TESTING MAIZE HYBRIDS' BEHAVIOUR AGAINST FUSARIUM ATTACK

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Abstract

The behaviour of ten maize hybrids (T 145, T 165, T.M. 188, T STAR, T 201, T 200, T FAV., T 160, T SU 182, and T SU 210) obtained at SCDA Turda, county of Cluj against Fusarium attack during 2008 and 2009 was studied. Concerning the stem breaking, different average level of attack was recorded in both experimental years. The foliar area was affected by necrosis of the foliar limb, the most affected being when humidity and temperature conditions supplied for plat germination are not appropriate. The maize production and cob quality was also studied.

Key words: cobs, mycotoxin, maize, Fusarium

INTRODUCTION

One of the main objectives of plant breeding and creating new hybrids and strains is represented by the increase of their resistance to disease and pests attack. Within Romanain climatic conditions, generally speaking, and in Transylvanian, in particular, the most harmful disease of maize cultures, which must be taken into consideration within the improvement process is the fusariosis. This disease is mainly produced by two species of the Fusarium genus (graminearum and moniliforme), that may manifest alone or associated, function of environmental conditions, as soil, clime, technology, etc. (Ofori E. and N. Kyei-Baffour, 2010; Murillo-Williams et al., 2008).

The mushrooms of Fusarium genus may be transmitted from one year to another through many ways, the main inoculum sources being represented by vegetal debris from soil (on which mushrooms continue the evolutive cycle as resistance micelium), animal manure not entirely fermented, seed harvested from attacked and not certified lots destined for hybridation, use of not corespondingly selected seeds and chemically not treated with fungicedes detined to fight against insects, etc. (Oláh B. et al., 2006).

The spreading of reproduction organs, that make possible the infection with these mushrooms may be obtained on many ways, the most important vectors being the wind, rain drops, and several pests.

The disease manifestation, the pheno-phases and attacked organs are very different, function of signaled Fusarium specie, sensitivity or resistance of cultivated hybrids, suitability of hybrids for a certain culturea area and above mentioned environmental conditions. Of great importance in producing harmful effects on attacked plats are the metabolic intermediate products - mycotoxins (Bacon C.W. et al, 2001; Fandohan P. et al, 2003, Odagiu Antonia et al., 2007; Oroian I. et al., 2009; Proctor R.H. et al., 2006).

These particularities represent the reason we perform this study concerning the behaviour of several maize hybrids against fusariosis attack and the influence of the attack on production level.

MATERIAL AND METHODS

The research was performed during 2008 and 2009 at SCDA Turda, county of Cluj, and represents the first phase of a more developed programme, which will be carried on for five years (2008 – 2012). It aimed the study of fusariosis attack on different organs and identification of the attack influence on maize hybrids production level.
Data were harvested from ten maize hybrids developed at SCDA Turda: T 145, T 165, T.M. 188, T STAR, T 201, T 200, T FAV, T 160, T SU 182, and T SU 210 and a control. The statistical approach includes the average calculation and Duncan test. We used STATISTICA v. 6.0 programme.

RESULTS AND DISCUSSION

The data presented in Tables 1 and 2, concerning the fusariosis attack on stems, show different behaviour in studied hybrids concerning the stem breaking phenomenon, and different average level of attack in both experimental years, especially. Contradictory data were recorded in some hybrids (T 145, T 200), and a final conclusion can be mentioned only after the end of the entire research programme.

Table 1

The reaction of some maize hybrids against Fusariosis attack (stem breaking) - Turda, 2008

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	T 145	8.4	-0.3	-
2	T 165	16.6	7.9	*
3	T.M. 188	12.2	3.5	-
4	T STAR	2.8	-5.1	-
5	T 201	4.3	-4.4	-
6	T 200	23.5	14.8	***
7	T FAV.	8.0	-0.7	-
8	T 160	5.1	-3.6	-
9	T SU 182	3.0	-5.7	-
10	T SU 210	3.8	-4.9	-
Average		8.7	-	-
		LSD 5% = 6.3	LSD 1% = 8.4	LSD 0.1% = 11.1

In 2008, the attack frequency recorded an average of 8.7% with a maximum of 23.5% ($p < 0.001$) in T 200 hybrid and lowest attack degree in T STAR hybrid (2.8%), while due to the climatic conditions in 2009 the attack was more severe. The average by entire hybrid group was of 19.2%, with a maximum of 25.08% in Turda 145 hybrid ($p < 0.01$), and minimum attack degree of 13.60% in Turda Super hybrid.

