UDC 631.48.

H.Gh. Ghazaryan[1], S.Z. Kroyan[1]

CLASSIFICATION AND NOMENCLATURE OF SOIL SUBTYPES OF THE REPUBLIC OF ARMENIA ACCORDING TO INTERNATIONAL STANDARDS

[1]Branch of Armenian National Agrarian University "Scientific centre of Soil Sciences, Agrochemistry and Melioration after H. P. Petrosyan", Admiral Isakov ave. 24, Yerevan, Republic of Armenia 004, ghazaryan_soil@yahoo.com, kroyan.samvel @ mail.ru

Abstract. The Republic of Armenia is a small mountainous country with vividly expressed vertical zoning and scarce in soil, where among all the components of the landscape soil cover is also exposed to zoning patterns typical of mountainous countries. In the article is analyzed the compliance of the classification of genetic subtypes of the soil of the republic with international criteria. The classification of all genetic soil types and subtypes separated in the territory of the republic is based on the criteria presented in International World Reference Base for Soil Resources (WRB).

Key words: soil type, subtype, international classification, genetic horizon, World Reference Base for Soil Resources (WRB).

INTRODUCTION

Land is an indispensable tool for agricultural production. It is also one of the most important components of the landscape. Armenian Republic is a typical mountainous country with poor land resources. The complex mountainous relief of the area, the diversity of surfaces and the sharp fragmentation, the spotted geological structure, different covered character of soil-making maternal rocks, the abrupt variations in the altitude, also the variety of climatic conditions have promoted to the formation of spotted soil cover. That is why in the small territory of the republic almost all soil types meet, which is widespread in the vast territory of the Greater Caucasus. Landfills in the territory of the Republic are subjected to the upward zoning, moving from low to high elevation peaks. Depending on the unique physical-geographical conditions of each upward zone, they have formed and developed by origin, composition, structures and agro-industrial characteristics of different genetic types and subtypes. As a result of large-scale earthworks were classified 14 genetic soil types, 27 subtypes and many sexes, types, varieties and variants. 8 of 14 land plots have zonal nature and occupy more than 83.1 % of the republic's territory. The total area of azonal soils is only 4.2 %. Other part of republic territory (12.7 %) is located under radical rock outlets, scattered stones, water reservoirs and constructions.

In the second half of the 20-th century had made a thorough investigations of republic lands, classification of lands and nomenclature(which is also applied today) by scientists of Research Institute of Soil Science and Agrochemistry. Nowdays considering the international classification criterias of WRB system, there is a need to do a new classification and nomination of republic lands. On 1998 in Montpellier in accomplished international conference of land specialists, was made a decision to create the management database of land resources- World Reference Base for Soil Resources(WRB) in the whole world, which can allow the communication with the land specialists of another countries. For classicifation with this system there were taken into account the origin of soil making maternal rocks, structure, character, climatic conditions, the genealogical specifications of lands, physic-chemical and biological internals, opportunities for land use in different areas of economic activity, environmental restrictions and etc. The international WRB system is created by international group of land specialists from whole world.

According to WRB system standarts of lands international classification the land types and subtiples of republic area were grouped in 9 abstract groups, which analysis is given below [1-3].

OBJECTS AND METHODS

The compliance of the names of all soil types and subtypes existing in the territory of the Republic of Armenia with the standards of international WRB system served as research material. Soil cover of the republic served as the object of the research. Research has been carried out according to the criteria adopted by the WRB system.

RESULTS AND DISCUSSION

Taking into account conditions of the subtype, the structure of soil profile and the main properties of individual genetic horizons, most acute expression of any factor of soil formation processes, the soil type has been divided into different subtypes.

Based on the above considerations, especially WRB system standards, the soil types existing in the Republic of Armenia have been divided into the following subtypes:

Calcisols – As semi-desert brown soils were formed within the borders of Ararat Basin which has homogeneous climatic conditions, mother-types and plant coverage, only one brown typical subtype was separated within the mentioned soils, which has received the name Typical fulvous according to the International Classification of soils.

