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Control of Residual Quantities Organophosphorus Insecticides in the Apple Orchard

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Annotation: The article presents the results of studies on the dynamics of residual amounts of organophosphorus insecticides used in the garden. It has been established that only contact organophosphorus preparations that do not penetrate into plant objects (fufanon, karbofos-500, kemifos, etc.) have properties of low stability in the external environment and rapid decay on the objects being treated. Systemic preparations (active substances chlorpyrifos, zolon, dimethoate, etc.) are distinguished by significantly greater stability in the external environment, are subject to strict regulation and are limited in practical use.

Keywords: pesticide residues, maximum permissible level, maximum permissible concentrations.

Introduction: Environmentally safe use of pesticides involves a detailed study of their behavior in specific agro-ecological conditions.

*The work was carried out in the Bukhara region, Gijduvan district. Plant and soil protection from pests comparing these data with weather conditions during the period of chemical treatments, it is possible to adjust the regulations for the use of the preparation in specific soil and climatic conditions and, thereby, prevent possible contamination of fruits and the environment with pesticide residues.

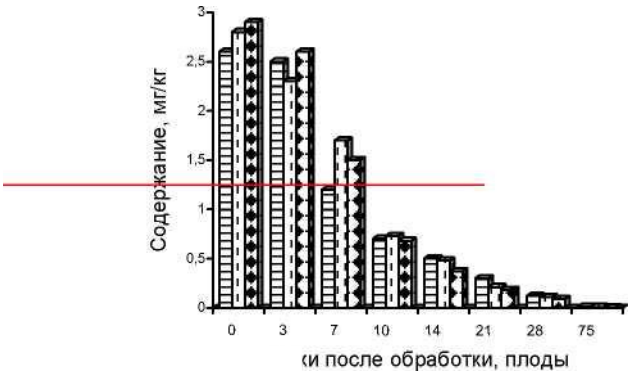
The use of organophosphorus pesticides is often associated with environmental pollution with residual amounts of insecticides, so the aim of the research was to identify patterns in the dynamics of residual amounts of the main organophosphorus insecticides used in apple tree protection systems.

Objects and methods of research. The work was carried out in two farms of the Bukhara region. Samples of soil and apple fruits were collected using standard and original methods. Analyses to determine residual quantities of insecticides were carried out using gas-liquid chromatography methods on a Tsvet-550M chromatograph with the Khromos computer program.

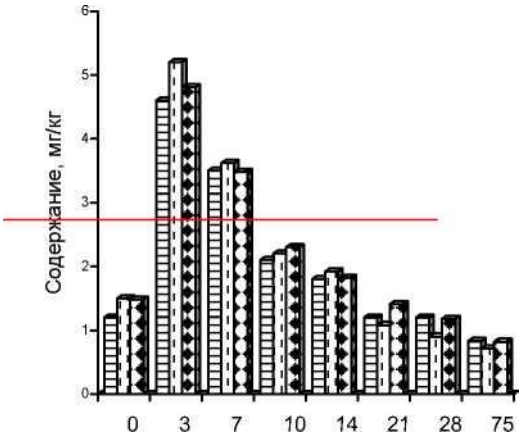
Discussion of results. The main impact pollutants of garden agrocenoses are organophosphorus insecticides, which unite a large group of preparations of various chemical structures, based on esters of phosphorus acids. Among them, a prominent place is occupied by esters of dithiophosphoric acid [fufanon, EC (570 g / l), kemifos, EC (570 g / l), carbophos-500, EC (500 g / l) (active ingredient malathion)]. The basis for the widespread use of organophosphorus insecticides of this group in protecting apple orchards from pests was, first of all, their high insecticidal efficiency and relatively rapid inactivation in the external environment. By means of this group of organophosphorus preparations, a real opportunity will be presented, having an energetic effect on the exterminated object, not to accumulate on the treated plant objects, but to be inactivated in a short time. Insecticides based on the active substance malathion are quickly destroyed in the soil and apple fruits, the half-life of malathion does not exceed 5-7 days. They are easily hydrolyzed when heated and washed. The metabolites formed in this case are easily soluble in water and are low-toxic. Insecticides based on malathion are approved by the "List of pesticides and agrochemicals permitted for use in Uzbekistan for 2009" [3] for practical use in industrial gardens, only under the mandatory condition of complete exclusion of their residues in removable

harvest.

Fufanon, kemifos, karbofos-500 disintegrate in garden agrocenoses much faster and 10-14 days after treatment are found both in apple fruits and in the soil in quantities that do not exceed hygienic regulations (Fig. 1).



