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Mechanical composition and properties of irrigated soils of syrdarya region

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Abstract: The article presents the main soil types in the region and their distribution by mechanical composition. It also presents methods for determining the mechanical composition of the region's soils and the results of the analysis of the mechanical composition of the soil by fractionation.

Keywords: Soil, mechanical composition, gray-meadow, meadow, salinity level, fraction, section, light loam, medium loam.

Introduction: The Resolution of the President of the Republic of Uzbekistan No. PP-71 dated February 13, 2024 "On Additional Measures to Combat Agricultural Land Degradation, Support Increasing the Humus Content and Productivity of Soils" establishes the procedures for allocating subsidies from the State Budget in order to prevent the negative impact of climate change in the Republic, reduce the degradation of agricultural lands, and increase crop productivity and soil productivity by increasing the humus content in the soil.

Today, in our republic, with special attention to the rational and effective use of land and water resources, research and assessment of the effect of physical, chemical and biological properties of soil on its productivity is considered one of the main tasks.

The irrigated meadow soils of Bukhara region are rich in humus (1.1-1.45%) and nitrogen (0.08-0.12%) and as a result of agro-irrigation runoff penetrating deep into the mud, an agro-irrigation layer is formed, the amount of humus is more, and according to the mechanical composition, the soil is heavy loam and medium loam [2.10.11].

The mechanical composition of soils has different effects on its physical, water-physical, physico-chemical, physico-mechanical, agrochemical, and biological properties. The ability of soils to hold water, its ability to rise through capillary tubes, and its ability to conduct water (filtration) are related to their mechanical composition. The mechanical composition determines the quantitative criteria and balances of moisture, heat, nutrition regimes, humus and nutrients

vitally necessary for plants [1.12.13.14.].

In the grassland soils located in the Mirzachul region, the amount of physical clay particles (<0.01 mm) varies within a very wide range across layers, from 8.2-15.9% to 63.4-66.5%. Among mechanical elements, large dust particles (0.05-0.01 mm) occupy the main place, fine particles (<0.001 mm) make up 4.2-10.8% [4.5.6.7.15].

Freshly irrigated non-soaked and weakly soaked meadow-gray soils have different mechanical composition and are mainly composed of heavy and light loam.

Freshly irrigated non-soaked and weakly soaked meadow-gray soils have different mechanical composition, consisting mainly of heavy and light sands, the amount of physical clay particles (<0.01 mm) varies from 21.4-25.5% in light sands, 48.1-53.0% in heavy sands, and 61.8-78.5% in clays , among the mechanical elements, large dust particles (0.05-0.01 mm) prevail, the amount of dust particles, excluding some horizons, is from 6.2-7.5% to 18.5-20.7% [8.9].

In order to improve the agrophysical properties of the soil under the conditions of different levels of salinity, it was observed that the improvement of the agrophysical properties of the soil was observed when cotton was planted for one year in a short rotation rotation, and then mash for grain + mash for siderate + 20 t/ha of manure + winter wheat were planted before winter wheat [3].

The state of soil reclamation and its productivity directly depends on the mechanical composition of the soil. 53.6% of the irrigated lands of Syrdarya region consist of medium loam, 31.3% light loam, 8.0% heavy loam, 6.1% sandy loam, 0.8% clay and 0.2% sandy mechanical composition [4].

The total land area in the administrative border of Syrdarya region is 427.6 thousand hectares, and the irrigated land is 287.4 thousand hectares. The land area of the region intended for agriculture amounts to 373.7 thousand hectares, or 87.4% of the total land area. Hydromorphic and semi-hydromorphic soils are widespread in the region. The irrigated soils of the Syrdarya region consist of light gray, meadow-gray, and gray-meadow soils. Irrigated meadow soils make up 13.2% of the total area of the region and are mainly distributed in Gulistan, Saykhunabad and Sirdarya districts. Pale ice soils are the main areas of the region. The soil nutrient supply is as follows: humus content is 0.5 - 1.0 percent, nitrogen 0.05 - 0.09 percent, phosphorus 0.05 - 0.2 percent, and potassium 2 - 2.5 percent.

