

## ORGANOPHOSPHORUS PESTICIDE RESIDUES FROM SOIL AND CUCUMBER FRUITS

### REZIDUURILE DE PESTICIDE ORGANOFOSFORICE DIN SOL ȘI FRUCTE LA O CULTURĂ DE CASTRAVEȚI

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**Abstract:** This paper presents a study on the content of organophosphorus pesticides (OPPs) in a cucumber crop, in two different cultivation systems, conventional (intensive) of Tg. Frumos area and "V. Adamachi" organic farm that belongs of UASYM Iasi. The aim of this study is to evaluate whether the content of OPPs correlate with cultivation system applied in poly-tunnels. OPPs residues were analyzed by atomic absorption spectrophotometry on Shimadzu GC-2100. As a result of analysis, in conventional farm were detected in soil and fruits residue of pesticides as: Omethoate, Phorate and Phosmet. Pesticide contents were within the maximum allowed by EC Regulation no. 396/2005.

**Key words:** Cucumis sativus, insecticides, contaminants, crop

**Rezumat:** Lucrarea de față prezintă un studiu cu privire la conținutul de pesticide organofosforice dintr-o cultură de castraveți, din două sisteme diferite de cultivare, convențional (intens chimizat) din zona Tg. Frumos și organic, din ferma "V. Adamachi", ce aparține USAMV Iasi. Scopul definit al acestui studiu este de a evalua măsura în care conținutul de pesticide organofosforice se corelează cu sistemul de cultivare aplicat în solarii. Determinarea reziduurilor de pesticide organofosforice s-a efectuat prin spectrofotometrie cu absorbție atomică, utilizând echipamentul Shimadzu GC-2100. În urma efectuării analizelor, au fost detectate în ferma convențională, atât în sol, cât și în legume următoarele reziduuri de pesticide: Omethoate, Phorate și Phosmet. Conținuturile de pesticide s-au încadrat în limita maximă admisă de Regulamentul CE nr. 396/2005.

**Cuvinte cheie:** Cucumis sativus, insecticide, contaminanți, cultură

## INTRODUCTION

Over the years and with the development of fast growing industry, and increase the number of population, the need to produce much food for its necessary. This has led to an intensive chemical treatment of crops, which with time has produced a massive land degradation (Munteanu *et al.*, 2010; Stoleru *et al.*, 2013). That makes to the accumulated of organic and inorganic contaminants in soils, which can react with each other thus producing new compounds, more

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hazardous to human health, but also the flora and fauna which affected the environment (Stoleru, 2013; Dumitrescu *et al.*, 1998; Pădurariu, 2011).

Due to excessive soil degradation and the need increasing more food, the idea of organic farming is increasingly appreciated and "embraced" by producers and the number of organic farms increased from year to year (Stoleru, 2013; Munteanu *et al.*, 2010).

The using of pesticides in agriculture, most often irrational cause pollution of soil and products, on the extensive areas.

## MATERIAL AND METHOD

Research carried out in "V. Adamachi" farm from Iași (organic farm L1), and A.F. Maxim from Tg. Frumos (conventional farm L2), desiring thus, analyzes comparing in both systems of cultivation on the content of organophosphorus pesticides (Fig.1).



Fig.1 The area of study UASVM Iași (L<sub>1</sub>) and AF Maxim Tg. Frumos (L<sub>2</sub>)

During to 2014 have been analysed the content for 23 OPPs (Mevinphos, Molinate, Heptenophos, Omethoate, Naled, Monocrothopos, Phorate, Fonofos, Metribuzin, Parathyon-methyl, Metalaxyl, Malathion, Fenthion, Parathion-Ethyl, Isofenphos, Mecarbam, Penthoate, Myclobutanil, Fensulfothion, Phosmet, Phosalone, Demeton-S-Methyl-sulfoxide) on 20 soil samples and 10 samples of vegetables from the two farms (Tabel 1).

Sampling was carried in two phases: • Phase I - before planting (10-11 March);

- Phase II a – after the last harvest (9-10 August).

