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Classification of Grey-Cinnamon (Chestnut) Soils with Nutrient Source of the Shamkirchay Reservoir and Analysis of Morphogenetic Diagnostic Indices

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Abstract

The mountain grey-cinnamon (chestnut) soils which are irrigated by the Shamkirchay water reservoir is formed mainly on the foothill, plain and partly on the mountainousborders and orographically on the northern east slope of the Little Caucasus are situated between $40^0 39^/$ - $41^0 00^/$ north latitude and $45^0 50^/$ - $46^0 20^/$ east longitude. The classification of mountain grey-cinnamon soils in the zone with 54263,74 ha on subtypes and analysis of the morphogenetic diagnostic indices has been given in the article. 7 subtypes of mountain grey-cinnamon soils are formed in the zone: separate morphological description of each subtype was analyzed in the article. At the same time, a modern state of the main physicochemical and fertility indices of the soils in the basin zone and information about the researches performed in the soils inside of the Shamkir, Goy-gol and Samukh borders have been presented. The diagnostic indices of the soil sections in the characteristic places, morphological description and agrochemical features of the soil profiles on subtypes and their analysis result were explanatory analyzed. Humus, total nitrogen, phosphorus and potassium, granulometric composition (sand, dust, silt and clay fractions) environment reaction of soil (pH) and calcareous ($CaCO_3$) were fixed, statistically analyzed.

Keywords: water reservoir, canal, agro-ecological evolution, mountain grey-cinnamon (chestnut), humus layer.

Introduction

One of the most global problems of the XXI century is protection of the environment, including soil cover. Though the man plays a main role in nature-human-nature relations, it directly and indirectly depends on nature. Air, water, material blessings, natural resources, raw materials for industry are important

blessings which are presented to the man by the nature. Recently, the environment has been subjected to anthropogenic change. The high development of the modern scientific-technical progress deepened this process (Babayev *et al.*, 2011a; Babayev *et al.*, 2011; Sadig & Mammadov, 2018; Sadigov, 2013; Sadigov, 2018b).

The zones which are irrigated by the Shamkirchay water reservoir developed historically as a farming zone. Here 6 soil types and 12 subtypes are formed in the zone with 72279,34 ha. The information about mountain grey-cinnamon (chestnut) soils (54263,74 ha) is given in the article.

The zone of mountain grey-cinnamon (chestnut) soils on subtypes is given in hectare scale on the first table. The mostly spreading subtype is ordinary grey-cinnamon (chestnut) soils which form 17063,25 ha, but the lastly spreading subtype is fully undeveloped mountain grey-cinnamon (chestnut) soil with 4480,47 ha. The soils analyzed are presented with blue color on Table 1 in the article (Sadig & Mammadov, 2018; Sadigov, 2013; Sadigov, 2018a).

Mountain grey-cinnamon soils spread at 200-600 meter height from sea level in the research zone. Here the vegetation mat grass-tipsak different grassy plants and wormwood-ephemera-grain plants spread in dry steppes. The soil forming rocks are lime-stones, lime-stony conglomerates, tuffaceous breccia and their soft weathering products.

The winter of the zone is dry, but the summer is subtropical climatic. The days with the temperatures above 10^0 C are 210-240, but the days with the temperatures above 5^0 C are 240-270.

Generally, mountain grey-cinnoman soils cover 75,07 % of the research zone. Before us, study of the soil cover of the Little Caucasus was performed by V.V.Dochucaev, M.M.Sibirtsev, M.P.Babayev, V.H.Hasanov, Ch.M.Jafarova, H.M.Hajiyev, B.G.Shakuri, K.A.Alakbarov, V.R.Volobuev, M.E.Salaev, A.A.Ibrahimov, A.M.Shikhlinsky, A.N.Izyumov and other scientist (Babayev *et al.*, 2011; Ministr, 1972; Mammadov, 2007; Sadigov, 2013).

