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Original Research Article

Determination of Some Soil Characteristics of Rangelands in Central and Western Parts of Samsun Province

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ABSTRACT

This study was carried out in order to determine the physical, chemical, and fertility properties of rangeland soils located in central and western parts of Samsun province. In this concept, 50 soil samples were taken from the study area. In the studied soil, it was found that sand, clay, and silt values of the investigated rangeland soils are 13.45-73.24%, 10.23-65.82%, and 13.88-57.93%, respectively. The pH of the soils varied between medium acid and slightly alkaline, and it was determined that there was no problem in rangelands in terms of salinity. Furthermore, lime and organic matter contents of them were 0.08-41.32% and 1.23-8.16%, respectively. Moreover, it was detected that the available phosphorous contents of the soils changed in the range of 0.2-38.5 kg P_2O_5 da^{-1}, the total N contents changed in the range of 0.071-0.479%, extractable K values, Ca, Mg, Na, and B values varied in the ranges of 29-612 mg kg^{-1}, 322-10590 mg kg^{-1}, 39-698 mg kg^{-1}, 36-466 mg kg^{-1}, and 0.16-6.70 mg kg^{-1}, respectively. When the useful microelement status of rangeland soils was examined, Fe, Cu, Zn, and Mn were determined to be 3.69-146.96 mg kg^{-1}, 0.54-6.18 mg kg^{-1}, 0.16-3.41 mg kg^{-1}, and 10.97-103.11 mg kg^{-1}, respectively.

Keywords: Samsun, rangeland, soil fertility, macroelement, microelement

INTRODUCTION

Natural meadows and rangelands have tremendous importance in reducing the greenhouse effect on the earth, preventing erosion by breaking the kinetic energy of water with the vegetation it contains, and using water more effectively, increasing the soil fertility, improving animal production by complying with the management rules, and, thus, reducing animal product costs, and hosting various wild animals. Meadows and rangelands, where quality roughage is provided in the cheapest and easiest way, cover an area of about 14.6 million hectare in Turkey (TÜİK 2019). Meadows and rangelands in the Black Sea region of Turkey, where there are most fertile meadows and rangelands in terms of their quality (Ayan *et al.* 2007), are also adversely affected by a number of changes in the ecosystem, such as erosion, climate change, and global warming, besides the excessive, unconscious, and untimely grazing. The threat of desertification and drought associated with global warming both deteriorates the structure of rangeland vegetation and reduces the soil fertility of these areas (Karagüllü and Kendüzler 2008). According to the results of the study conducted in agricultural and rangeland soils, which are under the threat of erosion and drought, which generally have strongly alkaline pH and are salt-free, and which have excessive lime and low organic matter contents, and a sandy clay-loam texture, it was found that phosphorus (P) was low, potassium (K) and calcium (Ca) were excess, magnesium (Mg) and copper (Cu) were sufficient, iron (Fe), zinc (Zn), and manganese (Mn) were insufficient, and it was reported that while the pH, lime, and Fe contents of agricultural soils were lower than those of rangeland soils, other parameters were higher (Zengin *et al.* 2012).

Within the framework of sustainable agriculture, taking into account economic and ecological factors, rangelands, which take an essential place in the development of animal husbandry and the obtainment of low-cost animal production, need to be protected and improved. This depends on the improvement of the grass yield and quality by managing the mentioned areas in accordance with certain principles such as grazing capacity and grazing time, and at the same time by rehabilitating the rangeland vegetations, which have been degraded and have a low yield capacity, through timely and correct methods. In addition to climate, vegetation, and some cultural practices, soil structure is also one of the leading factors that affect the quantity and quality of grass

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obtained from rangelands. For this reason, it is crucial to know and/or reveal some characteristics of rangeland soils, especially in terms of shedding light on rangeland rehabilitation activities.

This study was performed to determine the soil's basic fertility properties and its some macro and microelement contents in rangelands, which take an important place in animal husbandry in Samsun province.

