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**БІОЛОГІЧНИЙ ЗАХИСТ РОСЛИН ЯК ОДИН ІЗ ЧИННИКІВ ПОДАЛЬШОГО РОЗВИТКУ
ОРГАНІЧНОГО ЗЕМЛЕРОБСТВА В УКРАЇНІ****Amons S.E.**

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**BIOLOGICAL PROTECTION OF PLANTS AS ONE OF THE FACTORS OF FURTHER
DEVELOPMENT OF ORGANIC AGRICULTURE IN UKRAINE****Анотація.**

Стаття присвячена ролі біологічного захисту рослин у забезпеченні фітосанітарної, екологічної та продовольчої безпеки. Наголошено, що в даний час гостро назріла необхідність активізації подальшого розвитку фундаментальних і прикладних досліджень в рамках прийнятої концепції фітосанітарної оптимізації агроєкосистем, де біологічному захисту відводиться кардинальна роль в збереженні біорізноманіття, відновленні біоценотичної регуляції, отриманні натуральної продукції, захисту навколишнього середовища.

Особлива увага в роботі приділена проблемі органічного землеробства, його перспектив та ролі в розвитку біологічного захисту рослин, що дає можливість ознайомитися з досягненнями, перспективами розвитку, а також з проблемами біологічного захисту рослин, і зробити крок вперед у вирішенні, перш за все, питань фітосанітарного оздоровлення та оптимізації агроєкосистем в сільському господарстві України, конкурентоспроможності вітчизняних сільськогосподарських товаровиробників в умовах дії правил і принципів СОТ.

Abstract.

The article is devoted to the role of biological plant protection in ensuring phytosanitary, ecological and food safety. It is emphasized that now there is an urgent need to intensify the further development of basic and applied research within the accepted concept of phytosanitary optimization of agroecosystems, where biological protection plays a crucial role in biodiversity conservation, restoration of biocoenotic regulation, natural environment, environmental protection.

Particular attention is paid to the problem of organic farming, its prospects and role in the development of biological plant protection, which provides an opportunity to get acquainted with the achievements, prospects of development, as well as with the problems of biological plant protection, and take a step forward in addressing, above all, phytosanitary rehabilitation and optimization of agroecosystems in agriculture of Ukraine, competitiveness of domestic agricultural producers.

Ключові слова: захист рослин, біологічний метод, шкідники, хвороби, сільське господарство, органічна продукція, ефективність.

Keywords: plant protection, biological method, pests, diseases, agriculture, organic products, efficiency.

Introduction.

Agriculture plays an important and indispensable role in the life of human society, it has always had its own history, status and traditions. The trend towards constant population growth on the planet is accompanied by ever-increasing demands of society on the quality and safety of food.

On the other hand, issues related to plant protection are at the forefront of the interests of more and more people, the environment and the sustainable development of society. Therefore, there is an urgent need to address the controversial issues of today: to provide humanity with safe food, and on the other hand, to preserve the natural environment for future generations.

Society needs to jointly resolve these controversial issues and find a common path for its further coexistence.

The global environmental situation has deteriorated significantly in recent years, and some of the processes are not just destructive, but sometimes catastrophic and irreversible. Therefore, the problem of sustainable development and primitive environmental consciousness has already been discussed in recent history. Thus, in 1972, at a conference in Stockholm, the idea was formulated, the essence of which was to realize that the nature of human economic development must change dramatically.

Scientists, international organizations and political leaders of a number of developed countries have warned

about the need to reorient the development of the world economy for twenty years. Later, in 1992, the United Nations Conference on Environment and Development was held in Rio de Janeiro. Based on the results of its work, a conclusion was made, the essence of which was that the only promising way is the integration of economic development of mankind and respect for the environment [1, 2].

However, the policy of sustainable development proclaimed by developed countries in the late 1980s did not become a panacea for solving global environmental problems, so in today's environment a particularly effective way to solve environmental problems is the close cooperation of countries, governments and major environmental organizations in solving global and national environmental issues.

