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GRANULOMETRIC COMPOSITION AND NUTRIENT DYNAMICS OF IRRIGATED SIEROZEM-MEADOW SOILS FORMED ON THE THIRD FLUVIAL TERRACE OF THE SYRDARYA RIVER

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Annotation. The article presents the granulometric composition and the dynamics of nutrient elements based on field experiments conducted on soils with different bonitet scores under conditions of irrigated serozem-meadow soils widespread in the Mirzaabad district of the Syrdarya region. It was established that the genetic horizons of the soil profile are characterized by medium and light loam textures. The proportions of coarse silt and fine sand particles were found to be similar. Additionally, the dynamics of nutrient content were observed depending on the annual rates of mineral fertilizer application.

Key words: irrigated sierozem-meadow soils, genetic horizons, nutrient elements, dynamics.

Аннотация. В статье представлены гранулометрический состав и динамика питательных элементов в полевых опытах, проведенных на полях с разным баллом бонитета в условиях орошаемых сероземно-луговых почв, распространенных в Мирзаабадским районе Сырдарьинской области. Результаты показывают, что генетические слои почвенного профиля средне- и легкосуглинистые, и количества частиц крупной пыли и мелкого песка близки друг-другу, а также отмечена динамика питательных элементов в зависимости от годовых норм минеральных удобрений.

Ключевые слова: орошаемые сероземно-луговые почвы, генетические слои, питательные элементы, динамика.

Annotatsiya. Maqolada Sirdaryo viloyati Mirzabob tumanida tarqalgan sug'oriladigan bo'z-o'tloqi tuproq sharoitida turli ball bonitetli maydonlarda o'tkazilgan dala tajribalari tuproqlarining granulametrik tarkibi va oziqa elementlar dinamikasi keltirilgan. Natijalar ko'rsatishicha, tuproq profilining genetik qatlamlari o'rta va yengil qumoqli, bunda, yirik chang va mayda qum zarrachalari bir biriga yaqin ekanligi, shuningdek, mineral o'g'itlarning yillik miqdoriga bog'liq oziqa elementlar dinamikasi qayd etilgangan

Kalit so'zlar: sug'oriladigan bo'z-o'tloqi, genetik qatlam, oziqa elementlar, dinamika.

Introduction. It is well known that natural processes occurring in the environment are irreversible and closely interconnected. Therefore, the efficient and rational use of any natural resources, including soils, is of great importance at all times. Human activity has a significant impact on soil properties and fertility, leading to processes such as salinization, erosion, dehumification, and degradation of ecological conditions. This clearly demonstrates the crucial role of humans in the use of agricultural lands. Human intervention significantly influences

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soil formation, which, in turn, affects its properties either positively or negatively. For instance, crop rotation systems, soil cultivation, application of mineral and local fertilizers, irrigation, drainage, and similar practices greatly influence the development of soils and their main characteristics.

Indeed, in ancient times, much attention was paid to improving the meliorative state of soils and achieving high yields without harming the environment. However, in recent years, efforts have been made to increase crop yields, but due to the improper and insufficient use of nutrients, the nutrients that are extracted from the soil are not adequately replenished. This has a serious impact on the agro-ecological condition of the soil, accelerating the degradation of nutrient elements. This negatively affects the nutrient balance, soil fertility, crop yields, and ultimately the economic well-being of land users.

Research Object and Methods Used:

Field experiments were conducted on irrigated meadow-gray soils—hydromorphic soils where the groundwater level is around 2–3 meters deep, and sometimes even lower during drought years. These soils exhibit various degrees of salinization. They are transitional soils located in the semi-desert foothill zone of subtropical regions, within the light-colored gray soils area, formed on loess-like deposits of the III river terrace of the Syrdarya region [7; p. 44].

