

THE EFFECTIVENESS OF TREATMENTS IN THE CONTROL OF WHEAT DISEASES, MOARA DOMNEASCA LOCATION, ILFOV COUNTY

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Abstract

Our research aimed to determine the effectiveness of treatments in the control of wheat diseases between 2015-2019 at the Moara Domnească Didactic Resort, Ilfov County located in South Romania. Based on the data on monitoring the attack in the control and treated variants, the effectiveness of the treatments applied in the vegetation was determined. Observations were made on Glosa and Boema varieties in 2015-2017 and on Katou, Pitbul and Jaguar varieties in 2017-2019, for the pathogens *Blumeria graminis* f.sp. *tritici*, *Zymoseptoria tritici*, *Septoria spp.*, (FA), *Fusarium spp.* and *Puccinia recondita*. The effectiveness of the applied treatments was 90.7% in powdery mildew control (Boema variety, 2015/2016), 90% in septoria control (Jaguar variety, 2018/2019, 73% Boema variety 2016/2017), 66.6% in fusariosis control (Boema variety, 2016/2017), 73.3% in brown rust control (Jaguar variety, 2028/2019).

Key words: wheat, pathogens, variety, degree of attack, effectiveness.

INTRODUCTION

Wheat is the most important of the cultivated plants and one of the staple foods for the whole planet (Bilteanu, 1991; Muntean et al., 2003; Figueroa et al., 2018), a main source of calories and plant proteins (Curtis et al., 2002). The main source for the preparation of bread, wheat is given special and permanent attention in agricultural research. The state of health of the wheat crop has preoccupied and continues to concern the fundamental and applied research, in order to obtain high, stable and high quality productions. The impact of treatments on the attack of pathogens and wheat production is one of the preventive and curative measures that ensure the stability of wheat production. Wheat is attacked by a significant number of pathogens, including micromycetes *Blumeria graminis* f. sp. wheat, fungi of the genus *Septoria* spp. (teleomorphic forms *Zymoseptoria tritici* and *Parastagonospora nodorum*), *Fusarium* spp., *Puccinia recondita* can occur year after year in crops (Cristea, 2005). Important wheat diseases such as rust, fusariosis, spots caused by pathogenic fungi cause significant production losses every year, leading to better management (Figueroa et al., 2018). In the integrated control of these pathogens, chemical protection is an important

measure, especially in years with favourable conditions or in the case of less resistant genotypes. The presence of pathogens such as *Fusarium* spp. and *Parastagonospora nodorum* on wheat caryopsis can affect the quality of quantitative and qualitative indicators of seeds. Also, the attack of some pathogens can have an impact on the wheat crop technology regarding the crop rotation, reason for which the research of seed pathogens is a goal in the research activity of wheat seed pathology (Raicu and Baciu, 1978). The application of chemicals in the control of wheat diseases is part of their integrated control strategy. The effectiveness of treatments in combating plant diseases is a concern in establishing schemes to combat plant diseases (Cioneag et al., 2015).

MATERIALS AND METHODS

The aim of the research was to calculate the effectiveness of treatments applied in vegetation in the control of pathogens *Blumeria graminis* f. sp. *tritici*, *Zymoseptoria tritici*, *Septoria spp.*, *Fusarium spp.* and *Puccinia recondita*, in the period 2015-2019 at the Moara Domnească Didactic Resort, Ilfov County located in South Romania. The biological material was represented by the varieties Boema and Glosa in the agricultural

