

# THE CONTENT OF HEAVY METALS AND PESTICIDE RESIDUES IN SOILS OF MONITORING POLYGONS

## CONȚINUTUL DE METALE GRELE ȘI REZIDUURI DE PESTICIDE ÎN SOLURILE POLIGOANELOR DE MONITORING

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**Abstract.** *Research content of heavy metals in arable soils, carried out within 20 Monitoring polygons placed in all zones of Moldova, showed that concentrations not exceeding the Maximum admissible concentration (MAC) and can not be hazardous to the environment. The content of pesticide residues in soils showed a low concentration of DDT and HCH, which does not exceed the MAC. Remediation measures should target not only harmful to the removal of sources, but to include all measures to recover and restore affected agrochemical indices acquire their basic soil - fertility, as they are "cumulative deposits" and pollutant sources. Only a fertile soil has qualitative properties and "resistance" to the harmful effects of pollution degrading.*

**Key words:** monitoring, heavy metals, pesticide, pollution

**Rezumat.** *Cercetările conținutului de metale grele în solurile arabile, efectuate în cadrul a 20 poligoane de Monitoring amplasate în toate zonele Republicii Moldova, au demonstrat că acestea nu depășesc Concentrația maximal admisibilă (CMA) și nu pot fi periculoase pentru mediul înconjurător. Conținutul reziduurilor de pesticide în soluri a evidențiat o concentrație redusă de DDT și HCH care nu depășește CMA. Măsurile de depoluare trebuie să vizeze nu numai înlăturarea surselor cu efect nociv, dar să cuprindă toate măsurile menite să refacă indicii agrochimici afectați și să redea solurilor însușirea lor de bază – fertilitatea, întrucât acestea sunt „depozite cumulative” ale unor surse și agenți poluanți. Numai un sol fertil deține însușiri de calitate și de „rezistență” la efecte nocive, degradante ale poluării.*

**Cuvinte cheie:** monitoring, metale grele, pesticide, poluare

### INTRODUCTION

Uncontrolled application of fertilizers and pesticides or only the cultivation of agricultural plants on land previously contaminated causes of nutritional disorders, impaired quality of irreversible phenomena, hampers crop production; accumulate the elements and substances above the permissible limits for users. In most cases, plant pollution with heavy metals occurs amid intense negative effects caused by some high emissions of sulfur and nitrogen oxides. Plants accumulate heavy metals in conditions where the soil has polluted with these elements, in dependence on the type and specificity of the plant uptake and translocation of these elements, their tolerance level increased concentrations of chemical elements. Leaves, shoots and plant organs with photosynthetic activity

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accumulate high amounts of heavy metals than seeds. The phytotoxic effect of lead occurs at lower levels for beans, but sunflower is more tolerant and resistant to high concentrations of this element. Bioaccumulation of cadmium is higher in plants grown in acid soils and low in cereals and legumes (seeds) compared with that obtained in roots and leaves of vegetable plants. With regard to soil pollution effects on grown plants with copper, it has found that the intensity of phytotoxic phenomena is different and depending on the species, the most tolerant to increasing concentration of copper in soil were barley and beans and most sensitive were peas and oats (Rusu et al., 2005).

Pesticides content in soils shows a negative action on living organisms, accumulate in animal tissues, have carcinogenic properties, mutagenic, embryo toxic, neurotoxin effects, disrupt the immune system, contributing to anemia and liver disease (Regional Report., 2003).

## **MATERIAL AND METHOD**

Analysis of content of heavy metals and pesticide residues in soils has conducted by the Center for Monitoring of Soil Quality (CMCS) of the Department of Environmental Quality Monitoring of the State Hydrometeorological Service. Were analyzed the 20 soil samples collected from different agricultural zone of R. Moldova. In the soil samples were determined mobile forms of copper, zinc, lead; and organic-chlorinated pesticide residues (alpha-HCH, beta-HCH, gamma-HCH, 4,4-DDE, 4,4 - DDD, 4,4-DDT). Method of determination: atomic absorption spectrometry, device «SOLAAR».

## **RESULTS AND DISCUSSIONS**

The maximum admissible concentration (MAC) values of mobile forms of heavy metals in soil is: Cu – 3,0 mg/kg, Zn – 23,0 mg/kg, Pb – 6,0 mg/kg. According to the obtained results, the content of mobile forms of heavy metals in soils does not exceed the MAC and the concentration cannot be dangerous for the environment (table 1).

Pesticides used in agricultural technologies in the past, some substances with insecticide character, other with herbicide effect, are persistent, and their residues are present in soils and crop production. In previous years they were totally abandoned and were replaced by organic-chlorine insecticides (based on HCH-hexachlorocyclohexane and DDT-pp'-dichlorodiphenyltrichloroethane), as the organic-phosphorus (methyl-, etilparatione, malathione, mevinphose) due to their high persistence and recovery in soils and crop production. Determination of pesticide residues in soils in the Republic of Moldova has suspended in 1970. However, the high degree of pesticide resistance and high capacity to migrate generated content need to monitoring the DDT and its metabolites in soil and environmental components. Herbicides applied for weed control has cumulative actions in time and sized their amount of residue in the soil, which ultimately determine the lingering effects including phytotoxicity to plants.

Applied in soil, the herbicides enter into interaction with this polydispersity system, participating in a variety of processes resulting effective action against not only weeds, but also effects the amount of residue remaining on the plants.

