Research Paper
Volume : 4 | Issue : 9 | Sept 2015 • ISSN No 2277 - 8179

Yield Parameters and Yield of Quality Protein Maize (Qpm) as Influenced by Sulphur Levels and Method of Application

Agronomy

KEYWORDS : Sulphur levels; Application methods; Quality Protein Maize

NAVATHA, N	Department of Agronomy, 4- Department of Soil Science and chemistry College of Agriculture
VANI, K.P	Department of Agronomy, 4- Department of Soil Science and chemistry College of Agriculture
SRINIVAS, A	Department of Agronomy, 4- Department of Soil Science and chemistry College of Agriculture
SURENDRA BABU P	Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad – 500030

ABSTRACT

Field experiment was conducted during Kharif 2014 at College farm, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad to study the yield parameters and yield of quality protein maize (QPM) as influenced by sulphur levels and method of application. The experiment was conducted in sandy loam by adopting factorial randomised block design (FRBD) with three replication and eight treatment combinations. The experiment was carried out with four sulphur levels (10 kg ha-1, 20 kg ha-1, 30 kg ha-1 and 40 kg ha-1) and two method of sulphur application (M1: 100% basal as single dose; M2: two split applications:- 50% each at basal and knee heigh stage). Among four sulphur levels 40 kg S ha-1 had resulted in higher cob length, cob girth, no. of grains per cob, test weight, grain and stover yield. Similarly, between the two method of application- M2, split application of sulphur at basal and knee heigh stage shown maximum cob length, cob girth, no of grains per cob, test weight, grain and stover yield compared with basal application of sulphur (M1).

INTRODUCTION

Maize (*Zea mays* L.) is an important food and feed crop among cereals which occupies third rank after wheat and rice in the world and has high production potential compared to any other cereal crop. Hence, it is called as the "Queen of cereals". In India, about 35% of maize produced is used for human consumption, 25% each as poultry and cattle feed and 15% in food and remaining used in industries for production of corn flakes, pop corn, starch, dextrose, corn syrup and corn oil etc. (Channabasamma, 2013).

Maize is being cultivated in 6.29 million ha area in India, with grain production of 10.3 million tonnes and average productivity of 16.4 q ha^{-1}. In Telangana total cropped area is 7.52 lakh ha with production and productivity of 35.25 lakh tonnes and 4.69 t ha^{-1} respectively. (Annual Report of Indian Institute of Maize Research, 2013). In many developing countries of Latin America, Africa and Asia, maize accounts for 15% protein and 20% of calories in world food diet. But unfortunately the nutritional profile of maize is poor as it is deficient in essential amino acids such as lysine and tryptophan. This is leading to poor net protein utilization, malnutrition and low biological value of traditional maize varieties (Vasal, 1999). To minimize malnutrition in developing countries, normal maize is replaced by quality protein maize developed by CIMMYT to ensure better income to the farmers, food and nutritional security to the consumers, where maize is consumed as staple food (FAO, 2004).

It is being realized that apart from the major nutrients, the role of secondary nutrients in general and sulphur in particular in increasing cereal production is well established (Jamal *et al.*, 2005). Sulphur is attaining importance in all regions of the world because of frequent sulphur deficiencies in time and space. Sulphur improves crop management through its favourable effect on environmental stress, resistance against pest and diseases (Luit *et al.*, 1999). When S is deficient in soil, full yield potential of the crop cannot be realized regardless of other nutrients even under good crop husbandry practices (Tandon, 1989). Updation of sulphur recommendation to maize is currently focused, therefore it would be a very opportune time to look at split applications of sulphur, to determine if timing should be considered for farmers growing maize. (Ahmad *et al.*, 1998). In light of the above the present investigation on sulphur levels and methods of application was taken up.

MATERIAL AND METHODS

The field experiment entitled "Response of Quality protein Maize to sulphur fertilization" was conducted at College farm, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad during *kharif* 2014. Experimental soil was sandy loam, neutral in reaction, low in organic carbon, available nitrogen and sulphur, medium in available phosphorous and high in potassium. Experiment was carried out with four sulphur levels (S_1: 10 kg ha^{-1}, S_2: 20 kg ha^{-1}, S_3: 30 kg ha^{-1} and S_4: 40 kg ha^{-1}) as first factor and method of sulphur application (M_1: 100% basal as single dose; M_2: Two split applications:-50% each at basal and knee heigh stage) as second factor comprising eight treatment combinations, laid out in randomized block design with factorial concept, replicated thrice.

