

## STATEMENT

On the dissertation thesis for acquiring educational and scientific degree “Doctor” (PhD)

Area of the higher education **5.0. Technical sciences**, professional field **5.13. General engineering**, scientific specialty ***Mechanization and electrification of crop production***, author of the dissertation thesis ***Iliyan Bojodarov Bojkov***, topic of the dissertation ***Stepless adjustment of the sowing rate for the Saxon A200 row drill***

Author of the statement is **prof. Borislav Gergiev Angelov, PhD**, University of Ruse “Angel Kanchev”, assigned with order №ПД-16-366/12.03.2024 from the rector of the Agricultural University – Plovdiv for member of the scientific jury

### 1. Relevance of the dissertation thesis

Currently the planting of agricultural crops is mainly done with seed drills, where the seeders are driven mechanically. The use of step mechanical gearing between the drive wheel of the seed drill and the shaft of the seed drill does not allow accurately achieving of the determined seeding rate and maintaining the seeding rate in the work process. A number of other operational factors affect the quality of seeding in mechanically driven seeders, such as slippage of the drive wheel, vibrations of the agricultural unit during operation, manual adjustment of the transmission ratio of the seeding device drive mechanism, etc. From the brief analysis, it can be seen that one of the main prerequisites for increasing the quality of planting is the development of the constructions of modern seed drills. In connection with this, in the scientific periodicals, very common are publications with the results of researches, in which stepless regulation of the planting rate is carried out. A number of authors define mechatronic drive systems as particularly promising in this direction.

The dissertation research, which has been proposed to me for the preparation of a statement, is aimed at creating a system for stepless regulation of the planting rate in seed drills for combined seeding. This gives me reason to conclude that the research is up-to-date, has a dissertation character and the obtained results have a high potential for implementation in practice.

## **2. Short analytical characteristic of the dissertation**

The dissertation is spread over 114 pages and consists of an introduction, four chapters, general conclusions, a list of references and six appendices. For better systematization of the presented material it consists of 22 figures and 16 tables. The list of used references includes 112 titles - 87 in Cyrillic and 25 in Latin.

Within the framework of the first chapter, the results of the analysis of the types of planting devices used in agricultural practice, the ways of regulating the sowing rate and the influence of the technological properties of the sown seeds on the sowing rate are included. At the end of the chapter, the possibility of evaluating the operating and economic indicators of the machine-tractor unit used for sowing is clarified. The first chapter ends with conclusions, based on which the purpose and main tasks of the dissertation research are determined.

At the beginning of the second chapter, the subject and the object of the research are defined. The seeding device of the Saxonia A200 seeder was accepted as the object of the study. After determining the subject and the object of the research, a general methodology of the research is proposed, which includes determining the necessary power to drive the sowing device and determining the amount of seeds planted for one rotation of the used toothed (pin) planting device. The proposed methodology also includes establishing the relationship between seed density, the amount of seed planted and the transmission ratio of the drive mechanism. At the end of the second chapter, the possibility of a comparative analysis of the reduced operating costs when using a mechanical or mechatronic drive of the sowing apparatus for the same machine-tractor unit is clarified.

The third chapter contains the results of the theoretical justification of the need for stepless management of the sowing rate. As a result of the performed theoretical research, a block diagram of a system for stepless regulation of the sowing rate is proposed. On this basis, two versions of a mechatronic drive system have been developed - with a direct and with an alternating current electric motor.

The results of the experimental studies carried out are placed in chapter four. The power required to drive the drills of a Saxonia A200 planter and the amount of seed sown per rotation of the drill shaft were experimentally determined. Through a multifactorial experiment, the functional relationship between the transmission ratio of the drive mechanism, seed density and the amount of planted seeds was determined. The obtained regression model was used to determine the transmission ratio of the proposed mechatronic system for stepless regulation and maintenance of the planting rate.

From the brief analytical description of the dissertation work, it can be seen that it represents a completed independent scientific study, which has its undeniable contributions in a scientific-applied and applied sense.

### **3. Contribution of the dissertation thesis**

In the list of contributions proposed by the author, a total of 7 contributions are included - respectively 3 of a scientific-theoretical nature and 4 of a scientific-applied nature. It is generally accepted that the contributions that are obtained as a result of a scientific study are related to one of the following three groups - scientific, scientific-applied and applied contributions. In this regard, I believe that it would be more correct if the first 3 contributions were defined as scientific - applied, and the remaining 4 - as applied contributions.

Although there is an opportunity to further refine the proposed contributions, I believe that they fully correspond to the results obtained from the research carried out and should be recognized.

### **4. Publications on the theme of the dissertation**

The results of the dissertation research were published in 5 scientific publications. One of the publications has one co-author, and the other four have three or more co-authors. Four of the publications are in English, one in Bulgarian. Two publications are referenced in the world-renowned scientific information database Scopus.

The minimum national requirements under Art. 2b, para. 2 and 3 of the Law on the Development of the Academic Staff in the Republic of Bulgaria, determined by the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria, have been fulfilled. With a total of 30 items required, of the indicators from group D, 50 items have been achieved.(indicators G7 and G8). On the other hand, from the content analysis of the dissertation publications, it can be seen that the main results of the conducted research have become available to the scientific community at home and abroad.

### **5. Opinion on the presence or absence of plagiarism in the dissertation**

In-depth familiarization with the content of the dissertation work and with the content of the mentioned 5 scientific publications gives me reason to state that the results of the dissertation research carried out do not contradict the results of earlier research in the same scientific field and complement them to the necessary extent. The results of previously conducted research by other authors, to which reference is made, are correctly cited.

### **6. Recommendations and remarks towards the dissertation**

Regarding the design of the dissertation work, I will allow myself to make the following comment. The results of the conducted research are placed in four chapters. A separate chapter (2nd chapter) contains the general methodology for carrying out the research.

I believe that, from a methodological point of view, it would be better if the content of the dissertation research was placed in the generally accepted for such research three chapters - analysis of the state of the problem, theoretical research and experimental research, and the methodology for conducting the research was placed in the beginning of the third chapter.

The comment I made has the nature of a recommendation and does not in any way cast doubt on the relevance of the research carried out and its scientific and applied value.

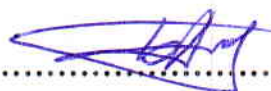
## **7. Conclusion**

The thesis proposed to me for statement fully meets the requirements of the Law for Development of the Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Implementation of the Law on the Development of the Academic Staff at the Agrarian University - Plovdiv. The set goal and tasks for the scientific research have been successfully fulfilled.

Based on the conclusions reached, I allow myself to recommend to the *Honorable Scientific Jury* to award the educational and scientific degree "*doctor*" in the scientific specialty *Mechanization and Electrification of Crop Production* from the professional field 5.13. *General engineering of Iliyan Bozhidarov Bozhkov*.

**May 7<sup>th</sup> 2024**

*Author of the Statement:* .....



**/prof. Borislav Angelov, PhD/**