm respectively), Number of leaf per plant 30, 60 and 90 DAS(@ 7.20, 12.40, 12.60 respectively), Dry weight (164.07g), Length of cob (18.32cm), Number of grain per cob (307.07), Test weight (216.31g), Grain yield (44.60 qha^{-1}) found in treatment T_8- [I_2+N_2] (@100%N:P:K, Zinc+ 100% Neem cake and PGPR or N_{120} P_{60} K_{60} Zn_{20} $Kgha^{-1}$ + Neem $Cake_{10}$ qha^{-1} $PGPR_{200}$g $10kg^{-1}$ seed) followed by T_7 as compared to control (T_0). Therefore, the research study exhibited that the significant increase on enrichment of Plant growth and yield of maize with combination of N: P: K, Zinc and Neem cake and PGPR.

Keywords: Neem cake, PGPR, micronutrient, growth and yield attributes

Introduction
Maize (*Zea mays* L.) is one of the most important cereal crops and occupies prominent position in global agriculture after wheat and rice. Maize being a C_4 plant is physiologically more efficient, has higher grain yield and wider adaptation over a wide range of environmental conditions. The crop has assumed a place of prominence in Indian agriculture owing to its varied usage. Globally, 67% of maize is used for livestock feed, 25% for human consumption and rest for industrial purposes. Maize is the most widely distributed crops of the world. It is cultivated in tropics, sub-tropics and temperate regions. India ranks fourth in the world and it shared area (4.88%) and production (2.55%) in 2012 (FAO 2012) [4].

The organic sources besides supplying N, P and K also make unavailable sources of elemental nitrogen, bound phosphates, micronutrients, and decomposed plant residues into an available form to facilitate to plant to absorb the nutrients. But it is also the fact that optimum yield level of maize production can't be achieved by using only organic manures because of their low nutrient content. Efficacy of organic sources to meet the nutrient requirement of crop is not as assured as mineral fertilizers, but the joint use of chemical fertilizers along with various organic sources is capable of improving soil quality and higher crop productivity on long- term basis. Highest productivity of crops in sustainable manner without deteriorating the soil and other natural resources could be achieved only by applying appropriate combination of different organic manures and inorganic fertilizers (Chandrashekara *et al*., 2000) [3].

Zinc is an essential micronutrient required by plants for normal growth and development. Like other heavy metals, excess Zn invariably shows marked alterations in electron transport, membrane permeability and uptake and translocation of nutrient elements (Wang *et al*. 2009b) [13]. Plant growth promoting Rhizobacteria (PGPR) has been used to enhance crop yield and improve agricultural sustainability. PGPR are directly involved in increased uptake of nitrogen through biological nitrogen fixation, synthesis of phytohormones, Solubilization of minerals such as phosphorus and production of side rophores that chelate iron and make it available to the plant root (Ahemad and Kibret *et. al.*, 2014) [1]. The present research study was conducted to evaluate the interaction effect of different levels of NPK, Micronutrient, Neem cake and PGPR on Plant growth, yield attributes of maize crop.

Materials and Methods

The present research study conducted at Research farm of the Soil Science& Agriculture Chemistry, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad, U.P. during *Kharif* season 2016-2017. The Maize variety SMH-3031 selected for research trial with nine treatments was laid out in Randomized Block Design with three replications. The gross cultivated area of field is about 196.24m^2 and net cultivated area 108 m^2 respectively. Line sowing method was adopted for seed sowing with 60 cm row to row spacing and 25 cm plant to plant spacing respectively. The seed rate of Maize crop @ 20-25 kg/ha was adopted under research study. The details of the treatment and treatment combination of NPK, Zinc and Neem cake and PGPR were given in Table 1 and Table 2 respectively employed for present study. The statistical analysis was carried out as per the methods suggested by Panse and Sukhatme, (1967) [8].

