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RESEARCH ON THE EFFECTIVENESS OF TREATMENTS IN COMBATING WHEAT DISEASES AT THE AGRONOMIC RESEARCH AND DEVELOPMENT STATION MOARA DOMNEASCA

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SUMMARY

of the doctorat thesis entitled:

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The progress made in wheat cultivation technology and the climatic changes of the last years motivated the research on the diseases and pathogens frequent in the wheat crop during the research period and the pathology of the wheat seed with an impact on the effectiveness of the phytosanitary measures undertaken in the experimental location.

The economic importance of wheat cultivation for the agriculture of the countries that lend themselves to the cultivation of this plant and the market requirements of wheat, research on specific and frequent diseases every year, such as powdery mildew, leaf septoria in the southern part of the country, fusariosis of the ears and the condition of seed health require permanent attention in agricultural research. Also, the effectiveness of phytosanitary interventions is an important indicator for the establishment of integrated technological schemes of agricultural crops. Knowing the impact of diseases on wheat production and the importance and role of research carried out in the chosen location, in the doctoral thesis researches have been carried out on the attack of the most frequent wheat diseases in the area of the Teaching and Research Station - Agronomic Development from the USAMV in Bucharest, under the aspect of monitoring the diseases detected in wheat, the effectiveness of intervention measures in the vegetation on them, an analysis of the state of health of the seeds of two genotypes grown in the experimental location, the effectiveness of the treatment in combating the seminal mycoflora, the impact of the pathogen attack on wheat production, the influence of variety and treatment factors and their interaction on it.

The purpose proposed in the realization of the doctoral thesis was to carry out some research on the effectiveness of seed and vegetation treatments used in the research location on wheat diseases in the cultivated varieties during the experimentation period.

To achieve the proposed goal, the following objectives were taken into account:

- presentation of detected diseases;
- identification of the etiological agents involved in the occurrence of the observed diseases;
- determining the attack of diseases in the analyzed genotypes;
- calculating the effectiveness of the treatments applied in the vegetation in the control of the detected diseases;
- the influence of the treatments on the obtained productions;
- analysis of the phytosanitary state of the wheat seed used within the unit;
- establishing the pathogenic mycoflora of wheat seeds in cultivated varieties;
- effectiveness of seed treatment;
- establishing biological parameters for *Fusarium* spp. fungi;
- statistical analysis of the obtained results;

The experiences placed within the wheat culture in the experimental location highlighted the diseases that occur year by year in the wheat culture within the Didactic and Research-Development

Station within the USAMVB, located in an area suitable for wheat culture and the evaluation of the effectiveness of the measures intervention applied within the unit that can be presented for study and application to those interested. In vivo research on the attack of foliar pathogens *Blumeria graminis* f.sp. *tritici* and *Zymoseptoria tritici* and of *Fusarium* spp. spikes were completed with in vitro research on wheat seed pathogens, their identification, incidence and effectiveness of seed treatment from light disinfection to chemical treatment. Laboratory research on the biological requirements of Fusarium fungi in relation to some abiotic factors such as culture media, temperature, light, completes the research on seed pathology, we consider them useful for establishing measures in agricultural practice. We believe that the research undertaken has a scientific and applied nature and completes the information regarding the attack of some pathogens present in the wheat crops in the area and makes important contributions regarding the reaction of the varieties analyzed under the conditions of the area and the experimental period to the attack of the monitored pathogens. Research on the effectiveness of the products used in the seed and in the vegetation constitutes a benchmark in their choice and the impact on diseases and wheat production. The thesis makes important contributions regarding the prioritization of the effectiveness indicator in the selection of products for combating plant diseases, realizing an integrated interpretation of combating diseases, which can ensure an originality and novelty, starting from the protection of the seed to ensuring the protection of the crop in vegetation of wheat. The data presented in the thesis regarding the products used, their effectiveness in the therapy of the detected diseases, the statistical analysis of the influence of variety and treatment factors on production have the character of applied research that is directly addressed to the farmers of the area. The applied research carried out in the framework of the thesis on the evaluation of the effectiveness of phytosanitary measures in combating wheat diseases within the Didactic and Agronomic Research-Development Station of USAMVB presents a scientific as well as an applied character and is supported by relevant laboratory studies. The doctoral thesis includes two parts: the first part, which presents the bibliographic study on the researched subject and the second part, dedicated to own research.Part I of the thesis includes Chapter I "The state of knowledge of the main foliar and ear diseases of wheat" which presents synthetically scientific data from the specialized literature regarding the most important diseases of wheat. Data are presented regarding the manifestation of the disease, the causative agent, information about the spread and transmission of the disease, the favorable conditions and the control possibilities for each analyzed disease.The second part of the thesis, named "Own research" includes the purpose and objectives of the work, the natural setting in which the research was carried out, the material and working method, calculation formulas used, the statistical analysis of the data obtained and their interpretation, the research carried out in in vivo and in vitro conditions for the monitored pathogens, general conclusions and recommendations, bibliography and annexes provided.

