REVIEW

on a dissertation for obtaining an educational and scientific degree "Doctor" in: field of higher education - 6. Agricultural sciences and veterinary medicine, professional field - 6.1. Plant growing, scientific specialty - Plant growing

Author of the dissertation: **Adelina Hristova Garapova**, full-time doctoral student at the Department of Plant growing at the Agricultural University, Plovdiv

Dissertation topic: Agronomic *characteristics of express tolerant sunflower hybrids (Helianthus annuus L.) depending on the soil nutrient supply*

Reviewer: **Prof. Dr. Tonya Dobreva Georgieva**,
Department of Plant Growing at the Agricultural University - Plovdiv;
field of higher education - 6. Agricultural sciences and veterinary medicine ",
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scientific specialty - Plant growing;
appointed a member of the scientific jury by order № RD - 16-281 / 15.03. 2021 by the Rector of the Agricultural University – Plovdiv

1. Brief introduction of the candidate

The doctoral student ADELINA HRISTOVA GARAPOVA was born on January 11, 1993. She obtained her higher education with a bachelor's degree at the Agricultural University - Plovdiv in the period 2012-2016 with a degree in Agronomy (Decorative Gardening). At the same university she successfully obtained a master's degree in Ornamental Plants and Landscape Design. During her studies, Adelina Garapova diligently sought various opportunities to enrich her knowledge and skills, participating in various courses and specializations. As a student she completed a long-term specialization at the Center for Continuing Education of the Agricultural University - Plovdiv and acquired an additional professional qualification "Teacher". She improved her digital skills by participating in a specialized computer training course at the Cambridge Center for Foreign Languages and Culture in Plovdiv.

During her regular doctoral studies Adelina is actively involved in interactive activities organized by the Department of Agricuilture within the European association ENTER. Thus, in 2018 she participated in a seminar related to the concept of corporate learning for sustainable development in the vocational education system. The following year, her motivated interest provoked her and she again participated in a seminar to deepen the professional skills and competencies of the academic staff of Agricultural University, in connection with the synchronization of education with the concept of sustainable

development. Prepared in this direction, motivated and focused on the problem, in April 2019 she actively participated in the Erasmus + project "ACROSS - Across Disciplines, Borders and People in Rural Development" by participating in a one-week training at Humboldt University - Berlin.

In her career so far, Garapova presents herself as a young researcher, with high language competencies and teamwork skills, with modern digital skills, absolutely necessary for the development of every young person.

2. Relevance of the problem

In Bulgaria, as in many European countries, the main vegetable fat that is permanently involved in the diet of the population is obtained from sunflower seeds. In recent years, consumption has increased, thus taking into account a healthier diet, ignoring animal fat more and more often.

The production of sunflower in our country has lasting traditions, due to both the relatively high yields and the scientific achievements of the Dobrudzha Agricultural Institute in General Toshevo. The importance is determined by the fact that this culture is the second most widespread in our country, of great importance for the bulgarian economy. In recent years, breeding programs have focused on obtaining high-yielding and high-fat hybrids. This requires constant detailed research on the technology of cultivation of new genotypes, adapted to different not only agrometeorological but also soil conditions.

In the conditions of intensified competition in the marketing of various products for monitoring the growth, development and productivity of sunflower, the producers face the dilemma of a creative approach in the adaptation of the used agrotechnology. Issues arise related to overcoming adverse and stressful factors during the growing season, along with the need for strict adherence to the principles of agricultural land management in relation to sustainable land use.

The offer of new, insufficiently studied hybrids, as well as the possibilities for maximum realization of their genetic potential, require in-depth research in this direction. All this unequivocally defines the topic as relevant and timely for practice.

All this predetermines the set goal: "To establish the impact of soil nutrient supply on certain biological and economic qualities in express tolerant sunflower hybrids." To achieve this goal, 4 main tasks are clearly formulated, related to the study of the phenological development of express tolerant sunflower hybrids and establishing the duration of the interphase periods depending on the variety and stocking of the soil; study of seed yield and its components; study of the physical qualities of the seeds, the fat content and their quality; establishing correlations between the studied quantitative and qualitative indicators characterizing the used express tolerant sunflower hybrids.

I emphasize that the formulation of the goal, as well as the specific tasks are fully adequate to the idea of the study and largely exhaust the emerging

problems in the adaptation and application of modern technologies in modern hybrids.

To perform the tasks, a three-year experiment is set in the fields of the educational-experimental and implementation base of the Agricultural University. The experimental scheme is organized so as to allow a rich statistical analysis. In the mutual combination of the tested factors, 10 variants are formed. The tested hybrids are 5 in number, set at two levels of stock. I accept that the number of variants, as well as the chosen configuration of the experience, correspond to the formulated goal and the requirements for the dissertation. Many indicators have been monitored, referring to two main groups - biological and chemical. Phenological observations, a set of biometric indicators, productivity indicators, physical and chemical properties of the seeds are included. A number of chemical analysis methods have been studied and used to account for some of the indicators. Modern software programs are used.

