THE INFLUENCE OF SOME TREATMENTS WITH DIFFERENT PRODUCTS OF PHYTOSANITARY USAGE (FUNGICIDES) ON THE ATTACK OF SOME FUNGI AND ON THE BARLEY PRODUCTION IN THE 2016 PEDOCLIMATIC CONDITIONS OF THE EASTERN BARAGAN

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Abstract

The barley is under attacked of many pathogenic agents during the vegetation period. Out of these pathogenic agents, the *Pyrenophora graminea* fungus had been producing barley's leaf stripe disease in the Eastern Baragan area, in 2016 (Velichi E. 2012). An experiment was created in the year 2016, using 4 products of phytosanitary usage, as follows: ACANTO PLUS (picoxistrobin + cyproconazole), MYSTIC 250 EC (tebuconazole); BUMPER 250 EC (propiconazole) and TOPSIN 500 SC (tiophanate-methyl) (Pest – Expert). This experiment consisted in 7 variants (6 variants with phytosanitary treatments in different combinations of products, plus a control sample not treated). The experiment was placed in randomised blocks. The 7 variants were placed in 6 repetitions. Out of the pathogenic agents monitored, the biggest attacks had been produced by *Pyrenphora graminea* fungus which produces leaf stripe at barley. For this, there had been analysed the first two leaves under the spike. The observations had shown that for all 6 variants of treatment, the attack degree (GA %) of the disease (barley's leaf stripe) was more reduced than at the control sample not treated. The productions of the variants treated (V1 … V6) had been higher than the production of the control sample not treated, V7. The productions of some variants of treatment had been significantly higher than the production of the control sample not treated (statistic insurance DL 5%). In what concerns the economic efficiency, the fungicide product MYSTIC 250 EC 0.5l/ha had proven to be the most efficient in what price was concerned.

Key words: *Pyrenophora* spp., tebuconazole, phytosanitary, randomised blocks

Hordeum vulgare barley is under attack of many pathogenic agents, such as: mildew - *Blumeria graminis* f.sp. *hordei*, leaf stripe - *Pyrenophora graminea*, leaf blotch - *Rhynchosporium secalis*, rust - *Puccinia hordei* (Iacob Viorica, Hatman, M., Ulea, E., Puiu, I. 1998). The first half of the year 2016 was difficult for barley, in what concerns the climatic conditions. Abundant rains and low temperatures had been registered in this period, which had created favourable conditions for the attack of some pathogenic agents. Here we mention especially *Pyrenophora graminea* fungus which produces at barley the disease called leaf stripe. This pathogenic agent attacks the barley crops each year, at high attack intensities. The other pathogenic agents mentioned had proven to be less dangerous for the barley crop.

MATERIAL AND METHOD

For performing the observations, it was conceived an experiment with 7 study variants. This experiment comprised 6 variants of phytosanitary treatment (fungicide products, their combinations, number of treatments) and a control sample not treated. The variants of the experiment were the following (tab.1):

- V1 - ACANTO PLUS 0.5 L/HA 1 treatment applied at spike's release (25.04.2016),
- V2 - ACANTO PLUS 0.5 L/HA 1 treatment applied at bellows phase (13.04.2016) + 1 treatment applied at the beginning of beans' filling (06.05.2016),
- V3 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (25.04.2016),
- V4 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied at bellows phase (13.04 2016)+1 treatment applied at the beginning of beans' filling (06.05.2016),
- V5 - [BUMPER 250 CE 0.25 L/HA + TOPSIN 500 SC 0.5 L/HA] 1 treatment applied at spike's release (25. 04.2016),
- V6 - BUMPER 250 CE. 0.25 L/HA + TOPSIN 500 SC 0.5 L/HA] 1 treatment applied at bellows phase (13.04 2016) + 1 treatment applied at the beginning of beans' filling (06.05.2016),
- V7 – Control sample not treated.

