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The Effect Of Organic, Mineral And Biopreparations On The Amount Of Nitrate Nitrogen In The Soil Depending On The Rates And Timing Of Application Of White Cabbage Plants

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Abstract: This article presents data on the changes in the content of nitrate nitrogen in the soil profile of irrigated typical gray soils under the application of biopreparations, mineral, and organic fertilizers to medium-maturing white cabbage plants, depending on the application rates.

Keywords: Typical gray soils, soil fertility, nitrate nitrogen dynamics, biopreparation, mineral fertilizers, organic fertilizers, medium-maturing white cabbage, seedling establishment period, beginning of head formation, pre-harvest stage.

Introduction: The Food and Agriculture Organization (FAO) defines the suitability of land for agriculture as the ability to produce the maximum potential yield from agricultural crops. Today, most of the land used for agriculture, based on adaptive farming, is of high quality, with 23% and 53% being of good quality. The largest regional share of high-quality land used for agriculture is in Central America and the Caribbean (42%) , followed by Western and Central Europe (38%) and North America (37%). The average share of high-quality land in developed countries is 32%. Soil fertility in developing countries is often low, with only 28% of all land used for agriculture being classified as high-quality land.

Agriculture is one of the main sectors of the national economy, because agriculture provides the population

with food, industry with raw materials, and livestock with fodder. Therefore, without comprehensive development of agriculture, it is impossible to widely develop other sectors of the national economy. For this reason, a program for deepening reforms in agriculture has been developed in our republic, which outlines the main directions of agricultural development.

It is known that when organic, mineral and microfertilizers are applied to agricultural crops, biological and biochemical processes in the soil are accelerated, and more organic matter accumulates. As a result, soil fertility increases and optimal conditions are created for the growth and development of crops, achieving high and high-quality yields. It is worth noting that biochemical processes in the soil directly depend on the biological activity of the soil, the types of crops planted, and the types of fertilizers used.

2021-2023 at the Central Experimental Farm of the Uzbek Research Institute of Vegetable, Melon and Potato Growing in order to determine the norms of mineral fertilizers that ensure high and high-quality yields of medium-sized white cabbage, as well as the norms and terms of organic, mineral and biopreparations to increase soil fertility in conditions of typical gray soils with a slope of 1.5 0, which have long been irrigated. The experiment consisted of 8 variants and was arranged in 3 rotations. Field experiments were conducted according to the methods of UzPITI [1; P. 180], B.J. Azimov and B.B. Azimov "Methodology of conducting experiments in vegetable, melon and potato growing" [2; P. 9-11], V.F. Belik's "Methodology of experimental work in vegetable and melon growing" [3; P. 30–45], "Methods of agrochemical analysis of soils and plants" [4. S. 128]. The experimental system is presented in Table 1.

According to AAKorchagin., MAMazirov., NAKomarova [6; P. 35], vegetable crops have high requirements for nitrogen fertilizer feeding during the growing season. The most intensive growth of cabbage is observed in July and August (84% of the total yield), at this time the cabbage plant absorbs a lot of nitrogen. In the future, the use of nitrogen fertilizers for vegetable crops will be sharply reduced and 20-30 kg / ha of nitrogen will be applied, provided that 60-120 tons of manure are applied.

Table 1

Experience system

No.	Annual rate of fertilizers, kg/ha; t/ha	Fertilizer application during the growing season, kg/ha; t/ha			
		Before plowing	Before planting	First feeding when seedlings take root	When the second feeding cabbage begins to roll
1	Without fertilizer - abs. control	-	-	-	-
2	Fertilizer 20 t/ha	20 t/ha	-	-	-
3	Biopreparation 30 l/ha	10 l/ha	10 l/ha	5 l/ha	5 l/ha –
4	Biopreparation 30 l/ha + Fertilizer 20 t/ha	10 l/ha +20 t/ha	10 l/ha	5 l/ha -	5 l/ha –
5	Biopreparation 30 l/ha +P-150, K-100	10 l/ha+ P-105, K-50	10 l/ha +P-45	5 l/ha -	5 l/ha + K-50
6	N -150, P-150, K-100	P-105, K-50	N -50, P-45	N -50	N -50, K-50

7	N -200, P-150, K-100	P-105, K-50	N -50, P-45	N -75	N -75, K-50
8	Biopreparation 30 l/ha + N -150, P-150, K-100	10 l/ha +P-105, K-50	10 l/ha, N -50, P-45	5 l/ha + N -50	5 l/ha + N -50, K-50

According to NMBelous., VFShapovalov., VBKorenev., VVTalizin [5; P. 17-21.], the state of irrigated arable soils in vegetable growing is currently of great concern. Many arable lands used for vegetable crops for a long time have lost their biological fertility and have become abiotic substrates. Intensive use of soils for vegetables has led to a decrease in the main parameters of fertility.

