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TESTING OF SOME INSECTICIDES ALLOWED IN ORGANIC FARMING AGAINST *Tanymecus dilaticollis* ATTACK OF MAIZE CROPS

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Abstract

This paper present the results obtained about the effectivess of some insecticides agaist Tanymecus dilaticollis atack in maize crops at NARDI Fundulea. These products are allowed in organic farming by Anexx 2 of Commission Regulation (EC) No 889/2008 for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. The insectisides used in the maize seeds tratament were: Neem-TS, Laser 240-TS and Bactospeine DF-TS in dose of 2.5 g/250 grams of seeds. In vegetation it were used: Neem-TV and Laser 240-TV in dose of 150 ml/ha. The used maize hybrid was Olt variety obtained at NARDI Fundulea. Also, it performed productivity elements and seeds yields and chemical compozition on Laboratory of Yields Quality of Crop Sciences Department, Bucharest Faculty of Agriculture. The insecticides effectiveness fluctuated between 5.5 when it was applied Laser 240-TS (2.5 ml/250 g. s.) and 6.12 when it was applied Laser 240-TV (150 ml/ha). The density of crop maize ranged between 98.5 plants/plot of Laser 240-TV apllied on seeds by comparison with the same product applied in vegetation. The largest yields was of 6676 kg/ha at insecticide variant with the best effectiveness Laser 240-TS (2.5 ml/250 g. s.). The chemical composition of seeds, in average, was: 12.27% protein; 70.83% starch; 4.41% oil; 1.26% ash; fibre 1.77%. These results showed that there was no influence of insecticides on yield quality.

Key words: *insecticides, maize, Tanymecus dilaticollis, organic agriculture, productivity.*

INTRODUCTION

Care and awareness of the world population on the environment, the dangers to health of the synthetic pesticides using and chemical fertilizers excessively and consumer preference for food produced safely and free of danger are major factors that lead to increased interest of everyone involved in alternative forms of agriculture in the world, as organic farming. Organic production systems are based on specific standards for food production and aims to produce them in a sustainable way both socially and materially. This system should be regarded as an integral part of sustainable development strategies as a viable alternative to conventional agriculture (Nastase and Toader, 2016). According to recent studies of Research Institute of Organic Agriculture FIBL and International Federation of Organic Agriculture Movements (IFOAM), the organic farming area is around 37.4 million ha, being recorded about 2 million of organic farms and the market of organic products means about $ 73.8 billion. In Romania, organic farming summarizes around 290,000 ha and of these, over 100,000 ha are cereals.

In Romania, organic farming has great opportunities for development and the legal basis for the organization of production and sale of organic products has been shaped by the following national and EU legal norms.

The Romanian legislation is up-to-date and follows EU Regulation (EC) No 834/2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91 and Commission Regulation (EC) No 889/2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. Organic producers must be certified by one of the accredited control and inspection bodies. There is a national logo for organic products, which is owned by the Ministry of Agriculture

and Rural Development. It can be used for products that comply with the Romanian Organic legislation.
On the other hand, maize is an important crop being cultivated on large areas in the world (over 160 million ha), also in Romania (2.5 million ha annually) because it is used in human nutrition, feed production and raw material for many other products (starch, alcohol, biofuel, etc.). In organic farming, the maize is cultivated over 50% from total surface. This importance derives from the fact that maize is mainly intended for animal feed. Also, according to organic farming rules, organic livestock must be fed with fodder crops obtained by organic farming rules.
But as is well known, the maize crop has many advantages, among which we can mention, great production potential, full mechanization, high ecological plasticity.
However, maize has some limited elements of production including pests that attack in the early stages of vegetation as gray maize weevil (*Tanymecus dilaticollis* Gylll.). They feed on young leaves from the leaf margin, and most damage occurs before the 4-leaf stage (BBCH 14). Drought and higher temperatures enhance feeding (Popov, 2006). *Tanymecus dilaticollis* has one generation per year and overwinters as adult in the soil (Paulian, 1972).
Therefore, where maize is cultivation in organic farming conditions, should be adhered to rules imposed by law. This means that to combat various pests in crop production to by maintaining of crop health using preventative measures, such as the choice of appropriate varieties resistant to pests and diseases, appropriate crop rotations, mechanical and physical methods and the protection of natural enemies of pests.
All synthetic insecticides are prohibited.
They may be used only products corresponding to Annex 2 of the Regulation (EC) No 889/2008.
In this context, it is very difficult to find a solution to combat this dangerous pest of maize crop.
This paper present the results obtained about the effectiveness of allowed insecticides in organic farming against *Tanymecus dilaticollis* attack of maize crops at NARDI Fundulea.

