Journal of Tropical Agriculture 36 (1998) : 62-64

EFFECT OF NITROGEN AND COPPER ON THE QUALITY OF FODDER MAIZE

Heavy doses of nitrogen and phosphate fertilizers may induce or accentuate copper deficiency symptoms (Antil *et al.*, 1988). Such application of higher dose of N is inevitable especially for fodder maize. Not only the yield increases substantially due to application of fertilizer but also it may influence the quality of fodder. From a physiological point of view, Cu is an important constituent of oxidase enzymes and several proteins in plant. There are very few published reports on the interaction of N and Cu on the quality of fodder maize. The present investigation was therefore undertaken to assess the quality of fodder maize as influenced by the application of nitrogen and copper.

A pot experiment was conducted on Typic Haplustalf and the experiment was laid out in a randomised block design with three replications. The physico-chemical properties of the soil were pH (1:2) 7.1, EC 0.15 dS m^{-1} organic carbon 0.56%, total copper 86 ppm and DTPA-extractable copper 0.9 ppm. Treatments included three levels of copper in the form of copper sulphate 0, 25 and 50 kg ha^{-1} applied to the soil in combination with four levels of nitrogen *viz.*, 0, 75, 150 and 225 kg ha^{-1} as urea. Four healthy maize seeds (cv. South African Tall) were sown in each pot and only two seedlings were allowed to grow after emergence for 60 days. Soil moisture was maintained at field capacity during crop growth period. Third leaf from the top was collected separately from each pot to determine ascorbic acid, true protein and oxidase activity. In fresh leaf sample, ascorbic acid was estimated by titration with indolphenol dye (Mahadevan and Sridhar, 1986) and ascorbic acid oxidase by the method outlined by Bar-Akiva *et al.* (1969). Crude fibre in plant sample was estimated by acid-alkali digestion method (Singh and Pradan, 1981).

A significant increase in the ascorbic acid content of fresh leaves of the plant was noticed by increased application of copper and nitrogen (Table 1). The highest ascorbic acid content was noticed at 225 kg ha^{-1} of N with 50 kg ha^{-1} of $CuSO_4$. The nitrogen application also increased the ascorbic acid content. Nitrogen might have increased the biosynthesis of amino acids and subsequently due to presence of sulphur in $CuSO_4$, specific enzymes and protein containing active SH-group would have formed. This might have helped in increasing enzymatic activities and more vitamin biosynthesis (Singh *et al.*, 1983).

Increased ascorbic acid oxidase activity was observed due to the application of Cu and N. The ascorbic acid oxidase activity was found to increase with increase in copper application. Increased enzyme activity with increasing level of copper application suggests that ascorbic acid oxidase activity in plant was influenced by the concentration of copper in soil (Hill, 1973). Since ascorbic acid oxidase is a copper protein enzyme, the activity of the enzyme might have increased due to the application of copper and nitrogen.

A significant increase in protein content was noticed with increase in the levels of Cu and nitrogen. Protein content of maize was higher in treatments containing copper in combination with nitrogen than that of corresponding level of copper alone. Such increase in protein content with increasing levels of nitrogen was also observed by Tripathi *et al.* (1971). Nitrogen plays a vital role in protein synthesis and hence higher protein content could be expected at increased nitrogen level. The increase in protein due to copper application might be due to an increase in the synthesis of protein that contains bulk of copper in the fraction of soluble low molecular weight such as plasto cyanin (Klyavinya *et al.*, 1983).

Application of N to soil increased crude fibre content of maize, but the same was decreased due to Cu application. N application enhanced the meristematic activities of cells, resulting in the formation of more complex carbohydrates like crude fibre (Tripathi *et al.*, 1971). The decrease in crude fibre content in plants due to Cu application might have promoted the synthesis of non-carbohydrates in plant.

The authors are thankful to the Indian Copper Development Centre, Calcutta for providing financial assistance for the conduct of the experiment.

Table 1. Ascorbic acid content, ascorbic acid oxidase activity, protein and crude fibre content of fodder maize as influenced by Cu and N application

Nitrogen /copper level	Ascorbic acid content $\mu g\ h^{-1}$				Ascorbic acid oxidase $\mu g\ g^{-1}$				Protein %				Crude fibre %			
	Cu_0	Cu_1	Cu_2	Mean	Cu_0	Cu_1	Cu_2	Mean	Cu_0	Cu,	Cu_2	Mean	Cu_0	Cu,	Cu_2	Mean
N0	90.0	105.5	113.3	103.0	214.0	287.3	296.5	265.9	6.3	6.5	6.7	6.5	25.4	24.2	24.0	24.5
N1	95.6	125.4	140.5	120.5	218.4	310.2	400 1	309.8	68	70	7 1	69	25.8	25.0	24.9	25.2
N2	1104	145.0	148.6	134.7	226 3	350 4	425 5	334 1	69	7 1	72	7 1	26.5	26.0	25.9	26.1
N3	115.2	158.5	166.2	146.7	229.6	391.3	443.0	354.6	7.0	7.8	8.0	7.6	27.0	26.6	26.0	26.6
Mean	102.8	133.6	142.2	126.2	222 1	334 8	391 4	316 1	68	7 1	73	7.0	26.2	25.5	25.2	25.6
	SEm		CD (1%)		SEm		CD (1%)		SEm		CD (1%)		SEm		CD (1%)	
N	0.49		1.94		0.60		2.40		0.04		0.17		0.12		0.49	
Cu	0.42		1.68		0.52		2.08		0.04		0.130.1		0.11		0.43	
N x Cu	0.84		3.36		1.04		4.16		0.07		0.30		0.21		NS	

Figures are the mean values of three replications

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