MATERIALS AND METHODS

Fifty soil samples taken from some rangelands located in the central and western parts of Samsun province constitute the material of the study (Figure 1). According to the land use and land cover classification, in Samsun province, there are 8739.09 hectares of rangeland and 122723.10 hectares of rangeland and agricultural areas with natural vegetation. Soil samples were taken from the 0-20 cm depth with a stainless steel shovel following the general rules (Jackson 1958) and in a way to represent each rangeland.

The sand, clay, and silt ratios of the soil samples were determined by the Bouyoucos hydrometer method (Bouyoucos 1951) through measuring soil reaction (pH) using a pH meter with a glass electrode in the prepared saturation sludge (Richards 1954), and the pH analysis of samples taken from acidic soils was performed by using a 1: 2.5 soil-water solution (Sağlam 1978). The electrical conductivity (EC) values of the soils were determined by measuring them in the extract obtained from saturation sludge by a conductivity device (Richards 1954), lime ($CaCO_3$) contents were determined with a Scheibler calcimeter by the volumetric method (Çağlar 1949), and organic matter content was determined by the modified Walkley-Black wet burning method (Nelson and Sommers 1982). The available P contents of alkaline and neutral soils were determined according to the Olsen method (Olsen *et al.* 1954), the P contents of acidic soils were determined according to the Bray and Kurtz method (Bray and Kurtz 1945), and the total nitrogen (N) contents were determined according to the modified Kjeldahl method (Methods of Soil Analysis 1982). The extractable K, Ca, Mg, and sodium (Na) contents were determined by extracting soil samples with 1 N ammonium acetate (pH= 7.0) solution (Soil Survey Staff 1992). The extractable boron (B) content was detected based on the color intensity of the complex, which was formed by the extractable amount of B with hot water from the soil and azomethine-H (Methods of Soil Analysis 1982).

The extractable Fe, Cu, Zn, and Mn contents of the soil samples were determined by reading Fe, Cu, Zn, and Mn contents in the obtained filtrates on the atomic absorption spectrophotometer (Perkin Elmer AAnalyst 300) after extracting the soil samples with DTPA + TEA (pH: 7.3) in a way as reported by Lindsay and Norvell (1978).

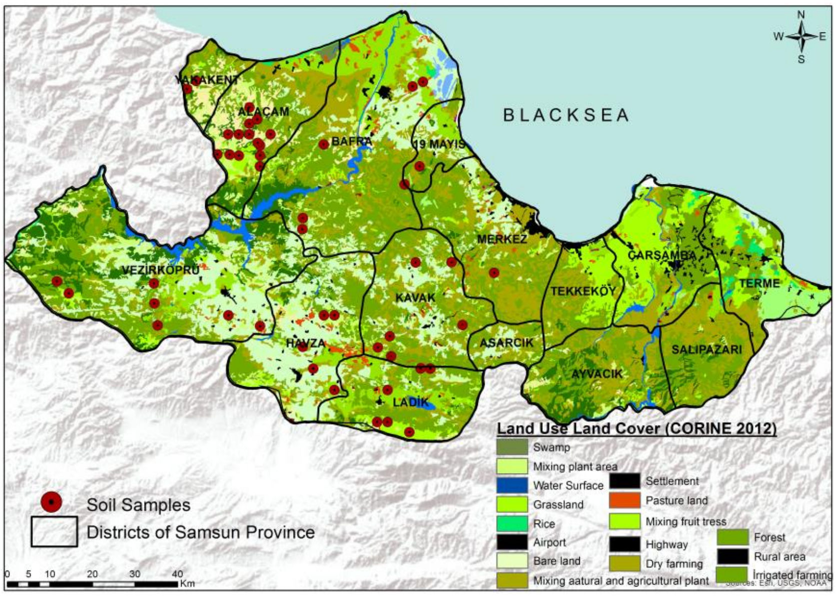

Figure 1. The land use status of Samsun province according to the CORINE 2012 classification and soil sampling points.