Experimental site

The experiment was conducted at the crop Research farm of the Soil Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P. which is located on the south of the Allahabad city. It is situated at 250^o SW, 25^{0}24'23''N latitude and 81° 50'38'' E longitude and 98 m above the mean sea level.

Climatic condition in the experimental area

The area of Allahabad district comes under subtropical belt in the South East Uttar Pradesh, which experience extremely hot summer and fairly winter. The maximum temperature of the location reaches up to 46^0 C-48^0 C and seldom falls as 4^{0}C – 5^{0}C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100mm annually.

Meteorological condition

The Allahabad district comes under sub-tropical climate receiving the mean annual rainfall of about 1100 mm. Major rain fall received from July to end of October 2016. However, occasional precipitation is also not uncommon during winter. The winter months are cold while summer months are very hot and dry. The minimum temperature during the crop season was 21.39 ^{0}C and the maximum was 38.82^{0}C the minimum humidity was 46.42 and maximum was 89.85 the meteorological data during experimental period. The following observations were recorded such as Plant height (cm) at 30, 60 and 90 DAS, Number of leaves/plant at 30, 60 and 90 DAS, Dry weight(g), Length of cob (cm), Number of grains per cob, Test weight (g) and Grain yield (qha^{-1}) discussed given below:

Plant height (cm)

Height of crop plants under different treatments recorded at 30, 60 and 90 days after sowing. Three plants from each plot were selected in randomly and tagged for observation to be recorded in cm from ground level up to the base of the last fully opened leaf of the main shoot.

Number of green leaves per plant

Total number of green leaves per plant recorded at 30, 60 and 90 days after sowing in which three plants randomly selected from each plot and tagged for observation to be recorded.

Length of cob (cm)

Length of cob under different treatments recorded at maturity of crop. Three plants randomly selected from each plot and tagged for observation to be recorded in centi meter from shoot tip to end point of cob.

Number of grains per cob

Number of grains per cob under different treatments was recorded after harvest of crop. For these three cobs were selected randomly from each plot and tagged for observation.

Test weight (g plot^{-1})

Sample of one thousand healthy seeds were selected randomly collected the seeds of each plot and their weight recorded in gm plot^{-1}.

Grain Yield (q ha^{-1})

The crop plant each plot harvested and put for sun drying. After the cobs and plants properly dried, threshing done manually (by beating) and seeds obtained weighed on single pan physical balance. The grain yield from the net plot area recorded in gm/plot and figure converted into q ha^{-1}.

Dry weight (g plot^{-1})

Plant samples uprooted from each plot in maturity stages for their fresh weight and after that they sun dried for 4-5 days after that plant sample dried in the oven at 60^{0}C for 48 hours, dry weight and fresh weight of plant sample record in grams.

Table 1: Details of Treatment

Treatment	Dosage/ha in Percentage	Symbol
Level of N, P & K	0% NPK as Urea, DAP and MOP	Io
	50%NPK as Urea, DAP and MOP	Ii
	100% NPK as Urea, DAP and MOP	12
Level of Neem cake, PGPR & Micronutrient	0% Neem cake, PGPR & Micronutrient	No
	50% Neem cake, PGPR & Micronutrient	Ni
	100% Neem cake, PGPR & Micronutrient	N2

Table 2: Treatment combination of NPK, Zinc and Neem cake and PGPR

Treatments	Treatment combination	Symbol
T_0	Control	Io + No
T_1	[@. 0% NPK, Zinc + 50% Neem cake and PGRP]	Io + NI
T_2	[@. 0% NPK, Zinc + 100% Neem cake and PGRP]	Io + N2
T_3	[@. 50% NPK, Zinc + 0% Neem cake and PGRP]	Ii + No
T_4	[@. 50% NPK, Zinc + 50% Neem cake and PGRP]	It +NI
T_5	[@. 50% NPK, Zinc + 100% Neem cake and PGRP]	Ii + N2
T_6	[@. 100% NPK, Zinc + 0% Neem cake and PGRP]	12+ No
T_7	[@. 100% NPK, Zinc + 50% Neem cake and PGRP]	12 + NI
T_8	[@. 100% NPK, Zinc + 100% Neem cake and PGRP]	12 + N2

Results and Discussions

The experimental results of the present investigation have been presented along with proper discussion under the following points.

