RESEARCH ARTICLE

# EFFECT OF THE NUTRIENT ON YIELD AND YIELD ATTRIBUTING CHARACTERS IN MAIZE CROP

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**Abstract:** The field experiment on maize crop was conducted at research farm of C.S.A. University Of Agriculture & Technology Kanpur, during Kharif season 2015-16 and 2016-17. The doses of experiment were Control, 100% NPK , 100% NPK+ S40, 100% NPK + Zn5, 100% NPK+S40 +Zn5, 125% NPK, 125% NPK + S40, 125% NPK + Zn5, 125% NPK + S40 + Zn5 and 150% NPK. The results showed that the grain yield of maize first year (2015) varied from 14.33 to 30.78 q $ha^{-1}$ and in second year (2016) varied from 14.85 to 32.80 q $ha^{-1}$ and the straw yield of maize first year (2015) varied from 38.91 to 81.10 q $ha^{-1}$ and in second year (2016) varied from 39.48 to 82.13 q $ha^{-1}$ . It was noted the number of plant in maize varied from 109.75 to 112.25 $plot^{-1}$ and 109.60 to 112.00 $plot^{-1}$, Plant height (cm) from 175.25 to 213.75 $plant^{-1}$ and 178.75 to 219.48 $plant^{-1}$, Number of cob from 1 to 1.48 and 1.10 to 1.45 $plant^{-1}$, length of cob from 13.40 to 22.45 and 14.60 to 23.49 cm $plant^{-1}$, Test weight from 20.28 g to 32.37 g 100 $grain^{-1}$ and 20.87 g to 33.01 g100 $grain^{-1}$ in first and second years, respectively.

**Keywords:** Maize, Nutrient, Crop, Production

## INTRODUCTION

Maize (*Zea mays L.)* is becoming very popular cereal crop in India because of increasing market price and high production potential of hybrid varieties in both irrigated as well as rainfed conditions. Hence the trend of replacing some cash crops with maize in intensive cultivation is observed in present condition. Maize crop has better yield response to chemical or inorganic fertilizers. Hence heavy doses of their fertilizers are applied to maize. Though these practices help to increase the temporary increase the production of crop deterioration of natural resources (viz. land, water and air) is also the another side of such high input intensive cultivation. Efficiency of balanced use of fertilizers is an alternative for obtaining high sustainable yields.

Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. It is cultivated on nearly 150 mha in about 160 countries having wider diversity of soil, climate, biodiversity and management practices that contributes 36% (782 mt) in the global grain production. The United state of America is the largest producer of maize contributes nearly 35% of the total production in the world and maize is the driving factor of the U.S. economy.

The cereals occupy about 54% of total cropped area in India. The India produces Maize occupies about 3.6% of the total cropped *area* of India. Maize is the third most important cereal crop in India after rice and wheat. It accounts for 9 per cent of total food grain production in the country. Karnataka, Rajasthan, Andhra Pradesh, Maharashtra, and Uttar Pradesh are the major maize producing states together contribute 60 per cent of area and 70 per cent of maize production in India. Last year in India in 2015-16, maize occupied 86.27 lakh ha area and production was estimated 13 per cent low about 210.2 lakh tonnes (Third Advance Estimates dt. 9-5-2016) as against 92.71 lakh ha and 241.7 lakh tonnes in previous year respectively. In Gujarat, the maize occupies more area in 2015-16 about 4 lakh ha as against 3.82 lakh ha in 2014-15 but production remains slight low about 5.96 lakh tonnes as against 6.31 lakh tonnes in previous year. Hence, maize price remain stable around Rs. 300 per 20 kg throughout the year with slight ups and downs. This is mainly due to reduction of export from 28.26 lakh tonnes in 2014-15 to about 6.5 lakh tonnes in 2015-16 as maize price remained slight higher than the world level.

Maize is ranks second to wheat among the world cereal crops (FAO 1986). Some 70 countries grow maize over 1,00,000 hectares or more, out of which 53 from the developing nations. Developed market economies account for 30% of the global maize area, but provide 50% of the total production as their average yields is three times higher than the world average. Developing nations accounted for 60% of the world total maize area, but produce only 40% of the global harvest **(Timothy et al., 1988).** In 1996, the total area under maize production was 141,116,000 $ha^{-1}$ with a total yield of 590,091,000 metric tons of which 266,214,000 tons were harvested for grain.

