RESEARCHES REGARDING THE CONTROL OF WIREWORMS (*AGRIOTES SPP.*) THROUGH CHEMICAL SEED TREATMENT IN MAIZE CROP

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Abstract

The results presented in the study refer to the prevention and fighting of wireworms (Agriotes spp.) through the method of chemical corn seed treatment. The newest chemical products have been selected in order to analyze their efficiency against attacks on both the germinating seed and the underground stem. The results obtained in the field, both those regarding efficiency as well as production were compared to those obtained in the untreated reference lot, as well as to a standard product, and the final data was statistically processed through the method of variance analysis.

Key words: wireworms, seed, efficiency, chemical treatment, corn.

INTRODUCTION

Among pests that attack corn crops, the larvae of click beetles (*Agriotes spp. Coleoptera Elateridae*), commonly known as wireworms, are considered especially dangerous, due to the fact that they are polyphagous insects that cause significant damages in corn crops during the germination – yielding period. (Pălăgeşiu I. et al., 2000) The critical period of attack is when the seed is germinating, as the pests are attracted by the carbon dioxide eliminated during this time, but also by the amino acids contained in the corn seeds up to the phase of 2-3 leaves.

However, the attack of wireworms is not restricted to cereal crops, as these pests may also attack vegetable crops, such as cucumbers, melons, tomatoes, potatoes, cabbage or carrots because the rich foliage of these plants creates a humid microclimate that favours the proliferation of these species (Teodorescu G. et al., 2003).

These crops are exposed to the attack both in the field as well as in greenhouses and foil tunnels, because the pest attacks when the soil temperature and humidity rise (Paşol P. et al., 2007). The attack of wireworms is favoured by the degree of humidity in the soil, the larvae moving vertically or horizontally depending on this particular element (humidity) as well as on the reaction of the soil, as these larvae grow in soils having an acid or a slightly acid reaction. However, on a global scale, they can be found in all kinds of soils: light or heavy, acid, neutral or basic,

richer or poorer in organic substances, but always in soils with a high degree of humidity (Borcean I. et al., 2005)

Wireworms also attack starch cereal (wheat, barley, oats), causing significant damage during the years that are favourable to their attack (Popov C. et al., 2001).

Several species of the *Agriotes* genus are present in our country, such as: *Agriotes ustulatus* – 40.1%, *Agriotes obscurus* – 17.3%, *Agriotes flavicornis* – 10.9%, *Agriotes pilosus* – 6.9%, *Agriotes lineatus* – 3.8% (Manole T. et al., 1999).

MATERIAL AND METHOD

Several new insecticides were employed for the present study, all of which belong to the third and fourth levels of toxicity; their required dosage is between 2 and 10 l/t of seed. They were preferred not only for these obvious advantages, but also because carbamic insecticides, which have been widely used in the past despite their toxicity and required dosages (between 25-30 l/t), are no longer used in the chemical seed treatment. (Ianoşi S.I., 2001).

Seed treatment was performed in a laboratory and the recommended dosage for each product was observed. The placement of the experiments was done according to the method of the Latin rectangle in three repetitions, each containing 12 variants and a reference lot; the distance between rows was 70 cm and the distance between plants within a single row was of 30 cm, 25 seeds being sown on each row.

After the sprouting of the plants, in the 2-3 leaves stage, the attack of wireworms on the underground portion of the plant stem was noticed and the seeds that had not yet emerged were controlled by recording how many of them had been attacked by wireworms. At this time, other elements were also recorded, such as the frequency of emergence and possible phytotoxicity phenomena caused by the products.

The resulted data was then used to calculate the efficiency of the products on the seed and on the underground stem, depending on the attack recorded in the reference lot, which received no treatment at all. Cruiser 350 FS was the standard product used for the statistical processing of all the data.

RESULTS AND DISSCUSIONS

Many products have been used in the fighting of this pest over time; an example is fipronil, used in seed treatment (Chaton PF. et al., 2008).

The results presented in the table were obtained in 2009 and 2010. The density after sprouting was of 240 plants in the reference lot and 281

plants in the Nuprid variant. Wireworms attack was reduced in the treated variants compared to the reference lot, these results further confirming the need to protect seeds and young plants.

The attack was not as strong as initially expected, mainly due to the fact that the springs of recent years have been particularly dry, thus the low levels of humidity in the soil did not favour the attack. Therefore, the obtained data reveal that only 5.6% of the seeds were attacked in the reference lot, higher levels being recorded in previous years. (Bucurean E., 2007)

The products employed in the chemical treatment of the corn seed were thiamethoxam based (Cruiser), tefluthrin based (Force) or imidacloprid based (Nuprid). The dosage was 6 l/t, except for Cruiser, Force, Poncho 600 FS and Fipronil, which required a different dosage.

It is important to point out that no phytotoxicity phenomena have been recorded, neither during the first development stage of the plant nor during its maturity phase.

In 2009, the frequency of attack on the underground stem of the plants was 18.2% in the reference lot and between 0.5% – 3.1% in the treated variants. The attack on the seed was of 9.4% in the reference lot and between 0.3% - 2.7% in the treated variants.

The statistical processing of the efficiency data revealed that the differences were significant and distinctly significant compared to the standard product, Cruiser. The results are presented in table 1.

