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CHANGES IN MORPHOLOGICAL PROPERTIES OF MOUNTAINOUS ORDINARY CARBONATE BLACK SOILS (CHERNOZEMS) OF THE REPUBLIC OF ARMENIA IN TERMS OF CLIMATE WARMING

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Abstract. Based on the conducted studies the distinctive morphogenetic features of mountainous ordinary carbonate black soils of the Republic of Armenia have been identified. The issues of identification of those changes which occur in main morphogenetic properties of mountainous ordinary carbonate black soils as a result of their long-term and intensive agricultural use are discussed in the paper. It was proven that the long-term and unsystematic use, particularly the irrigation contributed to significant expansion of genetic horizons, destruction of structural units, displacement of carbonates from upper horizons down the profile, compaction of soil mass at a considerable depth as well as leaching of mechanical fractions.

Key words: ordinary, carbonate, black soils, morphology, soil profile, genetic horizons.

INTRODUCTION

Morphological description of soils is one of the main methods of study. Many of the conclusions concerning the genesis, systematic conditions of soils and their agro-productive properties are based on the data of morphologic descriptions. On the current stage, in conditions of the climate change and anthropogenic impact, morphogenetic features of soils which have been cultivated for a long time are exposed to changes. In the Republic of Armenia changes in morphological properties of soils are more intensively observed in the areas where mountainous ordinary carbonate black soils are wide-spread.

OBJECTS AND METHODS

The object of the research are mountainous ordinary, mainly carbonate black soils of the Republic of Armenia. Field experiments were conducted by the method of field soil mapping, and the laboratory experiments were carried out by generally accepted modern methods in soil science. [1, 2]. The study was conducted by comparing the virgin and cultivated soil types.

RESULTS AND DISCUSSION

Within the Republic of Armenia the mountainous ordinary, mainly carbonate black soils are found by spread massives on Shirak plateau, in Abovyan and Talin regions, as well as their big areas are observed in Ani and Artik regions. In the system of vertical soil structures mountainous ordinary carbonate black soils occupy the bottom row, where the annual amplitude rises up to 32^0 C. In summer mean monthly temperature of the soil reaches higher than 26^0 C. They develop on the products of weathering tuff lava, lake-alluvial, proluvial sandy-loam deposits [3].

The capacity of mountainous ordinary carbonate black soils compared with typical and alkaline black soils is significantly smaller. Carbonates are distributed throughout the total soil profile. The short-term moisturizing and periodic drying of the soil have effect on the structure and morphological features of the ordinary carbonate black soils which develop on southern, well-warmed slopes. Morphological feature of the mountainous ordinary carbonate black soils is their profile with a noticeable differentiation of the genetic horizons. Capacity of the A horizon in weak soils does not exceed 15 cm, and of the B horizon – 25 cm. In the soils of average capacity the power of A horizon increases up to 30 cm, and of B horizon – up to 35 cm [4, 5, 6]. Deep horizons of these soils are sometimes gravelly. The color of the upper horizons ranges from choco-

late to dark grayish – brown. By mechanical composition they refer to loamy and rarely to clay soil types. In the mountainous ordinary carbonate black soils accumulations of silt fractions in the middle horizons is not observed.

The idea of the morphological structure of virgin and arable mountainous ordinary carbonate black soil profile can be got from the description of the following sections:

Virgin land –the section is laid 2.7 km south from Shirac village on a wavy slightly- sloping plain. The soil-forming rocks are eluvial carbonated sediments. The section has the following morphological structure: A1-A2 - B - BC-C1-C2, where:

A1 0-13 cm - black with dark brown hue, heavy-loamy, fine cloddy- powdery, porous, loose, stones with diameter less than 3 cm, slightly effervescent, the passage to the next horizon is gradual;

A2 13-28 cm - black with dark gray hue, heavy-loamy, fine-fractured, compact, stones with a diameter up to 3 cm, slightly effervescent, gradual passage;

B 28-54 cm - dark chestnut with rusty spots, heavy-loamy, cloddy, compacted, porous, weakly- effervescent, gradual passage;

BC 54-79 cm - pale whitish, light-loamy, destructured, porous, loose, violently effervescent, the passage is gradual;

C1 79-102 cm – pale with whitish spots, light-loamy, destructed, porous, loose stones with a diameter up to 5 cm, violently effervescent, gradual passage;

C2 102-I40 cm - gray, sandy loamy, destructed, finely-porous, loose, stones with a diameter more than 6 cm, strongly effervescent.

