

## RESEARCH ON THE ESTABLISHMENT OF CHEMICAL CONTROL TECHNOLOGY ON ADULTS OF SPECIES *DIABROTICA VIRGIFERA VIRGIFERA* LE CONTE (WESTERN CORN ROOTWORM)

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### Abstract

The potential of damage of *Diabrotica virgifera virgifera* Le Conte species increasing year by year in Romania, in western part of the country where the pest was discovered (1996), tends to become a regular presence in maize crops and had a large area positioning as a key pest in maize monoculture or in crops cultivated year after year. The chemical control of adults constituted an important strategy for decreasing of density population and in the same time the decreasing of laying eggs and limitation of appearance area. Major damage made by adults and larvae were noticed in the maize crop monoculture conditions and maize crop monoculture conditions and maize crop in the first year. Using insecticides based on cipermetrin, imidacloprid, lambda cihalotrin, deltametrin, zeta-cipermetrin, tiacloprid, at density which is over economic threshold (10 adults/m<sup>2</sup>) assured a high efficacy and are recommended against adults of *Diabrotica virgifera virgifera* Le Conte species.

**Key words:** *Diabrotica virgifera virgifera* Le Conte, maize, distribution, insecticides, control, efficacy

### INTRODUCTION

Western corn rootworm from the first alert in 1996 (Nadlac, Arad county) quickly spread to the north-east, east and south, covering an extended area around the western part of the country, plain and plateaus of Transylvania, and is found throughout the south and half in Muntenia (Cean M., 2004, Groza I., 2003, Popov C., 2004).

The speed of spreading in the North of Europe was faster, being on an average of 40 km/year, being recorded differences among years by the climate conditions with values between 4 km (1998) and 88 km (1995). In the East of Europe the spreading speed is comprised between 0-47 km/year (Romania, Ukraine), and in the West of Europe, Bulgaria and Balkan countries between 0-88 km/year (EPPO, Reporting Service, 2003).

The big area of spreading, in a relatively short time, express the fact that the pest, finding favorable ecological conditions, had stabilized in the

infested area, creating themselves quite a big and dangerous population by the damages produced on the corn crop. The big weight of the corn crop and monoculture, besides the favorable climatic conditions, constituted the most important factors of the massive reproduction and territorial spreading. Western corn root worm attack occurs at both the root and aerial part of the plant. Adults attack foliage, silk, pollen and ear, and larvae attack the maize roots.

*Diabrotica virgifera virgifera* Le Conte has a good potential to adapt to different conditions and a high reproductive rate which facilitates its establishment in new areas year by year (S.Dinnensen, et. al., 2009).

Crop rotation is an important method of limiting the population and that reduce the damage, but will not prevent onset and spread of this pest.

In order to reduce the number of adults and thus to deposit eggs to decrease level of larvae populations, below economically threshold, chemical pest control is an important component of the strategy to control this pest.

Researches made at ARDS Oradea purposed the establishing of sustainable control of adults program using latest generation of insecticides with improved qualities efficacy and low ecotoxicological risk.

#### **MATERIAL AND METHOD**

Researches were made in the area of propagation of the species, at ARDS Oradea, in terms of prolonged monoculture of corn between 2008-2010. Sowing maize was usually done in the last decade of April.

The experiences were organized in randomized blocks, in four replications with plot size about 100m<sup>2</sup>.

Application of treatments were made at visual warning, in period of panicle appearance (plants fenology BBCH 55-61) and at density over economically threshold (PED 10.0 adults/ m<sup>2</sup>). The equipment used for the application was hand pump using 300 l/ha solution.

The corn field was monitored before the panicle appearance, soon as the silk appears in top ear, counting the existing adults. Also the sounding were continued until the corn silk is brown. Were tested following products and rates: Faster 10 EC (cipermetrin 10 g/l), Nuprid Al 200 SC (imidacloprid 200g/l), Kaiso Sorbi (lambda cihalotrin 5%), Decis Mega 50EW (deltametrin 50g/l), Calypso 480 SC (tiacloprid 480 g/l), Karate Zeon (lambda cihalotrin 50 g/l), Fury 10 EC (zeta - cipermetrin 10%). The efficacy of insecticides used were made at 24-48 hours after treatment. Population of adults/m<sup>2</sup> was non-uniform distributed so for the calculation of efficacy was used Henderson-Tilton's Formula.

Climatic factors in experimental evolution favored western corn rootworm evolution.

## RESULTS AND DISCUSSION

An important role in determining the control strategy of adults of *Diabrotica virgifera virgifera* Le Conte it is made by prognosis of pest occurrence, based on the monitoring system of adults in correlation with climatic conditions and cultivation system of maize in the area.

Monitoring of maize fields it is make using special entomologic traps, traps with sexual pheromone and attractive plants, etc. but the method of adults number determination on m<sup>2</sup> it's considered as the most favorable in the point of view of the accuracy of results, because this method follows the best the dynamic of natural swarm in time and space(Veronica Toth, 2005) .