In the section Material and methods, agrotechnics of experience, the main elements of the applied agrotechnology are presented. It is adapted to the soil and climatic characteristics of the area and the selected hybrids. Weed control is compliant with DuPontTM ExpressSunR technology. To achieve the goals of the experiment more precisely, sowing and harvesting were done manually.

4. Visualization and presentation of the obtained results

The dissertation is presented on 174 pages. It is structured in 9 main sections, presenting in full the main parts of such scientific work. The Introduction is on two pages. The same, concise and motivated, points to the problems to be developed and presented in the dissertation. The Literature review is located on 18 pages, divided into 6 subsections and cites a total of 268 sources - in cyrillic and latin. Purpose and tasks are presented concisely on one page. The Material and Methods section, on 5 pages, presents a complete and correctly described methodology for placing the experience, selected options, indicators, analyzes. The section Soil-climatic characteristics is obligatory for such scientific developments. In it, the agrochemical analysis of the soil before sowing in the two points is presented in tabular form - with different stock, according to the set methodology. The agrometeorological situation in the years of research is presented graphically, which supports the perception of the presented information. Results and discussion is the largest section - it is presented on 87 pages and contains 25 tables and 30 figures. The conclusions and contributions are presented in 4 pages.

The photos used for illustration are discreetly included in the text, the tables are clearly constructed, the figures are varied and very revealing.

5. Analysis of the obtained results

The results obtained are presented in 5 subsections, each of which is richly illustrated and supported by evidence.

Phenological development was monitored and analyzed, with detailed tables and figures showing the dates of entry into each phenological phase for the three experimental years. The five varieties were compared with extreme precision, taking into account the observed differences in the phase of the second pair of leaves. The total duration of the vegetation periods and the ratio between the duration of the interphase periods are presented graphically, which further facilitates the perception and analysis of the collected information. In all three years, the Arcadia variety stands out as the earliest, and Magma SU and Subaro as hybrids with longer vegetation. This information is extremely valuable for growers, who must select suitable varieties for a specific region, taking into account not only the productivity but also the biological characteristics of the genotype and its suitability for growing in these places.

The second subsection presents in an original way the information collected from the biometric measurements. The height of the plants is taken into account, in the conditions of the two reserves of soil with nutrients in the three consecutive years. The influence of the individual sources of variation on the value of the plant height indicator has been established and proved by dispersion analysis. The thesis for proven differences between the hybrids, as well as with regard to the stock of soil, is confirmed, but no connection is established between the factors Stock and Hybrid. On average for the three years the plants are 14.6 cm taller with better soil reserves, which logically confirms the thesis about the influence of plant nutrition on growth in height.

Stem thickness is an important indicator that is associated with plant resistance to lodging. The data are presented in the same style of information presentation. The applied two-factor analysis of variance shows a statistically significant influence of the two tested factors on the thickness of the stem, analogous to the other factor related to the stem - plant height. The combined interaction of the two factors is not statistically proven.

Leaf area analysis provides valuable information for each hybrid, which is later associated with productivity. The strong influence of the Stock factor on this indicator is confirmed by the statistical data processing.

The diameter of the head is a major productive component. The P64LE25 and LG 59.580 hybrids stand out with the largest heads, reported at higher stocks. The stock of Arcadia hybrid has the clearest effect, leading to differences of 3.22 cm in the diameter of the head, and the smallest difference is in the LG 59.580 hybrid - 1.92 cm. These, as well as other data, once again determine the need for in-depth studies on the specific response of genotypes to major agronomic factors.

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Undoubtedly, the most complex indicator characterizing the productive potential of the hybrids selected in the study is seed yield. On average for the three years studied, the thesis was confirmed that better soil stock has a positive effect on seed yield in all studied sunflower hybrids. The dissertation found that the most productive hybrid was the LG 59.580, followed by the P64LE25, Subaro, Magma and Arcadia. The analysis of the biological yield provides detailed information about the accumulation of fresh plant mass by organs in the conditions of the two soil stocks. The data are presented graphically, which allows a more analytical perception of the information. On this basis, the summary is made that in the conditions of Plovdiv the sunflower plant consists of 35% , 21% leaves, 17% head and 27% seeds. The genotypic response is also taken into account. The largest share of seeds is in the most highly productive hybrids - 29.4% for LG59.580 and 31.3% for P64LE25. The collected information allows to calculate other interesting indicators - harvest index of the head and harvest index of the seed. The data were processed statistically, after which specific summaries were made.