Table 1

Soil and fruit code samples				
Farm type	Location	No of samples	Soil code sample	Fruit code sample
Organic	UASVM Iași , Ph I	5	S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub> , S <sub>4</sub> , S <sub>5</sub>	C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub> , C <sub>4</sub> , C <sub>5</sub>
	UASVM Iași , Ph II	5	S <sub>11</sub> , S <sub>12</sub> , S <sub>13</sub> , S <sub>14</sub> , S <sub>15</sub>	
Convențional	A.F. Maxim , Ph I	5	S <sub>6</sub> , S <sub>7</sub> , S <sub>8</sub> , S <sub>9</sub> , S <sub>10</sub>	C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub> , C <sub>4</sub> , C <sub>5</sub>
	A.F. Maxim , Ph II	5	S <sub>16</sub> , S <sub>17</sub> , S <sub>18</sub> , S <sub>19</sub> , S <sub>20</sub>	

In the ecological system were applied differentiated fertilization with organic products (Orgevit-1500 kg /ha) and microbiological (Micoseed plus – 120 kg/ha), and for conventional farm was applied soluble fertilizer with Nutrispore, amount of 900 kg/ha, applied 10 by 10 days, started with bed preparation.

Biological material was represented by hybrid Artist, from Bejo Seed.

Analyses were carried out on samples of soil and fruit as well.

The method used in the research laboratory at the Sanitary Veterinary Iasi and determination of organophosphorus pesticides was performed by means of gas chromatography (GC) - Schimadzu 2010 equipped with detectors NPD and ECD.

## RESULTS AND DISCUSSION

As a result of the yield determinations, the highest number of fruit/plant (fr/pl) was in version fertilized with Orgevit (26 fr/pl), and those that were fertilized with Micoseed had a lower number of fruit/plant, respectively 17 fr/pl (Table 2)

Fruit weight is other important factor for the cucumber production. From this point of view have been remarked plants fertilised with Nutrispore (129,26 g/fr.).

Table 2

**Dynamics of fruits/plant and weight of fruit of cucumbers**

Experimenteal version	Fruits/plant	Weight of fruit (g)	Weight fruits/plant (kg)
Artist F1 x Orgevit	26	113,78	2,933
Artist F1 x Micoseed	18	129,03	2,238
Artist F1 x Nutrispore	17	129,26	2,326
Artist F1 x Control	16	111,27	1,779

In the table 3 are present the total yield till to 10 August, before the end of crop. Cucumber yield varied from 39,529 t/ha up to 65,171 t/ha.

Table 3

**Total yield of cucumber (2014)**

No.	Experimental version	Yield (t/ha)	Relatively yield (%)	Differeneces to Control and significance
1.	Artist F1 x Orgevit	65.171	164,87	25,642 <sup>***</sup>
2.	Artist F1 x Micoseed	49.728	125,80	10,199 <sup>*</sup>
3.	Artist F1 x Nutrispore	51.683	130,75	12,154 <sup>**</sup>
4.	Artist F1 x Control	39.529	100,00	0,00

LSD 5%=8.231 t/ha; LSD 1%=12.004 t/ha; LSD 0.1%=16.5151 t/ha;

**The content of organophosphorus pesticides from soil**

The results of the analysis of the OPPs content from soil samples collected during phase I, are shown in Table 4.

From the analysis carried out on the soils samples from V. Adamachi farm was not detected any type of OPPs. V Adamachi explore organic farming since 2006 and does not use synthetic chemical pesticides.

Results for soil samples from Tg. Frumos farm highlight the contents of Omethoate between 0.01mg/kg (S<sub>6</sub>, S<sub>8</sub>, S<sub>9</sub>) and 0.02 in S<sub>10</sub>. Also, have been found traces of Phorate in quantities of 0.001 mg/kg for S<sub>7</sub> and S<sub>9</sub>, 0.002 mg/kg for S<sub>6</sub> and S<sub>10</sub> and 0.003 mg/kg for the sample S<sub>8</sub>, and Phosmet: 0.005 mg/kg in S<sub>6</sub> and S<sub>10</sub>; 0.006 mg/kg in S<sub>7</sub> and S<sub>9</sub> and 0.007 mg/kg in sample S<sub>8</sub>.

