RESEARCHES REGARDING TO INFLUENCE OF AGROPHYTOTECHNICAL AND CHEMICAL MEASURES IN CONTROL OF WESTERN ROOT WORM (*DIABROTICA VIRGIFERA VIRGIFERA LE CONTE)*

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Abstract

This paper it is based on researches made in the second cycle of experiments (2009-2010) in long term experiments with crop rotation since 1990 in Oradea on a preluvosoil condition where were applicated higher rates of nitrogen (N_0, N_{30}, $N_{60,}$ $N_{120,}$ N_{180}, N_{240}).

Influence of different methods of prevention and control of Diabrotica virgifera virgifera Le Conte species presents the importance of agrophytotechnical methods and the main role it is done by crop rotation, fertilization, density of plants and chemical control. The larvae attack manifested only in the advanced monoculture with reduced values are rates of N_{120} kg/ha with an average on this three plant density used 40.000, 60.000 and 80.000 plants/ha by 19,5% comparative with unfertilized background with value about 32,7%.

For the larvae control, the treatment of seeds with insecticides Force Zea (12,5 l/t)or Gaucho 600 FS(10,0 l/t) assured an decreasing of attack degree under mark of 2,5 used on IOWA scale.

For the control of adults were used insecticides like: Decis Mega (0,250 l/ha), Kaiso Sorbi 5WG (0,250 kg/ha) and Karate Zeon (0,250 l/ha).

Key words: Diabrotica virgifera virgifera Le Conte,crop rotation, background, attack degree, chemical control.

INTRODUCTION

The invasion of Europe by the Western Corn Rootworm (*Diabrotica virgifera virgifera Le Conte*), one of the most destructive corn pests, is ongoing and represents a serious threat to the European agriculture (Miller et al., 2005). After it's accidental introduction in Serbia prior to 1993 it's now actively spreading throughout Southeast Europe and from there into Central Europe (Wudtke et. al., 2005).

First in 1996 D.*virgifera* was detected in Romania near Arad. As this species is classified as a quarantine pest officially required measures, have to be applied to avoid further spread and to eradicate the population.

As it seems to be unlikely that the invasion of *D. virgifera* can be stopped completely, locally adapted control measures have to be developed to be prepared to advise farmers accordingly. Assessing potential of different prevention and control methods reveals the importance of certain crop management measures, as crop rotation and other agrophytotechnical factors and chemical control (Furlan L. si colab., 2002; Radinić et.all., 2002).

MATERIAL AND METHODS

The researches carried out in the second cycle of experiment between 2009-2010 in long term experiments made in 1990 with different type of rotation: maize monoculture, rotation by two years: wheat-maize, by three years: soybean-wheat-maize. Maize hybrid was PR 37 No1 was sowed at three density: 40.000, 60.000 and 80.000 plants/ha using an common background of phosphorous and potassium ($P_{80}K_{60}$) and six rates of nitrogen fertilizer: N_0, N_{30}, N_{60}, N_{120}, N_{240}. Were determined the weight of plants which had attack symptoms (%) depending by studied parameters and the influence of crop rotation on *Diabrotica virgifera virgifera Le Conte* population.

In the monoculture first year conditions in separated experiences with maize were noticed chemical control (for larvae by a side and for adults by another side). In control of larvae were used following products: Gaucho FS (*imidacloprid*) and Force Zea (*teflutrin + tiametoxam).*Seed treatment was made with two – three days before sowing.

Observations were made in all the vegetative period and plants with attack symptoms ("goose neck") were analyzed and after that were established the attack degree with Iowa Scale (1- plants without symptoms, 6 – plants with massive attack).

For the control of adults were tested products like: Karate Zeon (lambda - cihalotrin), Decis Mega 50 EW (deltametrin) and Kaiso Sorbi 5 WG (lambda cihalotrin). Efficacy of insecticides was determined through the analysis of living adults at 24 and 48 hours since treatment.

RESULTS AND DISCUSSION

Analyzing the effect of nitrogen fertilization on weight plants attacked by larvae only in the case of monoculture.

Fertilization with nitrogen contribute to increasing and development of plants favoring the root system if were used optimum rates of nutritive elements.

In the case of preluvosoil optimum rates of nutritive elements for maize crop did not exceed 120 kg nitrogen/ha utilized on backgrounds with P and K.