Soil samples were collected and chemically analyzed using the methodologies outlined in Methods of Agrochemical, Agrophysical, and Microbiological Research in Irrigated Cotton Areas [5; p. 439], Methods of Agrochemical Analysis of Soils and Plants [4; p. 187], and E.V. Arinushkina's Guide to Chemical Analysis of Soils [1; p. 490], as well as Guide to Conducting Chemical and Agrophysical Soil Analyses for Land Monitoring [6; p. 74]. The field experiments were conducted following the methodologies in Methods of Conducting Field Experiments [3; p. 147] and the recommendations provided in Application of Mineral and Local Fertilizers in Cotton Growing [8; p. 24], Layered Application of Mineral and Organic Fertilizers in Irrigated Soils [2; p. 35], and Technologies for Achieving High Yields in Cotton Growing [9; p. 72].

Resultsand Analysis.

Field experiments were conducted in the "Dehqonobod" area of Mirzaabad district, Syrdarya region. The experimental plots are located on irrigated meadow-gray soils. It was determined that the mechanical composition in the genetic horizons of the soil profile mainly consists of medium and light loamy soils.

The fertility of the field contours used in the experiments, i.e., their bonitet score, varies. In the "Dehqonobod" area:

Contour 432 was rated at 51 bonitet points,

Contour 216 at 47 points, and

Contour 223 at 36 points.

Field trials using cotton as the test crop were conducted under the conditions of these contours.

Information on the mechanical composition of the irrigated meadow-gray soils distributed in the selected pilot fields of the "Dehqonobod" area of Mirzaabad district can be seen in Table 1. According to this data, the main soil samples taken from profile cuts had a predominantly medium loamy texture in their genetic horizons. In the 21-S-M-BK profile, the 0–74 cm layers consisted of medium loam, while the lower layers had a light loamy mechanical composition.

In the 1-S-M-BK and 11-S-M-BK profiles, coarse silt particles were found to be dominant. In the 21-S-M-BK profile, the amount of coarse silt and fine sand particles were nearly equal. It should be particularly noted that in this same profile, the content of coarse sand particles was found to be higher compared to the other profiles.

1 table

Mechanical Composition of Irrigated Meadow-Gray Soils

Profile №	Layer Depth (cm)	Particle Size Distribution (% by diameter in mm)							Physical Clay	Soil Mechanical Composi
		Sand			silt			clay		
		>0,25	0,25-0,1	0,1-0,05	0,05-0,01	0,01-0,005	0,005-0,001	<0,001		
Mirzaabad District, "Dehqonobod" Area, Bek Cluster LLC, Contour 432 (Bonitet Score: 51)										
1 S-M-BK	0-30	0,7	0,9	23,8	40,7	13,6	11,6	8,7	33,9	medium loam
	30-43	0,8	1,0	21,8	43,2	12,8	11,9	8,5	33,2	medium loam
	43-75	0,7	0,8	20,1	45,9	15,4	13,6	3,5	32,5	medium loam
	75-105	0,8	0,9	21,1	44,8	13,9	12,5	6,0	32,4	medium loam
	105-142	0,6	1,1	19,8	45,6	12,4	11,9	8,6	32,9	medium loam
	142-174	0,5	1,3	18,9	46,7	14,6	12,9	5,1	32,6	medium loam
"Dehqonobod" massif, Bek Cluster LLC, contour 216, 47 bonitet points										
11 S-M-BK	0-28	0,9	0,7	22,2	42,3	13,4	11,8	8,7	33,9	medium loam
	28-47	0,8	0,6	15,9	49,5	12,8	11,2	9,2	33,2	medium loam
	47-82	1,2	0,9	23,5	41,9	14,2	11,4	6,9	32,5	medium loam
	82-110	1,1	0,7	23,6	42,2	14,3	10,3	7,8	32,4	medium loam
	110-156	1,2	5,9	25,6	34,4	14,5	9,9	8,5	32,9	medium loam
"Dehqonobod" massif, Bek Cluster LLC, contour 223, 37 bonitet points										
21 S-M-BK	0-30	0,4	0,5	14,5	45,3	14,4	13,2	11,7	39,3	medium loam
	30-46	0,5	0,7	13,8	44,3	13,9	14,3	12,5	40,7	medium loam
	46-74	0,7	0,6	13,2	41,6	16,3	15,2	12,4	43,9	medium loam
	74-102	12,9	4,8	26,1	27,4	10,9	9,7	8,2	28,8	light loam
	102-141	13,2	5,2	24,5	28,9	11,4	8,9	7,9	28,2	light loam

