

Warsaw, 2023-11-20

**UMAN NATIONAL UNIVERSITY OF HORTICULTURE
MEMBERS OF THE SPECIALIZED DOCTORAL
DISSERTATION DEFENSE COUNCIL D74.844.01**

OPINION

Official reviewer of the habilitation thesis of Dr. Olha Oleksandrivna Drozd entitled "*Basics of pome fruit storage with post-harvest treatment with ethylene inhibitor*", submitted for defence in order to obtain the degree of habilitated doctor of agricultural sciences in the specialisation 06.01.15 "Pre-treatment of plant products"

The opinion was prepared at the request of the Academic Council for the Defence of Habilitation Dissertations D 74.844.01 of the National University of Horticulture in Uman, included in the Council's decision of 10.11.2023.

The opinion was prepared in accordance with Article 16 of the Procedures for awarding and withdrawing the degree of Doctor of Science, approved by the Resolution of the Cabinet of Ministers of Ukraine of 17 November 2021 No. 1 197¹⁾ and in accordance with Article 7(III) of the Decree on the Specialised Academic Council for the Awarding and the Withdrawing of the Degree of Doctor of Science, approved by the Ordinance of the Minister of Education and Science of Ukraine of 13 December 2021, No. 1359²⁾, and the attached documentation including the habilitation dissertation and self-report.

Notes.

- 1) <https://zakon.rada.gov.ua/laws/show/1197-2021-%D0%BF#Text>
- 2) <https://zakon.rada.gov.ua/laws/show/z0028-22#Text>

The reviewed thesis is a uniform, aesthetically prepared study with a typical layout for this type of habilitation theses, with the right proportion of chapters. It consists of: an introduction, 8 chapters, conclusions, a list of publications and appendices. The work includes 277 pages of text, 152 tables, and 71 figures. The literature list includes 555 items. The appendices are 118 pages long.

1. Degree of relevance the chosen topic of the dissertation

The choice of the dissertation topic is accurate, scientifically important, and potentially valuable for the development of Ukraine's agricultural economy. Ukraine will



Надійшов у спеціалізований дисциплінарний рад Д 74.844.01. 20.11.2023р.
Висновок секретаря: Ольга Трасюк

strengthen its position among the major producers of apples and pears in Eastern Europe. There is no doubt that the best way to manage these fruits is to store them effectively.

Improper harvest time and insufficient cooling of the fruit after harvest deteriorate its storability. To maintain the high quality of the fruit and reduce its losses, modern storage technologies are used. One of them is storage under controlled atmosphere conditions. However, the construction of such chambers requires large financial outlays, whereas in cheaper cold stores, the shelf life of the fruit is shorter. This is due, among other things, to the increased presence of ethylene in the atmosphere of the chambers, which enzymatically accelerates their maturation. Under its influence, there is an increase in the intensity of respiration of fruits and their susceptibility to rotting and some physiological diseases, which intensifies losses.

Extending the shelf life of fruit under the conditions of ordinary cold storage can be achieved by inhibiting the climacteric increase in ethylene production. This goal is achieved by preventing the formation of active ethylene-receptor complexes. Application of the 1-methylcyclopropene (1-MCP) ethylene inhibitor reduces the metabolic changes that occur in the fruit during storage and thus delays the achievement of maturity in consumption and aging of apples and pears. This research topic is characterised by a high level of topicality.

To sum up, the choice of the topic of the evaluated habilitation thesis is accurate and undoubtedly valuable from the scientific, economic, and social point of view, and it also has great potential for use in storage practice.

2. Degree of validity of the scientific statements, conclusions and recommendations formulated in the dissertation, their novelty, and national or global significance

The results of interesting research and comprehensive conclusions included in the habilitation dissertation of Dr. Olha Drozd precisely summarise the conducted experiments and formulate valuable recommendations for practice as the technological instructions for the storage of late-ripening cultivars of apples and pears with the use of an ethylene inhibitor. They are original and undoubtedly enrich our knowledge in the field of post-harvest fruit physiology and storage. They can also be used successfully in practice by producers of apples and pears, and they constitute the basis for the development of a chapter in the handbook for producers of these fruits in Ukraine.