Table 1. Soil types and subtypes included in the Shamkirchay

№	Name of lands	Areas (ha)	
		On types	On subtypes
1.	Mountain cinnamon-meadow	725,77	
2.	Mountain-forest-cinnamon	2498,43	
3.	Mountain grey-cinnamon (chestnut)	54263,74	
3.1.	Fully undeveloped mountain grey-cinnamon (chestnut)		4480,47
3.2.	Anciently irrigated solonetzlike ordinary grey-		3912,56

	cinnamon (chestnut)		
3.3.	Irrigated mountain bright grey-cinnamon (chestnut)		7603,44
3.4.	Irrigated solonetzlike ordinary grey-cinnamon (chestnut)		17063,25
3.5.	Irrigated gazh mountain ordinary grey-cinnamon (chestnut)		5086,97
3.6.	Irrigated mountain ordinary grey-cinnamon (chestnut)		6299,59
3.7.	Anciently irrigated saline mountain ordinary grey-cinnamon (chestnut)		9817,46
4.	Mountain grey-cinnamon (chestnut) meadow	10522,55	
4.1.	Irrigated mountain grey-cinnamon (chestnut) meadow		10522,55
5.	Alluvial-meadow	683,96	
5.1.	Leached alluvial-meadow		546,44
5.2.	Weakly developed calcareous alluvial-meadow		137,52
6.	Alluvial-meadow-forest	558,75	
6.1.	Glayey-alluvial-meadow-forest		558,75
7.	Strong high gypsum fully developed clayey-salty rocks-soil-grounds	837,98	
8.	Cobblestone fine sediments of the riverbeds	2168,16	
Total		72279,34	

Material and methods

The material for the research was determined in 2 parts: theoretic and practical part. So, the result of the long complex researches about classifiation, nomenclature and diagnostics of soils in Azerbaijan has been analyzed in the theoretic part. The alalyses were performed in the soil section. On the basic of the modern methods used in the world experiment , the results were obtained in the practical part. The land map was compiled on the basis od ArcCIS program and the soil types and subtypes were concerned to the International Land Names (WRB). During the research, the soil horizons indexing was performed. The genetic indications of soils were adapted to the correlation with the main indices of Azerbaijan land classifications od WRB system (Soil groups).

The main aim of the research is an investigation on subtypes of the mountain grey-cinnoman soil type in which the Shamkirchay water reservoir is nutrient, study of the impact of natural and antropogenic factors, regulation of the fertility indices in these soils, adapting of morphogenetic diagnostics and soil subtypes nomenclature to modern classification.

Mountain grey-cinnamon soils with nutrient source of Shamkirchay reservoir

widely spread in 54263,74 ha in three districs (in Shamkir, Goy-gol, Samukh regions). Mountain grey-cinnamon soils in the same regions are taken as a research object. Anciently, irrigated solonetzlike mountain ordinary grey cinnamon (chestnut), irrigated solontzlike ordinary grey-cinnamon (chestnut), irrigated mountain bright grey-cinnamon (chestnut), irrigated gazh mountain ordinary grey-cinnamon (chestnut), irrigated mountain ordinary grey-cinnamon (chestnut), anciently irrigated saline mountain ordinary grey-cinnamon (chestnut) soils have been analyzed. Recently, there have been couple of analyses on some mountaninous zones such as irrigated solonetzlike mountain.

