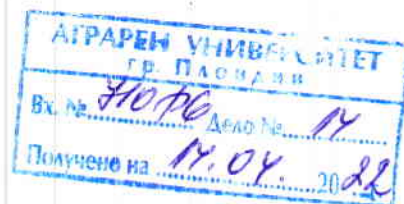


OPINION



On Ph.D. thesis about awarding the educational and scientific degree „Doctor“ in: doctoral program "Plant Growing", Field of higher education: 6. Agricultural Sciences and Veterinary Medicine, Professional field 6.1 "Crop science"

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Thesis title: Study on main units of the technology of *Triticum monococcum* L., *Triticum dicoccum* Sch. and *Triticum spelta* L. in the conditions of organic farming

Referee: Prof. Dr. Neli Kirilova Valkova - Institute of Field Crops, Chirpan, professional field 6.1 Crop Production, scientific specialty "Breeding and Seed Production of Crops", appointed as a member of Scientific jury according to Order No. РД-16-149 of 28.02.2022 of the Rector of the Agricultural University – Plovdiv.

1. Relevance of the problem.

Against the background of the planned legislative measures to reduce the use of pesticides and fertilizers on agricultural land and increase the area for organic farming in the EU's common agricultural policy, as well as the increased interest by consumers of products, made from einkorn and spelled flour, the study of these crops as an alternative source of food in organic farming is not only relevant but also extremely important

The problems developed in the presented dissertation are related to the optimization of technological units of the cultivation of one-grained and two-grained einkorn and spelled in the conditions of organic farming. Emphasis is placed on research related to the development, growth, productivity and quality of grain in the three types of wheat under the influence of the tested factors and the relationships between them. The relevance of the problem is discussed in the introduction as well as throughout the main section of the dissertation. The obtained results and the conclusions made are of theoretical significance and practical applicability.

2. Purpose, tasks, hypotheses and research methods.

The aim of the study is to optimize the main elements of the technology - sowing density and fertilization - in three ancient types of wheat - *Triticum monococcum* L., *Triticum dicoccum* Sch. and *Triticum spelta* L., in the conditions of organic farming.

In order to fulfil the set target, the study explores seven clearly-defined problems, the solution of which gave answers concerning the phenological development of the three types of wheat in the conditions of different years and the relationships between the duration of the inter-phase periods and the growing season with the tested factors;

the dynamics of growth, tillering, the formed productive tillering and photosynthetic activity of wheat species depending on the different densities of sowing and fertilizing; the influence of factors on productivity, elements of productivity and grain quality and correlations between yield and spike components.

The author has chosen suitable methods and approaches that are relevant for the field of study. The data presented in the study examines a total of three types of ancient wheat - *Triticum monococcum* L., *Triticum dicoccum* Sch. and *Triticum spelta* L., three sowing densities - 500, 700 and 900 seeds/m² and two variants of fertilization with fertilizers for organic farming - Italpolina and Naturamin. A large number of indicators in field and pots experiments were monitored and modern scientific equipment was used, which allowed for objective information. The obtained results were analyzed by applying appropriate statistical methods - two-factor analysis of variance and correlation analysis and the software products were used: SPSS for Windows, v 9.00; Duncan's Multiple Range Test, which allowed for more accurate data estimation.

3. Visualization and presentation of the obtained results and cited literature.

The dissertation presented for review is in the volume of 171 pages, of which: 3 pages - introduction; 31 pages - literature review; 18 pages - purpose, tasks, material and methods of the research; 95 pages - results and discussion; 5 pages - conclusions and contributions and 18 pages - used literature. The main text of the dissertation includes 12 figures, 86 tables and 11 photos, which are well designed and informative. In general, the dissertation is structured correctly, contains all the necessary sections, and the content corresponds to the goals and objectives.

The text is written in good style and is terminologically sound. At the end of each section a summary of the results is made. The cited literature includes a total of 204 sources, of which 16 in Cyrillic and 188 in Latin. Of these, 75 publications are from the last 10 years. The literary review is very well structured and corresponds to the topic and the main directions of the dissertation. The doctoral student shows good awareness of what has been achieved on the problem treated in the dissertation, both in the country and abroad and this undoubtedly has helped to correctly define the goals and objectives of the study, as well as to competently interpret and summarize the data obtained.

4. Discussion of the results presented in the study.

The obtained results are analyzed, summarized and interpreted correctly, in a good scientific style. The PhD candidate demonstrates good knowledge of the subject and the latest analysis methods used in this field. The comparison of the data received from him with those of other Bulgarian and foreign authors show his personal contribution to the dissertation development. I also appreciate the concrete

conclusions drawn at the end of each chapter. The study contains a complete bibliography and all used sources are cited correctly.

