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New approaches to changing the sorption properties of loess rocks

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ABSTRACT

The purpose of the study: to study the change in the absorption capacity and sorption properties of loess rocks when introducing an organomineral complex

Object and methods of the study.The irrigated areas of the Verkhnechirchik district of the Tashkent region were chosen as the object of the study. A series of field works were carried out, during which the composition of the soil, the dose of the organomineral complex and nitrogen fertilizer were changed.

Results of the study. The results of lysimetric studies showed that the introduction of OMC on the background of N200P140K100 has a significant effect on the transformation of nitrogen compounds in the soil. When introduced at rates of 10 and 15 t / ha, the content of ammonia nitrogen in the soil significantly increases compared to the control at all times of determination. Thus, in the arable layer of the variants with the introduction of the organomineral complex (OMC) at rates of 10 and 15 t/ha, the content of ammonia nitrogen in the 3rd quarter of 2021 was, respectively, 15.8 and 20.1 mg\kg, in the 4th quarter 11.7 and 13.4 mg\kg, in the 1st quarter of 2016 10.4 and 12.2 mg\kg against 6.4-7.2 mg\kg in the control.

Conclusions: Thus, the introduction of OMC helps to reduce the formation of nitrites and nitrates in the aeration zone, which serves to prevent their leaching into groundwater and underground water. The use of OMC is an effective mechanism for eliminating excess nitrate concentrations in the aeration zone and accumulating nitrogen in ammonium and organic form.

INTRODUCTION

Groundwater protection depends on natural and man-made factors. Natural factors include the depth to the groundwater level, the presence of low-permeability rocks, lithology and sorption properties of soils and rocks of the aeration zone. [1,3,6] Man-made factors include the conditions of the presence of pollutants on the earth's surface and in the aeration zone, their chemical composition, migration capacity, sorption, chemical stability, decay time, the nature of interaction with soils, grounds and groundwater. [7] At the same time, the only barrier to the penetration of pollutants into groundwater from the surface are the soils and grounds of the aeration zone. [4,5,6]

In this regard, it is important to develop new technologies that improve the ecological state of soils and help reduce groundwater pollution with residual amounts of mineral fertilizers and pesticides.

Objective of the study: to study the change in the absorption capacity and sorption properties of loess rocks when introducing an organomineral complex (hereinafter referred to as OMC).

Object and methods of the study. The object of the study was the irrigated areas of the Verkhnechirchik district of the Tashkent region. A series of field works were carried out, during which the composition of the soil, the dose of the organomineral complex and nitrogen fertilizer were changed.

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Table 1. The influence of OMC on the dynamics of ammonium content in sierozem-oasis soil, mg/kg

Options	Depth, cm	NH_4, mg/kg			
		II quarter 2021 г.	III quarter 2021 г.	IV quarter 2021 г.	I quarter 2022 г.
1. $N_{200}P_{140}K_{100}$-фон	0-30	6,3	6,3	6,8	7,1
	80-100	3,9	4,3	4,3	4,9
	180-200	3,3	3,4	3,9	4,1

	280-300	-	-	-	-
2. Фон +10 t/ha ОМК	0-30	7,0	15,8	11,7	10,2
	80-100	4,7	4,9	5,5	4,5
	180-200	2,1	3,3	2,8	3,2
	280-300	-	-	-	-
3. Фон +15 t/ha ОМК	0-30	7,2	20,1	13,4	12,0
	80-100	4,9	4,8	4,0	4,1
	180-200	2,6	3,4	3,1	3,4
	280-300	-	-	-	-

Table 2. The influence of OMC on the dynamics of nitrate content in sierozem-oasis soil, mg/kg

Options	Depth, cm	NO_3, мг/кг		
		III quarter 2021 г.	IV quarter 2021 г.	I quarter 2022 г.
1. $N_{200}P_{140}K_{100}$-фон	0-30	29,1	19,2	21,1
	80-100	21,1	15,2	10,9
	180-200	11,7	14,1	11,2
	280-300	14,0	6,6	13,6
2. Фон +10 t/ha ОМК	0-30	25,8	15,4	17,7
	80-100	16,6	9,0	8,7
	180-200	12,6	5,3	6,9
	280-300	7,9	4,1	3,7
3. Фон +15 t/ha ОМК	0-30	24,4	31,3	16,8
	80-100	12,7	9,9	15,4
	180-200	7,9	6,7	8,5
	280-300	5,5	4,2	2,4

The nitrate content in the arable soil layer in the 3rd quarter of 2021 was 25.8 and 24.4 mg/kg, respectively, versus 29.1 mg/kg in the control. The same pattern was observed in the remaining periods for determining the nitrate content in the soil. At the same time, there was a tendency for the nitrate content in the soil to decrease in the 4th quarter of 2021 and the 1st quarter of 2022, which is obviously the result of their absorption by plants during the growing season, leaching of nitrates and denitrification processes. The nitrate content in the soil gradually decreases with depth; they were found in all layers of the studied soil thickness in all variants. The nitrate content at a depth of 300 cm at the beginning of the experiment fluctuated within 4.7-9.1 mg/kg. After application of mineral fertilizers and OMK in variants with the rate of 10 and 15 t/ha, the nitrate content was, respectively, 7.8 and 5.6 mg/kg against 14.2 mg/kg in the control, which indicates a decrease in nitrate leaching when OMK was applied. At the same time, the lowest nitrate content (2.4-3.7 mg/kg) were observed after six months in variants where OMK was applied. During the same periods of determination, the nitrate content in the control, at the same depth, was, respectively, 13.7 and 14.2 mg/kg, which is significantly higher compared to variants with OMK application.

The results of experiments on lysimeters showed that the accumulation of nitrate nitrogen in soils with the use of OMC is an effective mechanism for eliminating excess nitrate concentrations by 1.7 and 5.6 times, respectively, in the aeration zone at a depth of 300 cm in variants with a rate of 10 and 15 t/ha and accumulating nitrogen in ammonium and organic form compared to the control.

Conclusions: Thus, the introduction of OMC helps to reduce the formation of nitrites and nitrates in the aeration zone, which serves to prevent their leaching into groundwater and underground water. The use of OMC is an effective mechanism for eliminating excess nitrate concentrations in the aeration zone and accumulating nitrogen in ammonium and organic form.

REFERENCES

- Agrochemical methods of soil research. Moscow, Nauka Publishing House, 1975.
- Arinushkina E.V. – Manual of chemical analysis of soils. Moscow, 1970.
- Bairov A.Zh. Soil chemical analysis of minerals and organic matter. Uzbekistan State University of Agricultural Sciences, Geodesy, Cartography and Land Cadastre Survey. Tashkent, 2005.17s.
- Gamzikov G.P., Barsukov P.A. Nitrogen balance during long-term application of fertilizers in agrocenoses on sod-podzolic soil. Agrochemistry. 1997. 9. pp. 5–10.
- Mavlyanov N.G., Mavlyanov E.N. Creation of an "Ecological Shield" to Protect Groundwater from Agricultural Pollutants.// Geology and Mineral Resources. - Tashkent, No. 2, 2005.-pp. 71-74s.
- Khodjaev V.G. Study of Pollution of the Aeration Zone and Groundwater in the Chirchik River Valley with Pesticides and Nitrogen Compounds and Substantiation of Water Protection Measures. Tashkent. Funds of the State Enterprise "Institute GIDROINGEO", 1985.
- Khodjaev V.G. On the Migration of Nitrogen Compounds in the Aeration Zone. J. Agrochemistry. No. 6. 1983.