

STUDY CONCERNING THE INFLUENCE OF MAIZE SOWING DENSITY ON *USTILAGO MAYDIS* ATTACK

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ABSTRACT - Study concerning the influence of maize sowing density on *Ustilago maydis* attack

Research aim was to test the tolerance of a range of maize hybrids in different sowing density to infectious pressure of the pathogen *Ustilago maydis* in climatic conditions from Didactic Research Station of USAMVB Timisoara. Present paper provides important data for agricultural practice from hybrids reaction to pathogen *Ustilago maydis* point of view for the experimental area. Experimental results give an overview of pathogen behavior in relation to hybrids experienced by groups of precocity.

Keywords: maize hybrids, *Ustilago maydis*, sowing density.

INTRODUCTION

Between July and August of the years 2009 and 2010 there was carried out a number of observations in the maize experimental of field crops from Didactic Research Station of USAMVB Timisoara. It was very interesting to see the differences between hybrids susceptibility sown at different densities to the attack of fungus *Ustilago maydis*. These results could be considered some interesting information's for other researchers and farmers in the light of the previous research from this domain (DAVID GH. et al., 1999).

MATERIAL AND METHOD

Experimental conditions where those from the Didactic Research Station of USAMVB Timisoara. In the figures below are described temperature (Figure 1) and rain water amount (Figure 2) between 2009 and 2010. To ensure a better comparison we manage to introduce also there the data of multiannual average for these two weather parameters available for the experimental field.

The purpose of this study was to see the behaviour of an assortment of hybrids sown at different densities to infection with common smut of maize (*Ustilago maydis*) under natural conditions from Didactic Research Station of USAMVB Timisoara. There were performed observations in the field concerning the frequency and intensity of fungus attack at corn cobs. Based on those data it was calculated the attack degree as synthetic indicator performed statistic interpretation after the method for two factors experiments. Biological material consists from the following hybrids DKC 3511, DKC 4626, DKC 4964, DKC 4983, DKC 5170 and DKC 5783. These hybrids came from different precocity groups as it follows: DKC 3511 is classified in FAO 310 precocity group, DKC 4626 belongs in FAO 350 precocity group, DKC 4964 belongs in FAO 390 precocity group, DKC 4983 belongs to FAO 400 precocity group, DKC 5170 belongs to FAO 460 precocity group and DKC 5783 belongs to FAO 490 precocity group. In this way hybrids used in experience cover a larger period of plants cobs susceptibility to the corn smut and so we can appreciate which is the most exposed precocity group (BORCEAN A. et al, 2007).

Statistic calculations were done only for attack degree because this parameter is practically a synthesis of both, attack frequency and attack intensity.

Figure 1: Monthly temperature averages from 2009 and 2010, compared with long term averages recorded at Timișoara Meteorological Station.

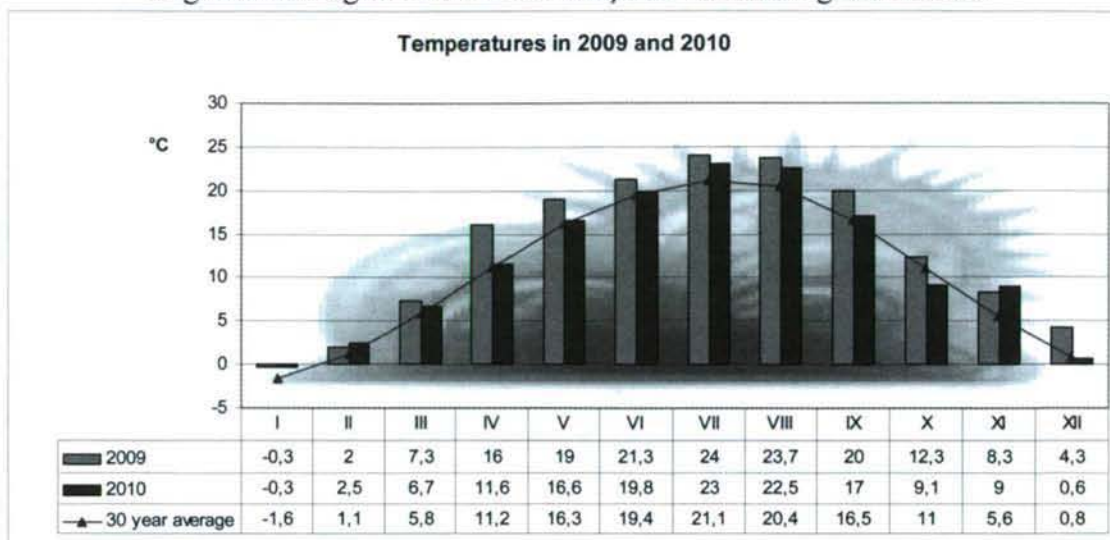
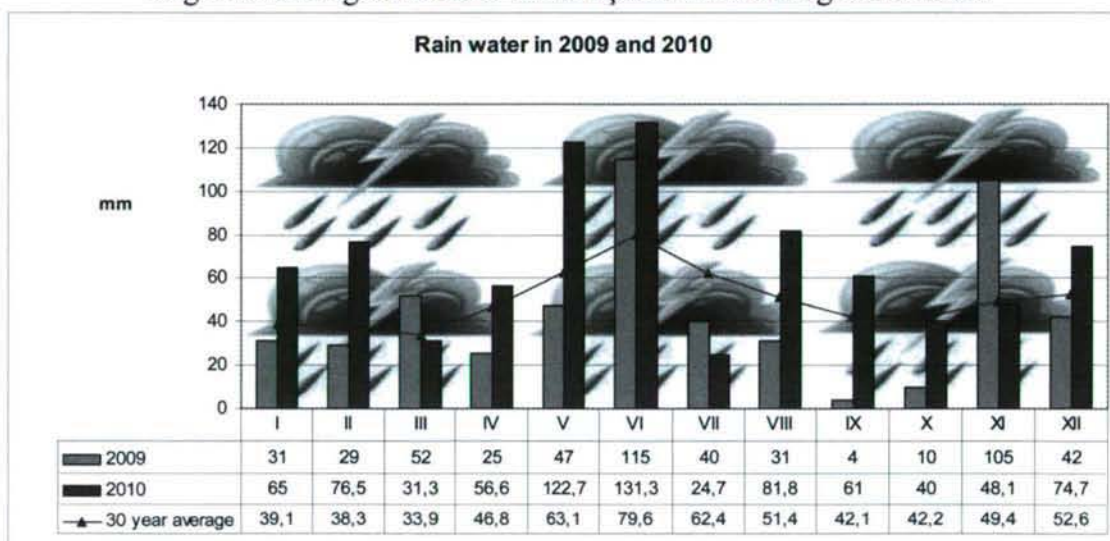