Gray-meadow soils constitute the main part of regional irrigated agriculture. According to the mechanical composition, the soils are mainly light and medium loam. These soils are transitional (intermediate) soils from gray soils to grassland soils. Depending on the degree of salinity, the soils are of different degrees of salinity, among which there are weak, medium and strong salinity types.

The mechanical composition of the soils of the Syrdarya region varies depending on the location:

Sandy loam and light loamy soils – often found near rivers. They dry out quickly and do not retain moisture well.

• Medium and heavy gley irrigated soils – suitable for livestock and agriculture. These soils require good tillage.

• Clay soils – they retain moisture well, but can become waterlogged if the irrigation system is not well established.

The physical and mechanical properties of soil depend not only on its mechanical and structural composition and moisture content, but also on many chemical properties, the fine-dispersed fraction of the soil, and the composition of cations. The main goal of studying the mechanical composition of soil is to determine the amount of mechanical elements of various sizes and to develop a classification of its mechanical composition. In sandy and sandy loam soils, which contain a large amount of sand particles, the particles do not stick to each other and are scattered. Therefore, water moves very quickly from top to bottom through this type of soil layer, the air and temperature regime is good, and it offers very little resistance to tools that work the soil. However, humus, nitrogen, and other important nutrients accumulate poorly in the upper layer of the soil, because they are washed down to the lower layers. Heavy soils with a clay composition, although rich in nutrients, are not sufficiently productive due to unfavorable other conditions. Currently, soil particles are determined by N.A. Kachinsky's classification based on their quantity. The mechanical composition of the soil can be determined by 3 different methods.

- "Dry" method. To do this, take a small amount of soil, crush it well in the palm of your hand, then blow it lightly, and judge the mechanical composition of the soil by the number of dust particles remaining in the palm. The heavier the mechanical composition of the soil in the area being tested, the more particles will remain in the palm. This is the crudest method of determining the mechanical composition in the field, and only allows you to distinguish between heavy and light soil groups.

Determination by "clay rings". For this, 3-5 grams of soil is taken in the palm and a doughy clay is made by

adding some water. It is made into rings, and depending on its external condition, groups of mechanical particles such as sand, loam, glay, silt are separated. Depending on the mechanical composition, prepared rings can be as follows.

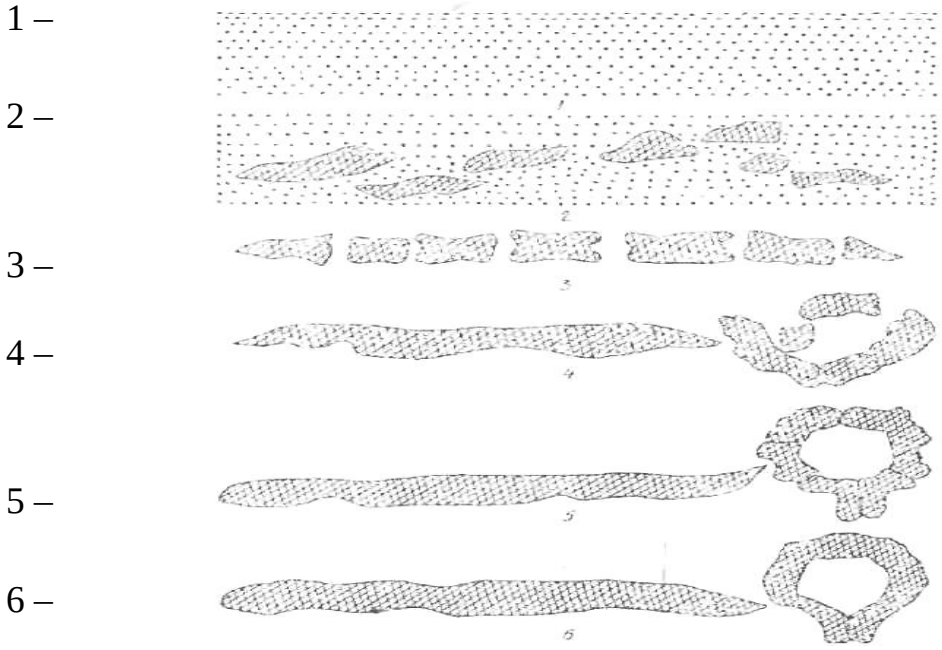

Figure 1. Determining the mechanical composition of the soil by making "muddy rings":

1-sand; 2-sandy loam; 3-light loam; 4-medium loam; 5-heavy loam; 6 -glay.

