



World Conference on Agricultural and Earth Sciences

Hosted Online from Istanbul, Turkey

Date: 20th October, 2026

Website: <https://econferencia.com>

MORPHOLOGICAL AND AGROCHEMICAL CHARACTERISTICS OF MEADOW-SWAMP SOILS IN CENTRAL FERGANA AND CRITERIA FOR IMPROVING THEIR FERTILITY

Iskandar Q. Yuldoshev

Doctor of Philosophy (PhD) in Agricultural Sciences, Junior Researcher,
Institute of Soil Science and Agrochemistry Research, Tashkent, Uzbekistan

E-mail yuldosheviskandar364@gmail.com

0009-0007-7545-3310

Sobitov O'limasboy Tojaxmedovich

Doctor of Biological Sciences, Senior Researcher, National Center for
Knowledge and Innovation in Agriculture, Tashkent, Uzbekistan

E-mail ulmasbek.sobitov@gmail.com

0000-0001-2345-6789

Abstract

This study examines the morphological structure, agrochemical status, and profile distribution of the major nutrients (N, P, and K) in irrigated meadow-swamp soils of Central Fergana. These soils, formed under semi-hydromorphic and hydromorphic conditions, were analysed for declining humus content, sodium-ion accumulation in the soil exchange complex, and its adverse effects on physicochemical properties. Scientific and practical recommendations were developed to improve soil fertility and reclamation status through the application of calcium-containing amendments, particularly gypsum, and the differentiated use of mineral and organic fertilisers.

Keywords: morphological characteristics, agrochemical indicators, humus, nutrient regime, soil fertility, reclamation status, calcium-containing amendments, gypsum application, hydromorphic regime.



World Conference on Agricultural and Earth Sciences

Hosted Online from Istanbul, Turkey

Date: 20th October, 2026

Website: <https://econferencia.com>

Introduction

The morphological characteristics of irrigated meadow-swamp soils in Central Fergana are closely related to their formation conditions, parent materials, groundwater regime, and the long-term effects of irrigation [1, 2]. These soils generally develop on alluvial deposits and are characterised by clearly differentiated soil horizons. The upper arable layer commonly has a loamy or clay-loam texture typical of meadow soils, while the composition and thickness of lower horizons may vary according to local hydrological conditions [3].

Carbonate accumulation is usually observed in the lower part of the profile, whereas signs of salinity may occur in certain areas. Changes in horizon colour, the degree of compaction, carbonate inclusions, and salt accumulation are recorded during morphological description. These features are important indicators for evaluating soil-forming processes and fertility status [4]. Since these soils have formed under semi-hydromorphic and hydromorphic conditions, their profiles are characterised by uneven moisture distribution, periodic changes in redox conditions, and the occurrence of saline layers at different depths [5]. Such conditions can restrict root development and reduce the efficiency of nutrient uptake by crops.

Agrochemical Properties and Nutrient-Regime Dynamics. The agrochemical properties of meadow-swamp soils in the study area determine their potential for efficient agricultural use and the selection of appropriate fertiliser and reclamation measures [6]. Humus is mainly concentrated in the upper arable layer, where plant residues and applied organic materials accumulate; its content decreases sharply with depth. This vertical distribution affects the nutrient supply, aggregation, water-holding capacity, and biological activity of the soil.



World Conference on Agricultural and Earth Sciences

Hosted Online from Istanbul, Turkey

Date: 20th October, 2026

Website: <https://econferencia.com>

Nitrogen and phosphorus are also relatively more concentrated in the upper layer. However, under irrigated conditions, the rapid mineralisation of organic matter and nutrient removal by crops require regular and differentiated application of mineral and organic fertilisers [5, 6]. Although plant-available potassium is often present in sufficient quantities, its mobility, leaching, and uptake by plants can become more complicated in saline areas [6, 7]. Therefore, fertiliser rates should be selected with due consideration of the soil's nutrient status, texture, salinity level, and crop requirements.

Salinisation and sodification increase the content of sodium ions in the soil exchange complex. Excess exchangeable sodium adversely affects the physicochemical properties of soil, causing structural degradation, dispersion of fine particles, reduced water permeability, and deterioration of the air–water regime [7, 8]. Consequently, the nutrition of agricultural crops becomes less favourable, while the efficiency of applied fertilisers may decrease.

Reclamation Significance of Cation-Exchange Capacity and Exchangeable Cation Composition. The cation-exchange capacity and composition of exchangeable cations are key criteria for evaluating the agroecological and reclamation status of these soils [8, 9]. A higher proportion of exchangeable calcium and magnesium supports the stability of soil aggregates, whereas an increased sodium content indicates a risk of sodification and physical degradation. Therefore, determining the composition of exchangeable cations provides a basis for selecting reclamation measures, including gypsum application, improvement of irrigation and drainage conditions, and the differentiated use of organic and mineral fertilisers.



