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Boron content of wide soil groups of Siverek (Şanlıurfa) region

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Abstract
In the study, it was aimed to determine the boron content of the wide soil groups in Siverek county of Şanlıurfa province and to determine relations with some properties of the soil. For this purpose, a total of 76 soil samples were taken from two different depths (0-20 and 20-40 cm) and 38 points, representing the wide soil groups of Siverek county of Şanlıurfa. Texture, pH, salt, lime, organic matter and available boron contents of the soils were determined in the samples. The results of the research show that the pH contents of soils is between 6.91-7.98; salt content is between 0.02-0.13%; clay content is between 24.32-67.76%; sand content is between 2.40-62.96%; silt content is between 6.00-68.72%; lime content is between 0.38-14.55%; organic matter content is between 1.11-3.35% and boron content of them is between 0.01-1.99 mg/kg. The obtainable boron content of the wide soil groups of Siverek county of Şanlıurfa province was found to be 65.38% too little, 26.32% little, 7.90% adequate at the depth of 0-20 cm, whereas it was found to be 81.58% too little, 15.79% little and 2.63% sufficient at 20-40 cm depth. It was determined that there is a positive significant relationship between the obtainable boron content of soil and pH and lime contents. In addition, significant positive relationships between pH content and silt and lime were determined. Not only a negative significant relation between clay content and silt content of soils was determined, but negatively significant relations between sand content and silt and organic matter were determined, as well. At the same time, positive correlations were determined between the lime content of the soils and the organic matter.

Key words: Boron content, wide soil groups, soil properties

INTRODUCTION

Very few and limited levels of agricultural areas and agricultural inputs on earth increase the value of agricultural regions. The chemical, physical and biological properties of soils have an important place directly and indirectly on the amount of crops to be obtained from agricultural land. In order to obtain the best results from agricultural production, the well-known soil texture and characteristics is a very important factor affecting the agricultural production process (Karaduman and Çimrin 2016).

The desired level of plant nutrients in the soil is closely related to different environmental factors, including climatic conditions, together with soil factors such as pH, salt, body, organic matter, lime and KDK (Özyazıcı et al. 2013, Sevindik et al. 2017). It is known that the amount of boron in the soil affects the factors such as the type of plant, the amount of organic ions, the temperature of the soil, as well as the variety of the plant and the pH of the soil (Şimşek et al. 2003).

Boron deficiency is not as little as it is seen in more than 80 countries around the world (Shorrocks 1977). Lehto et al. (2010); Bell and Dell (2008), according to the area of the precipitation of sandy soils and alkaline pH soil is very common in the lack of boron. In addition to this, the lack of good soil management and fertilization is the inevitable result when the deficiency of plant nutrient elements in

the soil increases with the advancement of agricultural activities. On the other hand, boron toxicity is a serious problem in arid regions where predominantly trees are not dominated in many parts of the world, and the window between deficiency and toxicity is generally known to be very narrow (Lehto et al. 2010). In other words, while the boron, which is found in very low amounts in some soils, has a deficiency for plants as a nutrient, it can be reached to toxic level for the plants by giving too much. Boron element in the production of pectic cells in the cell wall in plant production has been suggested to play an important role (Lehto et al. 2010), although many studies on the effect in the plant in general, the plant functions are not understood clearly (Demirtaş 2005).

