



OPINION

on a dissertation for obtaining the educational and scientific degree "**Doctor**" by:
field of higher education 6. Agricultural Sciences and Veterinary Medicine,
professional field 6.1. Crop Science, the scientific specialty Field Crops.

Author of the dissertation: Georgi Stoyanov Raykov – PhD student in independent training at the Department of Plant Breeding at the Agricultural University, Plovdiv.

Topic of the dissertation: "Effective methodology for identification of highly productive and stable winter wheat genotypes by combining traditional and innovative statistical approaches".

Prepared the opinion: Prof. Dr. Nurettin Tahsin Tahsin , Agricultural University - Plovdiv, field of higher education 6. Agricultural Sciences and Veterinary Medicine, professional field 6.1. Crop Science, the scientific specialty Field Crops.
Appointed as a member of the scientific jury by order No. RD-16-208/02.02.2026 of the Rector of the Agricultural University, Plovdiv.

1. Relevance of the problem.

The relevance of the topic of the dissertation is determined by the choice of the most widespread crop in Bulgaria and the world - winter wheat. Determining an effective methodology for identifying highly productive and stable winter wheat genotypes by combining traditional and innovative statistical approaches is the basis for obtaining higher yields with the growing food demand for this crop and is one of the important scientific tasks at the moment. In traditional research related to the creation and zoning of new more productive and stable wheat varieties, as well as the optimization and improvement of cultivation technology, in modern conditions, the possibility of combining these selection methods with modern statistical and biotechnological tools is of interest. The application of new effective identification methods and the innovative approach applied to wheat is the reason for accelerated development in genetic terms and the creation of varieties with high productive and quality potential.

2. Purpose, tasks, hypotheses and research methods.

The aim of the dissertation is clearly and precisely formulated to establish the possibility of combined application of traditional and innovative statistical approaches for complex assessment of winter wheat varieties while simultaneously determining productivity, stability and adaptability under contrasting growing conditions. It is set on the basis of an in-depth literature review, which includes a total of 195 sources. To

achieve this goal, the solution of five main tasks has been set, which I believe are correctly selected, follow a logical sequence and are completely sufficient for its successful achievement. The research methodologies used in the dissertation work are consistent with the tasks that must be fulfilled. As starting material in the work, 118 winter wheat genotypes were used, representing a wide variety of local Bulgarian varieties and foreign samples, provided by leading scientific and private breeding centers in Europe, Asia and North America. Their selection is subject to four main criteria that guarantee representativeness and applicability of the results. They are described in detail and correctly, including their main characteristics (experiment planting schemes, applied agro technical measures, etc.), yield and its components. The doctoral student very skillfully links the specificity of individual phenophases with specific meteorological conditions. The choice of statistical methods is consistent with the main goal, to ensure a reliable, multidimensional and prognostically justified assessment of the genotypes included in the experiment, tested in the conditions of three fundamentally different meteorological years of study. The methods are described in detail, their choice is justified, and is supported by modern literary sources. The data on the soil-climatic characteristics are presented correctly.

3. Visualization and presentation of the results obtained.

The obtained results constitute a significant part of the dissertation work. The section begins with descriptive statistics, illustrated by Boxplot diagrams showing the variation of the observed agronomic traits. An assessment of the influence of the environment, genotype and the interaction between them on the yield and its elements was made, as well as an analysis of the relationships between the traits and their effect on productivity. Linear (LMM) and nonlinear (RF) models, structural equation models (SEM) were used. The most economical option - Model 5, which includes only the two main components NGM (number of grains per square meter) and TGW (1000-grain weight), demonstrates high efficiency, as with a minimum number of paths it explains 98.2% of the variation in yield. The results are illustrated graphically and in tables. Based on these results, the doctoral student applies cluster analysis to establish the optimal number of clusters, as this directly affects the quality of the classification and interpretation of the results. Then, he evaluates the stability and productivity of the genotypes, applying BLUP analysis, WAASB index, WAASBY index, and YSI index. The superiority index (P_i) shows the deviation of each genotype from the highest yields achieved in each environment, with lower index values reflecting closer performance to the optimum regardless of the conditions. The genotypes used in the dissertation are classified according to this indicator, and the results are presented in a table. In addition, a classification was made in terms of the Kang stability index (KSI), which integrates both the yield and stability of the genotypes. The results are presented in a table. A comparative analysis was made between the three indices, and the results presented by means of a network diagram demonstrate not only the skillful

handling of statistical methods in agriculture, but also the high computer literacy of the doctoral student. The results obtained allow the productivity and stability to be analyzed separately with the single indices used. Therefore, the doctoral student has also sought the possibility of applying the so-called multi-trait selection indices, which allow for a combined consideration of stability and average productivity. The doctoral student ranks the genotypes used in relation to two more indices – MTSI and MGIDI, and then makes a comparative arrangement of the genotypes by the rank of the indices. These results are illustrated by means of a Venn diagram of the overlap between the leading 20 genotypes according to MGIDI, MTSI and WAASBY.

The results obtained from the experiment are systematized into 15 important conclusions, which are formulated very precisely and present the development of the dissertation work in chronological order.

4. Contributions of the dissertation work.

Based on the results obtained, a total of 11 contributions have been made, 6 of which are scientific and 5 are applied scientific. They are formulated briefly, precisely and with a clearly expressed scientific style. The goals and objectives of the dissertation have been met, and the result is the doctoral student's contributions to the scientific research of winter wheat.

5. Critical notes and questions.

In fulfilling the goal and tasks of the dissertation, specific results with a clear analysis have been presented, which is why I have no critical remarks and questions to the doctoral student. I have a recommendation that he continue his work on the problems of the interaction of common wheat varieties and the environment not only from a breeding point of view, but also in the direction of varietal agrotechnics in winter wheat. Because in the conditions of serious climatic and genetic changes, the topic will become increasingly relevant, both from a scientific point of view and from the need to introduce more resistant winter wheat varieties into production.

6. Published articles and citations.

To meet the required scientometric indicators, the doctoral student fulfills the required number of points with two published articles in the journal of Thrace University "*Agricultural Science & Technolog* ", in one of which he is the first author, and in the second he is an independent author. 5 citations are also presented.

The presented abstract objectively reflects the structure and content of the dissertation.

CONCLUSION:

In conclusion, I would like to point out that the dissertation proposed by doctoral student Georgi Stoyanov Raykov meets all the requirements for the

educational and scientific degree "Doctor" in terms of structure and content. In essence, it is a methodologically well-structured and complete scientific product.

Based on the correctly conducted experiments, the obtained results, the various research methods applied by the doctoral student, the generalizations and conclusions made, I believe that the presented dissertation meets the requirements of the Law on the Prevention and Control of Diseases and Diseases and the Regulations for the Application of the Law on the Prevention and Control of Diseases and Diseases at the Agricultural University - Plovdiv, which gives me reason to evaluate it **POSITIVELY** .

This gives me reason to propose to the esteemed Scientific Jury to also vote positively and award Georgi Stoyanov Raykov the educational and scientific degree "*Doctor*" in the scientific specialty *of Field Crops*.

Подписите в този документ са заличени

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PREPARED THE

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