- Determination of the mechanical composition of the soil using sieves. It is used to separate its stones and sand into certain groups (large, medium, fine). Usually, sieves with holes with a diameter of more than 3 mm are used to determine the stony part of the soil. Determination of the degree of stonyness of the soil is most often carried out in field conditions. To do this, 1 kg of soil is taken and passed through a sieve. The remaining stony part is cleaned of small particles stuck to the stones using special wool brushes, then weighed on a technical scale with an accuracy of 0.1 g and its percentage is calculated.

The experiments were conducted in the conditions of soils prone to salinization in the Syrdarya region. In order to determine the physical and mechanical properties of the soil, in 2023, a cross-section was excavated from 3 points of the experimental area, and samples were taken from the 0-30, 31-60, 61-90, and 91-120 cm layers of the soil and their mechanical composition was determined.

1- table

Mechanical composition of soil 2023 year.

Soil cross-section, №	A sampled layer, cm	Factions, %							Physical clay, %	Mechanical composition
		>0.25	0.25-0.1	0.1-0.05	0.05-0.01	0.01-0.005	0.005-0.001	<0.001		
1	0-30	1,3	1,1	17,4	42,9	8,0	15,1	14,3	**37,4**	**medium loam**
	31-60	5,8	3,3	29,7	39,8	5,6	8,7	7,2	**21,5**	**light loam**
	61-90	5,9	3,7	28,4	41,3	4,8	8,7	7,2	**20,7**	**light loam**

	91-120	6,3	2,5	17,4	46,1	6,4	11,1	10,3	**27,8**	**light loam**
2	0-30	1,9	1,8	15,2	42,9	8,0	15,9	14,3	**38,2**	**medium loam**
	31-60	5,8	3,6	32,6	40,5	2,4	8,0	7,2	**17,5**	**sandy loam**
	61-90	5,3	2,7	33,3	40,5	2,4	9,1	6,8	**18,3**	**sandy loam**
	91-120	6,6	2,9	19,7	44,5	8,0	10,3	8,0	**26,2**	**light loam**
3	0-30	2,1	1,4	16,3	42,9	7,2	15,9	14,3	**37,4**	**medium loam**
	31-60	8,3	5,0	25,6	37,4	7,2	9,5	7,2	**23,9**	**light loam**
	61-90	5,2	4,4	27,7	41,3	6,4	8,7	6,4	**21,5**	**light loam**
	91-120	6,0	3,8	21,9	43,7	7,2	9,5	8,0	**24,6**	**light loam**

According to the results of the analysis, it was observed that the amount of physical clay in the soil sample of the 0-30 cm layer of the soil at the 1 point of the section is 37.4%, and according to the mechanical composition, the mechanical composition of the soil samples in the 31-60 cm, 61-90 cm, and 91-120 cm layers is light loam. The mechanical composition of the soil samples in the 31-60 cm and 61-90 cm layers of section 2 is sandy loam, and the mechanical composition of the soil sample in the 0-30 cm layer in section 3 is medium loam. According to the results of laboratory analysis, the mechanical composition of the soil samples in the 31-60 cm, 61-90 and 91-120 cm layers has a light loam mechanical composition.

CONCLUSION

In conclusion, it can be said that loamy soils are considered to be among the best soils, because loamy soils have the most suitable water, air, and temperature regimes, creating favorable conditions for physicochemical and biochemical processes. Therefore, before developing agronomic measures that increase soil productivity, the correct and accurate determination of soil mechanical composition is an important factor in the study of cultivated areas.

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