Yalçın and Çimrin (2017) aimed to determine boron content of meadow and pasture soils in Kırıkhan-Reyhanlı region of Hatay province and to determine their relationships with some properties of soil. According to the results of their work; pH contents of soils 6.85-8.16; salt content 0.01-0.21%; clay contents 4.60-65.30%; sand contents% 8.70-85.40; silt contents 8.00-58.00%; lime content 3.40-53.95%; organic matter contents were found between 0.29-5.52% and the contents of boron were found between 0.00-1.31 ppm. At the same time, in terms of boron content of meadow pasture soils at a depth of 0-20 cm 70% very little, 27.50% less, 2.50% sufficient level, 20-40 cm depth 72.50% very little, 17.50% They found that less than 10% of them have sufficient levels. In addition, the negative relationship between the boron and sand contents of the soil is determined while the important relationship between the contents of salt, clay, silt and lime content of the boron. Özyazıcı et al. (2013) aimed to reveal the physical and chemical properties of the alfalfa cultivated soil and the problems related to plant nutrition in Artvin region. According to the results of the study; the soil is generally of clayey loam, sand, sandy loam and sandy loam, 55.13% of them have neutral reactions, 58.97% of them have low calciferous and no salinity problems. In addition, it was determined that 46.16% of the soil has the deficiency of extractable boron and 16.67% of the soil has the deficiency of the extractable Mn. Taban et al. (2004), who determined the fertility status and nutritional problems of the soil made of garlic cultivation in the Kastamonu Taşköprü region, found within the results of their study that the soil in the region has no issues of salinity; in 85.00% of the soils KDK had> 25 mg/kg soil, and in 55.00% of the soils organic matter was insufficient, in 45.00% of the medium and 67.50% of it was insufficient in terms of boron. Budak and Günal (2015) aimed to map the distance-dependent variation of the available boron concentration in the salt and alkaline soils in the Bor district of Niğde province by geostatistical methods. As a result of the study, the boron concentration of the soil varied between 1.41 and 97.84 mg/kg and the average concentration was 47.76 mg/kg. They found that in a large part of the study area soils the boron concentration is over 5 mg/kg, which is the toxic limit for most crops.

In this study, the sludge contents of wide soil groups in Siverek district of Şanlıurfa province will be investigated and their relations with some soil properties will be investigated. As a result, it was aimed to contribute to the yield and quality of agricultural production in wide soil groups in Siverek district.

MATERIAL AND METHOD

A total of 76 soil samples from 38 points, 0-20 and 20-40 cm depths were taken in a manner to represent the region in the area of Siverek county of Şanlıurfa province in accordance with the procedure (Figure 1; Table 1). The soil samples brought to the laboratory on the same day were dried in the shade and dried by a 2 mm sieve.

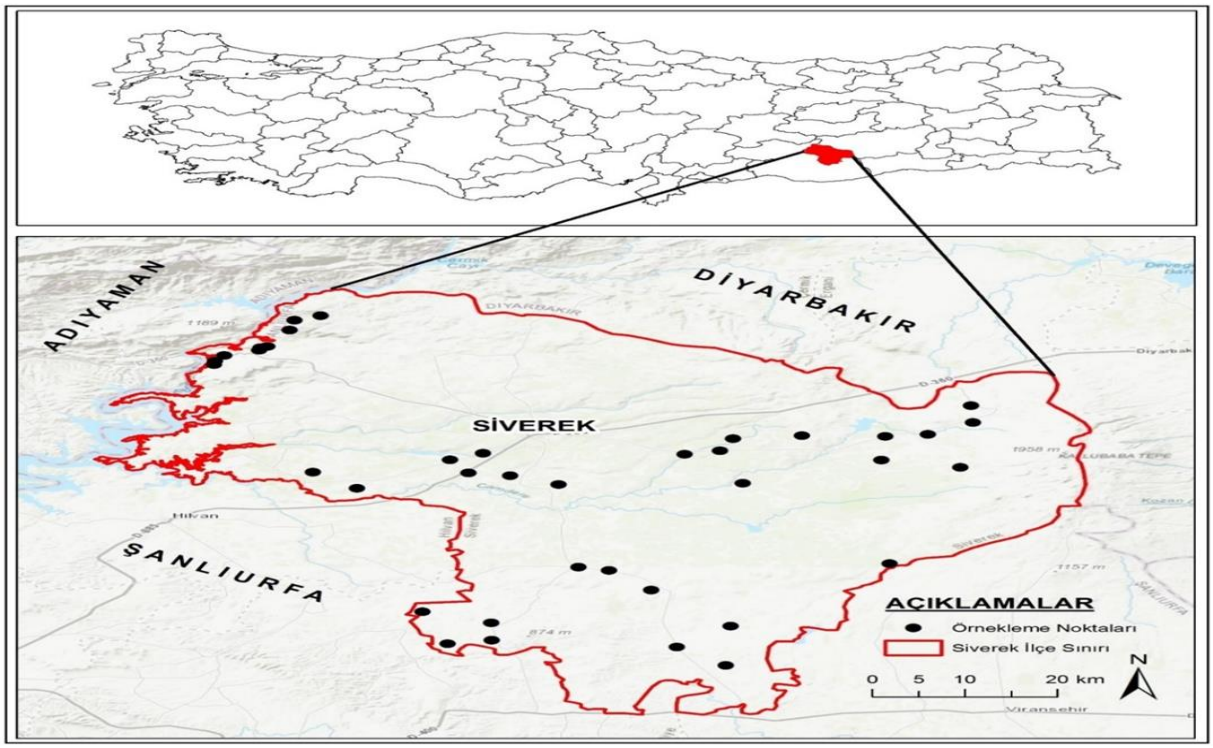

Figure 1. Representation of soil samples taken on Siverek district map.

