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THE BIOLOGICAL EFFICACY AND ENVIRONMENTAL SAFETY OF NANOAGROCHEMICALS

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The results of the research on indicators for agrochemicals impact on yield and quality of crops. It is shown that during state testing nanoagrochemicals require deeper environmental studies to avoid negative impacts on biota ecosystems.

Nanoagrochemicals, yield and quality of crops, environmental safety, biotest.

Nanotechnology in crop involving the use of drugs newest generation nano agrochemicals and nanopestytsydiv of "smart" release "nanokatalizatoriv" capable of 1.5-2 times increase productivity of crops. However, the specific physical and chemical properties of nanoparticles that make up the nanopreparativ may have unexpected risks to ecosystems; influence on biological objects at the molecular level, changing the direction biochemical processes and, in certain circumstances, be biocidal properties.

The rapid introduction of nanomaterials in agricultural practices not only opens up new prospects, but also poses a threat to natural ecosystems and man. Therefore, the urgent issue is developing a system of environmental assessment nanopreparativ that will justify their use regulations and determine the best environmentally friendly application rate for crops.

The aim of research was to identify the possible environmental risks of the use of nano agrochemicals.

Materials and methods. Nanopreparaty studied Nano-Gro and Avatar-1, which are used in agriculture to create optimal conditions for the growth and development of crops.

Nano-Gro, a drug manufactured in the USA, it is water-soluble granule diameter of about 4 mm, weighing 0.05 grams of active components destiny mass of sulphate of iron, cobalt, aluminum, magnesium, manganese, nickel and silver 2,84 • 10-9% granules or 1,43 • 10-11 g

Avatar-1 drug of domestic manufacture is particularly pure colloidal solution carboxylates natural food acids and biogenic especially pure metals nanoscale (1-100 nm) at a concentration, mg / l: Cu 800, Zn 70, Mg 800, Ag 1,3, Mn 50, Co 25, Cr 0,3, Mo 25, Fe 80, Se 15, Ge 15,0 in deionized water purity of 99.99999%.

Field research conducted in conditions of stationary field experiment Department of Plant NUBiP Ukraine (CAP NUBiP "Agronomic Research Station" Right Bank Forest-Steppe Ukraine). Soil research areas suhlynkovyy medium black soil type, humus content is 4.4%, pH of salt extract - 7,5 content of mobile forms of nitrogen 114.9 mg / kg soil phosphorus - 62.1 mg / kg soil potassium - 265 6 mg / kg soil.

Studied concentrations corresponding to such standards making nanopreparativ for crops:

Nanopreparat	Application rate, mg / ha	The concentration of the solution,%
Nano-Gro	100 (recommended)	0,05
	200	0,10
	300	0,15
	400	0,20
Avatar-1	50 (recommended)	0,025
	100	0,050
	150	0,075
	200	0,100

In experiment studied winter wheat, grade Brilliant sugar beets and hybrid Anastasia. Farming equipment growing - a traditional area for Right-Bank Forest. Winter wheat was treated in a tube output stage and start heading; sugar beet - at phase six leaves, in line merger, the merger between the rows.

Environmental safety nanopreparativ were determined using bioassays: watercress - salad (Lepidium sativum L), pea seeds (Pisum sativum L), radish seeds with white tip (Raphanus sativus L), barley (Hordeum L), soil microorganisms (groups who are participate in the converted nitrogen and determine its ability nitrifikatsiynu). Indicators set by inhibition of ISO 14238: 2003 [2].

Statistical analysis of the results of research conducted using the program MS Excel 2010 and in accordance with the procedures set out in the writings BA armor [1].

Results and discussion. We know that change causes nanopreparaty disaccharides and concentration of chemical elements in plant tissues and thus affecting the metabolic and growth processes. Use nanopreparatif can result in plant stress for about 14 days, when they begin allocated natural growth stimulants (auxins, gibberellins and cytokinins), and after that period comes very rapid growth and development of roots, which in turn contributes to a more active absorption of nutrients substances and water from the soil and improve plant yield.

The results of field studies have shown that nanopreparaty positively affect the productivity of field crops. Thus, the yield of winter wheat varieties Briliant an average of 3 years when applying Avatar-1 in a dose of 50 ml / hectare was 3.47 t / ha, Nano-Gro in a dose 100 ml / ha - 3.71 t / ha, under control - 2.96 t / ha, and sugar beets under 65.3 t / ha, 65.8 t / ha and 60.7 t / ha, respectively (table. 1).

1. Effect nanoagrochemicals

on crop yield, soil -chornozem typical medium suhlynkovyy (2013-2015).

