

THE BEHAVIOUR OF SOME NATIVE AND FOREIGN MAIZE HYBRIDS TO THE ATTACK OF PESTS AND PATHOGENIC AGENTS, UNDER CONDITIONS OF CHEMICALLY TREATED SEED

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ABSTRACT - The paper presents the results of experimental studies conducted in 2003 at the Agricultural Research and Development Station of Podu-Iloaiei, Iași County, on the behaviour of some native and foreign maize hybrids, to the attack of pathogenic agents and pests, under conditions of using untreated and chemically treated seed. A good resistance to the attack of pathogenic agents was found in hybrids Turda 198 and Turda 200, with a very good sprouting ($F=93\%$) and a good resistance to the attack of pests. From the foreign maize hybrids with treated seeds, the Pelican hybrid has shown a good sprouting and a high resistance to the attack of diseases and pests. The comparative analysis of the behaviour of native and foreign maize hybrids to the attack of pests and pathogenic agents has shown a better sprouting (80.75%) in the 10 native hybrids, compared to the eight foreign hybrids (68.62%), an efficiency of seed treatment with higher values in native hybrids, and the diminution of the pest and pathogen attack (*Gibberella fujikuroi*, *Sorosporium holci-sorghii*, *Ustilago maydis*, *Agriotes spp.*, and *Ostrinia nubilalis*).

Key Words: maize hybrids, pathogenic agents, pests, treated seed, insecto-fungicides

REZUMAT - Comportarea unor hibrizi de porumb autohtoni și străini la atacul de agenți patogeni și dăunători, în condițiile utilizării de sămânță tratată chimic. În lucrare se prezintă rezultatele cercetărilor și studiilor experimentale obținute în anul 2003, la SCDA Podu-Iloaiei, jud. Iași, privind comportarea unor hibrizi de porumb autohtoni și străini, la atacul de agenți patogeni și dăunători, în condițiile utilizării de sămânță netratată și tratată chimic cu diferite produse fitosanitare. S-a evidențiat o rezistență ridicată la atacul de agenți patogeni a

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hibrizilor Turda 198 și Turda 200, cu o răsărire foarte bună ($F=93\%$) și o bună rezistență la atacul dăunătorilor. La hibrizii de porumb din import, cu sămânță tratată, hibridul Pelican a prezentat o bună răsărire, rezistență ridicată la atacul bolilor și a dăunătorilor. Analiza comparativă a comportării hibrizilor de porumb autohtoni și a celor străini, la atacul agenților patogeni și al dăunătorilor evidențiază la cei 10 hibridi autohtoni o răsărire mai bună (80,75%), comparativ cu cei 8 hibridi din import (68,62%) și o eficacitate a tratamentului la sămânță cu valori superioare la hibrizii autohtoni, cu reducerea atacului de patogeni și dăunători (*Gibberella fujikuroi*, *Sorosporium holci-sorghii*, *Ustilago maydis*, *Agriotes spp.*, *Ostrinia nubilalis*).

Cuvinte cheie: hibridi de porumb, agenți patogeni, dăunători, sămânță tratată, insectofungicide

INTRODUCTION

The seeds, on the surface of tegument, in endocarp or coleoptile, carry infectious germs (viruses, bacteria and fungi) or they can result from plants with severe physiological forms (Baicu, 1971).

From the phytopathological point of view, the following pathogenic agents are transmitted through maize seeds: *Fusarium moniliforme* and *Fusarium graminearum*, *Nigrospora oryzae*, *Ustilago zaeae*, *Sorosporium holci-sorghii*, *Drechslera turcica*, etc.

In order not to register qualitative and quantitative yield losses, before soil incorporation, seeds must be treated. By seed treatments, most of pathogenic agents which are present at seed surface are destroyed, and the used products ensure the protection of emerging plantlet against some pathogenic agents or saprophytes and other pests from soil, during 2-3 weeks after emergence (Baicu, 1982). The maize seed treatment is the most important measure for protecting crops against pathogens, which are transmitted through seeds and soil and, therefore, this measure is compulsory.

