UDC 631.6
AGRIS P30
https://doi.org/10.33619/2414-2948/100/35

AGROECOLOGICAL CHARACTERISTICS OF IRRIGATED GRASS-GRAY SOILS OF THE MIL-MUGHAN ECONOMIC REGION

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АГРОЭКОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ОРОШАЕМЫХ ЛУГОВО-СЕРОЗЕМНЫХ ПОЧВ МИЛЬ-МУГАНСКОГО ЭКОНОМИЧЕСКОГО РАЙОНА

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Abstract. The article provides an interpretation of the agroecological characteristics of irrigated grass-gray soils of the Mil-Mughan economic region and provides extensive information about the physicochemical properties of these soils. Based on studies conducted on irrigated meadow-gray soils, the following results were obtained: the genetic layer of soil 0-55 cm was washed away from easily soluble salts, the humus content in all other genetic layers was 0.3-2.1%, total nitrogen 0.11-0.20%, absorbed bases total 18.0-23.0 mg-eq., physical clay (<0.01 mm) 44.0-65.0%, silt particles (<0.001 mm) 18.0-24.0%, density 1.18-1.32 g/cm^3, nitrate nitrogen (N/NO_3) 3.0-14.0 mg/kg, ammonia nitrogen (N/NH_3) 3.0-20.7 mg/kg, C:N — 6.0-7.0, hygroscopic moisture 9.1-4.6%, $CaCO_3$ 8.0-17.0%.

Аннотация. Представлена интерпретация агроэкологической характеристики орошаемых травяно-серых почв Миль-Муганского экономического района и приведены обширные сведения о физико-химических свойствах этих почв. На основании исследований, проведенных на орошаемых лугово-сероземных почвах, были получены следующие результаты: генетический слой почвы 0–55 см был вымыт от легкорастворимых солей, содержание гумуса во всех остальных генетических слоях составило 0,3–2,1%, общего азота 0,11–0,20%, абсорбированных оснований всего 18,0–23,0 мг-экв., физической глины (<0,01 мм) 44,0–65,0%, частиц ила (<0,001 мм) 18,0–24,0%, плотности 1,18–1,32 г/см^3, нитратного азота (N/NO_3) 3,0–14,0 мг/кг, аммиачного азота (N/NH_3) 3,0–20,7 мг/кг, C:N — 6,0–7,0, гигроскопической влаги 9,1–4,6%, $CaCO_3$ 8,0–17,0%.

Keywords: soil, physicochemical properties, irrigated soils.

Ключевые слова: почва, физико-химические свойства, орошаемые почвы.

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https://doi.org/10.33619/2414-2948/100

Natural and reclaimed irrigated grass-gray soils of the Mil-Mughan economic region were studied by V. R. Volobuev, M. R. Abduyev, G. Sh. Mammadov, G. Z. Azizov, A. D.Hashimov and other scientists [3-8, 10-14, 16].

V. R. Volobuyev, in his scientific research, determined that in the strip around the Kur River, formerly, soils similar to gray soils were formerly formed in the flood-lands-deltaic moisture regime and spread out. However, the flood-lands regime of the Kur River is disrupted, and dry-steppe and semi-desert conditions prevailed for the soil formation process. The scientist proposed giving these lands the name grass-gray, which is a steppe version of grasslands [12].

G. V. Dobrovolsky, V. A. Kovda, in their scientific works, noted that the influence of surface flooding and groundwater on river flood-lands weakens the process of hydromorphic soil formation on declining coastal terraces and microdepressions, which leads to the formation of zonal soils [10].

Materials and methods

Irrigated grass-gray soils are common in the Kur-Araz plain, partly in Samur-Devechi and Nakhchivan [4, 5, 8], the climate is dry-subtropical semi-desert, humidity coefficient >1.0; temperature above 100 is only 4192-4848°, FAR-130-133 kcal/cm^2, the number of days with temperature above 10° is 300-330 days, the number of days with temperature above 5° is 350-360 days [15].

Subtypes — irrigated grass-gray, irrigated meadow-gray.