Figure 2: Monthly rainfall water amount from 2009 and 2010, compared with long term averages recorded at Timișoara Meteorological Station.



RESULTS

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 and the results of statistic interpretation are in tables 2 and 3.

In 2009, the attack degree values, over all experimental factors were between 0.32 and 5.50 (Table 1). This underlines once again the wide variation in attack frequency and intensity of experimental versions.

Regarding to statistic interpretation of experimental data, hybrids showed a variation in the degree of attack on all averages of the two densities used, between 0.83 and 3.25 (Table 2).

Table 1: Field readings for frequency and intensity recorded in Timișoara and calculated attack degree of fungus
Ustilago maydis (D.C.) Cda between 2009 and 2010.

Year	Hybrid	Density	Frequency (%)				Intensity (%)				Attack degree			
			R1	R2	R3	x	R1	R2	R3	x	R1	R2	R3	x
2009	DKC 3511	4 plants / m ²	10	5	10	8,33	5	5	10	6,67	0,5	0,25	1	0,58
		5 plants / m ²	20	15	25	20,00	20	15	15	16,67	4	2,25	3,75	3,33
	DKC 4626	4 plants / m ²	10	15	5	10,00	1	5	5	3,67	0,1	0,75	0,25	0,37
		5 plants / m ²	25	15	20	20,00	20	10	15	15,00	5	1,5	3	3,17
	DKC 4964	4 plants / m ²	10	10	5	8,33	5	5	10	6,67	0,5	0,5	0,5	0,50
		5 plants / m ²	15	25	20	20,00	10	20	25	18,33	1,5	5	5	3,83
	DKC 4983	4 plants / m ²	15	5	10	10,00	5	15	15	11,67	0,75	0,75	1,5	1,00
		5 plants / m ²	20	20	25	21,67	25	20	30	25,00	5	4	7,5	5,50
	DKC 5170	4 plants / m ²	10	5	10	8,33	2	5	5	4,00	0,2	0,25	0,5	0,32
		5 plants / m ²	15	20	20	18,33	10	20	10	13,33	1,5	4	2	2,50
2010	DKC 5183	4 plants / m ²	5	5	5	5,00	5	10	5	6,67	0,25	0,5	0,25	0,33
		5 plants / m ²	15	10	15	13,33	15	10	5	10,00	2,25	1	0,75	1,33
	DKC 3511	4 plants / m ²	15	10	5	10,00	10	10	15	11,67	1,5	1	0,75	1,08
		5 plants / m ²	20	20	25	21,67	20	15	30	21,67	4	3	7,5	4,83
	DKC 4626	4 plants / m ²	15	5	15	11,67	5	15	15	11,67	0,75	0,75	2,25	1,25
		5 plants / m ²	15	25	15	18,33	25	20	15	20,00	3,75	5	2,25	3,67
	DKC 4964	4 plants / m ²	5	10	15	10,00	15	5	10	10,00	0,75	0,5	1,5	0,92
		5 plants / m ²	25	15	25	21,67	15	15	25	18,33	3,75	2,25	6,25	4,08
	DKC 4983	4 plants / m ²	5	10	10	8,33	10	15	5	10,00	0,5	1,5	0,5	0,83
		5 plants / m ²	15	20	15	16,67	20	15	20	18,33	3	3	3	3,00
Hybrids average	DKC 5170	4 plants / m ²	5	5	5	5,00	10	10	5	8,33	0,5	0,5	0,25	0,42
		5 plants / m ²	15	5	10	10,00	25	15	15	18,33	3,75	0,75	1,5	2,00
	DKC 5183	4 plants / m ²	5	5	1	3,67	5	5	10	6,67	0,25	0,25	0,1	0,20
		5 plants / m ²	15	10	10	11,67	15	10	15	13,33	2,25	1	1,5	1,58
		4 plants / m ²	9,17	7,50	8,00	8,22	6,50	8,75	9,17	8,14	0,55	0,63	0,78	0,65
		5 plants / m ²	17,92	16,67	18,75	17,78	18,33	15,42	18,33	17,36	3,31	2,73	3,67	3,24

