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THE INFLUENCE OF DIFFERENT SLOPES OF THE RELIEF ON THE CHANGES IN THE GRANULOMETRIC AND MICROAGGREGATE COMPOSITION OF KASTANOZEMS OF THE LESSER CAUCASUS

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Abstract

Based on the conducted field-soil and chamber-laboratory research, the influence of different slopes of the relief on the changes in some agrophysical properties of Mollic Kastanozems of the northeastern part of the Lesser Caucasus was investigated.

The accumulative-sludge layer (AU=45-50 cm) of Mollic Kastanozems formed under relatively optimal moisture conditions and well-developed grass cover on the shaded slopes of the relief is characterized by sufficient humus (4.3-5.4%), nitrogen (0.32-0.38%), absorption capacity (50.9-53.2 mmol-eq), leaching from carbonates and accumulation in the middle layers (Bca+B/Cca=50-95 cm) ($CaCO_3$=16.7-20.8%), and clayey granulometric composition (<0.01mm=58.4-63.8%;<0.001mm=29.6-32.2%). The available diagnostic indicators indicate a high degree of aggregation (77.8-80.0) in the humus layer of the soil (AU=45-50 cm), the presence of sufficiently water-resistant "true" microaggregates (27.1-36.2%), on the contrary, a sharp decrease in the dispersion coefficient (20.0-22.1) and a significant increase in the deeper layers (33.4-34.3). The change in these agrophysical indicators along the soil profile is fully consistent with the decisive role and amount of humus and silt fraction in the aggregation of the soil structure, which is especially valuable in agriculture. However, since most of the area on shaded slopes is used under long-term cereal crops, the decrease in the soil arable layer (AUa=25-30 cm), humus (3.3-3.9%), nitrogen (0.25-0.32%), absorption capacity (46.6-50.9 mmol-eq), silt-colloid particles (<0.001mm=25.4-26.1%) also led to a significant decrease in the degree of aggregation (63.0-64.9) and water-resistant microaggregates, and, conversely, an increase in the dispersion coefficient (35.1-37.0).

In the accumulative-sludge layer (AUca=35-40 cm) of Mollic Kastanozems formed on sunny slopes under relatively arid microclimate conditions and xerophilous grass cover, a significant decrease in humus (2.6-3.9%), nitrogen (0.19-0.29%), and absorption capacity (41.4-46.7 mmol-eq.), as well as a relatively lightening of the granulometric composition (<0.01 mm=52.4-57.6%;<0.001 mm=20.4-27.1%), led to a decrease in the degree of aggregation (65.8-72.5) and water-resistant "true" microaggregates (22.6-25.9) in the dominant fractions of the soil, and, conversely, an increase in the dispersion coefficient (27.5-34.2).

Keywords: relief, slope exposition, soil profile, humus, granulometric composition, microaggregate composition

Introduction

As early as the beginning of the 20th century, the classics of soil science, V.V. Dokuchayev [9], L.I. Prosolov [13], N.M. Sibirtsev [16], etc., showed in their works that the relief factor has a great influence on the formation of soil properties in mountainous areas. A.J. Gerard even noted that the relief is a "mirror" of the soil cover [19].

The influence of relief condition on soil formation in the Lesser Caucasus has been extensively investigated in long-term regional–geographic soil studies conducted by Salayev [6], and more recently by V.H. Hasanov [1, 2] and E.E. Mammadov [5, 20]. These studies have demonstrated that elevation and topographic features, particularly slopes steepness and exposure, play a significant role in the formation of morphogenetic profiles of soil types and subtypes in the region. It has been noted that soils located on sun-exposed slopes receive greater solar radiation than those on shaded slopes, resulting in a more pronounced thermal regime. This difference substantially influences soil formation processes, the development of diagnostic soil horizons and properties, the spatial differentiation of elementary soil units, and the intensity of erosion processes. However, the effect of slope condition in association with aspect on variations in soil structure - which constitute the basis of the agrophysical properties of soils—has received comparatively limited attention in previous studies.

The objective of this study was to determine the influence of slope conditions on soil physical properties of Mollic Kastanozems, in particular, on the granulometric and microaggregate composition, degree of aggregation, dispersion coefficient, and changes in water-resistant microaggregates.