Quality protein maize hybrid (HQPM-1) was sown in *kharif*- 2014 at a spacing of 60 cm x 20 cm. A uniform dose of 80 kg P_2O_5 and potassium @ 60 kg ha^{-1} was applied to all the treatments. Entire dose of phosphorous and half of potassium were applied at sowing. Nitrogen was applied as per the treatments through urea in three equal splits (at basal, knee-heigh and tasseling stages). Similarly the remaining potassium and nitrogen was top dressed at tasseling stage. Sulphur was applied through gypsum in two methods of applications i.e. M_1- 100% basal application at; M_2- two split applications:-50% each at basal and knee heigh stage as per the treatments.

RESULTS AND DISCUSSION

Yield parameters

Data on yield attributes is presented in Table 1. Application of sulphur at varied levels and method of application significantly influenced yield attributing characters like cob length, cob girth, number of grains per cob, test weight etc.

Application of 40 kg S ha^{-1} recorded maximum cob length (15.2 cm), cob girth (13.1 cm), number of grains per cob (331) and test weight (26.6 g) and minimum cob length (13.0 cm), cob girth

(11.0 cm), number of grains per cob (277) and test weight (23.1 g) were obtained with 10 kg S ha^{-1}. Split application of sulphur as basal and at knee heigh stage (M_2) had shown increased cob length (14.5 cm), cob girth (12.3 cm), number of grains per cob (305) and test weight (25.1 g) which were significantly superior over the cob length (13.7 cm), cob girth (11.6 cm), number of grains per cob (276) and test weight (24.4 g) when maize fertilized with sulphur as basally. The improved nutritional environment as a result of increased sulphur supply might have favourably influenced the carbohydrates metabolism due to role of sulphur in energy transformation and activation of enzymes, which resulted in improved yield attributes. These results are in agreement with Ali *et al.* (2013) and Nanthakumar *et al.* (2014).

	Cob length (cm)			Cob girth (cm)			No. of grains cob^{-1}			Test weight (g)		
Sulphur levels (S)	Basal (M_1)	Split (M_2)	Mean	Basal (M_1)	Split (M_2)	Mean	Basal (M_1)	Split (M_2)	Mean	Basal (M_1)	Split (M_2)	Mean
S_1 : 10 kg ha^{-1}	13.1	[illegible]	13.0	10.8	[illegible]	11.0	269	285	277	22.7	23.5	23.1
S_2 : 20 kg ha^{-1}	13.3	14.1	13.7	11.3	11.9	11.6	289	305	297	24.1	24.4	24.2
S_3 : 30 kg ha^{-1}	14.0	15.1	14.5	12.1	12.5	12.3	297	325	311	24.8	25.5	25.2
S_4 : 40 kg ha^{-1}	14.7	15.8	15.2	12.5	13.7	13.1	316	345	331	26.1	27.1	26.6
Mean	13.7	14.5		11.6	12.3		276	305		24.4	25.1	
	SEm±	CD (p=0.05)		SEm±	CD (p=0.05)		SEm±	CD (p=0.05)		SEm±	CD (p=0.05)	
S	0.23	0.67		0.29	0.77		4.54	13.2		0.31	0.90	
M	0.16	0.47		0.14	0.40		3.21	9.34		0.22	0.64	
S x M	0.33	NS		0.40	NS		6.43	NS		0.43	NS	

M_1: 100% basal application of sulphur M_2: Sulphur as 50% basal+50% at knee heigh stage

