

DISEASES AND YIELD OF NEW VARIETIES OF BARLEY AND WHEAT IN DOBROGEA REGION

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Abstract

The paper presents the behavior of some barley and wheat varieties under 2018 and 2019 conditions in Dobrogea area. In demonstrative plots carried out at S.C. SPORT AGRA SRL Amzacea, Constanța County is presented data about the main pathogens and yield results. Climatic conditions of these 2 years, favoured a major attack of pathogens. For barley a high attack of Rhynchosporium secalis with an attack rate (AR) of 6-30% and Pyrenophora teres in a lower attack rate of 3-20% in most varieties was reported in the April observations. For wheat, Septoria tritici showed an AR between 17-27% and Pyrenophora tritici-repentis showed a low attack (AR = 4.5-17.5%). The pathogen Puccinia striiformis was present in low percentage (AR = 0-13.5%) in the 2018 April observations. For crop protection against pathogens, 2 foliar treatments with fungicides were applied, Artea 330 EC (ciproconazol 80 g/l + propiconazol 250 g/l) 0.4 l/ha, in March and Priaxor EC (fluxaproxad 150 g/l + piraclostrobin 75 g/l) 1 l/ha and in April, respectively. After the last treatment with very good efficacy, there was noticed a decrease in the attack on most pathogens recorded in May observations. Fungal treatments have stopped the development of foliar and ear diseases. The beneficial effects were found in the good yields obtained. For barley crop, the highest yields were 8000 kg/ha for Predator and 8500 kg/ha for Panonic variety. Wheat cultivation yields ranged from 7500 kg/ha for Miranda and 8000 kg/ha for Avenue variety. Quality indices ranged from 70 to 76% for hectolitre weight and 11-14% for protein. All these special yields have been obtained under non-irrigated conditions.

Key words: barley, wheat, main pathogens, yields.

INTRODUCTION

In the last years, various grain varieties created by foreign companies have been placed in cultivation without being deeply known their behavior in the climatic conditions of the Romanian district, Dobrogea. Romanian varieties of winter grains occupy a percentage more than 70% of the cultivated area (Roman et al., 2011).

Even if new varieties of wheat and barley have more yield to offer, breeders must take into account the resistance to pathogens attack (Stadlmeier et al., 2019) and quality indices (Đekić et al., 2017; Luković et al., 2017). These tools may vary depending on the cultivated area (Kaya & Akcura, 2014), so there is a need for demonstration plots in different areas. The increase of draught areas made necessary the testing of drought-resistant barley and wheat lines (Jinga et al., 2010; 2017) identified through extensive field testing and selection in a decentralized participatory breeding programme (Ceccarelli et al., 2007). The paper

aimed to present the main pathogens of barley and wheat crops varieties, quality indices and the yields obtained in 2018 and 2019 at S.C. SPORT AGRA SRL Amzacea, Constanța County, on demonstrative plots.

MATERIALS AND METHODS

The experimental plots were organised in 2018 and 2019, in the field of SC SPORT AGRA SRL Amzacea, Constanta County (South-East of Romania) (Figure 1). The studied crops were winter crops: barley and wheat. The experience was situated on a land belonging to the South Dobrogea Plateau, represented by cambic chernoziom with a profile deeper than other chernozioms, a blackish-brown soil of 40-50 cm thickness, medium texture (Demeter, 2009). The content of nutrients was: mobile P index - 72; N index - 4; K index - 200; humus - 3.11%; neutral pH - 7.2. The climate is deeply temperate continental, with an average annual temperature of 10.7-11.7°C, with a high temperature in the period 20th June to 15th

