RESULTS CONCERNING THE ATTACK OF THE FUNGUS *FUSARIUM GRAMINEARUM* IN ALMAJULUI DEPRESSION

Anişoara ZABERCA, A. BORCEAN

U.S.A.M.V.B. Timişoara, Calea Aradului 119, Timişoara, 300645, Romania
E-mail: anyanyzaby@yahoo.com

Abstract: *Research aim was to test the tolerance of a range of maize hybrids to infectious pressure of the pathogen Fusarium graminearum in climatic conditions of Almaj Depression. Stage of research is being characteristic for partial interpretation of experimental data after the first experimental year, in preparation the doctoral thesis. Experimental field was located in climatic conditions Almaj Depression. Technology was the standard applied to this area. The experience was bifactorial. First factor was the hybrid grown with six graduations, provenance hybrids was Monsanto with different vegetation periods, (DKC 3511, DKC 4626, DKC 4964, DKC 4983, DKC 5783 and DKC 5170). Factor B was the plant density with tw graduations (N_0, N_{100} and N_{200}) all three doses were applied on a constant background elements of P_{80} K_{80}. The novelty is relatively high, work providing important data for agricultural practice in the experimental area, taking in consideration the implications of fungus Fusarium in yield preservation during winter in normal farm conditions. In this work were carried out research including one of authors, known as the reference and possible reactions of the pathogen depending on local biocoenosis factors. Limits of the research are that data from the fungus Ustilago maydis are just after one year bonitation. Practical implications of the research consisted of playing a part of a complex study of strategy in the protection of maize reference experience. The originality of the work comes from the fact that data are relevant in view of uniformity of hybrid origin, these data are only part of the data submitted for interpretation in the preparation of the doctoral experience of the author. Importance of the paper became from bringing in front of the specialists of one of the topics in the experiences of the author's doctoral preparing, to evaluate the accuracy of techniques addressed. The relevant data, experimental results give an overview of pathogen behavior in relation to hybrids experienced by groups of precocity.*

Key words: *Fusarium graminearum, plant tolerance, nitrogen amount*

INTRODUCTION

Between July and August 2009 and 2010 we have made a number of observations in the maize experimental of field from city region Bozovici from Almaj Valley. It was very interesting to see the differences between hybrids to the attack of fungus *Fusarium graminearum* and, as a part of a larger study concern the main pathogens of maize behavior in the climate conditions from the region

MATERIAL AND METHODS

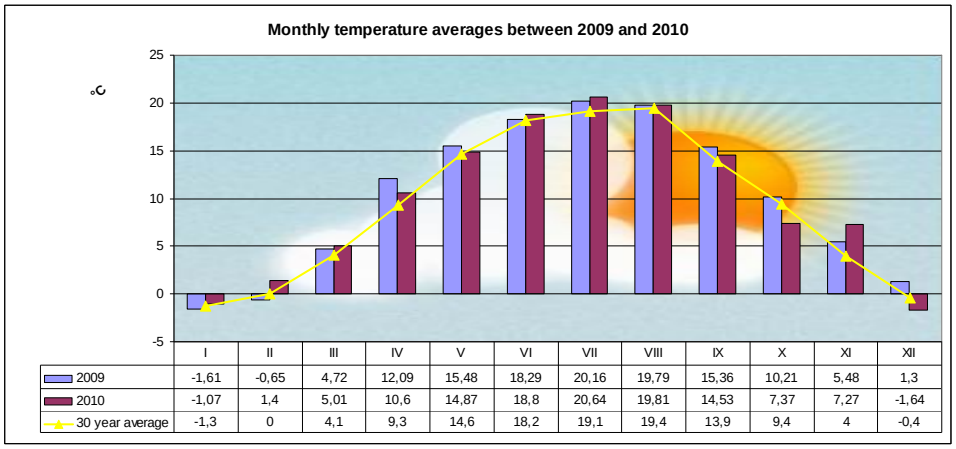
The purpose of this study was to see the behavior of a large assortment of hybrids to infection with *Fusarium gramintearum* under natural conditions from the hilly part of southern Banat of Romania. The field observations consist from readings of the frequency of attack, intensity of attack at corn cobs. On the base of those data it was calculated the attack degree as synthetic indicator and also it was performed statistic interpretation after the method for one factor experiments.