The paper presents the behaviour in comparative crops of 10 native maize hybrids and eight foreign hybrids cultivated at the Agricultural Research Station of Podu-Iloaiei, in 2003.

MATERIALS AND METHODS

In this trial, we have tested 10 native maize hybrids: Turda-Moldova 188, Turda 165, Turda 198, Turda 200, Turda 201, Turda Super, Turda-Suceava 182, Turda Favorit, Elan and Montana and eight foreign maize hybrids: DK 335, DK 386, DK 391 (Monsanto - France) and Alpha, Peso, Furio, Occitan, Pelican (Syngenta Agro SRL Romania).

The maize seed was chemically treated with one of the following mixtures of phytosanitary products (Șandru, 1996): Semafor 20 ST (2l/t) + Tiradin 500 CS (3l/t); Cruiser 350 FS (9l/t) + Tiradin 500 CS (3l/t); Tirametox 625 CS (3.75 l/t) + Tiradin 500 CS (3l/t).

THE ATTACK OF PATHOGENIC AGENTS ON MAIZE HYBRIDS

Each hybrid was cultivated in three variants, a variant being formed of two rows with the length of 8.5 m. Variant 1 – treated seed - Semafor 20 ST (21/t) + Tiradin 500 CS (31/t); Variant 2 – treated seed - Cruiser 350 FS (91/t) + Tiradin 500 CS (31/t); Variant 3 – treated seed - Tirametox 625 CS (3,75 l/t) + Tiradin 500 CS (31/t).

Observations were carried out on the frequency (F%) of the attack of pathogenic agents, seed germination, plant development (height) and frequency of pest attack (the pests are vectors of the pathogenic agents).

RESULTS AND DISCUSSION

The analysis of data from *Table 1* has shown, under conditions of our experiment, a high resistance to the attack of pathogenic agents of hybrids Turda 198 and Turda 200. The Turda 200 hybrid had a very good sprouting (F=93%), and both hybrids presented a good resistance to the attack of pests (*Table 2*).

Table 1

Efficiency of phytosanitary products applied at seed treatment in native maize hybrids, on the frequency of the attack of pathogenic agents, at the Agricultural Research Station of Podu-Iloaiei, year 2003

Variant	Treated hybrids	Seed treatment	Plants attacked by pathogenic agents (F%)				
			<i>Gibberella fujikuroi</i>	<i>Gibberella zeae</i>	<i>Drechslera turcica</i>	<i>Sorosporium holci-sorghii</i>	<i>Ustilago maydis</i>
1	Turda-Moldova 188	V1	1.0	0.2	4.0	0	0
		V2	0.2	0.3	5.1	0	0
		V3	0.3	0.1	3.8	0	0
2	Turda 165	V1	0.3	0.4	3.0	0	0
		V2	0.4	0.3	2.0	0	0
		V3	0.1	0.1	2.0	0	0
3	Turda 198	V1	0	0.1	3.0	0	0
		V2	0	0.4	1.2	0	0
		V3	0	0.1	0.8	0	0
4	Turda 200	V1	0.4	0.4	2.0	0	0
		V2	0.3	0.2	1.8	0	0
		V3	0.2	0.1	1.0	0	0
5	Turda 201	V1	0.1	0.2	4.0	0	0
		V2	0.3	0.3	5.0	0	0
		V3	0.1	0.1	4.3	0	0
6	Turda Super	V1	0	0.3	2.3	0	0
		V2	0	0.3	2.9	0	0
		V3	0	0.1	2.0	0	0
7	Turda-Suceava 182	V1	0.4	0	3.1	0	0.7
		V2	0.2	0	3.0	0	0.5
		V3	0.1	0	3.1	0	0.3
8	Turda Favorit	V1	0.2	0.4	4.2	0	1.0
		V2	0.4	0.5	4.1	0	0.8
		V3	0.1	0.2	4.0	0	0.1

