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Effect of Climatic Factors on Copper and its Antagonist Contents in the Soil

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Abstract: Copper deficiency in ruminants occurs either as a primary or as a secondary deficiency. Most of the copper deficiencies in livestock which occur naturally are conditioned by the presence of dietary factors that interfere with the absorption or utilization of copper by the animal. The main subjective of this study was to evaluation of effect of climatic factors on copper and its antagonist contents in the soil. In this study, during the seasons, researchers aimed to recording the rainfall, environmental temperature, soil temperature and humanity. In this study, researchers collected about 72 soil samples (18 samples in each season) from different areas of Ahar city, East Azerbaijan province of Iran. Then, samples were sent to the laboratory and the trace elements content of soil samples was measured by atomic absorption method. Results showed that Cu, Zn, Fe, Ca, S, Co and Mo was 20.36, 7.3, 43.73, 173.26, 596, 10.69 and 16.12, respectively. In conclusion can be conclude that present study is unique because there was no documented literatures about cu and its antagonist content in the soil of East Azerbaijan area. So, researchers suggests that there is more study needs to conclude about this matter.

Key words: Climatic factors, copper, antagonist, soil, animal, Iran

INTRODUCTION

The management of agricultural wastes through application to land focuses on its use as a resource to enhance or sustain soil quality and productivity rather than as a waste product for disposal. Trace elements are released into the environment from the natural weathering of rocks and minerals from various sources related to human activity. Although, the concentration of these elements occurring naturally in the environment is generally small, they may directly or indirectly affect the chemical composition of foodstuff and animal feed, potable water supplies and airborne particulates and dust (Singh and Steinnes, 1994). The practical implication of these trace elements in the environment relates to their availability for plant uptake from the soil and their release into water systems. Contamination of the environment by trace elements is generally related to the quantities that are added to the soil or water from man-made sources such as industrial discharge and volatile emissions, sewage sludge, livestock manures and other wastes. The content of trace elements in soil is an indicator of possible excesses or deficiencies for plant nutrition and ultimately animal and human health (Dudas and Pawluk, 1977; Boila *et al*., 1984, 1985; Kruger *et al*., 1985; Gupta, 1986). Research has been conducted on the effects of sewage sludge application on agricultural land and on plant uptake of trace elements (Zwarich and Mills, 1979; Webber and Shamess, 1987). However, limited information is available on background levels of trace elements in Manitoba soils (Haluschak and Russell, 1971; Madden, 1974; Mills and Zwarich, 1975). In consideration of the ever increasing pressure being placed on land by more intensive land management practices and the increasing use of agricultural land for waste management, it is important to document the trace element status of Manitoba soils.

Micronutrients are significantly affected by soil pH decreasing with increasing soil pH. Solubility of Fe decreases a 1000 fold for each unit increase in soil pH in the range of 4-9 (Lindsay, 1979) and consequently, most Fe deficiencies occur on calcareous soils. The activity (consequent bioavailability) of Mn, Cu and Zn decreases a 100-fold for each unit increase in soil pH. Amounts of exchangeable metals in soil are related to their concentrations in soil solutions, so soil pH affects exchangeable Fe, Mn, Cu and Zn similarly. Zinc is an essential element for normal crop growth and Zn deficiencies can severely impair crops and reduce yields (Fageria *et al*., 2002; Gangloff *et al*., 2002). Copper plays a number of important biological roles in animals through several Cu-dependent enzymes (Xin *et al*., 1991). Copper deficiency in ruminants occurs either as a primary or as a secondary deficiency. Most of the copper deficiencies in livestock which occur naturally are conditioned by the presence of dietary factors that interfere with the

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absorption or utilization of copper by the animal (Underwood and Suttle, 1999). These dietary factors such as iron, molybdenum or sulfur, interfere with the absorption and metabolism of copper (Suttle, 1991). In the rumen, molybdenum combines with reduced sulfur to form tetrathiomolybdate that binds copper and prevents its absorption while other thiomolybdates and molybdates are absorbed into blood and bind endogenous copper to render it unavailable for metabolic purposes (Mason, 1982). The main subjective of this study was to evaluation of effect of climatic factors on copper and its antagonist contents in the soil.

MATERIALS AND METHODS

Present research was descriptive-analytical types of studies. In this study, during the seasons, researchers aimed to recording the rainfall, environmental temperature, soil temperature and humanity. In this study, researchers collected about 72 soil samples (18 samples in each season) from different areas of Ahar city, East Azerbaijan province of Iran. Then, samples were sent to the laboratory and the trace elements content of soil samples was measured by atomic absorption method. Data was analyzed by SPSS Software.

RESULTS AND DISCUSSION

Data related to the 5 area are showed in the Table 1. Data related to seasonally rainfall, temperature and humanity are showed in Table 2.

