

INNOVATIONS ON GRAIN CROP PROTECTION

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Наведені інновації із захисту зернових культур від шкідливих організмів. Важливими напрямками інноваційної діяльності Інституту захисту рослин НААН із даної проблеми є розробка техно-логій створення стійких сортів рослин; розробка ефективних заходів прогнозування фітосанітарної ситуації посівів; визначення ролі агротехнічного методу захисту посівів, оптимізація хімічного методу захисту; розробка біологічних заходів захисту рослин від шкідників та хвороб; розробка ефективних заходів захисту посівів та зернових запасів від карантинних шкідливих організмів.

Ключові слова: інновації, науково-технічна продукція, захист зернових культур, шкідливі організми.

Strategic and the most effective sector of the national economy is grain farming. Average grain output for 2006–2010 was 40,4 mln of tons per person. Significantly increased gross charges of production in 2008, 2009 and 2011 up to 53,3, 46,0 and 56,7 mln. t. respectively, and in 2013 has reached 63.4 mln. t. Today Ukraine provides 3 % of global grain production and more than 10 % of world export.

The program “Grain of Ukraine” gave the opportunity in the near future reach the annual grain production in the country of 80 mln. tons. It is quite possible when you consider area of sown main crops (winter wheat – 6 mln. of ha, winter and spring barley – 3,3 mln. of ha, corn – 3,5 mln. of ha) and their potential productivity within 70 % [3].

However, weather conditions (warming) and economic factors (the withdrawal of hundreds of thousands of hectares of land from economic use, violation of crop rotation, lack of technology and fuels and lubricants, chemical and biological protection means, etc.) often it is the reason of an aggravation of phytosanitary condition of grain crops. Under these conditions, there are massive reproduction and high harm pests, plant pathogens and weeds, through crop grain shortfall could reach 30 or even 50 % [2–5]. According to all above mentioned protection of crops from pests is an important reserve for a significant part of the additional production of improved quality.

One of the factors that hinder the stable development of grain farming country is also a low level of scientific support industry, in particular the lack of integrated innovation databases in protection of crops. But the widespread introduction of scientific achievements can reduce the potential shortfall of yields in 70–75 % pesticide load on agroecosystem – 30 % [1].

Our objective was to analyze created in Plant Protection Institute of the National Academy of Agrarian Sciences of Ukraine innovations and identify those which promote largely contributed to solving the problem of protecting crops from harmful organisms for a considerable part of the additional yields of improved quality.

Materials for the study were innovative developments of divisions of Institute of Plant Protection NAAS for 2000–2014 years. According to conducting of analysis were allocated those that are directly related to the protection of crops from pests, diseases and weeds.

Working due to the program of scientific research “Plant protection and phytosanitary security”, scientific departments of the Institute of Plant Protection NAAS were involved in the creation and promotion of innovative product. Thus, over 40 % of innovation institutions applies the problem of protecting crops.

Great importance is attached to the development of the technologies of wheat varieties resistant to diseases and pests. Introduction of innovative technologies based on the use of optimal parameters and terms of creating complex backgrounds infectious, can accelerate the process of selection of winter wheat with combined resistance to leaf rust, oidium, Septoria and cercospora 3–5 years. The use of the identified sources of resistance with high performance and stable resistance to pathogens (leaf rust, oidium, septoria) by 50 % helps to reduce the term

of new varieties of winter wheat. Thus, in the cooperation with Myroniv Institute of wheat named after V. Remeslo of NAAS were created wheat varieties Demetra, Economka and Myronivska storicna, which are characterized by resistance to diseases. The use of standardized 9-point scale assessing the level of resistance of winter wheat in the complex of pests (aphids, leech, cereal, cereal flies) is a prerequisite for selection on stability and full certification of varieties. When using resistant varieties of winter wheat simplified cultivation technology, chemical protection of crops from pests and diseases is minimized, which significantly reduces production costs of grain production.

There are many scientific developments regarding the protection of crops, such as winter wheat, barley, corn, oats, peas, buckwheat from pests and diseases. An important role in shaping the satisfactory condition of crops given organizational and economic farming practices – the crop rotation, optimum sowing times and rates, using of resistant varieties, fertilizing.

Great importance is attached to environmental safety of chemical plant protection, such as seed treatment, seed treatment insecticides, insecticide treatment of crops with the criteria of pests and the availability of effective entomophagous.

Due to economic and environmental problems in developed economies of the steppe zone introduced optimized system of chemical protection of winter wheat by sucking pests. Thus, the use of mixtures of insecticides (pyrethroid + organophosphate) by half-consumption rates reduces the number of eurygaster bug, aphids, thrips by 90–92 % and got 8 % of extra harvest. The effectiveness of such a mixture compared to the use of preparations alone for the complete rules slightly higher and longer. The grain damage by eurygaster bug may decline to 3 times gluten content – grow by 2 % or more, and the resulting seed is 2–3 grade.

In research fields of Donetsk institute of agroindustrial production and Institute of irrigated agriculture NAAS was approved scientific development "mixture of insecticides to protect germination from winter wheat grain beetles». It was noted the feasibility of spraying wheat stubble placed after stubble predecessor from damage by pests specified mixtures of different mechanism of action of insecticides – pyrethroids for organophosphate with low consumption rates. Thus, technical efficiency diazinon mixture of active ingredients and alpha cypermethrin against grain beetles in winter wheat reached 95 %, while only diazinon – 90–93 %. This rate of insecticide active ingredient per hectare when used in the mixture is reduced by 30–50 %, saving costs of chemical protection of winter wheat is 30–40 %. Saved harvest amounted to respectively 0,28 and 0,32 t/ha.

