АГРАРЕН УНИВЕРСИТЕТ
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Review

on a dissertation for the award of the educational and scientific degree "Doctor" in the field of higher education: 5. Technical Sciences; professional field: 5.13 General Engineering; scientific specialty: Mechanization and Electrification of Plant Growing

Author of the dissertation:

Petya Angelova Genkova, PhD student in independent training at the Department of Agricultural Mechanization at the Faculty of Viticulture and Horticulture of the Agricultural University, Plovdiv. The PhD student is supervised by Assoc. Prof. Dr. Manol Angelov Dallev and Assoc. Prof. Dr. Dimitar Razpopov.

Topic of the dissertation:

"Comparative study of active disk working bodies for surface tillage of the soil".

Reviewer:

Assoc. Prof. Dr. Eng. Ivan Braykov Ivanov, field of higher education: 5.Technical Sciences; professional field 5.1 Mechanical Engineering; scientific specialty: "Mechanization and Electrification of Plant Growing" appointed as a member of the Scientific Jury by order No. RD 16.1272/16.12.2025 by the Rector of the Agricultural University of Plovdiv.

1. Brief introduction of the candidate

Asst. Eng. Petya Angelova Genkova was born on 16.11.1981 in the city of Plovdiv. She graduated from the Higher Education Institution in 2016 with a Bachelor's degree in Agricultural Engineering, and in 2020 - a Master's degree in Financial Management and Accounting, professional qualification - Economist.
She was enrolled as a doctoral student in independent training at the Department of Agricultural Mechanization - AU-Plovdiv by order N RD -26-64/15.07.2024 of the Rector of AU-Plovdiv. She was enrolled with the right to defend her thesis by order N RD -26-72/24.11.2025. Since 2022, she has been appointed as an assistant professor at the Department of Agricultural Mechanization at the Agrarian University - Plovdiv.

2. Relevance of the problem

Soil tillage machines with active working bodies have entered mass practice and are used by many leading companies producing such equipment. With machines with active working bodies, a predetermined and achieved aggregate composition of the soil can be obtained, maximally meeting the agrotechnical requirements of the crop. The improvement of this type of agricultural machinery is a topical problem, which also makes the topic of the dissertation topical.

3. Purpose, tasks, hypotheses and research methods

The purpose is to comparatively study 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.

The working bodies are flat disks with different profiles rigidly fixed at an angle to the direction of movement of a rotating shaft.
The tasks are to substantiate technological parameters and characteristics determining the construction of such a body, by experimentally and theoretically studying through mathematical modeling the influence of factors on indicators related to the quality of work and achieving the desired aggregate composition of the soil.
The hypothesis is for a shockless action of the active flat disk on the soil.
The research methods include simulation modeling, both single-factor and multi-factor planning of the experiment, as well as the use of software products for processing the results of the study.

4. Visualization and presentation of the obtained results

The dissertation work is developed in a volume of 129 pages and contains Introduction, seven chapters/ Analysis of the state; Goal, tasks and object of research; Mathematical modeling of the trajectory of movement of points from the disk; Methodology of experimental research; Results of experimental research; Conclusions; Contributions./
The dissertation presents 25 tables, 66 figures, 17 formulas and 1 scheme. The figures are well presented, clear, drawn with a computer, and for the most part they are from the processing of the results with software products.

5. Discussion of the results and used literature

In the theoretical studies (chapter III) based on mathematical modeling, a kinematic analysis of the working body was made.
Experimental studies include 4 subsections, namely:
Maintaining the set depth of tillage of soil background plowing and stubble; Study of the aggregate composition of soil background plowing and stubble; Study of the uniformity of introducing ameliorant into the soil; Study of the profile of the bottom of the furrow. The study was conducted under the factors of soil moisture, forward speed of the machine and type of working body (disk). The study was conducted under the condition of a passive experiment of soil background plowing and stubble on heavy clay soil.
The object of study is an actively driven shaft, along which at an angle of 300 are located rigidly fixed flat disks with a diameter of 400 mm.
The kinematic analysis presents parametric equations for the movement of points of the tool along the three axes of the spatial coordinate system, which are illustrated in three planes at different values of the factors involved.
The study determined the optimal speed of the unit for maintaining the set depth of cultivation depending on the soil background and soil moisture for both types of working tools.
The fragmentation of the soil into three fractions <1 mm, from 1-25mm and > 25 mm was also studied depending on three factors: moisture, working speed and soil background. Corresponding mathematical models were derived. The results are illustrated with tables of equations and graphs.
In the study of the uniformity of introducing an ameliorant into the soil, the optimal speed of movement of the unit was determined depending on the depth of incorporation for two soil backgrounds and two working tools.