Table 1. Soil samples were taken

Soil Number	Sample Place	Soil Class (IUSS WRB Working Group 2015)	Soil Number	Sample Place	Soil Class (IUSS WRB Working Group 2015)
1	Gözelek	Cambisol	20	Aşağıkarabahçe	Vertisol
2	Karakoyun	Cambisol	21	Sabanlı-1	Cambisol
3	Çeltik	Cambisol	22	Karakeçi	Cambisol
4	Çanakçı	Cambisol	23	Turna	Cambisol
5	Yücelen-1	Cambisol	24	Başbuk-1	Calcisol
6	Yücelen-2	Cambisol	25	Başbuk-2	Calcisol
7	Ediz	Cambisol	26	Alayurt	Cambisol
8	Çatlı	Cambisol	27	Aşağıkaracaören	Cambisol
9	Erkonağı	Cambisol	28	Karadibek	Cambisol
10	Gedik	Cambisol	29	Sabanlı-2	Vertisol
11	Gazi	Cambisol	30	Ergen-1	Cambisol
12	Eğriçay	Cambisol	31	Narlıkaya-1	Cambisol
13	Savucak	Vertisol	32	Narlıkaya-2	Cambisol
14	Karacadağ-1	Vertisol	33	Narlıkaya-3	Cambisol
15	Sumaklı	Vertisol	34	Ergen-2	Cambisol
16	Keçikıran	Cambisol	35	Ergen-3	Cambisol
17	Karacadağ-2	Cambisol	36	Kayalı-1	Cambisol
18	Altınahır	Cambisol	37	Kayalı-2	Cambisol
19	Altınlı	Cambisol	38	Kayalı-3	Cambisol

Methods

The total soluble salt content of the soils was measured in the electrical conductivity instrument in the saturation sludge extract and the pH values in the pH meter instrument (Richards 1954). Lime ($CaCO_3$) contents were measured with Scheibler calcimetres (Allison and Moode 1965). It was determined by

hydrometer method (Bouyoucos 1952). The organic matter contents of soils were determined by the Walkley-Black method modified by Jackson (1960). Available B analysis of the soils was determined using ICP-OES device in strainer obtained using 0.01 M mannitol + 0.01 M $CaCl_2$ extract solution (Cartwright et al. 1983). Correlation and regression analysis of soil properties and available boron contents were done by SPSS 17 statistical program (Düzgüneş et al. 1987).

RESULTS AND DISCUSSION

Some Physical and Chemical Properties of Soils

Some physical and chemical properties of soil properties used in the research are given in Table 2. The pH content of the study soils was 6.91 in the samples and the highest pH content was 7.98. The average pH content of the soil samples of 0-20 cm depth was 7.54, whereas the samples with a depth of 20-40 cm were 7.57 and it was 7.55 in two depths. According to Ülgen and Yurtsever (1995), the pH of the soil samples ranged from neutral to slightly alkaline, whereas 42.10% of the soils were neutral and 57.90% were slightly alkaline (Table 2). Saraçoğlu et al. (2014), who work in the same land, reported similar results in the study of some of the soil and plant nutrient contents of the territory of Halfeti district of Şanlıurfa province.

The salt content of the soil in the study area was 0.02%, the highest salt content was 0.13%. The average of 0 to 20 cm of soil samples was 0.06%, while the samples with a depth of 20-40 cm were 0.07% and the mean of both depths was 0.07%. According to the limit values reported by Richards 1954, the total salt content of the soil samples was determined as salt-free (Table 2). In the same region, the general nutrition status of some olive orchards located in the center and districts of Şanlıurfa was investigated by Söylemez et al. (2017) who also reported that all of the % salt contents of soils were in the salt-free class.

