AGRONOMIC STRATEGIES FOR MAXIMIZING THE PRODUCTIVITY OF HYBRID MAIZE

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Abstract: Field experiment was conducted at the Experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar to study the various agronomic strategies for improving the productivity of hybrid maize. The experiment was laid out in randomized block design with three replications. The treatments consists of T_1 – Control (No fertilizer application), T_2 – 100% Recommended dose of nitrogen (135 kg N ha^{-1}), T_3 – 125% RDN (168.75 kg N ha^{-1}), T_4 – 150% RDN (202.5 kg N ha^{-1}), T_5 – 100% RDN + 0.5% $ZnSO_4$ as foliar spray, T_6 - 125% RDN + 0.5% $ZnSO_4$ as foliar spray, T_7 – 150% RDN + 0.5% $ZnSO_4$ as foliar spray, T_8 – 100% RDN + 0.5% Zn EDTA as foliar spray, T_9 – 125% RDN + 0.5% Zn EDTA as foliar spray, T_{10} – 150% RDN + 0.5% Zn EDTA as foliar spray. Growth components *viz.*, plant height, LAI, DMP and yield components *viz.*, number of grains cob^{-1}, grain yield and stover yield were recorded. Among the treatments, application of 150% RDN + 0.5% $ZnSO_4$ as foliar spray (T_7) recorded higher values of growth components, yield parameters and yield of maize.

Keywords: $ZnSO_4$, Zn EDTA, foliar spray, maize

Introduction

Maize (*Zea mays*) is one of the third most important cereals, next to rice and wheat in the world as well as in India. Maize has been an important cereal crop because of its high production potential compared to any other cereal crop and adaptability to wide range of environments. Besides being a potential source of food for human beings, it is used for feeding cattle, poultry and industries. Some of its commercial products are corn oil, corn flakes, corn starch, tanning material for leather industry, jelly, etc and nowadays it is used in manufacturing of shortening compounds such as soaps, varnishes, paints and similar other products. Maize grain has greater nutritional values and it is grown extensively in temperate, subtropical and tropical regions in the world. Maize is also drought resistant and can be grown almost every corner around the world.

In the world, maize is grown over an area of 168 million hectares with a production of 945.8 million tones and the productivity of 5.7 t ha^{-1}. In India, maize occupies an area of 8.67 million hectares with a production of 21.73 million tones and the productivity of 2.54 t ha^{-1}. In Tamil Nadu, it is cultivated in an area of 0.36 million hectares with a production of 2.38 million tones and the productivity of 6.5 t ha^{-1} and also it occupies fourth position in Indian maize production (AICRP, 2016).

Maize is an exhaustive crop which requires all types of macro and micro nutrients for better growth and yield potential. Among the essential nutrients, nitrogen is the most important limiting factor for plant growth and its application increases the nitrogen and crude protein content in grains. Nitrogen supply positively enhances grain yield in all hybrids, primarily by increasing kernel number. N supply also impacts the yield protein relationship by stimulating the protein synthesis rather than by inhibiting the starch production (Uribelarrea *et al.*, 2004). The micro nutrient zinc is an essential nutrient for the standard and healthy growth and development of plants. It plays a major role in synthesis of protein, enzyme activation, oxidation and revival reactions and metabolism of carbohydrates. Zinc deficiency results in poor root development, stunted growth and small leaves internodes. In corn, zinc deficiency depicts as a white or yellow band parallel to the midrib. Zinc deficiency is usually corrected by application of $ZnSO_4$ (Preetha and Stalin, 2014). Zinc EDTA is easily translocated within the plants, hence it can be used for foliar application. It is quickly available to the

plant system and versatile in nature. Chelated EDTA hold on to the trace elements and stop them from binding to other elements. It also enhances photosynthesis, catalyze carbon dioxide into carbohydrates thus improve the strength of photosynthesis, increase the sugar content and also increase the grain protein content.

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 levels and foliar application of zinc on hybrid maize. The experimental field is situated at 11° 24' N latitude and 79° 44' E longitude at an altitude of +5.79 m above mean sea level. The climate of Annamalainagar is moderately warm with hot summer months. Soil is low in available nitrogen, medium in available phosphorus and high in available potassium.

The treatments consists of T_1 – control (No fertilizer application), T_2 - 100% Recommended dose of nitrogen (135 kg N ha^{-1}), T_3 - 125% Recommended dose of nitrogen, T_4 - 150% recommended dose of nitrogen, T_5- 100% RDN + 0.5% $ZnSO_4$ foliar spray, T_6 - 125% recommended dose of nitrogen + 0.5% $ZnSO_4$ foliar spray, T_7 - 150% RDN + 0.5% $ZnSO_4$ foliar spray, T_8 - 100% RDN + 0.5% Zn EDTA foliar spray, T_9 - 125% RDN + 0.5% Zn EDTA foliar spray, T_{10} - 150% RDN + 0.5% Zn EDTA foliar spray. In all the treatments total phosphorous and potassium are applied as basal as per the recommendation schedule except in control (T_1). The experiment was laid out in randomized block design with three replications and the data were statistically analysed. Growth parameters *viz*., plant height, LAI and dry matter production were observed. Yield attributes *viz*., number of grains cob^{-1}, grain and stover yields were recorded. The data presented was subjected to statistical analysis following the methods suggested by Panse and Sukhatme (1978).

