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CHANGES OF CERTAIN PROPERTIES OF RAINFED SOILS DUE TO EROSION IN THE NORTH-EAST AND SOUTH-WEST AREA OF UZBEKISTAN

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Today, in the world, “The area under agricultural crops is 1.6 billion hectares, of which 1.3 billion hectares are rainfed lands and 60% of agricultural products are cultivated in them”[1]. In the cultivation of agricultural products, it is important to use various agrotechnologies to effectively use rainfed land, maintain and increase its fertility, and obtain high and quality crops.

In the world, scientific research is being carried out in a number of priority directions on agro-technologies for increasing land fertility through the use of natural moisture in rainfed soils, organic and mineral fertilizers and biopreparations. In particular, special attention is paid to agrotechnologies aimed at determining the effect of absorbents, organic and mineral fertilizers, and biopreparations on agrophysical and agrochemical properties of rainfed soils, their biological activity and productivity.

In rainfed soil areas, surface water erosion threatens all soil properties. The mechanical composition of the soil significantly affects all other properties of the soil (chemical, physical, etc.). If we pay attention to fine-particle clay and colloidal fractions, most scientists say that soil fertility is directly related to the amount of muddy fractions in it. According to M.M. Tashkuziev, the amount of humus and nitrogen increases as the size of the fractions decreases. According to H.M. Maksudov, it is noted that humus reserves (57-79%) are in clay fractions in dark serozems [1,2,3].

I.M.Gabbasova et al. (2016) studied the changes of eroded soils over time depending on agricultural use in the territories of CIS (Bashkiria). In the northern forest-steppe zone, the development of erosion processes was stopped using soil-saving processing technologies and crop rotation. In weakly eroded light gray forest soils, the thickness of humus-accumulative horizons increased, the amount of humus increased, and it was found that the conversion of arable land to rainfed land was the most effective. Also, it was observed that in podzol and typical black soils, in the conditions of crop rotation (grain) and classical tillage, ploughing the

land gave good results, especially depending on the level of erosion, the humus reserve decreased towards the lower layers. The development of water and wind erosion processes on the slopes depends on the level of the slope: after 35 years, the granulometric composition of the eroded soils of varying degrees on the slopes with unobstructed streams was reduced, and the fractions of fine dust increased at the bottom of the slope [4].

The mechanical composition of the soil greatly affects the chemical, physical and biological properties of the soil. The mechanical composition of the soil is determined according to the nutrients absorbed by the plants and the level of soil moisture. The mechanical composition of the soil and the chemical composition of different fractions are also different. As the diameter of the effective mechanical elements in the fractions decreases, the amount of humus, absorption capacity, as well as maximum hygroscopicity, moisture capacity, capillarity and soil compaction increase several times [1,2,5,6,7,8,9].

Eroded rainfed dark serozems of Sukok region of Chotkol mountain range and Boysun mountain of Hisar mountain range. Soil analyzes were carried out based on E.V. Arinushkina's "Manual on chemical analyzes of soil", statistical analysis of the obtained results was performed on the basis of B.A. Dospekhov's "Methods of field experiments" methodical manual [10].

Changes in the mechanical composition of the rainfed dark serozems of the western Chotkol mountain slope and foothill under the influence of erosion processes. It was found out from the research that the mechanical composition of rainfed soils in different parts of the slope is not the same, the mechanical composition of the soil depends on the rock that forms the soil and the degree of erosion. The mechanical composition of the soil has not changed in the areas where the relief is flat and not affected by water erosion.

In eroded soils with a significant degree of slope, the amount of physical clay decreases sharply, while in soils "accumulated" as a result of erosion, it increases on the contrary. All this information on the mechanical composition of rainfed soils subjected to flow-water erosion is presented in Table 1. The amount of physical clay in the mechanical composition of dark serozems formed in loess and loesslike deposits has changed under the influence of erosion. For example, in non-eroded dark serozems, the amount of physical clay in arable layers was 51,9%, in highly eroded soils – 42,34%.

The amount of silt and fine dust fractions can be shown as information that clearly shows the effect of water erosion on the mechanical structure of the soil (Table 1). Due to the leaching of silt and small dust fractions in the mechanical composition of the eroded rainfed dark serozems, the amount of physical clay has decreased, the mechanical composition of the soil has been lightened. In addition, it is clearly observed that the upper layer of eroded soils is not enriched with dispersed particles compared to the non-eroded soil layer. This means that the soil formation process in eroded soils has a unique character and is different from the normal soil formation process in non-eroded soils. As a result of erosion, it is observed that the mechanical structure of the "washed-out and accumulated" soils was more strongly affected by the erosion process, and the mechanical structure of

the soil section was aggravated up to the deeper layers. It was also found that the amount of physical clay and silt accumulated in soils "washed out and accumulated" as a result of erosion is 8-10% more than in eroded soils.

