

Impact of soil works on dynamics and spread of *Diabrotica virgifera virgifera* LeConte in the conditions of Western Romania

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Abstract *Diabrotica virgifera virgifera* LeConte originates in Kansas, USA, and was mentioned and described by the entomologist John Lawrence Le Conte in the year 1867 (4).

In Europe, *Diabrotica virgifera virgifera* LeConte appeared in the 1990s, being seen for the first time in a maize field around the airport of Belgrade, in 1992.

In order to determine the dynamics of the population of *Diabrotica virgifera virgifera* LeConte, we have chosen as a research method ploughing, grubbing and discing. Soil works create conditions favourable to plant development which makes them more tolerant of pest attacks (1).

Because the eggs of *Diabrotica virgifera virgifera* LeConte are laid 10-15 cm deep in the soil, soil works destroy and diminish the population of this pest. Research results show there is a correlation between the soil work chosen and the degree of attack by the pest. Research shows that grubbing had the least effect on the population of *Diabrotica*, while ploughing and disking had significantly stronger effects on this pest.

Diabrotica virgifera virgifera LeConte larvae feed on maize roots producing important losses and thus contributing to slowing down growth and diminishing the yield (2, 3, and 5). There are over 22 host plants, but maize is the most important host plant economically. West maize root-worm can damage maize (*Zea mays*) roots seriously and can result in serious yield losses (6). Studies concerning the establishment potential of the West maize root-worm carried out by researchers in Croatia, France, and Germany by FAO for the entire Europe show that this insect is capable of surviving and developing wherever maize is cultivated in Europe.

Material and Methods

The study started with a pre-assessment of root damage in autumn 2009 followed by the soil cultivation and was terminated in 2012. Trials were performed in a field with a significant natural *D. virgifera* infestation. Farmers' equipment was used to ensure a realistic soil preparation. Plot size was 500 m² with 8 replications.

Assessment of root damage in the autumn (5x5 plants per plot) was done by using the „root injury scale“. Cages (2 per plot) were used to assess the exact number of emerging adult *D. virgifera* (weekly counts).

Key words

Diabrotica, population, roots, maize, plough, disc, grubber

In the trial field, we had 3 soil working variants, as follows:

Var. 1 Plough, 25 cm working depth, in autumn

Var. 2 Grubber with crumble roller, 25 cm working depth, in autumn

Var. 3 Grubber with crumble roller, 25 cm working depth, in spring (Due to technical reasons in spring the grubber was replaced by a heavy disc harrow, 20 cm working depth)

All plots are planted with maize, using a practical sowing combination.

Results

After the three trial years, we obtained the first conclusive results concerning the impact of soil works on the dynamics of the population of *Diabrotica virgifera virgifera* LeConte. Final results show that, during the three trial years, the most damaging effect in controlling the adults of this pest was when disking in the spring.

We would like to emphasise the fact that, on the plot on which we used the disc, the number of insects captured in the cages was 930 (Table 1) in the three trial years. The least visible effect in controlling the West maize root-worm was when working the soil with the grubber (Figure 1). On the plots worked with

the grubber in the fall in all three trial years, we captured a total of 1,389 insects.

Table 1

Number of adult *Diabrotica* in the cages

	2010	2011	2012	2010-2012
Plough, autumn	586	284	177	1047
Grubber, autumn	980	304	105	1389
disc harrow spring	554	281	95	930

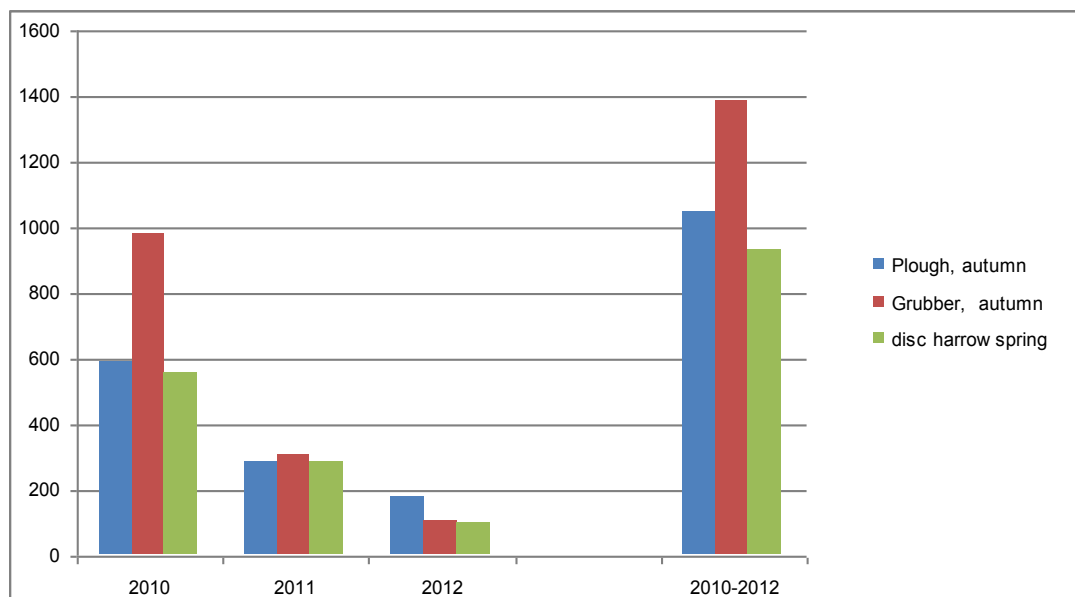


Fig. 1. Impact of soil works on the dynamics of the population of *Diabrotica virgifera virgifera* LeConte

