THE STUDY OF ORGANOPHOSPHORUS PESTICIDE RESIDUES IN SOIL AND VEGETABLE PRODUCTS IN DIFFERENT GROWING SYSTEMS

STUDIUL REZIDUURILOR DE PESTICIDE ORGANOFOSFORICE DIN SOL SI LEGUME, IN DIFERITE SISTEME DE CULTIVARE

HURA Carmen[1], PERJU Cristina[1],
MUNTEANU N. [2],STOLERU V.[2]
e-mail: carmen_hura@yahoo.com

Abstract. *In this paper are presented the research results obtained in 2010, in SIECOLEG Project, regarding the assessment of some organophosphoric pesticide residues (55 active substances) from 80 samples soils and 25 samples vegetables from different growing systems (ecological, in conversion and conventional). In all samples analysed the organophosphoric pesticide residues were included in admissible limits (Regulation (EC) nr. 396/2005).*

Key words: residues, organophosphoric pesticides, soil, vegetables.

Rezumat. *În lucrarea de faţă sunt prezentate rezultatele cercetării obţinute în anul 2010, in cadrul proiectului 52141/2008 – SIECOLEG, cu privire la evaluarea unor reziduuri de pesticide organofosforice (55 substante active), din 80 probe sol si 25 probe de legume, în difertite sisteme de cultivare (ecologic, in conversie şi convenţional). În toate probele analizate reziduurile de pesticide organofosforice s-au incadrat in limitele maxime admise (conform Regulamentului (EC) nr. 396/2005).*

Cuvinte cheie: reziduuri, pesticide organofosforice, sol, legume.

INTRODUCTION

Irrational use of pesticides in agriculture causes pollution of large areas of soi land food with nitrate / nitrite, pesticides and heavy metals.

In most cases, pesticides used to protect crops exerts its toxic action not only as to pests and pathogens, but also to animals; there is a risk that people can be affected due to toxic residues ingested with food (Hura, 2005, 2007).

Given the importance of this issue and the fact that in our country amounts were used, it was useful considered to know the content of pollutants in some soils cultivated with vegetables, as well as in fresh vegetable products.

The aim of the research is to assess the extent to which chemical factors are risk factors for plants and humans exceed the limits above which are pollutants. In this way producers and consumers become aware of the importance of organic vegetable production and the negative influence of during the use of pesticides on the ecological balance and the harvest, that human health.

[1] NIPH/ Regional Center of Public Healthy Iasi, Romania
[2] University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

MATERIAL AND METHOD

Organophosphorus pesticide residue content was analyzed in 105 samples, of which 85 soil samples and 25 samples of plant products (tomatoes, peppers, eggplants, cabbage, onions), in three cultivation systems (organic, in conversion and conventional), using standard methods. The soil samples were collected during 2010 in two phases, as follows: spring (before the establishment of crops) and summer (at harvest maturity).

Samples of soil (table 1) and plants (table 2) was carried out in certain locations, as follows:

• certified organic land: Bacau Vegetable Research Station - SCL and Iasi University of Agriculture - USAMV;

• land in conversion: Andrieseni (Family Association - FA Rotariu C.)

• conventional land: Roman (AgroFlamanzi), Tg. Frumos (Family Association - FA Maxim I., Family Association - FA Vavilov M.), Matca (Family Association - FA V. Marin).

Table 1

Number of soil samples analyzed and their codification

Land status	Location	No. of samples	Samples codification
Ecological	SCL Bacau	12	S32, S33,S34, S35,……..S43
	USAMV/ spring	3	S5, S6, S7
	USAMV/ autumn	6	S26, …….. S31
In conversion	Andrieseni Iasi	11	S59, …….. S69
Conventional	Sere Roman/ spring	4	S1, S2, S3, S4
	Sere Roman/ autumn	4	S78, S79, S80, S81
	Tg. Frumos/ spring	7	S8, S9, S10, S11, S12, S13, S14
	Tg. Frumos/ autumn	14	S44, S45, S46, S47, S48, S49, S50, S51, S52, S53, S54, S55, S56, S57, S58
	Matca	11	S15, S16,…….. S25

In the study were determined organophosphorus pesticide residues (44 active substances) in soil samples and vegetable products.