RESULTS AND DISCUSSION

The sand, clay, and silt contents of the rangeland soils varied between 13.45-73.24%, 10.23-65.82%, and 13.88-57.93%, respectively (Table 1). The soil samples were analyzed in six different texture classifications, including clay, clay loam, loam, sandy clay loam, silty loam, and sandy loam. In the classification performed according to the Soil Survey Staff (1951), it is observed that 54% of the investigated rangeland soils have clay loam (CL), 20% have clay (C), 8% have loam (L) and sandy loam (SL), 6% have sandy clay loam (SCL), and 4% have silty loam (SiL) textures (Table 2). On the other hand, a significant negative correlation was found between the sand content of soils and clay (r= -0.777**), silt (r= -0.518**), pH (r = -0.316*), extractable Ca (r= -0.513**), and Cu (r= -0.298*), and it had a significant positive correlation with extractable Fe (r= 0.362**). Likewise, the clay contents of soils had a significant positive correlation with pH (r= 0.413**), extractable Ca (r= 0.580**), Mg (r= 0.388**) and Cu (r= 0.356*), and a significant negative correlation with extractable Fe (r= -0.493**) (Table 3). The results obtained in terms of sand-Cu and clay-Cu were observed to be consistent with the results obtained by Çimrin and Boysan (2006), Parlak *et al.* (2008), and Günal and Erdem (2015), and the results obtained in terms of the sand-Fe correlation were observed to contradict the results obtained by Çimrin and Boysan (2006) and Günal and Erdem (2015). The results obtained in terms of sand-clay, sand-silt, sand-pH, sand-Ca, clay-Ca, and clay-Mg were understood to be consistent with the results obtained by Parlak *et al.* (2008).

Table 1. Descriptive statistics of rangeland soils in terms of basic fertility parameters and some macro and micronutrients (n= 50).

	Texture (%)			pH	EC	$CaCO_3$	O.M.	Available P	Total N
	Sand	Clay	Silt		(dS m^{-1})	(%)	(%)	(kg P_2O_5 da^{-1})	(%)
Lowest	13.45	10.23	13.88	5.23	0.194	0.08	1.23	0.2	0.071
Highest	73.24	65.82	57.93	7.84	0.963	41.32	8.16	38.5	0.479
Average	36.36	32.52	31.12	6.76	0.442	3.97	3.04	5.9	0.184
Kurtosis	0.65	0.82	1.60	-1.25	2.29	10.76	5.01	10.81	1.941
Skewness	0.70	0.57	0.56	-0.42	1.32	3.01	1.95	3.10	1.423
Median	34.62	31.35	31.05	6.92	0.41	0.61	2.87	3.31	0.162
StdS	12.83	11.07	8.15	0.76	0.16	7.75	1.28	7.17	0.089
Variance	164.50	122.59	66.36	0.57	0.03	60.00	1.65	51.45	0.008
CV	35.27	34.05	26.18	11.17	37.31	195.02	42.26	121.29	48.562
	Extractable macro and microelements (mg kg^{-1})								
	K	**Ca**	**Mg**	**Na**	**B**	**Fe**	**Cu**	**Zn**	**Mn**
Lowest	29	322	39	36	0.16	3.69	0.54	0.16	10.97
Highest	612	10590	698	466	6.70	146.96	6.18	3.41	103.11
Average	166	4663	205	127	1.94	33.43	1.92	0.79	36.36
Kurtosis	3.23	-0.57	3.07	3.64	1.48	3.96	3.72	4.69	1.61
Skewness	1.60	0.44	1.74	1.83	1.10	2.02	1.79	1.99	1.48
Median	130.15	4204.25	157.75	95.54	1.79	18.69	1.63	0.57	28.00
StdS	120.83	2540.85	142.03	89.12	1.40	34.19	1.11	0.67	23.14
Variance	14601.05	6455906.17	20173.76	7942.41	1.97	1169.11	1.23	0.45	535.66
CV	72.61	54.49	69.26	69.93	72.46	102.27	57.76	85.15	63.65