Chapter II, The natural framework in which the research was carried out, presents the natural conditions of the Moara Domnească Agronomic Teaching and Research-Development Station during the research period.

In the third chapter, Material and working methods, the research methods used in the macroscopic diagnosis of the analyzed diseases and microscopic of the pathogens responsible for their triggering, the calculation formulas used in determining the frequency, intensity and degree of attack, the calculation the effectiveness of the treatments applied to the vegetation and to the seed, the organization of the experiments, such as the monitored genotypes, in field and laboratory conditions and the statistical calculation method.

Chapter IV, Results and discussions, includes the own results obtained after carrying out research in field and laboratory conditions. The researches regarding the manifestation of the observed diseases, leaf septoria, powdery mildew and fusariosis were carried out on the basis of concrete observations, which complete the clinical picture of the pathology of the identified diseases and are accompanied by original figures from the experimental field that support the described symptoms. Microscopy research was carried out with high-performance equipment and identified the specific fruiting of the analyzed pathogen.The research carried out in 2014/2015, on the varieties grown on site and analyzed and in the monitored experiments, highlighted powdery mildew attack and leaf septoria. The powdery mildew attack on the control variant recorded an incidence of 74% in the Boema variety and 82% in the Glosa variety. The intensity of the attack had values of 18% in Boema and 16% in the Glosa variety, which led to

levels of the powdery mildew attack of 13.3% in the Boema variety and 13.1% in Glosa, noting that the two varieties showed value differences regarding the incidence and intensity of the attack. Septoriosis attack was manifested with a frequency of 86% in the Boema variety and 89% in the Glosa variety and with relatively close intensity values of 24% in Boema and 22% in Glosa, resulting in attack levels of 20.6% and respectively 19.5%. This year, treatments were applied with the products Tebucur 250 EW 0.5l/ha and Topsin 1.25l/ha so that, following the observations made after the application of the treatments, an effect was found to reduce the frequency of the mealybug attack to 44% in the variety Boema and 38% in Glosa and the intensity decreased to 9.5% in the Boema variety and 10.2% in the Glosa variety. After applying the treatments, the septoria attack reached frequency values of 56% and 54% in the varieties analyzed and the intensity was reduced to values of 18.5% in Boema and 17.5% in Glosa. It was found that the product acted well on the incidence of septoria attack.The observations made in the experimental year 2015/2016 confirm the presence of powdery mildew and septoriosis attack this year as well, with frequency values of 65% for powdery mildew in the Boema variety and 72% in the Glosa variety. The intensity values were 20% for Boema and 15% for the Glosa variety. The level of the flouring attack was 13% and 10.8% respectively in the untreated variants. *The Zymoseptoria tritici* attack was manifested with values of 70% in the case of the Boema genotype and 75% in the Glosa and the intensity of the attack was 20% in the Glosa variety and 25% in the Boema, determining an attack degree of 17.5% and respectively 15%, for the analyzed varieties. The administration of treatments with Artea 0.4l/ha and Topsin 1.25l/ha decreased the attack of the two pathogens. The incidence of flouring was reduced by 21% and 26% and the intensity to about 6% in the analyzed varieties. Septoriosis attack recorded frequency values of 21% in the Boema variety and 28% in the Glosa variety and the intensity dropped to 13% and 11%, respectively. Compared to the control variant with GA=17.5% in the Boema variety the level of attack was reduced to 2.73% in the treated variant and in the Glosa variety from 15% in the control variant the attack reached 3.1%, after applying the treatments.