In the pilot field with a bonitet score of 55 in the "Dehqonobod" massif where field experiments were conducted, various doses and ratios of mineral fertilizers were applied. The levels of mobile nitrogen were recorded as follows: Before sowing: Variant 2: 5.3 mg/kg in the plow layer, 4.6 mg/kg in the subsoil layer Variant 3: 5.7 mg/kg in the plow layer, 4.3 mg/kg in the subsoil layer Variant 4: 7.2 mg/kg in the plow layer, 5.2 mg/kg in the subsoil layer At the 2–3 true leaf stage: Variant 2: 8.6–7.5 mg/kg Variant 3: 9.9–7.6 mg/kg Variant 4: 14.1–10.2 mg/kg At budding stage: Variant 2: 23.1–17.5 mg/kg Variant 3: 31.7–20.9 mg/kg Variant 4: 38.2–29.8 mg/kg At flowering stage: Variant 2: 18.8–15.6 mg/kg Variant 3: 24.0–16.6 mg/kg Variant 4: 29.5–23.6 mg/kg At the end of the growing season: Variant 2: 13.2–10.9 mg/kg Variant 3: 17.4–14.2 mg/kg Variant 4: 21.4–18.3 mg/kg As for mobile phosphorus, the results were: Before sowing: Control (no fertilizer): 8.4 mg/kg (plow layer), 7.3 mg/kg (subsoil) Variant 2: 10.1–7.1 mg/kg Variant 3: 11.0–9.2 mg/kg Variant 4: 13.9–12.5 mg/kg At the 2–3 true leaf stage: Control: 7.6–7.4 mg/kg Variant 2: 11.4–7.9 mg/kg Variant 3: 14.3–11.5 mg/kg Variant 4: 19.0–15.1 mg/kg At budding stage: Control: 7.0–6.8 mg/kg Variant 2: 12.4–8.9 mg/kg Variant 3: 16.5–11.9 mg/kg Variant 4: 28.4–19.5 mg/kg At flowering stage: Control: 5.7–5.4 mg/kg Variant 2: 10.1–7.1 mg/kg Variant 3: 13.4–9.5 mg/kg Variant 4: 23.1–15.5 mg/kg At the end of the growing season: Control: 4.1–3.8 mg/kg Variant 2: 7.3–4.9 mg/kg Variant 3: 9.7–6.6 mg/kg Variant 4: 18.2–11.8 mg/kg

2-table

Dynamics of Nutrient Elements in Irrigated Meadow-Gray Soil (Pilot Field with 47 Bonitet Points, 2018–2020 Average)

Variants	**Layer Depth, cm**	Mobile N-NO_3, mg/kg				
		Before planting 1-5.04	2-3 true leaves 1-5.05	Budding 1-5.06	Flowering 1-5.07	End of vegetation 1-5.09
Mobile Nitrogen						
Variant 1 (Unfertilized Control)	0-30	3,7	5,5	5,5	4,9	3,8
	30-50	3,2	4,5	4,2	3,6	2,7
2-variant $N_{150}P_{105}K_{75}$	0-30	4,7	7,6	20,5	16,7	11,7
	30-50	4,3	6,9	16,3	14,6	10,2

