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The Effect of Local Fertilizers, Mineral Fertilizers and Biopreparations on the Agrophysical Properties of the Soil and the Phosphorus and Potassium Fractions in the Cultivation of White Cabbage

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ABSTRACT

In this article, a description of cabbage with a delicious taste, rich in vitamins and biological substances, which is currently grown as a vegetable crop in the Republic of Uzbekistan. White cabbage is consumed fresh and processed throughout the year. It has dietary and therapeutic properties. It is consumed by people with heart disease, obese people, and those who are sick. Its juice is used in the treatment of inflammation of the stomach. and it is stated that it has a good effect on cabbage yield and product quality when it is fed with the method of fertilization Biopreparation 30 l/ha + N-150, P-150, K-100 in its cultivation.

KEYWORDS: Application of local fertilizers, mineral fertilizers and biopreparations food products, cabbage, non-fertilizing method, fertilization standards, biometric measurements, sugar, ascorbic acid, nitrates, N150 P150 K100.

It is known that one of the determinants of soil fertility is its agrophysical properties. Particles in the composition of soil, i.e. humus and mineral nutrients, are in a granular state. The more granular the soil is, the better it is for plants to absorb heat, air, water, and nutrients dissolved in it, as well as the speed of microbiological processes in the soil.

According to the Munyanziza et al. [237; rr. 77-85], Lupwayi et al. [232; rr. 251-261], Chan et al [207; rr. 325-334], soil granularity affects the movement of soil water, protects soil nutrients from leaching erosion, decreases crop productivity, external and internal factors, and helps to increase biodiversity. On the other hand, if the grain size of the soil decreases, the soil undergoes degradation, and at the same time, the soil (area) becomes unsuitable for growing crops.

Table 1. The effect of local fertilizers, mineral fertilizers and biopreparations on changes in the amount of water-resistant macroaggregates larger than 0.25 mm in the soil in the cultivation of white cabbage, %

№	Annual rate of fertilizers, kg/ha; t/ha	Soil layers, cm	2021		2022		2023	
			At the beginning of the season	At the end of the season	At the beginning of the season	At the end of the season	At the beginning of the season	At the end of the season
1	Without Fertilizer-abs. Control	0-30	19,8	9,9	19,5	9,7	19,3	9,6
		30-50	12,4	8,3	12,3	8,1	12,4	8,2
2	Manure 20 t/ha	0-30	20,0	13,2	19,8	12,9	19,9	13,1
		30-50	12,3	9,1	12,1	9,3	12,5	9,3

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3	Biopreparation 30 l/ha	0-30	19,9	12,8	19,7	12,5	19,7	12,7
		30-50	12,4	9,9	12,3	9,7	12,2	9,2
4	Biopreparation 30 l/ha + Manure 20 t/ha	0-30	20,2	14,1	19,9	13,6	20,0	13,8
		30-50	12,5	10,2	12,6	10,1	12,4	10,0
5	Biopreparation 30 l/ha +P-150, K-100	0-30	20,1	13,8	20,0	13,4	19,9	13,4
		30-50	12,3	10,4	12,1	10,1	12,0	10,1
6	N-150, P-150, K-100	0-30	20,1	14,1	20,0	13,9	19,9	13,9
		30-50	12,4	10,7	11,9	10,4	11,8	10,2
7	N-200, P-150, K-100	0-30	20,3	14,3	20,1	14,0	20,0	14,0
		30-50	12,4	10,9	12,2	10,7	12,1	10,5
8	Biopreparation 30 l/ha + N-150, P-150, K-100	0-30	20,0	15,1	20,0	14,9	19,9	14,7
		30-50	12,5	10,9	12,3	10,4	12,0	10,7
9	Biopreparation 30 l/ha + N-200, P-150, K-100	0-30	20,2	15,4	20,1	15,1	20,0	15,9
		30-50	12,6	10,8	12,5	10,6	12,3	10,8

In the research, it was found that the influence of white cabbage on soil grain depends on local fertilizers, mineral fertilizers and stimulants. The obtained scientific data are presented in Table 1. First of all, it should be noted that soil samples were taken and analyzed separately from the tillage and sub-tillage layers from each option and returns. That's why these data differ between options at the beginning of the season.

According to the scientific data presented in Table 1, the amount of water-resistant macroaggregates larger than 0.25 mm in the soil, regardless of the local fertilizers, mineral fertilizers and stimulants applied to white cabbage, was found to decrease by two times towards the end of the season compared to the beginning of the season.