In the conditions of 2016/2017, there was also an attack of fusariosis of the ears. The powdery mildew attack had an incidence of 45% in the Boema variety and 58% in the Glosa variety and the intensity was 14% and 12% in the untreated variants of the researched varieties. In the Boema variety, septoria attack occurred with a frequency of 75% and intensity of 17%, and in the Glosa variety, the incidence was 56% and the intensity was 15%. The degree of attack was 12.7% for the Boema variety and 8.4% for the Glosa variety. Fusarium head blight registered a presence of 6% in Boema and 4% in Glosa. The application of treatments with Orius 0.4l/ha and Acanto plus 0.5l/ha decreased the level of attack on the detected pathogens. Thus, the flouring attack was significantly reduced in both varieties. In the case of the Boema variety, the attack level reached 1% and in Glosa the attack was 1.6%. Septoriosis of the leaves registered values of the degree of attack of 3.4% in the Boema variety compared to the control variant with 12.7% and 2.4% in Glosa compared to the control with 8.4%. The incidence of fusarium attack was 2% in both varieties, after applying the treatments. The research on the effectiveness of the treatments applied in the vegetation found that the application of the treatments in the conditions of the year 2014/2015 had effectiveness values that reached 71.22% for the Boema variety in controlling powdery mildew and 73.28% in combating the same disease for the Glosa variety. Septoriosis control was 79% effective for the Boema variety and 71% for the Glosa variety. In the conditions of the year 2015/2016, the effectiveness increased, being over 93% and 86% in combating powdery mildew in the Boema and Glosa varieties, respectively, and 84% in Boema and 79% in the Glosa variety, in combating septoriosis. In the fight against the two pathogens, the application of the two treatments in the conditions of 2016/2017 had the effectiveness of 84.12% and 77% in the therapy against powdery mildew in the two varieties and over 73% and 71% in the control of septoria. Fusarium wilt control was 50% in the Glosa variety and 66.6% in the Boema variety.The results of the research on the influence of the treatments and the variety on the production of the wheat crop in the pedoclimatic conditions of the Moara Domnească Farm: *The influence of the treatments (factor A) on the productions obtained in the wheat crop in the pedoclimatic conditions of the Moara Domnească Farm, in the agricultural year 2014 - 2015*: from analysis of the data regarding the influence of crop protection treatments in the vegetation (Factor A) on the productions obtained in the wheat crop, it was found that the productions varied between 2150 kg/ha in a_1 variant without application of treatments in vegetation and 4600 kg/ha in the variant a_2 at which treatments were applied.