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Variants	Layer Depth, cm	Mobile N-NO_3, mg/kg				
		Before planting 1-5.04	2-3 true leaves 1-5.05	Budding 1-5.06	Flowering 1-5.07	End of vegetation 1-5.09
Mobile Nitrogen						
3-variant $N_{250}P_{175}K_{125}$	0-30	6,0	10,5	35,0	28,5	20,7
	30-50	5,3	9,3	27,0	21,4	18,6
4-variant $N_{350}P_{245}K_{175}$	0-30	6,7	13,1	37,0	26,4	19,2
	30-50	5,9	11,7	28,9	21,2	16,4
Mobile Phosphorus						
1-variant (o‘g‘itsiz nazorat)	0-30	9,3	8,5	7,8	6,3	4,6
	30-50	8,6	8,7	8,1	6,4	4,5
2-variant $N_{150}P_{105}K_{75}$	0-30	8,4	9,5	10,3	8,4	6,1
	30-50	8,3	9,2	10,4	8,3	5,7
3-variant $N_{250}P_{175}K_{125}$	0-30	11,4	14,8	17,1	14,0	10,1
	30-50	10,8	13,5	14,1	11,2	7,8
4-variant $N_{350}P_{245}K_{175}$	0-30	15,3	20,9	31,1	25,3	20,9
	30-50	12,8	24,8	32,1	25,5	19,9
Exchangeable Potassium						
1-variant (Unfertilized Control)	0-30	154	174	160	146	121
	30-50	146	154	142	127	114
2-variant $N_{150}P_{105}K_{75}$	0-30	177	193	230	187	136
	30-50	171	174	208	165	148
3-variant $N_{250}P_{175}K_{125}$	0-30	185	220	285	232	199
	30-50	179	212	274	245	186
4-variant $N_{350}P_{245}K_{175}$	0-30	208	262	365	297	246
	30-50	200	260	336	299	238

Exchangeable Potassium: Before sowing, the content of exchangeable potassium was recorded as follows: Control variant (without fertilizer): 126–111 mg/kg Variant 2: 158–137 mg/kg Variant 3: 149–138 mg/kg Variant 4: 159–126 mg/kg At the 2–3 true leaf stage: Control: 154–129 mg/kg Variant 2: 173–139 mg/kg Variant 3: 177–163 mg/kg Variant 4: 200–163 mg/kg At the budding stage: 141–119 mg/kg (Control), 206–166 mg/kg (Variant 2), 229–210 mg/kg (Variant 3), 279–211 mg/kg (Variant 4) At the flowering stage: 129–107 mg/kg (Control), 168–132 mg/kg (Variant 2), 186–158 mg/kg (Variant 3), 227–187 mg/kg (Variant 4) At the end of vegetation: 106–95 mg/kg (Control), 122–118 mg/kg (Variant 2), 160–143 mg/kg (Variant 3), 188–149 mg/kg (Variant 4) Pilot Field (47 bonitet points): Mobile Nitrogen before sowing was: Control: 3.7 mg/kg (plow layer), 3.2 mg/kg (subsoil) Variant 2: 4.7 and 4.3 mg/kg Variant 3: 6.0 and 5.3 mg/kg Variant 4: 6.7 and 5.9 mg/kg At the 2–3 true leaf stage: Control: 5.5 and 4.5 mg/kg Variant 2: 7.6–6.9 mg/kg Variant 3: 10.5–9.3 mg/kg Variant 4: 13.1–11.7 mg/kg At the budding stage: 5.5–4.2 mg/kg (Control), 20.5–16.3 mg/kg (V2), 35.0–27.0 mg/kg (V3), 37.0–28.9 mg/kg (V4) At flowering: 4.9–3.6 mg/kg (Control), 16.7–14.6 mg/kg (V2), 28.5–21.4 mg/kg (V3), 26.4–21.2 mg/kg (V4) End of vegetation: 3.8–2.7 mg/kg (Control), 11.7–10.2 mg/kg (V2), 20.7–18.6 mg/kg (V3), 19.2–16.4 mg/kg (V4) Mobile Phosphorus before sowing: Control: 9.3 mg/kg (plow), 8.6 mg/kg (subsoil) Variant 2: 8.4–8.3 mg/kg Variant 3: 11.4–10.8 mg/kg Variant 4: 15.3–12.8 mg/kg At the 2–3 true leaf stage: Control: 8.5–8.7 mg/kg Variant 2: 9.5–9.2 mg/kg Variant 3: 14.8–13.5 mg/kg Variant 4: 20.9–24.8 mg/kg At the budding stage: Control: 7.8–8.1 mg/kg Variant 2: 10.3–10.4 mg/kg Variant 3: 17.1–14.1 mg/kg Variant 4: 31.1–32.1 mg/kg At flowering: Control: 6.3–6.4 mg/kg Variant 2: 8.4–8.3 mg/kg Variant 3: 14.0–11.2 mg/kg Variant 4: 25.3–25.5 mg/kg At the end of vegetation: Control: 4.6–4.5 mg/kg Variant 2: 6.1–5.7 mg/kg Variant 3: 10.1–7.8 mg/kg Variant 4: 20.9–19.9 mg/kg A similar trend was observed for exchangeable potassium (see Table 2). Pilot Field with 37 Bonitet Points: Mobile Nitrogen before sowing: Variant 2: 4.7–4.2 mg/kg Variant 3: 6.0–5.3