The experiment was placed in randomised blocks. These 7 variants were placed in 6

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repetitions. Each experimental parcel had an area of 14 m^2 (7 x 2m). The total number of experimental parcels was of 42. The area of an experimental variant was of 14 m^2 x 6 repetitions = 84 m^2. The total area of the experiment was of 84 m^2 x 6 = 504 m^2. The treatments were executed manually, with a machine of "vermorel" type. "Trend" adjuvant product was added in the irrigation solution, in concentration of 0.03%. Weeds control was done with the help of Mustang herbicide, in a dosage of 0.5 l/ha. The experiment had as purpose establishing the efficiency of the mentioned phytosanitary products, reported to their price, as well as the efficiency and respectively the lucrativeness of applying one or two phytosanitary treatments during the barley's vegetation period.

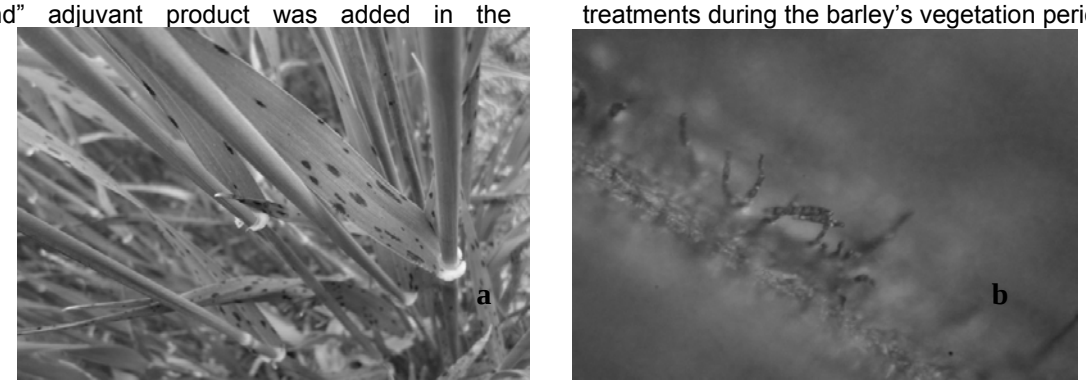

Figure 1 **Barley leaf stripe *Pyrenophora graminea*** **a – attack on leaves, b – conidia (original)**

Figure 2 **Aspects from the experiment field in the blooming phase (original)**

Figure 3: **Aspects from the experiment field in the full maturity phase (original)**

Table 1

The results of the experiment with fungicide products (6 variants of treatment + control sample not treated) in what concerns the attack (G.A. %) of *Pyrenophora graminea* fungus at barley ("flag" leaf and the next leaf). The observations were performed on the date of May 15th, 2016

Variant	"flag" leaf			The second flag		
	G.A%	Dif. against the control sample	Significance	G.A%	Dif. against the control sample	Significance
-V1 - ACANTO PLUS 0.5 L/HA 1 treatment applied at spike's release	24.06	34.27	***	74.5	20.91	***
-**V2** - ACANTO PLUS 0.5 L/HA 1 treatment applied at bellows phase + 1 treatment applied at the beginning of beans' filling	6.21	52.12	***	41.83	53.58	***
- **V3** - MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release	27.9	30.43	***	72.92	22.49	***
-**V4** -MYSTIC 250 EC 0.5 L/HA 1 treatment applied at bellows phase +1 treatment applied at the beginning of beans' filling	13.93	44.40	***	37.03	58.38	***
-V5 - [BUMPER 250 CE 0.25 L/HA+TOPSIN 500 SC 0.5 L/HA] 1 treatment applied at spike's release	32.15	26.18	***	87.08	8.33	***
-V6 - BUMPER 250 CE. 0.25 L/HA+TOPSIN 500 SC 0.5 L/HA] 1 treatment applied at bellows phase +1 treatment applied at the beginning of beans' filling	23.85	34.48	***	78.33	17.08	***
-V7 – Control sample not treated	58.33	-	-	95.41	-	-

DL G.A. % for the "flag" leaf
DL 5% = 3.35%
DL 1% = 4.54%
DL 0.1% = 5.98%

DL G.A. % for the second leaf:
DL 5% = 4.08%
DL 1% = 5.54%
DL 0.1% = 7.30%

Table 2

The results of the experiment with fungicide products (6 variants of treatment + control sample not treated) in what concerns the production (t/ha) obtained at the variants treated as compared to the control sample not treated