Source: own calculation

Legend: - R1, R2 and R3- repetitions of the experience variant;
- x – average of the R1, R2 and R3- repetitions;

The highest degree of attack was recorded in hybrid DKC 4983 with a mean difference compared to the control was significantly distinct. The lowest values of degree of attack occurred at most tardy hybrids, as it is the average of DKC 5170 which stood at a negative significant difference compared to the control and hybrid DKC 5183 whose average was at a distinct negative difference.

Table 2: Statistic interpretation data for attack degree of fungus *Ustilago maydis* from the experience with densities from Timișoara in the year 2009

Factor A Hybrid	Factor B - Density		Averages of factor A	Differences	Signific
	4 plant/m ²	5 plant/m ²			
DKC 3511	0.58	3.33	1.96	0.06	-
DKC 4626	0.37	3.17	1.77	-0.13	-
DKC 4964	0.50	3.83	2.17	0.27	-
DKC 4983	1.00	5.50	3.25	1.35	**
DKC 5170	0.32	2.50	1.41	-0.49	0
DKC 5183	0.33	1.33	0.83	-1.06	00
Hibrids average	0.52	3.28	1.90	Witness	-

DL 5% = 0.3 DL 1% = 0.9 DL 0.1% = 1.7

Factor B - Density	4 plant/m ²	5 plant/m ²
Averages of factor A	0.52	3.28
Differences	Witness	2.76
Significance	-	***

DL 5% = 0.7 DL 1% = 1.1 DL 0.1% = 1.5

Source: own calculation

The results of statistical analysis of the effect of increasing sowing density on the attack degree, confirms the results of the analysis of the impact of higher planting density on the frequency and intensity of *Ustilago maydis* fungus attack. From Table 2 it is clear that an increase from 4 plants/m² to 5 plants/m² led to an increase in the attack degree, the difference between the two experimental versions was statistically very significant.

In the year 2010 as it came from Table 3, the degree of attack as synthetic index of frequency and intensity of attack had a median response between the two parameters. Thus, the amplitude of variation of degree of attack over all hybrids and densities tested, ranged from 0.2 to 4.83 (Table 3.).

Analysis of the attack on hybrids of experience has shown that this parameter provides a clearer synthetic reaction in a specific germplasm experimental context. So you can see a clearer segregation of the fungus *Ustilago maydis* attack tolerance depending on hybrids precocity. So the degree of attack at the earliest hybrids was higher than that of the later hybrids.

Statistical analysis (Table 3.) indicates that the most sensitive hybrid DKC 3511 had a significant difference compared to the control. This is followed by hybrids with half early ripening DKC 4626 and DKC 4964 that showed significant differences compared with controls. At the opposite side was the reaction to pathogen attack over the half tardy hybrid DKC 5170 which registered a significantly negative difference compared to the control. Also late ripening hybrid DKC 5183 registered a distinctly negative significance difference compared to the control.

Table 3: Statistic interpretation data for attack degree of fungus *Ustilago maydis* from the experience with densities from Timișoara in the year 2010

Factor A Hybrid	Factor B - Density		Averages of factor A	Differences	Signific
	4 plant/m ²	5 plant/m ²			
DKC 3511	1.08	4.83	2.96	0.97	**
DKC 4626	1.25	3.67	2.46	0.47	*
DKC 4964	0.92	4.08	2.50	0.51	*
DKC 4983	0.83	3.00	1.92	-0.07	-
DKC 5170	0.42	2.00	1.21	-0.78	0
DKC 5183	0.20	1.58	0.89	-1.10	00
Hibrids average	0.78	3.19	1.99	Witness	-

DL 5% = 0.4 DL 1% = 0.9 DL 0.1% = 1.4

Factor B - Fertilizers	4 plant/m ²	5 plant/m ²
Averages of factor A	0.78	3.19
Differences	Witness	2.41
Significance	-	***

DL 5% = 0.8 DL 1% = 1.2 DL 0.1% = 1.7

Source: own calculation

If sowing density is increased, statistical analysis confirms the results of the frequency and intensity of corn cob smut attack. This is because increased planting density from 4 plants/m², 5 plants/m², led to increasing attack with a very significant difference.

CONCLUSIONS

The increase of plant sowing density has on all hybrids the effect of the increase of infection pressure with an increase of attack parameters of fungus *Ustilago maydis*, specially in the years with favourable climatic conditions.

The most susceptible hybrids on corn cobs smut attack, under lower plain climatic conditions, are the early ripening hybrids.

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