Biological material consist from the following hybrids DKC 3511, 4626 DKC, DKC 4964, DKC 4983, DKC 5783 and DKC 5170

Experimental conditions where those from the city region Bozovici from Almaj

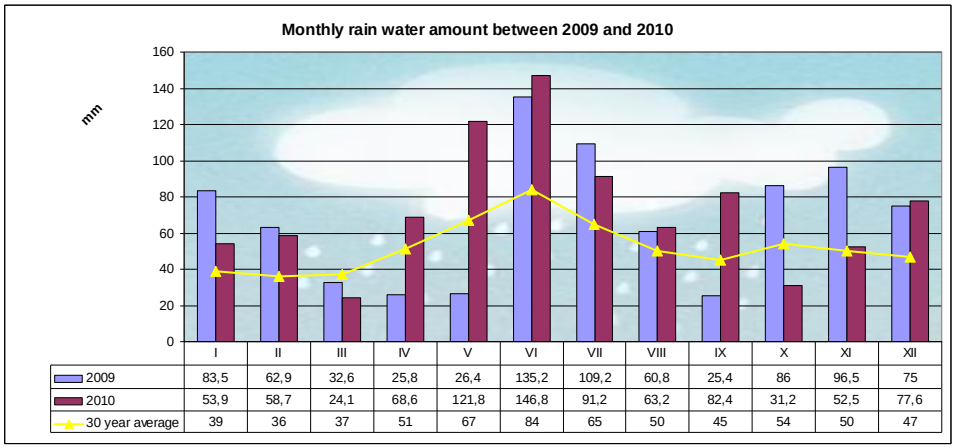
Valley . In the figures below are described temperature (figure 1) and rain (figure2) between 2009 and the multiannual average for this two whether parameters available for the experimental field.

The soil from the experimental field was a luvosol moderately gleyed with weak acid reaction, moderate humus content, eubazic. In principal, this soil is favorable for maize with condition to bring the necessary amount of nutrients with fertilizers.. This was one of the motives that we have decide to test the fertilizers effect on the interaction between maize hybrids and cobs pathogens.



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2009	-1,61	-0,65	4,72	12,09	15,48	18,29	20,16	19,79	15,36	10,21	5,48	1,3
2010	-1,07	1,4	5,01	10,6	14,87	18,8	20,64	19,81	14,53	7,37	7,27	-1,64
30 year average	-1,3	0	4,1	9,3	14,6	18,2	19,1	19,4	13,9	9,4	4	-0,4

Figure 1. Monthly temperature averages, compared with long term averages recorded at Bozovici Meteorological Station



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2009	83,5	62,9	32,6	25,8	26,4	135,2	109,2	60,8	25,4	86	96,5	75
2010	53,9	58,7	24,1	68,6	121,8	146,8	91,2	63,2	82,4	31,2	52,5	77,6
30 year average	39	36	37	51	67	84	65	50	45	54	50	47

Figure 2. Monthly rainfall water amount, compared with long term averages recorded at Bozovici Meteorological Station

Weather conditions during the vegetation period in the period between years 2009 and 2010 comparing with the 30 years average (figure1 and figure 2) was more favorable for maize in 2010 because almost all values of month temperatures and rain water was higher than those

registered in 2009. From the pathogen point of view, the weather was also more favorable in 2010 than in 2009 between July and August. Even in these conditions we have to remark the lack of rains at the end of August and in September 2009, but situation came almost in normal in 2010(figure 2.). This bring the effect of values depression in 2009 for fungus attack on corn cobs.

RESULTS AND DISCUSSIONS

The results of the observations concerning attack frequency and intensity from the field are in table 1. Based on these observations there was calculate the attack degree as synthetic indicator, figures of this parameter is also in table 1. Because the attack degree is a synthetic indicator of attack frequency and intensity of attack we will refer at it for statistic calculation.

In 2009 frequency registered lower values the intensity of attack, but this situation was corrected in 2010 when the rain amount during summer month raise the attack parameters. This evolution is reflected in the attack degree values trend. As it can be seen in table 2, the year 2010 was much more favorable for fungus *Fusarium sp.* attack on maize cobs than year 2009.

Hybrids has shown the real potential of their tolerance at pathogen attack. The results shown in table 2 enlighten DKC 4983 as the most tolerant hybrid at *Fusarium sp.* attack, with a very significant negative difference to control, the experimental average for this factor. The second hybrid as tolerance to pathogen attack was DKC 4626 with a significant negative difference to control.