## MATERIAL AND METHOD

The experiment was conducted at research farm Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during the Kharif season 2015 and 2016. The maize verity Azad Uttam were taken for study with 10 treatment and 4 replication the initial characterstics of soil (initial stage) were also analyse to know the nutrient status of soil. The soil of experimental field is low in organic carbon, available

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$N_2$ and available Zn but medium in case of available P, K and available S. The pH and EC was soil in normal range. The pH EC and organic carbon are analyse by the method described by Jackson (1967). Available $N_2$ was determine by Alkaline permanganate method as described by Subbiah and Asija (1956). Available phosphorus was extracted with 0.5 M $NaHCO_3$ Olsen et al. (1954). The P was determine in extract by vandomolybdate yellow colour method Jackson (1967). The available K was determined by flame photometer. Available sulphur was determined by Chesnin and Yien (1950). Available zinc was estimated by atomic absorption spectrophotometer. The plant samples were also analysed for N P K, S and Zn. Nitrogen was determined by Kjeldal's method (Jackson 1967). Phosphoras was determined calorimetrically (Chapman and Pratt, 1961). Potassium was determined by flame photometric method. Sulphar was determined by Chesnin and Yien (1956). Zinc was determined by atomic absorption spectrophotometer.

**Table 1.** Yield % increased over control on grain and Straw yield of maize in both year

| Treatments | Grain yield in q $ha^{-1}$ | | | | Straw yield in q $ha^{-1}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | 2015-16 | % Increase over control | 2016-17 | % Increase over control | 2015-16 | % Increase over control | 2016-17 | % Increase over control |
| T1 | 14.33 | | 14.85 | | 38.91 | | 39.48 | |
| T2 | 21.16 | 32.16 | 22.30 | 33.40 | 56.52 | 31.33 | 57.39 | 31.20 |
| T3 | 25.15 | 43.02 | 26.60 | 44.17 | 66.40 | 41.40 | 67.11 | 41.17 |
| T4 | 24.40 | 41.27 | 25.60 | 41.99 | 66.29 | 41.30 | 67.76 | 41.73 |
| T5 | 27.60 | 48.07 | 28.90 | 48.61 | 72.52 | 46.34 | 73.50 | 46.28 |
| T6 | 24.92 | 42.49 | 26.96 | 44.91 | 67.97 | 42.75 | 68.43 | 42.30 |
| T7 | 27.80 | 48.45 | 29.50 | 49.66 | 69.46 | 43.98 | 70.01 | 43.60 |
| T8 | 27.15 | 47.21 | 28.40 | 47.71 | 68.64 | 43.31 | 69.66 | 43.32 |
| T9 | 30.78 | 53.44 | 32.80 | 54.72 | 81.10 | 52.02 | 82.13 | 51.92 |
| T10 | 26.16 | 45.22 | 29.40 | 49.48 | 69.63 | 44.11 | 68.87 | 42.67 |
| **S.E. (d)** | **0.468** | | **0.544** | | **0.184** | | **0.174** | |
| **C.D. (P=0.05)** | **0.960** | | **1.116** | | **0.378** | | **0.358** | |

**Table 2.** Effect of nutrients on plant population, plant height and test weight.

| Treatments combination | No. of plants $plot^{-1}$* | | Plant height (cm) | | Test weight (100 grains) | |
|---|---|---|---|---|---|---|
| | 2015-16 | 2015-16 | 2015-16 | 2016-17 | 2015-16 | 2016-17 |
| Control | 109.75 | 175.25 | 20.28 | 20.87 | 20.28 | 20.87 |
| 100 % NPK | 110.75 | 180.75 | 23.58 | 24.11 | 23.58 | 24.11 |
| 100% NPK+$S_{40}$ | 111.00 | 182.50 | 25.30 | 25.72 | 25.30 | 25.72 |
| 100%NPK+Zn5 | 110.25 | 183.00 | 24.78 | 25.44 | 24.78 | 25.44 |
| 100%NPK+$S_{40}$+Zn5 | 110.75 | 190.00 | 28.03 | 28.53 | 28.03 | 28.53 |
| 125%NPK | 110.25 | 189.00 | 24.65 | 25.22 | 24.65 | 25.22 |
| 125%NPK+$S_{40}$ | 111.50 | 194.00 | 27.25 | 27.75 | 27.25 | 27.75 |
| 125%NPK+Zn5 | 112.50 | 196.00 | 27.00 | 27.34 | 27.00 | 27.34 |
| 125%NPK+$S_{40}$+Zn5 | 112.25 | 213.75 | 32.37 | 33.01 | 32.37 | 33.01 |
| 150%NPK | 110.25 | 192.25 | 27.92 | 25.75 | 27.92 | 25.75 |
| **S.E. (d)** | **1.149** | **1.801** | **0.678** | **0.699** | **0.678** | **0.699** |
| **C.D. (P=0.05)** | **N.S.** | **3.696** | **3.589** | **N.S.** | **1.392** | **1.435** |