Table 1

Efficiency of products used in fighting of wireworms in corn crops – Oradea 2009

Variant	Dosage l/t	F% stem	F% seed	E% stem	E% seed	E% average
Cruiser 350 FS	9.0	2.7	1.0	77.7	82.1	79.9
Picus 600 FS	6.0	1.3	0.6	89.3	89.3	89.3
Sentinel 70 WS	6.0	0.9	0.5	92.6	91.1	91.9*
Poncho 600 FS	9.0	2.3	0.3	81.8	90.6	86.2
Gaucho 600 FS	6.0	1.6	2.2	91.2	76.7	83.9
Fipronil 50 FS	7.0	3.1	2.7	83.0	71.3	77.2
Force 20 CS	2.0	0.5	0.3	95.9	94.6	95.3**
Reference lot	-	18.2	9.4	-	-	-

LSD 5% - 10.5 LSD1% - 14.9 LSD 0.1% - 18.7

In 2010, the frequency of attack on the underground stem ranged between 12.1% in the reference lot and 0.4 – 3.3% in the treated variants, while the attack on the seed reached values between 5.6% in the reference lot and 0.1 - 1.6% in the treated variants.

The efficiency of the products differed from one variant to the next, mortality ranging from 75.4% (Palisade) and 96.2% in the case of the Toreador product. The results are presented in table 2.

Table 2

Results obtained in 2010 regarding the fighting of wireworms in corn crops

Variant	Dosage l/t	F% stem	F% seed	E% stem	E% seed	E% average
Cruiser 350 FS	9.0	3.3	1.3	72.7	76.8	74.8
Palisade 600 FS	6.0	2.5	1.6	79.3	71.4	75.4
Seedoprid 600 FS	6.0	1.9	1.1	84.3	80.4	82.4
Toreador 600 FS	6.0	0.7	0.1	94.2	98.2	96.2***
Force Zea SC	6.0	0.4	0.3	96.7	94.6	95.6***
Sentinel Syn 600 SC	6.0	0.7	0.2	94.2	96.4	95.3**
Nuprid Al 600 FS	6.0	1.1	0.8	90.9	85.7	88.3*
Reference lot	-	12.1	5.6	-	-	-

LSD 5% - 9.9 LSD1% - 15.7 LSD 0.1% - 20.8

The results presented in the table show that, after statistically processing the data regarding efficiency, the differences between the standard product, Cruiser, and most of the other variants were insignificant, except for the Toreador and Force Zea products, which showed very significant differences and the Sentinel Syn and Nuprid variants which had significant differences.

During the two years of experiments, the obtained production was greater in all the treated variants compared to the reference lot, which proves once more that protecting corn crops against wireworms' attack is a definite necessity in this area. The production results are presented in tables 3 and 4.

Table 3

Production results obtained in 2009

Variant	Dosage	Production		Diff. compared to reference lot	Significance
		Kg/ha	%		
Cruiser 350 FS	9.0	5480	110	470	***
Picus 600 FS	6.0	5614	112	604	***
Sentinel 70 WS	6.0	5780	115	770	***
Poncho 600 FS	9.0	5510	110	500	***
Gaucho 600 FS	6.0	5820	116	810	***
Fipronil 50 FS	7.0	5400	108	390	**
Force 20 CS	2.0	5900	118	890	***
Reference lot	-	5010	100	-	-

LSD 5%-250 kg/ha LSD l%-329 kg/h LSD 0.1 %-465 kg/ha

The differences of production in the treated variants were greater by 390 kg/ha (Fipronil) and 890 kg/ha (Force 20 CS) than the production obtained in the reference lot. These differences are statistically very significant.

Table 4

Production results obtained in 2010

Variant	Dosage	Production		Diff. compared to reference lot	Significance
		Kg/ha	%		
Cruiser 350 FS	9.0	5506	108	418	***
Palisade 600 FS	6.0	5411	106	323	**
Seedoprid 600 FS	6.0	5389	105	301	**
Toreador 600 FS	6.0	5726	112	638	***
Force Zea SC	6.0	6067	119	979	***
Sentinel Syn 600 SC	6.0	5727	113	639	***
Nuprid Al 600 FS	6.0	5466	107	378	**
Reference lot	-	5088	100	-	-

LSD 5%-220 kg/ha LSD l%-299 kg/h LSD 0.1 %-401 kg/ha

The differences regarding the production obtained in treated variants compared to the reference lot were positive, ranging between 301 kg/ha and 979 kg/ha, thus statistically proving most of the differences as distinctly and very significant.

CONCLUSIONS

The experiments conducted in order to prevent and fight this pest lead to the following conclusions:

- When setting up corn crops, which are preferred by wireworms, especially on acid soils, it is advisable to use a greater quantity of seed per surface unit, as cultures with good density endure the attack of wireworms, which sometimes may even go unnoticed.
- In infested fields where corn is supposed to be planted the following year, the ground must be kept clean of vegetation through repeated works, until autumn, when the larvae go into hibernal diapause.
- Plants which are not attractive to wireworms, such as peas, beans, rape, mustard, lentils and others, should be used as previous crops for corn.
- Mineral nitrogen based fertilizers used in adequate quantities have a harmful effect on the larvae.
- In wireworms infested fields, corn should not be sowed deeper than 10 cm in the ground; otherwise the pest's attack will be favoured.
- The products used for the treatment of the seed have been created in recent years, their main characteristic being the reduced required dosage per tone of seed. All the employed products have shown high levels of efficiency, protecting both the germinating seed and young plants up to the 2-3 leaves stage.

- The most remarkable results were obtained when treating the seed with Force, Signal, Toreador, and Sentinel, but the other products can also be recommended for protecting crops against pest attacks.

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