MATERIALS AND METHODS

Experience was conducted in the experimental field at Plant Protection Collective (NARDI Fundulea), in 2016.
The biologic material of maize crops was Olt variety, obtained of NARDI Fundulea. The insectisides used in the maize seeds tratament were: Neem-TS (natural neem oil) (2.5 ml/250 g. s.), Laser 240-TS (spinosad 240 g/l active substance) (2.5 ml/250 g. s.) and Bactospeine DF-TS (*Bacillus thuringiensis* subsp. *Kurstaki)* (2.5 g/250 g. s.). In vegetation it was used: Neem-TV (150 ml/ha) and Laser 240-TV (150 ml/ha) (Figures 1 and 2).

Figure 1. Insecticides used for seeds sowing, 2016) (NARDI Fundulea Experimental Field)

Figure 2. Aspects of seeds preparation and sowing (NARDI Fundulea Experimental Field, 18^{th} of May 2016)

Experimental plots have 42 m^2 (10 m length, 4.2 m width (6 rows), 0.7 m distance between rows) by randomized blocks, in four repetitions. The maize seeds were sowed manually with a planter, at a 35 cm distance between seeds on the row. This low density has the purpose to concentrate maize leaf weevil on the emerged maize plants to evaluate effectiveness of the insecticides used for the seed treatment. To avoid migration of maize leaf weevil adults from one plot to another, the experimental plots were laterally isolated with a 2 m wide strip sown with pea, a plant repellent to this insect (Paulian et al., 1972; Voinescu and Barbulescu, 1998).
We analyzed 20 of plants from each plot and we removed the plants from marginal rows of the plot.
The attack intensity of the *T. dilaticollis* were assessed when plants arrive at four leaf stage (BBCH 14), using a scale from 1 to 9, elaborated and improved by Paulian (1972). According this scale attack intensity ranged from 1 (unattached plant) to 9 (plant complete destroyed): x Note 1: plant not attacked; x Note 2: plant with 2-3 simple bites on the leaf edge; x Note 3: plants with bites or clips on leaf edge; x Note 4: plants with leafs chafed in proportion of 25 %; x Note 5: plants with leafs chafed in proportion of 50 %; x Note 6: plants with leafs chafed in proportion of 75 %; x Note 7: plants with leafs chafed almost at the level of the stem; x Note 8: plants with leafs completely chafed and beginning of the stem destroyed; x Note 9: plants destroyed, with stem chafed close to soil level (Toader et al., 2016).

Figure 3. *Tanymecus* attack on maize plant (NARDI Fundulea Experimental Field, 13rd of May, 2016)

After 30 days from plant emergence, the saved plants percentage was evaluated by counting all the emerged plants from a plot and comparing them with the sowing seeds number/plot.
On the other hand, chemical analyzes were performed to see if there have been changes in the chemical composition depending on the insecticide applied.

RESULTS AND DISCUSSIONS

Data from figures 4 and 5, demonstrate that, climatic conditions from spring period of the year 2016, at NARDI Fundulea, were medium favourable for maize leaf weevil attack. Monthly and annual average temperatures for the year 2016 compared to the annual average is presented in Figure 4.
Examination of the data, it can be seen that the average temperature for April was 14.0°C, with 2.9°C higher than the multiannual temperature (11.1°C).
For May, they were recorded average monthly temperature values by 0.8°C higher than the multiannual average (16.1).