Variant	Treated hybrids	Seed treatment	Plants attacked by pathogenic agents (F%)				
			<i>Gibberella fujikuroi</i>	<i>Gibberella zeae</i>	<i>Drechslera turcica</i>	<i>Sorosporium holci-sorghii</i>	<i>Ustilago maydis</i>
9	Elan	V1	0.3	0.5	6.0	0	0
		V2	0.5	0.4	5.5	0	0
		V3	0.1	0.3	6.0	0	0
10	Montana	V1	0.3	0.1	5.3	0	0
		V2	0.2	0.2	6.0	0	0
		V3	0.2	0.1	4.0	0	0

Variant 1 – treated seed - Semafor 20 ST (2l/t) + Tiradin 500 CS (3l/t)

Variant 2 – treated seed - Cruiser 350 FS (9l/t) + Tiradin 500 CS (3l/t)

Variant 3 – treated seed - Tirametox 625 CS (3,75 l/t) + Tiradin 500 CS (3l/t)

Table 2

Efficiency of phytosanitary products applied at seed treatment in native maize hybrids on plant development and frequency of pest attack at the Agricultural Research Station of Podu-Iloaiei, year 2003

Variant	Treated hybrids	Seed treatment	Analysed seeds (F%)		Plant height (cm)	Plants attacked by pests (F%)		
			Sprouted	Non-germinated		<i>Agriotes spp.</i>	<i>Helicoverpa armigera</i>	<i>Ostrinia nubilalis</i>
1	Turda-Moldova 188	V1	69	25	173	6	0	1.0
		V2	72	20	175	8	0	0
		V3	71	24	174	5	0	0
2	Turda 165	V1	80	16	180	4	0.3	1.2
		V2	85	12	184	3	0.2	0.5
		V3	78	18	180	4	0.1	1.0
3	Turda 198	V1	75	21	170	4	0	0
		V2	78	20	172	2	0	0
		V3	81	16	174	3	0	0
4	Turda 200	V1	92	4	178	4	0.1	0
		V2	93	5	180	2	0.3	0
		V3	94	4	179	2	0.2	0
5	Turda 201	V1	77	20	182	3	0	0.5
		V2	80	17	180	3	0	0
		V3	82	16	183	2	0	0
6	Turda Super	V1	75	21	175	4	0.3	0.3
		V2	78	19	172	3	0.2	0
		V3	79	19	174	2	0.1	0
7	Turda-Suceava 182	V1	80	16	168	4	0.5	0
		V2	83	14	170	3	0.4	0
		V3	80	17	170	3	0.6	0

THE ATTACK OF PATHOGENIC AGENTS ON MAIZE HYBRIDS

Variant	Treated hybrids	Seed treatment	Analysed seeds (F%)		Plant height (cm)	Plants attacked by pests (F%)		
			Sprouted	Non-germinated		<i>Agriotes spp.</i>	<i>Helicoverpa armigera</i>	<i>Ostrinia nubilalis</i>
8	Turda Favorit	V1	88	10	180	2	0.4	0.4
		V2	85	14	178	1	0.2	0.2
		V3	90	10	180	0	0.1	0.1
9	Elan	V1	86	12	172	2	0.5	0.6
		V2	87	12	170	1	0.4	0.3
		V3	88	11	173	1	0.3	0.4
10	Montana	V1	72	25	165	3	0.3	0.2
		V2	75	23	168	2	0.1	0.1
		V3	73	26	167	1	0.1	0

Variant 1 – treated seed - Semafor 20 ST (2l/t) + Tiradin 500 CS (3l/t)

Variant 2 – treated seed - Cruiser 350 FS (9l/t) + Tiradin 500 CS (3l/t)

Variant 3 – treated seed - Tirametox 625 CS (3.75 l/t) + Tiradin 500 CS (3l/t)

Elan and Montana hybrids have shown a high sensitivity to the attack of pathogenic agents, Montana and Turda Moldova 188 hybrids, a low sprouting; Turda, Moldova 188 and Elan hybrids have presented a low resistance to the attack of pests.

