



## REVIEW

on a PhD thesis for obtaining the educational and scientific degree "Doctor (PhD)" in: field of higher education 6. Agricultural Sciences and Veterinary Medicine, professional field 6.1 Crop production, scientific specialty Crop production.

**Author of the dissertation:** Yordan Rangelov Yordanov PhD student (part-time) at the Department of Crop Science at the Agricultural University, Plovdiv

**Topic of the dissertation:** STUDY ON THE MAIN SEGMENTS OF THE TECHNOLOGY OF TRITICUM MONOCOCCUM L., TRITICUM DICOCCUM Sch. AND TRITICUM SPELTA L. IN THE CONDITIONS OF ORGANIC AGRICULTURE

**Reviewer:** Prof. Dr Hristofor Kirchev Kirchev, Agricultural University, a field of higher education 6. Agricultural sciences and veterinary medicine, professional field 6.1 Crop production, scientific specialty Crop production.

Appointed a member of the scientific jury by order № RD-16-149 / 28.02.2022 by the Rector of AU.

### 1. Brief presentation of the applicant.

Yordan Rangelov Yordanov was born on August 2, 1972, in the town of Pazardzhik. During the period 2010-2012, he studied at the Agricultural University of Plovdiv and obtained a master's degree in Agribusiness, where he received professional skills in the following areas: Fundamentals of Agrarian Law, Fundamentals of Commercial Law, Marketing of Agricultural Production, Management of Agribusiness Organizations. Since 2010 he has been working at the Agricultural University of Plovdiv as an agronomist in organizing the activities of the Agri-Environmental Center and the educational work of UOVb. In 2018, after successfully winning a competition, he was enrolled as a part-time PhD student in the Department of Crop Science at the Faculty of Agronomy of the Agricultural University of Plovdiv. During his doctoral studies, in addition to the mandatory activities described in the curriculum and methodological plans, he participated in several seminars. He speaks German, Czech and English.

### 2. Relevance of the problem.

Organic food production is a new stage in the development of agriculture in the world. Along with the problem of population growth on the planet and the need for more food, there is also the problem of producing quality food. One of the directions for organic food production is grain production. Ancient wheat (einkorn and spelt) are very suitable for organic production due to their resistance to diseases and their low reaction to mineral fertilizers. Therefore, the current study, which aims to determine the development and productivity of *Triticum dicoccum* Sch, *Triticum spelta* L. and *Triticum*



*monococcum* L. at different sowing rates and different fertilization options suitable for organic production in the Central South Bulgaria region is relevant. for modern science and the production of biological products.

### **3. Purpose, tasks, hypotheses and research methods.**

The present study was conducted 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., under organic farming conditions.

To fulfil the set goal, seven tasks are set as follows:

1. To make a comparative characteristic of the phenological development of the three types of wheat in the conditions of the vegetation years. To trace the dependencies between the duration of the interphase periods and the vegetation period with the tested factors.
2. To monitor the dynamics of growth, tillering and the formed productive stems and to establish the influence on them of different densities of sowing and fertilizing.
3. To characterize the photosynthetic activity of the three types of wheat and to analyze its dependence on the tested factors.
4. To determine the influence of sowing density and fertilization on the productivity of *Triticum monococcum* L., *Triticum dicoccum* Sch. and *Triticum spelta* L. To establish correlations between yield and spike components.
5. To establish the elements of productivity and their relative influence on yield under the tested factors - year, species, sowing density and fertilization.
6. To study the physical qualities of the grain in the tested factors of the study.
7. To study the biochemical composition and the content of some macro- and microelements in the grain of the three species of wheat.

To achieve the goal and objectives of the study, two experimental productions are set - field and vessel experiments.

The field experiment was conducted at the Agro-ecological Center - Demonstration Center for Organic Agriculture at the Agricultural University - Plovdiv, in the period 2018 - 2021.

The Agro-Ecological Center has been a member of the International Federation of Organic Agriculture (IFOAM) since 1993. Since 1994 it has also functioned as a Demonstration Center for Organic Agriculture, whose production base provides training for students, teachers, farmers and agronomists in the field of production of organic plant production. The obtained production is certified by "Balkan Biosert" Ltd.