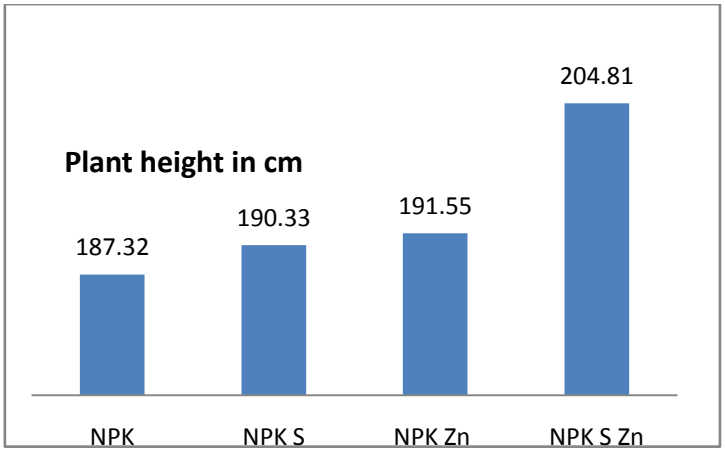


**Fig. 1.** Deferential responses of nutrients on plant height of maize

**Table 3.** Effect of nutrients on number of cobs and average length of cobs plant$^{-1}$

| Treatments combination | number of cobs plant$^{-1}$ | | Mean | length of cob in (cm) | | Mean |
|---|---|---|---|---|---|---|
| | 2015-16 | 2016-17 | | 2015-16 | 2016-17 | |
| Control | 1.00 | 1.10 | 1.05 | 13.40 | 14.60 | 14.00 |
| 100 % NPK | 1.27 | 1.17 | 1.22 | 14.28 | 14.93 | 14.60 |
| 100% NPK+$S_{40}$ | 1.39 | 1.31 | 1.35 | 14.93 | 15.54 | 15.23 |
| 100%NPK+Zn5 | 1.38 | 1.30 | 1.34 | 14.69 | 15.24 | 14.96 |
| 100%NPK+$S_{40}$+Zn5 | 1.43 | 1.34 | 1.38 | 16.45 | 17.71 | 17.08 |
| 125%NPK | 1.39 | 1.32 | 1.35 | 16.85 | 15.22 | 16.03 |
| 125%NPK+$S_{40}$ | 1.45 | 1.41 | 1.43 | 17.75 | 17.65 | 17.70 |
| 125%NPK+Zn5 | 1.44 | 1.40 | 1.42 | 16.83 | 17.47 | 17.15 |
| 125%NPK+$S_{40}$+Zn5 | 1.48 | 1.45 | 1.46 | 22.45 | 23.49 | 22.97 |
| 150%NPK | 1.43 | 1.35 | 1.39 | 15.41 | 15.72 | 15.56 |
| **S.E. (d)** | **0.020** | **0.044** | | **0.345** | **0.422** | |
| **C.D. (P=0.05)** | **0.041** | **0.090** | | **0.708** | **0.867** | |

