**Annals of Plant and Soil Research 20(1): 99–102 (2018)**

# Effect of nutrient management on maize (Zea mays) hybrid in eastern zone of Uttar Pradesh

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Received: October, 2017; Revised accepted: January,2018

## ABSTRACT

*A field experiment was conducted at Crop Research Station, Bahraich (Uttar Pradesh) during Kharif season of 2014 and 2015 to study the effect of nutrient management on the performance of hybrid maize (Zea mays L.). Five maize hybrids viz., DMH-8255, Hybrid- 9682, Dekalb-900, MM-7536 and NMH-920 were located in main plot and three levels of nutrients (120:60:60 kg NPK ha$^{-1}$), SSNM (225:60:65 kg NPK ha$^{-1}$) and farmer's practice (100:40:40 kg NPK ha$^{-1}$) were located in sub plot in split plot design with three replications. Results revealed that the higher yield attributes i.c. number of cob (82930 ha$^{1}$), length of cob (20.13cm), girth of cob (14.0cm), number of grains/row (32.70), number of grains row/cob (18.8), test weight (249.0g), shelling percentage (73.66%) and yield of cob (70.16q ha$^{1}$) were recorded under the hybrid Dekalb- 900. This was found significantly superior to rest of the hybrid. The application of fertilizer on the basis of SSNM (225:60:65 kg NPK ha$^{1}$) attributed to more number of cobs (82892 ha$^{1}$), length of cob (21.17cm), girth of cob (15.2cm), number of grains/row (32.80), number of grains row/cob (18.2), test weight (252.80g), shelling percentage (73.80%) and yield of cob (80.07q ha$^{1}$) which was found significantly superior to RDF and farmer's practice. The grain (51.81 q ha$^{-1}$) and stover yield (62.73q ha$^{1}$) along with maximum output (Rs. 78815 ha$^{-1}$) were recorded under maize hybrid Dekalb- 900. The grain (59.12qha $^{1}$) and stover yield (70.12q ha$^{1}$) with maximum net profit (Rs. 66780) were noted with the application of SSNM.*

**Keywords:** nutrient management, maize hybrid, yield, economics, Kharif maize

## INTRODUCTION

In India maize (*Zea mays* L.) is the third most important food crop after rice and wheat, cultivated over 8.55 m ha (2014-15) area under a wide range of agro-ecological situations ranging from sea level to an altitude of more than 3000 meters. Maize in India contributes 8% in the national food basket and more than Rs.100 billion to the agricultural gross domestic products (GDP) at the current prices apart from providing employment to nearly 100 million man-days at the farm, and downstream agricultural and industrial sectors. In addition to staple food for human population and quality feed for animals, maize serves as basic raw materials to the industries for production of starch, oil, protein, alcoholic beverages, food sweeteners and, more recently, bio-fuel. It is used as ingredient in more than 3000 products. In Uttar Pradesh the low yield of maize during Kharif season might be due to selection of poor genotypes. In India single cross hybrids were developed which have the yield advantage of about 45 to 50 % over traditional genotypes. However, still there is a lot of scope to improve the productivity of single cross hybrids through agronomic manipulation to realize the full genetic potential. Nutrients like NPK also play important role for growth of plant as well as development of yield attributing characters and yield of crop in Kharif season. Generally farmers of Uttar Pradesh are not using judicious levels of nutrients to the crop, hence not realizing potential yield of crop. Nitrogen, P and K are very important nutrients for maize crop in order to harvest high yield in Kharif season (Parthipan *et al.* 2003 ahd Singh *et al.* 2017). Imbalance use of nutrients to the crop is root cause for low yield of Kharif crop (Kumar *et al.,* 2014). Among the different inputs, nutrients play vital role in crop productivity. The inadequate management of nitrogen, phosphorus and potassium is considered a major limiting factor for maize grain yield. Nitrogen is important for the plant metabolism as it participates in proteins and chlorophyll biosynthesis, being necessary since the early phonological stages of plant development. It also participates in several major metabolic pathways of plant biochemistry and demonstrated that under appropriate levels of other nutrients in the soil, nitrogen provides