The cognitive value of the results for science and practice lies in the fact that they deepen the theoretical and practical aspects of the post-harvest treatment of apples and pears, in particular with the use of biologically active substances, which allows the efficiency of their storage and the profitability of fruit production.

A valuable element of this work is logical and well-formulated conclusions, although extensive, that accurately summarise the research and contain valuable recommendations for practice. They are reflected in the correct statistical analysis of the results obtained. It should be emphasised that the selected research methods and a wide range of determined physiological, physical, sensory, and chemical parameters of fruits fully meet the quantitative and qualitative criteria for work in the field of agricultural sciences. In addition, they testify to the in-depth understanding of the issues raised by the habilitator and her advanced research workshop.

The scientific value and significance of the results obtained on a national scale lies in solving a scientific and implementation problem related to the improvement of instrumental and sensory quality of late-ripening apple and pear cultivars, taking into account the region of tree cultivation, the degree of intensity of the orchard, the physiological state of the harvested fruits (harvest date), the cooling mode and their postharvest treatment with an ethylene inhibitor. This achievement is complemented by an issue related to the effectiveness of delayed fruit cooling of late autumn pear cultivars in combination with the use of differentiated doses of 1-MCP to maintain high commercial and consumer quality of fruit after storage. To this end, great emphasis was placed on the tastiness of the fruit, a distinguishing feature about which there is little information in the world literature on the subject, but which deserves special attention, as its significance goes beyond the framework of national research.

3. Completeness of presentation in scientific publications, included according to the topic of the dissertation

The results of the research were published in 36 scientific articles, including 20 articles in specialised Ukrainian scientific journals, 3 articles in publications indexed in the international scientometric databases Scopus and Web of Science, 13 in the proceedings of scientific conferences and 4 articles in journals disseminating knowledge. The results of the dissertation aroused great interest and gained great recognition at scientific, scientific-practical conferences, scientific and industry seminars in Ukraine and abroad.

The subject matter of the habilitator's scientific achievements is in line with the following subjects developed at the Uman National University of Horticulture: "Standardisation, technology of storage and processing of plant products", "Modern technologies of horticulture and viticulture", and "Postharvest treatment of fruits, vegetables, and grapes".

In the papers published as co-authors, the habilitator's contribution consisted of conducting the experimental part independently, statistical processing of the results, and preparation of materials for publication. The quality and size of the habilitator's scientific achievements, including the number and volume of publications, allow us to conclude that her achievements in this area are fully sufficient to defend her habilitation thesis.

4. Absence (presence) of academic plagiarism, fabrication, and falsification

After reviewing the materials received, I found no signs of plagiarism, fabrication, or falsification of the source data. When using the results and texts of other authors, appropriate references to source materials are provided. The results of the research included in the doctoral dissertation are not used in the habilitated thesis.

5. Comments and/or discussion questions regarding the provisions of the dissertation

Successful implementation of the ambitious research task to improve the quality of three apple cultivars ('Golden Delicious', 'Renet Simyrenko' and 'Honeycrisp') and two pear cultivars ('Snizhynka', 'Yanis') stored at a temperature increased by 2 ± 1 °C required from the author, on the one hand, knowledge in the field of biochemistry, physiology of fruit ripening and storage. On the other hand, a high level of technical proficiency, imagination, and following information from a large area of research was necessary, as well as accurate conclusions. The results of the research conducted in the years 2010-2017 allowed Dr. Olha Drozd to formulate important conclusions of innovative nature and practical importance. In the course of reading such extensive research, I have made a few remarks and questions, which I include below in order to clarify some of the issues during the discussion during the habilitation colloquium:

1. In the literature review, when discussing issues related to 1-MCP, one could also mention the novelty used in this compound in the orchard, before fruit harvest (Harvista™ preparation);

