ECONOMIC EFFICIENCY OF MAIZE SEEDS TREATMENT

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Abstract: Economic efficiency of maize seeds treatment.

The integrated protection schemes includes seed treatment as an important link that causes significant yield increases. To calculate economic efficiency of the corn crop, they were take into consideration the cost of all technological links. For seed treatment, it was selected the substance that has shown the best efficacy in controlling the major pests, namely *Tanymecus dilaticollis* and *Agriotes* sp. The seed treatment method has shown a good economic efficiency, leading to significantly increased production compared with untreated control.

Key words: seed treatment, ecological plant protection products, biological efficacy, economic efficiency

INTRODUCTION

In the most areas of the corn crop, damaging agents are very important limiting factors of production.

The dynamics of the attacked surfaces and the level of damage are different from one region to another, in close relation with climatic conditions favorability, the genetic resistance of the cultivar, and all these are influenced by the technological factors.

The specialized literature provides a multitude of data regarding the maize agro ecosystem protection against the diseases and pests: (G. Galani and coll. 2007).

Recent references about the entomofauna actually existing in the maize agro ecosystem they are recorded in the scientific studies such as: (I. Rosca and coll., 2007, Ioana Caragea 2007).

Some of the studies accomplished for the project PS 2.4.1., aimed the scientific substantiation of certain elements essential in establishing a guide system for the maize crop integrated protection. The data showed in this study are a part of the whole elements and have been used for the seeds chemical treatment efficacy assessment.

The trials were located in Secuieni maize field (SCDA) and aimed to establish the effect of some plant protection products (ppp) applied on seeds and during vegetation for control of certain harmful agents which could cause significant crop production losses.

Among the most used crop protection chemical methods, the seed treatment method fulfills the requested demands by an integrated control system achieved with a minimal environmental impact.

The long term pest control is based only on the last generation insecticides included in Annex I of 91/414/CEE Directive.

Purpose

The purpose of achieving a maize crop integrated protection scheme was economic efficacy assessment of the seed treatment method

MATERIAL AND METHOD

Biologic material:

Agriotes sp., Tanymecus dilaticollis Gyll., *Rhopalosiphum maidis* Fitch.

Experimental products:

- thiametoxam 350 g/l, imidachloprid 600 g/l, fipronil 500 g/l – for seed treatment

- SC-OLCa2-concentrated suspension based on Ca oleat and lecithin (1:0, 25); SC-OLCa3-concentrated suspension based on Ca oleat and lecithin (1:0, 4); Karate Zeon- treatment during vegetation period

Experiment location: Secuieni SCDA, Neamt.

The experiment included 4 variants and has been placed in randomized block method with four replicates, the experimental plot measured 28 square meters. The maize hybrid used in our trial was T-200. The experiment was placed on a typical brown soil, with 6.29 pH, 2.3 humus, 2.1 total nitrogen, 39 ppm P_2O5, 161 ppm K_2O.

The soil presents a good *Agriotes* larvae infestation, and a density varying between 7-9 exemplars/m^2. The technology has been carried out according to the Moldova area technology for maize cultivation. For sowing has been used a sawyer machine designed for experimental fields. It was also used ROTOSTAT COMPACT, an equipment designed for seed treatment applied in foaming.

During the experiment they have been performed observations and measurements upon the *Agriotes* larvae and *Tanymecus* adults attack, which influence the seed germination and the plants in two-three leaves fazes, and it was calculated the percentage of the saved plants 25 days after sprouting.

On each treated variant it was observed the phytosanitary evolution aspect of the plant, by comparison with the control, interfering with appropriate means (chemical and biological) to ensure a good culture protection until harvesting.

Before the maize inflorescence emergence it was observed on backside leaves the presence of *R. maidis* Fitch, the attack being favored by the climatic conditions and for the control they were used two ecological products and a synthesis pyrethroid.