Material and method

The object of the study was selected as a “standard research area” on Mollic Kastanozems (in the Agdag-Gara Silvi area of the Jalilli municipality of the Tovuz region) located in the low mountainous zone of the northeastern part of the Lesser Caucasus. The research area is located at an altitude of 650-700 m above sea level and is sharply dissected by various steep slopes and valley-shaped micro-depressions. The soil-forming rocks are composed of carbonate clays and silts. The vegetation cover consists of shrubs and well-developed grass cover. The area is characterized by dry steppe subtropical climate conditions, with precipitation of 380-400 mm and an average annual temperature of 12.1-12.5 °C.

A large-scale (1:20000) soil survey was conducted in the study area in 2022-2024 based on the relief plasticity method. Taking into account the shaded northwest and sunny southeast slopes of the relief, soil sections were dug to a depth of 1.5 m and soil samples were taken from genetic layers. During the field-soil survey, the geographical coordinates of the soil sections were determined based on GPS:

K № 51 N 410 10'35. 429"; E=450 39'23, 237";
K № 54 N 410 00'58, 528"; E=450 31'28, 184";
K № 56 N 410 00'27, 554"; E=450 31'74, 179";
K № 58 N 410 00'32, 428"; E=450 31'58, 354";

The morphological characteristics of the genetic layers of soil profiles (thickness, color, granulometric composition, new derivatives, structure, hardness, moisture, boiling under the influence of 10% HCl, etc.) were determined. Laboratory analysis of soil samples was carried out using the accepted methods. Humus and nitrogen were determined by the method of I.V. Tyurin, absorbed Ca•• and Mg•• - by D.V. Ivanov, pH was determined by a potentiometer in an aqueous solution, carbonate content (CO2) was determined by working with a calcimeter device - Shebler, granulometric composition - by working with $Na_2P_2O_7$, microaggregate and density - by the method of N.A. Kachinsky. The amount of real microaggregates, dispersion coefficient and degree of aggregation were analyzed by the classical method [7].

Analysis and discussion

The granulometric and microaggregate composition of the soil has a significant impact on its morphogenetic diagnostics, agronomic properties, land reclamation properties and fertility indicators [8, 11, 17]. In the study of the soil formation process, the change in the granulometric and microaggregate composition, especially the physical clay (<0.01mm) and silt (<0.001mm) fractions along the soil profile is considered the main diagnostic indicator [10, 12, 18].

The granulometric and microaggregate composition of soils used under various agricultural crops, in particular the degree of aggregation, water-resistant “true” microaggregates, and dispersion coefficient, are subject to significant changes [4, 14, 15].

Based on the existing methodology, a relief plasticity map of the research area (Aghdag-Qara Silvi, Jalilli municipality, Tovuz region) was compiled at a scale of 1:20000. The following relief components were distinguished in the relief plasticity map, which is complicated by the mountain slopes and valleys of the area in terms of geomorphology.

1. Shady northwest-facing slopes;
2. Sunny southeast-facing slopes;
3. Valley-shaped microdepressions.

From the morphological description of the soil sections laid in the study area, it is clear that the thickness of the humus layer (AUv), the leaching of carbonates and the formation, depth and solidification of the illuvial-carbonate layer (Bca), the structural aggregates of the genetic layers, the microaggregate and granulometric composition, moisture, especially the degree of erosion of the soil profile, etc. morphogenetic features differ significantly on the shady north-western and sunny south-eastern slopes of areas with the same height and inclination [2, 3, 5, 11].

On shady slopes, the humus content in the upper layer of dark mountain-gray-brown (chestnut) soils (AU=20-25cm) is sufficient (4.4-5.4%), its movement to a depth of 0.8-1.0 m (1.2-1.7%) is clearly noticeable. The total nitrogen content is also significantly higher (0.34-0.38%). The upper layer of the soil profile (AU=45-50 cm) is characterized by complete washing out of carbonates, and accumulation in the middle and deep layers (0.7-1.5 m) (CaCO3=11.6-20.8%). This soil is also highly supplied with absorbed bases. The absorption capacity in the accumulative-sludge layer is 50.9-53.2 mmol-eq, and in the middle and deep layers it is 30.0-42.8 mmol-eq.