August. This area is the most arid in the country, with 69 years multiannual average rainfall of 401 litters. Sowing was carried out on 7th October 2017 and 10th October 2018. Treatment of seeds was carried out with Yunta Quattro 373.4 FS (clotianidin 166.7 g/l + imidacloprid 166.7 g/l + prothioconazol 33.3 g/l + tebuconazol 6.7g/l) in dose of 1.6 l/ton. Twelve wheat varieties and three barley varieties were analyzed regarding their behavior under climatic conditions from Amzacea area, in agricultural year 2017-2018 and nine wheat varieties and six barley varieties in the next year, 2018-2019. The climatic conditions of autumn in 2017, 2018 and in spring in 2018, 2019, favored a strong attack by pathogens. Quantity of precipitations during the vegetation period for 2017-2018/2018-2019 years, are presented in Table 1. Due to the climatic conditions of the years 2018 and 2019, for the prevention and control of foliar and ear diseases, 2 treatments were performed. For the first year (2018), were applied Treatment I (March17): Artea 330 EC (cyproconazole 80

g/l + propiconazol 250 g/l) 0.4 l/ha; Treatment II (April20): Priaxor EC (piraclostrobin 150 g/l + fluxaproxad 75 g/l) 1 l/ha; Karate Zeon 50 CS (lambda-cyhalothrin 50 g/l), at a dose of 0.75 l/ha and for the second year (2019), were applied Treatment I (March 10): Artea 330 EC (cyproconazole 80 g/l + propiconazol 250 g/l) 0.4 l/ha; Treatment II (April 20): Priaxor EC (piraclostrobin 150 g/l + fluxaproxad 75 g/l) 1 l/ha; Karate Zeon 50 CS (lambda-cyhalothrin 50 g/l), at a dose of 0.75 l/ha and both were used for specific pest control.

The attack rate (AR) was calculated with the formula $AR = F \times I/100$ (F % - frequency of the attacked organs, I % - intensity of organs' attack). Observations on phytosanitary status of winter crops and collections of biological samples were made on April 17 and May 8, 2018 and April 18, May 25, 2019. Some of technological elements such as seed norm, plant density in autumn and spring, inflorescence emergence date, flowering date, plant height, yields and quality indices were evaluated.

Table 1. Precipitation during 2017/2018 and 2018/2019 growing season for wheat and barley (Amzacea, Constanta)

	Month											
	Oct.	Nov.	Dec.	Jan.	Febr.	March	April	May	June	July	Aug.	
Days	The growing season 2017/2018: Precipitation (mm) for 10-day periods											Sum
1-10	41	18	9	0	9	6	2	64	35	98	0	282
11-20	0	30	23	44	31	37	0	28	0	2	0	195
21-31	14.5	17	18	19	80	26	0	28	41	47	0	290.5
Sum	55.5	65	50	63	120	69	2	92	76	147	0	739.5
Days	The growing season 2018/2019: Precipitation (mm) for 10-day periods											Sum
1-10	0	10	20	10	0	10	19	0	10	12	7	98
11-20	3	10	12	26	8	0	1	6	4	22	0	92
21-31	0	37.5	15	0	0	6	15.5	12	0	10	0	96
Sum	3	57.5	47	36	8	16	35.5	18	14	44	7	286
Days	Average 1961-1990: monthly values of precipitation (mm)											Sum
1-31	34.3	42.4	41.0	27.7	24.0	29.1	31.8	37.7	47.1	38.9	37.4	464.0

RESULTS AND DISCUSSIONS

Observations on phytosanitary status of winter crops and collections of biological samples were made at two time points in order to see the pathogens behaviour to the fungicides (Figure 1 and Figure 2).

Due to the high rainfall during March and May, the attack of pathogens that cause diseases in cereal crops was very aggressive, requiring the

2 pesticides treatments. The last treatment with Priaxor EC reduced the intensity of the attack at a low level.

The highest AR at barley was 30% to *Rhynchosporium secalis* and the lowest AR was 2.0% to *Pyrenophora graminea*. For wheat the highest average of AR was 21.06% attributed to *Rhynchosporium secalis* and the lowest average of AR was 1.76% attributed to *Pyrenophora tritici-repentis* (Table 2).