Table 1

**The content of mobile forms of Zn, Cu, Pb (mg/kg) in soils (Ah 0-20 cm)**

Nr.	Commune	Soil	Zn	Cu	Pb
1	Bănești	Chernozem ordinary, swarding	0,74	0,43	0,49
2	Căzănești	Chernozem ordinary, arable	0,73	0,59	0,94
3	Chiștelnița	Chernozem stagnic, arable	1,03	0,64	0,68
4	Olănești	Chernozem ordinary, irrigate	1,38	0,64	0,81
5	Baccialia	Chernozem ordinary, arable	0,79	0,82	1,42
6	Calfa	Chernozem ordinary, swarding	0,78	0,26	0,27
7	Cimișeni	Cernoziom typical, irrigate	0,86	0,20	0,18
8	Cupcui	Chernozem ordinary, arable	0,53	0,47	0,90
9	Burlacu	Chernozem ordinary, arable	0,54	0,09	0,89
10	Burlacu	Chernozem ordinary, swarding	1,13	0,33	0,32
11	Congaz	Chernozem ordinary, arable	0,56	0,16	0,88
12	Napadova	Chernozem typical, arable	0,55	0,44	0,40
13	Alexandrovca	Grey soil, arable	0,71	0,28	0,90
14	Alexandrovca	Grey soil, virgin	0,48	0,51	0,26
15	Lebedenco	Chernozem ordinary, eroded	1,02	0,12	0,59
16	Grinăuți	Chernozem typical, swarding	1,07	0,56	2,05
17	Bălți, "Selectia"	Chernozem typical, arable	0,62	0,37	0,30
18	Ivancea	Chernozem cambic, unfertilized	0,59	0,54	0,28
19	Ivancea	Chernozem cambic, (NPK) <sub>60</sub>	0,68	0,24	0,29
20	Ivancea	Chernozem cambic, N <sub>300</sub> (PK) <sub>60</sub>	0,60	0,35	0,41

These soil-herbicide interaction processes have several actions: fixation by clay minerals and humus absorption from the soil, volatilization of adsorbing substances, leaching of the remaining quantities in the soil solution and obviously, their decomposition by biodegradation, inactivation and activation (Leah, 2010).

MAC for ΣHCH and ΣDDT in soil is 0,01 mg/kg. The determine limits of method are: α-HCH, β-HCH, 4,4-DDE, 4,4-DDD – 0,0004 mg/kg; γ-HCH – 0,0001 mg/kg, 4,4-DDT – 0,0008 mg/kg. Determination results revealed that the pesticide content of ΣHCH and ΣDDT in studied soil samples of monitoring polygons is insignificant and does not exceed the MAC (table 2).

Content amount of DDT ranging from 0,00013 mg/kg to 0,00604 mg/kg (MAC=0,001-0,060 mg/kg). The most of the total ΣDDT in soils returns to metabolite DDE. Maximal level of ΣHCH is 0,00012 mg/kg (MAC=0,001 mg/kg). In the total content of ΣHCH in soils, are predominated isomers as α-HCH and γ-HCH. The content of β-HCH isomer is less than the detection limit of the device (<0,0004 mg/kg), except for sample nr.7 (typical chernozem post irrigation with wastewater from livestock complex), the isomer - 0,0008 mg/kg.

From the above, to determine a lower polluting effect as, the preferred use the pesticides with containing the active substance as effectively, but to run out of

environment control and treatment (including land) as quickly as possible. This goal is becoming increasingly useful to solve the successive treatments, especially widespread in viticulture and orchards. The pesticides used to be able to decompose in the soil from one treatment to another, without the accumulation of pollutant, residues (*Starea mediului în Republica Moldova, 2007*).

Table 2

The content of pesticide residues in soils (Ah 0-20 cm), C, mg/kg

Nr	$\alpha$ - HCH	$\beta$ - HCH	$\gamma$ - HCH	4,4-DDE	4,4-DDD	4,4-DDT
1	0,0002	<0,0004	0,0002	0,0013	<0,0004	<0,0008
2	0,0001	<0,0004	0,0001	0,0054	0,0010	0,0016
3	0,0002	<0,0004	0,0001	0,0031	0,0012	0,0018
4	0,0001	<0,0004	0,0001	0,0084	0,0009	0,0015
5	0,0001	<0,0004	0,0001	0,0086	0,0010	0,0015
6	0,0001	<0,0004	0,0001	0,0032	<0,0004	<0,0008
7	0,0001	0,0008	0,0002	0,0198	0,0133	0,0273
8	<0,0001	<0,0004	<0,0001	0,0028	0,0004	<0,0008
9	0,0001	<0,0004	0,0001	0,0046	0,0008	0,0014
10	<0,0001	<0,0004	<0,0001	0,0019	0,0004	<0,0008
11	0,0001	<0,0004	0,0001	0,0116	0,0008	0,0016
12	0,0001	<0,0004	<0,0001	0,0022	0,0007	0,0013
13	0,0001	<0,0004	<0,0001	0,0029	0,0015	0,0030
14	<0,0001	<0,0004	<0,0001	0,0084	0,0011	0,0023
15	0,0001	<0,0004	0,0001	0,0051	0,0006	<0,0008
16	0,0001	<0,0004	<0,0001	0,0008	<0,0004	<0,0008
17	0,0002	<0,0004	0,0001	0,0162	0,0038	0,0057
18	0,0001	<0,0004	0,0001	0,0132	0,0014	0,0028
19	0,0001	<0,0004	0,0001	0,0302	0,0041	0,0069
20	0,0001	<0,0004	<0,0001	0,0272	0,0044	0,0071

## CONCLUSIONS

1. Research on heavy metal content in the main arable soils, carried out in 20 key polygons of monitoring placed in all zones of the Republic of Moldova, have found that their concentrations do not exceed the MAC and cannot be hazardous to the environment.

2. Determination on the same key polygons of pesticides residues in soils showed that their content has reduced and does not exceed the MAC.

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