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Effect of Different Moisture Regimes and Added Iron on the Availability of Zinc and Copper in Black Soils

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An incubation experiment was conducted with black soil in the laboratory to determine the effect of changes in moisture regime and added iron on the availability of zinc and copper at different intervals of incubation period. The availability of Zn and Cu were influenced both by moisture regimes and applied Fe. The results clearly indicated that available Zn and Cu were depreesed by increasing level of moisture regimes. An antagonic effect was observed between available Zn and added Fe.

Moisture regimes and added iron are known to influence the available zinc and copper. Venkatasubramanyam and Mehta (1975) observed that increasing level of Fe decreased available Zn and a pronounced effect was noticed at a higher moisture level. Brar and Sekhon (1976) reported that DTPA extractable Zn was higher under unflooded condition than under flooded condition. The effect of moisture regimes and added iron on soil available zinc and copper in a black soil was investigated in this study.

MATERIAL AND METHODS

An incubation experiment was conducted to study the effect of various moisture regimes and iron application on the availability of Zn and Cu in black calcareous soil. Twenty five g of soil was taken in cleaned beakers and Fe at the rate of 20 kg/ha in the form of ferrous sulphate and farm yard manure at the rate of 25 t/ha were added. The contents were incubated at estimated moisture for specified period up to six weeks. The particulars of treatment are presented below.

Moisture regimes :

M_1 .. At flooded moisture condition;
M_2 .. At 75% depletion of available soil moisture (ASM);
M_3 .. At 50% depletion of ASM: and,
M_4 .. At field capacity level

Incubation time :

Seven of weekly interval (0 to 7 weeks)

Water was added to the beakers whenever the moisture level reacted the determined depletion level. At weekly intervals the soil samples were extracted with 0.005M DTPA and available Zn and Cu were estimated with atomic absorption spectrophotometer (Varian Techtron AA 120) following the procedure described by Lindsay and Norvell (1978).

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RESULTS AND DISCUSSION

The results on available Zn (Table I) showed that the highest values were recorded at 50% depletion of ASM and this was followed by 75% depletion of ASM. Higher moisture regimes such as field capacity level and flooded moisture level recorded significantly lower values. One could, therefore, expect a depressive effect of higher moisture regimes on available Zn content, as for instance, in flooded soil grown to rice. Besides imbalance of ions bringing about inhibitory effect of Mn and Fe on the available Zn, higher moisture regimes themselves may bring about depression of available Zn status through reduced aeration or pH changes, Brar and Sekhon (1976) reported that the sub-mergence led to decrease of available Zn. Venkatasubramanyam and Mehta (1975) stated that adsorbed Zn over clay particles was further exposed to deposition on insoluble compounds such as ferrous hydroxide or basic ferrous sulphate which might effectively block the exchangeable soure of Zn from being released.

As regards the incubation period, there was no clear trend though at fifth week significantly higher values of available Zn were recorded. The differences between successive intervals were not very wide.

Available Cu content (Table II) also followed a more or less similar trend of changes in relation to moisture levels as that of available Zn. Low moisture regimes such as 75% depletion of ASM recorded significantly higher values followed by the 50% depletio of ASM. One important difference wa that with passage of incubation perioc there was regular and consistent tren of decrease of available Cu. It may therefore, be noted that available C and Zn tended to behave more o less similarly. Reduced conditions pro bably favoured the formation of les soluble, and less available forms of C as stated by Krauskope (1972). It i also possible that ionic imbalance bet ween Fe and Mn on the one hand an available Cu on the other could hav resulted in reduction of avilable Cu con tent, as was stated by Misra and Dwived (1977).

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TABLE I Effect of levels of moisture and iron on the availability of zinc (Mean of two replications in ppm)

Moisture	I_1	I_2	I_3	I_4	I_5	I_6	I_7	Mean
levels	0	1	2	3	4	5	6	
M_1	1.6	1.4	1.3	1.3	1.6	1.2	1.1	1.4
M_2	1.9	3.0	2.7	2.7	3.9	2.8	1.9	2.3
M_3	2.9	4.1	3.3	3.4	3.3	3.6	3.6	3.4
M_4	1 8	1.7	1.6	1.5	1.6	1.8	1.8	1.7
Mean	2.1	2.6	2.2	2.2	2.6	2.4	2.1	

Significance	S. E.	C. D. (P=0.05)
M	0.08	0.23
I	0.11	0.31
M×I	0.21	0.62

TABLE II Effect of levels of moisture and iron on the availability of copper (Mean of two replications in ppm)

Moistu.e	I_1	I_2	I_3	I_4	I_5	I_6	I_7	Mean
levels	0	1	2	3	4	5	6	
			— — — Incubation period in weeks — — —					
M_1	0.21	0.21	0.24	0.29	0.26	0.31	0.31	0.26
M_2	1.95	1.70	1.35	1.30	1.40	0.80	0.68	1.31
M_3	0.69	0.59	0.61	0.50	0.39	0.39	0.38	0.51
M_4	0.49	0.48	0.41	0.49	0.51	0.49	0.47	0.48
Mean	0.84	0.75	0.65	0.65	0.64	0·50	0.46	

Significance	S. E.	C. D. (P=0.05)
M	0·095	0.20
I	0.123	0.25
M×I	0.346	0.71