Anthrosols – Based on the structure of soil profile, the properties of individual genetic horizons, ground humidification and age-old use of soils, the following subtypes are separated within the soil type Anthrosols, which has received the following names according to the international classification: Humid-meadow, Meadow fulvous irrigated and Residual. Soils of Humid-meadow subtype occupy a relatively small space. They mainly develop in areas where the ground water level is very high (up to 1.5 m) and generally have a capillary nutrition. Ground waters are either lightly mineralized or freshwater. According to depth, buried or illuvial-humus horizons are met here, that have been formed as a result of regularly rinsing of soils in the past. Besides, carbonate horizon is also met in the lower layers of soil profile, which is caused by prolonged impact of ground water. Salinized and alkalized horizon is formed in the middle, very often also in the lower layers of profile in the distribution area of mineralized ground waters [4, 5].

Soils of Meadow fulvous irrigated subtype have a large areal. This subtype was formed both in the conditions of ground water nutrition and the humidification of irrigation water.

In such areas soil formation processes occur in a relatively weak ground nutrition conditions.

The depth of ground waters varies between 1,5-4,0 m. Usually they are freshwater or lightly mineralized.

One of the most important features of soils of Meadow fulvous irrigated subtype is that it does not have carbonate profile.

The soils are characterized by dark cinnamonic color of upper horizons and by dark brown color of lower horizons. The capacity ranges from 40-60, sometimes up to 70 cm [6, 7].

Residual subtype was formed on the old terrace of Aras River. Initially soil formation took place here in the conditions of capillary ground humidification, too. But now the ground water level has dropped and they are on 5-6 m and greater depths, as result of which capillary nutrition is cut from soil horizons, though the signs of ancient hydromorphism are still preserved and have a residual character. Currently the formation of these soils occurs under the influence of automorphic processes, in the conditions of irrigation and intensive cultivation.

Soils of Residual subtype are characterized by dark brown color of upper horizons and by dark brown color of lower horizons. One of the characteristic features of the soils is that there is more than 70 cm, powerful agro-irrigation horizon and weak discrimination of genetic horizons of the profile here.

Antrosols (Fluvisols) soil type is divided into two subtypes: Floodland-terraced, marsh and Floodland-terraced, meadow [8, 9].

Floodland-terraced, marsh soils are disseminated in lower terraces of river valleys, where there is excess of moisture. The mentioned soils are mainly located in those distribution areas of Floodland-terraced, meadow soils where ground water level is higher than 1 m and close to the ground surface. Here, the upper horizon of soils is rich in peaty, dilapidated organic materials and finely dispersed sludge particles where humus content sometimes reaches up to 17 %. Ground waters are not mineralized and do not contain water-soluble salts with qualitative composition and dangerous quantities for optimal growth and development of crops.

Soils of Floodland-terraced, meadow subtype are disseminated in those parts of river valleys that are exposed to the influence of alluvial horizons. That's why it becomes clear from the study of the morphological features of the soils that there is vividly expressed streaked structure of the profile and spotted mechanical structure here. Diversity is also observed in terms of the content of humus and carbonates.

Solonetz-Solonchaks soil type is divided into the following two subtypes: Saline alkali meadow-marsh and Saline alkali meadow [10].

Soils of Saline alkali meadow-marsh subtype have limited distribution and are met in the form of islets along Metsamor River, in the borders of the delta of Hrazdan River and peripheral regions of Yeraskh steppe.

Saline alkali meadow subtype occupies quite a lot of space (around 80 %). They are met in Armavir, Masis, Ararat regions with large masses.

Solonetz – This soil type has only one subtype - Saline paleo-hydromorphic.

Saline paleo-hydromorphic soils are characterized by a homogeneous structure of the profile, by weak discerning of the genetic horizons, by red or yellow color, by loamy or heavy loamy-sandy mechanical composition. The soils are mainly low-powered, containing gypsum, equally carbonatized, coherent, solid and cracked.

Umbrisols, (Leptosols) – As a result of field and laboratory research Umbrisols, (Leptosols) soil type has been divided into three subtypes: Turfy-terrace, Turfy (brown), Weak turfy (dark colored) [11].

Turfy-terrace subtype soils develop in alpine zone within the range of 2700-3600 m altitude above sea level, on the slopes having different curvature and location. They occupy a small space where many exits of radical rocks are very often observed.