The fat content is the main quality indicator of the seeds. On average for the three years the tendency to decrease the fat content in the better soil stock and in the five hybrids is preserved. These data are confirmed statistically. Despite the unproven differences between the hybrids, they are arranged by the PhD student as follows: P64LE25> Subaro> LG 59.580> Magma>Arcadia.

To characterize the quality of the seeds, 1000 seeds weight and Hectolitre mass were also analyzed. Significant differences between hybrids are found. The influence of soil stock is ambiguous.

The composition of the oil is also an important quality indicator. The focus of the PhD student is the ratio between saturated and unsaturated fatty acids. A detailed analysis was made for each hybrid separately, as well as for each year of the study.

The dissertation also presents data on the established correlations between both quantitative and qualitative indicators. They are presented tabularly by correlation coefficients, and graphically by Principled Component Analysis (PCA).

6. Conclusions and contributions of the dissertation

As a result of the three-year study, the doctoral student draws 12 main conclusions. They absolutely correctly and adequately reflect the results

obtained. They are interpreted with understanding, after a thorough analysis. They are formulated concisely, clearly, in an appropriate scientific style.

All this forms the final impression that the doctoral student gives - a graduate researcher, with rich knowledge and accumulated enough experience to organize and conduct research work.

Several scientific-theoretical and scientific-applied contributions have also been formed.

As more important scientific and theoretical contributions I accept the following:

- The influence of soil stock on the stem parameters of the tested hybrids was studied. Hybrids have been identified that develop the lowest stem (Magma) and the highest stem (Arcadia).
- The relationship between the stock of soil with macronutrients and the diameter and density of the head, as well as the number of seeds in it.
- Positive correlations were found between seed yield, oil yield, leaf area, number of seeds in the head, diameter of the head and diameter of the stem, as well as between the fat content and harvest index of the head and seeds.

The scientific-applied contributions are more oriented to the specialists who solve specific technological tasks related to the production of high-yielding and quality sunflower seeds:

- The most productive expert-tolerant hybrid for the conditions of Plovdiv has been established - LG 59.580, followed by P64LE25, Subaro, Magma and Arcadia;
- The share of all plant organs - vegetative and reproductive - in the formation of aboveground biomass has been established, namely: 35% stems, 21% leaves, 17% head and 27% seeds.
- The influence of the higher stock of soil with macroelements on the 1000 seeds weight, the hectolitre mass and the fat content in the seeds has been established. The P64LE25 hybrid stand out as the highest oil, followed by Subaro, LG 59.580, Magma and Arcadia.
- The average content of saturated (15%) and unsaturated (85%) fatty acids was found in the studied express-tolerant hybrids. The Magma variety has the lowest content of saturated and the highest of unsaturated fatty acids, and the Subaro variety has the highest content of saturated and the lowest of unsaturated fatty acids.

7. Critical remarks and questions

The dissertation meets all the requirements for such scientific work. It is structured correctly, the experiments are performed correctly, the results are analyzed in depth. The style and language are free of technical and other errors.

I would like to make two remarks:

1. The data obtained from biometric measurements, very well presented in figures and tables, could be quoted in the text more generally and briefly.

2. The first formulated scientific-applied contribution may not include the first sentence. The same sounds very trivial and does not bring new information.

I also have a question that I hope the PhD student will take as a challenge:

1. Please explain to the scientific jury the principal component analysis of the quantitative indicators in sunflower, presented in fig. 27.

8. Published articles and citations

In order to meet the minimum national requirements for awarding the educational and scientific degree "Doctor" and the requirements of the Regulations for the development of the academic staff at the Agricultural University, the doctoral student must have published his results in scientific journals.

A reference is presented for an independent publication, which brings the required number of points to Adelina Garapova, according to the minimum requirements. The article is in a prestigious journal, which is referenced and indexed in world-famous databases of scientific information (Web of Science). It was published in 2020 and presents the main results obtained from the first two research years.

There is no information about the cited in the report. I believe that this requirement is not applicable for such a short period after publication! A preliminary version of the Abstract is also attached. It fully reflects the content of the dissertation and can be printed.

CONCLUSION

Based on the different research methods learned and applied by the doctoral student, correctly performed experiments, summaries and conclusions, I accept that the presented dissertation meets the requirements of Law of the Development of Academic staff in the Republic of Bulgaria and the Rules of the Agricultural University for its application, which gives me reason to evaluate it POSITIVE.

I allow myself to suggest to the esteemed Scientific Jury to also vote positively and to award Adelina Hristova Garapova the educational and scientific degree "Doctor" in the scientific specialty of Plant Growing.

Date: 21 April 2021
Plovdiv

REVIEWER: .....
(Prof. Dr. Tonya Georgieva)