On the other side we can say that the hybrids DKC 4964 and DKC 5170 prove to be sensitive to *Fusarium sp.* attack, with very significant differences to control. It is also a fact that this two hybrids come from different precocity groups, and this prove once again that the resistance and tolerance at fungus *Fusarium sp.* is not influenced by the precocity.

Regarding at the hybrids behavior to different nitrogen amount, comparing with the lowest amount of nitrogen, statistic results show at 150 kg/ha and 200 kg/ha, that the plants become sensitive to pathogen attack. The higher values of attack frequency and intensity was in the variants where there was applied the largest amount of nitrogen. As becomes from table 2 the difference to control was very significant.

CONCLUSIONS

- The frequency and intensity of fungus *Fusarium graminearum* attack have a very high variation on all hybrids, some of them as DKC 4983 and DKC 4626 prove to have a high tolerance to this fungus, even under conditions when the technology and natural factors stimulate the fungus attack.
- From the tested hybrids, DKC 4964 and DKC 5170 prove to be sensitive to *Fusarium sp.* attack, with very significant differences to control.
- In both experimental years, there was an extension of the period of maximum sensitivity of plants(between period when stigmata are visible and the moment when kernels are in milk stage) to *Fusarium sp.* attack in the variants where was applied 200 kg/ha nitrogen.
- Regarding to the effect of nitrogen, it is very clear that the incresing of nitrogen dosage conduct to an increase of attack degree wich registry a distinct significan value of difference on the nitrogen amount of 150 kg/ha and a very significant difference on the nitrogen amount of 200 kg/ ha.

Table 1

Field readings for frequency and intensity and calculated attack degree of fungus *Fusarium graminearum* for the experimental variants in the between 2009 and 2010

Anul	Hibridul	Agrofondul	Frequency (%)				Intensity(%)				Attack degree			
			R1	R2	R3	Average	R1	R2	R3	Average	R1	R2	R3	Average
2009	DKC 3511	$N_{100}P_{80}K_{80}$	1	1	5	2,33	5	5	10	6,66	0,05	0,05	0,5	0,2
		$N_{150}P_{80}K_{80}$	5	10	5	6,66	10	5	20	11,66	0,5	0,5	1	0,66
		$N_{200}P_{80}K_{80}$	5	15	15	11,66	10	10	15	11,66	0,5	1,5	2,25	1,41
	DKC 4626	$N_{100}P_{80}K_{80}$	3	5	5	4,33	5	5	5	5	0,15	0,25	0,25	0,21
		$N_{150}P_{80}K_{80}$	3	10	5	6	5	5	10	6,66	0,15	0,5	0,5	0,38
		$N_{200}P_{80}K_{80}$	15	10	10	11,66	10	5	5	6,66	1,5	0,5	0,5	0,83
	DKC 4964	$N_{100}P_{80}K_{80}$	5	5	5	5	10	5	10	8,33	0,5	0,25	0,5	0,41
		$N_{150}P_{80}K_{80}$	10	5	10	8,33	15	5	15	11,66	1,5	0,25	1,5	1,08
		$N_{200}P_{80}K_{80}$	15	5	25	15	15	10	10	11,66	2,25	0,5	2,5	1,75
	DKC 4983	$N_{100}P_{80}K_{80}$	5	1	1	2,33	5	10	10	8,33	0,25	0,1	0,1	0,15
		$N_{150}P_{80}K_{80}$	5	5	5	5	5	10	5	6,66	0,25	0,5	0,25	0,33
		$N_{200}P_{80}K_{80}$	10	5	5	6,66	15	15	20	16,66	1,5	0,75	1	1,08
	DKC 5170	$N_{100}P_{80}K_{80}$	5	5	1	3,66	1	5	5	3,66	0,05	0,25	0,05	0,11
		$N_{150}P_{80}K_{80}$	10	5	10	8,33	5	5	5	5	0,5	0,25	0,5	0,41
		$N_{200}P_{80}K_{80}$	15	15	10	13,33	5	10	5	6,66	0,75	1,5	0,5	0,91
	DKC 5183	$N_{100}P_{80}K_{80}$	1	5	5	3,66	1	5	1	2,33	0,01	0,25	0,05	0,10
		$N_{150}P_{80}K_{80}$	5	5	5	5	1	5	5	3,66	0,05	0,25	0,25	0,18
		$N_{200}P_{80}K_{80}$	15	10	15	13,33	15	10	15	13,33	2,25	1	2,25	1,83
2010	DKC 3511	$N_{100}P_{80}K_{80}$	5	7	5	5,66	10	5	10	8,33	0,5	0,35	0,5	0,45
		$N_{150}P_{80}K_{80}$	8	15	10	11	10	15	20	15	0,8	2,25	2	1,68
		$N_{200}P_{80}K_{80}$	12	20	15	15,66	25	20	15	20	3	4	2,25	3,08
	DKC 4626	$N_{100}P_{80}K_{80}$	5	10	10	8,33	8	5	10	7,66	0,4	0,5	1	0,63
		$N_{150}P_{80}K_{80}$	15	10	7	10,66	15	15	10	13,33	2,25	1,5	0,7	1,48
		$N_{200}P_{80}K_{80}$	15	25	20	20	10	10	25	15	1,5	2,5	5	3
	DKC 4964	$N_{100}P_{80}K_{80}$	8	5	7	6,66	18	15	10	14,33	1,44	0,75	0,7	0,96
		$N_{150}P_{80}K_{80}$	15	5	10	10	20	25	15	20	3	1,25	1,5	1,91
		$N_{200}P_{80}K_{80}$	15	15	25	18,33	25	15	25	21,66	3,75	2,25	6,25	4,08
	DKC 4983	$N_{100}P_{80}K_{80}$	5	1	5	3,66	15	10	7	10,66	0,75	0,1	0,35	0,4
		$N_{150}P_{80}K_{80}$	5	10	5	6,66	15	10	20	15	0,75	1	1	0,91
		$N_{200}P_{80}K_{80}$	10	15	15	13,33	25	18	20	21	2,5	2,7	3	2,73
	DKC 5170	$N_{100}P_{80}K_{80}$	10	5	5	6,66	5	10	5	6,66	0,5	0,5	0,25	0,41
		$N_{150}P_{80}K_{80}$	10	15	10	11,66	15	5	10	10	1,5	0,75	1	1,08
		$N_{200}P_{80}K_{80}$	15	15	25	18,33	15	10	20	15	2,25	1,5	5	2,91
	DKC 5183	$N_{100}P_{80}K_{80}$	8	5	7	6,66	5	5	8	6	0,4	0,25	0,56	0,40
		$N_{150}P_{80}K_{80}$	15	5	10	10	10	5	15	10	1,5	0,25	1,5	1,08
		$N_{200}P_{80}K_{80}$	20	15	20	18,33	20	25	20	21,66	4	3,75	4	3,91
	Media	$N_{100}P_{80}K_{80}$	5,08	4,58	5,08	4,91	7,33	7,08	7,58	7,33	0,41	0,3	0,40	0,37
		$N_{150}P_{80}K_{80}$	8,83	8,33	7,66	8,27	10,5	9,16	12,5	10,72	1,0625	0,77	0,975	0,93
		$N_{200}P_{80}K_{80}$	13,5	13,75	16,66	14,63	15,83	13,16	16,25	15,08	2,14	1,87	2,87	2,29

