



REVIEW

of the dissertation work for acquiring the educational and scientific degree of Doctor, area of higher education 6. Agrarian Sciences and Veterinary Medicine; professional field 6.1. Crop Science; scientific specialty: Crop Science

Author of the dissertation work: Radko Petrov Hristov, a part-time doctoral student in the Crop Science Department at the Agricultural University of Plovdiv.

Title of the dissertation work: "Influence of Some Leaf Treatment Products on Yield and Quality of Grain of Common Wheat Varieties"

Reviewer: prof. Ivan Hristov Yanchev, PhD, Agricultural University of Plovdiv (AU Plovdiv), area of higher education: 6. Agricultural Sciences and Veterinary Medicine; professional field: 6.1. Crop Science; scientific specialty: Crop Science, appointed a member of the scientific panel according to Order № РД-16-263/14.03.2022 by the Rector of AU Plovdiv.

1. Brief biographical data of the candidate.

Radko Petrov Hristov was born on 15.09.1987. In 2010 he obtained the educational and qualification degree of Bachelor of Plant Protection, and in 2012 – a Master degree of Plant protection at AU Plovdiv.

From 2012 to 2016 he worked as a product manager in Bulagro AD – Stara Zagora. From 2016 to 2019 he was in the Operative Marketing Department /development of new products for the Bulgarian market/, and since November 2019 up to the present he has been working as a product manager – wheat and rape-seed for Bayer Bulgaria. The candidate has very good level of spoken and written English language competence.

2. Actuality of the problem

There are publications in the scientific literature that prove the great possibilities for regulation of the productivity and quality of common wheat due to detailed research of the biological requirements of new varieties, as well as the influence of ecological factors for their activity. It gives opportunities for yield regulation depending on soil and climatic conditions, as well varietal composition of common wheat.

The actuality of the presented scientific research is related to Bulgaria, being an EU member state, which is a serious motivation for the performance of research studies on the selection of new Bulgarian and foreign common wheat varieties, as well as their specific reaction towards leaf treatment products at particular conditions.

A number of research studies have reported data to prove that some examined common wheat varieties differ by their reaction toward some mineral leaf fertilizers and organic bio-stimulators.

Other studies do not give any data for qualitative and quantitative changes of nutrients in plants after their treatment with different products for leaf application.

There have been not enough studies on new mineral leaf fertilizers enriched in microelements and organic bio-stimulators on common wheat yield after treatment – individual and in combination with leaf bio-active substances, as well as with macro and micro-fertilizers.

Studies, related to quantity factors, as well as grain quality factors of common wheat, are timely and useful for theory and practice and for production increase of this valuable raw material used for the population living.

3. Aim, tasks and methods of the research study.

Aim - to establish the influence of Plantafol and Bombandier leaf treatment products on grain yield and quality of common wheat varieties: Enola, Anapurna, Ginra and Bilyana.

Tasks – to establish the influence of Plantafol and Bombandier leaf treatment products on growth of common wheat varieties: Enola, Anapurna, Ginra and Bilyana, on yield structural elements, on productivity, and their influence on the qualitative grain indicators /physical and chemical/ of these common wheat varieties.

In order to achieve the given aims and tasks, three-year field experiments were performed for the period 2016-2019.

The experiment was set on the Training and Experimental Field of Crop Science Department by the method of fractional parcels in four repetitions with size of the crop parcel - 15 m².

Studied factors and their levels

Factor A – variety: A₁ – Enola (standard); A₂ – Anapurna; A₃ – Ginra; A₄ - Bilyana

Factor B – leaf treatment products: B₀ – control (untreated and unfertilized); B₁ – control (untreated and fertilized); B₂ - Plantafol – 250 g/da; B₃ – Bombandier – 400 ml/da; B₄ – Plantafol (250 g/da) + Bombandier (400 ml/da)

The application of Plantafol and Bombandier leaf treatment products was performed individually and in combination in the following stage of wheat growth - end of tillering and beginning of jointing (29-31 by Zadoks` scale).

Phenology observations

The main phenology stages were registered by Zadoks` scale (shooting (Z10), tillering (Z22), jointing (Z31), boot stage (Z57), maturing (Z94)).