Thus, agricultural production has a direct connection with nature, which it affects through environmental, economic and social interests.

Formulation of the problem.

Chemicals used to kill pests poison the air, soil, plants, and can be harmful to humans. To carry out chemical control of pests and diseases have to spend significant funds, use complex and expensive equipment, spend in gardens and fields thousands of tons of toxic substances. As a result of the systematic use of chemicals, some of the surviving pests produce offspring resistant to specific pesticides. In addition, chemicals are harmful to entomophagous, resulting in the reproduction of such pests. Which used to be in small quantities. Therefore, manufacturers and scientists have to invent more and more new chemicals that differ from the previous mechanism of action on pests, which is also associated with high costs.

Therefore, an urgent issue in the further development of organic farming is the development of the concept of integrated green crop protection. This concept involves the use of safe means and methods of plant protection, but mostly not chemical - organizational and economic, agricultural and biological. At the heart of the biological method of plant protection against pests and diseases are natural, natural phenomena on top of parasitism and antibiosis (antagonism, fungistasis, suppression), which regulate the relationship between saprophytic, parasitic and pathogenic microbiota.

Organic farming - better meets the requirements of quality food production, it takes into account the sound management of natural resources and, thus, creates the conditions for the preservation of natural ecosystems, nature conservation and biodiversity.

In connection with global pollution in the XXI century, the urgency of using environmentally friendly methods and plant protection products using bioagents that regulate the number of pests is growing. In accordance with the accepted concept of phytosanitary optimization of crop production, there is a transition from the total use of chemicals to the use of environmentally friendly methods of plant protection. One of the ways to implement this program is to use biological methods of plant protection.

Relevance of the research topic.

Ukraine's agriculture has always been, and probably will be for a long time, a donor to other sectors of

the economy, a source of replenishment of national income to solve the country's urgent problems. The growth of demand and prices for food caused by the pandemic gives our country a chance to recover the economy, using the domestic agro-industrial complex as a locomotive.

Our country ranked second in the world in terms of total grain exports, as shown by the last marketing year. As a result, Ukraine is one of the "guarantors of food security in the world" and has the potential to further increase agricultural production.

For the further effective functioning of the agricultural sector, one of the main tasks is the development of the domestic organic sector of the agricultural sector. It is the most innovative and promising area of development in the agricultural sector, which requires a clear plan of action and measures in both the long and medium term.

Reaching the global level, the organic market continues to grow rapidly and is attracting increasing attention from the governments of many countries around the world, which are looking for multifunctional production systems that can bring the national economy to a new, better level of development.

An important role in agriculture is played by pesticides, which for more than a century have made a significant contribution to increasing the productivity of crops around the world, protecting them from many pests. Today, the chemical method of pest and disease control is the leader in the list of plant protection methods. Especially often used in modern intensive plant growing technologies. The chemical method of pest and disease control differs in high efficiency, as in the process of its application the whole arsenal of modern equipment is used and relatively small labor costs are required.

The advantage of the chemical method of pest and disease control is its optimality when it is necessary to destroy pests in the shortest possible time. However, this method of control cannot be considered environmentally friendly: many pesticides are toxic not only to the destroying pests, but also to beneficial insects, animals and humans. Some pesticides tend to accumulate in environmentally unacceptable concentrations in soil, water and food.

The powerful, sometimes poorly controlled chemical protection industry, over the past decades of pesticide poisoning, has posed a real threat of environmental catastrophe. The fact that pests become accustomed to chemical pesticides does not add optimism, as a result of which it is necessary to develop new, more toxic ones. Therefore, it is time to talk about the relevance of using the biological method for plant protection, especially since all these years the scientific base and practice of its use have been successfully developed in the world and in Ukraine in particular.