S.I. Novoselov., N.I. Tolmachev., A.V. Murzhinova [7; P. 14-15.] noted that to increase the yield of vegetable crops and maintain soil fertility, an important component that ensures high-quality stable yields and increases soil fertility is the agrotechnical factor. This problem can be solved on the basis of scientifically based crop rotation, tillage methods, fertilizer systems and plant protection.

In our research, changes in the amount of nitrate nitrogen in the soil as a result of the application of biopreparations, organic and mineral fertilizers in the cabbage crop, their rates and timing were determined (see Table 2). The experiments were conducted in one field for three years, the initial state before the experiment was determined, the period of seedling emergence, the beginning of the cabbage and before harvesting, soil samples were taken and analyzed from the 0-30 and 30-50 cm layers of the soil in two variants of the experiment.

The scientific data obtained in the experiment show that in the control variant 1, the average nitrate nitrogen content in the 0-30 cm and 30-50 cm soil layers during the three-year cabbage seedling period was 24.6 and 9.7 mg/kg, respectively. It is also worth noting that, due to the incomplete application of nitrogen mineral fertilizers to the white cabbage crop during this period, the nitrate nitrogen content was close to each other in all variants, but during the cabbage leafing and harvesting periods, the nitrate nitrogen content differed between the variants.

In the research, when white cabbage was grown without fertilizers in option 1, by the time the cabbage started to grow, the amount of nitrate nitrogen in the 0-30 cm and 30-50 cm layers of the soil was 27.7 and 9.9 mg/kg, or increased by 3, 1 and 0.2 mg/kg, respectively, compared to the period of seedling establishment. This is due to the fact that with the increase in air temperature in the summer months, the amount of nitrate nitrogen in the soil moves to the dry layers of the soil, that is, their greatest accumulation occurs in June, when the plant's demand for nutrients is the strongest. When the air temperature decreases, that is, before harvesting the white cabbage crop, the amount of nitrate nitrogen decreases by 23.7 and 9.6 mg/kg, respectively, in the soil layers.

In the second variant, where 20 tons of organic fertilizer (manure) was applied to the white cabbage crop, the amount of nitrate nitrogen in the topsoil and subsoil layers of the soil before the cabbage started to ripen and before harvesting was 28.9–10.4 mg / kg and 24.7–9.9 mg/kg, respectively, or 1.2–0.5 mg/kg and 1.0–0.3 mg/kg higher than the control variant, depending on the periods and soil layers, due to the organic fertilizer applied .

In option 3, where 30 liters of the “Baikal EM-1” biopreparation was applied to the white cabbage crop per hectare, on average, in the three years before the cabbage started to grow and before harvesting, the amount of nitrate nitrogen in the 0-30 and 30-50 cm layers of the soil was 28.4 mg/kg - 10.3 mg/kg and 24.2 mg/kg -9.8 mg/kg, respectively, or compared to the control option, the amount of nitrate nitrogen was 0.7-0.4 mg/kg and 0.5-0.2 mg/kg higher, depending on the period and soil layers, due to the use of the biopreparation , but 20 tons of organic fertilizers were applied per hectare. It was found that nitrate nitrogen was 0.5-0.1 mg/kg and 0.4-0.1 mg/kg lower than option 2.

In the 4th variant, when the “Baikal EM-1” biopreparation and organic fertilizer (manure) were applied to the white cabbage, the average nitrate nitrogen in the arable and subarable layers of the soil over the three years before the cabbage began to grow and before harvesting was 29.6-10.5 mg/kg and 25.3 - 10.1 mg/kg, respectively, or compared to the 3rd variant, when 20 tons of organic fertilizer were applied per hectare , the nitrate nitrogen in the 0-30 and 30-50 cm layers of the soil during the cabbage began to grow was 0.7 -0.1 mg/kg, and before harvesting, the nitrate nitrogen content was 0.6 -0.2 mg/kg, respectively , or compared to the 3rd variant, when the biopreparation was applied at a rate of 30 l/ha, the nitrate nitrogen

content was 1.2-0.2 mg / kg and It was noted that it was 1.0-0.3 mg/kg higher. Therefore, it was proven that applying both biopreparation and organic fertilizers to cabbage crops is more effective than applying them separately.