In control option 1 (2021), at the beginning of the season, the amount of macroaggregates in the 0-30 and 30-50 cm layers of the soil was 19.8% and 12.4%, and by the end of the season, these indicators were equal to 9.9 and 83%, respectively. In option 2, where 20 tons of fertilizers were applied to the white cabbage plant, according to the soil layers, it was 20.0 and 12.3% at the beginning of the season, and 13.2 and 9.1% at the end of the season, or in comparison with the control option, compared to the local fertilizers used it was found to be 3.3 and 0.8% more, respectively.

In options 6 and 7, the annual rates of mineral fertilizers N-150, P-150, K-100 kg/ha and N-200, P-150, K-100 kg/ha were applied to white cabbage by the end of the season, and 0-30 of the soil It was found that the amounts of water-resistant macroaggregates larger than 0.25 mm in the cm layer were 14.1 and 14.3% for the options, or 4.2 and 4.4% increased compared to the control option.

The 8th option of experiment, when biopreparation 30 l/ha and mineral fertilizers N-150, P-150, K-100 kg/ha were applied to white cabbage, the amount of water-resistant macroaggregates larger than 0.25 mm in the soil at the end of the season in the 0-30 cm layer of the soil was 15 ,1%, and in the 9th option, when 30 liters of biopreparation per hectare and N-150, P-150, K-100 kg were used in the driving layer of the soil, it was 15.4%, or 0.25 mm compared to the 8th option it was found that the amount of large water-resistant macroaggregates was 0.3% more. Similar results were obtained in the experiments conducted in the next two years of research (2022-2023).

In conclusion, in the cultivation of white cabbage plant under conditions of irrigation erosion and typical gray soils, 30 liters of biopreparation per hectare and N-200, P-150, K-100 kg of mineral fertilizers and 30

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l/ha of biopreparation and N-200, R- Application of 150, K-100 kg of mineral fertilizers had a positive effect on the amount of water-resistant macroaggregates larger than 25 mm in the soil.

Bulk density and porosity of soil

The roots of agricultural crops require specific optimal soil density. If the density of the soil exceeds the specified norm, it will have a negative effect on the growth and development of crops, and as a result, the weight of the crop will decrease.

It is known that when the volume mass of the soil improves, the porosity also increases accordingly. The increase in porosity, in turn, improves water, air, and plant nutrition in the soil, enhances the activity of microorganisms, and as a result, has a positive effect on the growth and development of crops.

Q. Mirzajonov., M. Nazarov., M. Nazarov., S. Zokirova., G'. Yuldashev [95; p. 72-82] stated that the volume mass of the soil should be 1.2-1.3 g/cm^3 for optimal growth of agricultural crops and obtaining a high and quality harvest.

Sh.N. Nurmatov [122; p. 24], according to the results of long-term scientific research, proved that the volume mass of the areas subjected to irrigation erosion increases as a result of the washing of soil particles, depending on the slope level.

In irrigated farming conditions, almost all agrotechnical activities have an effect on soil volume mass. If the volume mass of the soil is at an acceptable level before planting agricultural crops in the spring, it will return to the initial density state after the first watering.

In the experiment, the specific mass of the soil from the options and returns at the beginning of the season and at the end of the season was equal to 2.69-2.71 g/cm3, therefore, we took the specific mass of the soil as an average of 2.70 g/cm^3.

It should be noted that, regardless of the application of local fertilizers, biopreparations and mineral fertilizers to the white cabbage plant in different rates, the volume mass of the soil increased from the beginning (spring) to the end (autumn) of the season in all options, and it was found that the porosity decreased.

In the 1st option (2021), when no mineral, local and biopreparations were applied to the white cabbage plant, at the beginning of the season in the 0-30 cm layer of the soil, its volume mass was 1.307 g/cm^3, porosity was 51.6%, and at the end of the season, the volume mass was 1.391 g/cm^3, porosity was equal to 48.5%. in the 30-50 cm layer of the soil, the volume mass was 1.402 g/cm^3, the porosity was 48.1%, and 1.423 g/cm^3 and 47.3%, or the volume mass of the soil in the driving layer of the soil was 0.084 g/cm^3 higher than at the beginning of the season and the porosity decreased by 3.1%, and in the subsoil layer it was equal to 0.021 g/cm^3 and 1.4%, respectively (Table 2).

In option 2, where 20 tons of local fertilizers per hectare were applied to the white cabbage crop, the volume mass of soil in the tillage layer at the end of the season was 1.375 g/cm^3, and the porosity was 49.1%, or compared to option 1, the volume mass was 0.016 g/cm^3 less, and it was observed that the porosity was 0.6% higher. Against this background (20 t/ha of local fertilizer) in the 4th option, where 30 liters of biopreparation per hectare was applied, by the end of the season, the volume mass of the soil in the tillage layer was 1.356 g/cm^3, the porosity was 49.8%, or the volume due to the biopreparation used compared to the 2nd option it was found that the mass was less dense by 0.019 g/cm^3, and the porosity was 0.7% more.