The clay, sand and silt quantities of the soil of the major soil groups in Siverek district were at least 24.32%, 2.40% and 6.00% respectively, while the highest clay, sand and silt contents were 67.76%, 62.96% and 68.72%, respectively. The average clay, sand and silt contents of the soils at 0-20 cm depth were 34.61%, 21.08% and 44.31%, while the mean values were 33.68%, 23.07% and 43.25% for samples with a depth of 20-40 cm, and 34.15%, 22.08% and 43.78%, respectively. The land of Siverek district As seen in Table 2, 51.32% of silty clay, 10.53% clay, 10.53% clayey loam, 2.63% loamy 5.26% sandy clay, 9.22% silty loam, 3.94% of the silty clay and 6.75% of the sandy clay was entered into 8 different class of textures. Saraçoğlu et al. (2014), who work in the same land, reported similar results in the study of some of the soil and plant nutrient contents of the land of Şanlıurfa- Halfeti province.

Texture, pH, salt, lime, organic matter

The lime content of the research lands was 0.38% in the samples while the highest lime content was determined as 14.55%. The average lime content of the 0-20 cm depth samples was 3.64% in the depths of 20-40 cm and 3.87% in the depths of the soil. According to the classification of soil samples by Ülgen and Yurtsever (1995), although the contents of the lime ranged between low calcareous and medium calcareous, 2.64% of the soils were found to be low calcareous, 73.68% were calcareous and 23.68% were medium calcareous (Table 2). Saraçoğlu et al. (2014) The lime content of the soils of Halfeti district of Şanlıurfa province has changed between 0.38% and 33.80%, 4.00% of the soils are less calcareous, 48.00% is calcareous, 17.00% is medium, 9.00% is more than 22.00%. reported that they were too calcareous.

Table 2. Some physical and chemical properties and boron contents of wide soil groups in Şanlıurfa-Siverek Province.

Soil Number	Depth	pH	Salt %	Clay %	Sand %	Silt %	Texture class	Lime %	O.M. %	B mg/kg
1	0-20	7.28	0.04	24.32	21.68	54.00	SiL	1.47	1.90	0.06
	20-40	7.29	0.05	26.32	23.68	50.00	SiL	1.47	1.88	0.24
2	0-20	7.67	0.08	35.04	9.68	55.28	SiCL	2.71	1.95	0.15
	20-40	7.74	0.08	31.76	15.68	52.56	SiCL	2.69	1.66	0.29
3	0-20	7.74	0.06	30.32	13.68	56.00	SiCL	1.31	1.53	0.63
	20-40	7.79	0.07	30.32	14.96	54.72	SiCL	1.54	1.55	0.23
4	0-20	7.39	0.10	32.32	11.68	56.00	SiCL	1.31	2.11	0.39
	20-40	7.42	0.10	32.32	14.96	52.72	SiCL	1.69	1.99	0.39
5	0-20	7.44	0.10	34.32	7.68	58.00	SiCL	1.46	1.90	0.06
	20-40	7.40	0.10	32.32	10.96	56.72	SiCL	1.46	1.66	0.46
6	0-20	7.65	0.08	27.04	19.68	53.28	SiCL	3.16	2.27	0.07
	20-40	7.58	0.10	30.32	17.68	52.00	SiCL	1.54	2.05	0.28
7	0-20	7.74	0.08	30.32	13.68	56.00	SiCL	1.54	1.85	0.02
	20-40	7.80	0.08	31.04	20.40	48.56	CL	1.92	1.49	0.13
8	0-20	7.57	0.08	32.32	22.96	44.72	CL	4.39	3.33	0.01
	20-40	7.55	0.08	32.32	12.40	55.28	SiCL	2.69	3.26	0.18
9	0-20	7.88	0.05	26.32	20.40	53.28	SiL	10.47	1.64	0.11
	20-40	7.85	0.05	30.32	22.96	46.72	CL	10.16	1.60	0.81
10	0-20	7.48	0.09	34.32	12.40	53.28	SiCL	0.38	1.80	0.04
	20-40	7.52	0.10	32.32	12.96	54.72	SiCL	1.46	1.55	0.18
11	0-20	7.41	0.07	36.32	8.40	55.28	SiCL	1.15	1.58	0.65
	20-40	7.48	0.07	40.32	8.96	50.72	SiC	1.31	1.38	0.10
12	0-20	7.36	0.06	30.32	12.40	57.28	SiCL	1.15	2.51	0.01
	20-40	7.41	0.07	34.32	12.96	52.72	SiCL	1.15	2.41	0.12
13	0-20	7.11	0.06	67.76	2.40	29.84	C	1.08	1.85	0.52
	20-40	7.07	0.06	46.32	8.96	44.72	SiC	1.31	1.83	0.25
14	0-20	7.06	0.06	65.76	8.40	25.84	C	1.15	2.17	0.08
	20-40	7.10	0.06	64.32	11.68	24.00	C	1.23	1.88	0.18
15	0-20	7.27	0.07	52.32	14.40	33.28	C	1.00	1.58	0.41
	20-40	7.36	0.07	42.32	14.40	43.28	SiC	1.39	1.49	0.06
16	0-20	7.67	0.08	30.32	12.40	57.28	SiCL	3.52	1.27	0.03
	20-40	7.73	0.08	32.32	15.68	52.00	SiCL	4.52	1.11	0.81
17	0-20	7.73	0.07	30.32	16.40	53.28	SiCL	2.37	1.98	0.12
	20-40	7.75	0.07	26.32	21.68	52.00	SiL	2.68	1.69	0.27
18	0-20	7.78	0.06	34.32	8.40	57.28	SiCL	3.16	1.98	0.06
	20-40	7.82	0.07	28.32	13.68	58.00	SiCL	3.69	1.88	0.16
19	0-20	7.75	0.07	31.04	14.40	54.56	SiCL	1.46	1.53	0.89
	20-40	7.71	0.07	30.32	17.68	52.00	SiCL	1.77	2.10	0.11
20	0-20	6.98	0.04	48.32	18.40	33.28	C	8.74	2.17	0.01
	20-40	6.91	0.04	44.32	15.68	40.00	C	9.39	2.16	0.36

