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INFLUENCE OF NON-TRADITIONAL FERTILIZERS ON SOIL PROPERTIES

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Abstract
In the experiments carried out in the conditions of typical serozem soils of the Tashkent region under the 1:1 crop rotation scheme (cotton : wheat) the application of mineral fertilizers with the NPK norm: 200-140-100 and 150-105-75 kg/ha with the additional application of bentonite clays in the amount of 1500- 3000-4500 kg/ha for dying before the sowing of winter wheat, as well as irrigation regimes with a predetermined humidity of 60-70-60% and 70-80-70% of LFMC revealed that when irrigation is performed under the irrigation regime of 60-70-60% from LFMC, a decrease in the bulk mass in the 0-30 cm soil layer by 0.08 g/cm^3 is observed, and in the 30-50 cm layer it is 0.03 g/cm^3, permeable The soil height increased by 33 m^3/ha. When the irrigation regime was 70-80-70% of the LFMC, the bulk mass in the 0-30 cm soil layer decreased by 0.09 g/cm^3, and in the 30-50 cm layer by 0,07 g/cm^3, the water permeability of the soil increased by 42 m^3/ha.

Keywords: typical serozem soils, bentonite clays, mineral fertilizer norm, soil, volumetric mass, water permeability.

INTRODUCTION

High yield of agricultural crops depends primarily on soil reclamation and fertility. Today, many of our scientists are conducting scientific research on increasing soil fertility and improving the land reclamation condition.

Local fertilizers are of great importance in improving the agrophysical properties of the soil and increasing its productivity, but today, when there is a shortage and shortage of local fertilizers, the use of non-traditional agro-ores, which are environmentally friendly and cheap feedstuffs, gives good results in different soil and climatic conditions.

Due to the presence of many microelements in the bentonite mud, it fills the soil's lack of nutrients to a certain extent, improves the agrophysical properties of the soil and increases the level of productivity, helps the plant to absorb the mineral fertilizers applied to the soil.

Based on this, it is one of the urgent issues of today to study the positive effect of applying bentonite slurry under plowing on soil bulk density and water permeability, which is one of the agrophysical properties of soil.

RESEARCH OBJECT AND METHODOLOGY

Scientific research work was carried out in 2020-2023 in the central experimental fields of the Research Institute of Cereals and Legumes located in Andijan district of Andijan region.

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Experimental system 16 variants were placed in one layer in 3 repetitions. In the experimental field, the row spacing of the crops is 60 cm, and the length is 100 m. The area of each plot is 480 m², the calculated area is 240 m². The total area of experiments was 2.5 hectares.

Table 1. Experience system

№	*Options*	Watering order, relative to LFMC, %.	Annual amount of fertilizer, kg/ha		
			N	P_2O_5	K_2O
1	Without bentonite	60-70-60	200	140	100
2	Without bentonite		150	105	75
3	1500 kg/ha bentonite		200	140	100
4	1500 kg/ha bentonite		150	105	75
5	3000 kg/ha bentonite		200	140	100
6	3000 kg/ha bentonite		150	105	75
7	4500 kg/ha bentonite		200	140	100
8	4500 kg/ha bentonite		150	105	75
9	Without bentonite	70-80-70	200	140	100
10	Without bentonite		150	105	75
11	1500 kg/ha bentonite		200	140	100
12	1500 kg/ha bentonite		150	105	75
13	3000 kg/ha bentonite		200	140	100
14	3000 kg/ha bentonite		150	105	75
15	4500 kg/ha bentonite		200	140	100
16	4500 kg/ha bentonite		150	105	75

Note: Bentonite slurry rates indicated in the experimental system are applied annually before planting and the effect is studied during the growing season.

In the experiment, rates of bentonite slurry of 1500-3000-4500 kg/ha were applied under the plow every year before planting winter wheat, and its effect on soil agrophysical properties was studied during the growing season. This work was repeated for three years.

RESEARCH RESULTS

During the years 2020-2023, from the agrophysical features of the experimental field conducted in the soil-climatic conditions of Andijan region, in order to observe the changes in the volume weight and water permeability of the soil depending on the applied factors, samples were taken from different depths of the soil at the beginning of the period of operation, and the initial agrophysical condition of the field was determined (Table 2).

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Table 2. Initial volumetric weight of the soil at the beginning of the application period, g/cm^3.

Years	Soil layer, cm.	
	0-30	30-50
2009	1,34	1,41
2010	1,33	1,38
2011	1,35	1,40

By the end of the implementation period, when the soil bulk weight was studied in the cross-section of the options, differences between the options began to be noticed depending on the factors used.

For example, by the end of the 2010 operating period, when the soil moisture was irrigated in the order of 60-70-60% relative to LFMC, mineral fertilizers NPK were applied at the rate of 200-140-100 kg/ha, volume weight in the 0-30 cm layer of the soil at the beginning of the operating period (1,34 g/cm3) compared to the control option, the soil was compacted by 0.10 g/cm^3, in addition, 1,500-3,000-4,500 kg of bentonite slurry was applied per hectare (options 3-5-7), the volume weight of the soil was 0, Although it increased to 0.07-0.02-0.04 g/cm^3, it was observed that it was lower by 0.03-0.08-0.06 g/cm^3 compared to the control.

Mineral fertilizers NPK: when analyzing the options used at the rate of 150-105-75 kg/ha, the concentration in the 0-30 cm layer of the soil was 1500-3000-4500 kg per hectare, in the 4-6-8 options, 0.07-0 Although it increased to 0.05-0.03 g/cm3, it was found to be less than 0.03-0.05-0.07 g/cm^3 compared to the control.