In the study of the unevenness of the bottom of the furrow under the described experimental conditions, the speed of the aggregate was optimized for the different organs in order to comply with the agrotechnical requirements.

General conclusions and contributions of the dissertation work are drawn.
The literature used consists of 101 titles.

6. Contributions of the dissertation work

I classify the contributions to the scientific and applied ones, namely:
1. Two innovative active working bodies have been developed, which
combine the kinematics of a soil tillage machine with a horizontal axis of rotation and horizontal displacement of the soil by means of a disk working body.
2. A new approach has been proposed in the design of machines for surface soil cultivation, ensuring simultaneous crushing and displacement of the soil layer.
3. A mechano-mathematical model of motion has been created, describing
the movement of an actively driven disk working body mounted on a horizontal shaft at an angle to its axis. The model provides
an opportunity for analytical study of the interaction between the disk and the soil, taking into account the geometric and kinematic parameters of the system.
4. A methodology has been created for conducting numerical experiments at the design stage, through which the optimal values of the mounting angle and the diameter of the disk can be determined.
5. A methodology for simulation modeling of the interaction process of the working body with the deformable volume of soil has been developed.

I classify the following contributions as applied:
1. Two types of actively driven new working bodies for surface soil cultivation have been designed.
2. Two prototypes of disk working bodies with different profiles for surface soil cultivation have been studied.
3. 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.
4. Speed ranges for mixing ameliorant have been experimentally established, at which optimal incorporation into the soil is achieved.
7. Critical notes and questions
1. In Chapter I - analysis of the situation, the kinematics of a milling machine with a horizontal axis of rotation and the kinematics of a new design of a machine for surface soil cultivation are presented. The machine combines horizontal displacement of the soil by a disk working body and the kinematics of a soil tillage milling machine with a horizontal axis of rotation. In this regard, no analysis of the operation of active working bodies as parts of combined soil tillage machines has been made in order to compare their parameters and indicators. All this does not provide concreteness in the direction of improving the active working body.
2. From the general type of milling machine with the corresponding working bodies presented in Fig. 15,16 (p.36) it is not clear how the frequency of rotation of the rotor is determined, how the working depth is adjusted - with wheels or sliders, for what reasons the thickness of the disks, the profile of the disks, etc. is chosen.
3. It is not described how the diameter of the discs, the mounting angle and the material of the discs were selected. It is not clear whether there are no untreated strips left.
4. When determining the optimal values of the studied parameters, the speed of the aggregate and the soil moisture are at three levels. It is not clear why the soil moisture of the plowed background and the stubble background differ significantly in the study?
5. Some of the regression dependencies in Chapter III are not numbered - pp. 52,56,70,72, etc.
6. Some of the figures in Chapter II are not described - fig. 15, 16, 17, 18, etc.

7. In Chapter V, the PTO speed is given - 540 min-1. The machine rotor speed is not given to calculate the kinematic indicator. This is an important factor and could have participated in real experiments, and not only in simulation experiments.

8. Published articles and citations

Three publications are presented, in three of which he is the lead author, and two are independent. The articles are in English.

No citations are known.

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

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 Agricultural Research and Development of the Republic of Bulgaria and the Regulations of the Agrarian University for its application, which gives me reason to evaluate it **POSITIVELY.**

I would like to propose to the esteemed Scientific Jury to also vote positively and award Asst. Eng. Petya Angelova Genkova the educational and scientific degree **"doctor"** in the scientific specialty "Mechanization and electrification of crop production".

12.01.2026

City of Plovdiv

Подписите в този документ са заличени

във връзка с чл.4, т.1 от Регламент (ЕС) 2016/679

(Общ Регламент относно защитата на данни).