Plants height (cm) at 30, 60 and 90 DAS

The results of the research study depicted that maximum plant height of maize at different days after sowing (DAS) 30, 60 and 90 was found in T_8 (@$N_{120}P_{60}K_{60}$ Zn_{20} $kgha^{-1}$ + NC_{10} qha^{-1} $PGPR_{200}$g $10kg^{-1}$seed) which was 86.52, 168.68, 175.64cm respectively followed by T_7 (@N_{120} P_{60} K_{60} Zn_{20} kg ha^{-1} + NC_5 q ha^{-1} $PGPR_{100}$g $10kg^{-1}$ seed) which was 83.45, 165.41, 171.89 cm as compared to T_0(control) (@N_0 P_0 K_0 Zn_0 $kgha^{-1}$ + NC_0 qha^{-1} $PGPR_0$g $10kg^{-1}$ seed) which was 60.52, 138.95, 145.33 cm respectively. Table 3 depicted that the Interaction effect of NPK, zinc and Neem cake and PGPR on plant height of maize was also found significant which was gradually increased with an increase in dose of NPK, zinc and Neem cake and PGPR. The significant result of the present study was also reported by Garba *et al*. (2014) study result showed that combination of NSC and NPK significantly ($p< 0.005$) increased maize number of leaves and stem girth as well as leaf area and height ($p< 0.001$). Significant increased ($p< 0.001$) were also recorded on maize grains yield, stover yield total dry matter yield and relative yield increase also, maize harvest index was significantly ($p< 0.005$) higher from the treated plots compared to control. Umesha *et al.* (2013) [12] also found that the results of the treatment (T_{13}) having recommended dose of NPK + Azotobacter chroococcum + Bacillus megaterium + Pseudomonas fluorescence + enriched compost has showed highest plant height at 30, 60, 90 days after sowing and at harvest (120 days) (31.70, 180.93, 186.07 and 188.13 cm respectively), dry matter production at harvest (375.80 g), weight of cob (207.63 g), grain yield per plant (158.93 g), grain yield per ha (54.53 q) and test weight of seeds (33.10 g).

Number of leaves per plants at 30, 60 and 90 DAS

The results of the research study depicted that the maximum number of leaves per plant of maize at different days after sowing (DAS) 30, 60 and 90 was found in T_8 (@N_{120} P_{60} K_{60} Zn_{20} $kgha^{-1}$ + NC_{10} qha^{-1} $PGPR_{200}$g $10kg^{-1}$ seed) which was 7.20, 12.40, 12.60 Comparison to T_7(@N_{120} P_{60} $K_{60}Zn_{20}$ $kgha^{-1}$ + NC_5 qha^{-1} $PGPR_{100}$g$10kg^{-1}$ seed) 5.87, 7.87, 11.97 as compared to T_0(control) (@N_0 P_0 K_0 Zn_0 $kgha^{-1}$+NC_0 qha^{-1} $PGPR_0$g $10kg^{-1}$seed) which was 3.14, 6.67, 7.00 respectively. Table 3depicted that the mean value of number of leaves of maize was found significant on different levels of NPK, zinc and Neem cake and PGPR which was gradually increased with an increase in dose of NPK, zinc and Neem cake and PGPR. The following similar research was also reported by Asghar *et al.*, (2010) [2] evaluate the effect of different NPK rates on growth and yield of maize cultivars; Golden and Sultan by application of increasing rate of NPK, delayed number of days taken to tasseling, silking and maturity of the crop. The plant height was significantly affected by different rates of NPK. Treatment F_3 (250-110-85) of NPK produced tallest plants than two other treatments in both the varieties. Too low or high NPK levels reduced the yield and yield parameters of maize crop. Treatment F_2 (175-80-60) seems to be the most appropriate level to obtain maximum grain yield under the prevailing conditions. Application of NPK beyond treatment F_2 (175-85-60) seems to be an un-economical and wasteful practice. Varieties (Golden& Sultan) seem to have similar production potential under uniform and similar growing condition.