In maize monoculture in the case of different sowing density and lowest weight were registered at rates N_{120}. Using of higher rates of nitrogen fertilizer determined on increasing of pH value and mobile aluminum Al^{3+}, agrochemical index which had negative effect on root system development and caused phytotoxic phenomena's. In the case of variant fertilized with N_{180} respectively N_{240} kg/ha the root system became sensitive and do not have the regeneration capacity after larvae attack leading to a visible increase of attacked plants weight (Table 1).

Table 1.

Influence of crop rotation and fertilization on weight plants attacked by *Diabrotica virgifera virgifera Le Conte* , Oradea 2009-2010

Variant	Crop rotation											
	Monoculture (pl/ha)				Wheat-Maize (pl/ha)				Soybean-Wheat – Maize (pl/ha)			
	40.000	60.000	80.000	Average	40.000	60.000	80.000	Average	40.000	60.000	80.000	Average
Unfertilized	21,6	33,8	42,6	32,7	0	0	0	0	0	0	0	0
$N_{30}P_{80}K_{60}$	20,0	31,3	39,5	30,3	0	0	0	0	0	0	0	0
$N_{60}P_{80}K_{60}$	18,2	25,2	36,2	26,5	0	0	0	0	0	0	0	0
$N_{120}P_{80}K_{60}$	6,3	17,1	35,1	19,5	0	0	0	0	0	0	0	0
$N_{180}P_{80}K_{60}$	9,8	19,2	37,7	21,2	0	0	0	0	0	0	0	0
$N_{240}P_{80}K_{60}$	12,6	20,0	38,5	23,7	0	0	0	0	0	0	0	0
Average	14,7	24,4	38,3	25,8	0	0	0	0	0	0	0	0

LSD 5% - 3.1

Per unit in these 6 backgrounds studied the minimum percent of plants with attack symptom (14,7%) were registered in the case of density by 40.000 plants/ha, this percent increasing with the increasing of density at 60.000 plants/ha (24,4%) respectively 80.000 plants/ha, that is why in the case of high density it is formed a higher quantity of roots the principal food for larvae and lead to the increasing of larvae number on roots.

The advantages produced by the fertilization with nitrogen against the attack caused by larvae are that roots affected regenerating and decreasing the plants weight. Rates of phosphors and potassium applicated did not influence the plants fall and the lowest percent of attacked plants (19,5) was registered at rates by $N_{120}P_{80}K_{60}$, similar results obtained in Yugoslavia where the application of NPK complex determined a low number of larvae and plants fall lower comparative with unfertilized variant (Kereši and colab., 2002)

Analyzing the impact of agrophytotechnical measures which had to limit the losses made by pests so in this way main place it is taken by crop rotation.

Dynamic of adults population from the appearance in the field (29.06.2009, 1.08.2010) had the maximum number in the maize monoculture when the highest flight of adults was 618 adults/ m^2 (Atravig – Cluj – Napoca traps) between 16.07.-30.07. The crop rotation of two and three years contribute to reducing of adults infestation with 48,2-59,6% (Fig.1.).

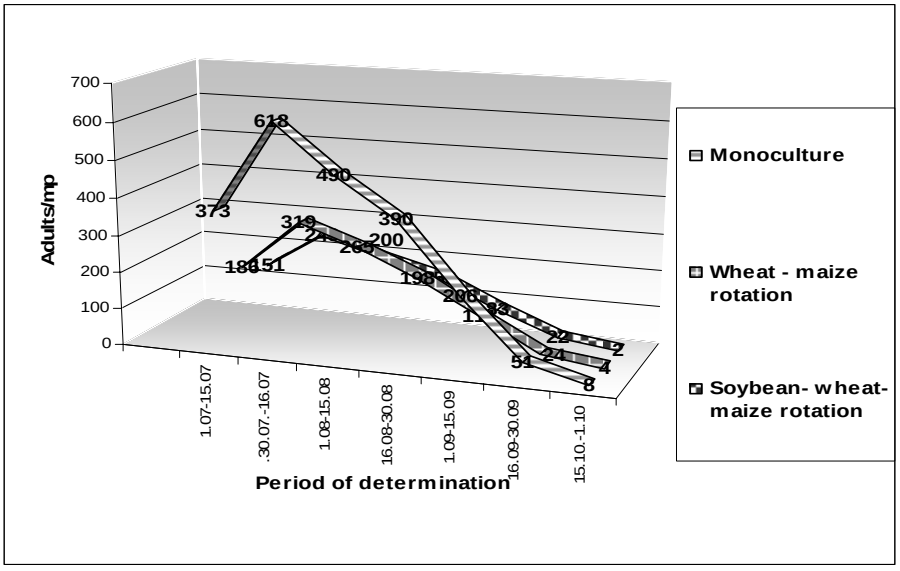

Fig.1. Influence of crop rotation on *Diabrotica virgifera virgifera Le Conte* species

Regarding to chemical control of larvae through the seed treatment present an importance for maize cultivated in long term monoculture conditions respectively in the first year of monoculture, in the conditions with moderate infestations.