The color of the humus layer in these soils is dark-gray, light-brown, and due to the granulometric composition, heavy-grained and clayey. The thickness of the humus layer is 27-30 cm, the depth of groundwater is 3-4 m [1, 3, 10].

Soil profile indexing, A Ya^{1}caz- A Ya^{11}, caz - BCHsg-Ccas.

The average annual temperature is 14.0-14.5^{0}C. Endorheic small lakes are noticeable in the study area [12]. Clay particles are <0.01 mm in soils, 45.0-70.0% of groundwater mineralization ranges from 5.2-11.0 g/l. The vegetation is dominated by ephemeral-wormwood and salt-resistant rich phytocenosis. Small tamarisks shrubs are also observed in microdepressions.

The irrigated lands of the region are used for vegetable growing, horticulture and grain fields, fodder crops and perennial pomegranate gardens [8].

The agrochemical and physicochemical analyzes of soil samples taken from the genetic layers of soil sections excavated at a depth of 1.5 m in the grass-gray soils of the study area were carried out using the following methods: a pH potentiometer, the amount of humus, I. V. Tyurin, the granulometric composition — N. A. Kachinsky, and absorbed bases — K. K. Gedroits, absorbed ammonia — D. P. Konev, nitrate nitrogen — Granval-Layou, total nitrogen and total phosphorus — K. E. Ginzburg and K. M. Sheglov, activated phosphorus — B. P. Machigin, general potassium— Smith, exchangeable potassium — P. B. Protasov, density and porosity — R. H. Mammadov, soil moisture by drying in a thermostat at 105°C [2, 5].

Results and their discussion

The research was carried out at the Mil experimental station, located in the village of Bolsulu, Beylagan region, and soil sections were laid. The morphological features of irrigated grass-gray soils are clearly manifested in the genetic structure of soil sections No. 1 and 2, the area is used for cotton crops [1, 4, 5].

AYsv 0-20 cm. Light-grayish, clay-loamy, fine-clumpy structure, plant roots, whitish salt stains, dry boiling, gradual transition.

AYs^{11} 20-35 cm. The color is the same as the top layer, the clayey clumpy-spherical structure, salt stains are clearly visible, slightly hardened, boiling, dry, clear transition.

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https://doi.org/10.33619/2414-2948/100

Bs 35-58 cm. Light-gray, with slightly brown spots, clayey-salty, large clumpy structure, slightly hardened, with large salt spots, dry, boiling, clear transition.

B_s/C^5 58-92 cm. Light-greyish, brown spots, light heavy-loamy, salt spots less noticeable, boiling, clear transition.

C/gs 92-120 cm. Heavy clayey, lightly salted, low humidity, boiling, clear transition.

C/gs 120-150 cm. Loamy, lightly salted, the humidity increases, boiling.

In soil sections, the following morphological features of grass-gray soils are observed: soils are light-gray in color, salt spots stand out from the surface, salinization of the soil profile to varying degrees, clumpy-spherical structure, hardening of the middle layers, brown-rusty spots of deep silty layers and signs of weak gleying [1, 7, 9, 10].

Agrochemical indicators of irrigated grass-gray soils are as follows (Table 1). These soils are poorly supplied with humus. Thus, in the upper layer (0-20 cm) the humus content is 2.1%, and in the lower layers it decreases sharply (0.6-0.3%).