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Table 2. The effect of local fertilizers, mineral fertilizers and biopreparations on the volume mass and porosity of the soil on white cabbage

№.	Annual rate of fertilizers, kg/ha; t/ha	Soil layers, cm	2021				2022				2023			
			At the beginning of the season		At the end of the season		At the beginning of the season		At the end of the season		At the beginning of the season		At the end of the season	
			g/cm^3	%	g/cm^3	%	g/cm^3	%	g/cm^3	%	g/cm^3	%	g/cm^3	%
1	Without Fertilizer-abs. Control	0-30	1,307	51,6	1,391	48,5	1,310	51,5	1,396	48,3	1,313	51,4	1,399	48,2
		30-50	1,402	48,1	1,423	47,3	1,404	48,0	1,426	47,2	1,404	48,0	1,428	47,1
2	Manure 20 t/ha	0-30	1,304	51,7	1,375	49,1	1,303	51,7	1,382	48,8	1,300	51,9	1,386	48,7
		30-50	1,401	48,1	1,415	47,6	1,401	48,1	1,417	47,5	1,401	48,1	1,419	47,4
3	Biopreparation 30 l/ha	0-30	1,306	51,6	1,384	48,7	1,307	51,6	1,387	48,6	1,310	51,5	1,392	48,4
		30-50	1,404	48,0	1,422	47,3	1,404	48,0	1,421	47,4	1,404	48,0	1,424	47,3
4	Biopreparation 30 l/ha + Manure 20 t/ha	0-30	1,301	51,8	1,356	49,8	1,302	51,8	1,364	49,5	1,299	51,9	1,370	49,3
		30-50	1,401	48,1	1,414	47,6	1,401	48,1	1,416	47,6	1,401	48,1	1,418	47,5
5	Biopreparation 30 l/ha +P-150, K-100	0-30	1,300	51,9	1,347	50,1	1,304	51,7	1,348	50,1	1,297	52,0	1,354	49,9
		30-50	1,402	48,1	1,415	47,6	1,401	48,1	1,413	47,7	1,401	48,1	1,416	47,6
6	N-150, P-150, K-100	0-30	1,299	51,9	1,338	50,4	1,302	51,8	1,345	50,2	1,300	51,9	1,350	50,0
		30-50	1,401	48,1	1,413	47,7	1,400	48,1	1,412	47,7	1,399	48,2	1,414	47,6
7	N-200, P-150, K-100	0-30	1,297	52,0	1,334	50,6	1,300	51,9	1,342	50,3	1,297	52,0	1,345	50,2
		30-50	1,400	48,1	1,411	47,7	1,400	48,1	1,410	47,8	1,397	48,3	1,412	47,7
8	Biopreparation 30 l/ha + N-150, P-150, K-100	0-30	1,295	52,0	1,325	50,9	1,298	51,9	1,333	50,6	1,299	51,9	1,339	50,4
		30-50	1,399	48,2	1,410	47,8	1,399	48,2	1,409	47,8	1,397	48,3	1,410	47,8
9	Biopreparation 30 l/ha + N-200, P-150, K-100	0-30	1,294	52,1	1,321	51,1	1,298	51,9	1,331	50,7	1,296	52,0	1,337	50,5
		30-50	1,399	48,2	1,410	47,8	1,397	48,3	1,409	47,8	1,398	48,2	1,410	47,8

Annual rates of mineral fertilizers N-150, P-150, K-100 kg and N-200, P-150, K-100 kg were applied to the white cabbage plant per hectare in the 6th and 7th options, at the end of the season in the 0-30 cm layer of the soil, according to the options volume mass 1.338 g/cm^3, porosity 50.4% and volume mass 1.334 g/cm^3 and 50.6%. In the 8th and 9th options, where 30 liters of biopreparation was used against the background of these mineral fertilizers, the volume mass was 1,326 g/cm^3, porosity was 50.9%, and the volume mass was 1,320 g/cm^3, porosity was 51.1%. Comparing the 6th and 7th options with the 8th and 9th options, it was found that the volume mass of the arable layer changed by 0.012 and 0.014 g/cm^3 and the porosity by 0.4 and 0.5% due to the biopreparation used.

So, it was found that the biopreparation we use has a positive effect not only on the growth and development of plants, but also on the agrophysical properties of the soil. The above laws were observed in the scientific data obtained in 2022 and 2023 of research.

In conclusion, it can be said that if 30 liters of biopreparation per hectare is applied to the white cabbage plant and mineral fertilizers N-200, P-150, K-100 kg/ha and N-150, P-150, K-100 kg/ha are applied together with it , it was found to have a positive effect on the agrophysical properties of the soil.

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