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the greatest increment to the yield. On soil-plant system, the N dynamics is influenced by many features of cropping system (tillage or no-tillage farming), crop management techniques, edapho-climatic conditions and the fertilizer type. Site specific nutrient management (SSNM) practice is very important for better growth as well as for yield of crop. In India much work has not been done on the production technology especially on site specific nutrient management application along with important hybrids of maize crop. Keeping this view in mind, an experiment was undertaken to study the maize hybrids with different levels of plant nutrients on growth and yield of maize hybrids in Kharif.

## MATERIALS AND METHODS

The experiment was conducted at the Crop Research Station, Bahraich, Uttar Pradesh during Kharif season of 2014 and 2015 with five maize hybrids *viz.,* DMH-8255, Hybrid 9682, Dekalb-900, MM-7536 and NMH-920 and three levels of nutrients *viz.,* recommended dose (RDF) (120:60:60 kg NPK $ha^{-1}$), site specific nutrient management (SSNM) (225:60:65 kg NPK $ha^{-1}$) and farmer's practice (100:40:40 kg NPK $ha^{-1}$). Bahraich district is situated at $22^0$ 45N, $88^0$ 16 E longitude and 30 m altitude. The soil of experimental field was sandy loam in texture having neutral reaction (pH 7.5), low in available N (210 kg $ha^{-1}$) and medium in P (12 kg $ha^{-1}$) and K (245 kg $ha^{-1}$). The experiment was laid out in split plot design in three replications. The hybrids were located in main plot and nutrients level in sub plot. The crop was sown on $5^{th}$ July in both the years. One-third dose of N and full dose of P and K were applied as basal at the time of sowing as urea, single superphosphate and muriate of potash, respectively and remaining 2/3 dose of nitrogen was applied as top dressing in two equal splits, first at the time of knee height stage and second at tassling stage of the crop. The irrigations and weed control measures were adopted in crop according to need of crop from time to time. Intercultural operations were also done two times during the crop season. Biometric observations such as plant height, cobs/plot, length of cobs, grains row/cob, number of grains/row, test weight, grain and stover yield were recorded at harvest of crop. Economics of each treatment was calculated on the basis of local market prices of inputs and outputs. The data relating to each character were pooled and analyzed as per procedure advocated by Gomez and Gomez, (1984).

## RESULTS AND DISCUSSION

### Effect of maize hybrids on growth and yield attributes

The data (Table 1) indicated that the significant differences were observed in growth and yield attributes among the hybrids. The maximum value of plant height (192cm) was recorded with hybrid NMH-920, which was significantly superior to other hybrids. The plant population $ha^{-1}$ data indicated that highest plant population (83031 plant $ha^{-1}$) was noted under hybrid Dekalb-900 and proved significantly superior to rest of hybrids. The cobs $ha^{-1}$ was also found higher in the hybrid Dekalb-900. The length of cobs (20.13 cm), girth of cobs (14.0 cm), number of grains row/ cob (18.8), number of grain/row (32.7), test weight (249 g) were noted higher in the hybrid Dekalb-900 over the hybrid DMH-8255, hybrid-9682, MM-7536 and NMH-920. It might be due to higher genetic potential of the hybrid. The lowest value of these characters was also noted under maize hybrids DMH-8255. The differences between maize hybrid in relation to growth and yield attributes were also reported by Ramchadrappa *et al.* (2007), Singh *et al.* (2013), Singh *et. al.* (2014) and Singh *et.al* (2016),

