COMPARATIV STUDY ON THE HEAVY METALS POLLUTION IN CONVENTIONAL AND ECOLOGICAL VEGETABLE CROPS

STUDIU COMPARATIV PRIVIND POLUAREA CU UNELE METALE GRELE LA CULTURILE LEGUMICOLE CONVENŢIONALE ŞI ECOLOGICE

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Abstract. *The degree of heavy metal pollution has been analyzed in comparison to two types of vegetable crops: conventional and organic The results show that both types of cultures, the degree of pollution with heavy metals does not exceed the maximum limits. Heavy metal content of organic crops ranged from undetectable to 3.02 µg/kg, and conventional crops, it ranged from faint to 9.34 µg/kg.*
Key words: pollution, vegetable crops, heavy metals.

Rezumat. *Gradul de poluare cu metale grele a fost analizat comparativ la două tipuri de culturi legumicole: convenţionale şi ecologice. Rezultatele obţinute evidenţiază faptul că la ambele tipuri de culturi, gradul de poluare cu metale grele nu depăşeşte limitele maxime admise. Conţinutul de metale grele la culturile ecologice a variat de la un nivel nedetectabil la 3,02µg/kg, iar în culturile convenţionale, acesta a variat de la slab detectabil la 9,34µg/kg.*
Cuvinte cheie: poluare, culturi legumicole, metale grele

INTRODUCTION

Heavy metal pollution is an issue of great interest to the global population and specifically for those responsible for it. Heavy metal pollution are a major risk factor for agriculture in general, and vegetable growing, in particular.

In the process of food preparation, heavy metals do not decompose, contrary to their concentration per unit mass can increase significantly. Metals, bioaccumulate through the body, stops or blocks the intracellular biochemical processes, or determine mutagenic and carcinogenic processes (Munteanu et al., 2010).

The main purpose of this study is to outline and determine to what extent are polluted with some heavy metals (Cd, Zn, Hg), in two types of vegetable crops, organic and conventional system.

MATERIAL AND METHOD

Research has been organized in two vegetable farms in Târgu Frumos, which applies to conventional agriculture and the farm "V, Adamachi" from University of

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Agricultural Sciences and Veterinary Medicine Iaşi (UASVM Iaşi), ecological certificated in 2008-2009.

Vegetable crops have been established as recommended by literature (Stoian, 2005, Stan and Munteanu, 2001, Stan et al. 2003).

Assessment of heavy metal pollution of vegetable products, was achieved in samples from different organs of vegetables plants.

The organic farm „Adamachi V." (UASVM Iasi), samples were collected from five species of vegetable: tomatoes (in polytunnels and field crops), cucumbers, eggplants, cabbage and onions. From the Tg. Frumos farms (Maxim and Vavilov), sampling was taken at the following crops: tomatoes, cucumbers, chillies, peppers, cauliflower and celery.

Analyses were performed in the Geochemistry Laboratory of the „Alexandru Ioan Cuza" University, by atomic absorption spectrometry method using a spectrophotometer model Shimadzu 6300 (Bulgariu, 2007).

RESULTS AND DISCUSSIONS

The results obtained from vegetable crops on heavy metals content of the samples (plant) are shown in tables 1-7. They allow us to see that the values that express the heavy metal content is within the maximum limits (MRL) under the laws in force on the heavy metal content of food.

a. Results from family farms in Tg. Frumos

Measurements on heavy metal content of vegetable products harvested from Tg. Frumos, from the two family farms AF Maxim Ioan (FM)and AF Vavilov Mihai (FV), are shown in tables 1-6.

Table 1

Cadmium content in plant collected from conventional farm AF Maxim (2008-2009)

Sample code	Place harvesting	Vegetable samples	Quantity of Cd		Differences from average
			µg/kg	%	
V11	field / polytunnel	tomatoes / Veneţia	1.59	101	0.02
V12		tomatoes / Izmir	1.98	126	0.41
V13		tomatoes / Balett	1.68	107	0.11
V14		cucumber / Merengue	1.10	70	-0.46
V15		chili peppers /	2.11	134	0.54
V16		cucumber /Mandi	2.54	162	0.98
V17		cauliflower / leaves	0.11	7	-1.46
V18		celery	1.48	94	-0.09
$\overline{X}$	**Average per farm**		**1.57**	100	-

Following tests carried out showed that the content varied from one plant to another product from a family to another. Cadmium content varied from 0.11µg/kg FM (cauliflower / leaves) to 2.54 µg/kg (cucumber Mandi) (table 1).