Table 2. Classification of mountain grey-cinnamon soils of WRB (Soil groups)

№	Name of soils	Clasification on WRB
1	Mountain grey-cinnamon (chestnut)	**Mgc**
1.1	Fully undeveloped mountain grey-cinnamon (chestnut)	Mgc^{fu}
1.2	Anciently irrigated solonetzlike ordinary grey-cinnamon (chestnut)	$Mgc^{ai.slo}$
1.3	Irrigated mountain bright grey-cinnamon (chestnut)	Mgc_1^{ib}
1.4	Irrigated solonetzlike ordinary grey-cinnamon (chestnut)	$Mgc_2^{i.sl}$
1.5	Irrigated gazh mountain ordinary grey-cinnamon (chestnut)	Mgc_2^{i}
1.6	Irrigated mountain ordinary grey-cinnamon (chestnut)	Mgc_2^{i}
1.7	Anciently irrigated saline mountain ordinary grey-cinnamon (chestnut)	$Mgc_2^{a.is}$

The researches were conducted in mountain grey-cinnamon (chestnut) soils on certain routes in 2015-2020. The sections were applied in the characteristic places (definition on geigraphical coordinates). The soil section was taken from characteristic places (one soil section on each subtype). It's density, granulometric composition, colour, structure, hardness and some morphological indications were registered. The geographical coordinates of the taken soil samples were defined by "Garmin GPS map 62s" apparatus. The taken soil was given to the laboratory of "Agroecology and Bonitation of Soils" in the Istitute of Soil Science and Agrochemstry of ANAS for physicochemical analyses and the required prosedures were realized on the basis of the adopted methods (AZS ISO, 2013; Ministry, 1972; Mammadov, 2007; Sadigov, 2016).

During the field researches, the total humus was investigated by I.M.Turin's method, total nitrogen-by Keildal and carbonates-by Calcimeter apparatus. In the form of $CaCO_3$, was analyzed by the titration method, total phosporius (P) and total potassium (K) by ICP-MS (agilent) apparatus, granulometric composition from one leading factors was analyzed by N.A.Kaachinsky's method. To define the absorbing ability, the absorbed cations were fixed by D.Ivanov's method, hygroscopic hymidity-by thermal method (soil is dried at $0,5^0$ temperature), the environment reaction of soil was fixed by pH meter (in 1:5 ratio) in water solution, ammoniac absorbed from nitrogen forms by Konvey, ammoniac solving in water by Nesler, nitrates by Grandal-lian method. The accuracy of the results was specified by the mathematic statistic (V.A.Dospekhov) method (Mammadov, 2007; Sadigov, 2016).

Results

One of the important problems is an investigation of mountain grey-cinnamon soils with nutriens source of New Shamkirchay reservoir. The mountain grey-cinnoman soils were attracted to the agricultural circulation since ancient times and it is in use today.

The sections in the characteristic places are concerned with the "Antropogenic changed soils class". Studying the water and air regime in such types of soil, controling the change of biological activity, defining formation of the cultured layer, observing the agroirrigation horizons formation in the profile and other investigation problems were performed.

The research zone concerned the "accumulative carbonate section" from the viewpoint of the section and types character of soil. Here, the soils used in agriculture were formed in sinceancient times. During periods of flood and abundent water, the river debris are rich in salts in some zones and nutrient on the upper layers of soils in the zones which were irrigated with muddy water of the Shamkirchay since ancient times. The cultural soil forming process occurs under an impact of the river debris products on upper layers in 40-80 cm of density in these soils.

Generated morphological description of the mountain grey-cinnamon soils historically formed in the research zone was given below:

0-20 cm: is observed with density and hardnes of gazh layer. The thickest layer and richness of humus are aviable. The color is dark-cinnamon, porous. Air permeability is good. It has small heaplike structure. It is medium clayey, moist

and rich in root and rootlets of plant, the insect ways activate, air and water conductivity. The soil fissures is clearly noticed. It is clearly transitional and boils under an influence of HCl. Depth of carbonate layer is slightly noticed.

20-50 cm: color is brownish, brown-cinnamon, large granular structural, porous. It is medium clayey, strong miost, plant roots, insect ways are slightly observed. The carbonate traces are clearly noticed in the soil. The large cracks are observed. It is clearly transitional and boils under an influence of HCl. Depth on carbonate layer is clearly noticed.

50-100 cm: color is bright cinnamon, humus layer is slightly noticed. It is heavy clayey, granular structural, hard, little moist, gradual transitional. It has separate tree and plant roots, and doesn't boil under an impact of HCl. Depth of carbonate layer is clearly noticed.

