

## REVIEW

of the Official Opponent

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Candidate of Agricultural Sciences, Associate Professor of the Department of Zoology, Entomology, Phytopathology, Integrated Plant Protection and Quarantine named after B. M. Litvinov,  
State Biotechnological University  
for PhD Thesis *Zhu Yinghui*

«Insights into profiling of resistance mechanism of alfalfa to atrazine», Submitted for a Scientific Degree of a Doctor of Philosophy Field of Study: 20 – Agricultural Sciences and Food Specialty 202 – Plant Protection and Quarantine

**Relevance and justification of the research topic.** Plant protection is an important component of modern agriculture, but it faces a number of serious challenges at the global level. Pests and diseases that are resistant to chemical protection agents are becoming an increasingly significant problem. The use of pesticides leads to certain pests developing resistance to them. This requires the search for new methods of control, which can be a complex and costly process. The frequent use of chemical pesticides and herbicides can lead to soil, water and air pollution. This not only harms natural ecosystems, but can also cause health problems for humans and animals. Climate change is causing changes in the distribution and activity of many pests and diseases. Warmer temperatures and extreme weather conditions can contribute to the rapid spread of pests and change the timing and location of the spread of some diseases.

Atrazine is easily soluble in water, which contributes to its leaching from fields into water bodies and groundwater. In China, studies have shown high concentrations of this herbicide in rivers and reservoirs, especially in areas of intensive agriculture. Therefore, the chosen topic is relevant.

**Connection of work with scientific programs, plans, and themes.** This study was conducted within the framework of a specific scientific topic, in collaboration

with Sumy National Agricultural University and the Henan Provincial Key Science and Technology Project "Research and application of herbicide soil residue pest control technology" (grant number 221111112300).

**Scientific novelty of the obtained results.** Lies in the detailed study of the harmful effects of atrazine on alfalfa, as well as in the disclosure of the mechanisms of plant resistance to the atrazine. The obtained data on the harmfulness and mechanisms of atrazine resistance of different alfalfa varieties will further provide a theoretical basis for breeding varieties 21 resistant to this herbicide. In field experiments, it was confirmed that the absorption of atrazine by resistant and susceptible alfalfa shows an increasing trend, and the degradation of atrazine by the soil shows a decreasing trend. Thus, this provides a theoretical basis for the scientific and rational use of atrazine.

**The practical significance of the results.** Based on the research results, alfalfa varieties resistant to atrazine were planted, and the toxic relationship between atrazine residues and alfalfa was clarified. The yield and quality of alfalfa were improved, and the soil pollution environment was improved. At the same time, the introduction of excellent varieties, the knockout of genes sensitive to atrazine, and continuous improvement of planting techniques have increased the yield and quality of alfalfa, reduced atrazine environmental pollution, and contributed to the sustainable development of agriculture. It has also played an important role in improving the ecological environment and alleviating the shortage of high-quality domestic forage. This is being studied and improved in the scientific project of the Henan Academy of Agricultural Sciences (Henan, China). The results obtained are included in the training programs for junior bachelors, bachelors and masters in specialty 202 "Plant Protection and Quarantine" of Sumy National Agrarian University.

**Reliability and approbation of research results.** Based on the results of the dissertation work, the author published 7 scientific works, including three publications in professional journals of Ukraine, one articles were published in Scopus (Q3), three abstracts of reports at scientific conferences.



**The structure and content of the dissertation, its completeness and compliance with the established requirements for design.** The structure and logic of the dissertation are clear, the construction is reasonable, the content is prominent, concise and clear, and the system is complete. It can fully demonstrate the work tasks and main achievements of the research and can reflect the entire research process. The structure, content and completeness of the dissertation fully comply with the established design requirements.

**Discussion clauses, comments and wishes regarding the content.** Under the conventional corn alfalfa rotation planting mode, the selected alfalfa with different resistance to atrazine can be planted in suitable areas, which is beneficial for improving the yield and quality of alfalfa, and can also cultivate SF alfalfa in large quantities to reduce the harm of atrazine residue. However, there are still several issues that need to be addressed in the future: For the 60 types of alfalfa, they were only screened indoors with stable conditions. In field experiments, various natural conditions are uncertain; There are differences in the resistance of different alfalfa varieties to atrazine stress, and changes in the main pathways of photosynthetic carbon utilization and metabolism, amino acid synthesis and UDP galactosyltransferase have been found at the transcriptional level. However, further tracking and research are needed on other key genes related to atrazine resistance. The next goal is to work towards solving these problems.

There are a few points worth discussing regarding the content of the dissertation:

1. Some language errors and formatting errors need to be polished.
2. The feasibility of different alfalfa varieties developing resistance to herbicide in field experiments is crucial. If a portion of atrazine undergoes photolysis or if alfalfa is affected by natural growth conditions, it is not conducive to the reproducibility of the experiment.
3. The dissertation lacks short conclusions after each chapter.

### **Remarks on the design of the text**

As a result of converting the text into PDF format (or other operations with the text), pages 2 of section (-1), some tables and figures in other sections were shifted;

Some parts of the text in figures of Chapters 3 and 4 have a size of less than 10 pt, which makes it difficult to perceive them.

**Correspondence of the dissertation to the specialty and the profile of the specialized academic council.** The dissertation work of Zhu Yinghui intitled «Insights into profiling of resistance mechanism of alfalfa to atrazine», which was submitted for defense to the specialized academic council for obtaining the degree of Doctor of Philosophy in the field of knowledge 20 -“Agricultural sciences and food” in the specialty 202 - “Plant Protection and Quarantine” in terms of its relevance, scientific and theoretical level, main results of validity, main provisions and results published in professional publications, and novelty of the setting and practical significance meets the requirements of the order of the Ministry of Education and Science of Ukraine No.40 dated January 12, 2017 “On approval of requirements for registration dissertation” and the Decree of the Cabinet of Ministers of Ukraine dated January 12, 2022 No.44 “On approval of the Procedure for awarding the degree of Doctor of Philosophy and cancellation of the decision of the one-time specialized academic council of the higher educational institution, scientific institution on awarding the degree of “Doctor of Philosophy”with amendments made according to the Resolution of the Cabinet of Ministers No. 341 dated 03.21.2022. The PhD candidate Zhu Yinghui deserves to be awarded the scientific degree of Doctor of Philosophy in specialty 202 - “Plant Protection and Quarantine”.

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**Inna Zabrodina**

Підпис *Inna Zabrodina*  
**ЗАСВІДЧУЮ**  
Керівник відділу дипломатства ДСТУ  
*ad Alexei Shyni*