It was very important the choice of the insecticide used during the vegetation period, and the selection of the product characterized by a reduced environmental impact in compliance with the demands of European regulations. The treatment has been applied using a 10 l capacity SOLO asperse pump on calm weather, without wind. The observations were noted before and after the treatment applications at 1, 3, and 7 days, both at treated and control variants. The efficacy was calculated after the Sun - Shepard formula;

$$\% E = \frac{Pt \pm Pck}{100 \pm Pck} \times 100$$

where:

Pt = % aphides before treatment - % aphides after treatment

Pck = % aphides in control, before treatment - % aphides in control, after treatment;

RESULTS

The results regarding the tested products efficacy, as well as the subsequent development of plants and harmful organisms have been in close relationship with the action of the biotic factors, among them a major importance occupying the zonal climatic conditions.

The agricultural year 2007- 2008 was characterized from the meteorological point of view having a normal weather, regarding the temperatures the deviations from the multiannual mean varied between -1.7ºC (November 2007) and 3.9ºC (February 2008), and regarding the rainfall, the quantities varied between -18,5 mm (June 2008), and 49 mm (April 2008).

The rainfalls reported during the April and May favored the *Agriotes* larvae attack observed from the seed germination in soil till the 3-5 leaves plant stage (control plot). In the same period the sunny days and the temperature between 8.7 and 16.2ºC were also favorable for the *Tanymecus* development.

The data showed in the tables 1 and 2 represent the efficacy of some insecticides used for the maize crop control against the attacks of wireworms (*Agriotes* spp.), and maize leaf weevil (*Tanymecus* spp.).

The data presented on table 1 emphasized an *Agriotes* larvae intense attack; so, on the treated variants the wireworms attack frequency varied between 1% and 3%, irrespectively 13% at the untreated control. The attack frequency on the plants in 2-5 leaves stage was noted between 1% and 9% in treated plots, irrespectively 17% in untreated control. The percentage of the saved plants after 25 days from sprouting were between 90 and 97% in treated variants, irrespectively 70% in untreated control, the differences between treated plots and control being statistically significant.

The experimental products efficacy results on the control of maize leaf weevil (*Tanymecus* spp.) are shown in Table 2. The attack frequency of *T. dilaticollis* was reported between 6 – 10% on treated plots by comparison with 18% on untreated control. The attack level was between 0.16% and 0.23% on treated plots in comparison with 1.07% on untreated control, the differences being significantly negative.

The results regarding maize crop protection against aphides attack are shown in table 3.

On the ecological treated plots, the products were applied in concentration of 1%, the best results was given by the SC- OL Ca_3 product, where the efficacy was between 86.9 and 91.98%, during the period of observation.

A good efficacy has been registered on the plot treated with SC – OL Ca_2, where after 7 days of treatment it was noted 90, 17%.

Karate Zeon had a very good efficacy, irrespectively of 100 %.

The present data were achieved in the conditions where untreated control has shown a growing population (between 490 - 710 of alive aphids / replicate)

This research aimed both achieving a superior maize yield quality and quantity, and the economic efficacy assessment of maize crop seed treatment method. The maize yield grain production in seed treated plots by comparison with untreated control is shown in table 4.

The data has shown a very good maize crop protection with a conjugate treatment application on seeds and during vegetation period. All productions gathered from treated variants have shown a statistically significant increase by comparison with the untreated control. The biggest difference of the yield has been registered on V2 variant, where for seeds treatment was used imidachloprid 600/l FS, and during vegetation was used an ecologic product based on Ca oleat and lecithin in aphides control.

To establish the economic efficacy of maize crop seed treatment method they were estimated the production expenses according to the maize technology as shown in table 5.

Based on the above mentioned data and yield values registered on treated variants, where the seeds were treated with thiametoxam 350 g/l and imidachloprid 600 g/l, it was calculated the economical efficacy of seed treatment method, and the achieved production increases as shown in table 6.

On both variants they has been achieved increased productions by comparison with the untreated control variant, but the greatest increase of 601 RON/ha has been registered on treated variant where the maize seeds received imidacloprid 600 g/l.

Table 1

Insecticides' action on the control of *Agriotes* sp.