The aim of the study is to conduct a scientific analysis of the state of the field of organic farming and develop ways to obtain environmentally friendly products with high consumer properties, including the introduction of organic schemes of domestic agricultural production in market conditions.

Analysis of recent research and publications.

Issues of theoretical and methodological foundations of the biological method of plant protection against pests in agriculture are given attention in the works of domestic and foreign scientists such as: Andreeva I.V., Broadway V.M., Dyadechko M.P., Clar J.K., Koppel H.S., Krutyakova V.I., Pisarenko V.M., Sweetman H.L., Flint M.L., Sternis M.V. and other.

However, the issues of introduction of biological plant protection by domestic farmers in the context of world experience and world prospects for the application of the bio method, the main trends in world markets for organic products and the prospects of organic farming were insufficiently covered. These issues need further study.

Research methodology.

In studying the issues of biological plant protection as a factor in the development of organic farming, trends and prospects for the development of the domestic sector of organic agriculture were studied works of domestic and foreign scientists, primary materials of the author's own research, periodicals. Monographic, statistical-economic, computational-constructive, abstract-logical and other methods were used as research methods.

Results of the research.

Plant protection is one of the most difficult activities associated with the production of crop products. This requires knowledge of the place of production, is the quality of the soil in a particular field, as well as climatic conditions and, most importantly, orientation on the harmfulness of the most important causes of diseases, pests and weeds in a given region, but it is impossible to fully take into account all harmful factors.

Pest risk is adequate knowledge and consistent action to limit their harmfulness below the level defined as the economic harm threshold. This is done by all available tools that should provide satisfactory conditions for the growth and development of the plant itself, and at the same time help prevent the emergence of pests. Unilateral use of chemical pests and weeds does not meet today's requirements. That is why special attention should be paid to preventive, agrotechnical measures, as well as the use of natural factors regulating the number of pests by parasitic and predatory insects, entomopathogens and others.

Natural populations of local entomophagous and entomopathogenic microorganisms began to be used in the practical protection of plants during the development of agricultural entomology. The action of beneficial entomophagous and entomopathogenic was considered as a biocoenotic process, the intensity of which depends on a number of factors, including the demographic status of the population of the pest, entomophagous, entomopathogenic microorganisms and varietal phenological characteristics of crops.

If it is necessary to control a specific type of pest, it is recommended to use additional methods of technology elements:

- necessary agrotechnical measures;
- cultivation of resistant to diseases or pests varieties;
- creating favorable conditions for the development of natural enemies of pests;

- introduction of biological agents;
- use of chemical plant protection products.

Given the close link between plant health and environmental protection, the use of environmentally friendly methods of pest and disease control through an integrated plant protection system that includes a biological method is becoming relevant and promising.

At the beginning of 2019, the share of biological products in the world was 6.7% of protective measures, is since 1991 it has increased 6.7 times. At one time, there were more than 300 biolaboratories in Ukraine. The use of the biomethod reached 27%. When using the biological method, according to the International Organization for Biological Plant Protection, more than 170 species of entomocariphages are widely used, but only 30 of them are used the most, which is 90% of the market.

According to the International Association of Organic Producers, of all companies producing biologics and biopesticides, 40% are in the United States, 35% in Europe and 25% in all other countries. The United States has the largest sales and the widest range of commercially available products. The United States is an example of large-scale commercialization of biopesticides, the country has mechanisms to stimulate market entry: a simplified registration system, a system to support the creation of new agents of the biomethod and the development of commercial forms of drugs and on their basis - to expand the range of ready-made forms already on the market.

The Chinese biologics market is the fastest growing in the world, with an annual growth rate of 22.4%. The government supports the development of the biopesticide market: in 2013, several programs were approved to accelerate the development of the biopesticide industry, and in 2017, new "Pesticide Management Rules" were approved. The Ministry of Agriculture has proposed to implement an action plan with zero growth in the use of synthetic pesticides by 2020 (2015).