The copper levels of soil and pastures in most parts of the country are unknown. Copper bioavailability can be low in ruminant diets, especially when molybdenum, sulfur and (or) iron are presented in moderate to high concentrations (Humphries *et al*., 1983; Suttle *et al*., 1984; Ward *et al*., 1993). Therefore, determination of copper in the diet or pasture has no diagnostic value in ruminants unless other elements which interact with copper are determined (Underwood and Suttle, 1999). Khan *et al*. (2006) conducted a study to determine the copper status copper was found, it was higher in Winter than that in of grazing sheep. Although, an adequate level of plasma Summer. The normal ranges of plasma and serum copper are wide and vary between species. The norms for serum copper are 9-15 μmol L^{-1} for ruminants (Underwood and Suttle, 1999). Serum copper levels between 3 and 9 μmol L^{-1} represent marginal deficiency and levels below 3 μmol L^{-1} represent functional deficiency or hypocuprosis (Radostits *et al*., 2007).

Liver copper values above 200 mg kg^{-1} DM in sheep are considered to be normal, levels of <80 mg kg^{-1} DM are accepted as low and <35 mg kg^{-1} DM is deficient (Radostits *et al*., 2007). The mean seasonal and annual copper concentrations of pastures in all of the studied towns were above 10 mg kg^{-1} DM. Pastures containing <3 mg kg^{-1} DM of copper will result in signs of deficiency, levels of 3-5 mg kg^{-1} DM can be considered as dangerous and levels >5 mg kg DM are safe unless complicating factors cause secondary copper deficiency (Radostits *et al*., 2007).

A soil test can be an important management tool in developing an efficient soil fertility program as well as monitoring a field for potential soil and water management problems. A soil test provides basic information on the nutrient supplying capacity of the soil.

According to the other researches, available K was high and available P was low. The critical level of available P (Bray II) for maize is 10-15 mg kg^{-1} (Howeler, 1990). Olsen and Sommers (1982) reported that available P concentration was 10 mg P kg^{-1} with Olsen Method for upland crops. The critical level of available P in Iran soils for majority of crops is 20 mg kg^{-1} soil. This implied that it was necessary to apply phosphate fertilizer for any crop planted at this site. Phosphorus is unique among the anions in that it has low mobility and availability in soils. It is difficult to manage because it reacts so strongly with both solution and solid phases of the soil (Hodges, 2010).

The available Fe, Zn, Cu and B in the soil were lower than the critical level but the available Mn was above the critical level. The soil of this research was calcareous with alkaline pH therefore available Zn and B were low. The critical levels of Fe, Zn and B have been determined by many researchers. Rezaei and Malakouti (2002) reported that critical levels of Fe, Zn and B in soils of Iran were

Table 1: Trace element content of soil samples in Summer

	Measured parameters						
Sample No.	Cu (PPM)	Zn (PPM)	Fe (PPM)	Ca (meq 100 g)	S (PPM)	Co (PPM)	Mo (PPM)
1	4.050	1.67	9.320	34.710	136	2.08	3.31
2	3.960	1.29	10.12	30.120	125	1.96	3.25
3	4.250	1.63	8.110	36.210	112	2.91	2.94
4	4.760	1.37	7.060	35.110	142	2.73	3.76
5	3.340	1.34	9.120	37.110	81	1.01	2.86
Sum	20.36	7.30	43.73	173.26	596	10.69	16.12

Table 2: The mean value of rainfall, temperature and humanity obtained from weather station in Summer

	Season		
Parameters	July	August	September
Rainfall (mm)	3.50	1.8	4.5
Environmental temp. (°C)	22.4	23.1	17.5
Humanity (%)	52.0	54.0	65.0
Soil temp. (°C)	28.3	28.9	24.5

4.8, 1.1 and 1.0 mg kg^{-1} soil, respectively. Johnson and Fixen (1990) stated that the critical levels of Fe, Zn, Cu and Mn by the DTPA Extraction Method and B by the hot water in the soil method were 5.0, 1.5, 0.5, 1.0 and 1.0, respectively. The actual total Fe content of a soil may exceed 50,000 mg kg^{-1} however, the portion available to plants may be <5 mg kg^{-1} (Hodges, 2010). Page *et al.* (1982) classified Fe and Zn as: 0-5 mg kg^{-1} (very low), 6-10 mg kg^{-1} (low) and 11-16 mg kg^{-1} (medium) for Fe and 0.0-0.5 mg kg^{-1} (very low), 0.6-1.0 mg kg^{-1} (low), 1.1-3.0 mg kg^{-1} (medium) and >3.0 mg kg^{-1} (high) for Zn.

Zn is one of the essential elements for plants and humans but it is deficient (<1.00 mg kg^{-1} DTPA extractable Zn) in most calcareous soils and consequently in plant and human diets. The critical level for DTPA-extractable Zn is 0.8 mg kg^{-1} soil (James and Topper, 1993). Sturgul (2010) reported that the optimum Zn soil test ranges are 3.1-20 mg kg^{-1} for all soil textures. The need for supplemental Zn applications should be confirmed with plant analysis in that scalped or severely eroded soils are more apt to be Zn deficient. Also, sands, sandy loams and organic soils are more likely to be Zn deficient than other soil types. Severe soil compaction can also reduce Zn availability. In addition, cool weather during the growing season may also induce Zn deficiency in high demand crops.

CONCLUSION

Finally, can be conclude that present study is unique because there was no documented literatures about Cu and its antagonist content in the soil of East Azerbaijan area. So, suggests that there is more study needs to conclude about this matter.

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