European Journal of Agricultural and Rural Education (EJARE)
Available Online at: https://www.scholarzest.com
Vol. 3 No. 5, May 2022
ISSN: 2660-5643

INFLUENCE OF ANTHROPOGENIC IMPACT ON THE GROUP COMPOSITION OF HUMUS IN IRRIGATED SOILS OF THE ZARAFSHAN VALLEY

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Article history:

Received: 6th March 2022
Accepted: 6th April 2022
Published: 20th May 2022

Abstract:

The main soil types of the Zeravshan Valley are sierozem and meadow soils, as well as their subtypes and varieties. The bulk of agricultural crops are cultivated in these soils. Each type, subtype and variety of soil differs within the taxon in terms of the degree of cultivation and the duration of irrigation. All this is reflected in their group composition of humus, which is of great importance in their fertility. Nevertheless, the group composition of the soils of the Zeravshan Valley is very poorly studied and its study is relevant. The study used the generally accepted methods for studying humus and its group composition.

The study showed that the long-term permanent culture of cotton, tobacco and wheat has significantly reduced not only the supply of humus, but also its quality. At the same time, the Cg: Cfc ratio changed in favor of an increase in fulvic acids. In addition, the proportion of the non-hydrolyzable residue increased significantly against the background of a decrease in the total humus content.

Preservation of the balance of humus and some improvement in the ratio of fractions of humic and fulvic acids in a positive direction is noted only in the cultivation of alfalfa and perennial plantings. The development and irrigation of the land in the first years had a negative effect on the humus state of the soils of the Zeravshan Valley. But with an increase in the duration of irrigation, these indicators improved and reached the best indicator on old and old-irrigated soils.

Thus, in the conditions of the Zeravshan Valley, powerful anthropogenic factors affecting the humus state of the soil, incl. the group composition are irrigation and types of crops cultivated in this region.

Keywords: Soils, agricultural crops, humus, humic and fulvic acids, non-hydrolyzable residue.

INTRODUCTION.

In the Zeravshan Valley, such types of soils are widespread, such as sierozem, meadow, meadow-sierozem, sierozem-meadow, gray-brown, desert sandy, takyr and a number of other soils. Among them, the main ones are serozem and meadow soils, which are considered the most fertile and constitute the bulk of the irrigated soils of the Zeravshan Valley. But in recent years, with an increase in the intensification of agriculture and anthropogenic impact, a decrease in the fertility of these soils has been observed, which is reflected in a decrease in the content and quality of humus. Therefore, to increase soil fertility, it is first of all necessary to study the regularities of changes in the content and quality of humus under the influence of anthropogenic factors associated with the cultivation of agricultural crops.

According to many researchers, the main source of soil fertility are humic substances that can provide plants with all the necessary nutrients, energy resources, increase the water-holding capacity of the soil, improve its physical and physicochemical properties, to increase the ability of the soil to resist the pressure of toxic substances, blocking their activity [6 ; 10; 11; 12; 14; 15; 16; 17]. Scientists from many countries have studied in detail the humus state, group and fractional composition of soils and the influence on them of various natural and anthropogenic factors, including land development and tillage [1; 3; 7; 9; 13; 16; 18; 19; 20; 21; 22], cultivation of agricultural crops [4; 8; 15; 19; 22], irrigation and fertilization [5; 9; 17; 19; 22].

But in the soils of the Zeravshan Valley, such studies were carried out very few in number and and a long time ago, although the decrease in the amount and quality of organic matter occurs with accelerated at pace.

The purpose of the research is to establish the patterns of changes in the humus state, incl. the group and fractional composition of humus in the serozem belt and the desert zone of the Zarafshan valley, depending on the age of irrigation and individual agricultural techniques, including the application of fertilizers and the type of crops cultivated.

METHOD.

Soil samples were taken from different types, subtypes and varieties of soils in the Zarafshan Valley from the reference sections along the genetic horizons. Then they were dried in a dark place. The humus content was determined by the Tyurin method, modified by Nikitin, and the fractional and group composition of humus by the Tyurin method, modified by Ponomareva and Plotnikova [2].

RESULTS AND DISCUSSION.

The study of the group composition showed that the humus of all types of the Zarafshan valley can be attributed to the fulvate type, and mainly in the upper horizons, it belongs to the humate-fulvate, that is, the ratio Cgk: Cfk is within 0.5-1

Depending on the crops cultivated and the mechanical composition, changes the content of humic acids, while content humic acids were higher after cultivation of alfalfa and in the garden, and after wheat it decreased. So, when cultivating alfalfa, the content of humic acids in the 0-30 cm layer was 24.9% (Table 2), in the 30-50 cm layer - 23.5%, after long-term wheat cultivation - 20.9% and 20.1 %.