The EU ranks third in the world for the production and use of biologics. In Europe, there are also programs to reduce the use of chemical plant protection products and constantly increasing safety requirements for humans and the environment when registering drugs, which encourages the use of alternative plant protection products (Regulation № 1107/2009 on the placement of plant protection products on the EU market. This direction is also developing in Latin America and Asia, and the global expansion of the world biopesticide market will be facilitated by the global trend of greening plant protection against diseases and pests, as well as the growing production of organic products [3].

Biological method of plant protection based on the use of living organisms to affect plant pests, pathogens and weeds. Entomophagous and acariphagous (mite-eating animals) are used to kill pests; phytophages that eat weeds; various microorganisms (bacteria, fungi, protozoa) and viruses that cause weeds and plant pests. The means of biological protection also include microorganisms that act as antagonists of pathogens of useful plants.

At the heart of the biological method of plant protection is the idea of the existence in nature of mechanisms for regulating the population of any living organism by its antagonists. It is implied that natural enemies are able to keep it at a lower level than in their absence. For example, biological regulation of pest numbers can occur naturally, but can also be directed (by manipulating their aboriginal natural enemies or introducing target antagonists).

The previously existing idea, the essence of which was to control pests, diseases and weeds until their complete destruction, was replaced by an understanding of the feasibility of biological control (regulation) of the number of pests.

The term "biological control" usually refers to the control of pests by their natural enemies. In a broader sense, it is the use of biological agents (intact organisms, components derived from organisms) to destroy or deter pests or to promote natural enemies.

The term "biological control" was first proposed by the American entomologist G.S. Smith in 1919 when describing the introduction of natural enemies of exotic (foreign) pests. Biological agents are not intended for the complete extermination of the population of the pest, but only to reduce its number in order to reduce its harmfulness. The reference point is the economic threshold of harmfulness, exceeding which should prevent the applied means. The success of biological protection means a reduction in the population density of the pest and its stabilization at a new, lower level [4].

It should be noted that the modern biological method of plant protection, based on interspecific population relations, began to take shape in the twentieth century. During this period, the fundamental works of D. Wallace, C. Darwin, D. Curtis and other researchers were published. A significant contribution to the development of the biomet method was made by American specialists A. Fitch, B. Welt, E. Riley and others. The first experiments on the practical use of beneficial insects in pest control were conducted in Europe. In France in 1840, the researcher Bouaziro used fragrant dye to destroy the silkworm unpaired goose. In Italy in the 1840s, A. Villa used turans and staphylococci to protect the orchard from pests [5].

Protecting crops from biotic stress remains a key issue for agriculture. After an era of excessive and often ineffective widespread use of chemicals, methods of integrated pest management are now focused on improving the efficiency of crops, protecting non-target organisms and increasing plant resistance. To meet these requirements, a biological form of protection seems ideal, but we are still discovering its significant potential.

Ecological basis of biological plant protection - involves the use of natural enemies of organisms that damage crops and other crops. Natural enemies include vertebrates and invertebrates, predators and parasites, as well as microorganisms. Modern advances in physiology and biochemistry, ecology and microbiology have contributed to the emergence of new promising areas in biological plant protection associated with the use of hormones, pheromones, antibiotics, genetically modified plants.

Modern biological protection products are highly effective in the long run and at the same time they are environmentally friendly for the environment, humans and pets. Their use is not harmful to beneficial insects and other non-target organisms. This increases biodiversity, promotes diversification and increases the resilience of natural systems and ensures quality agricultural production.

Biological protection is considered by experts to be an appropriate method from the point of view of ecological safety. It is also profitable economically. Biological methods work for a long time without requiring large costs, and when used properly, are very effective. The resulting effect usually does not occur immediately, but only after a long time, but it has a more permanent protective nature.

The biological method of plant protection against diseases and pests uses two main strategies:

- 1) support of beneficial organisms in this environment;
- 2) introduction, introduction of such organisms into the environment.