Morphological observations

– they were performed on 1/4 m² in 4 repetitions; - tillering was done in the autumn – number of plants m²;

- at the beginning of tillering – number of plants and number of tillers per m²;

- at jointing – number of main stems per m²;

- at maturing – plant height (from 10 plants), number of main stems per m².

The morphological features were analyzed with relation to the influence of the preparations towards the untreated and unfertilized controls individually.

Structural elements of yield

- ear length, cm; - number of ears per ear, number; - number of grains per ear, number

- mass of grains in an ear, g

Grain yield, kg/da (estimated toward standard grain moisture (13%).

Physical indicators of grain

- mass of 1000 grains, (g) – with weighing 2 samples per 500 grains;
- hectoliter mass, (kg) – with a pair of scales;

Biochemical analysis of grain

- content of protein in grain - in % by Keldal;
- content of wet and dry gluten in grain - in % with a gluten-washer;
- content of starch - in %
- content of fats - in %.

Physiological analyses

- leaf gas exchange; - chlorophyll fluorescence; - photosynthetic pigments (by Lichthentaler, 1987)

Mathematical data processing

In order to establish the influence of leaf treatment on the studied elements, data were processed by ANOVA method. Mathematical data processing from the conducted experiments was performed with SPSS-16 program. A dispersion analysis was applied in order to be done statistical evaluation for the presence or the lack of proven differences with relation to the studied features for each variety, as well as for all possible combinations between the levels of the studied factors. The multi-rang test of Dunkan was used in order to establish differences between the examined options at the smallest significant margin (LSD) – 0,05 (5%).

4. Illustration and presentation of the received results

Taking into account the volume and structure of the separate chapters of the dissertation works, it meets the requirements for acquiring the educational and qualification degree of Doctor.

The present dissertation work consists of 154 pages: introduction – 2 pages, literature preview – 26 pages; actuality of the issue – 2 pages; aim and tasks – 1 page; methodology of the experimental work – 15 pages; agro-machinery – 1 page; soil and climatic conditions – 7 pages; results and discussion – 78 pages; conclusions and contributions – 5 pages; references – 12 pages. The dissertation work is illustrated with 49 tables, 9 photographs, 1 figure and 1 scheme, which are appropriately formed and gave useful information. The dissertation work is well structured; it contains all necessary chapters and corresponds to the claimed aims and tasks. It was written on good standard and terminological language. It contains scientific and scientific-applied results, which represent original contribution in science. It is evident that the candidate possesses thorough theoretical knowledge by the scientific specialty Plant Science and is able to provide individual research.

5. Discussion of results and references

Results and Discussion chapter is presented on 78 pages. It includes 4 subchapters. The previous chapter comprehensively describes the methodology of experiments, the indicators under analysis, the used methods. Result discussion is done in sections. They are generalized in 10 conclusions at the end of the dissertation work.

In subchapter 1 entitled Influence of Treatment with Mineral Leaf Fertilizers Enriched with Microelements and Leaf Bio-stimulators on the Structural Elements of Wheat Yield it was established that maturity stage continued between 41-46 days in 2016/2017, 43-45 days in 2017/18 and 45-48 days in 2018/19.

All varieties had similar maturity stages and do not differ considerably from each other. A reason for this is that the tested varieties – Enola, Anapurna, Ginra and Bilyana – are early-mature in average, and being cultivated under equal climatic conditions they mature identically.

Regarding the number of shooting plants, the highest number was for Anapurna wheat variety with 403,76 plants in average, followed by Bilyana variety with 375,32 plants, Enola variety with 359,4 plants and Ginra with 345 plants per m². The number of shooting plants secures crop potential and yield from the beginning of wheat cultivation. Regarding the number of dormant plants in the winter period, variation was as follows: for Bilyana variety - 82 %, for Ginra variety – 90%, for Anapurna variety – 95%, for Enola variety – 95%. The survival rate of the examined wheat varieties was determined as very good taking into account the conditions of the experimental period. The highest tillering ability had Anapurna variety with 616 брата/м² averagely for the three test years, followed by Enola with 550 tillers/ m², Ginra with 509 tillers/ m² and Bilyana with 500 tillers/m². The highest productive tillering had Ginra variety with 441 stems/ m² followed by Enola with 434 stems/ m², Anapurna with 431 stems/ m² and Bilyana with 419 stems/ m².