Table 2

The reaction of some maize hybrids against Fusariosis attack (stem breaking) - Turda, 2009

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	Turda 145	25,8	6,7	**
2	Turda 165	17,5	-1.7	-
3	Turda Mold 188	22,6	3.4	-
4	Turda 200	20,9	1.7	-
5	Turda Super	13,6	-5.6	00
6	Turda 201	18,1	-1.1	-
7	Turda Favorit	17,1	-2.2	-
8	Turda Star	19,3	0.1	-
9	HTT 112	18,6	-0.6	-
10	HTT 120	18,1	-1.1	-
Average		19.2	-	-
		LSD 5% = 3.9	LSD 1% = 5.3	LSD 0.1

The symptom of plant (little plants) rotten is most frequently recorded when we use seeds with high percent of attack, and not chemically treated (tables 3 and 4). The way maize hybrids react against this disease is mainly determined by the humidity and temperature conditions supplied during plat germination. Inappropriate conditions may produce important looses in culture.

Table 3

The reaction of some maize hybrids against Fusariosis attack (plant rotten) - Turda, 2008

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	T 145	9.8	0.8	-
2	T 165	18.8	9.8	***
3	T.M. 188	9.3	0.3	-
4	T STAR	2.9	-6.1	00
5	T 201	7.3	-1.7	-
6	T 200	25.7	16.7	***
7	T FAV	8.0	-1.0	-
8	T 160	2.2	-6.8	00
9	T SU 182	4.3	-4.7	0
10	T SU 210	5.9	-3.1	-
Average		9.0	-	-
		LSD 5% = 4.2	LSD 1% =5.7	LSD 0.1% = 7.5

Table 4

The reaction of some maize hybrids against Fusariosis attack (plant rotten) - Turda, 2009

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	Turda 145	6.1	1.1	-
2	Turda 165	6.3	1.2	-
3	Turda Mold 188	1.9	-3.1	-
4	Turda 200	18.3	-13.5	00
5	Turda Super	2.7	2.3	-
6	Turda 201	1.4	3.6	-
7	Turda Favorit	2.3	2.7	-
8	Turda Star	4.1	0.9	-
9	HTT 112	4.6	1.4	-
10	HTT 120	2.4	2.6	-
Average		5	-	-
		LSD 5% = 7.8	LSD 1% =10.5	LSD 0.1% = 13.8

The biggest attack degree was recorded in T 200 maize hybrid in both experimental years (2008 and 2009), 25.7% ($p < 0.001$) and 18.3%, respectively ($p < 0.01$). The average attack frequency was of 9% in 2008, value that decreased to 5% in 2009. The lowest attack was recorded in T 160 in 2008 (2.2%) and in Turda Favorit in 2009 (2.3%).

During the vegetation phase, function of the evolution of climatic conditions correlated to the nutrition level, the foliar area can also be affected through the appearance of some burnings (necrosis) on foliar limb. In this case, it can be observed, too, that the average attack level differ from a year to the other experimental year, and hybrids' behaviour to this type of symptoms, was also different (tables 5 and 6). The ttack frequency was bigger in 2009 compared to 2008 with average of 47.5% and 57.3%, respectively.