Table 2

Number of plant samples analyzed in different areas

Land status	Location	No. of samples	Samples codification
Ecologic	SCL Bacau	4	V9, V10, V11, V12
In conversie	Andrieseni Iasi	7	V19, ……V25
Conventional	Tg. Frumos	6	V13,……..V18
	Matca	8	V1, V2, ……V8

Determination of pesticide residues was performed according to standards, as follows: SR EN12393-1, 2, 3:2009 – Fat-free foods. Multireziduu methods for determining pesticide residues GC and SR EN 15662 / 2009 - Foods of plant origin. Determination of

pesticide residues by GC-MS and / or LC-MS/MS after extraction / partition with acetonitrile and purified by dispersive method SPE-QuEChERS.

After processing the samples by extraction with organic solvents (acetonitrile, petroleum ether), pesticide residues were analyzed by gas chromatography method using a Shimadzu GC, model 2100, equipped with autosamples and using NPD detector for analysis of organophosphorus pesticides. Were used as standards for determining pesticide residues by gas - chromatography, these mixtures of pesticides: Pesticides Mix 17, Mix 154, Mix 155, Dr. Ehrenstorfer.

Interpretation of results on pesticide residues was carried out in accordance with Regulation (EC) no. 396/2005 on maximum residue limits of pesticides in fruits, vegetables, cereals and other plant products.

RESULTS AND DISCUSSIONS

Results on organophosphorus pesticide residues content (23 active ingredients - Mix 154) in soil samples collected from vegetable farms in 2010, are presented in table 3. Organophosphorus pesticide residues were not detected in any sample analyzed at the farm USAMV (samples S5, S6, S7). The soil samples collected from vegetable farms in Roman (samples S1, S2, S3) and Tg. Frumos (S8, S9, S10, S11, S12, S13, S14) were detected Omethoate residues, Phorate and Phosmet.

Organophosphorus pesticide residues (21 active ingredients - Mix 155) in soil samples collected from farms studied in 2010 were not detected in any sample analyzed. In table 4 the results on the content of organophosphorus pesticide residues (23 active ingredients - Mix 154) in soil samples collected from vegetable farms in the survey taken in August / 2010.

These residues were not detected in any sample analyzed from USAMV farm (samples S26 - S31). In the soil samples collected from conventional vegetable farms Tg. Frumos (sample S15 - S25), residues were detected in low concentrations Omethoate and Phosmet. Omethoate content ranged from 0.005 (S23) and 0.02 mg / kg (S20). Phosmet content ranged from 0003 (S15, S18) and 0.01 mg / kg (S17, S20).

Organophosphorus pesticide residues (21 active ingredients - Mix 155), from soil samples collected from vegetable farms studied in 2010 - were not detected in any sample analyzed.

In table 5 are shown the contents of organophosphorus pesticide residues in vegetable samples collected from areas Targu Frumos and Matca. The pesticide residues were not detected in most samples analyzed. Residues like Omethoate (V3-V8, V14 - V17), Phorate and Metribuzin in tomatoes fruit (V7) and Phosmet (V1 - V4, V7 - V8 and V13-V17) were detected, but within acceptable limits (< 0.01 mg / kg).

In table 6 are shown the contents of organophosphorus pesticide residues in vegetable samples collected from organic farms or in the process of conversion. The content of these pesticide residues have been detected in fresh produce from certified organic farms, in contrast to FA Rotariu have found remains of Omethoate (V20-V24) and Phosmet (V20, V21, V24, V25) but within acceptable limits (< 0.01 mg / kg).