The economic threshold it's about 10 adults/m<sup>2</sup> and in the case of entomological traps it's abut 7 adults/yellow trap unspecifc/24 hours (Rosca I., Popov C., 1999).

The level of infestation of *Diabrotica virgifera virgifera* Le Conte determined number of adults before treatment high values between 31,0-34,0 on m<sup>2</sup> with variation limits between 26 and 42 insects on m<sup>2</sup> (Table 1).

Table 1.  
Density of *Diabrotica virgifera virgifera* Le Conte adults species in maize crop

Variant	Rate l,g/ha	Number of adults/m <sup>2</sup>				
		RI	RII	RIII	RIV	Average
1. Faster 10 CE	0,150 l	34	30	31	33	32,0
2. Nuprid Al 200 SC	0,275 l	29	35	33	34	32,7
3. Decis Mega 50 EW	0,250 l	30	35	29	42	34,0
4. Kaiso Sorbi 5 WG	0,250 kg	28	40	30	26	31,0
5. Calypso 480 SC	0,150 l	33	28	32	36	32,2
6. Karate Zeon (STD.)	0,250 l	35	30	39	28	33,0
7. Fury 10 EC	0,200 l	28	36	30	36	32,5
8. Untreated	-	26	38	34	33	32,8

The evaluation of efficacy determined by tested insecticides and calculated based on live insects number were made at 24 and 48 hours, respective 14 days after treatments. Live adults evaluation on 24 hours after treatment registered an efficacy about 94,1-94,3 for insecticides Faster 10 EC (0,150 l/ha) respective Kaiso Sorbi (0,250 kg/ha) . In the moment of treatment application the level of infestation in this variants were between 31,0-32,8 insects/m<sup>2</sup> leading to a decreasing about 1,7-1,8 insects/m<sup>2</sup>. Karate Zeon (control product) at rate by 0,250 l/ha registered an efficacy by 93,7% respective a decreasing from 33,0-2,0 adults/m<sup>2</sup>. Treatments with Decis Mega (0,250 l/ha) and Nuprid Al 200 SC (0,275 l/ha) revealed a good efficacy in control of adults (93,7-93,6%) with a higher level of infestation in the moment of treatments application (32,7-34,0 insects/m<sup>2</sup>).Insecticide

Calypso 480 SC in rate by 0,150 l/ha registered a decreasing with 1,4 % (92,3%) of efficacy comparison with control product, respective with 1,7% in the case of insecticide Fury 10 EC (92,0%) in rate of 0,200 l/ha. Despite the decreasing of efficiency this insecticide registered good performance in control of adults about 32,2-32,5 adults/m<sup>2</sup> to 2,4-2,5 insects/m<sup>2</sup> (Table 2).

Table 2.

Efficacy of insecticides at 24 hours since treatments in control of *Diabrotica virgifera virgifera* Le Conte adults in maize crop

Variant	Rate l,g/ha	Number of live adults / m <sup>2</sup>					Efficacy %
		RI	RII	RIII	RIV	Average	
1. Faster 10 CE	0,150 l	2,0	1,5	1,7	2,0	1,8	94,1
2. Nuprid Al 200 SC	0,275 l	1,8	2,2	1,5	2,5	2,0	93,7
3. Decis Mega 50 EW	0,250 l	2,0	1,9	2,2	2,3	2,1	93,6
4. Kaiso Sorbi 5 WG	0,250 kg	1,8	2,0	1,5	1,5	1,7	94,3
5. Calypso 480 SC	0,150 l	2,4	2,6	2,3	2,3	2,4	92,3
6. Karate Zeon (STD.)	0,250 l	1,8	2,1	2,0	2,1	2,0	93,7
7. Fury 10 EC	0,200 l	2,3	2,7	2,4	2,6	2,5	92,0
8. Untreated	-	32	30	31	34	31,8	-

DL 5% = 3,58 DL 1% = 4,87 DL 0,1% =

6,57

Differences registered between products comparison with control product are statistic assured.

At 48 hours since treatment was noticed a higher efficacy in case of the insecticides Faster 10 EC and Decis Mega (93,3-93,5%) with a decreasing about 0,3-0,6% comparison with values registered at 24 hours after treatment. Were registered a decreasing about 0,6% in the case of control product, Karate Zeon (93,1%). The efficacy of treatments with Nuprid AL 200SC and Kaiso Sorbi (93,0%) it is similar with control product. A decreasing of efficacy with values between 0,9-1,1 % were registered in the case of insecticide Calypso 480 SC (91,4%) (Table 3).

At 14 days after treatment was noticed an increasing of number of live adults , respective a decreasing of products efficacy in comparison with results registered at 48 hours since treatment with values between 1,4-2,8%, but despite of efficacy decreasing the performance of insecticide was good with values between 90,0-91,3% (Table 4).

Table 3.

