Agrochemical properties of gray-pasture soils under irrigation of mirzachol oasis

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Abstract. This article presents the results of research conducted in the irrigated lands of the Mirzachol oasis, including information on the amounts of total and mobile shales of humus and nutrients in different degrees of plastered grassland soils. Changes in the amount of nutrients depending on the mechanical composition of the soil, i.e., when the nutrients in the soils with heavy mechanical composition are compared with the soils with light mechanical composition, it is shown that the amount of nutrients is higher in the relatively mechanical composition of heavy soils. The relatively low supply of humus and nutrients in the composition of gray-meadow soils is explained by the poor agro-physical and water-physical properties of plastered soils. Based on FAO data, the total area of gypsum soils in the world is presented and they are divided into groups according to the degree of gypsum. Opinions of various scientists and experts on the formation of gypsum in the lands of Mirzachol oasis, chemical properties of soils and soil reclamation conditions are presented. General and mobile forms of humus and nutrient elements in unplastered, weakly and moderately plastered soils were analyzed in detail. Recommendations aimed at improving the agrochemical condition of the studied soils, restoring and increasing their productivity are given.

1 Introduction

According to the information of the international organization FAO, gypsum soils in the world make up an area of 66,560 km^2, of which 16,616 km^2 or about 25.0 percent correspond to the territory of Central Asian countries. Today, not only in the world, but also in our country, the issues of growing the desired crop and ensuring food security through the effective use of hard-to-reclaim lands, including gypsum soils, remain extremely urgent. The complexity of reclamation of gypsum soils, the insufficient level of scientific research and development in this direction, cause such lands to leave the agricultural circulation or even cannot compensate for the costs incurred instead of income.

The rational use of land and water resources in the republic serves to increase, preserve and restore the melioration status of agricultural lands and the level of productivity. Because

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the salinity and plastering of the soil is closely related to the depth and mineralization of seepage waters. However, to this day, there are still unsolved issues and problems related to maintaining and restoring the fertility of hard-to-reclaim land, particularly gypsum land, and improving land reclamation, which are used in agriculture.

2 Method and materials

For our research, G.Yunusov massif, which is widely distributed in the area of Mirzaabad district of Syrdarya region, has various levels of gypsum fields, and this area consists of layered alluvial deposits, irrigated gray-meadow soils of the old alluvial plains of Syrdarya region.

The basis of the research methodology is the study and analysis of soil map data of the studied areas, summarizing the results of comparative-geographical, soil-cartographic, laboratory-cameral-analytical researches, methods of assessing the quality of massive irrigated lands. Preparatory, field, camera and cartographic works of the research were carried out on the basis of the accepted guidelines [1], and laboratory-analytical works were carried out on the basis of generally accepted methods [2].

It is known that many scientists have conducted research on the phosphorus status of soils. Phosphorus accumulation and transformation in soils under irrigated farming conditions is slightly different from soils formed under other natural conditions. Plants can use only 15-20% of the large amount of phosphorus that is applied as mineral fertilizer every year, and the rest remains in the soil and becomes insoluble in water under the influence of complex processes. Most of the phosphorus applied to the ground as a fertilizer turns into a form that cannot be assimilated by plants in a short period of time [5,6].

In the long-term scientific researches of M.M.Tashkuziev [3], gross chemical analysis of irrigated soils, including information on the content of humic, potassium, and phosphorous cations impregnated in them, according to the results of the analysis of the soils of Mirzachol regions, it is known that the composition of elements and minerals of soil particles is the same the difference is determined. It was found that the clay particles of these soils, as well as the peptized and aggregated clay particles, contain more hydromica, followed by montmorillonite mineral, and partly consist of chlorite and kaolinite.

I.U.Urazboev [4] during his scientific research, in the assessment of soil cover productivity, justified the existence of a relationship between the morphometric classification of the soil cover structure and the yield of agricultural crops. A baseline scale for evaluating the productivity of cotton and other vegetable crop fields on typical irrigated gray and grassland soils has been developed. It has improved the evaluation coefficients for soil properties such as the steepness and location of the slope, density, salinity and leaching level, humus reserve, nutrient supply, birch layer location, plastering and gypsum layer location.

N.Yu.Abdurakhmonov, O'.T.Sobitov [5,6,7,8,9] in the scientific research conducted in the gray-meadow and meadow gray soils of the Mirzachol oasis, the origin, formation, specific characteristics of the gypsum gray-meadow soils , the role of the gypsum layer in the soil cross-section, the shape of the gypsum layer, the thickness of the layer, and the amount in the plowed and root layers were determined, the current land reclamation condition of the gypsum soils was evaluated, and the impact of gypsum on the quality of the soil was recorded. Gray-meadow soils are divided into groups (categories) according to the depth of placement of gypsum layers, layer thickness, degree of gypsification and quantitative indicators. The agrophysical condition of irrigated gray-meadow soils with different levels of gypsum was evaluated and correlative relationships between them were determined. For the first time, it was scientifically proven that water-resistant macroaggregates change not according to the mechanical composition of the soil, but according to the level of plastering of the soil.