Variant	Prod. (t/ha)	Difference against the control sample	Significance
V1-ACANTO PLUS 0.5 L/HA 1 treatment applied at spike's release	5.62	1.50	-
V2-ACANTO PLUS 0.5 L/HA 1 treatment applied at bellows phase +1 treatment applied at the beginning of beans' filling	6.52	2.40	*
V3-MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release	5.80	1.68	-
V4-MYSTIC 250 EC 0.5 L/HA 1 treatment applied at bellows phase +1 treatment applied at the beginning of beans' filling	6.05	1.93	*
V5-[BUMPER 250 CE 0.25 L/HA+TOPSIN 500 SC 0,5 L/HA] 1 treatment applied at spike's release	6.05	1.73	-
V6-BUMPER 250 CE. 0.25 L/HA+TOPSIN 500 SC 0,5 L/HA] 1 treatment applied at bellows phase +1 treatment applied at the beginning of beans' filling	5.85	1.93	*
V7 (Mt nt.) - Control sample not treated	4.12	-	-

DL 5% = 1.83 t/ha
DL 1% = 2.50 t/ha
DL 0.1% = 3.41t/ha

The evaluation of the attack's frequency (F%), of the intensity of the attack (I%) and respectively, of the attack degree (G.A.%) was done separately, on each and every experimental parcel, analysing 10 plants/experimental parcel. To them it was assessed the degree of affectation (the

intensity of the attack I %) of the last 2 leaves, especially of the "flag" leaf, which has the biggest contribution to the production of a spike at cereals. The phytosanitary analyses of the plants samples were done with the help of the stereomicroscope and of the optic microscope at Brăila Phytosanitary Office's laboratory – Phytosanitary National Authority. These analyses had revealed the presence of *Pyrenophora graminea* fungus in the samples analysed, which produces the barley's leaf stripe.

In order to assess the production of each variant under study, there had been analysed beans samples from each experimental parcel, 4 samples / parcel, on percentage sampling basis. The demarcation of each sample was performed with a metric frame with the area of 0.25 m^2 (0.5/0.5m). The average of the experimental parcel had served for calculating the production of each and every experimental parcel. The statistic interpretation had been done with the help of the limit differences (DL %) (Săulescu N).

The variety used was Nectaria, a French barley variety for beer produced by Secobra Company. The variety is considered very valuable by the producers from this area. The caryopses produce quality malt and have a moderate content of proteins **(***Secobra Recherches* Centre de Bois – Henry, 2002).

Assessing the attack of a damaging agent can be done with the help of values (Prognosis and Warning Methods, 1980):

- Attack frequency (F %);
- Attack intensity (I %);
- Attack degree (G.A %).

- Attack frequency represents the relative value of the number of plants or organs of the plant under attack (n) reported to the number of plants or organs observed (N). The value of the frequency is established through direct observations on a number of plants or organs, according to the case and to the conditions, existing different methods of collecting the samples and of performing the observations. In the case of our observations regarding the foliar diseases, there had been taken into consideration the number of organs of plants attacked from the total of organs of plants observed (leaves), establishing thus the frequency of the attack expressed in percentages %. In case of blights, it had been used the number of spikes attacked, reported to the total number of spikes observed. The frequency was calculated with the help of the formula F%= nx100/N.
- Attack intensity represents the degree or percentage in which a plant or an organ of the plant is attacked and how much from the area of the plant or of the organ analysed (leaf, fruit) is covered by the disease under study.

The assessment of the area attacked had been done with the naked eye or with the magnifying glass, assessing the percentage occupied by spots or burns caused by the pathogenic agent. There can be recorded the damage percentage or grades can be awarded for each plant or organ attacked by the disease or/and by the pest. Grades usage can ease up greatly data summarizing. It can be used a scale with 6 degrees of intensity, as follows:

- Grade 0 no attack
- Grade 1 attack 1 – 3%
- Grade 2 attack 3 – 10%
- Grade 3 attack 11 – 25%
- Grade 4 attack 26 – 50%
- Grade 5 attack 51 – 75%
- Grade 6 attack 76 – 100%

After summarizing the data, the attack intensity had been determined with the following formula:

$$I\% = \frac{\Sigma (i \times f)}{n}$$

Where:

I% - Attack intensity (in %);

i – The intensity according to the grade awarded to the organ or plant attacked;

f – The number of cases (plants, organs) attacked;

n – The number of plants attacked.

