OPINION

on a dissertation for obtaining the educational and scientific degree **"doctor" (PhD)** in: field of higher education 6. Agricultural sciences and veterinary medicine, professional field 6.1 Plant breeding, scientific specialty "Agrochemistry" code 01.04.04.

Author of the dissertation: Ivan Dimitrov Velinov - PhD student at the Department of "Agrochemistry and soil science" at the Agricultural University, Plovdiv

Dissertation topic: Influence of nitrogen fertilization on the yield and quality of sorghum for grain

Compiled opinion: Prof. Ana Stoilova Saldjieva, Dr.sc., retired from the Field Crops Institute - Chirpan, field of higher education 6. Agricultural sciences and veterinary medicine, professional field 6.1 Plant breeding, scientific specialty "Breeding and seed production of cultivated plants" code 04.04.05 , appointed a member of the scientific jury, Order № RD-16-145 / 26.02.2021 by the Rector of AU.

1. Relevance of the problem. Ivan Velinov's dissertation is a modern scientific research related to an extremely topical problem - to increase the yield and improve the grain quality of grain sorghum by establishing the most effective levels of nitrogen fertilization. The chosen topic is important, given that nitrogen fertilization is one of the most intensive factors of modern agricultural technologies to increase crop yields. Sorghum develops a strong root system and extracts many nutrients from the soil, as a result of which the plants respond very well to fertilization with organic and mineral fertilizers. The study of the reaction of modern sorghum varieties in terms of productivity and grain quality to different levels of nitrogen fertilization is important for improving the agrotechnology of cultivation of this crop in our country. The development of the topic is of current importance and is determined by the need for systematic and in-depth research on this issue.

2. **Purpose, tasks, hypotheses and research methods.** The doctoral student clearly and precisely formed the aim of the research - to study the effect of nitrogen fertilization on the productivity, quality and efficiency of nitrogen use in sorghum for grain. In connection with the objectives of the study, five main tasks were set for implementation. In solving them, modern and adequate to the research methods and approaches were used. Appropriate methods for soil and plant analyzes were used. A large number of studies were conducted, which were the basis of the dissertation. The results of three-year studies (2017 - 2019) in vegetative pot and field fertilizer experiments are presented. In the first vascular experiment the influence of nitrogen nutrition in levels 0 - 800 mg N/kg of soil on the formation and distribution of dry biomass and the content of nitrogen, phosphorus and potassium in young sorghum plants was studied. In a second vascular experiment, eight levels of mineral nutrition were studied. The accumulated aboveground biomass, the exported amounts of nitrogen, phosphorus and potassium in the maturity phase, and their distribution between the grain and straw were analyzed. In a field experiment, the effect of increasing nitrogen fertilization rates from 0 to 30 kg N/da was studied in four replicates under non-irrigated conditions. A large number of indicators were monitored, incl. for agrochemical, energy and economic efficiency of nitrogen fertilization. The plant material was very carefully selected - the EU Alize hybrid was studied. The experimental results were statistically processed, which was the basis for the reliability of the results.

3. Visualization and presentation of the obtained results. The dissertation is structured correctly and contains the necessary sections. It is written in very good language, in an analytical and professional style. The total volume is 208 pages and includes 99 tables

and 10 figures, which are very informative and well arranged. In general, the presentation of the results, their illustration and the design of the dissertation is very good and precisely done.