The diagnostic indices have been analyzed in order to define fertility parameters of soils spreading in the zone. The analyses are explanatory described on Table 3.

The list of the sections applied in the characteristic places on subtypes of mountain grey-cinnamon soils aviable in the research area is given on Table 4.

It is clear from morphological description of different soil section applied in the research area of a result of the performed field-soil and cameral laboratorial researches that there are differences between AU_a-density of humus layer, a quantity of nitrogen by percentage, formation B_{ca}-layer with illuvial calcareous, depth and hardness, their structural-aggregates, granulometric composition, hydroscopic humidity and other morpho-diagnostic indications in different formations and farming areas.

In Table 3, the section concerning the fully undevoloped mountain grey-cinnamon (chestnut) soil subtype, an analysis of diagnostic indices of the 19^{th} section fertility parameters was analyzed. The section was fixed on geographic coordinates. X ccordinate (the east lenght) of the 19^{th} section was fixed 46^0 $3^{/}$ $53{,}690^{//}$ E, but Y coordinate (the north width) was fixed at 40^0 $43^{/}$ $28{,}922^{//}$ N (Table 4). These soils spread in 4480,47 ha area (Table 1). The humus layer density is 4,09-1,30 % along the profile in these soils. Nitrogen is 0,291-0,161 % according to humus. Hygroscopic humidity is 7,45-4,72 %, CO_2 % 18,48-7,82 %, $CaCO_3$ 14,02-7,82 % due to CO_2, a sum of absorbed bases is 40,42-29,97 mg-ekv, pH vibrates by 7,0-8,1. In granulometric composition of subtype, the percentage quantity less than <0,001 mm is 28,07-32,96 %, but the percentage amount less than <0,01 mm is 56,76-65,13 %. It is clear from the granulometric analysis that these soils are mainly medium and heavy clayey.

Table 3. Analysis of the diagnostic indices analyzed of fertility parameters in the sections applied on mountain grey-cinnamon soil subtypes in the characteristic places

№ section	Depth, cm	Humus %	Nitrogen %	Hygroscopic humidity	CO_2 %	$CaCO_3$ % due CO_2	SAB, mg-ekv	pH	Granulometric composition, %		Dry residue
									<0,001 mm	<0,01 mm	
Fully undeveloped mountain grey-cinnamon (chestnut)											
19	AU_a 0-17	4,09	0,291	5.83	7,82	7,82	40.39	7,2	29.65	61.90	-----
	A/B 17-48	2,53	0,193	6.01	17,76	13,41	40.13	7,0	28.07	62.53	0,1042
	B_{ca} 48-72	2,01	0,161	7.45	11,58	-----	40.42	7,3	32.96	65.13	0,1132
	B/C 72-99	1,30	Not.an	5.66	18,48	14,02	31,24	7,8	30.17	58.08	0,1138
	C 99-132	Not.an	-----	4.72	16,93	13,40	29,97	8,1	28.41	56.76	0,1154
Anciently irrigated solonetzlike ordinary grey-cinnamon (chestnut)											
92	AU_a 0-20	4,63	0,324	6.85	12,94	12,94	36.44	7,4	30.39	59.55	0.1025
	A/B 20-42	3,47	0,252	7.03	12,02	12,38	34.63	7,4	29.20	61.92	0.1278
	B_{ca} 42-62	1,96	0,157	6.61	12,54	14,03	33.41	7,6	26.44	62.55	0.1837
	B/C 62-101	1,13	Not.an	6.69	11,35	13,92	28.12	7,8	25.65	65.15	0.2106
	C 101-132	Not.an	-----	5.71	13,36	12,49	30.84	8,0	25.75	58.05	0.2371
Irrigated mountain bright grey-cinnamon (chestnut)											
81	AU_a 0-25	4.84	0.338	6.97	12,55	12,55	30.78	7,1	26.60	61.12	0.1006
	A/B 25-52	3.53	0.256	6.57	16,71	15,34	31.80	7,0	25.23	63.57	0.1082
	B_{ta} 52-86	2.28	0.171	6.95	12,04	11,91	29.06	7,3	26.39	68.82	0.1429
	B/C 86-110	2.00	0,160	7.53	15,86	-----	28,75	7,5	27.72	69.19	0.1487
	C 110-135	1.60	0.135	5.52	13,05	10,69	Not.an	7,9	28.55	64.62	0.2011