Figure 1

The influence of different relief slopes on diagnostic indicators of Mollic Kastanozems

Soil pit №	Genetic horizons and depth, cm	Humus, %	Nitrogen, %	$CaCO_3$, %	pH in water solution	Absorption capacity, meq			Density, g/cm^3
						Total	Ca^{+2}	Mg^{+2}	
Shady north-west faced slope									
51	AU'v 0-22	5,43	0,38	Yox	7,1	53,2	40,2	13,0	1,15
	AU"z 22-45	4,29	0,31	“-”	7,2	49,0	35,2	13,8	1,28
	A/Bca 45-58	1,34	0,10	2,1	7,5	38,1	27,6	10,5	1,32
	Bca 58-82	1,15	t.olm.	16,7	7,8	36,2	23,4	12,8	1,36
	B/Cca 82-115	0,86	“-”	20,8	7,9	32,5	17,1	15,4	1,38
	Cca 115-150	0,63	“-”	18,7	8,0	31,9	17,6	14,3	-
58	AU'a 0-25	3,88	0,32	Yox	7,0	50,9	36,6	14,3	1,12
	AU"a 25-48	3,26	0,25	“-”	7,1	46,6	33,0	13,6	1,31
	A/Bca 48-68	2,74	0,18	5,7	7,4	42,8	30,6	12,2	1,38
	Bca 68-86	1,66	t.olm.	11,6	7,8	30,9	21,2	9,7	136
	B/Cca 86-112	1,08	“-”	18,7	7,9	32,4	21,9	10,5	1,35
	Cca 112-145	0,75	“-”	19,1	8,0	31,9	19,9	12,0	-

Sunny south-east faced slope									
54	AU'vca 0-18	3,80	0,27	4,5	7,4	42,8	30,5	12,3	1,20
	AU"zca 18-35	2,45	0,19	15,2	7,6	41,4	29,0	12,4	1,35
	Bca 35-52	0,98	0,08	20,6	7,8	38,1	28,1	10,0	1,41
	B/Cca 52-75	0,69	t.olm.	18,0	7,9	35,2	25,7	9,5	1,36
	CIca 75-106	0,56	“-”	16,7	8,0	34,4	23,8	10,6	1,38
	CIIca 106-130	0,72	“-”	15,8	8,1	31,7	17,9	13,8	-
56	AU'vca 0-20	3,93	0,29	5,4	7,3	46,7	36,2	10,5	1,18
	AU"zca 20-36	2,60	0,20	17,1	7,6	45,6	34,4	11,2	1,30
	Bca 36-55	1,19	0,09	21,0	7,7	42,8	29,0	13,8	1,34
	B/Cca 55-82	0,77	t.olm.	17,5	7,8	36,9	24,4	12,5	1,37
	CIca 82-110	0,52	“-”	15,8	7,9	32,4	22,4	10,0	1,35
	CII 110-135	0,63	“-”	15,0	8,0	31,9	21,8	10,1	-

Mollic Kastanozems have a relatively heavy granulometric composition. In the upper layers (AU=22-25cm) the amount of physical clay (<0.01mm) is 55.8-58.4%, silt particles (<0.001 mm) are 25.4-29.6%, while in the middle layers their amount increases considerably (<0.01mm=57.6-64.4%; <0.001mm=26.1-32.2%). Corresponding indicators are also observed in the change in the microaggregate composition of physical clay (<0.01mm=31.5-40.6%; 33.8-36.4%) and silt-colloid particles (<0.001mm=6.5-8.9%; 8.9-9.5%) along the soil profile. The density of the soil in the soft humus layer (AUv=22-25cm) varies between 1.12-1.15 cm3, and in the hardened illuvial-carbonate layer (Bca=55-80cm) it varies between 1.32-1.38 cm^3.