It was developed and tested in the forest steppe zone system optimized chemical protection of winter wheat diseases. It provides systemic seed treatment preparation and processing of crops with fungicides during the critical periods of disease (stage 47–49, 55–61 stage 71–72 the international stage with European BBCH). To improve the performance culture disinfectants can be used in a mixture of biological products. To determine the feasibility of fungicidal treatments was used the model of integrated disease hazard leaves of winter wheat. The choice of drugs occurs through a database of properties and spectrum fungicides and disease database cereals. The application of the new system protection ensures the preservation of winter wheat crop in the amount of 0,88 t/ha, with grain quality meets the 3rd class; return is 95%. In different soil and climatic zones of Ukraine approved and implemented updated security system crops from weeds. Thus, the use of mixtures of herbicides – sulfonylurea (Lohran 75 WG, VG) and benzoic acid (Banvel 4S 480 SL, v.r.c.) for reduced consumption rates for winter wheat early exit tube plants in providing technical efficiency against major weeds (cole *Barbarea vulgaris* R.Br., *Descurainia Sophia* L., *Ambrosia artemisi-foia* L., *Convolvulus arvensis* L., *Cirsium setorum* M.B., *Chenopodium album* L., *Capsella bursa pastoris* L., *Thlaspi arvense* L., *Galium aparine* L., *Galeopsis tetrahit* L., *Equisetum arvense* L., *Stellaria media* L. and others) on the day 15 at the level 97 %, on the day 30 – 82 %. The spectrum of actions tank mixtures and duration of protective action compared with the individual drugs is much higher. Stored grain yield through the use of herbicides depending on the area and the level crop weediness can be up 8–30 %.

There are also toxicological studies. Thus, the formation of resistance found in populations of harmful eurygaster bug, cereal aphids to insecticides, proposed measures to overcome it. The ultimate goal of this is the improvement of chemical protection of cereals.

The prognosis is the basis for the planning and execution of works to protect crops, determine the need for chemicals, as well as material and labor costs.

To monitor the spread and proliferation of the most dangerous pests such as shovels moths, corn borer *Ostrinia nubilalis* Hb. Institute of Plant Protection NAAS recommended the use of pheromone traps. With the latter, compared with the trough of molasses, can increase productivity by 10 times, accountants by increasing the daily allowance account for 250 hectares and selective fishing lepidopteran insects, making it unnecessary laborious process analysis entomological collections. All this is extremely necessary for reliable prediction of hazard these herbivores and develop effective protective measures.

There was also developed the computer program of prognosis of the possible lack of harvest of winter wheat, corn, sunflower, rape as from pests same as complex of pests. It allows real-time operational transform environmental information on the current phytosanitary situation in the economic category, and at the same time determine the economic feasibility of chemical crop protection. Its use in practice significantly facilitates the work of agronomists and forecasters when planning protective measures.

Scientific and Technical Institute of plant protection in respect of cereals is in great demand among domestic and foreign manufacturing enterprises, institutions and agencies.

In the laboratory of analytical chemistry of pesticides developed highly sensitive methods for determination of pesticide active ingredients in plants, soil and water and fast ways to assess the quality of seed treatment. Using this innovative product, the Institute annually performs numerous analyzes for contracts with various customers.

Also performed research work related to the testing of chemicals for the study of their effectiveness in protecting crops from pests and preparations according to the definition of passport data, which is a significant contribution to the preparation of Environmental Safety Department of the Ministry of Ecology and Natural Resources of Ukraine "List of pesticides and agrochemicals permitted for use in Ukraine".

Institute of Plant Protection NAAS, together with its network (Experimental Station of Grape and Fruit Crops Quarantine, Trans-Carpathian Territorial Department of Plant Quarantine, Ukrainian Scientific-Research Quarantine on Plants Station) creating scientific and technical products of plant quarantine, some of which are related to the protection of crops from pests. Thus, in recommendations for the system of monitoring, forecasting of appearance of *Diabrotica virgifera virgifera* Le Conte and implementation of measures of protection of corn from this insect pest. There were also developed effective measures to protect stocks of grain from *Trogoderma granarium* Ev. and many species of quarantine *Bruchidae* sp. The practical use of innovations Plant Quarantine Office of the State Veterinary and Phytosanitary Service of Ukraine makes it possible to successfully carry out pest risk analysis and properly solve problems.

The Institute also implements research programs "Agricultural Biotechnology" and "Organic production of agricultural products." The final result of this work is to create a breeding establishments of gene bank resources of varietal wheat, triticale, wheat and wild forms and their high-performance varieties of wheat that could be an innovative product. Use of biological remedies while growing crops will increase the yield by 15–20 %, to ensure the profitability of 25–35 %, get environmentally safe and competitive products and expand the area under these crops to 25–30 % in organic agriculture.

Conclusions

Innovations of the Institute of Plant Protection of the National Academy of Agrarian Sciences on the protection of cereals are created in the following areas:

- development of technologies for creating plant varieties resistant to diseases and pests;

- improving of agrotechnical crop protection methods;
- development of effective measures forecasting phytosanitary condition of crops;
- development of optimized chemical protection;
- development of biological measures to protect crops from pests and diseases;
- development of effective measures to protect crops and cereal stocks from quarantine pests.

Widespread implementation of these innovations will help to stabilize the development of grain farming and thus successfully strengthen the agricultural sector and the economy as a whole.