O.M.: Organic matter, StdS: Standart deviation, CV: Coefficient of variation

The soil reactions of the soils investigated in the study were determined to vary between 5.23-7.84 (Table 1). According to the limit values reported by Ülgen and Yurtsever (1995), it is observed that 24% of the soil samples had a slightly alkali, 40% had a neutral, 34% had a slightly acidic, and 2% had a medium acidic reaction (Table 2). As it can be observed from Table 3, the pH value of soils had a significant positive correlation with EC (r= 0.287*), lime (r= 0.433*), and extractable Ca (r= 0.460**), and a significant negative correlation with organic matter (r= -0.325*), extractable Fe (r= -0.651**), and Mn (r= -0.575**). The results related to the pH-Fe correlation were observed to be consistent with the results obtained by Çimrin and Boysan (2006). In addition, the results related to the pH-Mn correlation were also detected as consistent with the results of some researches such as Demirer *et al.* (2003), Parlak *et al.* (2008), and Günal and Erdem (2015). Moreover, Demirer *et al.* (2003) and Parlak *et al.* (2008) found a significant positive correlation between the soil pH and lime content (r= 0.52** and r= 0.55**, respectively).

Table 2. Classification of rangeland soils in terms of basic fertility parameters and some macroelements.

Soil property	Limit value	Evaluation	Number of samples	%
Texture Classes (%)		Clay (C)	10	20
		Clayey Loam (CL)	27	54
		Loam (L)	4	8
		Sandy clayey loam (SCL)	3	6
		Silty loam (SiL)	2	4
		Sandy loam (SL)	4	8
pH	<4.5	Strongly acidic	---	---
	4.5-5.5	Moderately acidic	1	2
	5.5-6.5	Slightly acidic	17	34
	6.5-7.5	Neutral	20	40
	7.5-8.5	Slightly alkali	12	24
	>8.5	Strongly alkali	---	---
EC (dS m^{-1})	0-4	Salt-free	50	100
	4-8	Slightly salty	---	---
	8-15	Moderately salty	---	---
	>15	Very salty	---	---
$CaCO_3$ (%)	<1.0	Slightly calcareous	33	66
	1.0-5.0	Calcareous	7	14
	5.0-15.0	Moderately calcareous	6	12
	15.0-25.0	Much calcareous	3	6
	>25.0	Too much calcareous	1	2
Organic matter (%)	<1.0	Very low	---	---
	1.0-2.0	Low	8	16
	2.0-3.0	Medium	23	46
	3.0-4.0	Good	12	24
	>4.0	High	7	14
Available P (kg P_2O_5 da^{-1})	0-3	Very low	19	38
	3-6	Low	16	32
	6-9	Medium	9	18
	9-12	High	1	2
	>12	Very high	5	10
Total N (%)	<0.045	Very low	---	---
	0.045-0.090	Low	4	8
	0.090-0.170	Sufficient	24	48
	0.170-0.320	High	17	34
	>0.320	Very high	5	10
Extractable K (mg kg^{-1})	<100	Very low	19	38
	100-150	Low	8	16
	150-200	Medium	5	10
	200-250	Good	11	22
	250-320	High	2	4
	>320	Very high	5	10
Extractable Ca (mg kg^{-1})	<714	Very poor	2	4
	714-1430	Poor	---	---
	1430-2860	Medium	12	24
	>2860	Good	36	72
Extractable Mg (mg kg^{-1})	<54	Poor	2	4
	54-115	Medium	11	22
	>115	Good	37	74
Extractable Na (mg kg^{-1})	<34	Very low	---	---
	34-68	Low	11	22
	68-230	Medium	33	66
	230-460	High	5	10
	>460	Very high	1	2

The EC values of the investigated soils ranged from 0.194 to 0.963 dS m^{-1} (Table 1), and all samples were determined to be in the salt-free class according to the classification reported by Richards (1954) (Table 2). Significant positive correlations were found between the EC value of soils and available P (r= 0.411**), total N (r= 0.430^{**}), extractable Cu (r= 0.374^{**}), and Zn (r= 0.368^{**}) contents (Table 3). The results obtained in terms of the EC-Cu correlation were determined to be consistent with the results acquired by Parlak *et al.* (2008).