□ fufanon Yukemifos □ karbofos-500



day after treatment, soil

□ fufanon Yukemifos □ karbofos-500

Fig. 1. Dynamics of malathion decomposition in the fruits of the apple tree variety "Semirenko". And in the soil

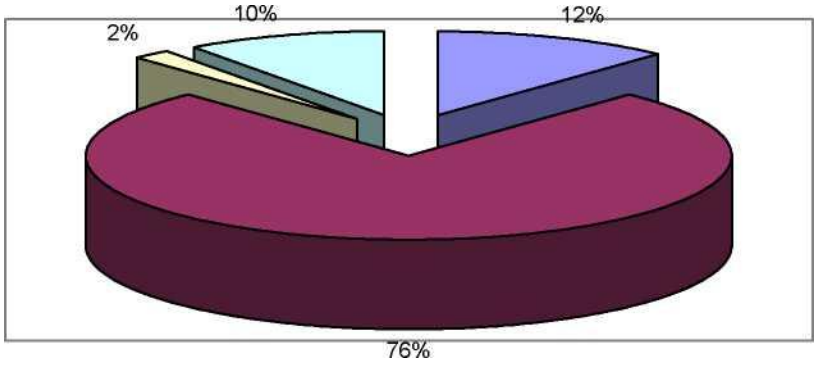
Based on two years of data, it has been established that the malathion content does not exceed the MRL (0.5 mg/kg) in 96% of apple fruit samples and the MAC (2 mg/kg) in 85% of soil samples collected after the "waiting period" had expired. The study of the degradation of insecticides of this group showed that only contact organophosphorus preparations that do not penetrate into plant objects (fufanon, karbofos-500, kemifos, etc.) have properties of low stability in the external environment and rapid decomposition on the treated objects.

Other organophosphorus pesticides, classified as systemic or intraplant pesticides, are characterized by a pronounced ability to penetrate into plants and spread to all their parts, including fruits. Systemic preparations, as a rule, are distinguished by significantly greater resistance in the external environment; these include insecticides (active ingredients chlorpyrifos, zolon, dimethoate, etc.), which are subject to strict regulation and are limited in practical use.

According to three-year data, it was established that the content of dimethoate (Bi-58 Novy, Di-68, danadim) exceeded the hygienic regulations in 36% of soil samples and 12% of apple fruit samples collected after the "waiting period" had expired. Exceeding the MAC (0.2 mg/kg) by 1.2-8.4 times for chlorpyrifos (Dursban, Pirinex, Nurell-D, Siren, Fosban, Darsban, Tsipi Plus) was noted in 54% of soil samples and the MRL (0.01 mg/kg) - by 1.4-2.8 times in 76% of apple fruit samples [2].

According to the research data of 2007-2009, the following were found to exceed the MRL in apple fruits: chlorpyrifos - 76%, dimethoate - 12% and phosalone - 2% (Fig. 2). Only in 10% of the samples did the content of residual amounts of the studied organophosphorus insecticides not exceed the MRL.

A direct relationship between the amount of chlorpyrifos in apple fruits and its content in the soil has been revealed. If the content of chlorpyrifos in soil samples is 2-3 times lower than the MAC, then its residues are absent in apple fruits [1].



□ Dimethoate Pchlorpyrifos Pfozalon Lower MRL

Fig. 2. Content of residual amounts of organophosphorus compounds in apple fruits

If xenobiotic residues are present in the soil at or above the MAC level, then in 75-82% of cases the MRL is exceeded in fruits.

The study on the degradation of chlorpyrifos was not initiated by chance. According to the Sanitary and Epidemiological Service, in 2008, the maximum permissible levels of chlorpyrifos were often exceeded in products imported to Uzbekistan (grapes, tangerines, apples, lemons, kiwi, peaches, cherries, apricots) from Turkey, Greece and the European Union.

Studies of the dynamics of chlorpyrifos, dimethoate and fosalone separately and against the background of other chemical preparations applied to summer and winter varieties of apple trees indicate that in early varieties the indicated processes occur faster than in late varieties.

Conclusions. Thus, when developing an apple tree protection system, it is recommended to take into account the fact that residual amounts of systemic organophosphorus insecticides (active ingredients: chlorpyrifos, dimethoate and phosalone) are present in apple fruits in concentrations exceeding the MRL in samples taken 40 days after treatment.

We recommend using microbiological insecticides or less toxic chemicals from the first ten days of August.

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