years 2015/2016, 2016/2017, Katou and Pitbul in the agricultural year 2017/2018 and the varieties Jaguar and Pitbul in the year 2018/2019. Treatments were performed with: Artea 0.4 l/ha (8.04.2016) and Topsin 1.25 l/ha (15.05.2016). The seed was treated with Sponsor 0.5 l/to. In 2016/2017, fungicide treatments were applied as follows: Orius 0.4 l/ha (27.04.2017) and Acanto Plus 0.5 l/ha (19.05.2017) and the seed was treated with Yunta Quattro in a dose of 1.6 l/to. In 2017/2018 the seed was treated with Yunta Quattro in a dose of 1.6 l/to and in the vegetation treatments were applied with Tebucur 0.5 l/ha (11.04.2018) and Falcon Pro 0.8 l/ha (30.05.2018). In 2018/2019, Orius 0.4 l/ha (05.03.2019) and Amistar 2.3 l/ha (13.05.2019) were applied to the vegetation and the seed was treated with Austral Plus 5 l/to. The frequency and intensity of the attack were calculated according to the formulas: Frequency (F%) = $n \times 100/N$, where N = number of plants observed (%), n = number of plants specific symptoms (%). The intensity was noted in percentages and calculated according to the formula: Intensity (I%) = $\Sigma (ixf)/n$ (%), where I = percentage given, f = number of plants/organs with the respective percentage, n = total number of attacked plants/organs. Based on the data obtained in calculating the frequency and intensity, the degree of attack was calculated: GA = F x I/100 (%), where GA = attack degree (%), F = frequency (%), I = intensity (%). The efficacy of the treatments was determined according to the formula E = [Gam-Gav/Gam] x 100 (%) (Abbott 'formulas), in which: Gam- degree of attack on the control variant, Gav- degree of attack on the treated variant.

RESULTS AND DISCUSSIONS

The data in Table 1 show that, in the period 2015-2017, the wheat varieties grown at Moara Domneasca showed a powdery mildew attack, caused by the pathogen *Blumeria graminis* f. sp *tritici*, leaf septoria caused by *Zymoseptoria tritici* (2015-2016), septoriosis (*Septoria* spp.) and fusariosis caused by micromycetes of the genus *Fusarium* (*Fusarium* spp.) whose level and evolution of the attack in the control variant (untreated) have already been published (Iosub et al., 2021). The application of the

treatments with the mixed products T1 (Artea 0.4 l/ha) and T2 (Topsin 1.25 l/ha) reduced the powdery mildew attack on the Glosa variety in 2015/2016 from 10.5% to 1.5%. There was a severe decrease in the frequency of the attack from 72% in the untreated control to 26% after the application of the two treatments. Also, the intensity of the attack was lower, calculating I = 5.5% compared to the control with I = 15%. In the conditions of this year, the presence of the attack of leaf septoria was observed, which reduced its attack to 3.1% after the administration of the treatments compared to the control variant in which the attack was 15%. In the case of the Boema variety, in the control variant GA = 13% and after the application of fungicides with the two treatments the attack decreased to 1.2%. Regarding the attack of *Zymoseptoria tritici*, in the Boema variety the level of the attack decreased to 2.7% after the application of the treatment scheme compared to the variant without treatments with GA = 17.5%. During the year 2016/2017, the cultivated varieties detected an attack of powdery mildew, septoria and fusarium on ears of wheat. The application of treatments with Orius 0.4 l/ha and Acanto Plus 0.5 l/ha was beneficial to the wheat crop. In the Glosa variety, the frequency of the powdery mildew attack reached 24% and the intensity reached 6.5%, resulting in an attack level of GA = 1.6%, compared to the control variant in which GA = 6.9%. Regarding the attack of micromycetes *Septoria* spp. there was a significant decrease in the incidence of the attack with F = 28%, compared to the control variant in which F = 56%. The level of attack was 2.4% after applying the treatments, compared to GA = 8.4% in the untreated plot. Micromycete attack *Septoria* spp. at the Boema variety was 3.4% after the application of the treatments, compared to the untreated variant in which the degree of attack was 12.7%. The value of the attack decreased so much, but especially its incidence, which was 32%, while in the untreated variant it was 75%. Chemical control, which often involves two or three sprays per season, remains the main mechanism for controlling leaf septoria and currently focuses on the use of alternative management strategies (Arraiano and Brown, 2017; Torriani et al., 2015).

Table 1. The influence of treatments on the attack of wheat pathogens, in the period 2015-2017

Variety	Treated (T) / Control (MT)	Pathogen/ year 2015-2016						Pathogen/ year 2016-2017					
		<i>Blumeria graminis</i> f. sp. tritici			Septoria spp.			<i>Blumeria graminis</i> f. sp. tritici			Septoria spp.		
		F (%)	and (%)	GA (%)	F (%)	and (%)	GA (%)	F (%)	and (%)	GA (%)	F (%)	and (%)	GA (%)
Glosa	T1	26	5.5	1.4	28	11	3.1	24	6.5	1.6	28	8.5	2.4
	T2	72	15	10.5	75	20	15	58	12	6.9	56	15	8.4
	MT	21	6	1.2	21	13	2.7	21	5	1.0	32	0.5	3.4
Boema	T1	65	20	13	70	25	17.5	45	14	6.3	75	17	12.7
	MT												6