Figure 1. Autumn grain crops - field trial



Figure 2. Phytosanitary status

Table 2. Autumn cereals phytosanitary status - April 17, 2018

Two-rowed Autumn Barley + Autumn Barley									
Variety	<i>Rhynchosporium secalis</i>			<i>Pyrenophora teres</i>			<i>Pyrenophora graminea</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
Bingo	100	30	30	30	10	3	70	15	10.5
Panonic	40	15	6	90	20	18	40	5	2.0
Predator	60	10	6	80	25	20	80	30	2.4
Wheat									
Variety	<i>Septoria tritici</i>			<i>Pyrenophora tritici-repentis</i>			<i>Puccinia striiformis</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
Avenue	100	20	20	70	20	14	25	5	1.25
Katarina	90	25	23.7	25	20	5	0	0	0
Miranda	100	20	20	70	25	17.5	0	0	0
Litera	70	30	21	45	20	9	0	0	0
Kraljca	80	25	20	35	15	5.3	20	5	1.0
Spranjca	75	25	18.7	45	10	4.5	30	5	1.5
Fiji	80	25	20	80	15	12	90	15	13.5
Silvja	90	30	27	70	25	17.5	0	0	0
Bubimir	80	25	20	40	30	12	20	7	1.4
El Nino	85	25	21.3	45	30	13.5	25	10	2.5
Tata Mata	80	30	24	35	25	8.7	0	0	0
Pepeljura	85	20	17	40	30	12	0	0	0

For barley, the attack of all pathogens were decreased up to 0% and were the attack does not

been eradicated entirely the AR were under 1%. For wheat the results were the same (Table 3).

Table 3. Autumn cereals phytosanitary status - May 8, 2018

Two-rowed Autumn Barley + Autumn Barley									
Variety	<i>Rhynchosporium secalis</i>			<i>Pyrenophora teres</i>			<i>Pyrenophora graminea</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
Bingo	6	2	0.1	3	1	0.01	10	5	0.5
Panonic	0	0	0	0	0	0	0	0	0
Predator	0	0	0	2	1	0.01	8	5	0.4
Wheat									
Variety	<i>Septoria tritici</i>			<i>Pyrenophora tritici-repentis</i>			<i>Puccinia striiformis</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
Avenue	5	2	0.1	0	0	0	5	1	0.05
Katarina	0	0	0	5	2	0.1	0	0	0
Miranda	0	0	0	0	0	0	0	0	0
Litera	0	0	0	10	5	0.5	0	0	0
Kraljca	8	2	0.1	0	0	0	2	1	0.02
Spranjca	5	2	0.1	0	0	0	5	2	0.1
Fiji	0	0	0	10	5	0.5	7	1	0.07

Wheat									
Variety	<i>Septoria tritici</i>			<i>Pyrenophora tritici-repentis</i>			<i>Puccinia striiformis</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
Silvja	5	3	0.1	0	0	0	0	0	0
Bubimir	8	2	0.1	0	0	0	2	1	0.02
El Nino	5	2	0.1	10	4	0.4	5	1	0.05
Tata Mata	10	3	0.3	0	0	0	0	0	0
Pepeljura	5	2	0.1	0	0	0	0	0	0

After the 2 fungicide treatments, foliar diseases were stopped at basal leaves. For barley attack decreased completely for all three pathogens analyzed. Also, the fungicide applied to the wheat stopped the pathogen attack both on the last leaf and on ear, very significant. In 2018, the average yield, in Romania at wheat was

4.8 tons/ha (INS, 2018) which means the yield obtained at S.C. SPORT AGRA was significantly greater than it. Ten of the varieties had over 7 tons/ha and 4 of these had over 8 tons/ha. All the cultivars tested had a hectolitre mass over 70 kg/hl (Table 4).