In the three trial years, we monitored the maize plant roots in the traps in order to be able to correlate the impact of soil works on the root damage rate by the larvae of *Diabrotica virgifera virgifera* LeConte (Table 2). In the trial year 2009-2010, the most significant impact in the control of the species

Diabrotica virgifera virgifera LeConte was when ploughing in the fall (Figure 2).

This can be explained by the fact that the eggs were subjected to frost: once the soil ploughed, the eggs were brought to the frost area and low temperatures of the winter resulted in the egg extinction.

Table 2

Root damage

	2010	2011	2012	2010-2012
Plough, autumn	2.7	2.0	1.7	2.1
Grubber, autumn	2.8	2.0	1.6	2.1
disc harrow, spring	2.7	2.1	1.7	2.1

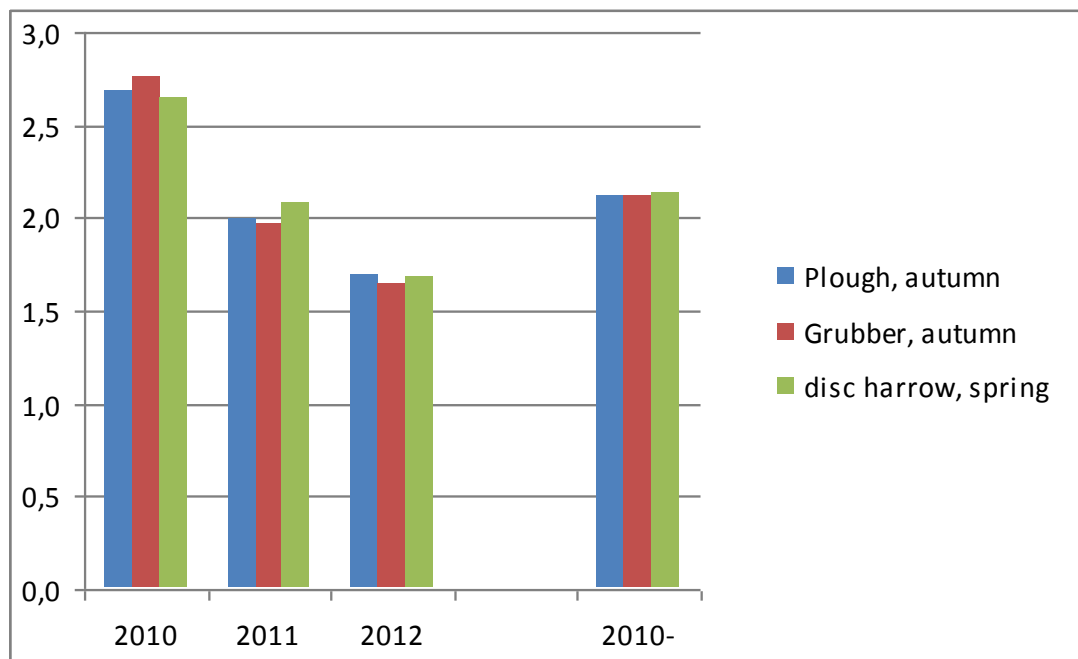


Fig. 2. The influence of soil preparation on the species *Diabrotica virgifera virgifera* 2010-2012

There were good results after using the harrow in the spring. The explanation is that, due to the friction between soil particles (friction induced by the intense movements of the active organs of the equipment), the eggs of the studied species were exposed to mechanical destruction.

In the trial year 201-2011, the presence of the layer of snow during the frost period protected the eggs, and the destructive effect of fall ploughing on the eggs was not as strong.

Using a harrow in the spring had the best results in pest control since the eggs seem to be more sensitive to soil movement than in the fall. As in the previous year, the use of the grubber in the fall resulted in the least visible effects on the pest population, which confirms previous results.

Final results after the three trial years show there are no significant differences between the soil work methods and the reduction of the number of larvae in the soil. All three methods contributed to the diminution of the larvae number in the soil; larvae were also destroyed by the climate conditions of each of the three trial years, but it seems that working the soil with a plough in combination with a harrow in the spring contributes more to the control of larvae of *Diabrotica virgifera virgifera* LeConte.

Conclusions

1. Maize cultivated in monoculture determines a strong attack by *Diabrotica Virgifera Virgifera* Le Conte, which asks imperatively for crop rotation.
2. Adult appearance and their flight are uneven from mid-June to the end of September.

3. The number of adult *D. virgifera* counted in the cages in 2010 was higher than in 2011 and 2012. It can be assumed that the heavy precipitations in 2010 caused a lower *Diabrotica* population density and a reduced number of eggs.

4. Working the soil in the fall with a plough and in the spring with a harrow resulted in a diminution of the population of *Diabrotica virgifera virgifera* LeConte

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