mg/kg Variant 4: 6.7–5.9 mg/kg At the 2–3 true leaf stage: Variant 2: 7.6–6.9 mg/kg Variant 3: 10.5–9.3 mg/kg Variant 4: 13.1–11.7 mg/kg At budding: Variant 2: 20.5–16.3 mg/kg Variant 3: 35.0–27.0 mg/kg Variant 4: 37.0–28.9 mg/kg At f lowering: Variant 2: 16.7–14.6 mg/kg Variant 3: 28.5–21.4 mg/kg Variant 4: 26.4–21.2 mg/kg End of vegetation: Variant 2: 11.7–10.2 mg/kg Variant 3: 20.7–18.6 mg/kg Variant 4: 19.2–16.4 mg/kg Mobile Phosphorus before sowing: Control: 9.3–8.6 mg/kg Variant 2: 8.4–8.3 mg/kg Variant 3: 11.4–10.8 mg/kg Variant 4: 15.3–12.8 mg/kg At the 2–3 leaf stage: Control: 8.53–7.8 mg/kg Variant 2: 9.5–9.2 mg/kg Variant 3: 14.8–13.5 mg/kg Variant 4: 20.9–19.3 mg/kg At budding: Control: 7.8–7.2 mg/kg Variant 2: 10.3–10.1 mg/kg Variant 3: 17.1–14.2 mg/kg Variant 4: 31.5–24.2 mg/kg At flowering: Control: 6.3–5.7 mg/kg Variant 2: 8.4–8.0 mg/kg Variant 3: 14.0–11.2 mg/kg Variant 4: 25.7–19.2 mg/kg End of vegetation: Control: 4.6–4.0 mg/kg Variant 2: 6.1–5.6 mg/kg Variant 3: 10.1–7.8 mg/kg Variant 4: 21.2–15.3 mg/kg Exchangeable Potassium: Control: 154–146 mg/kg Variant 2: 177–171 mg/kg Variant 3: 185–179 mg/kg Variant 4: 208–200 mg/kg At 2–3 true leaf stage: Control: 174–154 mg/kg Variant 2: 193–174 mg/kg Variant 3: 220–212 mg/kg Variant 4: 262–240 mg/kg At budding: Control: 160–142 mg/kg Variant 2: 230–208 mg/kg Variant 3: 285–274 mg/kg Variant 4: 334–279 mg/kg At flowering: Control: 146–127 mg/kg Variant 2: 187–165 mg/kg Variant 3: 232–199 mg/kg Variant 4: 272–210 mg/kg End of vegetation: Control: 121–114 mg/kg Variant 2: 136–120 mg/kg Variant 3: 199–151 mg/kg Variant 4: 225–167 mg/kg

Conclusion: During the vegetation period of cotton, the dynamics of nutrient elements were closely related to the amount of mineral fertilizers applied. Nutrient contents increased until the budding stage and then gradually decreased in the following growth stages. This trend is dependent both on plant development and fertilizer dosage. In the unfertilized control variant, nutrient elements decreased steadily from the beginning to the end of the growing season. Over three years, available phosphorus and exchangeable potassium in the plow layer decreased by 15–25%, and nitrate nitrogen decreased by 8–16%. The phosphorus decrease was particularly significant in the control variant without fertilizer.

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