The main mass of the grass roots is distributed to a depth of 20 cm, single roots reach up to 130 cm.

The arable land is irrigated. Section was 20 meters west of the virgin version.

The section has the following morphogenetic structure: A plow layer.- AB-B1 B2 - C, where:

Aplow layer. 0-28 cm - black with gray hue, clayey, sprayed granular-cloddy, porous, fractured, compacted, stones with a diameter up to 3 cm, does not effervesce, gradual passage;

AB 28-52 cm - black, clayey, cloddy granular, cloddy-granular, finely-porous, dense, single stones with a diameter up to 3 cm, no effervescent, gradual junction;

B1 52-78 cm - black, clayey, cloddy granular-cloddy, finely-porous, dense, stones with a diameter up to 3 cm, non-effervescent, gradual passage/junction;

B2 78-92 cm - Dark chestnut, heavy-loamy, granular-cloddy, finely-porous, dense stones with a diameter up to 5 cm, effervescent, the passage to the next horizon is sharp;

C 92-100 cm. – pale-whitish, light loamy, destructed, finely porous, dense, a large number of stones with diametre up to 10 cm, violently effervescent.

The main mass of plant roots is extended to a depth of 0-30 cm, single roots reach a depth of 91 cm.

Virgin land, the section is laid in Akhuryan region near Azatan village on the slightly-sloping plain. Soil-forming rocks are carbonated loams of andesite-basalts. The section has the following morphological structure: A1-A2 - B - BC-C1-C2, where:

A1 0-9 cm - black with dark gray hue, heavy-loamy, granular-powdery, porous, loose, weakly effervescent, gradual passage;

A2 9-20 cm - black with gray hue, clayey, cloddy granular, porous, weakly compacted, moderately effervescent, gradual passage;

B 20-37 cm - dark chestnut, clayey, cloddy, large-porous, fissured, compact, slightly effervescent, gradual passage;

BC 37-66 cm - pale whitish, heavy-loamy,fine-cloddy porous, compact, slightly effervescent, a sharp passage;

C1 66-103 cm - pale whitish with brownish hue, heavy-loam, destructed, finely-porous, dense, violently effervescent, gradual passage;

C2 103-120 cm - pale, medium-loamy, destructed, finely-porous, slightly compacted, violently effervescent.

The main root mass of plants is concentrated at a depth of 0-26 cm, single samples reach a depth of 88 cm.

Arable land is irrigated, the section is laid at 50 m to west from the plow section. It has the following morphogenetic structure: Aplow layer. - AB - B - BC-C1-C2 - C3, where:

Aplow layer 0-28 cm - Dark chestnut, with gray hue, clayey, fine-granuled, cloddy, finely-porous, fissured, dense, single small stones, non- effervescent, gradual passage;

AB 28-50 cm - dark chestnut, clayey, cloddy-granular, finely-porous, very dense, isolated small stones, non- effervescent, gradual passage;

B 50-63 cm - mottled, brownish-chestnut, with black spots, granular, finely-porous, very dense, with a single small stones, non- effervescent, gradual passage;

BC 63-81 cm - light-chestnut with a brown hue, heavy-loamy, slightly-granular, finely-porous, dense, single stones with a diameter up to 3 cm, violently effervescent, gradual passage;

C1 81-104 cm - yellow-whitish, medium-loamy, destructured, finely-porous, compact, single stones with a diameter up to 3 cm, violently effervescent, gradual passage;

C2 104-123 cm - pale-yellow, medium-loamy, destructured, finely-porous, weakly- compacted, stones with a diameter up to 5 cm, violently effervescent, gradual passage;

C3123-150 cm - pale-yellow (slightly lighter than the previous one) light-loamy, destructured, finely-porous, slightly compacted, stones up to 5 cm, very violent effervescence.

The main root mass is spread in the 0-30 cm layer, single roots are observed that reach a depth of 70 cm.