Table 5

The reaction of some maize hybrids against Fusariosis attack (necrosis on upper side) - Turda, 2008

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	T 145	51.2	5.7	-
2	T 165	43.4	-2.1	-
3	T.M. 188	48.4	2.9	-
4	T STAR	41.0	-4.5	-
5	T 201	53.3	7.8	-
6	T 200	46.4	0.9	-
7	T FAV.	31.3	-14.2	0
8	T 160	43.2	-2.3	-
9	T SU 182	56.4	10.9	-
10	T SU 210	40.1	-5.4	-
Average		45.5	-	-

LSD 5% = 14.0 LSD 1% = 18.8 LSD 0.1% = 24.8

Table 6

The reaction of some maize hybrids against Fusariosis attack (necrosis on upper side) - Turda, 2009

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	Turda 145	53,7	-4.4	-
2	Turda 165	47,5	-9.8	-
3	Turda Mold 188	61,5	4.2	-
4	Turda 200	50,5	-6.8	-
5	Turda Super	72,9	15.6	-
6	Turda 201	70,2	12.9	-
7	Turda Favorit	55,8	-1.5	-
8	Turda Star	51,3	-6.0	-
9	HTT 112	78,6	21.3	*
10	HTT 120	31,2	-26.6	**00**
Average		57.3	-	-

LSD 5% = 16.2 LSD 1% = 21.7 LSD 0.1% = 28.6

From the consumers' point of view, the most serious attack is on the maize cob and grains, due to the mycotoxin content that could produce important metabolic disorders and diseases of liver, kidney, reproductive organs. The level of cob attack may be correlated with the level of attack located at the bottom of the stems and on leaves, being strongly influenced by the climatic conditions recorded during grains maturation time interval. This can also influence the level of productions (table 8).

The attack frequency in cobs recorded an average of 9.7% by entire analyzed experimental time interval, while the frequency of attack with consequences on production recorded an average of 13.71%.

Table 7

The reaction of some maize hybrids against Fusariosis attack (cobs)

No.	Hybrid	Attack frequency (%)	Difference compared to control	Significance of difference
1	T 145	6.6	-3.1	0
2	T 165	10.4	0.7	-
3	T.M. 188	7.1	-2.6	-
4	T STAR	5.3	-4.4	00
5	T 201	9.4	-0.3	-
6	T 200	8.1	-1.6	-
7	T FAV.	9.9	0.2	-
8	T 160	13.9	4.2	**
9	T SU 182	14.2	4.5	**
10	T SU 210	12.5	2.8	-
Average		9.7	-	-

LSD l 5% = 3.0 LSD 1% = 4.0 LSD 0.1% = 5.3

Table 8

The reaction of some maize hybrids against Fusariosis attack (production)

No.	Hybrid	Total attack degree (%)	Production	Difference against control	Significance of difference
1	T 145	10.90	102.5	-3.5	-
2	T 165	17.60	103.6	-2.3	-
3	T.M. 188	13.00	103.4	-2.5	-
4	T STAR	6.45	119.4	13.5	***
5	T 201	11.69	108.3	2.4	-
6	T 200	19.00	99.9	-6.0	0
7	T FAV.	12.40	106.6	0.7	-
8	T 160	19.10	98.1	-7.8	--
9	T SU 182	15.89	106.2	0.3	-
10	T SU 210	14.02	111.2	5.3	-
Average		13.71	105.9	-	-

LSD 5% = 5.4 LSD 1% = 7.2 LSD 0.1% = 9

CONCLUSIONS

The studied hybrids had different behaviour concerning the stem breaking, and different average level of attack was recorded in both experimental years. Concerning T 145 and T 200 hybrids contradictory data were recorded and further research is needed in order to final conclusion can be mentioned only after the end of the entire programme.

During the vegetation phase, the foliar area can be affected by necrosis of the foliar limb, function of the evolution of climatic conditions correlated to the nutrition level.

The plant rotten most frequently appeared when seeds with high percent of attack not chemically treated are used. In this case, too, the phenomenon was recorded when humidity and temperature conditions supplied for plat germination are not appropriate.

The mycotoxins attack produce serious damages of the maize cob and grains, influencing in great measure the level of productions.

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