It was determined that the lime content of the soil samples taken from rangelands varied between 0.08-41.32% (Table 1). As it can be seen in Table 2, according to the classification reported by Ülgen and Yurtsever (1995), the soils were distributed between slightly and highly calcareous in terms of lime content, 66% of the soils were determined to be slightly calcareous, 14% calcareous, 12% moderately calcareous, 6% much calcareous, and 2% too much calcareous. In the studies conducted in Samsun rangelands, Erel *et al.* (2010) reported that the lime content of the rangeland soil of the Minöz Basin in Kavak district was 3.98%, and Şahinoğlu (2010) reported that the lime content of the Koşuköyü rangeland soil in Bafra district was slightly calcareous. When Table 3 was examined, significant positive correlations between the lime content of soils and extractable Ca (r= 0.288^{*}) and significant negative correlations between the lime content and extractable Fe (r= -0.314^{*}) were determined. The results obtained in terms of the lime-Ca content were determined to be consistent with the results obtained by Parlak *et al.* (2008).

According to the results obtained from the study, the organic matter contents of the rangeland soils in the central and western parts of Samsun province were determined to range between 1.23-8.16% (Table 1), and the analyzed soil samples were classified in terms of organic matter content according to the classification reported by Ülgen and Yurtsever (1995). Accordingly, the organic matter content in 16% of the soils was low, in 46% medium, in 24% good, and in 14%, it was high (Table 2). In the studies carried out in the region, the organic matter contents of rangeland soils were determined to be low (Erel *et al.* 2010, Şahinoğlu 2010). The organic matter content of rangeland soils had a significant positive correlation with total N (r= 0.749^{**}), extractable Fe (r= 0.493^{**}), Zn (r= 0.467^{**}), and Mn (r= 0.313^{*}) (Table 3). The results obtained in terms of organic matter-Fe and organic matter-Mn were determined to be consistent with the results obtained by Parlak *et al.* (2008).

The available P content of the investigated soils was determined to range between 0.2-38.5 kg P_2O_5 da^{-1} (Table 1). When soils were classified in terms of phosphorus content according to Ülgen and Yurtsever (1995), it was observed that 70% of the soils contained very low and low, 18% contained medium, and 12% contained high and very high levels of phosphorus (Table 2). According to these results, most of the rangelands can be said to be insufficient in terms of available P. In the studies conducted in different/similar ecologies (Şahinoğlu 2010, Çomaklı *et al.* 2012, Ağın and Kökten 2013, Taşdemir 2015), the available P contents of rangeland soils were found to be insufficient as in the results of our study. On the other hand, significant positive correlations were determined between the extractable P contents of the soils and extractable Zn (r= 0.336^{*}) (Table 3).

The total N contents of rangeland soils ranged from 0.071 to 0.479% (Table 1). As shown in Table 2, as a result of the classification of the total N contents of the investigated soils according to FAO (1990), most of the soils were found to be at sufficient-very high levels in terms of N. Significant positive correlations were detected between the total N contents of the soil samples and extractable Fe (r= 0.401^{**}) and Zn (r= 0.456^{**}) (Table 3).

The extractable K content of the analyzed soil samples is observed to range between 29-612 mg kg^{-1} (Table 1). In the classification performed according to Pizer (1967), it was determined that the extractable K contents of rangeland soils were distributed at "very low" and "very high" levels, and 54% of the soil samples contained very low and low, 10% contained medium, and 36% contained good, high, and very high levels of K (Table 2). As can be observed from Table 3, significant positive correlations were determined between the extractable K content of the soils and extractable Ca (r= 0.287^{*}) and Mg (r= 0.414^{**}). The results obtained in terms of K-Ca were determined to be consistent with the results obtained by Parlak *et al.* (2008).

Table 3. Correlation coefficients between the investigated soil properties of the study area (r).