As compared with the typical, especially, leached soils, the mountainous ordinary black soils are distinguished with low capacity. The capacity of the horizon A makes on the average 24 cm, A + B does not exceed 60 cm. Since ordinary black soils are in the intensive tillage zone and have been used in agricultural production since ancient times, marked morphological changes are observed in the soil profile. It's noteworthy that in arable soils the capacity of the innumerated horizons increases. Horizon A reaches a depth of 28-30 cm, while in the virgin land it makes only 20 cm. The humus-accumulative horizon A + B reaches a depth of 92 cm.

Extension of the soil profile of mountainous ordinary carbonated black soils, results apparently from the long-term irrigation, which accelerates the subsurface weathering of minerals.

In mountainous ordinary carbonated black soils, especially in the arable horizon, dispersal patterns are clearly observed, the color becomes lighter. In the cultivated soils, compaction occurs along the entire profile, excepting the lower horizons.

CONCLUSIONS

1. It has been proven that ordinary mountainous carbonate black soils as compared to leached and typical black soils are distinguished with low capacity.

2. While comparing the virgin and arable versions in arable soils a noticeable lengthening of genetic horizons is observed.

3. In the arable horizon a destruction of the structural units is observed, and the color becomes lighter.

4. In the cultivated versions a movement of carbonates from the upper horizons down the soil profile, that is mainly caused by their long-term irrigation.

5. It has been revealed that long-term and unsystematic irrigation contributed to the soil mass compaction at a considerable depth, as well as leaching of a part of products in the mechanical fractions.

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ТҮЙІН

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ЖЫЛЫ КЛИМАТ ЖАҒДАЙЫНДА АРМЕНИЯ РЕСПУБЛИКАСЫНЫҢ ТАУЛЫ КӘДІМГІ КАРБОНАТТЫ ҚАРА ТОПЫРАҚТАРЫНЫҢ МОРФОЛОГИЯЛЫҚ ӨЗГЕРІСІ

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Жүргізілген зерттеулер негізінде Армения Республикасының таулы кәдімгі қара топырақтарына тән морфогенетикалық ерекшеліктері анықталды. Мақалада таулы кәдімгі қара топырақтардың ұзақ уақыт және қарқынды ауыл шаруашылығына пайдалану нәтижесінде негізгі морфогенетикалық қасиеттерінде болатын өзгерістердің анықталу мәселелері қарастырылады. Ұзақ уақыт және жүйесіз пайдалану, әсіресе суару, генетикалық қабаттардың айтарлықтай ұлғаюына, құрылымдық бөліктердің бұзылуына, карбонаттардың жоғарғы қабаттардан төменгі кескінге орын алмастыруына, белгілі тереңдікте топырақ салмағының нығыздалуына, сонымен қатар механикалық фракция бөлшектерінің шайылуына жағдай жасайды.

Түйінді сөздер: кәдімгі, карбонатты, қара топырақ, морфология, топырақ кескіні, генетикалық қабаттар.

РЕЗЮМЕ

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ИЗМЕНЕНИЕ МОРФОЛОГИЧЕСКИХ СВОЙСТВ ГОРНЫХ ОБЫКНОВЕННЫХ КАРБОНАТНЫХ ЧЕРНОЗЕМОВ РЕСПУБЛИКИ АРМЕНИЯ В УСЛОВИЯХ ПОТЕПЛЕНИЯ КЛИМАТА

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На основании проведенных исследований выявлены характерные морфогенетические особенности горных обыкновенных карбонатных черноземов Республики Армения. В статье рассматриваются вопросы выяснения тех изменений, которые происходят в ос-

новных морфогенетических свойствах горных обыкновенных карбонатных черноземов в результате их длительного и интенсивного сельскохозяйственного использования. Установлено, что длительное и бессистемное использование, особенно орошение, способствовало значительному расширению генетических горизонтов, разрушению структурных отдельностей, перемещению карбонатов с верхних горизонтов вниз по профилю, уплотнению почвенной массы на значительной глубине, а также вымыванию части механических фракций.

Ключевые слова: обыкновенный, карбонатный, чернозем, морфология, профиль почв, генетические горизонты.