Table 1.
Qualitative composition of humus in soils of the Zarafshan valley

Types and subtypes of the studied soils	Numberofsections n	Horizondepth, cm	Totalsoil carbon, %	Carbon						Cga: Cfa
				Humicacids		Fulvicacids		Non-hydrolysableresidue		
				%	±m	%	±m	%	±m	
1. Soils of the serozem belt (Samarkand region)										
a. Automorphicsoils										
Typicalserozem (virginsoil)	3	0-30	0,775	26,3	-2,6 +2,5	31,7	-1,7 +2,1	42,0	-4,6 +2,9	0,83
	3	30-50	0,327	12,6	-0,4 +0,7	30,6	-3,9 +5,4	56,8	-5,0 +3,2	0,42
	3	50-70	0,287	8,4	-0,2 +0,4	27,7	-2,4 +2,8	63,8	-3,1 +2,7	0,31
	3	70-100	0,212	5,7	-0,6 +0,8	23,4	-0,9 +0,9	70,9	-0,7 +0,7	0,24
Typicalserozem (rainforest)	3	0-30	0,487	18,3	-1,9 +2,3	28,6	-1,2 +0,9	53,1	-2,5 +2,2	0,64
	3	30-50	0,313	16,1	-1,1 +2,8	26,6	-1,7 +1,6	57,3	-2,3 +2,6	0,61
	3	50-70	0,252	15,2	-1,8 +3,3	25,6	-1,1 +1,2	59,2	-2,8 +1,3	0,59
	3	70-100	0,216	14,4	-3,3 +3,6	24,9	-0,7 +0,2	60,6	-3,3 +1,1	0,58
Typical newly irrigated gray soils (serozem)	3	0-30	0,406	23,8	-4,2 +5,6	24,3	-1,8 +0,9	51,9	-6,5 +6,0	0,98
	3	30-50	0,286	22,0	-4,1 +6,2	25,2	-1,2 +1,8	52,8	-5,7 +5,3	0,88
	3	50-70	0,233	21,4	-5,2 +6,8	25,9	-1,2 +1,4	52,7	-5,6 +5,4	0,83
	3	70-100	0,218	19,8	-4,8 +6,8	27,1	-1,2 +0,6	53,1	-7,3 +6,0	0,73
Typical old-irrigated gray soil (serozem)	5	0-30	0,609	23,4	-2,9 +3,3	30,6	-2,2 +1,9	46,0	-3,5 +3,2	0,77
	5	30-50	0,455	22,0	-2,1 +3,8	29,0	-2,7 +2,6	48,9	-3,3 +3,6	0,76
	5	50-70	0,387	20,4	-2,8 +4,3	27,5	-2,1 +2,2	52,2	-4,8 +2,3	0,74
	5	70-100	0,337	18,9	-4,3 +4,6	26,6	-1,7 +1,2	54,5	-5,3 +3,1	0,71