World Conference on Agricultural and Earth Sciences

Hosted Online from Istanbul, Turkey

Date: 20th October, 2026

Website: <https://econferencia.com>

Table 1. Composition of Exchangeable Cations and Sodicity Status of Irrigated Meadow-Swamp Soils by Particle-Size Composition

Particle-size composition	Profile No.	Exchangeable Ca (%)	Exchangeable Mg (%)	Exchangeable Na (%)	Degree of sodicity
Heavy-textured	78	54.5–56.8	36.9–39.5	3.9–4.9	Non-sodic
Medium-textured	127	50.1–50.9	41.8–43.4	5.4–5.7	Slightly sodic
Light-textured	97	50.9–54.7	39.6–42.7	3.0–4.8	Non-sodic
Sandy loam	131	50.2–51.0	42.7–44.1	4.5–5.3	Slightly sodic
Sandy	153	49.5–51.9	41.2–44.4	3.2–4.0	Non-sodic

To‘g‘ri formula va qiymatlar rasmda aniq ko‘rindi. Tuzatilgan tarjima:

The findings showed that the cation-exchange capacity of meadow-swamp soils is relatively moderate, with calcium (Ca^{2+} , 49.5–56.8%) and magnesium (Mg^{2+} , 36.9–44.4%) as the predominant exchangeable cations. However, long-term irrigation, salt leaching, and the hydromorphic water regime have increased the sodium (Na^+) content in some saline and gypsiferous areas to 5.3–5.7%, resulting in slight sodicity.

An increase in exchangeable sodium disrupts soil physical structure, reduces porosity, and deteriorates the air–water regime. Therefore, soil fertility can be stabilised by managing cation-exchange capacity: leaching sodium from the soil and enhancing exchange reactions through calcium-containing amendments, such as gypsum.



World Conference on Agricultural and Earth Sciences

Hosted Online from Istanbul, Turkey

Date: 20th October, 2026

Website: <https://econferencia.com>

Conclusion

The morphological structure of irrigated meadow-swamp soils in Central Fergana has formed under the influence of alluvial deposits and semi-hydromorphic/hydromorphic conditions and is characterised by an uneven distribution of moisture and salts throughout the soil profile.

The agrochemical status of these soils is characterised by the concentration of humus and nutrient elements (N, P, and K) mainly in the arable layer. In saline areas, plant uptake of nutrients becomes more difficult, necessitating the scientifically based and differentiated application of organic and mineral fertilisers.

Analysis of the soil exchange complex showed that heavy and light loamy soils are non-sodic, whereas medium-textured and sandy loam soils belong to the slightly sodic class. Reclamation measures, including the application of calcium-containing amendments and improvement of the drainage system, are of practical importance for reducing the adverse effects of sodium cations.

References

1. Abdurakhmonov, N.Yu., Sobitov, U.T., Pulatov, M.K., & Yoldashev, I.Q. Meadow and meadow-swamp soils of Central Fergana and some of their properties. Bulletin of the Research Institute of Soil Science and Agrochemistry. Tashkent, 2018, no. 2, pp. 157–159.
2. Kuziyev, R.K., & Ismonov, A.J. Scientific and Practical Methods for Improving and Protecting Soil Fertility in Uzbekistan. Tashkent: Fan, 2015. 216 p.
3. Sattarov, J.S., & Jalilova, G.T. Ecological and agrochemical foundations of the transformation of organic and mineral compounds in irrigated soils. Uzbekistan Biological Journal. Tashkent, 2019, no. 3, pp. 41–45.



World Conference on Agricultural and Earth Sciences

Hosted Online from Istanbul, Turkey

Date: 20th October, 2026

Website: <https://econferencia.com>

-
4. Tyurin, I.V. Organic Matter of Soil and Its Role in Fertility. Moscow: Nauka, 1965. 320 p.
 5. Machigin, B.P. Methods of Agrochemical Research in Irrigated Cotton-Growing Areas. Tashkent: SoyuzNIKHI, 1977. 245 p.
 6. Komilov, O.K., & Axmedov, A.U. Determination and Classification of Soil Sodidity. Tashkent: Fan, 2012. 180 p.
 7. Lal, R. Soil carbon sequestration impacts on global climate change and food security. Science, 2004, vol. 304, no. 5677, pp. 1623–1627.
 8. Sparks, D.L. Environmental Soil Chemistry. 2nd ed. San Diego: Academic Press, 2003. 352 p.
 9. Axmedov, A.U. Soils of the Fergana Valley and Their Evolution. Tashkent: Fan, 2021. 165 p.