Results and Discussion

The data pertaining to the growth parameters are given in Table 1. Possible variations in growth parameters were recorded with the application of increased level of nitrogen along with the foliar spray of 0.5% $ZnSO_4$. Among the nutrient management practices, application of 150% RDN + 0.5% $ZnSO_4$ as foliar spray (T_7) exhibited an accelerated impact on growth characters and production of vigorous plant. This treatment exhibited the higher values for plant height at harvest may be due to increasing level of nitrogen as it increases cell division, cell enlargement and cell elongation and nucleus formation. Similar findings were reported by Dawadi and Sah (2012). Vegetative growth and consequently biological yield are highly dependent on consumption of micro and macro elements by the maize plant, so application of fertilizers that contain these elements leads to increase in biological yield of maize. These findings are in accordance with the results of Ehsanullah *et al*. (2015). Application of 150% RDN + 0.5% $ZnSO_4$ as foliar spray (T_7) excelled all other treatments by recording the higher values on leaf area index and dry matter production. This was on par with the treatments 150% RDN + 0.5% Zn EDTA as foliar spray (T_{10}). The increase in the values of leaf area index may be due to synergistic effect of nitrogen and zinc which are an integral part of chlorophyll that affect photosynthesis and produce rapid, succulent and green foliage and increased number of leaves.

The data pertaining to the number of grains cob^{-1} and yield are given in Table 2. Higher values of number of grains cob^{-1} was found in the treatment of 150 % RDN + 0.5% $ZnSO_4$ as foliar spray (T_7) which was statistically on par with the treatment 150% RDN + 0.5% Zn EDTA as foliar spray (T_{10}). This improvement in yield parameter was also observed by Mohsin *et al*. (2014), who stated the increase in cob length, cob diameter and number of grains cob^{-1} with application of zinc as foliar spray. This result might be due to direct absorption of zinc by foliar spray. Similar findings were also reported by Amanullah *et al*. (2016). Increased grain yield was recorded with the application of 150% RDN + 0.5% $ZnSO_4$ (T_7). This was on par with the application of 150% RDN + 0.5% Zn EDTA (T_{10}). Thus demonstrating the importance of combined soil application of N and foliar spray of $ZnSO_4$. Enhanced LAI, DMP, grain number cob^{-1} were all transformed into relatively higher seed yield in 150% RDN + 0.5% $ZnSO_4$ as foliar spray (T_7) during the cropping season.

Table 1. Effect of agronomic practices on growth parameters of maize

Treatments	Plant height at harvest (cm)	LAI at 60 DAS	DMP (kg ha^{-1})
T_1- Control	152.2	5.60	9977
T_2- 100% Recommended dose of Nitrogen (RDN) (135:62.5:50 kg of N, P_2O_5 and K_2O ha^{-1})	184.8	6.01	12540
T_3- 125 % RDN (168.75 :62.5:50 kg of N, P_2O_5 and K_2O ha^{-1})	189.3	6.38	13550
T_4 – 150% RDN (202.5 :62.5 :50 kg of N, P_2O_5 and K_2O ha^{-1})	196.8	6.98	14590
T_5 – 100% RDN + 0.5% $ZnSO_4$ foliar spray	191.7	6.59	13700
T_6 – 125% RDN + 0.5% $ZnSO_4$ foliar spray	198.8	7.12	14750
T_7 – 150 % RDN + 0.5% $ZnSO_4$ foliar spray	205.5	7.55	15700
T_8 – 100% RDN + 0.5 % Zn EDTA foliar spray	190.6	6.50	13640
T_9 – 125% RDN + 0.5 % Zn EDTA foliar spray	197.2	7.07	14660
T_{10} – 150% RDN + 0.5 % Zn EDTA foliar spray	203.9	7.50	15500
S.Ed	1.75	0.11	128.05
CD (p=0.05)	3.68	0.23	270.04

Table 2. Effect of agronomic practices on yield parameter and yield of maize

Treatments	Number of grains cob^{-1}	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1- Control	270	2500	5000
T_2- 100% Recommended dose of Nitrogen (RDN) (135:62.5:50 kg of N, P_2O_5 and K_2O ha^{-1})	380	4930	8500
T_3- 125 % RDN (168.75 :62.5:50 kg of N, P_2O_5 and K_2O ha^{-1})	405	5104	8735
T_4 – 150% RDN (202.5 :62.5 :50 kg of N, P_2O_5 and K_2O ha^{-1})	426	5556	9224
T_5 – 100% RDN + 0.5% $ZnSO_4$ foliar spray	412	5197	8880
T_6 – 125% RDN + 0.5% $ZnSO_4$ foliar spray	430	5710	9355
T_7 – 150 % RDN + 0.5% $ZnSO_4$ foliar spray	446	6023	9665
T_8 – 100% RDN + 0.5 % Zn EDTA foliar spray	408	5145	8800
T_9 – 125% RDN + 0.5 % Zn EDTA foliar spray	428	5635	9315
T_{10} – 150% RDN + 0.5 % Zn EDTA foliar spray	440	5925	9620
S.Ed	3.7	76.9	82.3
CD (p=0.05)	7.9	161.6	173.0

Conclusion

The application of 150% RDN + 0.5% $ZnSO_4$ as foliar spray (T_7) significantly influenced the growth parameters, yield attributes, grain and stover yield of maize. The application of higher level of nitrogen (150%) along with 0.5% foliar spray of $ZnSO_4$ was found to be suitable agronomic practice for realizing higher maize productivity.

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