EFFECT OF NITROGEN RATES AND MICRONUTRIENTS ON YIELD AND NITROGEN UPTAKE OF MAIZE

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Abstract: Field experiment was conducted at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar to evaluate the effect of nitrogen rates and micronutrients on yield and nitrogen uptake of maize. The experiment was laid out in Randomized Block Design and replicated thrice. Therewere altogether nine treatments *viz.*, T_1 – Control, T_2 - 75 % Recommended Dose Nitrogen, T_3 - 100 % Recommended Dose Nitrogen (135 kg ha^{-1}), T_4 -125 % Recommended Dose Nitrogen, T_5 -150 % Recommended Dose Nitrogen, T_6 - 75 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}, T_7 - 100% RDN+ Micronutrient mixture @ 25 Kg ha^{-1}, T_8 - 125 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}, T_9 - 150 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}. The results revealed that application of 150 % recommended dose of nitrogen + micronutrient mixture @ 25 kg ha^{-1} (T_9) recorded the maximum grain yield (5760 kg ha^{-1}), Stover yield (9361 kg ha^{-1}) and nitrogen uptake (199.32 kg ha^{-1}).

Keywords: Maize, nitrogen, micronutrients

Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops in the world next to rice and wheat. Maize has high production potential compared to any other cereal crop and also has great adaptability to wide range of environments. In India, maize occupies an area of 8.67 million hectares with a production of 21.73 million tonnes and the productivity of 2.54 t ha^{-1}. In Tamil Nadu, it is cultivated in an area of 0.22 million hectares with production of 0.81 million tonnes and a productivity of 3.7 t ha^{-1} and also it occupies fourth position in Indian maize production. (Gangaiya, 2013). Maize being a C_4 plant has higher yield potential which also depends on nutrient supplying capacity of the soil. However, its potential could not be utilized fully due to lack of proper agronomic management practices like nutrient management, season and variety (Sahrawat *et al.,* 2008). The productivity of maize is largely dependent on its nutrient management. It is well known that maize is a heavy feeder of nutrients.

One of the major factors contributing to high yield of maize is mineral nutrition. Among the macronutrients, nitrogen usually applied as commercial fertilizer, nitrogen has the quickest and most pronounced effect on cereal production. Inadequate nutrition, especially limitation of nitrogen, is one of the major bottlenecks of maize. Maize is highly responsive to N fertilization and high yield potential of modern varieties cannot be realized without N supply to the plant during the entire growing season. Nitrogen has quickest and remarkable effect on cereals production (Brady, 1999). Micronutrients are essential nutrients taken up and utilized by crops in very small quantities. Micronutrients have not only cured the nutritional disorder in the plant but are also known to improve the yield and quality. Among the micronutrients, Ca, B, Zn, Fe, Mg play a paramount role in physiological forms and functions ultimately induces the plant growth, flowering, source to sink relationship, seed yield and quality.

Materials and methods

Field experiment was conducted in the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar to evaluate the effect of nitrogen rates and micronutrients on yield and nitrogen uptake of maize. The site of experiment was located at 11°24' N latitude and 79°44' E longitude at an altitude of +5.79 m above mean sea level. The climate in general of the area is subtropical, receiving 1500 mm annual precipitation with daily

mean temperatures varying from 33 ± 4°C in summer to 23.5 ± 3°C in winter. The soil of the experimental field was clay loam in texture with a pH of 7.8. The soil was low in available nitrogen, medium in available phophorus and high in available potassium. The experimental field was irrigated with water lifted from Uppanar channel, a drainage outlet of Cauvery River, running along the southern boundary of the experimental farm.

The experiments were laid out in randomized block design with three replications. Therewere altogether nine treatments *viz.*, T_1 – Control, T_2 - 75 % Recommended Dose Nitrogen, T_3 - 100 % Recommended Dose Nitrogen (135 kg ha^{-1}), T_4 -125 % Recommended Dose Nitrogen, T_5 -150 % Recommended Dose Nitrogen, T_6 - 75 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}, T_7 - 100% RDN+ Micronutrient mixture @ 25 Kg ha^{-1}, T_8 - 125 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}, T_9 - 150 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}. The fertilizers were applied to the experimental field as per the recommended manurial schedule of 135:62.5:50 kg N, P_2O_5 and K_2O ha^{-1}. Urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O) fertilizers were used to supply N, P and K nutrients, respectively. The entire dose of phosphorus and potassium were applied basally. A half dose of nitrogen was applied basally and the remaining half doses of nitrogen were applied as two splits on 25 and 45 days after sowing. Nitrogen dose increased or decreased as per the treatment schedule. Micronutrient mixture @ 25 kg ha^{-1} was applied basally to the respective treatment plots.