Irrigated solonetzlike ordinary grey-cinnamon (chestnut)											
48	AU_a 0-29	3.47	0,252	5.83	11,96	11,96	37.69	7,6	26.52	57.28	-----
	A/B 29-50	3.09	0,228	6.01	19,08	17,23	37.41	7,8	25.71	54.89	------
	B_t 50-78	2.45	0,188	7.01	21,36	-----	35.36	7,7	27.19	56.98	0,0526
	B/C 78-100	1.45	0,126	5.60	21,36	18,76	39.56	7,9	26.93	60.15	0,1247
	C 100-140	Not.an	-----	5.83	18,49	20,63	38.20	8,2	30.50	62.16	0,1768
Irrigated gazh mountain ordinary grey-cinnamon (chestnut)											
102	AU_a 0-19	2.12	0.167	7.87	16,42	16,42	41.05	7,3	26.03	56.40	-----
	A/B 19-50	1.96	0.157	7.08	18,67	17,30	34.48	7,1	25.71	55.73	-----
	B_t 50-73	1.54	0.131	6.83	12,99	14,71	31.21	7,3	27.13	58.62	-----
	B/C 73-110	1.22	Not.an	7.07	12,99	-----	29.33	7,6	25.43	61.71	0,2647
	C 110-155	0.73	-----	6.94	17,28	15,85	35.84	7,8	28.57	59.36	0,6974
Irrigated mountain ordinary grey-cinnamon (chestnut)											
61	AU_a 0-20	4.36	0,307	6.97	8,12	8,12	34.08	7,0	27.99	55.47	-----
	A/B 20-39	3.53	0,253	6.57	7,93	9,77	35.80	7,1	26.48	54.50	-----
	B_t 39-60	2.28	0,171	6.95	9,02	8,86	35.29	7,0	25.44	55.73	0,3597
	B/C 60-76	1.64	0,133	7.53	-----	5,56	30,94	7,4	24.56	57.98	0,9745
	C 76-98	0,98	Not.an	5.52	-----	4,71	32.63	7,6	26,84	61.22	0,1129
Anciently irrigated saline mountain ordinary grey-cinnamon (chestnut)											
76	AU_a 0-22	3.54	0,256	6.40	7,85	7,85	34.91	7,4	26.67	70.83	-----
	A/B 22-41	3.22	0,236	6.50	14,62	11,73	28.08	7,6	30.96	69.62	-----
	B_t 41-58	2.64	0,201	7.43	12,50	13,31	24.23	7,5	29.17	67.41	-----
	B/C 58-70	1.25	0,113	7.87	21,28	16,04	35.84	8,1	26.41	66.95	0,4597
	C 70-102	1,02	Not.an	8.04	23,09	18,59	38.63	8,3	25.53	71.11	0,1246