Based on the conducted research, it has been established that the vegetation period of one-grained and two-grained einkorn and spelt was within 230-231 days and they need an average of 1499 to 1512 °C effective temperature. In all three species, the increase in the sowing rate increased the number of plants per m², and the best germination was reported in two-grained einkorn.

The analysis of the results shows that the year conditions strongly influenced the productive tillering, growth, productive stems, grain yield, spike structural elements, thousand grain weight and hectoliter mass. The influence of density and fertilization on the productive tillering and growth of wheat was weak and non-significant. An exception was the fertilization with Italpolina, which significantly affected the height of plants. It was found that *Tr. monococcum* showed the best values for both indicators.

The effect of soil and foliar fertilization on the photosynthetic activity of plants was studied and an increase in chlorophyll content and improvement of chlorophyll fluorescence parameters in spelt and one-grained einkorn plants was confirmed. Based on the performed analyses of productivity, the doctoral student reported the optimal sowing rates for both species: for *Tr. dicoccum* – 900 germinated seeds/m²; for *Tr. spelta* - 700 germinated seeds/m². The yield of *Tr. Monococcum* was not affected by sowing density. The application of Italpolina soil fertilizer significantly increased grain yield. The correlation dependences between the studied indicators in the three species were studied and medium and strong positive correlations were found between some of them.

Based on the analyses on the established dependences, it is indicated that the effect of sowing rate and fertilization on the grain quality indicators was weak. The highest values for thousand grains weight were found for spelt, and for hectolitre weight and bran percentage - for two-grained einkorn. Through the applied biochemical analysis of the grain it was found that the spelt had highest content of raw protein and microelements copper and iron; two-grained einkorn had the highest fiber and magnesium content, while one-grained einkorn was superior to the other two types in terms of zinc and manganese. Lysine in both types of einkorn was 0.37%.

As a result of the conducted research, 15 conclusions were formulated, synthesizing the conclusions of the doctoral student.

5. Contributions to the dissertation

The dissertation contains scientific-theoretical and scientific-applied contributions, which in terms of content, significance and usefulness for science and practice in the research field are completely sufficient to obtain an educational and scientific degree "Doctor". They are correctly reflected at the end of the dissertation. Among them, the most important are:

- For the first time in a complex multifactor study it was found the effect of increasing sowing rate and fertilization with soil fertilizer Italpolina and foliar fertilizer Naturamin on the growth, development and formation of productivity of local forms of two-grain einkorn, spelt and one-grain einkorn, in the conditions of biological system of agriculture.
- Based on the comparative evaluation in the experiment, the analysis of variance and the established correlations, concrete conclusions and recommendations were made for the individual species, related to sowing rate and fertilization.
- Through a complex of physiological parameters has been shown that the applied soil and foliar fertilization improved the photosynthetic activity of spelled, one-grained and two-grained einkorn plants.
- A comparative assessment of the physical, biochemical qualities and mineral composition of the grain (naked and bran) in the conditions of the tested factors and the biological system of agriculture was made.

I accept all contributions of the doctoral student. They are his personal research activity and evidence that he can conduct independently experimental work and correctly interpret the results obtained.

6. Critical remarks and questions.

I have no critical remarks or questions.

7. Published articles and citations.

The abstract presented objectively reflects the structure and content of the dissertation, the results obtained and conclusions and its separate reading provides sufficient information about the importance of the development. of the dissertation. In connection with the dissertation, two scientific publications have been published in the Journal of Mountain Agriculture on the Balkans, in one of which he was independent, and in the other the doctoral student was the first author. From the two publications the author collected 40 points and meets the minimum scientometric requirements for obtaining the educational and scientific degree "Doctor", according to the Law for the Development of Academic Staff in the Republic of Bulgaria. No open citations were reported.

CONCLUSION

On the basis of the various methods of research, the correctly performed experiments, the summaries and the conclusions made, the dissertation submitted meets the requirements of the a law for the development of the academic staff in the

Republic of Bulgaria and the Agrarian University Regulations for its application, which gives me a reason to rate it **POSITIVE**.

I allow myself to offer the honourable Scientific Jury also to vote positively and to award **Yordan Rangelov Yordanov** the educational and scientific degree of „Doctor„ in the scientific specialty "Plant Growing".

Date: 04.04.2022

Chirpan

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