On sunny slopes, a relative decrease in humus (2.5-3.9%) and a weakening of its movement to the lower layers (0.4-0.7%) are observed in the upper layers of dark mountain gray-brown (chestnut) soils (AU=30-35cm). These soils are also characterized by a decrease in the total nitrogen content (0.19-0.27%). The profile of dark mountain gray-brown (chestnut) soils formed on sunny slopes differs in their carbonation (CaCO3=4.5-5.7%) starting from the surface. The maximum amount of carbonates (CaCO3=17.5-20.6%) was determined in the middle layers. A certain decrease in the absorption capacity in the upper layers (38-46 mmol-eq) and, conversely, a relative increase in the pH in the aqueous solution (7.9-8.5) was determined. In the upper layer of the soil profile (AUv=18-20 cm), a significant lightening of the granulometric composition (<0.01mm=54.2-55.2%;<0.001mm=24.4-25.0%) was determined, and vice versa, a heavier one in the middle layers (<0.01mm=58.3-58.9%;<0.001mm=25.7-31.8%). Similar indicators are also observed in the change in the microaggregate composition of physical clay (<0.01mm=29.3-30.8%;31.6-32.1%) and silt particles (<0.001mm=7.6-8.3%;6.2-7.5%). Depending on the amount of humus and granulometric composition, the density in the upper layer (AUca=18-20cm) is 1.18-1.20 cm3, and in the lower layers (Bca+B/Cca=35-80cm) it is 1.34-1.41 cm3.

Figure 2

$\left(\frac{\text{qranulometrik}}{\text{mikroaqreqat}}\right)$ composition of Mollic Kastanozems

Soil pit №	Genetic horizons and depth, cm	Fractions, mm and amount in %							Dispersion coefficient	Aggregation degree by dominant fractions
		> 0,25	0,25-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	<0,01		
Shady north-west faced slope										
51	AU'v 0-22	-	19,44/30,80	22,12/37,72	15,92/11,96	12,96/12,96	29,56/6,56	58,44/31,48	22,19	77,81
	AU"z 22-45	-	16,96/34,56	19,20/37,80	18,56/6,68	13,08/14,48	32,20/6,48	63,84/27,64	20,12	79,88
	A/Bca 45-58	-	22,68/25,88	22,88/40,32	16,32/12,40	19,92/12,48	28,20/8,92	64,44/33,80	31,63	68,32
	Bca 58-82	-	29,28/28,32	18,68/48,28	9,36/5,16	19,68/10,56	23,00/7,68	52,04/23,40	33,40	66,60
	Cca 115-150	-	30,12/20,16	18,44/56,04	17,20/6,92	12,52/9,44	21,72/7,44	51,44/23,80	34,25	65,75
58	AU'a 0-25	-	20,64/24,48	23,52/34,88	12,32/17,16	18,16/14,60	25,36/8,88	55,84/40,64	35,06	64,94
	AU"a 25-48	-	18,04/19,28	23,12/44,32	16,84/11,72	15,92/15,04	26,08/9,64	58,84/36,40	36,98	63,04
	A/Bca 48-68	-	23,88/21,92	24,52/44,80	16,64/8,92	20,56/14,88	20,40/9,48	57,60/33,28	46,37	53,63
	Bca 68-86	-	27,24/24,48	26,12/38,32	8,24/14,32	21,68/15,88	16,72/7,00	46,64/37,20	41,87	58,13
	Cca 112-145	-	22,32/22,12	38,04/52,76	8,76/8,44	15,32/12,68	15,56/4,00	39,64/25,12	38,56	61,44
Sunny south-east faced slope										
54	AU'vca 0-18	-	21,64/30,48	24,20/40,24	9,08/13,08	18,00/7,92	27,08/8,28	54,16/29,28	27,53	72,47
	AU"zca 18-35	-	17,32/36,24	21,08/31,28	9,80/11,64	23,84/13,36	27,96/7,48	57,60/32,48	26,75	73,25
	Bca 35-52	-	21,28/27,44	20,40/40,92	5,80/13,48	26,68/11,00	24,84/7,16	58,32/31,64	28,82	71,18
	B/Cca 52-75	-	28,56/23,20	22,00/43,00	10,08/15,72	17,64/10,36	21,72/7,72	49,44/33,80	35,54	64,46
	CIIca 106-130	-	27,44/21,20	18,64/50,80	12,52/11,76	16,24/7,92	25,16/8,32	53,92/28,00	33,07	66,93
56	AU'vca 0-20	-	21,20/22,44	26,40/47,76	11,72/11,16	16,28/10,96	24,40/7,68	52,40/30,80	31,48	68,52
	AU"zca 20-38	-	15,76/24,08	29,48/38,32	14,80/9,96	19,60/20,68	20,36/6,96	54,76/37,60	34,18	65,82
	Bca 38-55	-	11,36/23,76	30,72/44,12	11,92/11,92	22,28/13,96	24,72/6,24	58,92/32,12	31,64	68,36
	B/Cca 55-82	-	16,88/27,52	32,68/52,12	12,88/8,72	19,16/5,80	18,40/5,84	50,44/20,36	31,74	68,26
	CII 110-135	-	17,80/19,48	36,76/52,44	9,92/11,24	14,96/10,56	20,56/6,28	45,44/28,08	30,54	69,46