Light gray soil (serozem) newly developed	5	0-30	0,461	16,5	-3,3 +2,3	24,8	-2,2 +4,8	58,7	-6,8 +3,3	0,67
	5	30-50	0,319	14,2	-3,6 +3,1	23,7	-2,1 +5,2	62,0	-8,2 +4,1	0,60
	5	50-70	0,260	12,7	-3,2 +3,8	22,5	-2,9 +6,0	64,8	-9,8 +5,0	0,57
	5	70-100	0,230	11,5	-4,3 +3,7	21,5	-2,6 +5,0	67,0	-7,9 +6,9	0,54
b. Semihydromorphicsoils										
Old-irrigated meadow-gray soil(serozem)	3	0-30	0,442	20,3	-1,1 +1,9	27,7	-1,0 +0,9	52,0	-0,9 +0,6	0,74
	3	30-50	0,387	18,8	-1,7 +1,8	26,3	-1,3 +1,7	54,9	-1,6 +3,0	0,72
	3	50-70	0,364	18,3	-1,8 +1,8	25,4	-1,2 +2,1	56,3	-2,1 +3,0	0,72
	3	70-100	0,361	17,4	-1,5 +2,0	23,7	-1,6 +2,1	58,9	-1,7 +3,0	0,74
c. Hydromorphicsoils										
Meadownewlyirrigated	4	0-30	0,572	22,4	-2,5 +3,3	25,5	-1,8 +3,1	52,1	-3,7 +5,5	0,88
	4	30-50	0,452	20,8	-2,6 +4,7	23,4	-1,2 +2,3	55,9	-5,4 +4,9	0,89
	4	50-70	0,257	19,2	-3,4 +1,9	22,4	-3,3 +3,3	58,4	-2,5 +3,3	0,86
	4	70-100	0,405	18,1	-3,8 +1,1	21,1	-1,9 +2,3	60,8	-2,3 +3,8	0,86
Meadowold-irrigated	2	0-30	0,651	25,1	-2,1 +4,2	27,2	-2,3 +4,0	47,7	-4,8 +2,7	0,92
	2	30-50	0,617	23,6	-1,9 +4,5	26,2	-2,3 +4,2	50,2	-4,9 +3,0	0,90
	2	50-70	0,564	22,2	-1,6 +3,1	24,5	-1,0 +3,1	53,3	-2,6 +2,0	0,91
	2	70-100	0,503	21,2	-1,5 +3,7	23,8	-1,1 +2,7	55,0	-4,7 +3,9	0,89
II. Desert zone (Bukhara region)										
Hydromorphicsoils										
Meadownewlydeveloped	3	0-30	0,379	10,1	-2,3 +1,3	16,3	-1,2 +2,8	73,7	-4,8 +1,3	0,62
	3	30-50	0,226	6,1	-1,6 +1,1	14,3	-1,1 +3,2	79,6	-6,2 +2,1	0,43
	3	50-70	0,194	4,4	-2,2 +1,8	13,0	-1,9 +3,0	82,7	-4,8 +1,0	0,34
	3	70-100	0,209	3,8	-2,3 +1,7	12,5	-1,6 +2,0	83,7	-5,9 +4,9	0,30
Meadownewlyirrigated	6	0-30	0,461	11,6	-5,5 +5,7	22,1	-3,2 +3,5	66,4	-6,3 +4,1	0,53
	6	30-50	0,373	10,4	-6,7 +6,3	20,7	-3,8 +3,5	68,9	-7,8 +7,9	0,51
	6	50-70	0,255	7,3	-4,1 +6,9	18,9	-2,6 +2,1	73,8	-8,7 +4,2	0,39
	6	70-100	0,234	6,2	-3,0 +1,5	18,3	-1,6 +2,0	75,5	-3,3 +2,5	0,34
Meadowold-irrigated	12	0-30	0,598	15,4	-3,5 +13,3	24,2	-3,8 +5,1	60,5	-13,7 +5,5	0,65
	12	30-50	0,491	13,4	-3,6 +12,7	22,1	-2,2 +3,3	64,5	-15,4 +4,9	0,60
	12	50-70	0,382	10,6	-5,4 +3,9	20,5	-4,3 +4,3	68,8	-4,5 +5,3	0,53
	12	70-100	0,359	9,0	-5,8 +3,1	19,6	-3,9 +4,3	71,4	-5,3 +7,8	0,46

Meadowoasis oldirrigated	11	0-30	0,604	21,3	-3,0 +5,2	26,5	-3,3 +5,0	52,2	-6,8 +4,7	0,81
	11	30-50	0,516	20,0	-3,9 +6,5	25,7	-3,3 +5,2	54,3	-8,9 +7,0	0,78
	11	50-70	0,420	19,0	-3,6 +5,1	24,7	-3,0 +5,1	56,3	-5,6 +5,0	0,78
	11	70-100	0,375	18,1	-3,5 +5,7	23,8	-3,1 +5,7	58,1	-6,7 +3,9	0,77

In the subregion of the plains of the serozem belt, the content of humic and fulvic acids, depending on the horizon, soil type, and also cultivated crops, varied within wide limits. A sharp decrease in the content of both humic acids and fulvic acid is observed along the soil profile, this is especially clearly observed in humic acids.

When cultivating cotton, the processing of row spacings, the intensive use of mineral fertilizers contributes to the rapid mineralization of humic and fulvic acids, which is noted in all types of soils. The highest content of humic acids in all types of soils in the cultivation of alfalfa and in the garden.

The cultivated crops also influenced the content of fulvic acids. Thus, in irrigated meadow and meadow-sierozem soils after wheat, fulvic acids were higher than after cotton, and vice versa in typical sierozem. In newly developed gypsum-bearing light sierozem soils, the content of humic and fulvic acids in absolute amount and relative content is less than in other considered soils. There were more fulvic acids and amounted to 24.8% in 0-30 cm and 23.7% in 30-50 cm soil layers (Table 1).

