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TRACE ELEMENT NUTRITION OF MAIZE UNDER SALINE CONDITIONS

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The effect of Zn, Cu and Fe application to maize grown on a clayey oil was investigated in pot culture. Applied trace elements improved the growth of 7 weeks old plants under saline conditions while under normal conditions they had little effect. Plant nutrition under saline conditions has been discussed. The effect on trace element composition has also been looked into.

INTRODUCTION

There is evidence that crop yields on salt-affected soils could be increased by improving their nutritional regimes. Research workers have shown better yields by improving macro-nutrient nutrition on these soils (Ravikovitch and Porat, 1967; Ravlkovitch and Voles, 1971; Aslam and Muhammad, 1972). Applied micro-nutrients have also been reported to increase the yields of tomato, berseem and millets on different textured salinized soils (Ravikovitch and Navrot, 1976). Applied Zn at various ESP levels was found to perform better than on the normal soil to produce rice grain and straw (Chaudhary and Bajwa, 1981). Workers elsewhere observed little effect of Zn and Cu applied to maize on a saline soil (Bhatti and Sarwar, 1977).

Increased food requirements warrant more research efforts for improving the productivity of the saline soils. A pot experiment was, therefore, conducted to see the effect of Zn, Cu and Fe applications on the dry matter yield and composition of maize on a salinized soils.

MATERIALS AND METHODS

The experiment was conducted on a clayey soil ~lable 1). The soil salinity was raised I to ~Ce of 5 and 7.5 d Srn beside controlat EC of 1 d. Srn usmg NaCI, Na S04' $CaCl_2$ and $MgCl_2$ in th:! ratio of, 5:1_q:4:1.. Zinc, Cu an~ Fe were applied at ttie rate of 20 mg kg as their sulphates alongwith basal dressing of Nand P. Four plants of maize (Variety - Akbar) were grown for 7 weeks in the plastic pots having 4 kg soil. Plants were then harvested and after washing with deionized water, they were dried at 80°C for 60 hours. Plants were ground in a Wiley type mill after recording dry matter yield (DMY). One g sub portion of the dried matter was digested in 15 rnl diacid mixture of $HN0_3$ and HCI0t,. (5:1). Zinc, Cu and Fe were determined using atomic absorption spectrometer.

RESUL TS AND DISCUSSION

Effect of trace elements on the plant growth

Zinc

The Zn applied at 20 kg-1 rate had little effect on the DMY under the normal soil condition while it increased DMY ($P < .01$) at first and second salinity levels (Table 2).

Copper

Application of 20 mg kg-1 Cu had little effect on the plant growth under non saline c0n..1itions while it increased (p .01)' the DMY at Ec 5 dSm (Table 2). This effect was suppressed at the second salinity level.

Iron

Applied Fe under non saline conditions depressed the DMY. Improved DMY due to supplemented Cu and Zn with Fe indicated its relationship with these elements (Olsen, 1972). In fact, applied Fe under saline conditions excelled Zn and Cu in growth promotion (Table 2).

Workers in other countries have also found similar results. Better performance of various crops was observed under saline

Table 1. Properties of the soil used in the experiment

Clay	$CaCO_3$	Organic matter	pH	EC	DTPA-extractable		
				$dS\ m^{-1}$	Zn	Cu	Fe
%					mg kg^{-1}		
38.5	1.7	1.1	7.4	1.0	0.7	1.6	6.6

Table 2. *Effect of applied trace elements and soil salinity on the DMY and trace element concentration in the maize plants on a clayey soil*

Applied trace elements [illegible]	DMY	Zn	Cu	Fe
[illegible]	[illegible]		ug [illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L.S.D. [illegible]	[illegible]	8.78	[illegible]	[illegible]
L.S.D. Salinity [illegible]	1.07	5.01	[illegible]	[illegible]
L.S.D. Trace elements [illegible]	[illegible]	6.45	[illegible]	[illegible]

conditions which were supplemented with Zn and Mn (Ravokovitch and Navrot, 1976). Elsewhere, better rice resistance to sodicity was noted due to Zn application (Chaudhary and Bajwa, 1981).

Concentration of various nutrients

Zinc

Applied Zn and soil salinity increased Zn concentration in the plants (Table 2). The effect of salinity could be attributed to the depressed DMY and soil Zn extraction due to the added salts (Ravikovitch et al. 1968., Stewart and Berger, 1965). Applied Cu and Fe had little effect on the plant Zn. However, decreased Zn due to applied Fe, though statistically non significant, indicated Zn-Fe interaction (Table 2). Researchers have shown Zn inhibition by Fe (Olsen, 1972).

Copper

Soil salinity and Cu application increased the Cu concentration in the plants (Table 2). The effect of salinity could be attributed to the depressed growth and effect of added salts on the Cu availability (Ravikovitch et al. 1968; Stewart and Berger, 1965). Decreased Cu concentration due to added Cu under the saline conditions could be attributed to the growth promotion which was verified by the total increased Cu conents (data not shown). Applied Zn, in general, decreased Cu concentration in the plant which was attributed to the dilution effect due to the growth promotion by the added Zn. Other workers have also noted Zn and Cu to have antagonistic, synergistic or little effect on the uptake of each other under different soil and plant conditions (Chaudhry et al., 1973; Kausar et al., 1976 Rashid et al., 1979). Applied Fe increased Cu in the plant under the non saline conditions, while decreased Cu under the saline conditions was attributed to the dilution effect due to the Fe induced growth improvement. Researchers have noted reduced Cu uptake due to applied Fe (Cheshire et al., 1967), but stimulatory effect of Fe on Cu uptake has never been reported.

Iron

Soil salinity and applied Fe increased its concentration in the plant (Table 2). Decreased Fe in the plant due to applied Fe under the saline conditions was attributed to its remarkable effect on the growth wich resulted in its dilution. Other workers have noted decreased Fe due to salinity and some have shown a steady decrease in soil Fe availability due to salinity (Hassan Nouri et al:; 1970; Hussain and Rashid, 1979; Nabhan and Cottenie, 1974). Applied Zn and Cu under non saline conditions had little effect on the Fe contents and their effect under saline conditions was attributed to the growth promotions which caused dilution of Fe. Decreased plant Fe due to applied Cu under saline conditions might help explain the lack of response to the applied Cu at high salinity.

Iron nutrition of the crops has always been very confusing. In this study also, despite high Fe contents in the plants, they responded to its application remarkably specially under saline conditions. Workers have shown that total Fe in the plant cannot be used as an index to predict response to its application. Instead, Fe++ was found a good index to predict the response to its application (Katyal and Sharma, 1980).

CONCLUSION

The study indicated good plant growth due to the addition of trace elements to the saline soil. The concentrations of these elements considered sufficient for plant growth on the normal soils might not be enough under the saline conditions (Ravikovitch and Navrot, 1976). That was perhaps the reason that plants showing little response to the added elements on the normal soil, though having lower concentrations of these elements than the plants growing on the saline soil, responded significantly to the applied trace elements under the saline conditions. Fertility management of the saline soils having marginal amounts of trace elements require more attention than the soils having sufficient supplies of these elements. The problem should be dealt with utmost care when relatively sensitive crops are to be grown on such soils because very often these elements have

been found interacting each other (Olsen, 1972).

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