Table 2. (continued)

Soil Number	Depth	pH	Salt %	Clay %	Sand %	Silt %	Texture class	Lime %	O.M. %	B mg/kg
21	0-20	7.82	0.06	30.32	16.40	53.28	SiCL	6.23	2.01	1.08
	20-40	7.85	0.06	30.32	15.68	54.00	SiCL	6.16	1.74	0.95
22	0-20	7.37	0.09	24.32	22.40	53.28	SiL	4.23	2.48	0.06
	20-40	7.39	0.08	30.32	19.68	50.00	SiCL	4.62	2.43	0.17
23	0-20	7.51	0.10	28.32	16.40	55.28	SiCL	2.31	2.01	0.43
	20-40	7.54	0.12	32.32	13.68	54.00	SiCL	1.62	2.02	0.32
24	0-20	7.65	0.08	30.32	14.40	55.28	SiCL	13.86	2.43	0.13
	20-40	7.71	0.08	28.32	14.96	56.72	SiCL	14.55	2.38	0.23
25	0-20	7.76	0.04	36.32	12.96	50.72	SiCL	7.77	2.56	0.10
	20-40	7.79	0.04	36.32	13.68	50.00	SiCL	8.47	2.35	0.15
26	0-20	7.81	0.05	28.32	2.96	68.72	SiCL	1.92	1.74	0.23
	20-40	7.88	0.04	23.60	10.96	65.44	SiL	2.69	1.77	0.10
27	0-20	7.77	0.06	28.32	13.68	58.00	SiCL	2.31	1.93	1.99
	20-40	7.74	0.06	30.32	14.96	54.72	SiCL	2.69	1.94	0.96
28	0-20	7.76	0.05	30.32	17.68	52.00	SiCL	8.31	2.38	1.13
	20-40	7.82	0.06	28.32	22.96	48.72	SiCL	8.39	2.43	0.23
29	0-20	7.49	0.12	46.32	21.68	32.00	C	3.46	3.35	0.15
	20-40	7.57	0.13	50.32	14.96	34.72	C	4.16	3.15	0.21
30	0-20	7.30	0.05	26.32	11.68	62.00	SiL	1.08	2.54	0.01
	20-40	7.39	0.05	27.76	30.96	41.28	SiCL	1.54	2.21	0.01
31	0-20	7.06	0.02	34.32	55.68	10.00	SCL	1.15	1.56	0.01
	20-40	7.09	0.02	34.32	54.24	11.44	SCL	0.85	1.44	0.04
32	0-20	7.22	0.02	37.04	47.68	15.28	SC	1.15	1.37	0.21
	20-40	7.31	0.02	37.04	48.24	14.72	SC	1.62	1.16	0.09
33	0-20	7.94	0.03	26.32	31.68	42.00	L	8.47	1.53	0.75
	20-40	7.98	0.03	28.32	42.24	29.44	CL	8.47	1.58	0.93
34	0-20	7.97	0.04	32.32	42.96	24.72	CL	7.54	1.43	0.64
	20-40	7.95	0.04	26.32	44.96	28.72	L	8.01	1.27	0.30
35	0-20	7.78	0.04	37.76	37.68	24.56	CL	11.55	2.98	0.79
	20-40	7.86	0.04	36.32	36.24	27.44	CL	12.55	3.10	1.82
36	0-20	7.32	0.02	38.32	45.68	16.00	CL	1.00	1.21	0.49
	20-40	7.41	0.02	32.32	54.96	12.72	SCL	1.31	1.13	0.14
37	0-20	7.47	0.02	30.32	62.24	7.44	SCL	1.54	1.48	0.33
	20-40	7.52	0.02	28.32	62.96	8.72	SCL	1.54	1.38	0.03
38	0-20	7.43	0.03	36.32	57.68	6.00	SC	1.54	1.74	0.22
	20-40	7.46	0.03	40.32	52.24	7.44	SC	1.54	1.60	0.06
Min		**6.91**	**0.02**	**24.32**	**2.40**	**6.00**		**0.38**	**1.11**	**0.01**
Max		**7.98**	**0.13**	**67.76**	**62.96**	**68.72**		**14.55**	**3.35**	**1.99**
Ave.	**0-20**	**7.54**	**0.06**	**34.61**	**21.08**	**44.31**		**3.64**	**1.99**	**0.34**
Ave.	**20-40**	**7.57**	**0.07**	**33.68**	**23.07**	**43.25**		**3.84**	**1.89**	**0.33**
	Ave.	**7.55**	**0.07**	**34.15**	**22.08**	**43.78**		**3.74**	**1.94**	**0.34**