Yield

Grain and stover yield of quality protein maize was significantly influenced by levels and method of application of sulphur. The data is presented in Table 4.2. Grain (5985 kg ha^{-1}) and stover yield (7272 kg ha^{-1}) increased with increasing levels of sulphur. Among methods of sulphur application, grain (5659 kg ha^{-1}) and stover yield (6880 kg ha^{-1}) were recorded highest with split application of sulphur at knee heigh stage (M_2), significantly higher than 100% sulphur as basal application (M_1). Improvement of vegetative structures for nutrient absorption and photosynthesis, production of assimilates under influence of applied sulphur and balanced source to sink ratio might have increased the yield attributes of maize, which there by increased grain and stover yield (Gahlout *et al.*, 2010). It is evident from these observations that adequate sulphur supply in split doses resulted in better utilization of carbohydrates to form more protoplasm, cell division, leaf expansion and improved vegetative growth of the plant. These results are also supported by Ahmad *et al.* (1998).

CONCLUSION

From this investigation it can be concluded that, out of four levels of sulphur and two methods of sulphur application tested, 40 kg S ha^{-1} (S_4) and split application of sulphur at basal and knee heigh stage (M_2) was beneficial in increasing yield parameters and yield in quality protein maize.

Table 2- Yield of Quality protein maize (QPM) as influenced by sulphur levels and method of application

	Grain			Stover		
Sulphur levels (S)	Basal (M_1)	Split (M_2)	Mean	Basal (M_1)	Split (M_2)	Mean
S_1 : 10 kg ha^{-1}	4658	5189	4923	5948	6507	6227
S_2 : 20 kg ha^{-1}	5260	5409	5335	6536	6685	6611
S_3 : 30 kg ha^{-1}	5628	5696	5662	6919	6939	6929
S_4 : 40 kg ha^{-1}	5862	6108	5985	7162	7381	7272
Mean	5352	5600		6641	6878	
	SEm±	CD (p=0.05)		SEm±	CD (p=0.05)	
S	102	298		110	322	
M	72	210		77	225	
S x M	144	NS		155	NS	

M_1: 100% basal application of sulphur; M_2: Sulphur as 50% basal+50% at knee heigh stage

REFERENCE

Ahmad, A.G., Abrol, Y.P and Abdin, M.Z. 1998. Effect of split application of sulphur and nitrogen on growth and yield attributes of Brassica genotype differing in time of flowering. Canadian Journal of Plant Science. 181: 193–199. | Ali, A., Iqbal, Z., Hassan, S.W and Muhammadyasin. 2013. Effect of nitrogen and sulphur on phenology, growth and yield parameters of maize crop. Science International. 25 (2): 363-366. | Channabasamma, A., Habsur, N.S., Bangaremma, S.W and Akshaya, M.C. 2013. Effect of nitrogen and sulphur levels and ratios on growth and yield of maize. Molecular Plant Breeding. 37 (4): 292-296. | Food and Agriculture Organization Statistical Year book. 2004. 2: 80-82. | IIMR. 2013. Annual Report of Indian Institute of Maize Research. Pusa. New Delhi. 82. | Gahlout, B., Singh, R and Lal, G.M. 2010. Effect of levels of nitrogen and sulphur on growth and yield of maize (Zea mays L.). Journal of Maharashtra Agriculture University. 35 (1): 149-151. | Jamal, A., Fazli, I.S., Ahmad, S., Abdin, M and Yun, S.J. 2005. Effect of sulphur and nitrogen application on growth characteristics, seed and oil yield of soybean cultivars. Korean Journal of Crop Sciences. 50 (5): 340-345. | Luit, J., De, K., Grill, D., Hawkesford, M.J., Schnug, E and Stulen, I. 1999. Plant Sulphur Research. Fundamental, Agronomical and Environmental Aspects of Sulphur Nutrition and Assimilation in Plants. Progress Report. 1997-1998. | Nanthakumar, S., Panneerselvam, P and krishnakumar. S. 2014. Effect of phosphorous and sulphur on growth, yield and quality parameters of hybrid maize. International Journal of Advanced Life Sciences. 7 (1): 85-92. | Tandon, H.L.S. 1998. Methods of Analysis of Soils, Plants, Water and Fertilizers. Fertilizer Development and Consultation Organization. 31. | Vasal, S.K. 1999. Quality protein maize story. Improving human nutrition through agriculture. Workshop by IRRI. Oct 5-7.