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PROPERTIES OF SOILS FORMED UNDER DIFFERENT GEOMORPHOLOGICAL CONDITIONS IN THE MIRZACHUL REGION

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Abstract: Soil properties can vary significantly depending on the geomorphological conditions under which they develop. This variation is directly linked to the diversity of soil parent materials, soil stratification, and variations in mechanical (particle-size) composition. This paper presents comparative data on the properties of irrigated gray-meadow (sierozem-meadow), meadow, and meadow-bog (marsh-meadow) soils located across the 1st, 2nd, and 3rd above-floodplain terraces of the Syr Darya River.

Keywords: terrace, proluvial, alluvial, loess-like deposits, groundwater table, soil salinity, particle-size distribution, humus, nitrogen, phosphorus, potassium, dry residue, sulfate, chloride.

Introduction

The river terrace on which soils are situated plays a crucial role in determining their agrochemical, agrophysical, and qualitative evaluation properties. Extensive scientific research has established that geomorphological positioning exerts a decisive influence on the genesis and transformation of soil attributes.

Y. Wang, Y. He, J. Zhan, and Z. Li [1] identified that the spatial configuration of soil particles depends directly on the terrace level along river basins. Comparing soils distributed across piedmont plains, central alluvial plains, and eastern coastal plains, they demonstrated that granulometric fractions—such as sand, loam, sandy loam, and clay—are distributed in accordance with regional geomorphological conditions.

E. A. Batrachenko [2] showed that soil properties depend primarily on parent materials. Furthermore, the intensity of anthropogenic impact on soils is governed by their geomorphological location. Relief variations within the Kursk region directly affect erosion processes, creating distinct ecological environments for soils situated in varied geomorphological positions.

S. S. Gudimovich [3] provided a comprehensive review of river terrace layout, terminology, and characterization, correlating specific soil properties with terrace morphology and synthesizing foundational scientific data alongside terrace profile schemes.

L. A. Yablonskikh [4] investigated the historical development of floodplain soils, highlighting that continuous hydromorphic saturation triggers severe gleying processes. This is morphologically expressed in profile color and structure; gleying fundamentally disrupts soil structure and reduces populations of beneficial aerobic microorganisms.

Extensive research has also addressed soil dynamics across various parts of the Mirzachul oasis under long-term agricultural development and irrigation. Prior investigations demonstrate that cropping systems improve soil fertility, and that noticeable property variations persist between the older and newly developed irrigation zones across diverse geomorphological settings [5–9].

Materials and Methods

To evaluate the properties of soils across different terraces of the Syr Darya River, field experiments were conducted using selected "benchmark (key) plots" on the 1st, 2nd, and 3rd terraces.

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These plots were chosen to be representative of the typical pedogenetic conditions of each terrace level. Full soil profile pits (sections) were excavated at each site. Morphological features were documented and compared. Soil samples were collected from genetic horizons and analyzed for particle-size distribution (granulometric composition), total humus, total nitrogen, total phosphorus, total potassium, available phosphorus and exchangeable potassium, as well as water-soluble salts via aqueous extraction.

Results and Discussion

Two agricultural massifs in the Gulistan district—"Boyovut" and "Uch Qahramon"—were selected as study sites. Below are the morphological descriptions, particle-size compositions, and agrochemical indicators of the representative soil profiles.

Profile 26 represents newly irrigated meadow-bog soils located on the 1st above-floodplain terrace of the Syr Darya River, composed of stratified alluvial deposits.

The texture is classified as medium loam (Table 1). Coarse silt particles predominate throughout the profile, which is typical for arid-zone alluvial soils. The humus-bearing horizon is 65 cm thick; the humus content reaches 1.30% in the 0–30 cm layer and 0.85% in the 30–50 cm layer. Available phosphorus is 8.5 mg/kg (0–30 cm) and 7.0 mg/kg (30–50 cm); exchangeable potassium amounts to 80 mg/kg and 120 mg/kg, respectively. A distinct gley horizon occurs at a depth of 100 cm. The groundwater table is situated at 125 cm.

Table 1. Soil particle-size (granulometric) distribution

Profile No.	**Horizon Depth, cm**	**Mechanical Fraction Sizes, mm (%)**							**Physical Clay Sum (<0.01 mm), %**
		1.0–0.25	**0.25–0.1**	**0.1–0.05**	**0.05–0.01**	**0.01–0.005**	**0.005–0.001**	**<0.001**	
Stratified alluvial deposits, 1st above-									

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Profile No.	Horizon Depth, cm	Mechanical Fraction Sizes, mm (%)							Physical Clay Sum (<0.01 mm), %
floodplain terrace of the Syr Darya River; newly irrigated meadow-bog soil									
26	0–35	0.5	0.2	13.6	43.3	22.4	12.1	7.9	42.4
	35–45	0.4	0.3	23.0	35.2	11.8	20.9	8.4	41.1
	45–60	0.3	0.3	19.0	46.3	22.5	7.4	4.2	34.1
	60–82	0.5	0.4	20.9	36.3	22.8	14.2	4.9	49.0

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Profile No.	**Horizon Depth, cm**	**Mechanical Fraction Sizes, mm (%)**							**Physical Clay Sum (<0.01 mm), %**
	82–100	0.3	0.2	22.3	33.9	24.2	17.2	1.9	43.0
	100–125	0.1	0.1	20.5	38.6	16.5	16.4	7.8	20.0
Stratified alluvial deposits, 2nd above-floodplain terrace of the Syr Darya River; irrigated									