Thus, under the influence of erosion, rainfed dark serozems of the right bank of Sokoksoy undergo drastic changes in the soil structure: the mechanical composition becomes lighter, silt and fine dust fractions become poorer, and larger fractions are enriched; processes such as aggravation of the mechanical composition and increase of silt and sand fractions in the lower layers are observed in the "washed-out and accumulated" soils as a result of erosion. All these changes due to erosion affect the chemical and agrochemical properties of the soil.

Table 1. - Changes in the mechanical composition of the rainfed dark serozems of the right bank of Sokoksoy depending on the degree of erosion

Soil and its erosion degree	Depth, cm	Fraction size, mm							
		>0,25	0,25-0,1	0,1-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	Sum of physical clay, %
Non-eroded soil	0-22	0,6	0,5	3,4	43,6	17,0	17,4	17,5	51,90
	22-52	0,3	0,5	5,5	46,1	18,9	13,1	25,6	47,60
	52-83	0,3	0,9	7,2	52,5	8,9	10,9	19,3	39,50
	83-129	0,1	0,1	4,3	52,1	14,0	11,9	17,5	43,40
	129-168	0,1	0,1	5,0	56,0	6,7	15,6	16,5	38,80
Weakly eroded soil	0-26	0,1	0,3	7,2	42,2	14,5	20,4	15,3	50,20
	26-45	0,1	0,3	6,6	39,2	14,7	21,0	18,1	53,80
	45-75	0,1	0,3	6,2	44,1	13,3	21,1	14,9	49,30
	75-105	0,1	0,3	6,9	42,9	15,9	15,5	18,4	49,80
	105-170	0,1	0,4	6,4	43,2	15,7	15,7	18,5	49,90
Moderately eroded soil	0-27	0,1	0,3	7,1	48,7	13,6	19,0	11,2	43,80
	27-45	0,3	1,0	6,1	43,8	14,1	19,0	15,7	48,80
	45-94	0,1	0,3	3,3	47,0	15,1	17,2	17,0	49,30
	94-170	0,1	0,3	8,6	44,0	15,3	15,9	15,8	47,0
Strongly eroded soil	0-25	1,1	5,1	3,8	47,8	16,6	16,3	9,3	42,34
	25-42	0,8	5,5	4,0	45,3	15,6	15,0	13,8	44,44
	42-68	0,9	6,1	8,2	34,5	15,7	16,7	17,9	50,30
	68-106	1,8	6,5	6,0	37,4	14,6	19,0	14,7	48,30
	106-136	1,3	5,3	5,1	38,7	15,6	19,3	13,7	49,60
	136-180	1,8	6,6	6,2	39,0	15,2	18,9	12,3	46,40

Washed out and accumulated soil	0-18 18-42 42-50 90-140 140-175	0,2 0,1 0,3 0,6 0,6	0,3 0,2 0,6 0,8 4,8	2,4 3,9 2,4 10,5 4,4	42,6 44,5 33,8 34,0 30,0	16,6 15,6 12,3 20,0 15,8	16,5 16,0 18,0 20,0 15,9	24,4 19,7 24,2 24,0 17,9	54,40 51,30 54,80 64,00 49,60

Changes in the mechanical composition of rainfed dark serozems of Boysun mountain slope and foothill under the influence of erosion processes.

According to our research, it was observed that the mechanical composition of the soils of Boysun mountain is not uniform along the slope, depending on the soil-forming parent rocks and the degree of erosion. The soils of the studied area are medium and light sandy and sometimes heavy sandy.

The amount of physical clay in the mechanical structure of dark serozems formed in loess and loesslike deposits has decreased due to erosion. In non-eroded dark serozems, the amount of physical clay in the arable layer is 42,3%, in moderately eroded soils it is 34,2%.

The results of the research show that clayification is less developed in the soils of Boysun mountain than in the soils of the Western Chotkol mountain range. It is characterized by the absence of particularly large dust particles, the lack of particularly large sand particles and the abundance of silt particles in the lower part of the profile. Physical clay content increases as one moves from typical serozems to mountain brown soils. In the middle layers of mountain brown soils, clayification is more clearly expressed due to the increase in silt and fine dust fractions.