	Sand	Clay	Silt	pH	EC	Lime	OM	P	N	K	Ca	Mg	Na	B	Fe	Cu	Zn
Clay	-0.777^{**}																
Silt	-0.518^{**}	-0.136															
pH	-0.316^{*}	0.413^{**}	-0.063														
EC	-0.134	0.031	0.169	0.287^{*}													
Lime	-0.227	0.155	0.146	0.433^{**}	0.239												
OM	0.075	-0.236	0.203	-0.325^{*}	0.273	-0.231											
P	-0.086	0.031	0.093	0.236	0.411^{**}	-0.023	0.223										
N	0.037	-0.110	0.092	-0.193	0.430^{**}	-0.156	0.749^{**}	0.192									
K	-0.068	0.117	-0.053	0.124	-0.051	0.154	-0.048	-0.153	0.068								
Ca	-0.513^{**}	0.580^{**}	0.019	0.460^{**}	0.101	0.288^{*}	-0.256	0.023	-0.244	0.287^{*}							
Mg	-0.270	0.388^{**}	-0.102	0.156	-0.096	0.079	-0.187	-0.082	-0.079	0.414^{**}	0.295^{*}						
Na	-0.089	0.173	-0.096	0.256	0.075	0.145	-0.249	-0.067	0.055	0.160	0.058	0.252					
B	0.038	0.001	-0.061	0.016	-0.241	-0.152	-0.231	0.066	-0.168	-0.155	-0.122	-0.132	-0.343^{*}				
Fe	0.362^{**}	-0.493^{**}	0.099	-0.651^{**}	-0.001	-0.314^{*}	0.493^{**}	-0.121	0.401^{**}	0.016	-0.451^{**}	-0.022	-0.117	-0.024			
Cu	-0.298^{*}	0.356^{*}	-0.015	0.126	0.374^{**}	-0.010	0.194	0.102	0.247	0.051	0.198	0.028	-0.031	0.097	0.012		
Zn	0.180	-0.112	-0.132	0.003	0.368^{**}	-0.140	0.467^{**}	0.336^{*}	0.456^{**}	0.016	-0.082	-0.124	-0.207	0.185	0.224	0.629^{**}	
Mn	0.175	-0.006	-0.267	-0.575^{**}	0.063	-0.254	0.313^{*}	-0.042	0.225	-0.138	-0.061	-0.156	-0.161	-0.146	0.303^{*}	0.203	0.221

As can be observed from Table 1, the extractable Ca and Mg contents of the soils vary between 322-10590 mg kg^{-1} and 39-698 mg kg^{-1}, respectively. As a result of the classification performed according to Loue (1968), the majority of the investigated agricultural areas were found to be at good levels in terms of extractable Ca and Mg (Table 2). The extractable Ca content of the soils was detected to be significantly positively correlated with extractable Mg (r= 0.295^{*}) and to be significantly negatively correlated with extractable Fe (r= -0.451^{**}) (Table 3). The results obtained in terms of Ca-Mg were determined to be consistent with the results obtained by Parlak *et al.* (2008).

The extractable Na content of the study area soils was determined to range between 36-466 mg kg^{-1} (Table 1). In the classification of the examined rangeland soils performed according to Loue (1968), it was determined that 22% of the soils contained low, 66% contained medium, 10% contained high, and 2% contained very high levels of extractable Na (Table 2). Significant negative correlations were detected between the extractable Na values of the soils and extractable B (r= -0.343^{*}) (Table 3).

The extractable B contents of the soils varied between 0.16-6.70 mg kg^{-1} (Table 1). In the classification performed according to Wolf (1971), it was determined that 32% of the soil samples contained very low and low levels of boron, 42% contained sufficient, 24% contained high, and 2% contained very high levels of extractable B (Table 4).

The extractable Fe, Cu, Zn, and Mn contents of the soils were determined to range between 3.69-146.96, 0.54-6.18, 0.16-3.41, and 10.97-103.11 mg kg^{-1}, respectively (Table 1). According to the limit values reported by Lindsay and Norvell (1969), the majority of the extractable Fe contents of the rangeland soils were determined to be sufficient, and in terms of extractable Cu, all of the analyzed samples were determined to be at a sufficient level according to Lindsay and Norvell (1978). According to the limit values stated by FAO (1990), it was detected that in terms of extractable Zn, 56% of the samples were at a low and very low, 44% were at a sufficient and high level, and that, in terms of extractable Mn, 4% of the samples were at a low, and 96% were at a sufficient and high level (Table 4). As a result of the performed correlation analyses, significant positive correlations were determined between extractable Fe and extractable Mn (r= 0.303^{*}), extractable Cu and extractable Zn (r= 0.629^{**}) (Table 3). The results obtained in terms of Zn-Cu and Fe-Mn were determined to be consistent with the results acquired by Parlak *et al.* (2008).