The experiment is three-factor, based on the method of split plots with the size of the reporting plot 15 m<sup>2</sup>, in four replications. The following factors and their levels were studied:

Factor A - Wheat species:

A1 – *Triticum dicoccum* Sch.;

A2 – *Triticum spelta* L.;

A3 – *Triticum monococcum* L.;

Factor B - Sowing density



B1 – 500 g.s./m<sup>2</sup>

B2 – 700 g.s./m<sup>2</sup>

B3 – 900 g.s./m<sup>2</sup>

Factor C - Fertilizers for organic farming

C1 - Control - without fertilization

C2 – Italpolina - soil fertilizer, in a dose 0,7 t/ha

C3 – Haturamin WSP - amino acid product for foliar treatment - three treatments in tillering, stem elongation and spike emergence with 30g/da

When combining the factors, the following are formed: A (3) x B (3) x C (3) = 27 variants in 4 repetitions = 108 plots.

The indicators of the study are Number of sprouted plants per m<sup>2</sup>; Phenological development; Physiological indicators: Indicators of leaf gas exchange; The content of the photosynthetic pigment chlorophyll; Chlorophyll fluorescence parameters; Plant height; Common and productive tillering; Productive stems; Harvest index; Structural elements of the spike - length of the spike, number of spikes, number of grains and mass of grains in the spike; Grain yield; Physical indicators of the grain - mass per 1000 grains; test weight; Biochemical parameters of the grain - crude protein, crude fibre, crude ash, grain dry matter, lysine content, macro- and micronutrient content.

Mathematical data processing includes two-way analysis of variance and correlation analysis performed using SPSS for Windows, v 9.00; Duncan's Multiple Range Test.

The vessel vegetation experiment was performed according to the following scheme in four replications:

1. Control - unfertilized soil;
2. Soil fertilized with Italpolina (0,03 g/vessel - 70 kg/da)
3. Foliar fertilization with Naturamin WSP (abundant wetting of plants - 30 g/da)

#### **4. Visualization and presentation of the obtained results.**

The presented scientific paper contains 172 pages, 86 tables, 12 figures and 11 photos. The list of cited literature contains a total of 204 literary sources, 16 of which are in Cyrillic and the rest in Latin.

The dissertation contains all generally accepted sections for this type of presentation, namely: Contents - 2 pages; Introduction - 3 pages; Literary review - 31 pages; Aim and tasks of the research - 1 page; Material and methods - 9 pages; Agricultural techniques of experience - 2 pages; Agroclimatic characteristics - 6 pages; Results and discussion - 95 pages; Conclusions - 4 pages; Scientific and applied contributions - 1 page and Literature - 17 pages.

The literature review is divided into subsections describing studies on the origin, distribution and significance of einkorn, emmer and spelled. Growth and development of einkorn, emmer and spelled. Current studies on the influence of fertilization and sowing density on the development and productivity of ancient wheat. Influence of biofertilizers on the intensity of photosynthesis and chlorophyll content in plants. Studies on the chemical composition of the studied wheat.

The agroclimatic characteristic includes the general climatic characteristic of



the area of the experiment - the city of Plovdiv, the soil characteristic of the field, as well as the analysis of the agrometeorological conditions in the period of the study.

## **5. Discussion of results and literature used.**

As a result of the precisely performed experimental activity, the obtained data are described and discussed in the section Results and discussion. The section is divided into 11 subsections.

The first subsection describes the phenological development of ancient wheat species. The dates of occurrence of the germination phenophases are reflected (BBCH 11); third leaf (BBC18); tillering (BBCH 28); stem elongation (BBCH 38); spike emergence (BBCH 59); milk maturity (BBCH 78); waxy maturity (BBCH 89) and full maturity (BBCH 99). The use of the corresponding code on the BBCH scale gives a clear idea of the exact moment of phenophase reading. The duration of the interphase periods and the sum of the active temperatures by phases in each of the three types of wheat were reported.

The following subsection describes the influence of year, wheat species, sowing density and fertilization on plant germination both by year and on average for the study period.

