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RESEARCH PAPER

Yield and quality of maize (*Zea mays* L.) as influenced by different levels of nitrogen, phosphorus and zinc

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Abstract : A field investigation was conducted during the *Rabi* season of 2009-10 to study yield and quality of maize as influenced by different levels of nitrogen, phosphorus and zinc. The results indicated that application of 120 and 160 kg N ha^{-1} were at par and produced significantly higher grain and stover yield as compared to 80 kg N ha^{-1}. The mean grain yield recorded under the application of 120 and 160 N ha^{-1} was 5209 and 5550 kg ha^{-1} which accounted for 11.35 and 18.64 per cent increases over 80 kg N ha^{-1}. Nitrogen levels had significant influence on the protein content in grain. Protein content increased under the levels of 120 and 160 kg N ha^{-1} was to tune of 4.93 and 7.68 per cent, respectively over application of 80 kg N ha^{-1}. Application of 60 and 80 kg P_2O_5 ha^{-1} were at par and produced significantly higher grain yield than that of 40 kg P_2O_5 ha^{-1}. The grain yield showed increase under the levels of 60 and 80 kg P_2O_5 ha^{-1} were 8.97 and 10.13 per cent increase over 40 kg P_2O_5 ha^{-1}. Protein content was not influenced significantly due to phosphorus application. Grain yield, stover yield and protein content were significantly influenced due to different levels of zinc. The per cent increase was to the tune of 10.21 in case of grain yield, 7.76 in case of stover yield and 4.15 in case of protein content.

Key Words : Nitrogen, Phosphorus, Zinc, Maize, Yield, Quality

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INTRODUCTION

Maize (*Zea mays* L.) the "queen of cereals", popularly known as corn, is one of the most important cereals of the world, ranking third among the food crop, next to rice and wheat, both in respect of area and production. Maize crop is utilized in many ways, like other grain crops. Green cobs are roasted and eaten by people with great interest. Several food dishes including chapattis are prepared out of maize flours and grains. It is also a good feed for poultry, piggery and other animals. It supplies raw materials for various industries manufacturing starch, alcohol, acetic acid, glucose,synthetic rubber, dyes, resin, etc. Maize is also important not only because of its great adaptability to widely divergent conditions but also because of its high responsiveness to better management practices particularly irrigation and fertilizers. Its sweet flavour and crisp nature contribute to its popularity making as an indispensable ingredient in many fancy dishes of today. It contains 8.20 g carbohydrates, 10.04 g protein, 0.20 g fat, 86 mg phosphorus, 28 mg calcium and 0.10 mg iron per 100 g of edible portion (Thakur, 2000). Its byproducts, such as tassel, young husk silk and green stalk provide good cattle feed which contained crude protein 10.6 per cent, acid detergent lignin 2 per cent, neutral detergent fibre 55.1 per cent, acid detergent fibre 26.8 per cent and moisture 86.4 per cent (Cheva and Paripattan, 1988). It is an attractive low calorie vegetable and it has high fibre content without cholesterol.

Nitrogen is the key element in crop growth and is the most limiting nutrient in Indian soil. The paramount importance of nitrogen for increasing the yield has been widely accepted. Nitrogen influences the quality of product by improving the

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level of protein, succulence and palatability. Nitrogen plays an important role in synthesis of chlorophyll as well as several amino acids (Bar-Yosef *et al*., 1989). Corn responds well to phosphatic fertilizers in almost all the soil types. It has been observed that application of phosphorus increases growth and yield, along with dry matter production (Bar-Yosef *et al*., 1989). It is associated with several vital physiological, metabolic and biochemical functions such as utilization of sugars and starch, photosynthesis, cell division, fat and albumin formation. Application of micronutrient also play significant role in improvement of grain yield of maize. Among, micronutrient zinc plays an important role in photosynthesis, nitrogen metabolism and regulates auxin concentration in the plant. The Zn deficiency was found wide spread in Indian soil.

MATERIALS AND METHODS

The field experiment was conducted at Pulses Research Station, Anand Agricultural University, Model Farm, Vadodara, Gujarat during the *Rabi* season of the year 2009-10. Soil of the experimental field was sandy loam with pH 7.5. It was very deep and fairly moisture retentive, low in available nitrogen, zinc and organic carbon and high in available phosphorus and potash. The treatments consisted of 3 levels of nitrogen (80, 120 and 160 kg N ha^{-1}), 3 levels of phosphorus (40, 60 and 80 kg P_2O_5 ha^{-1}) and 2 levels of zinc (0 and 5 kg Z ha^{-1}). The treatments were replicated 3 times in Factorial Randomized Block Design. The full dose of phosphors and zinc and 1/3rd quantity of nitrogen according to treatments were applied at the time of sowing. Remaining 2/3rd quantity of nitrogen was applied in two equal split *i.e.* at knee high stage and at tesseling stage. Seeds of single cross hybrid HQPM-1 was dibbled on 8 Nov. 2009 and harvested at 10 March 2010. Eight irrigation and other intercultural operation were done as and when required.