The frequency of the attack of *Fusarium* spp. on the ears was also reduced, which in the case of the Glosa variety reached 2% compared to the control and in the case of the Boema variety the frequency of the ears of wheat with fusariosis decreased from 6% to 2% (Table 1). In the conditions of 2017-2018, the Katou and Pitbul varieties were found to have powdery mildew and septoria (Iosub et al., 2021). Compared to the control variant (MT), the attack was severely reduced following the applied treatment scheme (Orius 0.4 l/ha and Acanto Plus 0.5 l/ha). Thus, the frequency of the powdery mildew attack decreased to 43% and the intensity to 11.5%, which determined a value of the degree of attack of 4.9% compared to the control variant with GA = 16% for the Katou variety. In the case of the same variety, the attack of septoria on the leaves was reduced to 5.1% compared to 17%.

There was a significant decrease in the intensity of the attack. In the Pitbul variety, in the treated variant the powdery mildew attack reached half (GA = 7.5%) of the value of the attack in the control variant (GA = 15%).

A significant reduction of the attack was registered in the case of the attack of septoria in the Pitbul variety in which GA = 2.2% compared to 9.7% in the untreated variant, due primarily to the decrease of the value of the attack intensity which reached 5% compared to 15% (control) (Table 2).

The application of fungicide treatments is part of the control strategy of fusarium wilt, but McMullen et al. (2012) show that mixtures of triazoles can provide 30-60% control due to the resistance of the pathogen to these substances. *Septoria nodorum* is effectively managed through a combination of genotype, chemical

control and cultural practices such as crop rotations (Francki, 2013).

Table 2. The influence of treatments on the attack of wheat pathogens, between 2017-2018

Variety	Variant	Pathogen/year 2017-2018					
		<i>Blumeria graminis</i> f. sp. tritici			Septoria spp.		
		Treated (T) / Control (MT)	F (%)	I (%)	GA (%)	F (%)	I (%)
Katou	T	43	11.5	4.9	54	9.5	5.1
	MT	80	20	16	85	20	17
Pitbul	T	17	7.5	1.3	44	5	2.2
	MT	45	15	6.7	65	15	9.7

In the conditions of 2018-2019 for the Pitbul and Jaguar varieties for the detected diseases, the attack had diminished values compared to the control variants.

In the case of the Pitbul variety, there was an attack of septoria in which both the frequency and intensity of the attack were reduced to 22% and 6.5%, resulting in an attack value of 1.4%, compared to the untreated variant in which the values of the incidence and intensity of the attack determined an attack rate of 5.8%. In the plots cultivated with the Jaguar variety, an attack of powdery mildew, septoria and brown rust was observed. In the case of the attack of these diseases, the values of the attack decreased after the application of the treatments (Tebucur 0.5 l/ha and Falcon Pro 0.8 l/ha) compared to the control variant.

The attack of powdery mildew reached 1.3% compared to 5.3%, the attack of septoria decreased to 3.5% compared to 13% (control) and the attack of brown rust to 1.2% compared to 4.5% (control) (Table 3).

In the case of fungicides against powdery mildew, the phenomenon of pathogen resistance must be monitored (Genet and Jawaroska, 2009).

Table 3. The influence of treatments on the attack of wheat pathogens, between 2018-2019

Variety	Variant		Pathogen / 2018-2019							
	treated	<i>Blumeria graminis</i> f. sp. <i>tritici</i>	<i>Septoria</i> spp.			<i>Puccinia recondita</i>				
	(T)/control (MT)	F (%)	and (%)	GA (%)	F (%)	and (%)	GA (%)	F (%)	and (%)	GA (%)
Pitbul	T	-	-	-	22	6.5	1.4	-	-	-
	MT	-	-	-	45	13	5.8	-	-	-
Jaguar	T	19	7	1.3	32	11	3.5	16	7.5	1.2
	MT	48	11	5.3	65	20	13	35	13	4.5