Dry weight (g)

The data of the results depicted that the maximum dry weight of plant (g) per plot in maize measured with the help of single pan physical balance was found in T_8 (@N_{120} P_{60} K_{60} Zn_{20} $kgha^{-1}$ + NC_{10} qha^{-1} $PGPR_{200}$g$10kg^{-1}$ seed) which was 164.07g Comparison to T_7 (@N_{120} P_{60} K_{60} Zn_{20} $kgha^{-1}$ + NC_5 qha^{-1} $PGPR_{100}$g $10kg^{-1}$ seed) 162.28g as compared to T_0 (control) (@N_0 P_0 K_0 Zn_0 $kgha^{-1}$ + NC_0 qha^{-1} $PGPR_0$g $10kg^{-1}$ seed) which are 142.55g respectively. Table 3 depicted that the dry weight of plant (g) per plot was found significant which gradually increased with an increase in dose of NPK, zinc and Neem cake and PGPR. The significant Similar results were also reported by Pratap *et al.* (2016) [10] to find the maximum dry weight, test weight and yield were found in the treatment T_2 ($C_2I_2M_2$) *viz*, 154.43, 230.33 and 50.50 q ha^{-1}in combination between the combination of compaction, micronutrients and farm yard manure, which enhanced yield for alluvial soil.

Length of cob (cm)

The results of the research study depicted that the maximum length of cob was found in T_8 (@N_{120} P_{60} $K_{60}Zn_{20}$ $kgha^{-1}$ + NC_{10} qha^{-1} $PGPR_{200}$g$10kg^{-1}$ seed) was 18.32cm Comparison to T_7 (@N_{120} P_{60} K_{60} Zn_{20} $kgha^{-1}$ + NC_5 qha^{-1} $PGPR_{100}$g $10kg^{-1}$ seed) 17.61 cm and minimum length of cob was found in T_0 (N_0 P_0 K_0Zn_0 $kgha^{-1}$ + NC_0 qha^{-1} $PGPR_0$g$10kg^{-1}$ seed) 11.13cm are respectively. Table 3depicted that the maximum length of cob was gradually increased with an increase in dose of NPK, zinc and Neem cake and PGPR. The similarly results were also reported by Patra *et al.* (2009) [9] reported that integrated nutrient management on maize in which results indicated that T_8 (25% RDF + 5 + Vermicompost ha^{-1}) recoded significantly higher LAI and dry matter production, cob length, grain yield and (50% RDF + 5 t FYM ha^{-1}) uptake of nitrogen, phosphorus and potassium over other treatments. In terms of economics T_5 fetched higher net returns (₹ 21256.38) and T_3 (75% RDF + 2.5 t FYM ha^{-1}) recorded the highest B:C ratio (1.40).