Table 1

AGROCHEMICAL CHARACTERISTICS OF IRRIGATED GRASS-GRAY SOILS

Section No.	*Depth, cm*	*Humus %*	*Nitrogen*			*Phosphorus*		*Potassium*	
			Total %	*N/NO_3 mg/kg*	*N/NH_3 mg/kg*	*Total %*	*Active mg/kg*	*Total %*	*Exchangeable mg/kg*
1	0-20	2.10	0.20	13.1	20.7	0.20	21.9	2.23	280.2
	20-35	1.20	0.14	8.4	12.3	0.14	18.1	1.94	224.5
	35-58	0.78	0.11	5.2	6.1	0.13	8.0	1.54	160.3
	58-92	0.57	0.05	2.7	3.2	0.06	6.4	1.00	90.0
	92-120	0.42	-	-	-	-	-	-	-
	120-150	0.37	-	-	-	-	-	-	-
2	0-18	1.90	0.19	14.0	21.0	0.19	20.9	2.20	265.1
	18-32	1.35	0.12	8.7	17.2	0.15	18.4	1.90	231.1
	32-55	1.03	0.09	6.0	12.5	0.12	8.7	1.49	150.0
	55-89	0.65	0.03	3.6	3.9	0.05	5.8	1.05	78.0
	89-125	0.51	-	-	-	-	-	-	-
	125-150	0.32	-	-	-	-	-	-	-

These soils are also poorly supplied with total nitrogen (0.11-0.20%). Total potassium is 1.0-2.2%, total phosphorus is 0.12-0.20%. Of the nutrients, nitrate nitrogen (N/NO_3) 3.0-14.0 mg/kg, ammonia nitrogen (N/NH_3) 3.0-20.7 mg/kg, active phosphorus 6.0-21.0 mg/kg, exchangeable potassium is determined to be 78.0-280 mg/kg.

The physicochemical parameters of irrigated grass-gray soils are as follows (Table 2): The sum of the absorbed bases ranges between 18.6-23.9 mg-eq., its amount increases in the middle and deep layers (21.5-26.8 mg-eq.). An alkaline environment (pH 7.7-8.6) is observed in the soil profile. According to the granulometric composition, the amount of physical clay (<0.01 mm) in irrigated grass-gray soils is 44.3-68.4%, the silt fraction (<0.001 mm) is 20.7-35.8%. In these soils, moisture content is 12.0-17.7%, porosity is 22.0-56.2%. Carbonates are evenly distributed along the profile ($CaCO_3$, 12.0-17.3%). C:N 6.0-7.3, density 1.18-1.32 g/cm^3, hygroscopic humidity 3.10-4.65% [2].

The granulometric composition in the profile of irrigated grass-gray soils is aggravated due to the constant implementation of agrotechnical, agro-reclamation measures, long-term use under various crops and anthropogenic impacts [1, 3, 10].

Thus, studies conducted on irrigated grass-gray soils of the Mil-Mughan economic region show that, according to the accepted gradation, these soils are poorly provided with nutrients easily

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https://doi.org/10.33619/2414-2948/100

absorbed by plants. Therefore, it is necessary to apply the necessary fertilizers to obtain high-quality products from plants, including cotton, and increase the productivity of these lands [9-11]. On irrigated grass-gray soils, it is important to apply manure, nitrogen, phosphorus and potassium fertilizers. So, nitrogen is very necessary for plant development. When plants are not sufficiently supplied with nitrogen, they grow poorly. The main source of nitrogen in plant nutrition is nitric acid salts [2, 6].