In the desert zone of the Zarafshan Valley, the content of humic acids in hydromorphic soils was very low compared to similar soils in the serozem belt. So, in the newly developed meadow soil in the 0-30 cm layer, the content of humic acids was 10.1%, in the newly irrigated soil - 11.6%, in the old-irrigated soil - 15.4%. With an increase in the age of irrigation of these soils, the decrease in the proportion of humic acids in the humus composition was more uniform. The proportion of fulvic acids varied in the in the same order, while the proportion of non-hydrolyzable humus residue changed the opposite. Thus, the content of humic acids is higher in the old irrigated meadow soil.

Cultivated crops also influenced the content of humic acids. Thus, in the old-irrigated meadow soil, the highest content of humic acids was observed during the cultivation of alfalfa and rice, and during the cultivation of wheat, and especially cotton, the content of humic acids decreased. In the irrigated meadow soils, their high content was noted during the cultivation of alfalfa, and low after the cultivation of maize and cotton (Table 2).

In all the soils of the desert zone, the content of humic acids rises during the cultivation of alfalfa, this was especially noticeable in the upper horizons of the soil. In the cultivation of wheat, corn and cotton, the lowest content of humic acids was observed. No clear pattern was observed in the change in the content of fulvic acids. The same pattern is also noted in the soils of the serozem belt (Table 2).

Table 2.

Changes in the qualitative composition of humus in the 0-30 soil layer of the Zarafshan valley depending on the cultivated crops.

Types and subtypes of the studied soils	Cultivatedcrops	Carbon			Cga :Cfa
		humicacids	Fulvicacids	Non-hydrolyzableresidue	
Soils of the gray earth belt (Samarkand region)					
Automorphicsoils					
a) typical newly irrigated gray soil(serozem)	Lucerne(alfalfa)	29,4	25,2	45,4	1,17
	Cotton	22,4	25,2	52,3	0,89
	cerealcrops(grain-ear)	19,6	22,5	57,9	0,87
6) typical old-irrigated gray soil (sub-areas of foothills)	Lucerne(alfalfa)	24,9	29,6	45,5	0,84
	cerealcrops(grain-ear)	20,9	31,4	47,7	0,67
	Perennialplantations	25,4	31,0	43,7	0,82
	Virginland	26,3	31,7	42,0	0,83
в) light gray soil newly developed	Lucerne(alfalfa)	18,5	29,6	51,9	0,63
	cerealcrops(grain-ear)	16,0	23,5	60,5	0,68
	Perennialplantations	16,0	23,7	60,3	0,68
Semihydromorphic					
ameadow-sierozem soil,	Cotton	19,6	27,8	52,6	0,71

old-irrigated	cerealcrops(grain-ear)	19,2	28,6	52,2	0,67
	Perennialplantations	22,2	26,7	51,1	0,83
Hydromorphicsoils					
а) newly irrigated meadowsoils	Cotton	22,4	25,5	52,1	0,88
б) meadow soils old-irrigated	cerealcrops(grain-ear)	25,1	27,2	47,7	0,92
Desertzone (Bukhararegion)					
Hydromorphicsoils					
а) newly-developedmeadow	Perennialplantations	10,1	16,3	73,7	0,62
б) newlyirrigatedmeadow	Lucerne(alfalfa)	17,3	22,6	60,1	0,77
	Cotton	9,1	21,8	69,2	0,42
	cerealcrops(grain-ear)	12,5	22,2	65,3	0,56
в) meadowold-irrigated	Lucerne(alfalfa)	23,7	24,8	51,5	0,96
	Cotton	13,4	25,3	61,3	0,53
	cerealcrops(grain-ear)	13,3	23,5	63,1	0,57
г) meadow-oasis old-irrigate	Lucerne(alfalfa)	24,1	25,8	50,1	0,93
	Cotton	19,7	26,3	53,9	0,75
	cerealcrops(grain-ear)	21,9	27,1	51	0,81

The mobility of humus can be judged by the amount of non-hydrolyzable residue. The lowest proportion of non-hydrolyzablehumic substances was noted after growing alfalfa and in the soil under an apple tree, and in soils under cotton, tobacco, and wheat, the proportion of non-hydrolyzablehumic substances was the highest.

CONCLUSION.

Thus, the content of humus in the soils of the belt of typical gray soils and in the soils of the desert zone changes not only depending on genetic properties and other natural factors, but also on the age of irrigation and cultivated crops. So, regardless of the type of soil, in general, in all studied zones, the influence of long-term irrigation and cultivation of agricultural crops on the content and reserve of humus, their change along the horizons is noted.

In the process of long-term irrigation and agricultural use in old and old-irrigated soils, there was an accumulation of organic matter, not only in the upper layers, but also throughout the soil profile. Along with an increase in the content of humus, as the duration of irrigation increases, its quality improves.

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