### Effect of maize hybrids on yield and economics

The data on grain and stover yield (Table 2) revealed that the maximum grain (51.81 q $ha^{-1}$) and stover yield (62.73 q $ha^{-1}$) were recorded under the hybrid Dekalb-900 which was 8.1, 3.6, 12.0, 5.8 per cent higher in grain and 7.4, 3.74 4.8, 5.5 per cent in stover yield over the hybrid DMH-8255, Hybrid-9682, MM-7536 and NMH-920, respectively. The variations in yields between all the hybrids might be due to genetical variation in the hybrids. The lowest yields of grain (47.59 q $ha^{-1}$) and stover (58.05 q $ha^{-1}$) were recorded in hybrid DMH-8255. The higher shelling percentage (73.66 %) was also noted in the hybrid Dekalb-900. The data revealed the higher net income of (Rs. 57149 $ha^{-1}$) was recorded in the hybrid Dekalb-900. The variations in net income between hybrids might

be due to variation in grain and stover yield. The B:C ratio was also noted in similar manner under both the hybrids. The Similar findings were also reported by Singh *et al.* (2014) and Ramchandrappa *et al.* (2007).

Table 1: Effect of hybrids, nutrient levels on growth and yield attributes (mean of two year)

| Treatment | Plant population (000) /ha | Plant height (cm) | No. of cobs (000)/ha | Length of cobs (cm) | Girth of cobs (cm) | Shelling Percen-tage | No. of grains /row | No. of grains row /cobs | 1000 seed weight (g) |
|---|---|---|---|---|---|---|---|---|---|
| Hybrid | | | | | | | | | |
| DMH-8255 | 82971 | 188.0 | 82556 | 18.46 | 11.33 | 72.00 | 28.7 | 17.4 | 241.0 |
| Hybrid 9682 | 82913 | 188.0 | 82776 | 19.36 | 12.33 | 72.33 | 30.82 | 17.8 | 243.0 |
| Dekalb-900 | 83031 | 185.0 | 82930 | 20.13 | 14.0 | 73.66 | 32.70 | 18.8 | 249.0 |
| MM-7536 | 82970 | 192.0 | 82774 | 18.8 | 12.66 | 72.33 | 29.40 | 17.6 | 243.0 |
| NMH-920 | 82870 | 188.0 | 82598 | 18.36 | 13.0 | 72.00 | 30.68 | 17.4 | 242.0 |
| CD (P=0.05) | 115.0 | 2.35 | 110.0 | 0.50 | 0.10 | 0.40 | 0.48 | 0.25 | 1.25 |
| Nutrients level | | | | | | | | | |
| RDF120:60: 60 kg NPK $ha^{-1}$ | 82965 | 187.88 | 82658 | 18.68 | 12.2 | 72.44 | 30.45 | 17.8 | 244.2 |
| SSNM225:60:65 kg NPK $ha^{-1}$ | 83024 | 195.88 | 82892 | 21.17 | 15.2 | 73.8 | 32.80 | 18.2 | 252.8 |
| Farmer practices 100 :40:40 kg NPK $ha^{-1}$ | 82865 | 182.22 | 82615 | 17.46 | 11.0 | 71.2 | 28.65 | 16.4 | 238.5 |
| CD (P=0.05) | 118.0 | 2.15 | 108.00 | 0.18 | 0.80 | 0.35 | 0.38 | 0.24 | 1.10 |

**Effect of nutrient levels on growth and yield attributes**

Data (Table 1) indicated that significant variations were recorded under different fertilizer practices to the crop. The highest plant height (195.88cm) was recorded with SSNM (225:60:65 kg $ha^{-1}$) which was higher over the RDF (120:60:60 kg NPK $ha^{-1}$) and farmer's practice (100:40:40 kg $ha^{-1}$). The yield attributes such as plant population, number of cobs/ha was significantly higher with SSNM treatment over the RDF and farmer's practice. The length of cobs (21.17 cm), girth of cobs (15.2 cm), number of grain row (18.2) and number of grains/row (32.8), shelling percentage (73.8%), test weight (252.8g) were higher under the SSNM practices over the other fertilizer practices. This might be due to availability of more nutrients to the crop ultimately plant yield attributes increased in comparison to rest of nutrient levels. The similar findings were also reported by Sahoo *et al.* (2006 and 2007), Saha *et. al*. (2006) and Singh *et al.* (2013, 2014 and 2016), The lowest value of plant height and yield attributes were recorded under the farmer's practice (100:40;40 NPK $ha^{-1}$) which might be due to low availability of nutrients to the crop for development of growth and yield attributes.