The organic matter content of the soils was 1.11% and the highest organic matter was 3.35%. The average organic matter of the samples in the 0-20 cm depth of soil was 1.99% and 1.89% in the samples with a depth of 20-40 cm and 1.94% in two depths. According to Ülgen and Yurtsever (1995) classification of soil samples, although organic matter varied between very low and medium level, 63.16% of the soils were less, 30.26% were medium and 6.58% were good organic matter (Table 2). The aim of the study was to determine the general nutritional status of some olive orchards in the center

and districts of Şanlıurfa in the same region. Söylemez et al. (2017) The organic matter contents of the lands of Şanlıurfa have been reported to be between 0.37% and 2.32% and, 88.24% of the soils have low organic matter content.

The lowest boron concentration was 0.01 mg/kg and the highest boron concentration was 1.99 mg/kg. The contents of the samples taken from 0-20 cm depth of soil were 0.34 mg/kg and the soil samples of 20-40 cm depth were 0.33 mg/kg and 0.34 mg/kg. Wolf (1971) in terms of boron boundary values in the soil compared to the province of Şanlıurfa Siverek district in terms of boron content of wide soil groups at a depth of 0-20 cm 65.78% very little (<0.4 mg / kg), 26.32% less (0.5- 0.9 mg / kg, 7.90% was sufficient (1.0-2.4), at 20-40 cm depth, 81.58% was found to be very small, 15.79% was low and 2.63% was sufficient (Table 2). The aim of the study was to determine the general nutritional status of some olive orchards in the center and districts of Şanlıurfa in the same region Söylemez et al. (2017) reported similar results.