In the case of our experiment, grades from 1 to 6 had been awarded, separately, to "flag" leaf and to the next leaf situated below it.

- The attack degree is the expression of the extension of the gravity of the attack on the crop or on the total number of plants for which we are making the observations. The value expression of GA is given by the relation:

$$G.A\ (\%). = \frac{F \times I}{100}$$

In most of the cases, there is a negative correlation between the attack degree of a pathogenic agent or pest and the quantitative and/or qualitative level of the production of a crop.

RESULTS AND DISCUSSIONS

The agricultural year 2015 – 2016 was a very difficult year for barley crop from the point of view of the attacks of the pathogenic agents specific to barley. It must be underlined the very important fact that the barley (*Hordeum vulgare*) is a species more sensible to the attack of the diseases than wheat. However, it compensates through earliness and implicitly, through a passive resistance to drought, offering productions more certain than in the case of the wheat in the years with deficit from the precipitations point of view.

In what concerns the dynamic of the occurrence of the pathogenic attacks at barley, we mention the following aspects:

- *Rhyncosporium secalis* had not significantly affected the barley in the autumn of 2015 (G.A. < 1%).
- *Blumeria* (*Erysiphe graminis*) had also affected it, but without creating problems (G.A. 1 – 1.5%).
- *Pyrenophora graminea* had affected the barley, being necessary to apply phytosanitary treatments. The attack degree (G.A. %) was of 58.33% at variant V7 - untreated control sample, on the date of May 15th, 2016. It must be underlined the fact that this pathogen had proven to be the most dangerous pathogenic agent of barley's, like in the previous years.
- There had not been observed attacks of the blights specific to barley (*Ustilago nuda* and *Ustilago hordei*).
- Barley's rust (*Puccinia hordei*) had not significantly affected the barley (G.A. < 1.5%).

If we analyse the data from table 1, we observe that the attack degree of the fungus *Pyrenophora graminea* was differentiated as follows:

- V1 - ACANTO PLUS 0.5 L/HA 1 treatment applied at spike's release (25.04.2016) had determined an attack degree of the fungus *Pyrenophora graminis* of 24.06% at flag leaf and 74.5%, so less by 34.27% and respectively by 20.91% as against the control sample not treated (V7).
- V2 - ACANTO PLUS 0.5 L/HA 1 treatment applied at bellows phase + 1 treatment applied at the beginning of filling the beans had determined an attack degree of the fungus *Pyrenophora graminea* of 6.21% at flag leaf and of 41.83%, so less by 52.12% and respectively by 53.58% as against the control sample not treated (V7).
- V3 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release had determined an attack degree of the fungus *Pyrenophora graminea* of 27.9% at flag leaf and of 72.92%, so less by 30.43% and respectively by 22.49% as against the control sample not treated (V7).
- V4 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied in bellows phase + 1 treatment applied at the beginning of spike's beans filling had determined an attack degree of the fungus *Pyrenophora graminis* of 13.93 % at flag leaf and of 37.03%, so less by 44.40% and respectively by 58.38% as against the control sample not treated (V7).
- V5 [BUMPER 250 CE 0.25 L/HA + TOPSIN 500 SC 0.5 L/HA] 1 treatment applied at spike's release had determined an attack degree of the fungus *Pyrenophora graminis* of 32.15 % at the flag leaf and of 87.08%, so less by 26.18% and respectively by 8.33% as against the control sample not treated (V7).
- V6 [BUMPER 250 CE. 0.25 L/HA + TOPSIN 500 SC 0.5 L/HA] 1 treatment applied in the bellows phase + 1 treatment applied at the beginning of beans' filling had determined an attack degree of the fungus *Pyrenophora graminis* of 23.85% at the flag leaf and of 78.33%, so less by 34.48% and respectively by 17.08% as against the control sample not treated (V7).
- V7 - Control sample not treated had been affected by *Pyrenophora graminis* at values of the attack degree (G.A. %) of 58.33% at the flag leaf and 95.41% at the second leaf.