Strategies for controlling wheat rust include cultural practices, chemical and genetic control (Elis et al., 2014). The effectiveness of the treatments applied to the varieties cultivated in the period 2015-2019 was calculated (Table 4). The effectiveness of treatments is a concern in the strategy of combating diseases in cultivated plants (Toth and Cristea, 2020; Chireac and Cristea, 2021; Buzatu et al., 2018; Jaloba et al., 2019; Cioneag et al., 2016; Alexandru et al., 2019). The application of the two treatments in combating powdery mildew in 2015/2016 to Glosa and Boema varieties had efficiencies of 86.6% and 90.7%, respectively. Regarding the attack of leaf septoria, the efficacy had values of 79.3% for the Glosa variety and 84.5% for

the Boema variety. It can be appreciated that the attack of powdery mildew and septoria of the leaves, in the conditions of the year and considering the genotype, by applying the treatments, the efficacy values were high, especially for the Boema variety. In the conditions of 2016/2017, the highest values of the effectiveness of the treatments were registered for the Boema variety, over 84% for powdery mildew and 73% for *Septoria* spp. The effectiveness in control the attack of *Fusarium* spp. was 66.6%. In the Glosa variety, the efficacy values were over 70% in the case of monitored foliar pathogens and 50% in the case of fusarium head blight.

Table 4. Effectiveness of treatments in combating wheat diseases (2015/2017)

Variety	Alternative	2015-2016				2016-2017				Fusarium	
		<i>Blumeria graminis</i> f. sp. <i>tritici</i>		<i>Zymoseptoria</i> <i>tritici</i>		<i>Blumeria graminis</i> f. sp. <i>tritici</i>		<i>Septoria</i> spp.		spp.	
		GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)
Glosa	T	1.4	3.1	10.5	79.3	1.6	2.4	2.4	71.4	2	50
	NT	86.6	15	86.6	76.8	6.9	8.4	4	12.7	4	66.6
Boema	T	1.2	2.7	1.2	84.5	1.0	3.4	73.2	2	6	
	NT	90.7	17.5	13	84.2	6.3	12.7	6			

In the conditions of 2017/2018 for the Katou and Pitbul varieties, the applied treatments had an effectiveness of about 69.4% against the powdery mildew attack of the Katou variety

and of 80.6% for the Pitbul variety. Regarding the attack of septoria, the effectiveness of the treatments was 70% for the Katou variety and 77.3% for the Pitbul variety (Table 5)..

Table 5. Effectiveness of treatments in combating wheat diseases (2015/2017)

Variety	Alternative	2017-2018				2018-2019				Puccinia	
		<i>Blumeria graminis</i> f. sp. <i>tritici</i>		<i>Septoria</i> spp.		<i>Blumeria graminis</i> f. sp. <i>tritici</i>		<i>Septoria</i> spp.		recondite	
		GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)	GA (%)	E (%)
Katou	T	4.9	5.1	-	-	-	-	-	-	-	-
	NT	16	69.4	17	70	-	-	-	-	-	-
Pitbul	T	1.3	2.2	-	-	-	-	1.4	75.8	-	-
	NT	6.7	80.6	9.7	77.3	-	-	5.8	-	-	-
Jaguar	T	-	-	-	-	1.3	75.4	3.5	90.8	1.2	73.3
	NT	-	-	-	-	5.3	-	13	4.5		

Higher efficacy values were found for the Pitbul variety compared to the Katou variety under the same conditions of the year (Iosub et al., 2021). And the application of the treatments had an effectiveness of 75.8%. In the case of the Jaguar variety, the effectiveness of the applied treatments was 90.8% in control of septoria and 73.3% in the case of the brown rust attack

CONCLUSIONS

The application of treatments in control of wheat diseases to the varieties cultivated in the Moara Domneasca location in South Romania, in the period 2015-2019 led to a severe reduction of the attack and incidence of some pathogens (*Fusarium* spp.). The effectiveness of the treatment scheme in 2016/2017 had an effectiveness of 90.7% in combating powdery mildew and 84.5% in control of leaf septoria in the Boema variety. The treatments applied in 2016/2017 had a higher effectiveness against the attack of powdery mildew, *Septoria* spp. and fusarium wilt in the Boema variety compared to the Glosa variety and in 2017/2018 in the Pitbul variety there were values of 80.6% in control of powdery mildew and 77.3 % against *Septoria* spp. In 2018/2019, the Pitbul variety did not register a powdery mildew attack and the effectiveness in control of the attack of septoria was 75.8%. Brown rust was detected in the case of the Jaguar variety (2018/2019) with a treatment efficiency of 73.3%.

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