The analysis of diagnostic indices of the fertility parameters in the 92th section concerning the Anciently irrigated solonetzlike mountain ordinary grey-cinnamon (chestnut) soil subtype was performed (Table 3). These soils are 3912,56 ha in the research zone (Table 1). The cut was fixed on geographical coordinates. X coordinate of the Section 92 (the east lenght) is at 46^0 $17^/$ $3{,}536^{//}$ E, Y coordinate (the north width) is at 40^0 $48^/$ $6{,}586^{//}$ N (Table 4). In Anciently irrigated solonetzlike mountain ordinary grey-cinnamon (chestnut) soils, the humus layer density along the profile is 4,63-1,13 %. According to humus nitrogen is 0,324-0,157 %. Hygroscopic humidity is 7,03-5,71 %, 11,35-13,36 % with CO_2, $CaCO_3$ is 12,38-14,03 % with CO_2, a sum of absorbed bases is 36,44-28,12 mg-ekv, pH 7,4-8,0. The percentage quantity less than <0,001 mm is 25,65-30,39 %, the percentage amount less than <0,01 mm is 58,05-65,15 %. It is clear from granulometric analysis that these soils are medium and heavy clayey (Table 3).

The analysis of diagnostic indices of the fertility parameters in the 81th section concerning the irrigated mountain bright grey-cinnamon (chestnut) soil subtype was also conducted (Table 3). These soils are 7603,44 ha in the research zone (Table 1). The cut was fixed on geographical coordinates. X coordinate of the Section 81 (the east lenght) is at 46^0 $12^/$ $35{,}697^{//}$ E, Y coordinate (the north width) is at 40^0 $53^/$ $25{,}626^{//}$ N (Table 4). In irrigated mountain bright grey-cinnamon (chestnut) soils, the humus layer density along the profile is 4,84-1,60 %. According to humus nitrogen is 0,338-0,135 %. Hygroscopic humidity is 7,53-5,52 %, 16,71-12,04 % with CO_2, $CaCO_3$ is 15,34-10,69 %, with CO_2, a sum of absorbed bases is 31,80-28,75 mg-ekv, pH 7,0-7,9. The percentage quantity less than <0,001 mm is 28,55-25,23 %, the percentage amount less than <0,01 mm is 61,12-69,19 %. It is clear from granulometric analysis that these soils are medium and heavy clayey (Table 3).

Irrigated solontzlike mountain ordinary grey-cinnamon (chestnut) soils

The analysis of the diagnostic indices of section 48 fertility parameters, due to this soil subtype, was analyzed. These soils spread in 17063,25 ha zone (Table 1). The section is fixed on geographical coordinates. X coordinate of the Section 48 (the east lenght) is at 46^0 $16^/$ $5{,}315^{//}$E, Y coordinate (the north width) is at 40^0 $45^/$ $12{,}766^{//}$ N (Table 4). The humus layer density along the profile is 3,47-1,45 %. Nitrogen corresponding to humus is 0,252-0,126 % in these soils. Hygroscopic moisture is 7,01-5,60 %. 21,36-11,96 % with CO_2, $CaCO_3$ is 20,63-11,96 %, due to CO_2, a sum of absorbed bases is 39,56-35,36 mg-ekv, pH is 7,6-8,2. The percentage quantity less than <0,001 mm is 25,71-30,50 %, the percentage amount less than <0,01 mm is 54,89-62,16 %. It was clear that these soils are medium and

heavy clayey. Through dry residue isn't observed on the upper layers but it is observed towards low layers (Table 3).

The analysis of the diagnostic indices of section 102 fertility parameters concerning Irrigated gazh mountain ordinary grey-cinnamon (chestnut) soil subtype was analyzed. These soils spread in 5086,97 ha zone (Table 1). The section is fixed on geographical coordinates. X coordinate of the Section 102 (the east lenght) is at 45^0 56/ 2,709// E, Y coordinate (the north width) is at 40^0 57/ 14,711// N (Table 4). The humus layer density along the profile is 2,12-0,73 %. Corresponding to humus nitrogen is 0,167-0,131 % in these soils. Hygroscopic moisture is 7,87-6,83 %. 18,67-12,99 % with CO_2, $CaCO_3$ is 17,30-14,71 %, due to CO_2, a sum of absorbed bases (SAB) is 41,05-29,33 mg-ekv, pH is 7,1-7,8. The percentage quantity less than <0,001 mm is 25,43-28,57 %, the percentage amount less than <0,01 mm is 55,73-61,71 %. It was clear that these soils are medium and heavy clayey look like another soil subtypes. Through dry residue isn't observed on the upper layers but it is observed towards low layers, too (Table 3).