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Profile No.	**Horizon Depth, cm**	**Mechanical Fraction Sizes, mm (%)**							**Physical Clay Sum (<0.01 mm), %**
meadow soil									
33	0–40	0.5	0.1	17.7	31.7	21.4	18.8	9.8	50.0
	40–60	0.8	0.2	16.8	35.9	24.1	13.2	9.0	39.3
	60–80	0.1	0.1	15.8	37.3	18.5	18.3	9.9	43.7
	80–100	1.8	0.2	28.5	33.0	15.7	13.4	7.7	36.5
	130–160	0.4	0.5	20.8	49.9	10.7	9.6	8.1	28.4
Alluvial-proluvial and loess-like deposits,									

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Profile No.	**Horizon Depth, cm**	**Mechanical Fraction Sizes, mm (%)**							**Physical Clay Sum (<0.01 mm), %**
3rd above-floodplain terrace of the Syr Darya River; irrigated gray-meadow soil									
34	0–35	0.8	0.1	18.3	40.1	18.3	11.8	10.6	40.7
	35–50	1.6	0.1	14.7	38.0	15.6	19.6	10.4	45.6
	50–75	0.3	0.3	12.6	38.9	16.4	18.0	13.5	47.9

Profile No.	Horizon Depth, cm	Mechanical Fraction Sizes, mm (%)							Physical Clay Sum (<0.01 mm), %
	75–100	15.9	0.6	16.4	41.1	9.7	9.8	6.5	26.0
	140–200	0.7	0.2	20.9	36.0	28.3	8.4	3.5	40.2

Profile 33 is located on the 2nd above-floodplain terrace of the Syr Darya River within stratified alluvial deposits, representing irrigated meadow soils.

The mechanical composition ranges between heavy and light loams. The humus layer is 65 cm thick, with an average humus content of 1.37% in this zone. The gleyed layer is recorded at 120 cm. The groundwater level lies at 200 cm.

Profile 34 represents irrigated gray-meadow soils on the 3rd above-floodplain terrace, formed over alluvial-proluvial and loess-like deposits.

The soil texture varies from medium to light loam. The humus horizon reaches 60 cm with a humus content of 1.40%. Available phosphorus is 15.2 mg/kg in the 0–30 cm layer and 8.5 mg/kg in the 30–50 cm layer; exchangeable potassium measures 220 mg/kg and 50 mg/kg across these respective layers. Bulk density is moderate. Gleying is absent throughout the surveyed profile. The groundwater table is found significantly deeper, at 255 cm.

Comparative evaluation of these terraces demonstrates that groundwater depth is the primary distinguishing variable: it is shallowest on the 1st terrace (125 cm) and drops to nearly 2.5 meters on the 3rd terrace. Consequently, the depth and expression of the gley horizon directly mirror this hydrogeological gradient.

Conclusions

Soils within the same regional territory exhibit pronounced morphological and physicochemical differences depending on their terrace position. These variations are most apparent in morphological features: meadow soils display darker colors due to sustained humus accumulation, while persistent moisture triggers gley formation, resulting in characteristic bluish-gray horizons. Concurrently, regular differences occur in particle-size distribution, salinity levels, and nutrient availability. Given these hydrological and morphological characteristics, prioritizing moisture-tolerant (hygrophilic) crops is recommended for agricultural lands on the 1st terrace of the Syr Darya River.

References

1. Wang, Y., He, Y., Zhan, J., & Li, Z. (2022). Identification of soil particle size distribution in different sedimentary environments at river basin scale by fractal dimension. Scientific Reports, 12, 10960. https://doi.org/10.1038/s41598-022-15141-6
2. Batrachenko, E. A. (2021). Investigation of the soil cover ecological state under the different geomorphological elements conditions. IOP Conference Series: Earth and Environmental Science, 677, 042081. https://doi.org/10.1088/1755-1315/677/4/042081
3. Gudimovich, S. S. (2005). River terraces (some remarks on morphology, genesis and classification). Bulletin of the Tomsk Polytechnic University, 308(5), 45–50.
4. Yablonskikh, L. A. (2001). Proceedings of Voronezh State University. Series: Geography. Geoecology, (1), 25–31.
5. Turdimetov, Sh. M., & Rakhimov, Z. (2022). Influence of leguminous and fodder crops on soil agrophysical properties and crop yields. Annals of Plant Sciences, 11(1), 4705–4711.
6. Turdimetov, Sh. M. (2022). Changes in the duration of irrigation of Mirzachul Oasis soils. Bulletin of Gulistan State University, (1), 39–47.
7. Turdimetov, Sh., Khudoyberdiyeva, Z., & Tadjibayev, A. (2023). Quality assessment of gypsum soils of Mirzachol Oasis. Journal of Population Therapeutics and Clinical Pharmacology, 30(12), 295–301.
8. Turdimetov, Sh., Urazalieva, M., & Esonboeva, N. (2023). Properties and quality assessment of hydromorphic soils of Mirzachol Oasis. European Chemical Bulletin, 12(Special Issue 1, Part-B), 3992–4000.
9. Batirov, Kh. A., Turdimetov, Sh. M., & Nurillaeva, R. B. (2023). Ecological role of different siderate crops in improving soil properties. American Journal of Agriculture and Horticulture Innovations, 3(11), 01–06.