In subchapter 2 entitled Structural Elements of Yield it was proved that for Enola variety the greater number of ears was registered in variants treated with Plantagol and the combination Plantafol+Bombandier. The lowest value was registered for the untreated and unfertilized control (B₀). The highest value of this element was reported in the combined application of both preparations for Anapurna variety. Taking into account Ginra variety, it was established that the untreated control (B₁) had higher reveal of this feature. All differences towards B₀ and B₁ in Bilyana variety were unproven, which showed no considerable difference of feature's reveal due to the tested leaf treatment products. The most significant difference was reported for Ginra variants, which were not treated with the leaf treatment products, as well as Enola variants, treated with the combination of both products and with Plantafol.

One of the features directly related to grain yield is the number of grains per ear. For Enola variety it was proven that the highest number of grains was received at individual and combined application of both products. For Anapurna variety a higher value of this feature was reported when the variants were treated in combination and individually with Bombandier preparation compared to the reported value of the untreated and unfertilized control. All other differences were non-significant. For Ginra variety it was also proven the difference between the plants with individual application of Bombandier and the untreated and unfertilized control. For Bilyana variety it was not established considerable difference in this indicator. The most significant influence was reported for Anapurna variants treated with Bombandier, as well as those treated in combination of both products compared to the untreated variant. All varieties treated with leaf treatment products were influenced positively and showed higher results.

The indicator Mass of Grains per Ear has a leading role in the formation of yield. For Enola variety it was established that the individual and combined treatment of the variants with the leaf products led to higher values of this indicator compared to both controls – B₀ and B₁. The same influence was reported for Anapurna variety. Higher values of the indicator were reported in the individual and combined application of the leaf products. Ginra variety also reacted positively to the combined application of both products, although the differences towards the controls were insignificant. For Bilyana variety there was reported a greater mass of grains per ear for the variant treated with Bombandier compare to B₀. The most significant influence was reported for anapurna variety treated with the combination of bothe products, as well as the variant treated with Plantafol.

Chapter 3 was entitled Influence of the Application of Mineral Leaf Fertilizers

Enriched with Microelements and Leaf Bio-stimulators on Wheat Productivity.

For Enola variety the highest yields were established after the combined and individual application of the leaf products. The differences towards both controls were statistically proven.

The same was reported for Anapurna variants. The highest yield was established after the combined application of Plantafol+Bombandier, followed by the variants treated individually with Plantafol and Bombandier.

For Ginra variety the higher yield was reported for variants treated individually and in combination with the tested leaf products compared to both controls. Differences were statistically insignificant. For Bilyana variety a higher yield was reported for the variant treated with the combined leaf products, followed by the variants treated individually.

Results from the mathematical processing proved that Anapurna variety had the highest average yield after the combined treatment with the leaf products, as well as after their individual application. Anapurna was followed by the variants treated individually with the products. For Enola variety the combination Plantafol+Bombandier led to a higher yield.

Subchapter 4 was entitled Economic and Technological Features of Common Wheat Grain. Variants of Enola variety had higher values of the indicator Mass of 1000 grains when treated with Bombandier and the combinations of both products. A higher mass of 1000 grains was registered for the variants of Ginra variety when treated with Bombandier and the combination of both preparations compared to the control B₀.

With relation to Bilyana variety, the differences regarding this indicator were statistically proven for the variants treated individually with Bombandier, as well as in combination of both leaf products. The highest results regarding the mass of 1000 grains were reported for Anapurna variety, as well as for Ginra, treated with the combination Plantafol+Bombandier. The applied leaf products upon Enola variety had positive influence on the hectolitre mass, especially after the individual treatment with Bombandier. For Anapurna variety it was established that the combined application of the leaf preparations had significant influence on the hectolitre mass. The influence of Plantafol was also proven. Higher values in the variants of Ginra variety were reported after the individual and combined treatment of the leaf products. Plantafol influenced variants compared to the control B₀. For Bilyana variety the difference between the combined influences of the studied factors towards both controls was proven at a level of significance P 5%.

