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INFLUENCE OF FERTILIZERS AND AMELIORANTS ON THE QUALITY OF BEET ROOT DINING IN CASE OF SOIL CONTAMINATION CADMIUM

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Relevance. Today, the pollution of agrobiocenoses by heavy metals (HM) acquired special urgency, since about of fifth part of agricultural land in Ukraine is affected these pollutants. Especially dangerous are mobile forms of heavy metals in the soil, which determine the level of danger for plants, and ultimately to humans. Especially dangerous are mobile forms of heavy metals in the soil, which determine the level of danger for plants, and ultimately to humans. Therefore the increase of contents of mobile fractions of heavy metals in soil leads to their higher concentrations in vegetable plants. Under such conditions, an important issue is to provide people with high quality, environmentally safe food, among which an important place occupied by vegetables.

Therefore, today is of a great importance is the development, research and practical application in specific soil and climatic conditions of the effective and accessible, ecologically safe system fertilizing the vegetable crops, which will contribute high-speed detoxification of cultivated soil contaminated with heavy metals restoring its fertility, increasing the buffering properties of soil systems promoting obtaining the ecologically and biologically safe production of beetroot.

Applications of a meliorants as antidotes, prevents migration of contaminants into adjacent environments, reducing toxicity of the processes caused by pollution.

Analysis of recent research and publications. Among the vegetable plants in Ukraine, the share of root crops is 18% of the total area, among which the beetroot occupies 44.1 thousand hectares. It should be noted that the biological stability of beetroot against the toxic effects of heavy metals is low because the exceeded levels of maximum permissible concentration (MPC) of hazardous mobile forms of Cd^{2+}, especially in acidic, poor in humus content and clay, light granulometric composition

soils can reduce the crop capacity and quality of beetroots.

The purpose of research. The purpose of the research is to study the effect of organic, mineral and organic-mineral systems fertilizing in combination with liming on mobility of Cd^{2+} in soil and translocation of cations in plants depending on different gradations pollution, and the impact of heavy metals on the biochemical structure of beetroot.

Materials and methods. During the three years of research in Lviv National Agrarian University studies there were conducted the researches on the effects of different fertilizer system and meliorants on the behavior of cadmium in the system of «soil-plant».

Salt $CdCl_2$, were used as the pollutants that were introduced as an aqueous solution in simulated contamination levels 1; 3; 5 MPC in the total forms separately in autumn in soil in 0-20 cm depth and in a two week later there was applied the meliorants $CaCO_3$ at the norm 5 t/ha (by hydrolytic soil acidity) according to the scheme of experiment. The soil of experimental plot is a dark gray podzolic whith light granulometric of composition.

Sowing of beetroot (variety Bordo Kharkovsky), as a test-plant was carried in second decade of May in previously contaminated of soil with heavy metals. The mineral fertilizer nitroamofos of brand 16:16:16 and the organic fertilizer Biohumus according to the scheme of experiment were applied in early spring.

The scheme of the field micro-plot two-factor experiment concerning the growing of beetroot included such variants: 1) Control variant (without fertilizers); 2) $N_{68}P_{68}K_{68}$; 3) Biohumus 4 t/ha; 4) $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha; 5) $N_{68}P_{68}K_{68}$ + $CaCO_3$ 5 t/ha; 6) Biohumus 4 t/ha + $CaCO_3$ 5 t/ha; 7) $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + $CaCO_3$ 5 t/ha.

The following factors were studied in the laboratory-field model experiments:

Factor A – the levels of soil contamination by cadmium;

Factor B – the fertilizer system and meliorants

We determined the concentration of mobile and total forms of Cd in soil and the concentration of element in the plants of beetroot by the method of atomic

absorption spectrophotometry and also the biochemical composition of plants according to standardized methods.

Results and discussion. The research has established that soil and climatic conditions, the fertilizer system, meliorants and the levels of soil contamination by heavy metals had a great influence on the mobility of cadmium in the soil by cultivating the beetroot. It must be noted, that by increasing the level of soil contamination by cadmium from 1 to 5 MPC there was observed the only tendency to the increase of concentration of heavy metals mobile forms in the soil of all variants, but the general laws of mobility of heavy metals in the soil among the variants were stored. However, great influence on the mobility of cadmium in the soil had great influence of fertilizers and ameliorants.

It was established, that for all variants of experiment, where were used the mineral fertilizers and ameliorants the concentration of mobile forms of cadmium in soil was lower, comparing with a control variant, where were not applied the agrochemicals. But the efficiency of fertilizers concerning the reducing of mobile forms Cd^{2+} in soil in various variants was manifested differently. Thus, the application of only the organic fertilizer Biohumus in full form 4 t/ha was less effective in binding the mobile forms of cadmium in soil, than mineral fertilizers at full norm $N_{68}P_{68}K_{68}$. However, the mobile fraction of cadmium were successfully fixed by soil-absorbing complex by joint application of organic and mineral fertilizers at half of the norms $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha, but the most effective was the application of the same norms fertilizers, but with liming of soil $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + $CaCO_3$ 5 t/ha

Research has established that on the biochemical composition beetroot had an impact a variety of factors, namely: soil and climatic conditions, the growing season of plants, fertilizer system, meliorants and the level of soil contamination with heavy metals. So, observed the general trend, namely by increasing the levels of contamination of soil cadmium from 1 to 5 MPC in all the variants, the indexes of the quality of roots (dry matter content, total sugars, ascorbic acid) has been decreased, but the content of nitrate has been increased. Fertilizers and ameliorants in different amount and proportions have shown a significant effect on the biochemical

composition of roots, compared to control variant.

It should also be noted, that the best biochemical parameters roots (dry matter, the amount of sugars, vitamin C) and lower nitrate levels have been received on the variants with liming of soil. But all the same the best quality of beetroot with minimal concentrations of cadmium and lead, was received at application of comprehensive system of fertilizers at norm $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + $CaCO_3$ 5 t/ha.

The research has established, that the application of organic and mineral fertilizers in combination with liming of soil at norm $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + 5 t/ha CaCO3 on the contaminated dark gray soil with cadmium has helped to reduce the concentration of mobile forms of Cd^{2+} in soil, thus significantly reduced their accumulation in plants of beetroot, which is reflected in high quality of roots safe for consumption.