Tabel 2.

Statistic analize of fungus *Fusarium sp.* attack between 2009 and 2010

Factor A Year	Factor B Hibrid	Factor C- Fertilizers			Averages of Factor A	Differences	Signif
		N_{100} P_{80} K_{80}	N_{150} P_{80} K_{80}	N_{200} P_{80} K_{80}			
2009	DKC 3511	0,2	0,66	1,41	0,67	-0,52	000
	DKC 4626	0,21	0,38	0,83			
	DKC 4964	0,41	1,08	1,75			
	DKC 4983	0,15	0,33	1,08			
	DKC 5170	0,11	0,41	0,91			
	DKC 5183	0,10	0,18	1,83			
2010	DKC 3511	0,45	1,68	3,08	1,73	0,53	***
	DKC 4626	0,63	1,48	3			
	DKC 4964	0,96	1,91	4,08			
	DKC 4983	0,4	0,91	2,73			
	DKC 5170	0,41	1,08	2,91			
	DKC 5183	0,40	1,08	3,91			
Averages	DKC 3511	0,32	1,17	2,24	1,19	Witness	-
	DKC 4626	0,42	0,93	1,91			
	DKC 4964	0,68	1,49	2,91			
	DKC 4983	0,27	0,62	1,90			
	DKC 5170	0,26	0,74	1,91			
	DKC 5183	0,25	0,63	2,87			

DL 5% = 0,04 DL 1% =0,06 DL 0,1% = 0,10

Factor B - Fertilizers	DKC 3511	DKC 4626	DKC 4964	DKC 4983	DKC 5170	DKC 5183	Average
Averages of Factor B	1,24	1,08	1,69	0,93	0,97	1,25	1,19
Differences	0,04	-0,1	0,5	-0,26	0,22	0,05	Control
Significance	-	0	***	000	***	-	-

