REVIEW

on the dissertation for the acquisition of the educational and scientific degree of "doctor", Field of higher education: 5.0 Technical sciences, Professional field: 5.13 General engineering, Scientific specialty: Mechanization and electrification of crop production

Author of the dissertation:

Petya Angelova Genkova, doctoral student of independent training at the Department of "Agricultural Mechanization" at the Agricultural University-Plovdiv

Topic of the dissertation:

"Comparative study of active disk working bodies for surface soil cultivation" in accordance with Art. 30 (3) of the PPZRASRB and Art. 49 (3) of the PPZRASAU,

Reviewer:

Assoc. Prof. Dr. Eng. Dimitar Kirov Kehayov, with competencies in Field 5.0 Technical sciences, Professional field: 5.1 Mechanical engineering, Scientific specialty: Mechanization and electrification of Plant Breeding, appointed as a member of the scientific jury by order RD-16-1272 of 16.12.2025

I. Brief presentation of the candidate

Petya Angelova Genkova is a doctoral student in independent training at the Department of Agricultural Mechanization, Faculty of Viticulture and Horticulture at the Agricultural University-Plovdiv. She obtained her bachelor's degree at the Agricultural University-Plovdiv as an engineer, majoring in Agricultural Engineering. Again at the Agricultural University-Plovdiv, but at the Faculty of Economics, she completed a master's program in the specialty Financial Management and Accounting. Since March 2022, she has been an assistant professor at the Department of

Agricultural Mechanization at the Agricultural University-Plovdiv. By order RD 26-64/15.07.2024, she was enrolled in doctoral studies in independent training at the Department of Agricultural Mechanization at the Agricultural University-Plovdiv.

II. Relevance of the problem

The topic of the dissertation is very relevant. The studied working bodies make it possible to prepare the soil for the following technological operations (sowing, planting, etc.) in one working stroke. In this way, the number of passes of the machines through the cultivated area is reduced, its compaction is reduced and soil fertility is preserved for a longer time.

Solving the problems related to the rational use of new machines, the application of technologies for minimal soil tillage reduces the risk of wind erosion and improves the ecological balance.

III. Purpose, tasks, hypotheses and methods of the study

The purpose of the dissertation is clearly and precisely formulated: to compare the work of two innovative working bodies, with different profiles and active drive, for surface tillage of the soil, combining the kinematics of a soil tillage machine with a horizontal axis of rotation and the horizontal displacement of the soil by a disk working body.

To achieve this goal, 5 tasks have been identified.

The hypotheses are correctly constructed and are aimed at key aspects of soil tillage - maintaining a set working depth, crushing the soil layer, uniformity of the bottom of the furrow, uniform mixing of ameliorants, development of a theoretical model for the movement of a point of the working body in the soil.

The methodology is the result of an extensive literature review. It contains theoretical development, shows good knowledge of the Planning of the experiment and Statistical methods for processing experimental data.

IV. Visualization and presentation of the obtained results

The dissertation work proposed to me for review is in the field of Mechanization of crop production. It is located on 129 pages, contains 25 tables, 66 figures, 1 scheme and 39 formulas.

For its writing, the author referred to 101 sources, all in Cyrillic.

The obtained results are presented in tables, and the results of the statistical analyses are very well illustrated with numerous figures.

The chosen structure of the dissertation work logically connects the title, the set goal and the formulated tasks with the results of the research.

V. Discussion of the results and used literature

In the richly illustrated section "Results of experimental studies", the doctoral candidate presents his observations and research. A consistent comparison of the effect of the work of the two working bodies on the observed indicators has been made. Their advantages and disadvantages are indicated under different soil conditions (soil background).