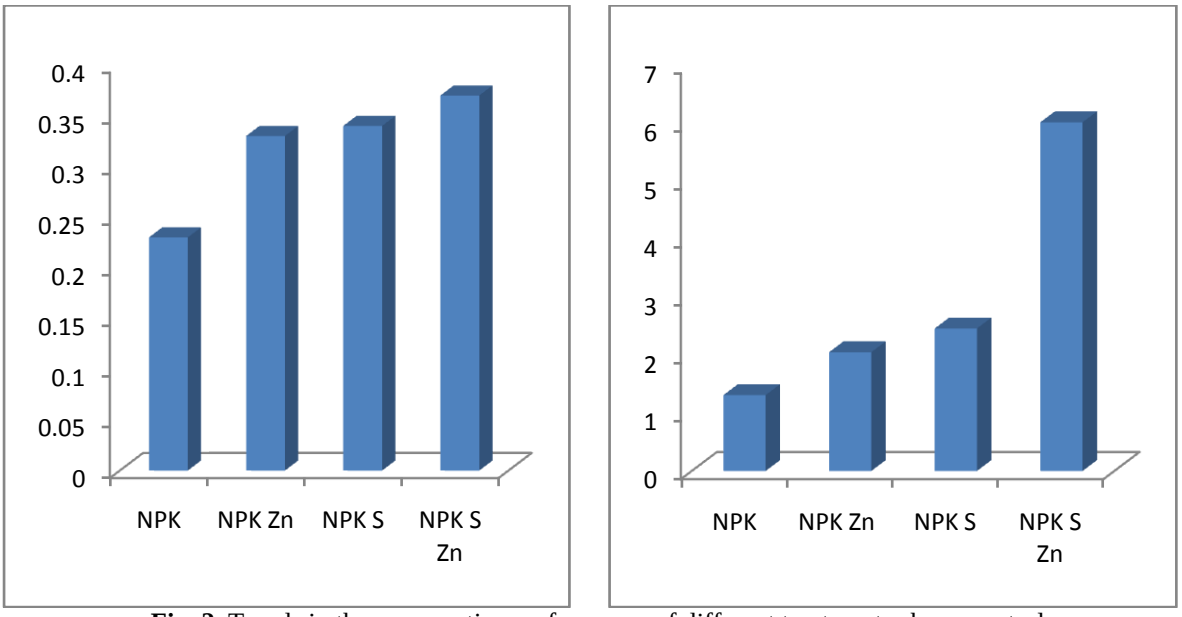


**Fig. 2.** Trends in the comparative performance of different treatments above control.

## RESULT AND DISCUSSION

Fertilizers are play very important role in the yield of economy of the crop. Fertilizer alone contributed 55 to 60% to achieve the biological yield of a crop. In inceptisols five most limiting nutrients have been identified i.e. N,P,K,S and Zn. The element S and Zn are the recent additions in this list. The several side nutrient specific trails conducted at different locations both on farm and off farm established the

need of sulphur and zinc along with NPK for yield maximization. The results of present study are discussed as under:-

**Grain yield:-**. There were significant variations in the data under different treatments. During first year it varied from 14.33 to 30.78 q $ha^{-1}$ with a mean value of 24.94 q $ha^{-1}$. About 53.44% yield increases with the addition of 125% N,P,K,S and Zn in comparison to control in first year and in during second year the data varied from 14.85 to 32.80 q $ha^{-1}$ with a general mean value of 26.53 q $ha^{-1}$. About 54.72% yield increases with the addition of 125% N,P,K,S and Zn in comparison to control in second year. Several other scientists reported the results in conformity with the results of present study. Reddy et al.(2010), Zea et al. (2007) and Singh and Tripathi (2008).

**Straw yield:-** There were significant variations in the data under different treatments. During first year it varied from 38.91 to 81.10 q $ha^{-1}$ with a mean value of 65.74 q $ha^{-1}$. About 52.02% yield increases with the addition of 125% N,P,K,S and Zn in comparison to control in first year during second year the data varied from 39.48 to 82.13 q $ha^{-1}$ with a mean value of 66.43 q $ha^{-1}$. About 51.92% yield increases with the addition of 125% N,P,K,S and Zn in comparison to control. The dose of 125% NPK + S40+Zn5 gave the maximum straw yield. The results are statistically significant and all the treatment gave superior than control. Increased straw due to addition of N,P,K,S and Zn containing fertilizers has been reported by many workers Muthu Kumarraja et al. (2010). The results of present investigation are in agreement with these workers.

**Plant population** - It was observed that the treatment effect on plant population were not significant. However it varied from 109.75 to 112.50 and 109.60 to 111.67, during first and second years, respectively. The plant papulation of maize as affected by nutrient treatments is given in Table 1.

**Plant height** - As observed from the data all treatments has significantly greater plant height than control. It was further observed that 125% NPK was significantly superior to 100% NPK. Addition of sulphur to 100% NPK increased the plant height very near to significant value but did not reach the level of significance during both years. Addition of zinc to 125% NPK resulted in significant increase in plant height during both the years however the zinc had no significant effect with 100% NPK during both the years. The plant height of maize as affected by nutrient treatments is given in Table 1.

**Test weight** -The data revealed that test weight varied from 20.28 to 32.37 g and 20.87 to 33.01 g during first and second years, respectively. The treatment differences were significant and all the fertilizer treatments were significantly better than control. There was no significant difference in test weight under 100% and 125% NPK both the years but 150% NPK was significantly better than former two levels. Application of Sulphur, zinc and S+Zn proved significantly superior over 100% and 125% NPK alone. The test weight of maize as affected by nutrient treatments is given in Table 1.

**Number of cob** - The minimum and maximum numbers were recorded in control and 125%NPK+$S_{40}$+Zn5 and the latter came out to be the best treatment in respect of cob number during both the years. All the treatments were significantly superior to control. The number of cob of maize as affected by nutrient treatments is given in Table 2.

**Cob length** – Cob length was significantly affected by different treatments. It varied from 13.4 (in control) to 22.45 cm (in 125%NPK+$S_{40}$+Zn5) during first year and the same treatment offered range of variation from 14.6 to 23.48 cm. Hence 125%NPK+$S_{40}$+Zn5 was the best treatment in this respect and the next best treatment was 125%NPK+$S_{40}$ with a mean value of 17.70 cm on the basis of mean of the years. Cob length was significantly increased due to application of 125% NPK over 100% NPK during first year but these levels did not differ significantly during second year. The cob length of maize as affected by nutrient treatments is given in Table 2.

## CONCLUSION

The dose of 125% NPK+S40+Zn5 was the best dose amongs all in terms of grain yield, straw yield and yield attributing characters. So it is concluded that application of Sulphur and Zinc along with the combination of 125NPK gave best results to the farmers.

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