Number of grains per cob

The results of the data depicted that the maximum number of grains per cob was found in T_8 (@N_{120} P_{60} K_{60} Zn_{20} $kgha^{-1}$ + NC_{10} $qha^{-1}$$PGPR_{200}g10kg^{-1}$ seed) was 307.07followed by T_7 (@N_{120} P_{60} K_{60} Zn_{20} $kgha^{-1}$ + NC_5 qha^{-1} $PGPR_{100}$g $10kg^{-1}$ seed) 305.87 as compared to T_0(control) (@N_0 P_0 K_0 Zn_0 $kgha^{-1}$ + NC_0 qha^{-1} $PGPR_0$g $10kg^{-1}$ seed) 286.20 are respectively. Table 3depicted that the maximum number of grains per cob was gradually increased with an increase in dose of NPK, zinc and Neem cake and PGPR. The similar results were line with Preetha *et al*., (2014) [11] revealed that the highest plant height, thousand grain weight, cob yield, stover and grain yield were recorded in the treatment with 7.50 kg Zn ha^{-1} in location 1 having low initial Zn status, 5.00 kg Zn ha^{-1} in locations 2 and 3 having medium and high initial Zn status respectively. Thus, the highest grain yields of 7.42, 7.45 and 7.56 t ha^{-1} were obtained with application of 7.50, and 5.00 kg Zn ha^{-1} in location 1 and location 2 and 3 respectively, the yield increase being 39.08, 33.15 and 28.84% over NPK control. The results of the study clearly

indicate that there was a significant response to the applied Zn in soil having severe Zn deficiency, while the soil having adequate Zn status also showed comparatively.

Test weight (g 1000grains)

The results of the research study depicted that the maximum test weight of (g 1000grains) was found in T_8 (@N_{120} P_{60} K_{60} Zn_{20} kgha^{-1} + NC_{10} qha^{-1} $PGPR_{200}$g 10kg^{-1} seed) was 216.31 g followed by T_7 (@N_{120} P_{60} K_{60} Zn_{20} kgha^{-1} + NC_{10} qha^{-1} $PGPR_{200}$g 10kg^{-1} seed) 214.92g as compared to T_0 (@N_{120} P_{60} K_{60} Zn_{20}kgha^{-1} + NC_{10} qha^{-1} $PGPR_{200}$g10kg^{-1} seed) are 193.56 g respectively. Table 3 depicted that the test weight of maize seeds (g 1000grains) was gradually increase with an increase in dose of NPK, zinc and Neem cake and PGPR. The similar results were also reported by Jat *et al*. (2014) [6] to study the effect of integrated nitrogen management (INM) and intercropping systems on yield attributes and yield of maize during *Kharif* seasons of year 2009 and 2010 at KVK, Chomu, Jaipur (Rajasthan). The treatments included cropping patterns *viz*. sole maize, maize + one row mung bean, maize + two row mung bean and sole mung bean and integrated nitrogen management i.e., control, 60 kg N ha^{-1}, 60 kg N ha^{-1} + biofertilizer, 120 kg N ha-^{1}, 120 kg N ha^{-1} + bio-fertilizer and biofertilizer Intercropping maize and mung bean markedly influenced cobs/plant, length of cobs, grains cob^{-1}, 1000-grains weight, grain yield ha^{-1} and stover yield ha^{-1} of maize. Higher stover and grain yield was found with maize + two rows of mung bean over maize + one row of mung bean and sole maize in both the years.

Grain yield (qha^{-1})

The results of the data depicted that the maximum grain yield (q ha^{-1}) was found in T_8 (@N_{120} P_{60} K_{60} Zn_{20} kgha^{-1} + NC_{10} qha^{-1} $PGPR_{200}$g10kg^{-1}seed) 44.60 q ha^{-1} Comparison to T_7 (N_{120} P_{60} K_{60} Zn_{20} kgha^{-1} + NC_5 qha^{-1} $PGPR_{100g}$ 10 kg^{-1} seed) 42.39 q ha^{-1} and minimum grain yield was found in T_0 (N_0 P_0 K_0Zn_0 kgha^{-1} + NC_0 qha^{-1} $PGPR_{0g}$ 10kg^{-1} seed) 26.33 q ha^{-1} are respectively. Table 3depicted that the grain yield of maize (q ha^{-1}) were gradually increase with an increase in dose of NPK, zinc and Neem cake and PGPR. The similar results were also reported by Kumara *et al*. (2015) [7] the study was conducted on organic farming in cropping system at Agricultural and Horticultural Research Station, Kathalagere, Karnataka state from 2003-04 to 2013-14 to develop the organic farming packages for system based high value crops. The experiment comprises of eight treatments. Among all the treatments, the T_1- 50% recommended NPK + 50% N as FYM + inorganic sources of micro-nutrients as per soil test (10 kg $ZnSO_4$ ha-^{1}) has given maximum system equivalent yield (SEY) of 5.22-10.57t ha-^{1}yr after third year of conversion period followed by T_6-T_2 + bio fertilizer containing N and P carriers and 4year conversion period followed similar trend. After 10th year conversion period T_7 recorded maximum system equivalent yield of 5.22 to 10.04 t ha^{-1} yr^{-1} followed by T_1 (50% recommended NPK + 50% N as FYM + inorganic sources of micro-nutrients as per soil test (10 kg $ZnSO_4$ ha^{-1}).

