ПЛОДОРОДИЕ ПОЧВ

UDC 631.417.2 (479.25)

Manukyan R.R.

HUMUS STATE TRANSFORMATION OF THE RECLAIMED SOLONETZ-SOLONCHAK SOILS OF ARARAT VALLEY DURING THEIR AGRICULTURAL USE

National Agrarian University of Armenia, 0009, Yerevan, Teryan 74, Republic of Armenia, e-mail: hoxagitutyun@mail.ru

Abstract. The effective use of soil resources largely depends on the content, composition and reserves of humus, which characterizes fertility, agro-industrial properties and productivity of soils.

The changes in some of the basic chemical, physical-chemical properties and humus state of soda solonetz- solonchaks, meliorated solonetz -solonchaks and irrigated meadow-brown soils of the Armavir region in Ararat valley are investigated.

In a relatively short period of time, improvement in the basic properties of soils is observed, which positively affects their humus state. The reclaimed solonetz-solonchaks become closer to irrigated meadow-brown soils in their desalinization and dealkalization rate, salt content, CO32-, pH, water-soluble and absorbed sodium, as well as in the composition of humus cluster.

Key words: humus state, transformation, main soil properties, reclaimed, solonetz-solonchak, irrigated meadow-brown soils.

INTRODUCTION

Efficient use of land resources is related to a number of factors, mainly to the quantity and quality of the organic substances available in the land, which in its turn characterizes the level of soil fertility and productivity. The lands main vital agro -industrial properties depend on the humus content, composition and reserves.

The humus transformation processes of the arable and reclaimed solonetz-solonchak lands during their agricultural use in conditions of our republic are very little investigated.

The objective of the current work is to study the humus content, the transformation of clusters composition and reserves in sodium solonetz-solonchak soils, in solonetz-solonchaks with different reclamation degree and as a reference in the irrigated meadow-brown soils for the comparison.

In conditions of considerable evaporation of semi-desert arid zone climate, lack of natural outflow of the highly situated mineralized ground waters the lands of Ararat valley have been formed, including the salinized lands. The evaporation amount during the year exceeds the precipitation quantity [1] by more than 5 times according to the multi-year average data. The deficit among the climate elements is supplemented at the expense of ground waters. The salinization nature of the land is related to the hydrological characteristic traits of the valley.

OBJECTS AND METHODS

The main chemical, physical-chemical properties and humus content, composition and reserves change of the sodium saline-alkaline, reclaimed saline-alkaline and irrigated meadow brown soils have been investigated during the agricultural use of arable lands of Armavir region in Ararat valley. Similar investigations on the humus state of the sodium saline-alkaline lands connected with the soils chemical reclamation has been conducted by S.M. Arazyan [2], investigations related to the secondary salinization of the irrigated meadow brown soils have been conducted by R.R. Manukyan and others [3]. The humus content has been determined by Turin's method and its cluster composition according to Kononova and Belchikova's pyrophosphate method [4].

The salinization and alkalization of the hydro-morph solonetz-solonchak soils of Ararat valley is caused under a number of hydro geological circumstances: ground water mineralization and its high position, their capillary rise and evaporation, environmental strongly alkaline reaction (pH = 9-11), considerable saturation of the absorbed sodium (50-80 % out of the amount of exchangeable cations).

RESULTS AND DISCUSSIONS

The research results show that in sodium solonetz-solonchak soils the sodium content is rather high (3,4-2,9 mg/eq), the environmental reaction is strongly alkaline (pH = 9,4-9,0), water-soluble salts amount reaches 1,11-0,98 %, the absorbed sodium quantity is rather high 21,80-16,35 mg/eq (Table 1).

Table 1 – Some chemical and physical-chemical properties of sodium solonetz-solonchaks, reclaimed solonetz-solonchaks and irrigated meadow brown soils of Armavir region

Soil type	Depth, cm	pH	Salts amount, %	CO_3^{2-}	Water-soluble Na^+	Absorbed Na^+
				mg/eq		
Sodium saline-alkaline/solonetz-solonchak	0-25	9,4	1,11	3,4	18,35	21,80
	25-50	9,0	0,98	2,9	13,66	16,35
Incompletely ameliorated solonetz-solonchak	0-25	8,5	0,32	0,17	3,84	6,47
	25-50	8,7	0,40	0,55	2,70	4,28
Ameliorated solonetz-solonchak	0-25	8,1	0,14	n/a	0,95	2,30
	25-50	8,1	0,13	n/a	0,78	1,17
Irrigated meadow brown	0-25	7,6	0,14	n/a	0,70	1,38
	25-50	7,6	0,16	n/a	0,77	1,84