Table-2. Changes in the mechanical composition of the dark serozems of Boysun mountain depending on the degree of erosion

Fraction size, mm									
Section number and name	Depth, cm	> 0,25	0,25-0,1	0,1-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001	Sum of physical clay, %
Non-eroded, watershed	0-20	0,5	1,0	1,5	54,7	14,8	13,6	13,9	42,3
	20-52	0,5	1,0	1,3	53,3	11,5	20,2	12,2	43,9
	52-75	0,3	1,0	3,3	52,2	12,0	16,8	14,4	43,2
	75-110	0,1	0,1	29,8	29,1	7,4	14,8	18,7	40,9
	110-150	0,1	0,4	1,9	46,0	11,6	21,2	18,8	51,6
Moderately eroded, north slope	0-20	1,0	3,0	4,3	47,5	8,6	18,3	17,3	35,2
	20-42	0,5	1,0	8,6	51,2	7,7	19,1	11,9	38,7
	42-70	0,2	0,8	2,9	53,9	7,9	20,3	14,0	42,2
	70-91	0,5	1,5	5,7	53,3	9,4	16,9	12,7	39,0
	91-112	0,1	0,4	3,3	52,2	8,0	16,4	19,6	44,6
	112-150	0,3	1,0	5,5	42,0	8,1	19,0	21,0	48,1

Moderately eroded, south slope	0-23	0,8	0,2	13,0	51,8	9,8	11,8	12,6	34,2
	23-40	0,3	0,2	12,1	54,1	10,5	10,4	12,0	32,9
	40-65	2,0	0,1	8,4	54,9	7,7	14,7	12,2	34,6
	65-100	2,0	0,5	16,0	42,4	9,5	13,0	16,6	39,1
	100-122	2,5	0,5	14,1	48,5	4,7	13,8	15,9	34,4
Washed out and accumulated	0-21	2,0	3,0	3,2	47,7	17,1	12,9	14,1	44,1
	21-35	0,5	1,5	1,7	54,3	10,8	18,7	13,0	42,5
	35-52	0,2	0,8	9,7	45,7	10,2	19,1	14,3	43,6
	52-74	0,1	0,4	0,9	58,2	6,5	17,8	16,1	40,4
	74-121	1,3	0,6	1,9	56,2	8,0	19,8	12,2	40,0

In conclusion, it can be said that the study of the mechanical composition of the soils of Boysun mountain shows that there are sharp changes in the soil composition under the influence of erosion at different exposures of the slope: processes such as a reduction in the mechanical composition, a decrease in silt and fine dust fractions, and an increase in large fractions were observed. Compared to serozems, the amount of physical clay increases in the mountain brown soils, and the mechanical composition decreases in the soils of the southern slope. On the one hand, it depends on the soil-forming parent rocks, and on the other hand, it means that it depends on water erosion.

References

1 Makhsudov Kh. M., Shamsiddinov T. Sh. Eroded soils of the right bank of the Sukoksoy river and the western spurs of the Chotkol range and ways to increase their fertility [Text]/ Achievements of Science and Technology of the APK, - 2003. - No. 12. - P. 39-40.

2 Makhsudov Kh. M. Peculiarities of soil and ecological conditions of the soils of the southern spurs of the Hisar range [Text]/ Makhsudov Kh. M., Shadraimova K. I., Shamsiddinov T. Sh // Integration of agricultural education, science and production in the system of personnel training. Tashkent, - 2006. – No. 10. - P. 141-153.

3 Shamsiddinov T. Sh. Rainfed dark serozems and their susceptibility to water erosion [Text]/ Scientific and practical ways to improve environmental sustainability and socio-economic support of agricultural production, - 2017. - P. 328-331.

4 Gabbasova I.M., Suleymanova R.R., Khabirov I.K., Komissarov M.A., Fruauf M., Liebelt P., Garipov T.T., Sidorova L.V., Khaziev F.Kh. Changes in eroded soils over time depending on their agricultural use in the southern Cis-Urals [Text]/ Soil Science Russian Academy of Sciences, - 2016. ISSN: 0032-180X.

5 Makhsudov Kh.M., Gafurova L.A. Eroded mountain and foothill soils of Uzbekistan. [Text]/ Soils of Uzbekistan and some directions of improving their fertility" // Mekhnat, T., - 1998.

6 Muratkasimov A.S. The current condition of rainfed typical serozems and ways of their effective use (as an example of soils of Gallaorol district). [Text]/ PhD thesis, - 2019. – P.13.
7 Sodikova G.S. Soil-ecological conditions of Boysun mountain, biological activity of soils and the impact of erosion processes on them. [Text]/ Abst.diss.cand.biol.sci. Tashkent, - 2011. – P.37.
8 Sodikova G.S., Shamsiddinov T.Sh. Surface water erosion on rainfed soils in mountainous regions. Current problems in the theory and practice of agricultural science and their solutions. [Text]/ A collection of materials of the international conference dedicated to the "90th anniversary of the establishment of Tashkent State Agrarian University". - December 14-15, 2020 – P.1012-1016.
9 Kamilov B.S. Humate substances effect on biological activity and physical properties of eroded soils of Uzbekistan [Text]/ Kamilov B.S., Makhkamova A.Sh. Sodikova G.S., E.T.Kodirov. // Environmental Research. A virtual conference, - 2021. 15-19 November. IOP Publishing. DOI 10.1088/1755-1315/939/1/012041
10 Arinushkina E.V. Guidelines for the chemical analysis of soils [Text]: M., Moscow State University, - 1970. - P.487.