RESULTS AND DISCUSSION

The results in respect of grain and stover yield shows that differences due to different levels of nitrogen were found to be significant. The grain and stover yields were also significantly influenced by nitrogen applications. Application of 120 and 160 kg N ha^{-1} were at par and produced significantly higher grain and stover yields as compared to 80 kg N ha^{-1}. The mean grain yield recorded under application of 120 and 160 kg N ha^{-1} were 5209 and 5550 kg ha^{-1} which accounted for 11.35 and 18.64 per cent increase over 80 kg N ha^{-1}. Nitrogen levels had significant influence on the protein content in grain. Treatment 120 kg N ha^{-1} and 160 kg N ha^{-1} were at par and recorded significantly higher protein content over 80 kg N ha^{-1}. Protein content increased under the levels of 120 kg N ha^{-1} and 160 kg N ha^{-1} was to tune of 4.93 and 7.68 per cent, respectively over application of 80 kg N ha^{-1} (Table 1). The present findings support the results of Shanti *et al.* (1997), Paliwal *et al.* (1999), Patel *et al.* (2006), Kumar (2009) and

Table 1: Yield and quality of maize as influenced by nitrogen, phosphorus and zinc levels

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)	Protein content in grains (%)
Levels of nitrogen, kg ha^{-1} (N)				
N_1 : 80	4678	6959	39.95	8.72
N_2 : 120	5209	7628	40.37	9.15
N_3 : 160	5550	7742	41.32	9.39
S.E. ±	142.4	122.8	0.832	0.085
C.D. at 5%	408.7	352.5	NS	0.244
Levels of phosphorus, kg ha^{-1} (P_2O_5)				
P_1 : 40	4838	7137	39.99	8.97
P_2 : 60	5272	7568	40.82	9.13
P_3 : 80	5328	7625	40.84	9.16
S.E. ±	142.4	122.8	0.832	0.085
C.D. at 5%	408.7	352.5	NS	NS
Levels of zinc, kg ha^{-1} (Z)				
Z_1 : 0	4896	7165	40.34	8.90
Z_2 : 5	5396	7721	40.76	9.27
S.E. ±	116.2	100.2	0.689	0.069
C.D. at 5%	333.7	287.8	NS	0.199
Sig. Interactions	-	-	-	-
C.V. %	11.74	7.00	8.71	3.97

Bindhani *et al.* (2007).

Increasing levels of phosphorus increased the grain and stover yield significantly. Application of 60 and 80 kg P_2O_5 ha^{-1} were at par and produced significantly higher grain yield than that of 40 kg P_2O_5 ha^{-1}. The mean grain yield recorded under application of 60 and 80 kg P_2O_5 ha^{-1} were 5272 and 5328 kg ha^{-1} which accounted for 8.97 and 10.13 per cent increase over 40 kg P_2O_5 ha^{-1}. This increase in grain yield with increase in phosphorus levels may be attributed probably to the development of extensive root system, which enabled the plants to absorb more nutrients from the soil depth and might have enhanced photosynthetic activities. The positive effect of phosphorus levels on grain and stover yield have also been reported by Kumpawat and Rathore (1995) and Patel *et al.* (2000). Protein content was not influenced significantly due to phosphorus application. However, it was numerically increased with increases in phosphorus levels from 40 to 80 kg P_2O_5 ha^{-1} (Table 1). These findings are in conformity with the results of Arya and Singh (2000).

Grain yield, stover yield and protein content was significantly influenced due to different levels of zinc. Application of 5 kg Z ha^{-1} significantly increased grain and stover yields as compared to control. The per cent increase was to the tune of 10.21 in case of grain,7.76 in case of stover yield and 4.15 in case of protein content (Table 1). The grain yield, stover yield and protein content increased owing to zinc application which takes part in metabolism of plant as an activator of several enzymes and in turn may directly or indirectly affect the synthesis of carbohydrate and protein. These results are in conformity with the results Arya and Singh (2000).

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