The most important morphological features of Turfy-terrace soils are the presence of peaty horizon of 5-10 cm power, brown, sometimes dark brown color of humus horizons, medium strength, strong rockiness, especially in the lower horizons, loamy-sandy, rarely also light loamy-sand mechanical composition, weak discerning of the genetic horizons and the absence of carbonates throughout the profile.

Turfy (brown) soils are formed in the lower parts of alpine zone and in the upper parts of sub-alpine zone within the range of 2700-3500 m altitude above sea level, on the slopes having different curvature and location.

The most important morphological features of Turfy (brown) soils are brown, dark brown, sometimes black color of humus horizons, well expressed waterproof granular structure, the absence of carbonates throughout the profile, loamy-

sandy mechanical composition, weak discerning of the genetic horizons. The capacity of humus horizons is not large, relatively powerful soils are met in low-lying areas of the relief. Humus content can reach up to 16 %.

Soils of Weak turfy (dark colored) subtype develop under short and dense alpine plant communities. They are distinguished by black or brown-black color, by small granular structure of upper horizons, large capacity (75 cm) of humus horizons, acid reaction, considerable saturation of absorbing complex, significant content of exchangeable aluminum and high content of nitrogen and humus.

Phaeozems soil type is divided into Black-earth and Typical subtypes.

Soils of Black-earth subtype occupy a large area in Sevan basin, central Armenia and in Shirak region. The mentioned soils occupy the upper part of meadow steppe zone where climatic conditions are severe.

Flora is fairly thick and lush here, steppe and meadow communities of mesophilic nature are largely dominate here. Humus content sometimes reaches up to 18 %.

One of the most important morphological features of the soils of Black-earth subtype is black or brown color of humus horizons and light brown color of the lower horizons.

Typical subtype occupies large areas in southern, southwestern, and sometime in southeastern locations of arid slopes of Southern and Central Armenia. The mentioned soils have intermediate position between Kastanozems soils and Acrisols soils. Here humus horizons of the soils have light color compared to the previous subtype due to the lower humus content (9-10 %).

Cambisols (Acrisols) soil type is divided into Leached, Typical, Carbonate subtype [11-13].

Leached subtype is the most disseminated and the soils of Carbonate subtype occupy the smallest area. Leached soils are mainly disseminated in the middle and upper parts of the forest zone. They develop in relatively more humid areas than the soils of Carbonate Typical subtype. Main morphological features of Leached soils are gray or brown color of the whole profile, full- washing of carbonates, weak discerning of the genetic horizons, nutty structure, high humus content (7-12 %) in the upper horizons, neutral or weak acid reaction, high absorption capacity, the presence of exchangeable acidity in the upper parts of the zone, clayization of middle and lower part of the profile, the lack of the phenomenon podzolics.

Typical soils have intermediate position between soils of Leached and Carbonate subtypes and are mainly disseminated in middle and lower parts of the forest zone. One of the important features of these soils is refining upper and middle horizons from calx, cinnamonic or dark cinnamonic color, nutty structure and clayization of the profile.

Soils of Typical subtype are mainly used in agricultural production. There have been significant changes in soil profile as a result of lengthy and uncoordinated use. In particular, structure considered valuable from agronomic point of view has disintegrate, the amount of water-resistant aggregates has reduced, humus content has decreased, etc.

Carbonate soils develop in the lower part of the forest zone on southern and eastern slopes. From morphological point of view, these soils have a profile rich in carbonates, dark brown color of humus horizons, granular structure sometimes also nutty structure of humus horizons, loamy-sandy sometimes also light loamy mechanical composition and some cementation of the whole profile especially in middle horizons. The presence of illuvial carbonate horizon is also typical of these soils.

Chernozems - Depending on hydrothermic regime of the zone, the nature of

the relief, maternal rocks and other conditions of soil formation, soils are divided into Leached, Typical and Carbonate subtypes [14].

Humus horizons are washed from carbonates in the soils of Leached subtype, carbon content starts from B horizon in case of Typical subtype, and these are available in all soil profile in Carbonate soils.

Leached subtype is met with large areas in Northern Armenia, especially in Ashotsk plateau and Lori field. The mentioned soils were formed on the weathered soft mass of andesite-basalt, Liparit-dacints, porphyrites, tofo lavas.

