OPINION

on a dissertation for obtaining the educational and scientific degree "Doctor" in the Area of Higher Education 5. Technical Sciences, Professional Field 5.13 General Engineering, Specialty: Mechanization and Electrification of Crop Production

Author of the dissertation: Eng. Petya Angelova Genkova, PhD candidate in independent study at the Department of Agricultural Mechanization, Agricultural University – Plovdiv.
Title of the dissertation: *"Comparative Study of Active Disc Working Tools for Shallow Soil Tillage"*
Reviewer: Assoc. Prof. Eng. Galya Milcheva Hristova, PhD from Trakia University, Stara Zagora, Area of Higher Education 5. Technical Sciences, Professional Field 5.13 General Engineering – Mechanization and Electrification of Crop Production, appointed as a member of the scientific jury by Order No. RD-16-1272/16.12.2025 of the Rector of the Agricultural University.

1. Relevance of the topic

The problem addressed in the dissertation – *Comparative Study of Active Disc Working Tools for Shallow Soil Tillage* – is undoubtedly relevant both nationally and internationally. In recent decades, agriculture has increasingly shifted toward sustainable technologies that combine processing efficiency with the preservation of soil resources. Shallow tillage is a key element in conventional systems, reduced tillage practices, and erosion control, with the selection and optimization of working tools having a significant impact on soil quality, energy consumption, and machine productivity.
Active disc working tools represent a promising direction in mechanization, as they provide improved control over the kinematics of soil interaction, create a more uniform tilled surface, and potentially reduce draft requirements and energy input. Nevertheless, the available scientific literature on their behavior under varying structural and technological parameters is limited, highlighting the need for in-depth experimental and analytical research.
In this context, the dissertation addresses a current, practically significant, and scientifically underexplored problem related to the optimization of working tools for modern soil tillage systems. This determines its high applicability for agricultural machinery and its importance for engineering and agronomic education and practice.

2. Aim, Objectives, Hypotheses, and Research Methods

The dissertation presents clearly defined scientific aim and tasks that correspond to the theme and scope of the research. The main aim of the dissertation is to conduct a comparative study of different types of active disc working tools for shallow soil tillage, evaluating their kinematic, energy-related, and agrotechnical performance under various structural and technological conditions. The aim is properly formulated

and aligns with current scientific and practical needs in the field of agricultural mechanization.

The defined tasks are logically connected to the aim and include: analysis of the current state of the problem and existing structural solutions of active disc working tools; development of a mathematical model describing the trajectory and kinematics of the disc surface points; identification of the main structural and operational factors influencing the working process; conducting laboratory and field experimental studies; analysis and comparison of the results, followed by formulation of conclusions and recommendations. These tasks are adequate, well-structured, and sufficiently specific to ensure the successful achievement of the stated scientific aim.

The dissertation also implicitly contains several hypotheses, namely: that the kinematics of the disc working tool with different structural parameters can be described using an appropriate mathematical model; that variations in structural and technological characteristics lead to measurable differences in energy and agrotechnical performance; and that active disc working tools may improve the quality of shallow tillage compared to passive analogues under certain conditions. Although the hypotheses are not explicitly formulated in a separate section, they are clearly identifiable and logically follow from the aim and tasks. It would be advisable for the dissertation to present them in a more structured manner.

The methodological framework is appropriate, scientifically grounded, and consistent with the stated aims and tasks. The combination of theoretical modelling and experimental studies enables a reliable assessment of the performance of different disc working tool designs.

3. Visualization and Presentation of the Obtained Results

The experimental and theoretical results are presented in the dissertation through 25 tables, 66 figures, geometric schemes, and descriptive explanations, which overall support the understanding of the working process of the examined active disc working tools. The visualization is sufficient to follow the logic of the analysis and the influence of the main factors on kinematics, energy consumption, and agrotechnical performance.

The graphical materials, as formatted, contain the necessary information to compare the individual variants, and most figures adequately reflect the trends in the behavior of the working tools. The tables with experimental data are clearly structured, and the presentation of the results allows for further analysis and interpretation.

Overall, the visualization is of good quality, includes the necessary elements, and facilitates the interpretation of the findings. However, the presentation could be improved through more comprehensive statistical annotations, more precise labeling, and a closer connection between the graphical material and the discussion.

4. Discussion of the Results and References

The discussion of the results is logically structured and clearly traces the relationship between the theoretical developments, experimental data, and the conclusions

drawn. The PhD candidate correctly analyzes the influence of the structural and technological parameters on the performance of the active disc tools.
The literature used, comprising 101 sources, is relevant, but relatively limited in scope, particularly with respect to international publications and more recent developments in the field.

5. Contributions of the Dissertation
The 11 contributions presented by the PhD candidate (5 scientific and 6 scientific-applied) are clearly formulated and correspond to the aim and tasks of the research. They encompass both theoretical developments and practically oriented results, demonstrating completeness and scientific validity of the conducted work.

Scientific Contributions
The scientific contributions formulated by the PhD candidate are correctly defined and meet the requirements for scientific novelty. They include original theoretical developments, new models and methodologies, as well as identified dependencies that expand the current knowledge of the kinematics and working processes of active disc working tools. Their classification as scientific contributions is justified, as some also contain elements of applied relevance, but remain sufficiently theoretically substantiated to belong to this group.

Scientific-Applied Contributions
The scientific-applied contributions are properly formulated and reflect real engineering and technological results, validated through experimental testing. They have clear practical significance, being related to the design and testing of prototypes, determination of optimal operating regimes, and formulation of technological recommendations. Their classification as scientific-applied contributions is correct and consistent with the content of the dissertation.

6. Critical Notes and Questions
The presented dissertation is well structured and substantiated, with the remarks being clarifying in nature and not affecting the overall quality of the research. It is necessary to provide clearer comparison of the results with data from other authors, as well as to refine the units and notations used in the figures and tables. I also recommend improving the readability of the labels and ensuring a clearer connection between the graphical data and the conclusions. For future work, it is advisable to avoid these shortcomings and to include international sources in order to strengthen the scientific validity and situate the results within a broader research context.

7. Published Articles and Citations
The PhD candidate has presented three publications related to the topic of the dissertation. The two articles in the journal *Scientific Atlas* examine in detail the influence of a new type of active disc working tools on soil aggregate formation under different soil conditions, complementing the experimental section of the dissertation.

The third publication, co-authored and presented at a scientific conference, reflects the applied aspects of the developed working tool and its potential agromeliorative application.

The publication activity meets the requirements for obtaining the educational and scientific degree "Doctor" and adequately presents the main results of the dissertation research to the scientific community. The submitted abstract objectively reflects the structure and content of the dissertation.

CONCLUSION

Based on the research methods learned and applied by the PhD candidate, the properly conducted experiments, and the formulated generalizations and conclusions, I consider that the presented dissertation meets the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations of the Agricultural University for its implementation. This gives me grounds to evaluate it **POSITIVELY**.

I take the liberty to propose that the esteemed Scientific Jury also vote positively to award Eng. Petya Angelova Genkova the educational and scientific degree **"Doctor" in Mechanization and Electrification of Crop Production**, Area of Higher Education 5. Technical Sciences, Professional Field 5.13 General Engineering.

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Plovdiv