Table 4. List of the sections applied on mountain grey-cinnamon (chestnut) soil subtypes in the characteristic places (fixing on geographical coordinates)

№	Name of soil subtypes	Classification on WRB	Number of section	X coordinate (east lenght)	Y coordinate (north width)
Mountain grey-cinnamon (chestnut) (Mgc)					
1	Fully undeveloped mountain grey-cinnamon (chestnut)	Mgc^{fu}	Section 19	46^0 3/ 53,690// E	40^0 43/ 28,922// N
2	Anciently irrigated solonetzlike ordinary grey-cinnamon (chestnut)	$Mgc^{ai.slo}$	Section 92	46^0 17/ 3,536// E	40^0 48/ 6,586// N
3	Irrigated mountain bright grey-cinnamon (chestnut)	Mgc_1^{ib}	Section 81	46^0 12/ 35,697// E	40^0 53/ 25,626// N
4	Irrigated solonetzlike ordinary grey-cinnamon (chestnut)	$Mgc_2^{i.sl}$	Section 48	46^0 16/ 5,315// E	40^0 45/ 12,766// N
5	Irrigated gazh mountain ordinary grey-cinnamon (chestnut)	Mgc_2^{i}	Section 102	45^0 56/ 2,709// E	40^0 57/ 14,711// N
6	Irrigated mountain ordinary grey-cinnamon (chestnut)	Mgc_2^{i}	Section 61	46^0 0/ 10,346// E	40^0 51/ 51,172// N
7	Anciently irrigated saline mountain ordinary grey-cinnamon (chestnut)	$Mgc_2^{a.is}$	Section 76	46^0 11/ 24,947// E	40^0 49/ 25,428// N

Irrigated mountain ordinary grey-cinnamon (chestnut) soil subtype

The analysis of the diagnostic indices of section 61 fertility parameters concerning to this soil subtype was analyzed. These soils spread in 6299,59 ha zone (Table 1). The section is fixed on geographical coordinates. X coordinate of the Section 61 (the east lenght) is at 46^0 0/ 10,346// E, Y coordinate (the north width) is at 40^0 51/ 51,172// N (Table 4). The humus layer density along the profile is 4,36-0,98 %. Corresponding to humus nitrogen is 0,307-0,133 % in these soils. Hygroscopic humidity is 8,04-6,40 %. 9,02-7,93 % with CO_2, $CaCO_3$ is 9,77-4,71 %, due to CO_2, a sum of absorbed bases (SAB) is 35,80-30,94 mg-ekv, pH is 7,0-7,6. The percentage quantity less than <0,001 mm is 24,56-27,99 %, the percentage amount less than <0,01 mm is 54,50-61,22 %. It was clear from granulometric composition that these soils are medium and heavy clayey, too. Through dry residue isn't observed on the upper layers but it is observed towards low layers (Table 3).

Anciently irrigated saline mountain ordinary grey-cinnamon (chestnut) soil subtype