Humus horizons are characterized by dark gray or dark brown color, carbonates are only in the soil-forming maternal rocks and there is some accumulation of silt fraction in the middle and upper horizons of soils. Soils of Typical subtype are prevalent in Lake Sevan basin, Aparan-Hrazdan regions. Weathered materials of andesite-basalt, porphyrites, tofo lavas serve as soil- forming mother-types. Discerning of the genetic horizons is vividly expressed, where A horizon is distinguished by relatively fragile structure and B or BC horizons by solid structure. There is some accumulation of silt fraction in the middle and upper horizons of the mentioned soils, too.

Soils of Carbonate subtype are mainly disseminated in the field of Shirak and in Central Armenia. Soil-forming mother-types are represented by weathered materials of volcanic and sedimentary rocks, where the content of carbonates reaches up to 30-35 %. Discerning of the genetic horizons is well expressed in soil profile, there is no accumulation of silt fraction in the middle and upper horizons here.

Kastanozems - Dry steppe soil zone is distinguished by the variety of climatic conditions. Kastanozems soil type specified in this zone is divided into Dark chestnut and Light chestnut subtypes.

Soils of Dark chestnut subtype with small surfaces are disseminated in the upper areas of dry steppe natural-soil zone and are mostly bordered by the soils of Chernozems Carbonate subtype. The content of humus ranges from 3,0-4,2 % in the upper humus accumulating horizons. This subtype is disseminated in relatively flat and lightly fragmented areas of the relief, for that reason they are distinguished by a relatively large capacity, fragile structure, homogeneous color of horizons and low content of carbonates.

Soils of Light chestnut subtype are disseminated in low-lying areas of the natural-soil zone. Humus content is about 3.0 % in humus accumulating horizons. Light chestnut soils are rocky, carbonate, not alkalized, low-powered and medium powered and considerably solid. Unlike previous subtypes, these soils are lightly aggregated and contain less amount of water-resistant aggregates [15].

CONCLUSIONS

According to the international soil classification system, as a result of grouping and new naming, main soil types and subtypes of the territory of the Republic of Armenia have received the following names:

Semidesert brown soils – (Calcisols) - Typical fulvous.

Irrigated meadow brown soils, floodplain-terraced soils - (Anthrosols) 1. Humid-meadow, 2. Meadow fulvous, irrigated, 3. Residual, 4. Floodland-terraced, marsh, 5 .Floodland-terraced, meadow.

Hydromorphone saline-alkaline soils and Paleohydromorphic connected alkaline soils - (Solonetz-Solonchaks) 1. Saline alkali meadow-marsh 2. Saline alkali meadow 3. Saline paleo-hydromorphic.

Brown soils or Brown chestnuts - (Kastanozems) – 1. Dark chestnut 2. Light chestnut

Mountainous black soils and meadow black soils - (Chernozems) 1. Leached 2. Typical 3. Carbonate

Cinnamonic forest, Forest sod – carbonate and Brown forest soils - (Acrisols, Cambisols) 1. Leached 2. Typical 3. Carbonate. Meadow prairie soils - (Phaeozems)- 1. Black-earth 2. Typical

Mountainous-Meadow Soils - (Umbrisols, Leptosols) - 1. Turfy-terrace 2. Turfy (brown) 3. Weak turfy (dark colored).

REFERENCES

1 The soils of the Armenian SSR, under the editorship of P.A. Edilyan and others. P.H. Hayastan. – Yerevan, 1976. – P. 383 (In Russian).

2 Ghazaryan H. Soils of Armenia. Soil Reources of Mediteranean and Caucasus Countries. – 2013. – P. 5-17 (in English).

3 Edilyan R.A., editor. Atlas of soils of the Republic of Armenia. – Yerevan, 1990. – 65 P. (In Russian).

4 K.G. Melqonyan, H. Gh. Ghazaryan, R. R. Manukyan "The environmental current situation of soils of agricultural importance", the level of the use of land, the improvement of management system and the ways of increasing effectiveness in the Republic of Armenia. – Yerevan, 2004. – P. 53 (in Armenian).

5 Amirjanyan J. A. Soil resources, Management of soil use and conservation. – Yerevan, 2000. – 83 p. (in Armenian).

6 H.Gh. Ghazaryan, S.Z. Kroyan Genetic and agroindustrial features of meadow brown irrigated soils of Republic of Armenia in terms of climate change and desertification // Annals of Agrarian Science. – Tbilisi, 2016. – № 14. – Pp. 326-330.