When growing cultivated plants, the first strategy is used in both traditional and ecological systems.

Biological plant protection is the use of a living organism to protect plant health. In a broader sense, which now prevails, this includes products whose active ingredients are also "natural substances", ie products of metabolism of animals, plants, bacteria and even some minerals.

This approach is quite controversial, the question arises: then where to put products based on sulfur and copper? Both elements are "natural". And also, for example, limestone. In any case, this method of plant protection is not only the prerogative of organic farming, its attempts to use it in traditional agriculture are still growing, and in some cases, it is already having a tangible effect.

The development of biological plant protection products has been systematically considered, at least since the beginning of the last century. Due to the widespread use of chemical protection, research in the field of biological plant protection was curtailed in the 1950s, but not completely stopped.

When growing cultivated plants, we make requirements for them that go beyond their primary properties. We want the fruits to be bigger and the flowers to be beautiful. Over the centuries of cultivation and breeding, as well as through the use of many auxiliary materials, farmers have recently achieved a significant increase in crop yields in recent decades. A lot of work has also been done to increase the susceptibility of cultivated plants to diseases and pests.

To implement a biological method of protection and greening of integrated protection systems, it is advisable to solve a complex problem of environmental protection and study the biological characteristics of natural populations of parasitic and predatory insects.

Biological protection is not primarily the eradication of harmful species, but the regulation of their numbers (biological control of numbers), which is based on four main strategies:

1) introduction into the population of harmful species of biological agent from a remote area for its long-term habitat and constant regulation of the number of phytophages, phytopathogens and weeds. This strategy was first used to successfully suppress worms (*Icerya purchasi*) by the beetle *Rhodolia cardinalis* (*Rhodolia cardinalis*), imported from Australia to the United States (California) in the XIX century. Therefore, this strategy is often called classical;

2) a single release (or introduction) of a biological agent into the agrocenosis for the purpose of its further reproduction and functioning as a regulator of the number of pests for a long time (but not always);

3) multiple (settling) release of biological agent for operative containment of harmful species;

4) conservation, activation and accounting of useful species in nature in different ways.

These are general strategies inherent to some extent in biological protection against pests, diseases and weeds [6].

The main directions of the practical biometod:

- preservation of beneficial organisms living in plantations (natural enemies of pests) and strengthening their role;

- the use of artificially bred entomophagous (parasites and predators) by launching them into the pest;

- introduction (import, settlement) and acclimatization of new useful organisms for the area (the so-called classical biometod);

- the use of various pathogens (pathogens) as bacterial, fungal and viral pesticides.

As a rule, biological methods are inferior to chemical methods in terms of biological efficiency (death of insects or weakening of disease development), but at low costs, they are often more cost-effective, as they not only suppress pests but also prevent mass outbreaks.

The advantages of biological agents - in their safety for humans, warm-blooded animals and beneficial insects, in the protection of the environment from contamination by pesticides.

In Ukraine, the use of biological plant protection products is currently extremely insignificant, although in the 90s of the last century favorable conditions were created for this. Recently, in the agricultural sector of the country there has been a steady negative trend of dominance of the chemical method of crop protection over biological. The decrease in the use of the biological method occurred in relative and absolute terms (Table 1).

These tables show a reduction in the dynamics of the share of the biological method in the total amount of crop protection. Thus, if in 1995 the protection of crops by biological methods was carried out on 3023 thousand hectares, which was 15.2% of all areas where the protection of crops was carried out, then in the future the area of application of biological methods decreased and, say, in 2018 amounted to 1967 thousand hectares (4% of all areas).