In the second irrigation procedure, the above rules are maintained, soil moisture is irrigated in the irrigation procedure of 60-70-60% compared to LFMC, and mineral fertilizers NPK: 200-140-100 kg/ha are applied at the rate of soil compaction in the 0-30 cm layer per head (1.34 g/cm^3) compared to the control variant, the soil was compacted by 0.14 g/cm^3, in addition, 1500-3000-4500 kg of bentonite slurry was applied per hectare (11-13-15), this indicator was 0.09-0.07-0 Although it was 0.05 g/cm^3, compared to the control, it was found that the density was less than 0.05-0.07-0.09 g/cm^3.

This indicator increases by 0.13 g/cm^3 compared to the control option (1.34 g/cm^3) when mineral fertilizers NPK: 150-105-75 kg/ha are applied, the volume weight of the soil in the 0-30 cm layer is 1500 - in cases where bentonite mud was used from 3000-4500 kg (options 12-14-16), it was known that it was densified up to 0.10-0.06-0.06 g/cm^3 compared to the beginning of the operation, but compared to the control it was 0.03-0, It was found that the density was low up to 07 g/cm^3.

As it can be seen from the given data, the increase in the number of irrigations caused an increase in the bulk density of the soil.

In the soil analysis conducted in the remaining years, results close to the data obtained in 2020-2021 were obtained, and it was observed that the volume weight of the soil was less in the variants with bentonite slurry compared to the control variant without bentonite slurry.

Another agrophysical property of soil is water permeability. Taking this into account, each year before the start of the experiment, the water permeability of the soil was determined at the beginning of the

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application period from five points using the envelope method and at the end of the application period in all options.

According to the received data (2020-2022), at the beginning of the implementation, the water permeability of the soil at five points showed an average of 824 m³/ha, 850 m³/ha, 832 m³/ha, and by the end of the implementation period, the following data were obtained when the options were studied. By the end of the period of 2010, when the soil moisture was irrigated in the order of 60-70-60% relative to LFMC, and in addition to the standards of mineral fertilizers NPK: 200-140-100 kg/ha, bentonite slurry was applied at the rate of 1500-3000-4500 kg per hectare, the period of operation 58-46-41 m³/ha less water was absorbed into the soil compared to the head, but 16-28-33 m³/ha more water was absorbed compared to the control (74 m³/ha). In addition to NPK standards of mineral fertilizers: 150-105-75 kg/ha, when bentonite slurry is used in the amount of 1500-3000-4500 kg/ha, compared to the beginning of the operation period, water was transferred less than 52-43-38 m³/ha, compared to the control option 18 -We can see that 27-32 m³/ha of water has absorbed more into the soil.

Table 3. Water permeability of the soil at the beginning of the operation, m³/ha/h.

Years	Water permeability of the soil for 6 hours, m³/ha
2020	824
2021	850
2022	832

In the second irrigation regime (70-80-70% compared to LFMC), we can see that the above laws are repeated, and in addition to the norms of mineral fertilizers NPK: 200-140-100 kg/ha, bentonite mud is applied from 1500-3000-4500 kg per hectare, to the control 22-33-34 m³/ha of water was absorbed into the soil, in addition to the norms of NPK mineral fertilizers: 150-105-75 kg/ha, when bentonite slurry of 1500-3000-4500 kg/ha per hectare is used, these indicators are 20-38 compared to the control option It was found that -42 m³/ha of water was more absorbed into the soil.

From the obtained data, it can be concluded that as the increase in the number of irrigations leads to an increase in the volume weight of the soil and a deterioration in water permeability, the use of bentonite mud in this regard preserves the agrophysical properties of the soil to a certain extent.

In our observations made during other years, we can see that the above laws are preserved, that is, in these experiments, in addition to mineral fertilizers, positive results were obtained in the options where bentonite slurry was used compared to the control.

In conclusion, we can say that:

1. In the conditions of gray meadow soils of Andijan region, at the beginning of the operation period, bentonite slurry in the amount of 1,500-3,000-4,500 kg per hectare is applied, soil moisture is 60-70-60% relative to LFMC, mineral fertilizers are applied in the order of irrigation, NPK: 200-140-100 kg/ha application, reducing the volume weight of the soil to 0.03-0.08-0.06 g/cm3 in the 0-30 cm layer, and to 0.03 g/cm³ in the 30-50 cm layer, making the water permeability of the soil 16-28-33 increases m3/ha. When irrigated in the same way and mineral fertilizers NPK: 150-105-75 kg/ha are

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applied, the volume weight of the soil in the 0-30 cm layer is up to 0.03-0.05-0.07 g/cm3, in the 30-50 cm layer it is 0. 02-0.03 g/cm3 makes it possible to reduce water permeability of the soil to 18-27-32 m3/ha.

2. When the soil moisture is 70-80-70% relative to LFMC, mineral fertilizers NPK: 200-140-100 kg/ha are applied at the rate of 0.05-0.07-0.09 g/cm^3 in the 0-30 cm layer of the soil. In a layer of 30-50 cm, density is up to 0.04-0.07-0.05 g/cm^3, water permeability of the soil is up to 22-33-34 m^3/ha, when mineral fertilizers NPK: 150-105-75 kg/ha are applied the volume weight of the soil decreases to 0.03-0.07 g/cm^3 in the 0-30 cm layer, to 0.04-0.06-0.05 g/cm^3 in the 30-50 cm layer of the soil, and the soil water permeability is 20-38- It will be possible to increase it to 42 m^3/ha.

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