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Research article

CORRELATIONS BETWEEN BORON CONTENT AND SOME SOIL PROPERTIES IN GROUNDNUT CULTIVATION, NORTH OF IRAN

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ABSTRACT: Relationship between soluble boron extracted with a hot water solution and pH, organic carbon, Ca, Calcium carbonate equivalent (CCE), available P and K, and clay content were performed for surface samples of 164 soils. The soils were inceptisol. To quantify the relations between soluble boron and the different soil parameters, simple linear correlations were performed. Hot-water extractable boron (HWB) was significantly correlated with clay content ($r = 0.17^{*}$), available P ($r = 0.17^{*}$), K ($r = 0.34^{*}$) and Calcium carbonate equivalent ($r = 0.25^{*}$) in all soils. In addition, there was a significant negative correlation between HWB and sand content ($r = -0.32^{*}$).
Key words: Boron, Peanut, Soil, Iran

INTRODUCTION

The types of minerals, organic matter (OM) and clays affects boron content in soils. Gupta [6] reported that soil pH, specific surface area, clay and organic carbon contents influenced Water-soluble boron in soil. Usually clayey and loamy soils have higher Boron concentrations than in sandy soils [5]. Due to minimize boron leaching from the soil, and maintains the element in a relatively available form, Soil OM plays an important role in boron availability [7]. Organic matter accounted for 69% of the variability of the boron extracted in hot water in thirty-three Egyptian soils at various depths [4]. A similar result concluded in Spanish soils by Ruiz-Neto et al [10] that the organic fraction of the ninety samples had a more significant effect on the soluble boron content than the inorganic fraction. The objective of this study was to determine the relationships between hot water-extracted boron (HWB) contents and some chemical and physical characterization of soils in 164 soils under peanut cultivation of Astaneh ashrafieh region of Guilan province.

MATERIAL AND METHODS

Surface (0-20 cm) samples were taken from 164 soils from peanut fields, Astaneh Ashrafieh, Guilan province, northern of Iran. Air-dry soil was sieved to pass a 2-mm screen, for particle size analysis using the hydrometer method, Soil pH and EC was measured in a 1:1(soil: water), organic carbon was analyzed by Walkley and Black method and available phosphorus was extracted Olsen method [9]. Hot water soluble boron (HWB) was determined by the Azomethine-H method [1]. Simple correlations were obtained using SAS (Statistical Analysis System) analytical program.

RESULTS AND DISCUSSION

Except for fewer soils, where the soluble boron content was high, other samples exhibited low or low-to-medium soluble boron contents (0.50 mg kg^{-1})(Table 1).

Table 1.Geographical positions and boron content of soils under groundnut cultivation

			No.	Range	Min.	Max.	Mean	Median	S.D.
Kisom	37 14 50/15 00	49 54 12/55 38	58	3.90	0.0	3.49	0.34	0.11	0.67
Kiashahr	37 24 11/24 61	49 54 25/54 77	52	0.97	0.16	1.13	0.51	0.48	0.23
Markazi	37 16 00/19 25	49 53 40/56 40	54	1.35	0.0	1.35	0.62	0.72	0.36

Some chemical and physical characteristics of the soil was reported in Table 2.

Table 2. Some chemical and physical properties of soils

Parameter	Mean	Range
pH)	7.8	7.03-9.22
EC(dS m^{-1})	0.27	0.13-1.26
O.C (%)	0.89	0.02-2.24
CCE (%)	10.49	2.0-38.5
P(mg Kg-1)	41.99	0.0-401.97
S(meq lit-1)	0.21	0.0-13.64
K(mg Kg-1)	259.04	28.4-1010.9
Ca(meq lit-1)	2.74	1.6-20.0
Sand (%)	42.93	13.0-87.0
Silt (%)	46.18	10.5-66.5
Clay (%)	10.87	0.0-54.0

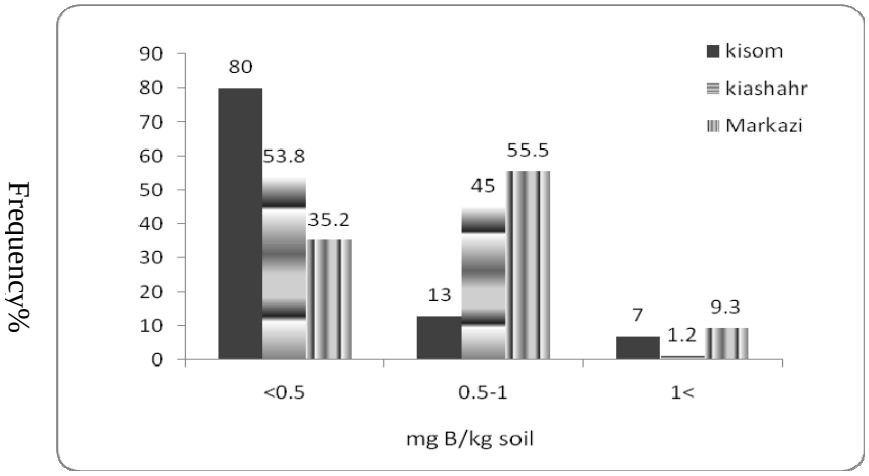

Figure 1. Frequency of boron content in three sites

Among the samples studied, the lowest value of soluble boron was found in the Kisom surface horizon, possibly linked to the high soil sand content (Table 2). The low quantity of boron may be attributed to the higher losses of this element due to leaching. Touchton et al [11] found relatively low concentrations of boron in the topsoil of coarse-textured soils. In relation to the highest value observed (3.49 mg/kg in Kisom), it is important to point the fact that this soil has the higher clay and organic carbon contents among the samples in this site (1.8 and 12% respectively).The pH varied from 7.03 to 9.22 (Table 2) and is in basic range. The correlations between HCB and pH were not significant whereas the soluble boron decreased with increasing pH (Table 3).

Table 3. Correlation coefficient between soil properties

	pH	OC	CCE	P	K	Clay	Sand	B
OC	-.368**	1						
CCE	.268**	-.262**	1					
P	-.329**	.522**	-.050	1				
K	-.271**	.463**	.030	.619**	1			
Clay	-.180*	.412**	.086	.115	.238**	1		
Sand	.256**	-.356**	-.037	-.150	-.246**	-.723**	1	
B	-.130	.004	.251**	.174*	.339**	.166*	-.315**	1
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								

Brasil Sobrinho [2] reported not significant correlations between HWB and pH, also not significant correlation between soluble boron and organic carbon was found. As shown in Table 2, the organic carbon content was low in these soils. The correlation between soluble boron and clay content was positive (Table 3). This result was expected, because it is common to find higher soluble boron contents in clayey soils than in sandy textured soils [8]. Also Casagrande [3] found a positive correlation (r = 0.51*) between the clay content and HWB. Among the other chemical parameters, amount of available P, K and calcium carbonate equivalent represented a positive correlation with soluble boron (Table 3). Thus it is concluded that HWB has statistically significant simple correlations with some soil properties.

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