2. in the context of post-harvest use of 1-MCP, an important aspect of the evaluated work is to demonstrate a lower amount of heat emitted during less intensive respiration of the fruit, which in practice means a lower demand for energy necessary to maintain the appropriate storage temperature. This issue is in line with international priorities regarding the need to save energy (reducing carbon dioxide emissions, and protecting the environment). Has this issue (savings on lower electricity consumption) been taken into account in the calculation of fruit storage costs (Annexes T.1 to T.4);
3. Although the structure of the paper provides a logical scientific argument, in the main part of it (results) I would advocate five chapters, each assigned to one variety (all results obtained for the fruits of a given variety included in one chapter). Nevertheless, the single distinguishing feature for the fruits of all the examined cultivars discussed in the chapter is not a significant drawback of the work;
4. Due to the increasing export of fruit from Ukraine, it would be worthwhile to compare the results of the evaluation of the quality of stored apples and pears also with the marketing standards in force in the European Union;
5. The results of the firmness of the flesh of apples and pears instead of being given in kilogrammes (kG), I suggest that in the future they should be given in SI units, i.e. expressed in Newtons (N), which makes it easier to compare one's own results with the data in the literature;
6. The author rightly presents the simple effects of individual experiments (e.g., the effect of the harvest date, the influence of 1-MCP, etc.), all the more so because they are usually clear. Similarly, it would also be useful to assess the effect of storage length on different characteristics of the fruit. However, the question arises: were there any interactions between the factors of experience? If so, it might be worth using them as material for future articles;
7. Instead of including LSD values in tables (although methodologically it does not raise any objections), letters could be used to indicate statistical significance between the compared means (a more transparent form for the reader);
8. The use of linear correlation (*Pearson's r*) also leaves some unsatisfactory in the case of nonlinear relations between variables. In this case, the relationships between the individual indices could be described by a nonlinear function (quadratic, logarithmic, exponential);

9. The economic considerations could be presented in foreign currency due to the high rate of change in economic conditions in Ukraine;
10. To further strengthen the position of fruit production in the economy of Ukraine and future integration with the EU, I suggest conducting similar research with the storage of fruit under controlled atmosphere conditions.

In all of my remarks, they do not diminish the scientific value of the work and its significance for science and practice, and do not affect the overall positive assessment. Their number primarily to the reviewer's interest of the reviewer in the work. I hope the habilitator will use them in the preparation of further scientific publications and a compact study for fruit producers.

In summary, I think Olha Drozd is a researcher with significant achievements. In carrying out her work, she demonstrated great organisational skills, she also demonstrated that she can plan, organise, and analyse research results at the highest level.

The habilitation thesis is comprehensive, appropriate in terms of content, and represents a high scientific level and introduces new elements to the current knowledge in the field of refrigerated fruit storage with the use of 1-MCP. The conducted research is largely original, and the results obtained are scientifically novel, and they are undoubtedly valuable not only for Ukrainian practice. The analysis of the habilitation dissertation and published scientific papers indicates that the author has presented a complete scientific and research work, which is an important contribution to the development of agricultural sciences.

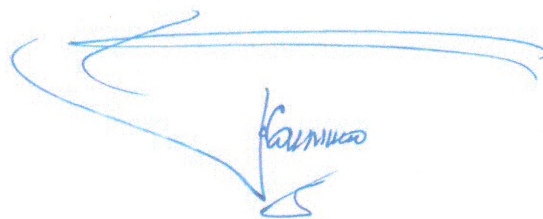
The presented paper corresponds to the content of the habilitation dissertation.

6. Conclusion on the compliance of the doctoral dissertation with the requirements of the Procedure for awarding and revoking the scientific degree of Doctor of Sciences, approved by Resolution No. 1197 of the Cabinet of Ministers of Ukraine dated November 17, 2021

After reading the habilitation dissertation of Dr. Olha Drozd and taking into account the topicality of the topic, the breadth of the research, the high methodological level, the novelty, the value for the science and practice of horticulture, the scientific achievements published in specialist journals sufficient in quantitative and qualitative terms, the recognition at conferences and seminars, as well as taking into account the importance of conclusions and practical recommendations for horticulture and agricultural science, I'm convinced that the

habilitation dissertation on "Basics of pome fruit storage with post-harvest treatment with an ethylene inhibitor" corresponds to the Procedure of the Specialised Academic Council for the Awarding and the Withdrawing of the Degree of Doctor of Science, approved by the Resolution of the Cabinet of Ministers of Ukraine of November 17, 2021 No. 1197, and its Author, Drozd Olha Oleksandrivna, meets the requirements of conferring the degree of habilitated doctor of agricultural sciences with a specialisation 06.01.15 "Pretreatment of plant products" (agricultural sciences).

Official Reviewer
Professor dr. habilitated
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I confirm the Professor's K. Tomala signature
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