**Effect of nutrient levels on yield and economics**

Data (Table 2) showed that the highest grain (59.12 q $ha^{-1}$), stover yield (70.12 q $ha^{-1}$) were noted with site specific nutrient management (SSNM) (225:60:65 kg NPK $ha^{-1}$) which was 16.2 and 33.0% higher in grain and 14.3 and 28.8% higher in stover yield over the RDF (120:60:60 kg NPK $ha^{-1}$ ) and farmer's practice (100:40:40 kg NPK $ha^{-1}$). It indicates that the recommendation domain of maize owing to ever declining soil health, specially some of the macro nutrients, increasing level of nutrient probably exerted a positive effect on the development of the source and sink strength of the plant which ultimately resulted in higher yield. These findings are in conformity with those of Singh and Singh (2006), Saha *et al.* (2006). Sahoo *et al.* (2007), Singh *et al.* (2013), Singh *et al.* (2014), Singh *et al.* (2016),

The data on economics (Table 2) showed higher net profit of Rs. 66780 and B:C ratio 3.9 with SSNM (225:60:65 kg NPK $ha^{-1}$) which was found 20.0 and 39.1% higher in net income and 12.3 and 22.3% in B:C ratio over RDF (120:60:60 kg NPK $ha^{-1}$) and farmer's practice (100:40:40 kg NPK $ha^{-1}$), respectively. The lowest net income (Rs. 40652) and B: C ratio (3.03) were noted under the farmer's practice which might be due to low yield of grain and stover with farmer practice.

Table 2: Effect of hybrids and nutrient levels on yield and economics (mean of two year)

| Treatment | Yield of cobs (q $ha^{-1}$) | Grain yield (q $ha^{-1}$ ) | Stover yield (q $ha^{-1}$) | Total output (Rs. $ha^{-1}$) | Net profit (Rs. $ha^{-1}$ ) | B:C ratio |
|---|---|---|---|---|---|---|
| Hybrid | | | | | | |
| DMH-8255 | 66.0 | 47.59 | 58.05 | 72440.00 | 50773.66 | 3.32 |
| Hybrid- 9682 | 68.83 | 49.91 | 60.38 | 75921.00 | 54255.00 | 3.47 |
| Dekalb-900 | 70.16 | 51.81 | 62.73 | 78815.00 | 57149.66 | 3.61 |
| MM-7536 | 67.91 | 49.24 | 59.71 | 74916.00 | 53250.00 | 3.43 |
| NMH-920 | 66.26 | 48.79 | 59.25 | 74239.00 | 52573.00 | 3.40 |
| CD (P=0.05) | 1.5 | 0.8 | 1.2 | 1050.00 | 780.00 | 0.012 |
| Nutrients level | | | | | | |
| RDF 120:60:60 kg NPK $ha^{-1}$ | 67.58 | 49.54 | 60.04 | 75368.00 | 53368.00 | 3.42 |
| SSNM 225:60:65kg NPK $ha^{-1}$ | 80.07 | 59.12 | 70.12 | 89780.00 | 66780.00 | 3.90 |
| FP 100:40:40 kg NPK $ha^{-1}$ | 55.83 | 39.57 | 49.91 | 60652.00 | 40652.00 | 3.03 |
| CD (P=0.05) | 1.15 | 1.18 | 0.70 | 1080.00 | 720.00 | 0.10 |

*FP = Framer Practice*

On the basis of results, it may be concluded that the hybrid Dekalb-900 fertilized with site specific nutrient management (SSNM) (225:60:65 kg NPK $ha^{-1}$) was found more productive and remunerative in comparison to other hybrids in Kharif. Therefore, it is recommended that the farmers of Eastern Uttar Pradesh should cultivate maize hybrid Dekalb-900 with SSNM based fertilizer application in Kharif for higher yield and profitability.

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