The tillering of *Triticum dicoccum* Sch., *Triticum spelta* L. and *Triticum monococcum* L. includes the influence of sowing density and fertilization on the number of productive tillers at the end of the growing season in the three wheat species, as well as the influence of year, wheat species, the density of sowing and fertilizing on the number of tillers in the spike emergence phase.

The following is a subsection describing the dynamics of growth in height depending on the species and fertilization, by phenological phases and years.

In the subsection foliar gas exchange of plants from emmer, spelt and einkorn in fertilization with soil and foliar fertilizer, the influence of fertilization on the intensity of photosynthesis, transpiration, stomatal conductance and intercellular CO<sub>2</sub> concentration in plant leaves was studied.

The influence of the tested factors on the productive stems and harvest index in the three types of wheat was studied.

The subsection grain yield describes the influence of sowing density and fertilization on grain yield in the three types of wheat both by years and on average for the study period.

The influence of the tested factors on the structural elements of the spike in the three types of ancient wheat was studied, and a complex assessment of the influence of the year, type, the density of sowing and fertilization on the main structural components of the spike was made.

The following are correlations between the main elements of productivity: between the main parameters of the spike and between grain yield and the elements of productivity in the three types of wheat.

The last subsection of the results related to the field experiment is related to the quality indicators of the grain. The influence of the tested factors on the physical qualities of the grain (weight per 1000 grains and test weight), the



influence of the year, the density of sowing and fertilization on the huskiness of the grain in the tested species were studied. The biochemical properties of the grain were studied - the content of crude protein, lysine, crude fibre and crude ash in all three types depending on the tested factors. The content of macro- and microelements in the grain - magnesium, copper, iron, zinc and manganese in different types of ancient wheat is described.

The influence of soil fertilization on some growth parameters of young spelt, emmer and einkorn plants has been established with the help of vessel experience.

Based on the obtained and analyzed results, the PhD student formulates 15 conclusions, which in summary summarize the study.

The cited literature, including 204 literature sources, shows the excellent theoretical preparation of the PhD student and his high level of awareness of the fundamental and latest scientific achievements on the researched problems both in our country and abroad.

## **6. PhD thesis contributions.**

The excellent theoretical and practical preparation of the PhD student, as well as the precisely performed experiments and analyzes of the data from them, allow him to form 5 scientific and applied contributions as follows:

### **Scientific and applied contributions**

1. For the first time in a complex multifactor study the influence of increased sowing rate and fertilization in local forms of the three ancient wheat species - *Triticum dicoccum* Sch., *Triticum spelta* L. and *Triticum monococcum* L.
2. The influence of the growing sowing rate from 500 to 900 gs/m<sup>2</sup>, in combination with two fertilizer products - soil fertilizer Italpolina and foliar fertilizer Naturamin, on the growth, development and formation of productivity of local forms of einkorn, spelt and emmer, in the conditions of the biological system of agriculture.
3. Specific conclusions and recommendations for the individual species related to sowing rate and fertilization are made, based on their comparative evaluation in the experiment, analysis of variance and the established correlations.
4. A set of physiological parameters has shown that the applied soil and foliar fertilization improves the photosynthetic activity of spelt, emmer and einkorn plants.
5. A comparative assessment of the physical, biochemical qualities and mineral composition of the grain (naked and hulled) in the conditions of the tested factors and the biological system of agriculture is made.

## **7. Critical notes and questions.**

I do not have any critical remarks or questions. The dissertation was written with a lot of work, a lot of effort was put in by both the PhD student and his supervisors.

The dissertation submitted to me for review fully meets the requirements of the Academic Staff Development Act and the Regulations for its application.

## 8. Published articles and citations.

According to the minimum scientometric requirements specified in the Regulations for the application of the law for the development of the academic staff, 2 publications related to the dissertation are listed, which fully cover and even exceed the required number of points.

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

## CONCLUSION:

Based on the different research methods learned and applied by the PhD student, correctly performed experiments, summaries and conclusions, I believe that the presented dissertation meets the requirements of the Law and the Rules of the Agricultural University for its application, which gives me a reason to evaluate it **POSITIVE**.

I would like to suggest to the esteemed Scientific Jury to vote positively and to award Yordan Rangelov Yordanov the educational and scientific degree "**Doctor**" in the scientific specialty of Crop production.

22.03.2022 г.  
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).