The experience pointed out that there was no difference between the used products as concerns their influence on seed germination, plant sprouting and development, and on the frequency of the attack of pests or pathogenic agents. The differences were shown by the genotypic resistance of the studied hybrids.

The products used for the treatment of seeds in maize hybrids have ensured a very good protection against the attack of pathogenic agents: *Gibberella zeae*, *Gibberella fujikuroi*, *Drechslera turcica*, *Sorosporium holci-sorghii*, and *Ustilago maydis* (Table 3).

Table 3

Average frequency (%) of the attack produced by pathogenic agents on chemically treated and untreated maize hybrids at the Agricultural Research Station of Podu-Iloaiei, year 2003

Hibryds	Seed treatment	Mean frequency (%) of the attack produced by:				
		<i>Drechslera turcica</i>	<i>Gibberella zeae</i>	<i>Gibberella fujikuroi</i>	<i>Sorosporium holci-sorghii</i>	<i>Ustilago maydis</i>
Native	Yes	3.47	0.220	0.203	0.009	0.118
Native	No	11.92	0.330	0.790	0.058	0.290
Early	No	12.07	0.750	1.970	0.083	0.520
Semiearly		12.25	0.440	0.905	0.075	0.370
Middle		13.47	0.085	0.160	0.025	0.180
Late		9.92	0.075	0.160	0.025	0.120

Table 3 presented comparatively the mean frequency of the attack of pathogenic agents on native maize hybrids, chemically treated, and the mean frequency of the attack of pathogenic agents on native maize hybrids, from comparative competition crops. For crop setting, we have used untreated seed, which proved once again the necessity of chemical treatment in maize seed.

Analysing data from Tables 4 and 5, which presented the behaviour of foreign hybrids under the same conditions, we have noticed that the Pelican maize hybrid had a good sprouting, a high resistance to the attack of pathogenic agents and a good resistance to the attack of pests.

Table 4

Efficiency of phytosanitary products applied in seeds of foreign maize hybrids on plant development and frequency of pest attack, the Agricultural Research Station of Podu-Iloaiei, year 2003

Variant	Hybrids	Treatments at sprouting	Analysed seeds (F%)		Plant height (cm)	Plants attacked by pests (F%)	
			Sprouted	Non-germinated		<i>Agriotes spp.</i>	<i>Ostrinia nubilalis</i>
1	DK 335 Monsanto	V1	68	24	164	8	1.5
		V2	70	25	161	5	1.0
		V3	68	26	165	6	1.0
2	DK 386 Monsanto	V1	72	18	195	10	0
		V2	71	22	192	7	1.0
		V3	68	24	198	8	0.1
3	DK 391 Monsanto	V1	58	33	191	9	0.5
		V2	62	27	201	11	1.0
		V3	60	30	188	10	0.1
4	Alpha Syngenta	V1	73	19	179	8	1.4
		V2	75	18	173	7	1.0
		V3	73	21	183	6	1.2
5	Peso Syngenta	V1	68	20	178	12	0.5
		V2	67	17	181	16	1.0
		V3	65	20	176	15	0.7
6	Furio Syngenta	V1	62	22	187	16	1.0
		V2	65	23	180	12	1.4
		V3	66	20	187	14	1.0
7	Occitan Syngenta	V1	67	20	176	13	1.3
		V2	65	22	169	13	1.0
		V3	67	23	173	11	0.7
8	Pelican Syngenta	V1	77	14	173	9	1.8
		V2	82	10	177	8	1.2
		V3	78	12	187	10	1.0

Variant 1 – treated seed - Semafor 20 ST (2l/t) + Tiradin 500 CS (3l/t)