Table 4. Classification of rangeland soils in terms of some microelements

Soil property	Limit value	Evaluation	Number of samples	%
Extractable B ($mg\ kg^{-1}$)	<0.50	Very low	6	12
	0.50-0.99	Low	10	20
	1.00-2.49	Sufficient	21	42
	2.50-4.99	High	12	24
	>5.00	Very High	1	2
Extractable Fe ($mg\ kg^{-1}$)	<2.5	Deficient (little)	---	---
	2.5-4.5	May show a deficiency (moderate)	1	2
	>4.5	Good (high)	49	98

Extractable Cu	<0.2	Insufficient	---	---
(mg kg^{-1})	>0.2	Sufficient	50	100
	<0.2	Very low	3	6
Extractable Zn	0.2-0.7	Low	25	50
(mg kg^{-1})	0.7-2.4	Sufficient	20	40
	2.4-8.0	High	2	4
	>8.0	Very High	---	---
	<4	Very low	---	---
Extractable Mn	4-14	Low	2	4
(mg kg^{-1})	14-50	Sufficient	38	76
	50-170	High	10	20
	>170	Very High	---	---

CONCLUSIONS

Considering that rangelands produce balanced and high-quality feed in terms of animal feeding, it is desirable that rangeland areas, as other cultural areas, have a high level of soil fertility. In the rangelands investigated in the study, especially considering that the available phosphorus, potassium, zinc, and lime contents that can be absorbed by plants are low, it is of great importance to improve rangeland soils in terms of these properties with rehabilitation programs to be applied. Therefore, during the planning stage of rangeland rehabilitation works, it is recommended to include deficient plant nutrients in fertilization works, which is one of the most effective rehabilitation methods in rangeland areas and can also be effective in the production of abundant and high-quality feed in rainy regions such as Samsun.

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REFERENCES

Ağın Ö and Kökten K (2013). Research on the botanical composition of a range in Karapolat village, Yedisu-Bingöl. Turkish Journal of Nature and Science, 2(1): 41-45. (In Turkish).

Ayan İ, Mut H, Acar Z, Başaran U, Töngel MÖ and Önal Aşcı Ö (2007). Vegetation, soil properties, and some problems of the floodplain rangelands located in the coastal area of Samsun province. Turkey VII. Field Crops Congress, Erzurum, Turkey, pp. 54-57. (In Turkish).

Bouyoucos GJ (1951). A Recalibration of the hydrometer method for making mechanical analysis of soil. Agronomy Journal, 43: 434-438.

Bray RH and Kurtz LT (1945). Determination of total, organic, and available forms of phosphorus in soils. Soil Sci., 59: 39-45.

Çağlar KÖ (1949). Soil Knowledge. Ankara University, Agriculture Faculty Publication No: 10. (In Turkish).

Çimrin KM and Boysan S (2006). Nutrient status of Van agricultural soils and their relationships with some soil properties. J. Agric. Sci., 16: 105-111. (In Turkish).

Çomaklı B, Fayetörbay D and Daşçı M (2012). Changing of botanical composition and canopy coverage ratio in rangelands at different altitudes. Atatürk University Journal of the Faculty of Agriculture, 43(1): 17-21.

Demirer T, Kaleli Ş and Öztokat Kuzucu C (2003). A study to determine fertility status in the Çanakkale-Lapseki agricultural areas, Turkey. Journal of Arid Environments, 54: 485-493.

Erel A, Gülser C and Özyazıcı MA (2010). Effects of different pasture amelioration methods on some soil properties in Minoz Creek Basin. Anadolu J. Agric. Sci., 25(S-1): 42-47.

FAO (1990). Micronutrient, Assessment at the Country Level: An International Study. FAO, Soils Bulletin by Mikko Sillanpaa, Rome.

Günal E and Erdem H (2015). Spatial variation of DTPA extractable iron, copper, zinc and manganese concentrations in Suluova and Merzifon plain soils. Soil-Water Journal, 4(2): 1-13. (In Turkish).

