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ENVIRONMENTALLY FRIENDLY METHODS OF PEST CONTROL IN AGRICULTURE

Tashkent State Pedagogical University
Ibragimova Kamola Zokirjon qizi
teacher

ABSTRACT

Relevance. Modern agriculture faces the need to increase yields while simultaneously reducing the negative impact on the environment. The widespread use of chemical pesticides leads to the pollution of soils and water resources, a decline in biodiversity, the accumulation of toxic substances in agricultural products and the development of pest resistance to chemical preparations. In this regard, the importance of environmentally friendly methods of pest control is growing — methods based on the use of biological, agrotechnical and biotechnological approaches that ensure the preservation of ecological balance and the safety of agricultural production.

Aim of the study. To examine environmentally friendly methods of pest control in agriculture, to assess their effectiveness, advantages and prospects of application for obtaining environmentally safe products and preserving natural ecosystems.

• Environmentally safe plant protection as the basis of sustainable agriculture. Modern agriculture faces the need to simultaneously increase yields and reduce the negative impact on the environment. The widespread use of chemical pesticides makes it possible to combat pests effectively; however, it leads to the pollution of soil, water and air, the accumulation of toxic substances in agricultural products and the development of pest resistance to chemical preparations. In this regard, the importance of environmentally friendly methods of plant protection, based on the use of natural mechanisms, is growing [1].

• Biological method of pest control. One of the most effective and environmentally safe approaches is biological plant protection. It is based on the use of natural enemies of pests — predatory insects, parasitic organisms, bacteria, fungi and viruses. For example, ladybirds destroy aphids, Trichogramma parasitises the eggs of many pests, and biopreparations based on the bacterium Bacillus thuringiensis effectively destroy caterpillars without causing harm to humans, animals or beneficial insects. Biological methods make it possible to preserve the natural balance and reduce the need for chemical protection agents [2].

• Agrotechnical methods of prevention. Agrotechnical measures play an important role in preventing the mass spread of pests. These include the observance of crop rotation, timely soil cultivation, the destruction of plant residues, the selection of resistant crop varieties, and correct sowing and harvesting dates. These measures create unfavourable conditions for the reproduction of pests and reduce the likelihood of outbreaks without the use of chemical preparations [1, 3].

• Use of mechanical and physical methods of protection. Environmentally safe plant protection includes the application of mechanical and physical methods of control. These include the manual collection of pests, the installation of traps, the use of protective nets, light and glue traps, and, in some cases, the treatment of plants with hot water or steam. These methods are particularly effective on small farms and make it possible to significantly reduce pest numbers without polluting the environment [2, 5].

• Use of biopreparations and natural substances. Preparations of natural origin containing microorganisms, plant extracts or products of the vital activity of bacteria and fungi are becoming increasingly widespread. Such agents decompose quickly in the environment, do not accumulate in the

soil and plant products, and are safe for humans, animals and most beneficial organisms. Owing to this, they are becoming an important alternative to traditional chemical pesticides [1, 7].

• Integrated plant protection system. The most effective modern approach is considered to be the integrated plant protection system. It combines agrotechnical, biological, mechanical and, when necessary, limited use of chemical means. The use of pesticides is permitted only when the economic damage threshold is exceeded, when the damage to the crop becomes significant. This approach makes it possible to preserve the harvest, minimise environmental damage and prevent the development of pest resistance [2, 6].

• Ecological advantages of natural control methods. The use of environmentally friendly technologies contributes to the preservation of soil fertility, the protection of water bodies from pollution, and the preservation of biodiversity and the populations of beneficial pollinating insects. In addition, the risk of toxic substances entering food products is reduced, which has a positive effect on human health and the quality of agricultural products [1, 6].

• Economic efficiency of ecological methods. Although the introduction of biological and agrotechnical methods may require additional knowledge and initial investment, in the long term they make it possible to reduce expenditure on chemical preparations, increase the resilience of agroecosystems and preserve land productivity. Environmentally safe technologies are particularly in demand in the production of organic agricultural products, the demand for which is constantly growing [2, 7].

• Environmentally friendly methods of pest control are an important direction of development for modern agriculture. Their application makes it possible to effectively protect the harvest while simultaneously preserving natural resources, biodiversity and the health of the population. The most promising solution is the integrated use of biological, agrotechnical and mechanical methods within the framework of an integrated plant protection system that ensures the sustainable development of agriculture and ecological safety [1, 5].

Conclusion. Environmentally friendly methods of pest control are an effective alternative to chemical means of plant protection. Their application contributes to reducing environmental pollution, preserving soil fertility, protecting beneficial organisms and improving the quality of agricultural products. The integrated use of biological, agrotechnical and other environmentally safe methods makes it possible to ensure the sustainable development of agriculture and to preserve natural resources for future generations.

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