From a statistical point of view, it can be seen that the application of the treatments led to a very significant increase in production of 2400 kg/ha. *The influence of the variety (B factors) on wheat production in the pedoclimatic conditions of the Moara Domnească didactic farm in the 2014/2015 agricultural year*: from the analyzed data it was found that under the influence of the variety (B factor) the productions varied between a value of 3200 kg/ha to a_1 - the Boema variety and 3400 kg/ha for b_2 - the Glosa variety. Compared to the Boema variety, the Glosa variety obtained an increase in production that is not statistically ensured. In conclusion, it can be said that between the two varieties tested there were no statistically ensured production differences, the varieties having potential for the cultivation area. *The influence of the treatments applied in the vegetation on the production of wheat in the pedoclimatic conditions of Moara Domnească in the agricultural year 2014 /2015 for the same variety (Interaction A x B)*: the analysis of the effect of the application of the treatments on the production of the wheat crop shows that for the variety Boema the productions varied between 2100 kg/ha in a_1 – control and 4300 kg/ha in a_2 to which treatments were applied. From the analysis of the influence of the application of the treatments on the production of the wheat crop, it is found that for the Glosa variety the productions varied between 22100 kg/ha in the a_1 - untreated and 4600 kg/ha in the a_2 to which the treatments were applied. The application of the treatments resulted in a very significant increase in production of 2400 kg/ha. *The influence of the cultivated variety on wheat production in the pedoclimatic conditions at Moara Domnească in the 2014-2015 agricultural year for the same treatment applied for plant protection (Interaction B x A)*: the analysis of the effect of the variety on the production of the wheat crop shows that in a_1 –control , productions varied between 2100 kg/ha - Boema variety and 2200 kg/ha - Glosa variety. Compared to the b_1 - Boema, the variety b_2 - Glosa recorded a production increase of 100 kg/ha. From the analysis of the influence of the cultivated variety on the production of the wheat crop, it is found that in a_2 - cu, the productions varied between 4300 kg/ha in b_1 - variety Boema and 4600 kg/ha in b_2 - variety Glosa. Comparing the productions obtained by the Boema variety with those obtained by the Glosa variety under the conditions of application of the treatments, it is found that the Glosa variety presented a significant increase in production of 300 kg/ha compared to the Boema variety.*The influence of the treatments (factor A) on the productions obtained from the wheat crop in the pedoclimatic conditions of the Moara Domnească Farm, in the 2015-2016 agricultural year*: the analysis of the data on the influence of the treatments (Factor A) on the productions obtained from the wheat crop found that the productions varied between 2235 kg/ha in variant a1 without application of and 4600 kg/ha in a_2 to which treatments were applied. Statistically, the treatments lead to a very significant increase in production , 2365 kg/ha. *The influence of the variety (Factors B) on wheat production in the pedoclimatic conditions of the Moara Domnească teaching farm in the 2015-2016 agricultural year*: under the influence of the variety (Factor B) the productions varied between a value of 3360 kg/ha for a_1 - the Boema variety and 3475 kg/ha for b_2 - the Glosa variety. Compared to the Boema variety, the Glosa variety obtained a production increase, which is not statistically ensured. In conclusion, it can be said that there were no statistically assured production differences between the two varieties tested. *The influence of treatments applied on wheat production in pedoclimatic conditions from Moara Domnească in the 2015-2016 agricultural year for the same variety (Interaction A x B)*: analyzing the effect of applying the treatments on the production of the wheat crop, it was found that variety Boema productions varied between 2,220 t/ha in a_1 and 4,500 t/ha in a_2 which treatments. The application of the treatments led to a very significant increase in production of 2365 kg/ha. As a result, analyzing the influence of the application of treatments on wheat crop production, it was observed that for variants b_2 - the Glosa variety, the productions varied between 2,250 t/ha in a_1 and 4,700 t/ha - a_2. The application of the treatments resulted in a very significant increase in production of 2450 kg/ha. *The influence of the cultivated variety on wheat production in the pedoclimatic conditions at Moara Domnească in the 2015-2016 agricultural year for the same treatment applied for plant protection (Interaction B x A*): analyzing the data from this year, regarding the effect of the variety on the production of the wheat crop, it is found that in a_1 - without treatments, the productions varied between 2220 kg/ha in b_1 - variety Boema and 2250 kg/ha in b_2 - variety Glosa. Compared to the variety b_1 - Boema, the variety b_2 - Glosa recorded an increase in production of 30 kg/ha, an increase that is not statistically ensured. From the analysis of the influence of the cultivated variety on the production of the wheat crop, it is found that in a_2 - with treatments, the productions varied between 4500 kg/ha to variety Boema, 4700 kg/ha to

variety Glosa. Comparing the productions obtained by the variety Boema with those obtained by the variety Glosa under the conditions of the application of plant protection products during the growing season, it is found that the variety Glosa showed a production increase of 200 kg/ha compared to the Boema variety, this increase is not statistically ensured.