Results and discussion

Grain, stover yield and nitrogen uptake of maize were significantly influenced by the application of different nitrogen levels and micronutrients (Table 1). Among the different treatments tried, T_9 (150 % RDN + Micronutrient mixture @ 25 Kg ha^{-1}) recorded the maximum values of grain yield (5760 kg ha^{-1}), stover yield (9361 kg ha^{-1}), and nitrogen uptake (199.32 kg ha^{-1}). Higher grain yield with higher nitrogen level favoured for better growth which might have resulted in better utilization of solar energy and intern led to enhanced values of yield-attributing characters, which cumulatively resulted in realizing higher grain yield of maize. These results are in conformity with the findings of Jehan *et al.* (2007) and Lone *et al.* (2013). Better nutrient uptake and efficient assimilation of applied nutrients resulted in higher growth and yield attributes and thus more grain and stover yield. Application of nitrogen and micronutrient increased the nutrient uptake which could be attributed to increased availability of nutrients throughout the growing period which inturn influenced the DMP that again paved way for higher nutrient uptake. These results are in conformity with the findings of Shaheen *et al*. (2010) and Verma (2011). Correlation test results showed that the nitrogen uptake positively correlated with grain (r = 0.988) and stover yield (r = 0.992), which gives the sense that an increase in nitrogen uptake by crop increased the grain yield (Fig 1) and stover yield (Fig 2).

Table 1: Effect of nitrogen rates and micronutrient application on yield and nitrogen uptake of maize

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Nitrogen uptake (kg ha^{-1})
T_1	2698	5891	81.33
T_2	3211	6551	109.12
T_3	3654	7128	128.64
T_4	4307	7668	149.37
T_5	4456	7915	156.21
T_6	4382	7790	153.61
T_7	5174	8719	180.72
T_8	5752	9298	195.21
T_9	5760	9361	199.32
S.Ed	82.09	175.36	6.76
CD (P = 0.05)	174.03	371.76	13.65

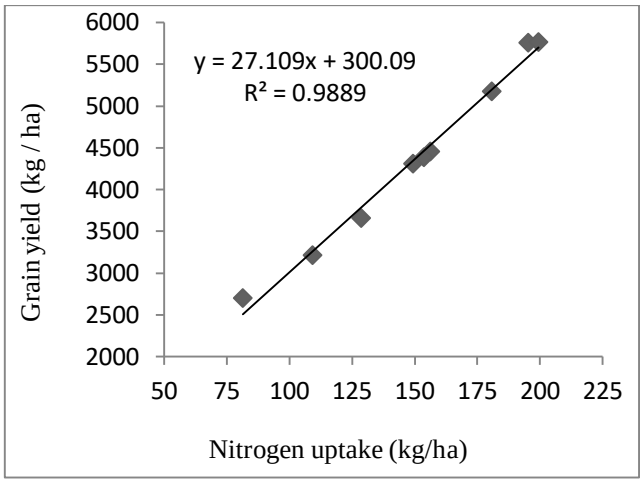

Fig 1: Effect of N uptake on Grain yield

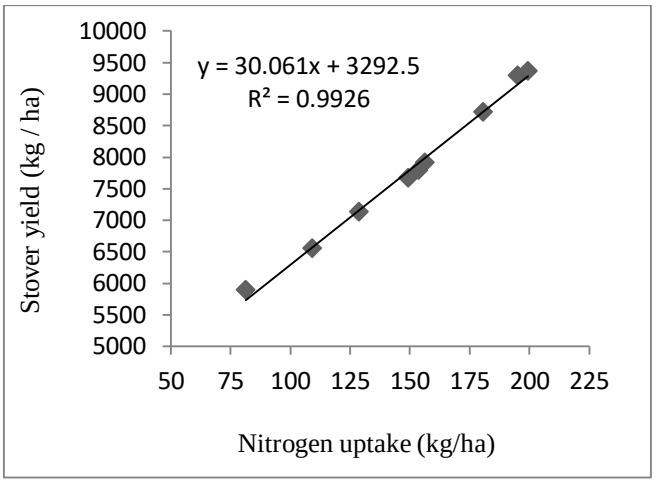

Fig 2: Effect of N uptake on Stover yield

Conclusion

The application of increased nitrogen dose and micronutrients registered the maximum grain yield, stover yield and nitrogen uptake. Therefore application of 150 % RDN + Micronutrient mixture @ 25 Kg ha^{-1} was found to be more effective for improving crop performance and productivity.

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