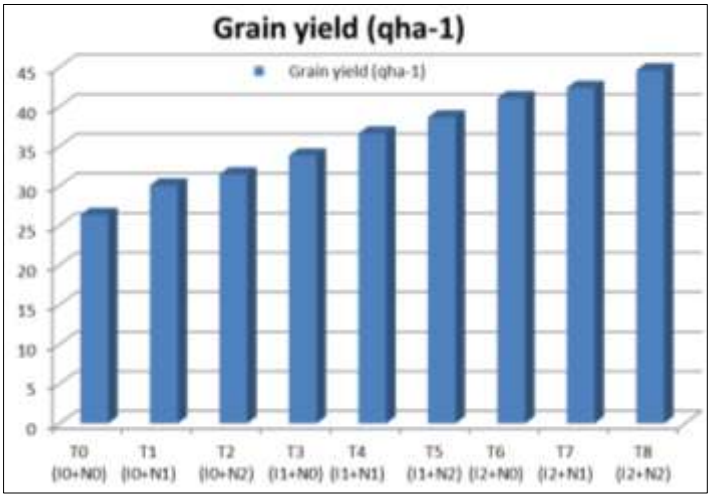

Fig 1: Response of different levels of treatments on grain yield of Maize

Table 3: Response of different levels of treatments on Plant growth and yield of Maize

Treatment	Dry Weight (g)	Cob Length (cm)	No. of Grains/Cob	Test Weight (g)	Grain yield (qha^{-1})	Plant height (cm) (DAS)			No. of leaves/plant (DAS)		
						30	60	90	30	60	90
T_0 (I_0+N_0)	142.25	11.13	286.20	193.56	26.33	60.32	138.95	145.33	3.14	6.67	7.00
T_1 (I_0+N_1)	144.37	12.41	289.07	199.48	30.05	62.79	142.54	147.81	4.07	7.74	7.54
T_2 (I_0+N_2)	147.24	13.62	292.40	201.81	31.46	66.83	146.61	151.07	4.27	8.34	10.60
T_3 (I_1+N_0)	151.08	14.30	296.13	205.50	33.84	69.82	149.64	155.45	4.74	8.14	8.54
T_4 (I_1+N_1)	155.13	15.25	298.93	207.79	36.62	73.45	153.55	159.39	4.80	8.94	8.67
T_5 (I_1+N_2)	157.41	16.05	301.73	209.86	38.66	76.64	157.61	162.62	5.00	8.40	9.27
T_6 (I_2+N_0)	160.74	16.89	304.27	211.72	41.08	80.27	161.65	168.14	6.00	8.94	9.80
T_7 (I_2+N_1)	162.28	17.61	305.87	214.92	42.39	83.45	165.41	171.89	5.87	7.87	11.97
T_8 (I_2+N_2)	164.07	18.32	307.07	216.31	44.60	86.52	168.68	175.64	7.20	12.4	12.60
F Test:	S	S	S	NS	S	NS	S	S	S	S	S
S.Em.(±)	0.684	0.164	0.378	1.617	0.353	4.979	0.793	0.455	0.324	0.306	0.342
C.D.at5%	1.450	0.348	0.802	3.428	0.7471	0.555	1.680	0.965	0.687	0.649	0.725