The influence of the treatments (factor A) on the productions obtained from the wheat crop in the pedoclimatic conditions of the Moara Domnească Farm, in the 2016-2017 agricultural year: analyzing the data on the influence of the treatments (Factor A) on the productions obtained from the wheat crop, it is found that the productions varied between 2290 kg/ha in variant a_1 without application of treatments and 4775 kg/ha in variant a_2 to which treatments were applied. From a statistical point of view, it can be seen that the application of plant protection treatments led to a very significant increase in production of 2485 kg/ha. *The influence of the variety (factors B) on wheat production in the pedoclimatic conditions of the Moara Domnească teaching farm in the 2016-2017 agricultural year:* from the analyzed data it was found that under the influence of the variety (Factor B) the productions varied between a value of 3515 kg/ha to a_1 - the Boema variety and 3550 kg/ha for b_2 - the Glosa variety. Compared to the Boema variety, the Glosa variety obtained a production increase which is not statistically ensured. In conclusion, it can be said that between the two varieties tested there were no statistically guaranteed production differences. *The influence of the treatments applied on the production of wheat in the pedoclimatic conditions at Moara Domnească in the agricultural year 2016-2017 for the same variety (Interaction A x B)*: analyzing the data on the effect of applying the treatments on the production of the wheat crop, it was found that for b_1 - the Boema variety the productions varied between 2280 kg/ha in a_1 - untreated and 4750 kg/ha in variant a_2 to which treatments were applied. The application of the treatments led to a very significant increase in production of 2470 kg/ha. From the analysis of the centralized data regarding the influence of the application of the treatments on the production of the wheat crop, it was found that for b2 - the Glosa variety, the productions varied between 2,300 t/ha in a_1 – control , 4,800 t/ha in a_2, treat. The application of the treatments increased production by 2,500 t/ha, very significantly. *The influence of the cultivated variety on wheat production in the pedoclimatic conditions at Moara Domnească in the 2016-2017 agricultural year for the same treatment (Interaction B x A):* regarding the analysis of the data obtained on the effect of the variety on the production of the wheat crop, it was found that in a1 - without treatments, productions varied between 2280 kg/ha in b_1 - Boema variety and 2300 kg/ha in the b_2 variant - Glosa variety. Compared to b_1 - Boema, the variety b_2 - Glosa recorded an increase in production, an increase that is not guaranteed statistically. From the analysis of the influence of the cultivated variety on wheat production, it was found that in a_2 - with fungicides applied during the growing season, the productions varied between 4750 kg/ha in b_1 - Boema variety and 4800 kg/ha in b_2 - Glosa variety. Comparing the productions obtained by the Boema variety with those obtained by the Glosa variety under the conditions of application of the treatments, it was found that the Glosa variety showed a production increase of 50 kg/ha, compared to the Boema variety, this increase not being statistically ensured. In laboratory conditions, the pathogens responsible for the occurrence of diseases in the field were identified and the mycoflora of the seeds from the Boema and Glosa genotypes was investigated, finding that the mycoflora of the seeds was composed in higher proportions of fungal species of the genera *Alternaria, Aspergillus, Fusarium*. Seed treatment was 80-100% effective in combating seed pathogens. Research on the development of Fusarium fungi has shown that these micromycetes develop well at temperature values between 20 and 24 0C, it has no major preferences regarding the analyzed culture media, with the observation that it developed more abundantly than PMA media and PDA, forming a looser vegetative mass on the Czapeck medium, however, metabolized the monitored media. The vegetative growth of the fungus depending on the light/dark alternation parameter, it was found that it preferred the 16 hours of light/8 hours of darkness, where it developed the largest colonies. Research on the biological thresholds of fungi can have implications in agricultural practice when establishing interventions in cultivation technology.

Chapter V includes the general conclusions and recommendations resulting from the research undertaken.

The thesis comprises a total of 149 pages with 20 tables of which 18 are original and 56 figures of which 41 are original. The bibliography cites 165 references from specialized literature to which 19 are also web sources.