Version	Rule making, ml / ha	Sugar beets		Winter wheat	
		Productivity, t / ha	± to control	Productivity, t / ha	± to control
Control	-	60,7	-	2,96	-
Avatar-1	50	65,3	4,6	3,47	0,51
Nano - Gro	100	65,8	5,1	3,71	0,75
HIP $_{0,5}$		2,22	-	1,50	-

Along with the positive impact on productivity of plants nanopreparatif manifested their specific effect on product quality. Thus, during the cultivation of sugar beet nanopreparaty stimulate root development, root mass by with using Text-1 was 539.1 g, Nano-Gro - 804,3, at the test version - 516.0 g However, against the background of the increase in mass of roots dry matter content and sugars did not differ from the control option (table 2).

Results of the study's sustainable nanopreparatif showed that most sensitive of fitotestif was garden cress (Lepidium sativumL) - root growth inhibition was observed for doses are recommended production. Thus, even at low concentrations Avatar-1 (0.025%) was found shorter stems at 1.2 times the root - of 1.6, whereas maximum concentrations (0.100%) inhibition is increased respectively 1.3 and 2 3 times (Table. 3).

2. Effect nanoagrochemicals sugar content and dry matter in sugar beet roots (sort Brilliant)

Version	Sugar content,%	Dry matter content,%	Weight root, g
Control	18,3	23,9	516,0
Avatar-1	18,6	23,5	539,1
Nano - Gro	17,6	23,2	804,3
$HIP_{0.5}$	1,26	0,76	39,32

3. Effect on morphometric parameters nanopreparatif of test – cultures

Nano-preparat	Application rate, ml / ha	Root length, cm			The length of the stem, cm		
		Cress - salad	Pea	Radishes	Cress - salad	Pea	Radishes
Control	-	2,5±0,68		2,1±0,71	1,6±0,37	1,5±0,20	1,2±0,11
Avatar-1	50	1,6±0,06	**	1,9±0,18	1,4±0,0	1,7±0,1	1,3±1,0

					9	9	1
	100	1,3±0,10	-	2,8 ±0,14	1,5±0,21	1,5±0,01	2,1±0,81
	150	1,1±0,32	-	1,7±1,00	1,5±0,50	1,4±0,16	1,5±0,13
	200	1,1±0,60	-	1,6±0,37	1,2±0,30	1,7±0,13	0,9±0,15
	100	1,0±0,05	-	2,6±0,31	1,5±0,04	1,6±0,31	1,4±0,12
	200	1,6±0,36	-	2,2±0,04	1,3±0,10	1,8±0,40	1,5±0,13
Nano - Gro	300	0,8±0,04	-	2,0±0,64	1,4±0,03	1,7±0,83	2,2±0,87
	400	1,4±0,35	-	2,8±0,06	1,6±0,01	1,8±0,15	1,3±0,19

** During germination of seed peas developing embryo only one main root (epikotyl)

Similar results were obtained in the study nanopreparatif influence on the activity of soil microorganisms. We studied the bacteria involved in the turned soil nitrogen, have high sensitivity to chemical substances integral indicator of activity which is nitryfikatsiyna ability of soil. This indicator used for ecotoxicological assessment nanopreparatif. To characterize inhibition of indicator bacteria used inhibitory effect (ID of).

The study was observed that the use nanopreparatif led to a substantial decline in capacity nitryfikatsiynoyi soil: the index version it was 60.4 mg / kg soil, when applying Avatar-1 decreased to 19,6-29,5 and Nano- Gro 2,0-5,6 mg / kg. Accordingly observed inhibition of bacteria, as evidenced by the indicator inhibitory effect (ID of) (tab. 4).

4. Effect on nanopreparatif nitryfikatsiynu ability of typical chernozem medium suhlynkovoho

Version	Concentration, %	Nitryfikatsiyna capacity of soil, mg / kg	Inhibiting effect on mineralization (ID)
Control	-	60,4±1,50	-
	0,025	19,8±0,15	-49,0
Avatar-1	0,05	29,5±3,19	-37,0
	0,1	19,6±3,01	-49,0
	0,05	2,0±0,51	-70,0
Nano - Gro	0,1	5,6±1,86	-66,0
	0,2	4,8±0,57	-67,0

Thus, the results indicate the potential environmental risks when applying nanopreparatif to fertilize and protect crops.

Conclusions. Research nanopreparatif Avatar-1 and Nano-Gro in a northern steppes of Ukraine confirmed their positive impact on the productivity of crops such as winter wheat and beet sugar level of their productivity increased 1.1-1.2 times. However, it was found a positive impact on the quality of the harvest of crops.

Established nanoagrochemicals negative impact on ecosystems for biota reaction bioassays, indicating the potential environmental risks of their use. This confirms the need for deeper environmental studies during state testing nanoagrochemicals to avoid negative impacts on biota ecosystems.

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