As shown in table 2, FM zinc content ranged from 0.17 µg/kg (tomatoes) to 1.88 µg / kg (celery / leaves).

Table 2

Zinc content in plant samples collected from conventional farm AF Maxim (2008-2009)

sample code	Place harvesting	Vegetable samples	Quantity of Zn		Differences from average
			µg/kg	%	
V11	field / polytunnel	tomatoes / Veneţia	0.22	45	-0.27
V12		tomatoes / Izmir	0.18	37	-0.31
V13		tomatoes / Balett	0.17	35	-0.32
V14		cucumber / Merengue	0.22	45	-0.27
V15		chili peppers /	0.23	47	-0.26
V16		cucumber /Mandi	0.21	43	-0.28
V17		cauliflower / leaves	0.86	175	0.37
V18		celery	1.88	384	1.39
$\overline{X}$	**Average per farm**		**0.49**	100	-

Mercury content of plant in the FM (table 3) ranged from 0.46µg/kg (tomatoes Balett) to 2.17µg/kg (celery).

Table 3

The content of Hg in plant samples collected from conventional farm Maxim (2008-2009)

Sample code	Place harvesting	Vegetable samples	Quantity of Hg		Differences from average
			µg/kg	%	
V11	field / polytunnel	tomatoes / Veneţia	1.28	125	0.26
V12		tomatoes / Izmir	0.64	63	-0.38
V13		tomatoes / Balett	0.46	45	-0.56
V14		cucumber / Merengue	0.59	58	-0.43
V15		chili peppers /	1,00	98	-0.02
V16		cucumber /Mandi	0.73	72	-0.29
V17		cauliflower / leaves	1.35	132	0.33
V18		celery	2.17	213	1.15
$\overline{X}$	**Average per farm**		**1.02**	100	-

Measurements on cadmium in FV (table 4) shows that this metal ranged from undetermined quantity (peppers/Vedrana) in 9.34 µg/kg (sweet/Romantic).

Table 4

Cadmiu content in plant samples collected from conventional farm Vavilov (2008-2009)

Sample code	Place harvesting	Vegetable samples	Quantity of Cd		Differences from average
			µg/kg	%	
V19	field / polytunnels	pepper Romatica/ fruit	0.16	12	-1.19
V20		pepper Romatica/ leaves	9.34	692	7.99
V21		pepper Whitny/ fruit	0.08	6	-1.27
V22		pepper Whitny/ leaves	0.84	62	-0.51
V23		pepper Vedrana/ fruit	nd	nd	nd
V24		pepper Vedrana/ leaves	0.35	26	-1.00
V25		pepper Fidelio/ fruit	0.10	7	-1.25
V26		pepper Fidelio/ leaves	3.09	229	1.74
V27		cucumber / Amurg/fruit	1.19	88	-0.16
V28		cucumber / Amurg/leaves	0.27	20	-1.08
V29		tomatoes Ballet/fruit	0.79	59	-0.56
V30		tomatoes Ballet/leaves	sld	sld	sld
$\overline{x}$	**Average per farm**		**1.35**	100	-

FV zinc content ranged from 0.17 µg/kg (tomato) to 1.82 µg/kg (pepper/Vedrana) (table 5).