The chemical reclamation of solonetz-solonchak soils was carried out by means of 1 % sulfuric acid about 30 years ago. The reclaimed soils are characterized by the averagely sandy and clay mechanical composition, where the silt content makes 7-8% and the physical clay makes 21-28 %. Some part of the soils are reclaimed incompletely and the most part is reclaimed completely. In incomletely reclaimed solonetz-solonchaks all indicators are high: pH is 8,5-8,7, salts amount makes 0,32-0,40 %, CO_3^{2-} 0,17-0,55mg-eq, water soluble and absorbed sodium quantity makes 3,84-2,70 and 6,47-4,28 mg-eq respectively. While completely amelirated/reclaimed soils are in satisfactory condition; sodium is missing, the reaction is alkaline (pH = 8,1), water-soluble salts amount makes 0,14-0,13 %, the absorbed sodium amount doesn't exceed 2,3 mg-eq.

For comparison the ameliorated/ reclaimed state of the irrigated meadow brown soils of the same region have been also investigated. Irrigated meadow-brown soils, being the main production base of the Ararat valley, under favorable ameliorative conditions ensure a high yield of agricultural crop. According to a single scale of arable land assessment of the Republic of Armenia these soils were estimated at 94-100 points and were considered to be the best in the republic. Making only 9.3 % of all irrigated lands of the republic, they provided about 40 % of the gross agricultural production. The acquired data testify that the soils are also in sufficiently ameliorative conditions; the sodium is missing, the total salt content

doesn't exceed 0,16 %, water-soluble natrium (0,70-0,77 mg-eq /in 100 g soil) and the absorbed natrium content (1,38-1,84 mg-eq/ in 100 g soil) is also rather low.

Humus plays an important role in the process of soil fertility formation. Sodium solonetz-solonchak soils are characterized by low humus content, which doesn't exceed 0,4-0,5 % in 0-25 cm layers and in 25-50 cm layers it doesn't exceed 0,3 %. Humus reserves make 16,9 t/ha and 11.5 t/ha respectively and in 0-50cm layer it makes 28,4 t/ha (Table 2).

Table 2 – Humus content, composition and reserves in the soils of Armavir region in Ararat valley

Soil type	Depth, cm	Humus, %	Humus content,%		$C_{h.ac}:C_{f.ac.}$	Humus reserve, t/ha
			Humic acids	Fulvic acids		
Sodium saline- alkaline/ solonetz-solonchak	0-25	0,50	4,11	18,15	0,23	16,88
	25-50	0,34	1,54	42,56	0,04	11,48
Incompletely ameliorated solonetz-solonchak	0-25	0,82	8,51	14,63	0,58	27,67
	25-50	0,60	10,74	16,82	0,64	20,25
Ameliorated solonetz-solonchak	0-25	1,11	9,38	11,38	0,82	37,46
	25-50	0,86	11,04	11,22	0,98	29,03
Irrigated meadow brown	0-25	1,74	10,88	10,09	1,08	58,73
	25-50	1,43	12,56	10,87	1,15	48,26

The study of humus cluster composition shows that it is introduced by fulvic acids [5] in sodium solonetz-solonchaks.

In 0-50 cm layers of incomletely ameliorated solonetz-solonchaks some increase of humus content (0,82-0,60 %) and reserves (27,67-20,25 t/ha) takes place as compared to those of sodium solonetz-solonchaks, as a result of which the index of humic acids and fulvic acids ratio grows up (0,58-0,64) as well and the composition turns into humic-fulvic one.

While in completely ameliorated solonetz-solonchaks after the crops harvest process accumulation of organic residues and activation of humification processes occur, which enables the increase of humus (1,11-0,86 %) and humic acids quantities. At the same time the humus cluster composition keeps on staying on humic-fulvic one.

The humus state of irrigated meadow brown soils has been also investigated as a reference, where the humus content fluctuates within 1,74-1,43 % in half meter soil layers and the reserves amount fluctuates within 58,73-48,26 t/ha. Irrigation, a prolonged period of positive temperatures (above 100°C), a relatively high biological activity of the soil, contribute to the activation of humification processes and the formation of fulvate-humate humus of irrigated meadow-brown soils, in which humic acids predominate over fulvic acids. Related to the carbonate regime of the investigated soil humic and fulvic acids linked with calcium mainly prevail in the fractional composition of humic acid. Humus cluster composition is fulvic-humic.