The amount of "true" water-resistant aggregates in Mollic Kastanozems, %

Soil pit №	Genetic horizons and depth, cm	The amount of fractions is 0,25-0,01 mm		
		Composition		The amount of "real" microaggregates
		Microaggregate	Granulometric	
Shady north-west faced slope				
51	AU'v 0-22	72,36	36,16	36,20
	AU"z 22-45	68,52	41,56	27,16
	A/Bca 45-58	66,20	45,56	20,64
	Bca 58-82	66,60	47,76	18,84
	Cca 115-150	66,20	48,56	17,64
58	AU'a 0-25	63,60	46,16	17,04
	AU"a 25-48	59,36	44,16	15,20
	A/Bca 48-68	66,72	48,30	18,42
	Bca 68-86	72,80	53,56	19,26
	Cca 112-145	74,88	60,92	13,56
Sunny south-east faced slope				
54	AU'vca 0-18	70,72	44,84	25,88
	AU"zca 18-35	67,52	43,40	24,12
	Bca 35-52	68,36	52,68	15,68
	B/Cca 52-75	63,20	50,56	12,64
	CIIca 106-130	62,00	46,08	15,92
56	AU'vca 0-20	70,20	47,60	22,60
	AU"zca 20-38	62,40	48,24	14,14
	Bca 38-55	60,88	46,08	16,80
	B/Cca 55-82	64,64	49,56	15,08
	CII 110-135	61,92	44,56	17,36

Along with the above diagnostic indicators, dark mountain gray-brown soils of shady and sunny slopes also have different characteristics in terms of granulometric and microaggregate composition: the degree of aggregation by dominant fractions (0.25-0.05; 0.05-0.01mm), dispersion coefficient, and the amount of "true" water-resistant microaggregates.

On shaded slopes, the aggregation degree of the dominant fractions (0.25+0.01mm) in the upper layers of natural soils (AUa=45-50cm) is quite high (70.8-77.8-79.9), while in the lower layers (Bca-Cca) it gradually decreases (65.8-66.7). The dispersion coefficient, on the contrary, sharply increases from the upper layers (20.1-22.2) to the depth (33.4-34.3). The change of these indicators along the soil profile is fully consistent with the leading role and amount of humus and silt fraction in the aggregation of soil structures. The maximum amount of microaggregates (68.5-72.4%) and water-resistant "true" microaggregates (27.2-36.2%) was determined in the accumulative humus layer. In the soil-forming sediments, a sharp decrease in "true" water-resistant microaggregates (17.6-18.8%) was determined (Table 3). During our field-soil study, it was also observed from its morphological characteristics that the humus layer (AUa=45-50cm) has a well-aggregated, favorable granular structure compared to the middle and deep layers of the soil profile (Bca-B/Cgca-Cgca).

However, the relative decrease in humus (3.9%) and silt-colloid particles (<0.001mm=25.4%) in the sowing layer (AUa=0-25cm) of soils cultivated under cereal crops under long-term conditions (K-58) also affected the significant decrease in the degree of aggregation (64.9). On the contrary, a sufficient increase in the dispersion coefficient (35.1) was determined. A sharp decrease in microaggregates (63.6%) and “real” water-resistant microaggregates (17.0%) was also determined in the sowing layer of these soils.

In Mollic Kastanozems of the sunny slopes of the relief, the relative decrease in the accumulative-sludge layer (AUca=30-35cm), humus (2.6-3.9%), physical clay (<0.01mm=52.4-54.2%) and silt-colloidal particles (<0.001mm=24.4-27.1%) in granulometric composition also affected the significant decrease in the degree of aggregation of the dominant fractions (72.5-73.3), and on the contrary, a sufficient increase in the dispersion coefficient (26.8-27.5). Also, in the soils of the sunny slopes, a sharp decrease in microaggregates (67.5-70.2%) and “true” water-resistant microaggregates (22.6-25.9%) from the upper layers to the depth (61.9-63.2; 12.6-17.4) was determined.