Conclusion

It was concluded the various level of N P K, Zinc + Neem Cake and PGPR used in the research study showed that the treatment T_8- (@N_{120} P_{60} $K_{60}Zn_{20}$ Kgha^{-1}+ NC_{10}qha^{-1} $PGPR_{200}$g 10kg^{-1} seed) found to be the best in increasing plant height 175.64 cm, number of leaves per plant 12.60, cob length 18.32 cm, number of grains per cob 307.07, dry weight 164.07g, grain yield 44.60 q ha^{-1}, test weight 216.31g for maize. Hence, the various levels of N P K, Zinc + Neem Cake and PGPR could be recommended for enhancement the plant growth and yield production of maize crop.

Acknowledgement

The Authors are thanks to Head of Department and Advisor of Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture**,** Technology and Sciences, Allahabad, for providing guidance facilities and all necessary material for conduct the research study.

References

1. Ahemad M, Kibretm M. Mechanisms and applications of plant growth promoting *rhizobacteria*, current perspective. Journal King Saud, Univ. Sci. 2014;26:1-20.
2. Asghar A, Ali A, Syed WH, Asif M, Khaliq T, Abid AA. Growth and yield of Maize (*Zea mays* L.) cultivars affected by NPK application in different proportion. Pakistan Journal of Science. 2010;62(4):211-216.
3. Chandrashekara CP, Harlopur SF, Muralikrishna S, Girijesh GK. Response of maize to organic manures with inorganic fertilizers. Journal of Agricultural Science. 2000;13(1):144-46.
4. FAO. 2012. Available at: http://faostat.fao.org/site/567/default.aspx.
5. Garba J, Oyinlola EY. Neem seed cake and inorganic fertilizer amendments for sustained productivity of maize (*Zea Mays)* on Nigerian Savannah Alfisols. Journal of Agricultural Economics, Extension and Rural Development. 2014;2(8):146-155. ISSN-2360-798X.
6. Jat PC, Rathore SS, Sharma RK. Effect of Integrated Nitrogen Management and Intercropping Systems on Yield Attributes and Yield of Maize. Indian Journal of Hill Farming. 2014;27(1):91-99.
7. Kumara O, Sannathimmappa HG, Danaraddi VS, Basavarajappa DN, Patil R. Development of Organic Nutrient Management Package in Maize- Groundnut System in Alfisols of Karnataka. *IOSR* Journal of Agriculture and Veterinary Science (IOSR-JAVS) e-ISSN: 2319-2380, p-ISSN: 2319-2372. 2015 Apr;8(4):33-37.
8. Panse, Sukhatme. Statistical Analysis of variance. 1967.
9. Patra PS, Biswas S. Integrated nutrient management on growth, yield and economics of maize (*Zea mays* L) under terai region. Journal of Crop and Weed. 2009;5(1):136-139.
10. Pratap D, Singh J, Kumar R, Kumar OM, Rawat KS. Effect micro-nutrients and farm yard manure on soil properties and yield of maize (*Zea mays* l.) in lower Indo-Gangetic Plain of Uttar Pradesh.Journal of Applied and Natural Science. 2016;8(1):236-239.
11. Preetha PS, Stalin P. Response of maize to soil Applied Zink Fertilizer under Varying Available Zink Status of Soil. Indian Journal of Science and Technology. 2014;7(7):939-944.
12. Umesha S, Divya M, Prasanna KS, Lakshmipathi RN, Sreeramulu KR. Comparative effect of organics and biofertilizers on growth and yield of maize (*Zea mays* L). 2013. ISSN: 2347-4688, Online ISSN: 2321-9971.
13. Wang H, Liu RL, Jin JY. Effects of zinc and soil moisture on photosynthetic rate and chlorophyll fluorescence parameters of maize. Biologic Plantarum. 2009b;53:191-194.