Secuieni SCDA – 2008

Commercial product	Active substance	Dose (l/t)	Sprouted plants (%)	Seed attack frequency (%)	Plant attack frequency (%)	Saved plants after 25 days (%)
Cruiser 350 FS	thiametoxam	10	97***	3^{000}	5^{000}	92***
Gaucho 600 FS	imidachloprid	10	98***	2^{000}	1^{000}	97***
Cosmos 500 FS	fipronil	2,5	99***	1^{000}	9^{000}	90***
Untreated control	-	-	87	13	17	70
5% =			2.16%	3.74%	4.01%	3. 09%
1% =			3.64%	4. 92%	5. 12%	4.16%
0, 1% =			5. 01%	6. 01%	6. 54%	5.98%

Table 2

Insecticides' action on the control of harmful organism *T. dilaticollis*

Secuieni SCDA – 2008

Product	Dose l/t, Kg/t	F%	I%	GA%	Dif. GA%	Signification
Cruiser 350 FS	10	7	2,87	0,20	0,87	000
Gaucho 600 FS	10	6	2,76	0,16	0,91	000
Cosmos 500 FS	2,5	10	2,37	0,23	0,84	000
Untreated control	-	18	5,96	1,07	-	

LD 5% = 0.18%
1% = 0.33%
0, 1 % = 0.41%

Table 3

Biological action of some plant protection products on *Rhopalosiphum maidis* Fitch

SCDA – Secuieni - 2008

PRODUCT	Concentration (%)	% Efficacy after days:		
		1	3	7
SC – OLCa 2	1	83,10	87,35	90,17
SC – OLCa 3	1	86,90	89,20	91,98
Karate Zeon	0,015	100	100	100
Population evolution in untreated control - No. of alive aphids/rep.	-	490	570	710

Table 4

Maize grains yield

Variant	Saved plants after 25 days (%)	Production (Kg/ha)	Grains yield difference by comparison to the untreated control (Kg/ha)	Signification
V 1 Cruiser 350FS SC –OLCa 2	92	8482	1370	***
V 2 Gaucho 600FS SC – OLCa 3	97	8830	1718	***
V 3 Cosmos 500 FS Karate Zeon	90	8394	1282	***
Untreated control	70	7112	0	-

LD 0,1% 206.42
LD 1% 128.41
LD 5% 84.76

Table 5

Production expenses - maize grain culture

Operation	RON/ha
Autumn plough (25-28 cm)	238
Germinate bed preparation	200
Fertilization before sowing	42
Complex fertilizers (100 Kg/ha)	200
Pre-emergent herbicide	30
Guardian (2,5 l/ha)	62
Samanta (20 Kg/ha)	250
Sowing	50
Post-emergent herbicide I	30
Astral (1,25 l/ha)	170
Fertilizer during vegetation	42
Ammonium apostate (200 Kg/ha)	200
Mechanical weeding I	30
Post-emergent herbicide II	30
Ceradin (1l/ha)	39
Mechanical weeding II	30
Mechanical harvesting	211
Total production expenses at untreated control	**1854**
Cruiser 350 FS (10 l/t)	220
Total production expenses at thiametoxam 350 g/l treated variant	**2074**
Gaucho 600 FS (10 l/t)	86
Total production expenses at imidaclhoprid 600 g/l treated variant	**1940**

Table 6

The seed treatment economical efficacy

Variant	Production (Kg/ha)	Production expenses (RON/ha)	Price value (RON/kg)	Production value (RON/ha)	Profit (RON/ha)	Production increase vs. control (RON/ha)
Untreated control	7112	1854	0,4	2845	991	0
thiametoxam 350g/l	8482	2074	0,4	3393	1319	328
imidachloprid 600g/l	8830	1940	0,4	3532	1592	601

CONCLUSIONS

All the products used for seed treatment showed good results on the maize crop protection, in control of *Agriotes* sp. and *T. dilaticollis;*

The maize grain yield on treated variants has shown a very significant growth by comparison with the untreated control;

The seed treatment economical efficacy is reflected by the yields increases: 328 RON/ha on thiametoxam treated variant, 350 g/l, irrespectively 601 RON/ha on imidachloprid 600 g/l treated variants, by comparison to the untreated control.

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