Table 1

Dynamics of application of chemical and biological methods of protection of agricultural plants from pests in Ukraine*

Methods of crop protection	Years						
	1995	2000	2010	2015	2016	2017	2018
Volumes of application of methods of protection of agricultural crops, total, thousand hectares	19824	12970	38588	43816	45173	46798	49106
including:							
chemical	16801	11916	36553	41630	43117	44730	47139
biological	3023	1054	2055	2186	2056	2068	1967
The share of the biological method in the total protection of crops, %	15.2	8.1	5.3	5.0	4.6	4.4	4.0

Source: [7]

Organic farming is one of the fastest growing sectors of agriculture in the world and especially in the European Union.

Organic production must be natural in everything, it means caring for nature, people and the world at all stages. According to the monitoring conducted by the Ministry of Economy of Ukraine, in 2019 the total area of agricultural land with organic status and transition period amounted to about 468 thousand hectares (1.1% of the total area of agricultural land in Ukraine). There

were 617 operators of the organic market, of which 470 were agricultural producers [8].

In recent years, our country has seen a positive trend towards a steady increase in the number of producers of organic production and, accordingly, an increase in the area of agricultural land where certified organic production is carried out. For the Ukrainian market, this is a positive trend, which indicates an active filling of the domestic market with organic products and an increase in consumers of organic products (Table 2).

**Dynamics of organic production in Ukraine,
(2015-2019) ***

Years	Number of farms, pcs.	Raincoat organic s.-g. lands, thousand hectares	The volume of the domestic consumer market, million euros	Volumes of exports of organic products to countries around the world	
				tone	thousand dollars USA
2015	210	410.5	17.5	237.4	65.0
2016	360	411.2	21.2	245.1	78.0
2017	375	420.0	29.4	254.0	102.0
2018	510	429.1	33.0	390.0	157.0
2019	617	468.0	36.0	469.0	189.0
2019 +/- until 2015	407	57.5	18.5	231.6	124.0

Source: [9]

The table shows that in 2015 in Ukraine there were 210 farms that received the status of "organic", and in 2019 there were already 617 organic farms, and the total area of agricultural land on which organic production is conducted increased by 57.5 thousand and amounted to 468 thousand hectares. In Ukraine, since 2015, there has been a stable, annual growth of the domestic organic consumer market.

Due to the long-term use of organic farming systems (which include crop protection without the use of chemical plant protection products), the ecosystem can begin to cope with diseases and pests on its own, the number of treatments and protective measures will be reduced and climate stress reduced. Therefore, insecticide-free organic farming justifies itself both economically and environmentally. However, at the moment the level of introduction of organic agrobiotechnologies in the agro-industrial complex of Ukraine for most types of products does not exceed 3-4%.

As of December 1, 2020, there are 722 operators of the organic market in Ukraine, including 470 - agricultural producers, 114 have processing as a type of certified activity, of which 64 operators package products for the trade shelf. Among the regions that are leaders in the number of such enterprises are Odessa, Kherison, Kyiv, Poltava, Vinnytsia and Lviv regions. However, even among these companies, not everyone dares to abandon chemicals.

Some scientists believe that the role of pesticides in environmental pollution is negligible compared to other sources. However, we should not forget that one of the main ways in which the remains of pesticides in the human body - getting them with food. Therefore, in recent years in many countries around the world, including Ukraine, the use of chemicals dangerous to humans and the environment is banned, medical control is strengthened both when recommending the production of new drugs and their residues in food, strict regulations have been introduced norms and terms of processing of plants.

The tactics of pesticide use have also changed. Instead of systematic treatment of plants with chemicals to destroy pests, regardless of their number, it is recommended to strictly limit the implementation of extermination measures in cases where the number of pests ex-

ceeds the criterion of harmfulness, or economic threshold, ie the cost of preserved crops pays for environmental protection. This requires a closer combination, or integration, of chemical, biological, agronomic and other methods of plant protection, taking into account the complex environmental situation. This tactic is called integrated control, or integrated plant protection [10].