Table 2

Dynamics of nitrate nitrogen in soil, mg/kg (average over three years)

There is. tar. number	Annual rate of fertilizers, kg/ha; t/ha ; l/ha	Soil layers, cm	Seedling emergence period	When the cabbage starts to ripen	Before harvesting
1	Without fertilizer - abs. control	0-30	24.6	27.7	23.7
		30-50	9.7	9.9	9.6
2	Fertilizer 20 t/ha	0-30	25.2	28.9	24.7
		30-50	10.0	10.4	9.9
3	Biopreparation 30 l/ha	0-30	24.8	28.4	24.2
		30-50	9.8	10.3	9.8
4	Biopreparation 30 l/ha + Fertilizer 20 t/ha	0-30	25.8	29.6	25.3
		30-50	10.2	10.5	10.1
5	Biopreparation 30 l/ha + P-150 , K-100	0-30	26.0	30.3	25.9
		30-50	10.2	10.6	10, 2
6	N -150, P-150 , K-100	0-30	26.3	31.2	26.4
		30-50	10.5	10.8	10.2
7	N -200, P-150 , K-100	0-30	26.6	31.7	26.8
		30-50	10.5	10.9	10.3
8	Biopreparation 30 l/ha + N -150, P-150 , K-100	0-30	27.8	32.7	28.2
		30-50	10.8	11.3	10.5

It was found that in the experiment option 5 (biopreparation 30 l/ha and P-150, K-100 kg/ha), the average nitrate nitrogen content by year in the 0-30 and 30-50 cm soil layers before the cabbage began to grow and before harvesting was 30.3-10.6 mg/kg and 25.9-10.1 mg/kg, respectively, or 0.7-0.1 mg / kg and 0.6-0.1 mg/kg higher, respectively, in the periods and soil layers compared to option 4 (biopreparation 30 l/ha and manure 20 t/ha). Thus, it was found that the application of the biopreparation “Baikal EM-1” to white cabbage crops together with mineral fertilizers is more effective than the application of organic fertilizers.

In the 6th variant, where mineral fertilizers were applied to the white cabbage crop at the rates of N-150, P-150, K-100 kg/ha, and in the 7th variant, where N-200, P-150, K-100 kg/ha, the amount of nitrate nitrogen in the topsoil and subsoil layers of the soil before the white cabbage started to form heads and was harvested was found to be 31.2-10.8 mg/kg, 31.7-10.9 mg/kg, and 26.4-10.2 mg/kg, 26.8-10.3 mg/kg, respectively. Comparing these data, it was found that the amount of nitrate nitrogen in the soil for an additional 50 kg of nitrogen varied by 0.5-0.1 mg/kg and 0.4-0.1 mg/kg, respectively, depending on the period and soil layers.

The most optimal indicators in the experiment were observed in option 8, where an average of 30 liters of biopreparation and mineral fertilizers N-150, P-150, K-100 kg per hectare of white cabbage were applied over three years, and the content of nitrogen in the 0-30 and 30-50 cm layers of soil, respectively, before the cabbage began to grow and before harvesting, was 32.7-11.3 mg/kg and 28.2-10.5 mg/kg, or if we compare it with option 6, where mineral fertilizers N-150, P-150, K-100 kg per hectare were applied, it was found that the arable and sub-arable layers of soil before the cabbage began to grow and before harvesting were 1.5 - 0.5 mg/kg and 1.8 - 0.3 mg/kg higher. Therefore, compared to the application of mineral fertilizers N-150, P- 150, K-100 kg per hectare for white cabbage crops, it would be appropriate to apply the "Baikal EM-1" biopreparation at the rate of 30 liters per hectare with these mineral fertilizer standards.

Therefore, based on the above scientific data, it can be concluded that in order to maintain and increase soil fertility in irrigated typical gray soils, when the "Baikal EM-1" biopreparation is applied to the white cabbage plant at a rate of 10 l/ha before plowing, 10 l/ha before sowing, 5 l/ha when the seedlings take root and the cabbage begins to grow, and mineral fertilizers N-150, P-150, K-100 kg/ha are applied, the amount of nitrate nitrogen in the soil increases relatively and good conditions are created for the nutrition and growth of the white cabbage plant.

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