Efficacy of insecticides at 48 hours since treatments in control of adults of *Diabrotica virgifera virgifera* Le Conte in maize crop

Variant	Rate l,g/ha	Number of live adults / m <sup>2</sup>					Efficacy %
		RI	RII	RIII	RIV	Average	
1. Faster 10 CE	0,150 l	2,6	2,4	1,9	1,5	2,1	93,5
2. Nuprid Al 200 SC	0,275 l	2,1	2,8	2,0	2,3	2,3	93,0
3. Decis Mega 50 EW	0,250 l	2,4	2,2	2,3	2,3	2,3	93,3
4. Kaiso Sorbi 5 WG	0,250 kg	2,2	2,4	2,1	2,1	2,2	93,0
5. Calypso 480 SC	0,150 l	2,8	2,6	3,0	2,8	2,8	91,4
6. Karate Zeon (STD.)	0,250 l	2,2	2,5	2,4	2,1	2,3	93,1
7. Fury 10 EC	0,200 l	3,3	2,8	2,6	3,3	3,0	90,9
8. Untreated	-	30	34	36	33	33,2	-

DL 5% = 3,49    DL 1% = 4,5    DL 0,1% =

6,15

Table 4.

Results regarding to protection of maize against adults of *Diabrotica virgifera virgifera* Le Conte species

Variant	Rates l,g /ha	Number of adults/m <sup>2</sup>				Efficacy (Henderson -Tilton)		
		Before treatment	At 24 hours after treatment	At 48 hours after treatment	At 14 days after treatment	24 hour after treatment	48 hours after treatment	14 days after treatment
1. Faster 10 CE	0,150 l	32,0	1,8	2,1	3,0	94,1	93,5	91,3
2. Nuprid Al 200 SC	0,275 l	32,7	2,0	2,3	3,2	93,7	93,0	90,9
3. Decis Mega 50 EW	0,250 l	34,0	2,1	2,3	3,5	93,6	93,3	90,5
4. Kaiso Sorbi 5 WG	0,250 kg	31,0	1,7	2,2	3,0	94,3	93,0	91,0
5. Calypso 480 SC	0,150 l	32,2	2,4	2,8	3,5	92,3	91,4	90,0
6. Karate Zeon(STD.)	0,250 l	33,0	2,0	2,3	3,3	93,7	93,1	90,8
7. Fury 10 EC	0,200 l	32,5	2,5	3,0	3,5	92,0	90,9	90,0
8. Untreated	-	32,8	31,8	33,2	35,6	-	-	-

Studying the possibility of managing *Diabrotica virgifera virgifera* Le Conte adult population in field corn grown in monoculture and quantifying the effect of different insecticides was a decreasing in the density of insects, from a high level of infestation in the moment of

treatment about 31,0-34,0 insects/m<sup>2</sup>, at 48 hours since treatment 3,0-3,5 insects/m<sup>2</sup>, at 14 days since treatment 2,3-3,0 adults/m<sup>2</sup> respective fewer eggs deposited in corn crop.

The evaluation of insecticides efficacy show that this products maintained the effect on adults mortality registered at 48 hours since treatment, values between 93,0-93,5% in case of Kaiso Sorbi 5 WG, Nuprid Al 200 SC, Decis Mega, Faster 10 EC, similar efficacy with control product, Karate Zeon (93,1%) and till 14 days after application the decreasing was about 1,4-2% show a satisfactory efficacy at a level by 90,0-91,3%.

The results registered noticed that insecticides tested can be recommended for protection against adults of *Diabrotica virgifera virgifera* Le Conte forecast based on adults flight when density number is over economic threshold (10 adults/m<sup>2</sup>) in the period of silk and panicle appearance. It requires a second treatment at 10-12 days if it is registered strong infestation of pest.

## CONCLUSIONS

*Diabrotica virgifera virgifera* Le Conte is one of the most important pest for maize in some countries from central and east Europe and in the western part of Romania are affected year by year big surfaces with maize since it is appearance in 1996.

The main factors which favors the development of some significant populations it is made by monoculture and favorable conditions and cultivation system in the area.

For the establishing of a sustainable control program for adults were used the latest generation of insecticides with high quality of efficacy and decreasing the ecotoxicology and pollution risk of the environment.

The insecticides investigated were: Faster 10EC (0,150 l/ha), Nuprid Al 200SC (0,275 l/ha), Kaiso Sorbi 0,250 kg/ha, Decis Mega 50 EW 0,250 l/ha, Karate Zeon 0,250 l/ha, Fury 10 EC 0,200 l/ha, Calipso 480 SC 0,150 l/ha, and are recommended for the protection against adults of *Diabrotica virgifera virgifera* Le Conte and assured an efficacy at 48 hours since treatment about 90,9-93,5%. The performance of this insecticides are maintained at 90,0-91,3% at 14 days since treatment.

The insecticides will be applicated in the period of silk and panicle appearance (phenology phase BBCH 55-61) at a density over economic threshold (10 adults/m<sup>2</sup>) and in the case of using entomological traps the economic threshold is about 7 adults/m<sup>2</sup>, unspecific at 24 hours.

It is required an application of a second treatment at 10-12 days if it is noticed strong reinfestation with this pest, considering the long duration of adults stage characteristic for this species.

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