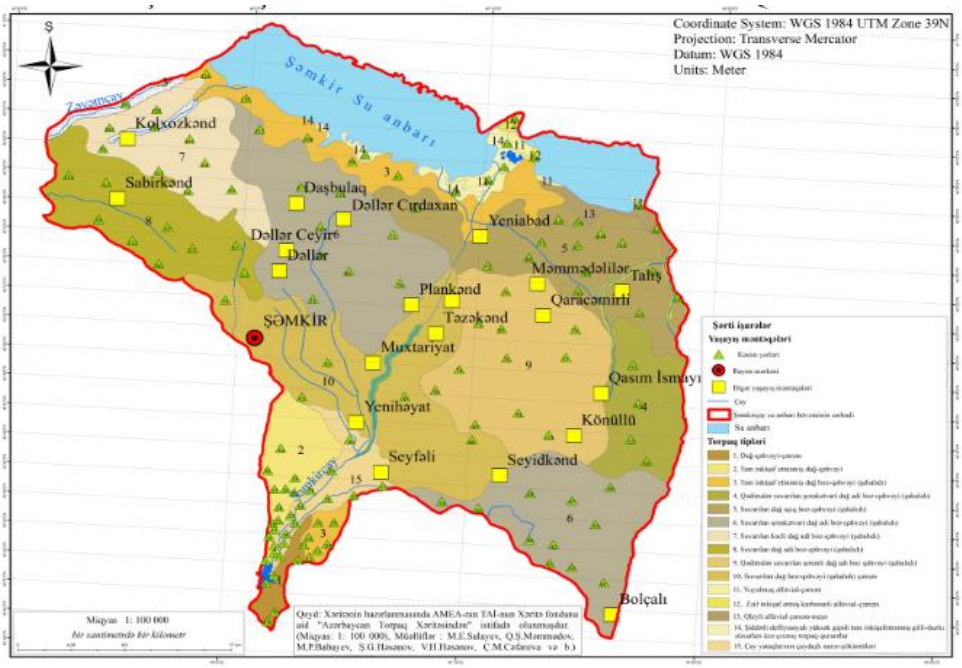

Figure 1. Sections applied in the characteristic places of mountain grey-cinnamon soils in the research zone

The analysis of the diagnostic indices of section 76 fertility parameters concerning to this soil subtype was analyzed. These soils spread in 9817,46 ha zone (Table 1). The section is fixed on geographical coordinates. X coordinate of the Section 61 (the east lenght) is at 46^0 $11^/$ 24,$947^{//}$ E, Y coordinate (the north width) is at 40^0 $49^/$ 25,$428^{//}$ N (Table 4). The humus layer density along the profile is 3,54-1,02 %. Corresponding to humus nitrogen is 0,256-0,113 % in these soils. Hygroscopic moisture is 7,53-5,52 %. 23,09-7,85 % with CO_2, $CaCO_3$ is 18,59-7,85 %, due to CO_2, a sum of absorbed bases (SAB) is 38,63-24,23 mg-ekv, pH is 7,0-7,6. The percentage quantity less than <0,001 mm is 25,53-30,96 %, the percentage amount less than <0,01 mm is 66,95-71,11 %. It was clear from granulometric analysis that these soils are heavy clayey and clayey. Through dry residue isn't observed on the upper layers but it is observed towards low layers (Table 3). The sections applied in the characteristic zone are shown in figure 1.

Conslution

1. The main physicochemical and nutrient on upper layer of soils were analyzed with modern methods as a result of the chemical analyses in soil samples taken from mountain grey-cinnamon (chestnut) soils.
2. On Table 1, the soil types and subtypes including in the Shamkirchay water reservoir, their zones (ha) are given. At the same time, the classification on WRB (soil groups) of mountain grey-cinnamon (chestnut) soils is shown on Table 2.
3. On Table 3, the analyses of the fertility parameters in the fertility parameters of the sections applied in the characteristic places on mountain grey-cinnamon (chestnut) soil subtypes was given. An analysis of the table was reflected in the article.
4. The sections applied in the characteristic places on mountain grey-cinnamon (chestnut) soil subtypes in the research area were shown both in table and map forms.
5. The diagnostic indices were studied by new methods on 7 subtypes of mountain grey-cinnamon (chestnut) soil subtypes. The ecological processes were analyzed and important results were obtained. So, humus, nitrogen, hygroscopic humidity, CO_2, $CaCO_3$ due CO_2, a sum of absorbed bases, pH environment of the zone, granulometric composition in 2 forms (<0,001 mm and <0,01), dry residue AU_a, A/B, Bta, B/C and C profils were studied in each soil section (Table 3).

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