Table 3

Contents of organochlorine pesticide residues (Mix 154) from soil samples In phase I (mg/kg)

Pesticides (active substances)	Samples codification													
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Methamidophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mevinphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Molinate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptenophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Omethoate	0.02	0.03	0.01	0.02	nd	nd	nd	0.02	0.05	0.05	0.04	0.01	0.05	0.05
Naled	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Monocrotophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phorate	nd	0.001	nd	nd	nd	nd	nd	nd	0.002	0.002	0.001	0.003	0.02	0.003
Fonofos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-methyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metalaxyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Malathion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fenthion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-ethyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Isofenphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mecarbam	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenthoate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Myclobutanil	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fensulfothion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phosmet	0.004	0.006	0.01	0.006	nd	nd	nd	0.01	0.006	0.007	0.006	0.008	0.006	0.007
Phosalone	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Demeton-S-methyl-sulfoxide	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd - undetectable

Table 4

Contents of organochlorine pesticide residues (Mix 154) from soil samples in phase II (mg/kg)

Pesticides (active substances)	Samples codification																
	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31
Methamidophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mevinphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Molinate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptenophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Omethoate	**0.008**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.007**	**0.01**	**0.005**	**0.01**	**0.008**	nd	nd	nd	nd	nd	nd
Naled	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Monocrotophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phorate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fonofos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-methyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metalaxyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Malathion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fenthion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-ethyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Isofenphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mecarbam	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenthoate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Myclobutanil	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fensulfothion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phosmet	**0.003**	**0.004**	**0.01**	**0.003**	**0.004**	**0.01**	**0.004**	nd	**0.007**	**0.005**	**0.006**	nd	nd	nd	nd	nd	nd
Phosalone	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Demeton-S-methyl-sulfoxide	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd - undetectable

Table 5

The content of organophosphorus pesticide residues (Mix 154) in vegetable samples (mg/kg)

Species / cultivar	Samples codification	Pesticides (active substances)			
		Omethoate	Phorate	Metribuzin	Phosmet
Peppers/California	V3	**0.007**	nd	nd	**0.004**
Peppers/Fidelio	V4	**0.01**	nd	nd	**0.002**
Tomatoes/Magnus	V5	**0.01**	0	nd	nd
Cucumbers/Merengue	V6	**0.003**	nd	nd	nd
Tomatoes/Magnus	V7	**0.002**	**0.001**	**0.002**	**0.003**
Cucumbers/Mirabelle	V8	**0.001**	nd	nd	**0.001**
Cucumbers/Merengue	V14	**<0.01**	nd	nd	**<0.01**
Peppers/Maradona	V15	**<0.01**	nd	nd	**<0.01**
Tomatoes/Belladona	V16	**<0.01**	nd	nd	**<0.01**
Cucumbers/Merengue	V17	**<0.01**	nd	nd	**<0.01**

Table 6

The content of organophosphorus pesticide residues (Mix 154) in plant samples collected in 2010 (mg/kg)

Species / cultivar	Samples codification	Pesticides (active substances)			
		Omethoate	Phorate	Metribuzin	Phosmet
Peppers/Belladona	V19	nd	nd	nd	nd
Tomatoes/Primadona	V20	**<0.01**	nd	nd	**<0.01**
Eggplant/Aragon	V21	**<0.01**	nd	nd	**<0.01**
Cucumbers/Merengue	V22	**<0.01**	nd	nd	nd
Onion/Stuttgart	V23	**<0.01**	nd	nd	nd
Green beans/Saxa	V24	**<0.01**	nd	nd	**<0.01**
Cabbage/Gloria	V25	nd	nd	nd	**<0.01**

CONCLUSIONS

1. In most of the analyzed samples of soil and plant products on the soils, the content of the main chemical contaminants have been detected and analyzed were within the maximum allowed under European and national regulation.

2. In conventional farms from Roman, Tg. Frumos and Matca a series of organophosphorus pesticide residues (Phorate, Phosmet, Omethoate) were detected, in majority of soil samples analyzed.

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