Table 4. Technological sheet for autumn crops in 2018

Variety	Seed norm (kg/ha)	Plant density in the autumn 14.11.2017	Plant density in the spring 11.01.2018	Inflorescence emergence date	Flowering date	Plant height (cm)	Yield (kg/ha)	Quality index	
								M HI (kg/hl)	Protein (%)
Two-rowed Autumn Barley + Autumn Barley									
Bingo	220	520	888	April 20	April 28	73	7375	70.5	-
Panonic	220	522	868	April 26	May 3	101	8500	70.6	-
Predator	220	534	848	April 23	May 2	86	7875	70.6	-
Wheat									
Avenue	250	440	772	April 27	May 4	71	8026	74.6	11.9
Katarina	250	422	828	April 30	May 7	70	7475	76.9	12
Miranda	250	468	660	May 3	May 8	94	7425	75.6	12.3
Litera	250	495	684	May 4	May 8	95	7125	74.2	12.4
Kraljica	250	484	812	May 1	May 5	68	8300	74.5	12.3
Spranjka	250	534	784	May 1	May 9	65	8106	75.2	11.9
Fifi	250	472	732	May 3	May 9	76	6666	77.0	14.5
Silvja	250	445	672	May 2	May 7	80	7675	77.2	12.7
Bubimir	250	432	764	May 2	May 7	71	6575	77.5	12.6
El Nino	250	476	796	April 30	May 5	75	8125	76.5	12.5
Tata Mata	250	502	772	May 4	May 9	87	7475	70.4	12.5
Pepeljura	250	464	784	May 4	May 9	91	7920	73.1	11.9

In 2019, for barley, the most dangerous pathogens were *Pyrenophora teres*, with an AR of 18 and 20 for Predator and OSK 6.2/3-13

respectively. For wheat only two cultivars had an AR over 2% to *Puccinia striiformis* (Table 5).

Table 5. Autumn cereals phytosanitary status -April 18, 2019

Two-rowed Autumn Barley + Autumn Barley									
Variety	<i>Rhynchosporium secalis</i>			<i>Pyrenophora teres</i>			<i>Pyrenophora graminea</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
PLETER	40	20	8	30	10	3	70	15	10.5
PREDATOR	40	10	4	90	20	18	40	5	2.0
OSK 6.2/3-13	20	10	2	80	25	20	80	30	2.4
OSK	20	15	3	10	30	3	50	20	10
OSK	30	10	3	20	40	8	30	30	9
PANONIC	30	20	6	10	20	2	40	20	8

Wheat									
Variety	<i>Septoria tritici</i>			<i>Pyrenophora tritici-repentis</i>			<i>Puccinia striiformis</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
GLOSA	80	20	16	70	20	14	25	5	1.25
AVENUE	90	25	23.7	25	20	5	20	10	2
RENATA	70	20	14	70	25	17.5	0	0	0
OSK 51.117	70	30	21	45	20	9	0	0	0
OSK 110/17	80	25	20	35	15	5.3	20	5	1.0
OSK 159/17	75	25	18.7	45	10	4.5	30	5	1.5
OSK 84/116	80	25	20	80	15	12	90	15	13.5
BOREALIS	90	30	27	70	25	17.5	0	0	0
ICONA 2S	80	25	20	40	30	12	20	7	1.4

The attack of pathogens reported in the experimental plots, showed a very high degree of attack, and the treatment was performed with a fungicide with effect in stopping the attack and to protecting the last leave and the spike, with the product PRIAXOR on 20 April.

For barley, the attack of all pathogens were decreased up to 0% and were the attack does not been eradicated entirely the AR were under 1%. For wheat the results were the same (Table 6).