Conclusion

Compared to the arid microclimate conditions of the relief and sunny slopes with xerophilous grass cover, the accumulative-humus layer (AU=45-50 cm) of dark mountain gray-brown soils formed on shady slopes with optimal moisture and good grass cover is provided with sufficient humus (4.3-5.4%), nitrogen (0.32-0.38%), absorption capacity (50.9-53.2 mmol-eq) and clayey granulometric composition (<0.01mm=58.4-63.0%;<0.001mm=29.6-32.2%), which affects the increase in some agrophysical properties of the soil, in particular the degree of aggregation (77.8-80.0), water-resistant “true” microaggregates (27.1-36.2%) and, conversely, the decrease in the dispersion coefficient (20.2-22.1). has shown.

However, the decrease in diagnostic indicators in the sowing layer (AUa=0-25cm) of soil types (K-58) used under cereal crops under long-term drought conditions led to a decrease in the degree of aggregation (63.0-64.9), a decrease in water-resistant "true" microaggregates (15.2-17.0%), and, conversely, an increase in the dispersion coefficient (35.1-37.0).

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KİÇİK QAFQAZIN TÜND DAĞ BOZ-QƏHVƏYİ TORPAQLARIN QRANULOMETRİK VƏ MİKROAQREQAT TƏRKİBİNİN DƏYİŞMƏSİNƏ RELYEFİN MÜXTƏLİF BAXARLI YAMACLARININ TƏSİRİ

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Xülasə

Aparılmış çöl-torpaq və kameral-laboratoriya tədqiqatı əsasında Kiçik Qafqazın şimal-şərq hissəsinin tünd dağ boz-qəhvəyi torpaqlarının bəzi aqrofiziki xassələrinin dəyişməsinə relyefin müxtəlif baxarlı yamaclarının təsiri araşdırılmışdır.
Relyefin *kölgəli yamaclarında* nisbətən optimal nəmlənmə şəraiti və yaxşı inkişaf etmiş ot örtüyü altında formalaşan tünd dağ boz-qəhvəyi torpaqların akkumlyativ-çürüntü qatı (AU=45-50 sm) kifayət qədər humus (4,3-5,4%), azot (0,32-0,38%), udma tutumu (50,9-53,2 mmol-ekv) ilə təmin olunması, karbonatlardan yuyulması və orta qatlarda (B_{ca}+B/C_{ca}=50-95 sm) toplanması ($CaCO_3$=16,7-20,8%), gilli qranulometrik tərkibli (<0,01mm=58,4-63,8%;<0,001mm=29,6-32,2%) ilə fərqlənir. Mövcud diaqnostik göstəricilər torpağın humus qatında (AU=45-50 sm) yüksək aqreqatlaşma dərəcəsinin (77,8-80,0), kifayət qədər suyadavamlı "həqiqi" mikroaqreqatların (27,1-36,2%) olması, əksinə disperslik əmsalının kəskin azalması (20,0-22,1) və dərin qatlarda xeyli artması (33,4-34,3) müəyyən edilmişdir. Torpaq profili üzrə bu aqrofiziki göstəricilərin dəyişməsi, xüsusən kənd təsərrüfatında dəyərli əhəmiyyətə malik torpaq strukturunun aqreqatlaşmasında

humusun və lil-fraksiyasının həlledici roluna və miqdarına tamamilə uyğun gəlir. Lakin, kölgəli yamaclarda ərazinin çox hissəsi uzun müddətli dənli taxıl bitkiləri altında istifadə olduğundan torpağın əkin qatında (AUa=25-30 sm), humusun (3,3-3,9%), azotun (0,25-0,32%), udma tutumunun (46,6-50,9 mmol-ekv), lil-kolloid hissəciklərinin (<0,001mm=25,4-26,1%) azalması, aqreqatlaşma dərəcəsinin (63,0-64,9) və suya davamlı mikroaqreqatların da xeyli azalmasına, əksinə disperslik əmsalının artmasına (35,1-37,0) səbəb olmuşdur.
Günəşli yamaclarda nisbətən arid mikroiqlim şəraitində və kserofil ot örtüyü altında formalaşan tünd dağ boz-qəhvəyi torpaqların akkumlyativ-çürüntü qatında(AU_{ca}=35-40 sm) humusun (2,6-3,9%), azotun (0,19-0,29%), udma tutumunun (41,4-46,7 mmol-ekv) xeyli azalması, qranulometrik tərkibin nisbətən yüngülləşməsi (<0,01 mm=52,4-57,6%;<0,001 mm=20,4-27,1%) nəticəsində torpaqda dominant fraksiyalar üzrə aqreqatlaşma dərəcəsinin (65,8-72,5) və suyadavamlı "həqiqi" mikroaqreqatların da (22,6-25,9) azalmasına, əksinə disperslik əmsalının yüksəlməsinə (27,5-34,2) təsir göstərmişdir.
Açar sözlər: relyef, yamacların baxarlılığı, torpaq profili, humus, qranulometrik tərkib, mikroaqreqat tərkib