7 H.Gh. Ghazaryan, S.Z. Kroyan N.M. Manukyan, M. Yu Kalashian. Current state of humus in irrigated meadow-brown soils in the Republic of Armenia // Annals of Agrarian Science. – Tbilisi, 2016. - №14. – Pp. 307-310.

8 The world correlative base of soil resources: the basis for the international classification and correlation of soils. Compilers and scientific editors Targulyan V. O., Gerasimova M. I. Partnership of Scientific Publications KMC. – Moscow, 2007. – 280 p. (in Russian).

9 Soil Atlas of Europe. European Commission. – 2005. – 128 P. (in English).

10 Bridges E.M. World soils. 3rd edition. – Cambridge UK: Cambridge University Press, 1997. – 176 P.

11 Tengiz F. Urushadze, Giorgi O. Ghamashidze Soils of Georgia. Soil Resources of Mediterranean and Caucasus Countries. Extension of the European Soil Database. – 2013. – P. 83-101 (in English).

12 T. Urushadzea, W. Blumb, T. Kvrivishvilia Classification of soils on sediments, sedimentary and andesitic rocks in Georgia by the WRB system // Annals of Agrarian Science. – 2016. – Volume 14, Issue 4. – P. 351-355 (in English).

13 World reference base for soil resourses. A framework for international classification, correlation and communication, World Soil Resources Report 103. – Rome: FAO, 2006. – 145 P. (in English).

14 World resourses institute. Climate analysis indicators. – Washington DC, 2008. – P 8. (in English).

15 World soil resourses. An explanatory note on the FAO World soil Resourses. Map at 1:25 000 000 scale. – 1991, Rev. 1. – 1993. (in English).

ТҮЙІН

У К. Казарян[1], С.З. Кроян[1]

ХАЛЫҚАРАЛЫҚ ӨЛШЕМДЕР БОЙЫНША АРМЕНИЯ РЕСПУБЛИКАСЫ ТОПЫРАҚТАРЫНЫҢ ІШКІ ТҮРЛЕРІНІҢ ЖІКТЕЛУІ МЕН НОМЕНКЛАТУРАСЫ

[1]НАУА филиалы "Г.Петросян атындағы топырақтану, агрохимия және мелиорация ғылыми орталығы", 0004, Ереван, Адмирал Исаков көшесі, 24, Армения Республикасы, e-mail markosianalbert@mail.ru, ghazaryan_soil@yahoo.com, manukyan.nm@mail.ru

Армения Республикасы ландшафттың барлық компоненттерінің, оның ішінде топырақ жамылғысының биік белдеуінің күрделі құрылымы шағын аумақты тау елі. Мақалада Республика топырақтарының генетикалық ішкі түрлерінің жіктелуінің халықаралық өлшемдерге сәйкестігі талданған. Топырақтың барлық генетикалық типтері мен ішкі түрлерінің жіктеу негізіне World Reference Base for Soil Resources (WRB) ұсынған халықаралық стандарттар қабылданды.

Түйінді сөздер: топырақ типі, ішкі түрі, халықаралық классификация, генетикалық көкжиек, әлем топырағының реферативтік базасы (WRB).

РЕЗЮМЕ

У. К. Казарян[1], С.З. Кроян[1]

КЛАССИФИКАЦИЯ И НОМЕНКЛАТУРА ПОДТИПОВ ПОЧВ РА ПО МЕЖДУНАРОДНЫМ КРИТЕРИЯМ

[1]Филиал НАУА "Научный центр почвоведения, агрохимии и мелиорации им. Г. Петросяна", Проспект Адмирала Исакова 24, г. Ереван 004, Республика Армения, e-mail: ghazaryan_soil@yahoo.com., kroyan.samvel @ mail.ru

Республика Армения малоземельная горная страна со сложной структурой высотной поясности всех компонентов ландшафта, в том числе и почвенного покрова. В статье анализировано соответствие классификации генетических подтипов почв республики международным критериям. За основу классификации всех генетических типов и подтипов почв приняты международные стандарты, представленные в World Reference Base for Soil Resources (WRB).

Ключевые слова: тип почвы, подтип, международная классификация, генетический горизонт, Реферативная База Почв Мира (WRB).