Andhra Pradesh J Agril. Sci : 1(3): 44-47, 2015

PRODUCTIVITY OF QUALITY PROTEIN MAIZE AS INFLUENCED BY NITROGEN AND SULPHUR NUTRITION

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ABSTRACT

A field experiment was conducted during *rabi,* 2014-15 at S.V. Agricultural College Farm, Tirupati to find out the response of quality protein maize hybrid (HQPM-1) to various N and S levels. The treatments consisted of four nitrogen levels (60, 120, 180, 240 kg N ha^{-1}) in combination with three sulphur levels (15, 30, 45 kg S ha^{-1}). The results of the experiment revealed that among the four nitrogen levels, application of 240 kg N ha^{-1} recorded the maximum cob length, cob girth, number of rows cob^{-1}, number of grains row^{-1}, grain weight cob^{-1}, test weight, grain yield (5101 kg ha^{-1}), stover yield (5569 kg ha^{-1}) and harvest index (47.79 %) followed by 180, 120 and 60 kg N ha^{-1}. Similarly, application of 45 kg S ha^{-1} resulted in significantly more cob length, cob girth, number of rows cob^{-1}, number of grains row^{-1}, grain weight cob^{-1}, test weight, grain yield (3679 kg ha^{-1}), stover yield (4029 kg ha^{-1}) and harvest index (47.28 %) followed by lower levels of sulphur. Hence, N and S can be applied at the rate of 240 kg ha^{-1} and 45 kg ha^{-1}, respectively to obtain higher yield.

KEYWORDS: Nitrogen, Quality protein maize, Sulphur, Yield components and Yield.

INTRODUCTION

Maize (*Zea mays L.*) is an important cereal crop in the world grown after wheat and rice. It is used as a food and feed crop and is known as the "Queen of Cereals" due to its high yielding potential. Maize grain accounts for about 15 to 56 per cent of total daily diet of people in 25 developing countries but the nutritional profile of maize is poor as it is deficient in essential amino acids such as lysine and tryptophan. Quality Protein Maize (QPM) is a special type of maize developed by researchers of International Maize and Wheat Improvement Center (CIMMYT) which is exactly similar to normal maize but contains the higher level of lysine (4%) and tryptophan (0.8%) thus giving the protein a balanced composition of amino acids. Hence, quality protein maize is necessary to minimize prevalence and persistence of malnutrition in developing countries and to ensure better income to the farmers, food and nutritional security to the consumers, where maize is consumed as staple food. Maize has high productiveness, but some production constrains lower its quantity and quality of production. Among these constraints for maize, imbalance and inadequate nutrition is consider to be one of the important factors. Therefore, a field study was undertaken to study the effect of nitrogen and sulphur on yield attributes and yield of Quality Protein Maize.

MATERIAL AND METHODS

A field experiment was carried out during *rabi,* 2014-15 at S.V. Agricultural College Farm, Tirupati. The experimental soil was sandy loam in texture, neutral in reaction (pH 6.9), low in organic carbon (0.43 per cent) and available nitrogen (125.4 kg ha^{-1}), high in available phosphorus (43.7 kg ha^{-1}), medium in potassium (146 kg ha^{-1}) and sufficient in sulphur (18.5 kg ha^{-1}). The experiment was laid out in randomized block design with factorial concept with twelve treatment combinations and replicated thrice. The treatments comprised of four nitrogen levels (60, 120, 180, 240 kg N ha^{-1}) in combination with three sulphur levels (15, 30, 45 kg S ha^{-1}). Quality Protein Maize hybrid (HQPM-1) was sown on 15th November, 2014 with a seed rate of 20 kg ha^{-1} at a spacing of 60 × 25 cm. A basal dose of 80 kg P_2O_5 and 80 kg K_2O was applied uniformly to all the treatments. Sulphur was applied as basal as per the treatments. The source of sulphur used was gypsum. The scheduled nitrogen was applied in three equal splits *viz.,* first half at the time of sowing as basal, ¼ as top dressing at knee high stage and remaining ¼ as top dressing at tasseling stage.