Table 2

PHYSICOCHEMICAL PARAMETERS OF IRRIGATED GRASS-GRAY SOILS

Depth, cm	*pH (water)*	*Granulometric composition, %*		*Sum of absorbed*	*Absorbed bases, mg-eq.*			*C:N*	*Moisture, %*	*Density, g/cm³*	*Porosity, %*	*Dry residue, %*	*Hygroscopic moisture, %*	*$CaCO_3$, %*
		<0.01 mm	*<0.001 mm*		*Ca*	*Mg*	*Na*							
Section N1														
0-20	7.7	62.5	29.6	26.8	21.0	4.2	1.6	6.0	17.7	1.32	55.0	0.173	4.60	8.0
20-35	7.9	60.3	32.1	23.9	19.9	3.0	1.0	7.3	15.4	1.27	53.7	0.290	4.65	12.7
35-58	8.0	63.8	35.7	22.0	15.3	5.5	1.2	6.8	13.1	1.23	50.9	3.324	3.62	12.5
58-92	8.2	65.1	21.0	18.5	14.5	3.8	1.3	-	12.0	1.18	42.5	1.450	3.45	14.1
92-120	8.5	44.3	16.5	21.0	17.0	3.8	1.2	-	-	1.26	32.3	1.015	3.82	17.2
120-150	8.6	40.0	14.7	23.5	20.1	2.8	0.6	-	-	-	-	-	-	11.6
Section N2														
0-18	7.9	66.2	32.0	24.2	18.2	4.5	1.5	6.4	17.5	1.27	56.2	0.184	3.80	7.8
18-32	8.0	68.4	47.5	23.6	17.6	4.7	1.3	7.5	16.0	1.23	48.3	0.216	3.10	8.6
32-55	8.3	70.5	24.7	21.5	16.9	3.5	1.1	6.7	15.3	1.26	41.5	0.415	4.50	12.5
55-89	8.4	65.6	21.8	18.6	14.3	3.3	1.0	-	12.8	1.19	36.1	1.015	4.22	14.4
89-125	8.5	61.0	20.7	12.7	8.7	3.2	0.8	-	-	1.16	22.3	0.870	3.54	17.3
125-150	8.6	49.3	19.4	14.0	11.0	2.5	0.5	-	-	-	-	-	-	11.0

Phosphorus fertilizer is also very important for plants, and plants only absorb as phosphorus combinations in the form of ions. Phosphorus is an essential nutritional element; without it, life is impossible not only for higher plants, but also for primitive organisms. Metabolism in plants occurs only in the presence of phosphoric acid. Phosphorus is involved in the growth and reproduction of plants, as well as in the process of transmission of hereditary features [2, 14].

Potassium is also considered essential for plant life. Most of the potassium in soils is in insoluble form and is poorly absorbed by plants. Manure is an organic fertilizer containing all the nutrients plants need. After application to the soil, it is mineralized under the action of microorganisms. Ammonia nitrogen is obtained from the decomposition of nitrogenous substances in manure in the soil. It is absorbed by plants and microorganisms. In manure, potassium, which is one of the 3 important nutrients, is in a more active form and the degree of its absorption is 60-70%. Manure also increases the uptake of phosphorus by plants [2, 4, 13].

If soils are routinely fed with lightly decomposed manure before planting, the ability of the plants to absorb nitrogen and other organic nutrients is greatly enhanced [3, 6, 9].

Conclusion

As a result of the research in irrigated grass-gray soils, the soil profile is washed from salts in the genetic layer of 0-55 cm, a cultural agro-irrigated layer is formed in the layer of 35-38 cm, humus is 0.50-2.10%, total nitrogen is 0.09 -0.20%, sum the absorbed bases 14.0-26.8 mg-eq., deterioration in granulometric composition (<0.01 mm 40.0-70.0%, <0.001 mm 19.0-35.0%),

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https://doi.org/10.33619/2414-2948/100

density 1.16-1.32 g/cm^3, activated phosphorus 6.0-21.0 mg/kg, exchangeable potassium 90-280 mg/kg, nitrate nitrogen 6.0-14.0 mg/kg, ammonia nitrogen 3.0-20.7 mg/kg, alkaline pH (7,9-8,5), porosity 30-56%, C:N is determined to be 6.0-7.5. It has also been determined that irrigated grass-gray soils are poorly supplied with absorbable nutrients, therefore advisory information on the application of various fertilizers to those soils is given [3, 9, 10].

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Работа поступила
в редакцию 11.02.2024 г.

Принята к публикации
20.02.2024 г.

Ссылка для цитирования:

Mammadov G., Heydarova R. Agroecological Characteristics of Irrigated Grass-Gray Soils of the Mil-Mughan Economic Region // Бюллетень науки и практики. 2024. Т. 10. №3. С. 234-239. https://doi.org/10.33619/2414-2948/100/35

Cite as (APA):

Mammadov, G., & Heydarova, R. (2024). Agroecological Characteristics of Irrigated Grass-Gray Soils of the Mil-Mughan Economic Region. *Bulletin of Science and Practice, 10*(3), 234-239. https://doi.org/10.33619/2414-2948/100/35