Relationship Between Boron Content and Some Other Soil Properties

The relationship between some physical and chemical properties of soil properties and boron contents can be found in Table 3. As can be seen from the analysis of the table, the pH content (r: 0.39 ***; Fig. 2) and the lime content (r: 0.32 ***; Fig. 3) have positive correlations with boron. In addition, the negative content (r: -0.56 ***) relationship between the pH content of the soil and the clay content, whereas a highly positive ones were determined between the content of the silt (r: 0.37 ***) and lime (r: 0.43***). It has been identified that there is the negative (r: - 0.66 ***) relationships between the salt content of the soils and the sand contents, while the salt content of the soils and the silt (r: 0.59 ***) and the organic matter (r: 0.37 ***) were significantly positive. Parlak et al. (2008) in the study which aims to determine the productivity status of the agricultural lands of the Eceabat district of Çanakkale, found similar results between the salt content of the soils and the sand, silt and organic matter content characteristics. In a study conducted in a different region, chemical fractions of the region of Tokat Kazovası and another study in which the relationships between these fractions and soil properties were determined, similar results were reported between the salt, sand and salt and silt and organic matter properties of the soils (Saltalı and Akın 2010). Negative significant (r: -0.40 ***) relationship was determined between clay content and silt content of soils. Soba et al. (2015) Ankara University Faculty of Agriculture Haymana research and application farm in the study of the productivity status of the soil clay and silt content of the soil properties have obtained similar results. The sand content of silt (r: -0.85 ***) and organic matter (r: -0.29 *) were determined as negative significant relationships between them. Significant relationships were determined between the lime content of the soils (r: 0.52 ***) and the organic matter (r: 0.32 ***).

Table 3. Correlation coefficients of the wide soil groups of Siverek district of Şanlıurfa province between boron and some soil properties.

	B mg/kg	pH	Salt (%)	Clay (%)	Sand (%)	Silt (%)	Lime (%)
pH	0.39***						
Salt (%)	-0.09	0.08					
Clay(%)	-0.07	-0.56***	0.04				
Sand (%)	-0.01	-0.07	-0.66***	-0.15			
Silt (%)	0.04	0.37***	0.59***	-0.40***	-0.85***		
Lime (%)	0.32***	0.43***	-0.14	-0.14	0.04	0.04	
OM (%)	0.01	0.01	0.37***	0.10	-0.29*	0.22	0.32***

* significant at 0.05 level, *** significant at 0.001 level

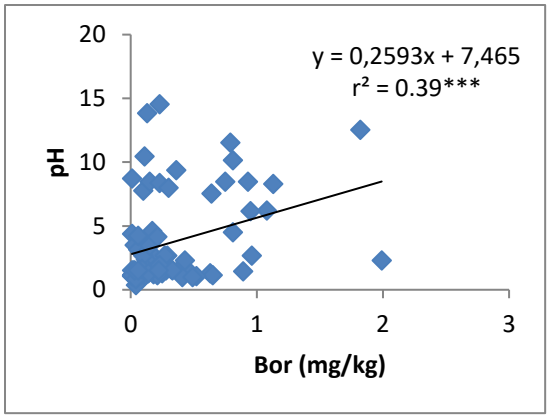

Figure 2. The relationship between the soil content of available boron and pH content

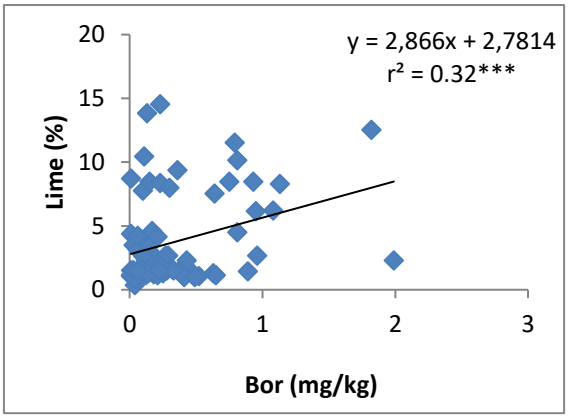

Figure 3. The relationship between the soil content of available boron and Lime content

CONCLUSION

It was tried to determine the wide soil groups in the Siverek district of Şanlıurfa province, the available boron state and its relationship with some soil properties. As a result, the soil of the wide soil groups in the province of Siverek in terms of soil reaction in general is suitable for planting with a slightly alkaline; as having a salt-free class they show a lack of any problems when considered in terms of salinity. It is determined that the soil of the wide soil groups of Siverek district of Şanlıurfa province has 8 different texture classes and 72.41% of the total amount of clayey soils, silty clayey clay and clay containing soils are found in the lands. It has been determined that the investigated soil has calcareous and medium calcareous environments in terms of lime and it has been observed that it has low and medium amount of organic content in terms of organic matter. In terms of the available boron of the studied Siverek district, it was determined that the amount of available boron contents of the soil (0-20 and 20-40 cm) at both depths (0-20 and 20-40 cm) was insufficient with very low and low. Boron fertilization should be done in order to increase the yield in this land.

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