4. Discussion of the results and used literature. The dissertation is based on interesting and intensive research, contains a lot of new data and a number of original and innovative elements. New and very valuable is the information obtained about the influence of the level of nitrogen nutrition on the dry mass and the content of nitrogen, phosphorus and potassium in young sorghum plants. It was found that young sorghum plants formed the largest amount of dry biomass and accumulated more nutrients (nitrogen, phosphorus and potassium) at nutrient level N_{600}. The absorption of the three nutrients and their distribution by organs (stem, leaves and roots) was studied. Sorghum grain yield was highest when grown at the $N_{600}P_{200}K_{200}$ level. Interesting are the results obtained in the conditions of field fertilization experience with increasing levels of nitrogen fertilization. It was found that on average for the period 2017 - 2019, grain yield was highest when 18 and 24 kg N/da were applied, which is a significant contribution to the dissertation. It was also found that the average export of nitrogen, phosphorus and potassium in the aboveground parts of sorghum was highest at the increased and high nitrogen level N_{24} and N_{30}. I highly appreciate the precisely made assessments of the different in nature and content indicators for the efficiency of nitrogen fertilization. It was found that nitrogen fertilization was the factor that affected by more than 65.6% the indicators of nitrogen efficiency, besides the agronomic efficiency for the grain protein (47.6%) and for the return of nitrogen in the grain (39.2%). The regression dependences for predicting the nitrogen nutrition for optimal grain and grain protein yield also are the contribution of the dissertation. It was found that for each kilogram of additional nitrogen fertilizer used, the grain yield will increase by an average of 13.8 kg/da, and the grain protein yield by 2.35 kg/da.

The results obtained in the dissertation work show that during the research period a large volume of research work was developed. The volume of the research, the presentation and interpretation of the results, and the conclusions made, show a good theoretical preparation of the doctoral student. The scientific research is at a high scientific level, and the obtained results have indisputable scientific and applied significance. In discussing them, the doctoral student correctly refered to Bulgarian and foreign authors from the specialized literature. The comparison of the obtained results with those of other authors outlined the contributions of the doctoral student. It is noteworthy that the doctoral student is well versed in specific scientific terminology. Conclusions were formed for each section, which had contributed to a more accurate formulation of the coclusion (summarized conclusions) at the end of the dissertation and contributions, and demonstrates the doctoral student's ability to assess and summarize the information obtained, and its relevance to theory and practice. Based on the summarized results, recommendations for the practice have been made, which deserve special attention.

The doctoral student has been well acquainted with the current state of the problem. The literature review has been made in sections and covered all areas of research. The use of a large number of literature sources from the specialized literature has contributed to the good awareness of the doctoral student. The list of used literature includes 278 sources, of which 31 in Cyrillic and 247 in Latin.

5. Contributions to the dissertation. Based on the results and analyzes, the doctoral student established trends and patterns and formulated contributions of scientific and applied significance. I accept all scientific and applied contributions to the achievements of the doctoral student, applicable and valuable for improving the agrotechnology of grain sorghum. For the most significant I indicate the following contributions:

Scientific and applied contributions

- The effect of deficient, optimal and high nitrogen fertilization under different hydrothermal conditions on the productivity and quality of sorghum grain has been established;
- Effective fertilization rates at sorghum for grain to increase the profitability of production have been substantiated through economic analysis;
- In order to avoid the soil depletion with nitrogen, an optimal nitrogen balance during annual fertilization in the cultivation of sorghum for grain has been created by applying a moderate nitrogen norm of 18 kg N/da.

Some results are also interesting from a theoretical point of view

- The study provides new scientific information that could be used to create models that predict productivity depending on nitrogen nutrition and the dynamics of agroclimatical conditions.

6. Critical remarks and questions. I have no significant critical remarks or questions. I have recommendations for the doctoral student to publish his materials in impact factor journals.

7. Published articles and citations. With reference to the dissertation, three scientific publications have been published in edited collective volumes. The doctoral student was an independent author of one, and of the other two, which were in a team, he was the first author of one, which outlined his active role. Did not report any citations found. The scientific-metric indicators cover the minimum national requirements for educational and scientific degree "doctor".

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

CONCLUSION:

Based on the learned and applied, by the doctoral student, different research methods, correctly conducted experiments, performed summaries and conclusions, I believe that the presented dissertation meets the requirements of Law for Development of the Academic Staff in the Republic of Bulgaria and the Regulations of the Agrarian University for its application, which gives me reason to evaluate it **POSITIVELY.**

I allow myself to suggest to the esteemed Scientific Jury also to vote positively and to award Ivan Dimitrov Velinov the educational and scientific degree "Doctor" in the scientific specialty "Agrochemistry" 04/01/04.

Date: 12.04.2021
Chirpan

COMPILED OPINION: .....

(Prof. Ana Saldjieva, Dr.sc.)