Table 6. Autumn cereals phytosanitary status - May 25, 2019

Two-rowed Autumn Barley + Autumn Barley									
Variety	<i>Rhynchosporium secalis</i>			<i>Pyrenophora teres</i>			<i>Pyrenophora graminea</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
PLETER	6	2	0.1	3	1	0.01	0	0	0
PANONIC	0	0	0	0	0	0	0	0	0
OSK6.2/3-13	5	10	0.5	10	5	0.5	0	0	0
OSK	10	2	0.2	10	2	0.2	0	0	0
OSK	0	0	0	5	4	0.2	0	0	0
PREDATOR	0	0	0	2	1	0.01	0	0	0
Wheat									
Variety	<i>Septoria tritici</i>			<i>Pyrenophora tritici-repentis</i>			<i>Puccinia striiformis</i>		
	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)	F (%)	I (%)	AR (%)
GLOSA	5	2	0.1	10	3	0.3	5	1	0.05
AVENUE	10	8	0.8	5	2	0.05	10	5	0.5
RENATA	20	3	0.6	0	0	0	0	0	0
OSK 51.117	10	4	0.4	0	10	2	0.2	0	0
OSK 110/17	8	2	0.1	10	5	0.5	2	1	0.02
OSK 159/17	5	2	0.1	8	5	0.4	5	2	0.1
OSK 84/116	10	5	0.5	0	0	0	7	1	0.07
BOREALIS	15	5	0.7	10	8	0.8	0	0	0
ICONA 2S	8	2	0.1	0	0	0	2	1	0.02

In 2018/2019 growing season the rainfall were less compared with 2017/2018 and that is why the yield had lower values. The values for

hectolitre mass werelower for barleyandhigher for wheat, four of themreachingvaluesover 80 kg/hl (Table 7).

Table 7. Technological sheet for autumn crops, 2019

Variety	Seed norm (kg/ha)	Plant density in the spring 01.02.2019	Inflorescence emergence date	Flowering date	Yield (kg/ha)	Quality index	
						M HI (kg/hl)	Protein (%)
Two-rowed Autumn Barley + Autumn Barley							
PLETER	220	440	May 7	May 12	6200	67.9	-
PREATOR	220	424	May 7	May 12	6275	68.6	-
OSK6.2/3-13	220	484	May 7	May 12	7012	69.1	-
OSK	220	436	May 9	May 12	6812	69.8	-
OSK	220	424	May 9	May 12	6450	65.9	-
PANONIC	220	420	May 9	May 12	6587	66.1	-
Wheat							
GLOSA	255	468	May 15	May 17	6187	80.7	11.6
AVENUE	260	512	May 12	May 15	6000	78.9	10.8
RENATA	260	488	May 14	May 17	5750	81	12.1
OSK 51.117	260	480	May 15	May 19	6375	79.3	10.8
OSK 110/17	260	440	May 15	May 19	5750	78.9	11.7
OSK 159/17	260	504	May 15	May 19	6125	80.2	12.1
OSK 84/116	260	516	May 16	May 19	6187	80.2	12.4
BOREALIS	260	496	May 13	May 17	5562	61.9	12.9
ICONA 2S	260	524	May 14	May 17	5287	79	13.6

CONCLUSIONS

Therefore, we can firmly assert that the heavy rainfall from March 2018 and 2019, favored the rise of pathogens. Both in April 2018 and in May 2019, after the application of the product PRIAXOR EC, could be observed that the degree of attack was significantly reduced.

To prevent and control the pathogens that cause diseases in autumn cereal crops, two treatments with fungicides were necessary under climatic conditions of 2018 and 2019. The beneficial effects were found in the good yields obtained. For barley crop, pathogen *Pyrenophora graminis*. showed reduced attack rates, compared to *Pyrenophora teres* or *Rhynchosporium secalis* in both years of experience.

For wheat crop, pathogens *Septoria tritici* and *Pyrenophora tritici-repentis* showed a reduced attack rates, compared to *Puccinia striiformis*., in both years of experience.

The productions obtained these years were very good, considering that they were obtained with non-irrigation technology.

Thereby, under 2018 conditions, the yields obtained ranged between 7375 and 8500 kg/ha and good quality index (hectolitre weight = 70.6 kg/hl) for barley and for wheat yields recorded were between 6575 and 8300 kg/ha.

In 2019, the yields obtained were contained between 6200 and 7012 kg/ha for barley, and between 5287 and 6375 kg/ha for wheat.

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