In the process of soil development, one of its most important properties, namely, its fertility, is formed. The process of exchange of substances between the soil and the microorganisms present in its composition in different amounts leads to the accumulation of nitrogen, ash elements (sulfur, phosphorus, etc.) in the upper layers of the soil (subsoil layer). These substances are mainly collected in the upper layers of the soil, and plant remains are located in this area, decomposition of organic substances and formation of soil fertility takes place. Table 1 shows the information on humus, total and mobile nitrogen, phosphorus, and potassium content in the studied soils.

It was found out from the research that the amount of humus in the upper layers of non-plastered gray-meadow soils distributed in the area is weak, there is almost no difference compared to the average plastered soils, and it was found that it decreased in the middle and lower layers of the soil section.

The amount of humus is 0.724-0.895% in the tillage layer of unplastered gray-meadow soils and 0.516-0.724% in the sub-tillage layers, and it decreases towards the lower layers. The amount of humus in the weak and moderately plastered soils is 0.802-0.965% in the upper tillage layer, 0.612-0.794% in the lower tillage layers, and decreases to 0.136-0.401% depending on the lower layers. According to the level of supply of humus, the amount in the arable layer, these soils belong to the low (0.4-0.8%) and medium (0.81-1.20%) supplied groups (Table 1).

It was found that the amount of nitrogen in the studied non-plastered and plastered soils is low throughout the soil section and fluctuates in the quantitative range from 0.009 to 0.065%. There are soil layers with slightly higher carbon-to-nitrogen ratios, which in turn mean that these grassland soils are generally somewhat rich in humus, but these soils are poor in nitrogen.

The amount of mobile phosphorus in the composition of soils is 19-21 mg/kg in the upper layer of non-gypsum gray-meadow soils, that is, it belongs to the group of poorly supplied soils (16-30 mg/kg). This indicator decreases to 2.0 mg/kg along the lower layers of the soil section.

Table 1. The amount of nutrient elements in various gypsum-containing irrigated soils.

Profile number	Depth, cm	Humus, %	Total nitrogen %	C:N	Nutrient elements, mg/kg			
					gross, %		mobile, mg/kg	
					phosp horus	potassium	P_2O_5	K_2O
Gypsum-free soils								
37	0-24	0.895	0.062	8.4	0.21	0.996	19.0	218
	24-40	0.724	0.058	7.2	0.20	0.815	18.0	185
	40-70	0.461	0.035	7.6	0.11	0.772	9.0	94
	70-98	0.246	0.020	7.1	0.09	0.616	7.0	72
	98-124	0.202	0.018	6.5	0.09	0.548	7.0	62
	124-143	0.212	0.018	6.8	0.07	0.492	6.0	53
	143-183	0.134	0.008	9.7	0.05	0.476	2.0	48
171	0-28	0.724	0.045	9.3	0.23	0.948	21.0	221
	28-49	0.516	0.031	9.7	0.20	0.81	19.0	192
	49-86	0.372	0.020	10.8	0.11	0.722	10.0	96
	86-114	0.322	0.018	10.4	0.08	0.602	7.0	72
	114-145	0.210	0.012	10.2	0.06	0.548	5.0	65
	145-185	0.192	0.010	11.1	0.05	0.301	4.0	55
Weak plastered soils								
143	0-32	0.965	0.065	8.6	0.24	1.084	23.0	211
	32-52	0.794	0.060	7.7	0.20	0.948	19.0	182
	52-71	0.624	0.054	6.7	0.11	0.802	10.0	91

	71-92	0.312	0.022	8.2	0.09	0.724	8.0	72
	92-110	0.192	0.012	9.3	0.08	0.610	7.0	58
	110-140	0.176	0.015	6.8	0.06	0.426	5.0	50
153	0-24	0.831	0.066	7.3	0.23	1.002	22.0	221
	24-47	0.524	0.038	8.0	0.20	0.912	19.0	180
	47-85	0.362	0.022	9.5	0.11	0.816	10.0	94
	85-110	0.184	0.010	10.7	0.09	0.624	8.0	89
	110-133	0.172	0.010	10.0	0.08	0.412	7.0	56
	133-172	0.154	0.009	9.9	0.06	0.306	5.0	50
Medium plastered soils								
128	0-20	0.802	0.065	7.2	0.21	0.924	18.0	223
	20-43	0.612	0.056	6.3	0.16	0.810	15.0	192
	43-70	0.219	0.022	8.4	0.09	0.720	8.0	89
	70-98	0.224	0.015	8.7	0.08	0.650	7.0	77
	98-131	0.166	0.012	8.0	0.07	0.542	6.0	65
	131-169	0.096	0.009	6.2	0.06	0.302	4.0	52
131	0-26	0.916	0.061	8.7	0.23	1.082	21.0	206
	26-41	0.582	0.032	10.5	0.19	0.924	18.0	197
	41-63	0.401	0.021	11.1	0.10	0.836	9.0	98
	63-82	0.202	0.012	9.8	0.09	0.715	8.0	89
	82-110	0.198	0.010	11.5	0.08	0.620	7.0	77
	110-166	0.136	0.007	11.3	0.07	0.435	6.0	62