DL 5% = 0,10 DL 1% = 0,13 DL 0,1% = 0,17

Factor C Fertilizers (kg/ha)	N_{100} P_{80} K_{80}	N_{150} P_{80} K_{80}	N_{200} P_{80} K_{80}
Averages of Factor B	0,37	0,93	2,29
Differences	Witness	0,56	1,92
Significance	-	***	***

DL 5% = 0,07 DL 1% = 0,10 DL 0,1% = 0,13

BIBLIOGRAPHY

1. BALTEANU GH., BIRNAURE V., SALONTAI AL., BORCEAN I., VASILICA C., Fitotehnie, Ed. Didactică şi Pedagogică Bucureşti, 515 pag., 1991
2. BORCEAN I, TABARA V., PIRSAN P., DEMENESCU T., BORCEAN A.,_Cercetări privind stabilirea principalelor verigi tehnologice la porumb în condiţiile Banatului, Lucrări Ştiinţifice, U.A.Iaşi,Vol. XXXIV, pag 157-163, 1992.
3. BORCEAN I.,TABARA V., PIRSAN P., DAVID GH., POP GEORGETA, BORCEAN A., ŞUVETI SIMONA,CIULOI ANCA.,BORUGA L. Comportarea a 40 hibrizi de porumb în condiţiile cernoziomului de la Timişoara, Simpozin-Cultura plantelor de câmp U.S.A.M.V.B. Timişoara, pag 3-9, 1996.
4. DAVID GH., BORCEAN A., Sweet corn – A crop plant with high perspectives on the Western Plain of Romania, University of Agricultural Sciences College of Agricuklture Mezötúr, 1999.
5. BORCEAN I., MIRCOVV. , IMBREA F., BORCEAN A.,_Preliminary results concerning the influence of electromagnetic treatments at maize, Universitatea Novi Sad, Biofizika u

poljoprivrednoi proizvodnji, pag. 187-190, Novi Sad 2002
6. BORCEAN I. , DAVID GH.,BORCEAN A., IMBREA F., BOTOS L., On the behaviour of some new maize hybrids in the conditions of brown luvic soils in the hill area of the Banat, Lucrări Ştiinţifice Facultatea de Agricultură, U.S.A.M.V.B. Timişoara, Vol XXXIV, pag 187-192, 2002.
7. BORCEAN A, DAVID GH., MOLNAR L., Observaţii privind comportarea unui sortiment de hibrizi de porumb la atacul ciupercii Ustilago maydis în condiţiile anului 2006 de la SD a USAMVB Timişoara. Trends in European agriculture development, Faculty of Agriculture Timisoara and Faculty of Agriculture Novi Sad International Symposium, 2007
8. BORCEAN I, BORCEAN A., 2004**,** Cultura si protecţia integrată a cerealelor, leguminoaselor şi plantelor tehnice, Editura de Vest, 509 pag.
9. BORCEAN I., ŢARAU D., BORCEAN A., DAVID GH., BORCEAN EUGENIA, Fitotehnia şi protecţia culturilor de câmp, Editura de Vest, 198 pag.
10. BORCEAN I., DAVID GH., BORCEAN A., Tehnici de cultură şi protecţie a cerealelor şi leguminoaselor, Editura de Vest, 346 pag.
11. POPESCU GH. – Fitopatologie, Ed. Mirton, Timişoara, 1998
12. M. HATMANU, I. BOBES, AL. LAZAR, C. GHEORGHIES, C. GLODEANU, V. SEVERIN, Corina Tuşa – Fitopatologie, Ed. Didactică şi Pedagogică, Bucureşti, 1989, 468 pag.
13. NITA SIMONA, BORCEAN A., Study regarding some varieties of Zea mays everta Stuart which grow under the pedo-climatic conditions in Almaj Depresion, „60 de ani de învăţământ superior în Oltenia", Annales of University of Craiova, Vol XXXVII / A 2007, pag. 664-666, 2007
14. PIRSAN P., DAVID GH., BORCEAN A., WAUTERS S., Cercetări cu privire la studiul unui sortiment de hibrizi proveniţi din vestul Europei în condiţiile de la Timişoara, Lucrări Ştiinţifice, U.S.A.M.V.B. Timişoara, Vol XXX, 1998.