The insecticides tested (Table 2.) determined a decreasing of larvae attack presented through the frequency of attacked plants from 28,5 to 8,3% at Force Zea, respectively to 8,5% in the case of insecticide Gaucho 600 FS with an efficacy by 70,9%, respectively 70,2%. Reducing of attack degree had an satisfactory level from 4,42 to 1,85 (Force Zea) respectively 1,87 (Gaucho 600 FS) which can be qualified through an efficacy about 58,1% and 57,7%.

Table 2.

Efficacy of insecticides used in control of larvae by *Diabrotica virgifera virgifera Le Conte* exprimed through frequency of attacked plants (%) and infestation degree

Variant	Rates l, kg/ha	Frequency of attacked plants %	Attack degree
1. Gaucho 600 FS (Std.)	10.0 l/t	8.5	1.87
2. Force Zea	12.5 l/ha	8.3	1.85
3. Netrat	-	28.5	4.42

The attack degree had values between 1.85-1.87 and under 2.5 (on IOWA scale) level which represent level of PED for *Diabrotica virgifera virgifera Le Conte.*

Control of adults was effectuated in the case that adults density it is over economic threshold of pest (10 adults/m^2). In our experiences the average density were about 36.8 adults/m^2 (40.6 in 2009 and 33.0 in 2010).

Efficacy of tested insecticides was determined by number of adults at 24 hours and 48 hours since treatment. In table 3it is presented the efficacy analysis of insecticide Karate Zeon, Decis Mega and Kaiso Sorbi 5WG. Efficacy at 24 hours since treatment had value between 92.8 and 93.6% respectively number of living adults/m^2 with values between 2.35-2.64. At 48 hours since treatment the efficacy it is decreasing to 91.8 - 92.2% because of decreasing of adults/m^2 with value between 2.9-3.06.

Efficacy take value from 92.9% using Decis Mega to 92.3-92.6% in the case of Karate Zeon, Kaiso Sorbi and assured a decreasing of adults number respectively eggs deposition and implicitly a decreasing of larvae from soil.

Table 3.

Efficacy of insecticides in control of adults of *Diabrotica virgifera virgifera Le Conte*, Oradea 2009-2010

Variant	Rates l.kg/ha	Live adults at 24 hours/ m^2	Eficacitate (%)	Live at 48 hours / m^2	Eficacy at 48 hours	Average Eficaccy
1. Karate Zeon (std.)	0.250	2.64	92.8	3.06	91.8	92.3
2. Decis Mega 50 EW	0.250	2.35	93.6	2.9	92.2	92.9
3 Kaiso Sorbi 5 WG	0.250	2.5	93.2	3.01	92.0	92.6
3. Untreated- adults/ m^2	-	36.8	0	37.6	0	0

CONCLUSSIONS

- For reducing of spreading and infestation with *Diabrotica virgifera virgifera Le Conte* it is established differential role of studied control methods.
- Only in long term monoculture were registered significantly attack of pest and in variants with crop rotation of two and three years it is not registered.
- In the case of fertilization with nitrogen at maize in monoculture the lowest weight of attacked plants was at rate of N_{120} (average on three density used 40.000, 60.000 and 80.000 plants/ha) was 10.5% and higher weight was in the unfertilized variant with value by 32.7%.
- Increasing of nitrogen fertilization at N_{180}, N_{240} determined a increasing of attacked plants value because of increasing of pH and mobile Al^{3+} values which had a negative effect on root system development (phytotoxicity phenomena's on preluvosoil).
- Dynamic of adults population related the maximum flight of the adults in period between 16 July – 30 July in maize monoculture (618 adults) and flight period it is 1 July – 15 October.
- For control of larvae in the plots with moderate infestation although in first year with maize monoculture were obtained a decreasing of attacked plants from 28.5% to 8.3-8.5%

using insecticides Force Zea (12.5 l/t), Gaucho FS (10.0 l/t) and the attack degree value it is under the economic threshold of pests (under 2.5 on IOWA scale).

- For adults control can be use with good results in descending orders of efficacy insecticides Decis Mega 50EW (0.250 l/ha), Kaiso Sorbi 5 WG (0.250 l/ha) and Karate Zeon (0.250 l/ha).

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