From the analysis of Table 2, there can be observed the production differences as compared to the control sample not treated V7, as follows:

- Variant V2 - ACANTO PLUS 0.5 L/HA 1 treatment applied in bellows phase (13.04.2016) + 1 treatment applied at the beginning of beans filling (06.05.2016) had achieved the highest production gain of 2.4 t/ha, as compared to the control sample V7
- Variant V4 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied in the bellows phase (13.04.2016) + 1 treatment applied at the beginning of beans filling (06.05.2016) had achieved a production gain of 1.93 t/ha.
- Variant V6 [BUMPER 250 CE. 0.25 L/HA + TOPSIN 500 SC 0.5 L/HA] 1 treatment applied in the bellows phase (13.04.2016) + 1 treatment applied at the beginning of beans filling (06.05.2016) had also achieved a production gain of 1.93 t/ha.
- The other variants: V1-ACANTO PLUS 0.5 L/HA 1 treatment applied at spike's release (25.04.2016); V3 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (25.04.2016) and V5-[BUMPER 250 CE 0.25 L/HA + TOPSIN 500 SC 0.5 L/HA] 1 treatment applied at spike's release (25.04.2016) had achieved production gains, respectively of 1.5 t/ha, 1.68 t/ha and 1.73 t/ha, but not insured statistically.

CONCLUSIONS

The observations performed in the spring of the year 2016 on the barley crop, in the pedoclimatic conditions of the Eastern Baragan had lead to the following conditions and recommendations:

1. The most dangerous pathogenic agent of barley had proven to be the *Pyrenophora graminea* fungus which produces the disease under the popular name of leaves "stripe". The

attack of this fungus had determined high production losses (1.93t/ha, 2.4t/ha) as compared to the control sample untreated.

2. There had been observed soft attacks of the fungus which attack the foliage, respectively barley's mildew - *Blumeria graminis* f.sp. *hordei*, leaf stripe - *Pyrenophora graminea*, barley's rust - *Puccinia hordei*, brown leaf blotch - *Rhynchosporium secalis*.
3. For a secure protection against the attack of the pathogenic agents specific to barley, it is recommended the application, in the difficult years (rainy and chilly), of 2 phytosanitary treatments with fungicides homologated products for barley from the triazoles group, such as: Acanto Plus (20% picoxistrobin + 8% cyproconazole) – 0.5 l/ha, Mystic (tebuconazole 250 g/l), Bumper (250 g/l propiconazole), Topsin 500 SC (500 g/l tiophanate-methyl) etc. The first treatment is recommended to be applied in the bellows phase and the second at the beginning of beans filling phase. One can choose also only one treatment in the difficult years, but the production gain is sensibly lower.
4. In the droughty years, unfavourable to the diseases attack, one single treatment can be applied at barley's blooming. In the conditions when in the year 2016 it is foreseen a price of 0.65 lei/kg for barley for beer, the gains of 2.4 t/ha and 1.93 obtained by the variants with two treatments is justified fully from economic point of view. For example, the price of a litre of Acanto Plus is around 350 lei and a litre of Mystic 250 EC is around 135 lei, in the condition when it is applied the treatment with 0.5 l/ha to both products. It seems that Mystic 250 EC product has proven to be more efficient from financial point of view than Acanto Plus, which costs higher than the double of Mystic 250 EC product. Bumper 250 EC product costs 176 – 180 lei/l. It is homologated 0.5 l/ha applied alone. Topsin 500 SC product costs 75 lei/l and is homologated 1.25 l/ha applied alone. The combination used in the experiment, of 0.25 l/ha Bumper 250 EC and 0.5 l/ha Topsin 500 SC, has proven to be quite efficient from economic point of view, but below the level of economic efficiency of Mystic 250 EC product. The latter has proven to be the most efficient from economic point of view.
5. Nectaria beer barley variety has proven to be quite resistant to the diseases specific to barley, achieving in conditions of 0 treatments with fungicides, a production relatively high of 4.12 t/ha, in the conditions the crop succeeded to the autumn rape.

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