Exchangeable potassium is 218-221 mg/kg in the driving layer of soils and decreases to 53 mg/kg towards the lower horizons. The studied gray-meadow soils belong to the group of medium-supplied soils according to the degree of supply of exchangeable potassium.

The amount of mobile phosphorus (R2O5) in weak gypsum soils is 22.0-23.0 mg/kg in the driving layer of the soil. It was found that the amount of this indicator decreases to 5.0 mg/kg along the lower layers of the cross-section and indicates that the lower layers of the soil are very poorly supplied with mobile phosphorus. Exchangeable potassium decreased to 211-211 mg/kg in the driving layer of soils, and to 50 mg/kg in the lower layers. These soils belong to the group of moderately supplied soils according to the amount of exchangeable potassium in the soil layer (Table 1).

The average amount of mobile phosphorus in plastered soils was found to be 18.0-21.0 mg/kg in the driving layer of the soil, and these soils form a group of soils with low supply. Along the lower layers of the section, this indicator decreased to 8.3-9.3 mg/kg, and the lower layers of the soil section were very poorly supplied according to the amount of mobile phosphorus. It was found that the amount of exchangeable potassium decreased to 206-233 mg/kg in the tillage layer of gray-meadow soils, and to 62 mg/kg in the lower layers. These soils are averagely supplied with exchangeable potassium in the driving layer (Table 1).

The main form of nutrition in phosphorus nutrition of plants is the mobile forms of phosphorus, and the amount of mobile forms of phosphorus in the upper layers fluctuated between 18.0 and 23.0 mg/kg in the studied irrigated gray-meadow soils, as well as in different levels compared to the irrigated non-gypsum soils. in plastered soils, the forms of mobile phosphorus are almost close to each other, and the studied soils belong to the group of soils with very little supply of mobile phosphorus [10] .

It was found that the total amount of nitrogen in the layers of gray-meadow soils with different degrees of gypsum, depending on the amount of humus, and the main amount of humus and nitrogen are mainly accumulated in the upper layers of the soil, and their amount gradually decreases along the soil section towards the lower layers [10]. .

(section 37) the total amount of nitrogen is 0.062% in the plowed layer of non-plastered irrigated gray-meadow soils, and its amount is 0.058% in the sub-plotted layer. Total phosphorus is 0.21%, potassium is 0.996%, and it was found that the amount of total phosphorus decreased to 0.05% and potassium to 0.476% towards the lower layers.

(section 143) the content of total nitrogen content in the plowed layer of irrigated gray-meadow soil with weak humus decreased to 0.065%, and to 0.015% in the lower layers. The amount of total phosphorus is 0.24%, and the amount of potassium is 1.084%, and it was found that the amount of phosphorus decreased to 0.06%, and the amount of potassium decreased to 0.426% towards the lower layers.

(Section 128) irrigated gray-meadow soils with an average content of nitrogen in the content of the plowed layer of the soil represent 0.065% and 0.056% in the sub-plotted layer. The amount of total phosphorus was 0.21%, and the amount of potassium was 0.924%, and it was observed that the amount of phosphorus decreased to 0.06% and the amount of potassium to 0.302% towards the lower layers (Table 1).

The amount of nutrients varies depending on the mechanical composition of the soil, if the nutrients in the heavy sandy soils are compared with the light sandy soils, the indicators of the nutrients are found to be higher in the relatively heavy soils. In addition, with increasing soil salinity, it was observed that the indicators of humus and nutrients in the soil decreased. Based on the obtained data, it should be noted that the amount of humus and nutrients in non-gypsum soils is relatively high compared to the various degrees of plastered soils in which gray-meadow soils are distributed, according to the results of research and chemical analysis.

3 Conclusion

1. The relatively low availability of humus and nutrients in the researched gray-meadow soils is explained by the poor agro-physical and water-physical properties of plastered soils.
2. It is observed that the amount of humus and nutrients did not change in the plowed and under-plowed layers of the irrigated gray-meadow soils of the area that were not plastered and with varying degrees of plaster, only redistribution took place between the layers. in this case, the amount of humus and nutrients will decrease sharply, as a result, the negative impact on the normal development and productivity of agricultural crops, especially tap root crops, is clearly visible. Therefore, it is advisable to plant alfalfa, sorghum, grassy and spiky crops with high amounts of organic and mineral fertilizers on soils with weak surface plastering with all forms of gypsum.

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