ВЛИЯНИЕ РАЗЛИЧНЫХ УКЛОНОВ РЕЛЬЕФА НА ИЗМЕНЕНИЯ ГРАНУЛОМЕТРИЧЕСКОГО И МИКРОАГРЕГАТНОГО СОСТАВА ТЕМНО-ГОРНЫХ СЕРО-КОРИЧНЕВЫХ ПОЧВ МАЛОГО КАВКАЗА

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Резюме

На основе проведенных полевых почвенных и камерно-лабораторных исследований изучено влияние различных уклонов рельефа на изменения некоторых агрофизических свойств темно-серо-коричневых горных почв северо-восточной части Малого Кавказа.
Накопительно-иловый слой (AU=45-50 см) тёмных горных серо-коричневых почв, сформиро-вавшийся при относительно оптимальных условиях влажности и хорошо развитом травяном пок-рове на затенённых склонах рельефа, характеризуется достаточным содержанием гумуса (4,3-5,4%), азота (0,32-0,38%), абсорбционной способностью (50,9-53,2 ммоль-экв), выщелачиванием карбонатов и накоплением в средних слоях (Bca+B/Cca=50-95 см) ($CaCO_3$=16,7-20,8%) и глинис-тым гранулометрическим составом (<0,01 мм=58,4-63,8%;<0,001 мм=29,6-32,2%). Имеющиеся диагностические показатели указывают на высокую степень агрегации (77,8-80,0) в гумусовом слое почвы (AU=45-50 см), наличие достаточно водостойких «истинных» микроагрегатов (27,1-36,2%), напротив, резкое снижение коэффициента дисперсии (20,0-22,1) и значительное увеличе-ние в более глубоких слоях (33,4-34,3). Изменение этих агрофизических показателей вдоль поч-венного профиля полностью согласуется с решающей ролью и количеством гумусовой и иловой фракций в агрегации структуры почвы, что особенно ценно в сельском хозяйстве. Однако, пос-кольку большая часть площади на затененных склонах используется под долгосрочные зерновые культуры, уменьшение пахотного слоя почвы (AUa = 25-30 см), гумуса (3,3-3,9%), азота (0,25-0,32%), абсорбционной способности (46,6-50,9 ммоль-экв), коллоидных частиц ила (<0,001 мм = 25,4-26,1%) также привело к значительному снижению степени агрегации (63,0-64,9) и водостой-ких микроагрегатов, и, наоборот, к увеличению коэффициента дисперсии (35,1-37,0).
В накопительно-иловом слое (AUca=35-40 см) тёмных горных серо-коричневых почв,

сформи-ровавшихся на солнечных склонах в условиях относительно засушливого микроклимата и ксеро-фильного травяного покрова, наблюдалось значительное снижение содержания гумуса (2,6-3,9%), азота (0,19-0,29%) и абсорбционной способности (41,4-46,7 ммоль-экв.), а также относительное осветление гранулометрического состава (<0,01 мм=52,4-57,6%;<0,001 мм=20,4-27,1%), что при-вело к уменьшению степени агрегации (65,8-72,5) и водостойких «истинных» микроагрегатов (22,6-25,9) в преобладающих фракциях почвы и, наоборот, к увеличению коэффициента дисперсии (27,5-34,2).

Ключевые слова: рельеф, экспозиция склонов, профиль почвы, гумус, гранулометри-ческий состав, состав микроагрегатов

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