Variant 2 – treated seed - Cruiser 350 FS (9l/t) + Tiradin 500 CS (3l/t)

Variant 3 – treated seed - Tirametox 625 CS (3.75 l/t) + Tiradin 500 CS (3l/t)

THE ATTACK OF PATHOGENIC AGENTS ON MAIZE HYBRIDS

Table 5

Efficiency of chemical treatments applied in seeds of foreign maize hybrids on the attack of pathogenic agents, the Agricultural Research Station of Podu-Iloaiei, year 2003

Variant	Tested hybrids	Seed treatment	Plants attacked by pathogenic agent (F%)				
			<i>Gibberella fujikuroi</i>	<i>Gibberella roseum</i>	<i>Drechslera turcicum</i>	<i>Sorosporium holci-sorghii</i>	<i>Ustilago maydis</i>
1	DK 335 Monsanto	V1	10.1	1.0	4.0	0.2	1.0
		V2	8.3	0.5	4.5	0	0
		V3	7.2	0.3	3.3	0	0.3
2	DK 386 Monsanto	V1	7.5	0.7	3.0	0	0
		V2	6.4	0.4	2.0	0.1	0.1
		V3	5.3	0.4	1.8	0	0
3	DK 391 Monsanto	V1	5.2	0.1	3.0	0	0.1
		V2	4.5	0	1.8	0	0
		V3	4.0	0	2.2	0	0
4	Alpha Syngenta	V1	4.8	0	1.5	0	0.1
		V2	5.5	0.1	1.0	0.1	0
		V3	4.2	0	0.7	0	0
5	Peso Syngenta	V1	6.0	0.1	3.0	0	0
		V2	4.4	0	2.2	0	0.1
		V3	4.0	0	1.8	0.1	0
6	Furio Syngenta	V1	7.7	0.1	3.2	0	0.1
		V2	6.5	0.2	2.7	0.1	0
		V3	5.0	0	1.8	0	0
7	Occitan Syngenta	V1	8.3	0.3	2.5	0	0
		V2	7.5	0.1	1.8	0	0.1
		V3	6.0	0.1	1.8	0.1	0
8	Pelican Syngenta	V1	4.4	0.5	1.5	0.1	0
		V2	3.8	0.1	1.6	0	0.1
		V3	3.0	0	1.0	0	0

Variant 1 – treated seed - Semafor 20 ST (2l/t) + Tiradin 500 CS (3l/t)

Variant 2 – treated seed - Cruiser 350 FS (9l/t) + Tiradin 500 CS (3l/t)

Variant 3 – treated seed - Tirametox 625 CS (3.75 l/t) + Tiradin 500 CS (3l/t)

The DK 391 and Furio hybrids had a weak sprouting and the Furio hybrid also presented a weak resistance to the pest attack. The DK 335 hybrid has shown a high sensitivity to the attack of pathogenic agents.

The products used for seed treatment in maize hybrids have ensured a very good protection against the attack of pathogenic agents: *Gibberella zeae*, *Gibberella fujikuroi*, *Drechslera turcica*, *Sorosporium holci-sorghii*, and *Ustilago maydis* (Table 6).

The comparative analysis of the behaviour of native and foreign maize hybrids to the attack of pests and pathogenic agents has shown that the native hybrids, obtained as a result of long-term breeding process, developed under specific soil and climatic conditions, had a good tolerance to weather and biological stress factors.