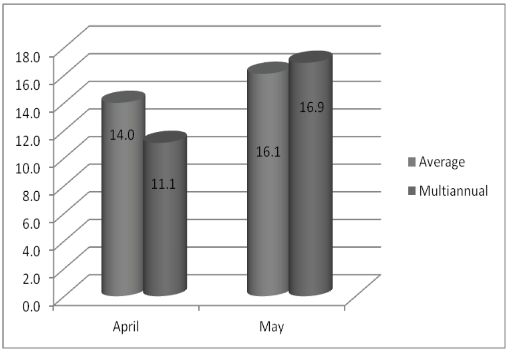

Figure 4. Evolution of the air temperatures in spring, at NARDI Fundulea, in 2016

2016 was characterized in April and May with a surplus of rainfalls. The largest amount fell in April, 73.7 mm, 14.7 mm more than the multiannual average. In May, the difference was only 8.9 mm by comparison with multiannual average (Figure 5).
These climatic conditions, from second decade of May, when maize plants were in first vegetations stages (BBCH 10-14) were mediu favourable for pest attack.

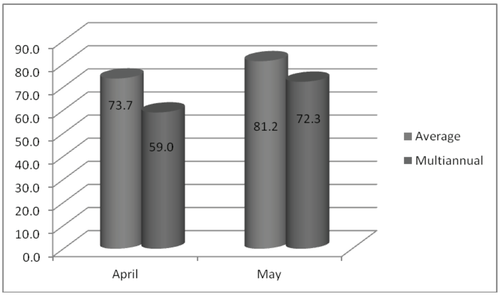

Figure 5. Evolution of the rainfalls in spring, at NARDI Fundulea, in 2016

Figure 6 presents the evaluation of *Tanymecus dilaticollis* attack intensity of maize plants, on a scale from 1 (not attacked plant) to 9 (complete destroyed plants). Using the scale in phase of four leafs, it was found plants with Notes 5 and 6, with leafs chafed were affected in proportion of 50-75% (Figure 7) According the results, the lowest attack was recorded in the treated seed with Laser 240-T5 (2.5. ml/250 g.s.) of 5.5 (Figure 8). Thus, we must emphasize the seed treatment compared with the same product applied in vegetation. It also notes that the other two treatments applied to seeds, efficacy was better than for treatments performed in vegetation. The higher attack intensity was recorded at Control variant, with 6.14.

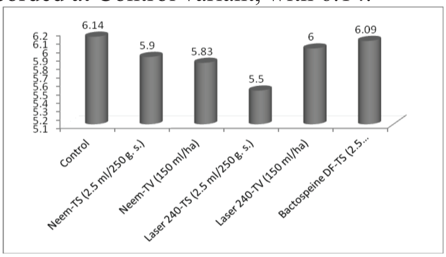

Figure 6. Attack intensity analysis (NARDI Fundulea Experimental Field, 13rd of May)

Figure 7. x Note 5: plants with leafs chafed were affected in proportion of 50-75% (NARDI Fundulea Experimental Field, 13rd of May)

Figure 8. Variant of seed treatment with Laser 240 (2.5 ml/250 g.s.) (NARDI Fundulea Experimental Field, 23rd of June 2016)

Regarding plant density/plots the best result was recorded in the treated variant with Laser 240-T5 (2.5. ml/250 g.s.), where it recorded 132 plant/plot. This result meaning over 77.65% of saved plants. Also, the good result obtained in case of seeds treatment with Bactospeine DF-TS (2.5 g/250 g.s.), respectively, 123.5 plant/plot and 72.65% saved plants (Figure 9).

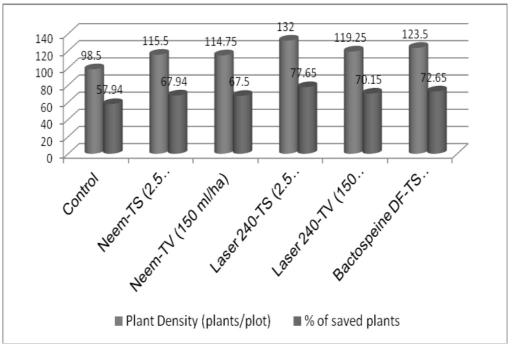

Figure 9. Density of plants at 30th of May 2016 (NARDI Fundulea Experimental Field)

These results demonstrated the effectiveness of treatments to maize seed with specific products comparative with treatments make in vegetation.

In case of the results regarding productivity elements and seeds yields, can highlight the variant of the insecticides were applied to seeds, respectively, Laser 240-T5 and Bactospeine DF-TS (2.5 ml/250 g.s.).

In these conditions, were obtained, 86.55% of grains weight/cob and TGW was 362.3 g for Laser 240-T5 and 85.58% of grains weight/cob and TGW was 336.6 g for Bactospine DF-TS (Figures 10 and 11).