CONCLUSION

Thus, in the result of soils desalinization and dealkalinization improvement in humus state occurs; the humus content and reserves increase, the

amount of fulvic acids decreases and that of humic acids increases, as a result of which the humus type changes: it is transformed from fulvic into humic-fulvic one and in its main properties it comes closer to the irrigated meadow brown soils.

REFERENCES

1 Aleksandrova L.N. Soil organic matters and its transformation processes. – M.: Science, 1980. – P. 287.

2 Kononova M.M. Soil organic matters. – M.: Science, 1963. - P. 314.

3 Arazyan S.M. Agro-chemical characteristics of the reclaimed sodium solonetz-solonchaks of Ararat valley and their productivity increase // Works of SRI of soil science and agrochemistry. – Yerevan, 1998. – Edition 30, vol. 1. – P. 150.

4 Mkhitaryan A.M., Hakobyan A.S. Daghestanyan G.G. Regularity of groundwater discharge for evaporation and convective heat transfer // Works of SRIHD. – 1972. – Edition 51. - P. 180.

5 Manukyan R.R., Bakunts S.G., Badalyan E.N. Humus features of irrigated meadow -brown soils of Ararat valley at their secondary salinization // Annals of agrarian science. – Tbilisi, 2005. – Vol. 3. – P. 97-101.

ТҮЙІН

Манукян Р.Р.

АУЫЛ ШАРУАШЫЛЫҒЫНДА ПАЙДАЛАНЫЛАТЫН АРАРАТ ЖАЗЫҒЫНЫҢ МЕЛИОРАЦИЯЛАНҒАН КЕБІР-СОРТАҢДАРЫНЫҢ ГУМУС ЖАҒДАЙЫНЫҢ ӨЗГЕРІСКЕ ҰШЫРАУЫ

Арменияның ұлттық аграрлық университеті,
009, Ереван, Терян көшесі 74, Армения Республикасы,
e-mail: hoxagitutyun@mail.ru

Топырақ ресурстарын тиімді пайдалану топырақтың агроөндірушілік қасиеттері мен өнімділігін сипаттайтын гумус қоры мен құрамына тәуелді болып келеді.

Армавир аймағындағы Арарат жазығының содалы кебір-сортаңдарының, мелиорацияланған кебір-сортаңдардың және суарылатын шалғынды-құба топырақтардың кейбір негізгі химиялық, физикалық-химиялық қасиеттері мен гумус жағдайының өзгерістері зерттелінді.

Салыстырмалы қысқа уақыт аралығында топырақтың негізгі қасиеттерінің жақсаруы байқалды, бұл сәйкесінше олардың гумус жағдайына оңтайлы әсер етті. Мелиорацияланған кебір-сортаңдар тұздану және кебірлену деңгейіне, құрамындағы тұздарға, CO_3^{2-}, pH, суда еритін және сіңірілген натрий, сонымен қатар гумустың топтық құрамына қарай суарылатын шалғынды-құба топырақтарға жақын келеді.

Түйінді сөздер: гумус жағдайы, өзгеріске ұшырау, топырақтың негізгі қасиеттері, мелиорацияланған, кебір-сортаң, суарылатын шалғынды-құба топырақтар.

РЕЗЮМЕ

Манукян Р.Р.

ТРАНСФОРМАЦИЯ ГУМУСОВОГО СОСТОЯНИЯ МЕЛИОРИРОВАННЫХ СОЛОНЦОВ-СОЛОНЧАКОВ АРАРАТСКОЙ РАВНИНЫ ПРИ ИХ СЕЛЬСКОХОЗЯЙСТВЕННОМ ИСПОЛЬЗОВАНИИ

Национальный аграрный университет Армении,
0009, Ереван, ул. Теряна 74, Республика Армения,
e-mail: hoxagitutyun@mail.ru

Эффективное использование почвенных ресурсов во многом зависит от содержания, состава и запасов гумуса, что и характеризует плодородие, агропроизводственные

свойства и производительность почв. Исследовано изменение некоторых основных химических, физико-химических свойств и гумусового состояния содовых солонцов-солончаков, мелиорированных солонцов-солончаков и орошаемых лугово-бурых почв Армавирского региона Араратской равнины.

За сравнительно короткий промежуток времени наблюдается улучшение основных свойств почв, что положительно сказывается и на их гумусовом состоянии. Мелиорированные солонцы-солончаки по мере их рассоления и рассолонцевания, по содержанию солей, CO_3^{2-}, pH, водорастворимому и поглощенному натрию, а также по групповому составу гумуса приближаются к таковым орошаемых лугово-бурых почв.

Ключевые слова: гумусовое состояние, трансформация, основные свойства почвы, мелиорированный, солонец-солончак, орошаемые лугово-бурые почвы.