Table 6

The average frequency (F%) of the attack produced by diseases and pests in native and foreign hybrids, at the Agricultural Research Station of Podu-Iloaiei, year 2003

Hybrids	Analysed seeds (number)		Frequency of attack (F%) produced by:						
	Sprouted	Non-germinated	<i>Gibberella fujikuroi</i>	<i>Gibberella zea</i>	<i>Drechslera turcica</i>	<i>Sorosporium holci-sorghii</i>	<i>Ustilago maydis</i>	<i>Agriotes spp.</i>	<i>Ostrinia nubilalis</i>
Native	80.75	16.84	0.203	0.22	3.47	0.009	0.118	3.0	0.23
Foreign	68.62	21.25	5.810	0.20	2.23	0.045	0.083	10.16	0.93

The native maize hybrids have shown a better sprouting (80.75%), in comparison with the foreign maize hybrids (68.62) and a better resistance to the attack of pathogenic agent *Gibberella fujikuroi* (F% = 0.203, comparatively to F% = 5.810, in foreign maize hybrids) of the pathogenic agent *Sorosporium holci-sorghii* (F% = 0.009) and of pests *Agriotes spp.* (F% = 3.0, comparatively to F% = 10.16, in foreign hybrids) and *Ostrinia nubilalis* (F% = 0.23, comparatively to F% = 0.93, in foreign hybrids). The native hybrids have shown a good resistance to the attack of *Gibberella zea*, *Drechslera turcica* and *Ustilago maydis*.

CONCLUSIONS

The analysis of observations carried out in 2003, at the Agricultural Research and Development Station of Podu-Iloaiei, in the comparative growing of native maize hybrids, which were set up by using seeds chemically treated with different phytosanitary products, shows, under conditions of our experiment, a high resistance of Turda 198 and Turda 200 hybrids to the attack of pathogenic agents. The Turda 200 hybrid has shown a very good sprouting (F=93%) and the both mentioned hybrids presented a good resistance to the attack of pests.

Elan and Montana hybrids have shown a high sensitivity to the attack of pathogenic agents, Montana and Turda Moldova 188 hybrids, a weak sprouting and Turda Moldova 188 and Elan hybrids, a weak resistance to the attack of pests.

The comparative analysis of the mean frequency of the pathogenic agent attack on native maize hybrids, chemically treated, and the mean frequency of the pathogenic agent attack on native maize hybrids from control comparative crops,

THE ATTACK OF PATHOGENIC AGENTS ON MAIZE HYBRIDS

for setting up of which we have used untreated seeds, demonstrates the necessity of chemical treatments in maize seeds.

The analysis of observations carried out in 2003, at the Agricultural Research and Development Station of Podu-Iloaiei, in the comparative crops of foreign maize hybrids, set up by using seeds treated chemically with different phytosanitary products, shows that the Pelican maize hybrid had a good sprouting, a high resistance to the attack of pathogenic agents and a good resistance to the attack of pests.

The DK 391 and Furio hybrids have a weak sprouting, and the Furio hybrid shows a low resistance to the pest attack. The DK 335 hybrid has a high sensitivity to the attack of pathogenic agents.

The experience has shown that there was no difference between the used products, as concerns the influence of the frequency of pest or pathogenic agent attack on seed germination, plant sprouting and development. We consider that differences came from the genotypic difference of studied hybrids.

The comparative analysis on the behaviour of native and foreign maize hybrids to the attack of pest and pathogenic agents shows that the native hybrids, obtained as a result of a long-term breeding process, developed under specific soil and climatic conditions, present a good tolerance to weather and biological stress factors. The native maize hybrids presented a good sprouting (80.75%), comparatively to foreign maize hybrids (68.62%) and a better resistance to the attack of the pathogenic agent *Gibberella fujikuroi* ($F\% = 0.203$, comparatively to $F\% = 5.810$, in foreign maize hybrids), of the pathogenic agent *Sorosporium holci-sorghii* ($F\% = 0.009$) and of *Agriotes spp.* ($F\% = 3.0$, comparatively to $F\% = 10.16$, in foreign hybrids) and *Ostrinia nubilalis* ($F\% = 0.23$, compared to $F\% = 0.93$, in foreign hybrids).

We recommend the native maize hybrids for setting up crops in the area, because they are better adapted to the weather and biological stress, comparatively to foreign hybrids.

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