Regarding the indicator Working depth and soil background Plouing, it has been established that disk 1 better maintains the set depth regardless of speed and humidity. With a soil background Stubble, disk 2 shows higher efficiency in terms of depth under similar conditions. The influence of the two factors - speed and humidity - is diverse. With increasing humidity, deepening and maintaining the set depth improves, with increasing speed the opposite effect is observed. For the indicator Soil aggregate fragmentation in both soil backgrounds, regardless of the working tool used, the highest content of agronomically valuable aggregates is obtained at a humidity of about 22% and a speed of 0.69 to 1.2 m/s. The uniform introduction of ameliorant into the soil along its depth is significantly influenced by the speed of work. The analysis shows that Disk 1 is more suitable for agrotechnical activities requiring uniform distribution of the ameliorant in the surface soil layer, especially at a lower working speed. In turn, Disk 2 provides a higher content of ameliorant in the upper layers, but with weaker

mixing in depth. The uniformity of the bottom of the furrow is significantly affected by the working speed. As the speed increases, the unevenness also increases.

The results of the dissertation work are useful and can be used directly in preparing the soil for sowing and planting. The obtained regression models are applicable in the educational process and production practice.

VI. Contributions

The abstract formulates scientific-applied and applied contributions. I agree with many of them. The contributions in the most general form can be defined as follows:

A. scientific-applied

A mechano-mathematical model of motion has been created, describing the motion of an actively driven disk working body mounted on a horizontal shaft at an angle to its axis. The model allows for analytical study of the interaction between the disk and the soil, taking into account the geometric and kinematic parameters of the system. It allows, through numerical experiments, to determine the optimal values of the installation angle and the diameter of the disk.

B. applied

1. Mathematical dependencies have been established for the influence of the speed of movement and soil moisture on the stability of maintaining a given depth of cultivation.

2. The operating modes of the created working bodies have been determined, which provide the maximum percentage of agronomically valuable soil structure in the range of 1–25 mm.

3. Speed ranges for mixing ameliorant have been experimentally established, at which optimal incorporation into the soil is achieved.

4. The degree of influence of the forward speed on the uniformity of the profile of the bottom of the furrow when operating a machine equipped with both discs has been established.

VII. Critical comments and questions

I have no significant comments on the dissertation and the abstract. The work in terms of structure, volume and content meets the requirements of the Law on the Development of Academic Staff of the Republic of Bulgaria and the regulations of the Agrarian University of Plovdiv for its implementation.

I have the following comments:

1. Task 1 from the section Aim and tasks in the Dissertation and the Abstract are different. In my opinion, this task should be dropped in both works.

2. In Fig. 12, p. 33, there are no positions and it is not clear which is which.

3. There is no need to repeat separate paragraphs from the Methodology section in the section Results of experimental studies.

4. Pg. 113, table 25 and the following comments use km/h, not the standard m/s.

5. On p. 115, conclusions 3 and 4 can be combined into one.

I have the following 2 questions for the PhD student:

1. For each statistical model, there are created Lines of uniform response in graphical form. How and for what can these graphs be used?

2. All authors cited in the dissertation are in Cyrillic. Is this an omission, a technical error, or is this really the situation?

VIII. Published articles, citations and format of the abstract

The abstract is formatted according to the requirements of the Bulgarian Act on the Protection of Scientific and Technological Research and Development and reflects in a short form the content of the dissertation research.

Doctoral student Eng. Petya Angelova Genkova has published 3 articles. In two of them she is an independent author, and in one - the first author. By publishing these scientific articles, the doctoral student exceeds the minimum points for verification in the database of NACID-Sofia.

IX. Conclusion

Based on the various research methods learned and applied by the doctoral student, the correctly conducted experiments, the generalizations and conclusions

made, I believe that the presented dissertation meets the requirements of the Law on the Development of Academic Staff of the Republic of Bulgaria and the regulations of the Agrarian University of Plovdiv for its implementation, which gives me reason to evaluate it positively

I would like to propose to the Honorable Scientific Jury to also vote positively and award **Eng. Petya Angelova Genkova** the educational and scientific degree "**DOCTOR**" in the scientific specialty "Mechanization and Electrification of Plant Growing".

08.01.2026
Plovdiv

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