Table 5

Zinc content in plant samples collected from conventional farm Vavilov (2008-2009)

Sample code	Place harvesting	Vegetable samples	Quantity of Zn		Differences from average
			µg/kg	%	
V19	field / polytunnels	pepper Romatica/fruct	0.32	42	-0.45
V20		pepper Romatica/ leaves	1.32	171	0.55
V21		pepper Whitny/fruct	0.38	49	0.39
V22		pepper Whitny/ leaves	1.69	219	0.92
V23		pepper Vedrana/fruct	0.36	47	-0.41
V24		pepper Vedrana/ leaves	1.82	236	1.05
V25		pepper Fidelio/fruct	0.25	32	-0.52
V26		pepper Fidelio/ leaves	1.68	218	0.91
V27		cucumber / Amurg/fruit	0.22	29	-0.55
V28		cucumber/Amurg/leaves	0.54	70	-0.23
V29		tomatoes Ballet/fruit	0.17	22	-0.60
V30		tomatoes Ballet/leaves	0.51	66	-0.26
$\overline{x}$	**Average per farm**		**0.77**	100	-

Mercury was detected in vegetal FV limits of 0.61 µg/kg (pepper - Fidelio) at 2.65 µg/kg (tomatoes Ballet) is presented in table 6.

Table 6

The content of Mercury in plant samples collected from conventional farm Vavilov (2008-2009)

Sample code	Place harvesting	Vegetable samples	Quantity of Hg		Differences from average
			µg/kg	%	
V19	field / polytunnels	pepper Romatica/ fruit	0.79	57	-0.59
V20		pepper Romatica/ leaves	2.17	157	0.79
V21		pepper Whitny/ fruit	0.78	57	-0.60
V22		pepper Whitny/ leaves	1.56	113	0.18
V23		pepper Vedrana/ fruit	0.98	71	-0.40
V24		pepper Vedrana/ leaves	2.17	157	0.79
V25		pepper Fidelio/ fruit	0.61	44	-0.77
V26		pepper Fidelio/ leaves	1.93	140	0.55
V27		cucumber / Amurg/fruit	0.78	57	-0.60
V28		cucumber/Amurg/leaves	1.48	107	0.10
V29		tomatoes Ballet/fruit	0.82	59	-0.56
V30		tomatoes Ballet/leaves	2.65	185	1.18
$\overline{x}$	**Average per farm**		**1.38**	100	-

b. Results from organic vegetable farm Adamachi V.

Concentrations of three heavy metals (cadmium, zinc, mercury) in plant samples collected from organic farm "Adamachi V." is presented in table 7. In the analysis performed cadmium concentration ranged from undetectable (cabbage) to 3.02 mg / kg. Zinc content ranged from 0.26 µg/kg tomatoes to 0.58 µg/kg cabbage. Mercury content was undetectable in all samples analyzed.

Table 7

The content of heavy metals in plant samples collected from organic Adamachi farm, Iaşi (2008-2009)

sample code	Vegetable samples	Quantity					Differences from average	
		Cd		Zn		Hg		
		µg/kg	%	µg/kg	%	µg/kg	Cd	Zn
V46	tomatoes	1.67	158	0.35	80	nd	0.61	-0.09
V47	cucumber	3.02	285	0.53	120	nd	1.96	0.09
V48	eggplant	0.44	42	0.49	111	nd	-0.62	0.05
V49	cabbage	nd	nd	0.58	132	nd	nd	0.14
V50	tomatoes	0.76	72	0.26	59	nd	-0.3	-0.18
V51	onion	0.47	44	0.46	105	nd	-0.59	0.02
$\overline{x}$	**Average per farm**	**1.06**	100	**0.44**	100	**nd**		

The content of cadmium, zinc, and mercury were within the maximum limits allowed by the legislation in force and the European regulations.

CONCLUSIONS

1. Research has shown that there is great variation in heavy metal content in vegetable products analyzed from the two operating systems.

2. The cadmium content in farm Tg. Frumos, ranged from faint to 9.34 mg/kg zinc content ranged from 0.17 mg/kg to 1.88 mg/kg and the mercury ranged from 0 43 mg/kg to 2.65 mg/kg intensivizare conditions and high yields these quantities do not represent a potential risk for vegetable crops.

3. The content of heavy metals in organic farm Adamachi of Veterinary Medicine in Iasi were within narrow limits, ranging from undetectable to 3.02 mg/kg, falling within acceptable limits for organic vegetable production.

4. In general we can say that most samples of the vegetable crop in the two systems, is not heavy metal pollution or not a pollution that would have a negative impact on consumer health.

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