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Table 1. Effect of nitrogen and sulphur levels on yield components of quality protein maize

Treatments	No. of cobs plant^{-1}	No. of rows cob^{-1}	No. of grains row^{-1}	Grain weight cob^{-1} (g)	Cob length (cm)	Cob girth (cm)	1000 grain weight (g)
Nitrogen Levels (kg ha^{-1})							
N_1 (60)	1.00	12.7	25.3	77.8	15.0	12.5	221.9
N_2 (120)	1.00	12.9	27.2	88.7	15.5	12.4	236.6
N_3 (180)	1.33	13.3	31.1	122.5	16.5	13.4	262.3
N_4 (240)	1.33	13.8	33.3	129.3	17.8	13.8	264.4
SEm±	0.11	0.2	0.9	5.0	0.3	0.2	5.8
CD (P=0.05)	NS	0.6	2.5	14.6	1.0	0.7	17.1
Sulphur Levels (kg ha^{-1})							
S_1 (15)	1.16	12.5	26.2	85.3	14.7	12.2	227.2
S_2 (30)	1.16	13.2	29.5	107	16.2	13.0	247.1
S_3 (45)	1.16	13.8	32.0	121.4	17.7	13.9	264.6
SEm±	0.11	0.2	0.7	4.3	0.3	0.2	5.1
CD (P=0.05)	NS	0.5	2.2	12.6	0.8	0.6	14.8
Interaction							
SEm±	0.22	0.4	1.5	8.6	0.6	0.4	10.1
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS

Table 2. Effect of nitrogen and sulphur levels on grain yield, stover yield and harvest index of quality protein maize

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
Nitrogen levels (kg ha^{-1})			
N_1 (60)	1561	2006	43.88
N_2 (120)	2577	2835	47.56
N_3 (180)	3993	4269	48.29
N_4 (240)	5101	5569	47.79
SEm±	50	72	0.80
CD (P=0.05)	147	210	2.36
Sulphur levels (kg ha^{-1})			
S_1 (15)	2997	3390	46.41
S_2 (30)	3247	3591	46.96
S_3 (45)	3679	4029	47.28
SEm±	44	62	0.70
CD (P=0.05)	128	182	NS
Interaction			
SEm±	87	124	1.39
CD (P=0.05)	NS	NS	NS

RESULTS AND DISCUSSION

Yield components

With increase in N and S levels all the yield components increased significantly except number of cobs plant^{-1}. Treatment with higher dose of N (240 kg ha^{-1}) (N_4) resulted in significantly higher cob length (17.8 cm), cob girth (13.8 cm), number of rows cob^{-1} (13.8), number of grains row^{-1} (33.3), grain weight cob^{-1} (129.3 g) and test weight (264.4 g), which was however, comparable with 180 kg N ha^{-1} (N_3) except for cob length. While, the least values for all the above parameters were obtained with 60 kg N ha^{-1} (N_1) and was found to be on par with 120 kg N ha^{-1} (N_2). Sulphur @ 45 kg S ha^{-1} (S_3) had shown longer cob length (17.7 cm), cob girth (13.9 cm), number of rows cob^{-1} (13.8), number of grains row^{-1} (31.9), grain weight cob^{-1} (121.4 g) and test weight (264.6 g) which were significantly superior over 30 and 15 kg S ha^{-1} (Table. 1).

Nitrogen is an essential nutrient required for the promotion of the meristematic tissue and physiological activities such as leaf spread, root development, plant dry matter production, leading to efficient absorption and translocation of water and nutrients and interception of solar radiation. Sulphur is essential for many growth functions of the plant like nitrogen metabolism and enzyme activity. These activities promote higher photosynthetic process which is translocates assimilates into various sink components *viz.,* cob length, cob girth, number of rows cob^{-1}, number of grains row^{-1}, grain weight cob^{-1} and test weight (Sutar, 2012 and Jena *et al.,* 2013).

Yield

Quality protein maize fertilized with 240 kg N ha^{-1} had resulted in higher grain yield (5101 kg ha^{-1}), stover yield (5569 kg ha^{-1}) and harvest index (47.79 %). The percentage increase in grain yield with 120, 180 and 240

kg N ha^{-1} over 60 kg N ha^{-1} was 39.42 per cent, 60.9 per cent and 69.39 per cent, respectively. Similarly, the highest grain yield (3679 kg ha^{-1}), stover yield (4029 kg ha^{-1}) and harvest index (47.28 %) were recorded with application of 45 kg S ha^{-1} followed by other lower levels (Table. 2).

The highest grain yield, stover yield and harvest index was due to better translocation of photosynthates from source to sink and higher growth attributing characters into different parts of plant and yield attributing characters like cob length, cob girth, number of grains per cob, test weight etc. (Naik *et al*., 2012 and Chaudhary *et al.*, 2013).

CONCLUSION

From the study it can be concluded that application of 240 kg N ha^{-1} along with 45 kg S ha^{-1} resulted in higher yield attributes and yield of Quality Protein Maize.

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