Table 4

**The content of organophosphorus pesticides in soil samples (phase I)**

Pesticide name	Soil code sample (mg/kg)						Maximum admitted limit (mg/kg)
	S <sub>1</sub> -S <sub>5</sub>	S <sub>6</sub>	S <sub>7</sub>	S <sub>8</sub>	S <sub>9</sub>	S <sub>10</sub>	
Omethoate	Nd	0,01	0,015	0,01	0,01	0,02	0,02
Phorate	Nd	0,002	0,001	0,003	0,001	0,002	0,1
Phosmet	Nd	0,005	0,006	0,007	0,006	0,005	0,05

nd\*= below the detection limit of the device

The OPPs residues found in soil samples because were used against the species of *Tuta absoluta* Mey. and *Tetranychus urticae*. Due to the large number of applications, OPPs have been accumulate in the soil and thus were found in soil samples analyzed, under MAL.

The results for soil samples collected from Phase II are shown in Table 5. OPPs were not detected in large numbers, or in quantities too important in phase-II, show that are metabolized and thus has an improvement of soil quality. The Omethoate found in much lower: in S<sub>16</sub> of 0.02 mg/kg, in S<sub>17</sub> was found 0.007 mg/kg, in S<sub>18</sub> and S<sub>19</sub> was 0.005 mg/kg, and in S<sub>20</sub> found 0.01 mg/kg.

Table 5

**The content of organophosphorus pesticides in soil samples (phase II)**

Pesticide name	Soil code sample (mg/kg)						Maximum admitted limit (mg/kg)
	S <sub>11</sub> -S <sub>15</sub>	S <sub>16</sub>	S <sub>17</sub>	S <sub>18</sub>	S <sub>19</sub>	S <sub>20</sub>	
Omethoate	nd	0,02	0,007	0,01	0,005	0,01	0,02
Phosmet	nd	0,01	0,004	0,002	0,007	0,005	0,05

The contents for Phosmet were much lower than first phase, so that the new contents are: S<sub>16</sub> and S<sub>19</sub> – 0.007 mg/kg, S<sub>17</sub> and S<sub>20</sub> – 0.005 mg/kg, and S<sub>18</sub> –

0,002 mg/kg. After soil analyzes taken in second step proved that their content according to MAL.

Regarding from sampling at the farm "V. Adamachi "this time too were not found residues of organophosphate pesticides.

### The content of organophosphorus pesticides in fruits

Same as soil samples collected at the farm "V. Adamachi ", in fruit samples were not detected residues of organophosphate pesticides (Table 6).

In contrast to the soil samples from the AF Maxim, in cucumber fruit were found organophosphorus pesticides in only two samples taken in the analysis.

In samples C<sub>6</sub> and C<sub>9</sub> have been found residues of Omethoate and Phosmet in quantity of 0.01 mg/kg. Regarding to the Phorate content, this pesticide did not found. Because were found only 0.01 mg/kg OPPs residues in fruit samples, shows that any where the fruit harvested from AF Maximum allowed MAL in the content of pesticides.

Table 6

The content of organophosphorus pesticides in fruit samples

Pesticide name	Fruit code sample (mg/kg)				Maximum admitted limit (mg/kg)
	C <sub>1</sub> ,C <sub>5</sub>	C <sub>6</sub>	C <sub>9</sub>	C <sub>7</sub> , C <sub>8</sub> ,C <sub>10</sub>	
Omethoate	nd	0,01	0,01	nd	0,02
Phosmet	nd	0,01	0,01	nd	0,05

### CONCLUSIONS

The highest yield was achieved in the experimental version fertilized with Orgevit, respectively 65.171 t/ha.

In soil samples collected in two stages from Adamachi farm have not been detected residues of OPPs.

In the samples taken from the AF. Maxim , have been detected three OPPs of the 23 taken into consideration: Omethoate, Phorate and Phosmet. In one sample was reached MAL respectively in the S<sub>10</sub> sample (0.02 mg / kg).

OPPS residue in fruits highlighted as part of soil content passes in fruit, so were traces of Omethoate and Phosmet in quantities of 0.01 mg / kg. Products obtained in organic cucumbers not pose a threat to human health in terms of the levels of OPPs. For the AF Maxim must be requires closer monitoring for the MAL risk.

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