Jackson ML (1958). Soil Chemical Analysis, Prentice-Hall, Inc. Englewood Cliffs, N.J.

Karagüllü O and Kendüzler M (2008). CORINE Classification Report. Forest General Directory, Ankara-Turkey. (In Turkish).

Lindsay WL and Norvell WA (1969). Development of a DTPA Micronutrient Soil Test. Soil Sci. Am. Proc., 35: 600-602.

Lindsay WL and Norvell WA (1978). Development of a DTPA Soil Test For Zinc, Iron, Manganese and Copper. Soil Sci. Soc. Am. J., 42(3): 421-428.

Loue AT (1968). Diagnostic Petiolaire des Prospectian Etudes sur la Nutrition at la Fertilization Potassiques de la Vigne. Societe Commerciale des Potasses d'Alsace. Services Agronomiques, 31-41.

Methods of Soil Analysis (1982). Methods of Soil Analysis-Part II. Chemical and Microbiological Properties, Agronomy Monograph No:9: 323-336, ASA-SSSA, Madison, Wisconsin, USA.

Nelson DW and Sommers LE (1982). Total Carbon, Organic Carbon, Organic Matter. In: AL Madison, Editor. Methods of Soil Analysis Part 2. Chemical and Microbiological Properties Second Edition. Wisconsin, USA: American Society of Agronomy Inc. pp. 539-579.

Olsen SR, Cole CV, Watanabe FS and Dean LA (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circular Nr 939, US Gov. Print. Office, Washington, D.C.

Parlak M, Fidan A, Kızılcık İ and Koparan H (2008). Determination of the fertility status of Eceabat-Çanakkale agricultural soils. Journal of Agricultural Sciences, 14(4): 394-400. (In Turkish).

Pizer NH (1967). Some Advisory Aspect. Soil Potassium and Magnesium. Tech. Bull. No.14:184.

Richards LA (1954). Diagnosis and Improvement Saline and Alkaline Soils. U.S. Dep. Agr. Handbook 60.

Sağlam MT (1978). Soil Chemistry Application Notes. Atatürk University, Faculty of Agriculture, Department of Soil, Erzurum-Turkey. (In Turkish).

Soil Survey Staff (1951). Soil Survey Manuel, Agricultural Research Administration U.S. Dept.of Agriculture Handbook. No.18, Gount Point Office Washington, p. 340-377.

Soil Survey Staff (1992). Procedures for collecting soil samples and methods of analysis for soil survey. Soil Survey Invest. Rep. I. U.S. Gov. Print. Office, Washington D.C.

Şahinoğlu O (2010). The effect of different improvement methods applied on rangeland in Koşu Village of Bafra on the hay yield, hay quality and botanical composition. PhD Thesis, Ondokuz Mayıs University Graduate School of Natural and Applied Sciences, Samsun-Turkey. (In Turkish).

Taşdemir V (2015). Research on the hay yield and botanical composition of a range in Bahcecik Village, Karakocan-Elazig. Master Thesis, Bingöl University, Graduate School of Natural and Applied Sciences, Bingöl-Turkey. (In Turkish).

TÜİK (2019). Basic Statistics, Agricultural Fields. Turkish Statistical Institute (TÜİK), http://www.tuik.gov.tr/UstMenu.do?metod= temelist (Date accessed: 25.10.2019).

Ülgen N and Yurtsever N (1995). Turkey: Fertilizer and Fertilizing Guide (4th Edition). Soil and Fertilizer Research Institute Publications, No: 209, Technical Publications No: T.66, 230p, Ankara-Turkey. (In Turkish).

Wolf B (1971). The Determination of Boron Soil Extracts, Plant Materials, Composts, Manuresi Water and Nutrient Solutions Soil Sci. and Plant Anal., 2(5): 363-374.

Zengin M, Tolay İ, Ocakoğlu F, Açıkalın S and Kır O (2012). Fertility status of agricultural and pasture soil affected by wind erosion in Central Anatolia. Selcuk Journal of Agriculture and Food Sciences, 26(1): 60-69. (In Turkish).