Despite its obvious advantages as an ecological method, biological control of phytopathogens and plant parasites cannot yet successfully compete with the chemical method of plant protection against diseases. The scope of its application is usually due to the forced exclusion or restriction of the use of pesticides due to their contamination of products - in protected soil, in protected areas, in the cultivation of vegetables and fruits for baby or dietary nutrition.

During the transition of agriculture from intensive linear technologies (directed selection, is management) to closed post-industrial (stabilizing selection, is regulation) with a mechanism of self-regulation, it is important to determine the regulatory role of hyperparasites and direct their use for biotic regulation of agricultural systems. The practice of using mycoparasitic organisms as agents of biological control of crop diseases is becoming more widespread in the world.

Despite the fact that currently biological drugs for plant disease control occupy a small part of the world market of pesticides, work to find promising bioagents, development of formulations and methods of their use, conducted in different countries, indicate real prospects for biometric incorporation into protection systems plants from pests [11].

Summing up, it should be noted that the growth of demand for organic products in Ukraine is growing every year. Consumers want to receive fruit and vegetable products without harmful impurities, fresh flowers and greens of domestic production. The trend for organic products is currently very high, so agricultural enterprises, which have implemented and operate a system of biological plant protection, successfully supply their products to domestic and foreign markets.

In our opinion, for the successful development of domestic organic production, much attention should be paid to the training of personnel working with the biological method. This method requires more skilled workers than chemical, and often consulting is a better

choice than self-application by trial and error, because the price of the biomethod is considerable. Timely monitoring of threats is especially important here, as all pests are able to produce significant outbreaks in a short period of time. We believe that the future of monitoring phytosanitary threats on cultivated crops is in minimizing the human factor, in robotization and digitalization of these processes.

We sincerely hope that the laws regulating the market of ecologically clean products of greenhouses and farms in Ukraine will be finalized soon. Such products will have to be provided with appropriate labeling, a mark of quality, which indicates that organic products will decorate our table, bring us health, and delight us with a long-forgotten taste of real, delicious vegetables and fruits "like from your garden."

One of the priorities of the National Economic Strategy for 2030 is to motivate citizens to switch to a healthy diet, including in order to reduce the risk of developing food-dependent diseases, as well as to develop a system of informing citizens about the quality of food.

It should be noted that the prospects for the use of biological methods in agricultural regions of Ukraine are steadily growing in connection with the tasks, and the results of developments in the use of biological plant protection products indicate the prospects for their use in integrated pest management programs aimed at restoring and maintaining biocenotic balance in agroecosystems [12].

Accumulated knowledge led to the conclusion that the capacious and multifactorial concept of biomethod cannot be narrowed down to the predominant use of one bioagent, as in this case it is impossible to control the development of a complex of pests inhabiting a crop during the growing season and prevent crop losses. It is necessary to form a set of biological means that allows not only to build a complementary application, but also to cover the spring reserves of pests, and in all phases of their development [13].

Ultimately, the biologization of crop production will reduce the use of pesticides, the cost of their implementation, and most importantly improve the environmental situation, that agricultural products and products from it will have a positive impact on the health and quality of life of the Ukrainian people.

Conclusions.

The growing number of organic farmers and the size of cultivated areas give hope that in the near future the range of organic products offered on the domestic market will increase significantly. The development of domestic organic farming is an opportunity both for sustainable agricultural production and for the consumption of this product.

Transition to ecological technologies of agricultural cultivation crops, which are based on the use of biological methods of plant protection, involves not just the rejection of mineral fertilizers and pesticides, but a deep understanding of the processes occurring in nature. By managing the processes of plant growth and development, regulating the number of microorganisms and soil representatives of the animal world, ensuring

plant resistance to pests and diseases, you can get quality products with minimal material, labor costs and high crop yields.

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It is now clear that the development of the biotechnology market in plant protection requires not only government support, regulation of chemical pesticides, development of new highly effective biopesticides, but also modern approaches to creating regulations and rules for the use of existing biological products.

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