



REVIEW

of doctoral dissertation for awarding the educational and scientific degree of “**Doctor**” in area of higher education: 6. *Agrarian sciences and veterinary medicine*; professional field: 6.1. *Horticulture*, scientific specialty *Plant Physiology*

Author of the doctoral dissertation: Rositsa Zhivkova Cholakova-Bimbalova, part-time doctoral student at the Department of Plant Physiology and Biochemistry, Agricultural University of Plovdiv

Topic of the doctoral dissertation: “Research of the reaction of maize (*Zea mays* L.) to low temperatures and the effectiveness of the following foliar fertilization”

Reviewer: Prof. Dr. Dragomir Gospodinov Valchev, Institute of Agriculture in Karnobat, area of higher education: 6. *Agrarian sciences and veterinary medicine*; professional field: 6.1. *Horticulture*, appointed as a member of the scientific jury with Order No ПД-16-506/18.06.2020 by the Rector of the Agricultural University.

1. Relevance of the problem

Maize is an important farming crop used for grain, silage and green forage. Worldwide, about 67% of maize is produced by the USA, China, Brazil and Mexico. In Bulgaria, maize is grown on an area of 3-4 million decares.

Maize is a heat-tolerant crop whose high-temperature requirements are expressed as early as the sowing period. Germination takes place at soil temperatures of 8-10⁰ C and in case of lower temperatures, the seeds can die. The growth of maize is slowed at 4-5⁰ C, and if these temperatures last for a longer period of time, the plants die. Late spring frost affect the leaves, and at a temperature of -4⁰ C for about 2-4 hours, the whole plant can be destroyed.

All these require an in-depth study of the effect of low positive temperatures on the main physiological processes in young maize plants and the possibilities for impact with foliar fertilizers and biostimulants.

Therefore, the topic is particularly dissertable and is of interest to science and practice.

2. Aim, tasks, hypotheses and methods of research

The aim of this dissertation is to study the influence of chronic low-temperature impact on the physiological status of young maize plants and the

possibility of overcoming the functional disorders caused by applied foliar fertilizers and biostimulants. To achieve this aim, six well-formulated tasks have been set for solving, which fully corresponds to the direction of the research. The tasks are related to describing the visual manifestations and changes in the growth of young maize plants which have undergone chronic low-temperature impact; monitoring the physiological response of maize plants to applied low-temperature impact through electrophysiological, conductometric and biochemical indicators; studying the effect of chronic low-temperature impact on the mineral and water status of maize plants; characterizing the photosynthetic activity of maize plants subjected to low-temperature impact by analyzes on the leaf gas exchange, the content of photosynthetic pigments and the chlorophyll fluorescence; studying the impact of foliar biostimulant on the physiological status of young maize plants grown at optimum temperature and low-temperature impact; studying and comparing the effects of foliar products applied during the period of low-temperature impact on the physiological status of young maize plants. Precise biometric and physiological measurements were taken. The whole study was performed by means of classical methods. The results were statistically processed with a one-way ANOVA analysis, followed by a Duncan test.

3. Visualization and presentation of the obtained results

The dissertation is well structured, contains all required sections and its volume is 122 pages. The dissertation is very well visualized. It contains 21 tables, 11 figures and 19 pictures. The interpreted data corresponds with the set tasks and obtained results.

4. Results, discussion and literature

The obtained results are analyzed skillfully and thoroughly. The language and style of the presented dissertation are scientific, concise and modern. The influence of low-positive temperatures on some physiological and biochemical indexes of young maize plants has been established. The influence of foliar fertilizers and a foliar biostimulant on some physiological and biochemical indexes of young maize plants has been studied. The extensive, thematically arranged literature review includes 215 authors, of which 6 are by Bulgarian and Russian authors and 209 are foreign publications, which shows that the doctoral student is well informed on the topic.

5. Contributions of the doctoral dissertation

The results of the research are summarized in 10 conclusions, which cover the scope of the study and are proof for successful completion of the set tasks.

Some of the more significant scientific and applied science contributions in the dissertation are:

1. By analyzing the induction kinetics of chlorophyll fluorescence according to Strasser et al. (2004), for the first time in studies of maize plants, it has been shown that low positive temperatures reduce the connectivity between light-collecting complexes and reaction centers of photosystem 2 and increase the relative pool of available electronic acceptors of photosystem 1 (NADP molecules) and its relative content.

2. By using the electrophysiological method of Panichkin et al. (2009), for the first time was monitored the bioelectrical reaction of maize plants to the impact of low temperatures, and as a result it was found that their functional activity decreases on the first day, the decrease increases to the third day and stabilizes at this level in the next period due to occurrence of acclimatization processes.

3. Through a complex of physiological and biochemical parameters it is shown that the new Bulgarian maize hybrid Knezha 307 has high sensitivity to low positive temperatures in the initial period of growth and development of the crop.

4. It was established that foliar application of biostimulants Terra-Sorb Foliar, Naturamin - WSP and Amino Expert Impuls and foliar fertilizer Polyplant during low-temperature exposure does not improve the growth of maize plants, rather than affect favourably their physiological status, which is prerequisite for faster recovery of growth in the post-stress period.

Based on the conducted research and obtained results were made appropriate recommendations for the practice.

6. Critical notes and questions

- Lambrev (Ламбрев, 2003) – page 23 is missing in Section VIII Literature

- Miedema (1982) – page 24 is better to be excluded

I have the following questions:

1. What criteria were used to select and include the said foliar biostimulant and foliar fertilizers in the study?

2. Which of the used physiological indicators is most suitable to assess the resistance of young maize plants to low positive temperature?

7. Published articles and citations

In regard to the dissertation were published four scientific publications and one is currently in press. Assist. Rositsa Cholakova-Bimbalova is first author in all five of them. No citations were announced.

The submitted abstract objectively represents the structure and content of the doctoral dissertation.

CONCLUSION:

On the basis of the various methods of research learned and applied by the

doctoral student, the correctly performed experiments, the summaries and conclusions made, I consider that the presented dissertation meets the requirements of the Development of Academic Staff in the Republic of Bulgaria Act and the regulations of the Agricultural University for its application, which gives me reason to evaluate it **FAVOURABLY**.

I allow myself to offer the honourable Scientific Jury also to vote favourably and to award Assist. Rositsa Zhivkova Cholakova-Bimbalova the educational and scientific degree of “**Doctor**” in scientific specialty Plant Physiology.

Date: 14.08.2020
Karnobat

REVIEWER:

(Prof. ~~Dr. D.~~ Valchev)