Figure 10. Cobs at harvesting

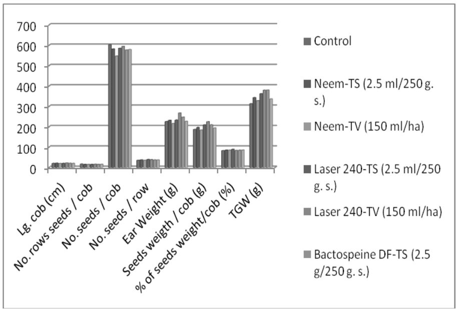

Figure 11. Productivity elements of maize at harvesting (NARDI Fundulea Experimental Field, 2016)

The main factor of yields is plants density (cob) at harvesting. Thus, the best seeds yields were recorded at two variants of insecticides applied on seeds, Laser 240-T5 (6676 kg/ha) and Bactospeine DF-TS (6447 kg/ha). The lowest values were found at Control variant, with 4899 kg/ha. Also, the low yields recorded at treatment in vegetation by comparison with the same produce in vegetation (Figure 12).

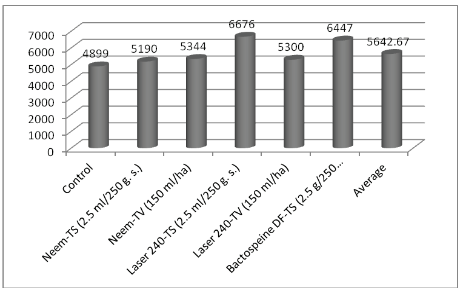

Figure 12. Yields of maize seeds (NARDI Fundulea Experimental Field)

In climatic conditions of 2016, the accumulation of reserve substances were favoured to accumulated more starch, over 70% in all variants. Content in other elements were not different from what is known in the literature about chemical composition of Olt maize variety. The amount of proteins averaged around 12%. The other compounds were, in average: starch - 70.83%; oil - 4.39%; ash - 1.31% and fibre 5.24%. According of these results can emphasis that the insecticides no influence on chemical composition of seeds at harvesting (Figure 13).

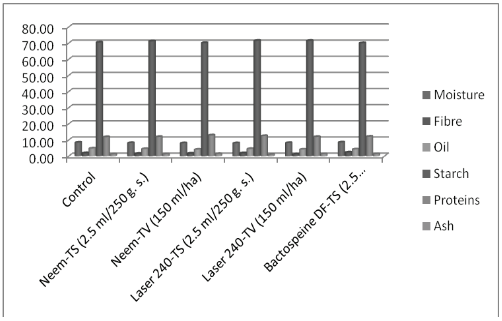

Figure 13. Chemical composition of maize seeds (NARDI Fundulea Experimental Field, 2016)

CONCLUSIONS

Regarding attack intensity, it was found that plants has Notes 5 and 6, when plants with leafs chafed were affected in proportion of 50-75%.

The best result was recorded in the treated seed with Laser 240-T5 (2.5. ml/250 g.s.) with an intensity attack of 5.5.

The higher attack intensity was recorded at Control variant, with 6.14.

Regarding plant density/plots the best result was recorded for the treated variant with Laser 240-T5 (2.5. ml/250 g.s.), with 132 plant/plot (77.65% of saved plants) and Bactospeine DF-TS (2.5 g/250 g.s.), with 123.5 plant/plot (72% saved plants).

In case of the productivity elements results, it can highlight the variant of the insecticides were applied to seeds, respectively, Laser 240-T5 and Bactospeine DF-TS (2.5 ml/250 g.s.) with TGW between 362.3 g and 336.6 g.

The best seeds yields has been obtained at same variants applied on seeds, Laser 240-T5 (6676 kg/ha) and Bactospeine DF-TS (6447 kg/ha).

The lowest values of yields seeds were found at Control variant, with 4899 kg/ha.

The low yields recorded at treatment in vegetation by comparison with the same product in vegetation.

In climatic conditions of 2016, the accumulation of reserve substances were favoured to accumulated more starch, over 70% in all variants.

Content in other elements were not different from what is known in the literature about chemical composition of Olt maize variety: proteins - around 12%, starch - 70.83%; oil - 4.39%; ash - 1.31% and fibre 5.24%.

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