Content of nitrogen, proteins and gluten in Enola variety increased compared to the control after treatment with Plantafol, as well as in combination Plantafol+Bombandier. A positive effect on the content of these indicators for anapurna variety was observed after treatment with Bombandier and the combination Bombandier+Plantafol. The individual application of Plantafol and Bombandier and in combination for Ginra variety led to the increase of the content of nitrogen, proteins and gluten. For Bilyana variety Plantafol application, as well as the combined application, also led to the increase of the examined indicators. Plantafol and Bombandier leaf treatment products improved the physiological processes (photosynthesis in particular) and grain quality for the four wheat varieties – Enola, Anapurna, Ginra and Bilyana. There were observed varietal differences within the examined indicators as a result of leaf product application.

The literature Review includes 79 titles, 3 of them in Cyrillic, and the rest – in Latin. The literature information gathered by the doctoral student Radko Hristov influenced the exact formulation of the aim and tasks, as well as the correct approach for the relevant solutions. The literature review related to the factors influencing growth, productivity and quality of common wheat grain was thorough and analytical. The literature review ranged a long period – from 1991 to 2020.

6. Conclusions and contributions of the dissertation work

The received results are exposed in 10 conclusions, which review the main achievements of the doctoral student. They are well structured and fairly reflect the received results. The conclusions give answer to the set tasks of the dissertation work in order to achieve the research aim.

The doctoral students have formulated the following scientific and scientific-applied contributions:

Scientific contributions

It has been established the influence of Plantafol and Bombandier leaf treatment products on growth of common wheat varieties: Enola, Anapurna, Ginra and Bilyana, on the structural elements of yield, on the productivity and quality of grain /physical and chemical/.

Scientific-applied contributions

It has been established the productivity of common wheat varieties; Enola, Anapurna, Ginra and Bilyana under the influence of individual and combined application of the tested leaf treatment products – Plantafol and Bombandier. It has been proven the positive effect of the products, being applied individually or in combination, on the examined indicators, which values were higher compared to the untreated control values. There have been established the optimal combinations between the tested wheat variety and the applied leaf treatment products depending on its biological features and the meteorological conditions during the vegetation period. Results give opportunities for future application of Plantafol and Bombandier products in the cultivation technology of the studied common wheat varieties Enola, Anapurna, Ginra and Bilyana.

7. Critical notes and enquiries

There have been cited few Bulgarian authors – twenty in number. There are many other Bulgarian authors who examine leaf treatment products application on common wheat.

On page 132 there have been cited publications of Asad and Rafique, 2002; Zeidan et al., 2010; Khan et al., 2010; Gomaa et al., 2015, Rawashdeh and Sala, 2015, which have not been mentioned in References chapter.

The above mentioned notes do not aim at decreasing the advantages, achievements and contributions of the dissertation work. They aim at helping the candidate in his future development in the research work.

I would like to recommend the candidate to continue his research studies taking into account separate units of the cultivation technology of new common wheat varieties in the conditions of different regions in Bulgaria.

8. Published research papers and citations

With relation to the dissertation work, the doctoral student Radko Hristov has been submitted 7 publications, 5 of which individual (2 in Journal of Mountain Agriculture on the Balkans; 1 in „Research works of СУБ-Plovdiv“; 2 in Zemedelie plus Journal); 1 in collaboration with other authors in Scientific Papers. Series A. Agronomy; 1 in collaboration in Journal of Mountain Agriculture on the Balkans. Radko Petrov Hristov has participated in five scientific forums (two international conferences in Romania – 2019 и 2020 г.; two conferences with international participation in в ИПЗЖ Troyan - 2019 и 2020 г.; one anniversary scientific session of СУБ Plovdiv.

There have no information whether the above mentioned publications have been cited up to the present.

The presented author's summary fairly reflects the structure and contents of the dissertation work.

CONCLUSION:

Taking into account the adopted and applied research methods by the doctoral student, the correctly performed experiments, the given conclusions, I consider that the presented dissertation work meets the requirements of the Act for Academic Staff Development in the Republic of Bulgaria, as well as the Regulations for its application of the Agricultural University of Plovdiv. It gives me grounds to evaluate it **POSITIVELY**.

I allow myself to propose to the honourable scientific panel to vote positively and to award Radko Petrov Hristov the educational and scientific degree of Doctor in the scientific specialty Plant Science.

Date: 21.04.2022
Plovdiv

Подписите в този документ са заличени

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