

COMMENTS ON CADMIUM AND LEAD CONCENTRATION IN SOME PLANTS AND FEED PRODUCTS FROM IASI AREA

OBSERVAȚII PRIVIND CONCENTRAREA CADMIULUI ȘI PLUMBULUI ÎN UNELE PLANTE ȘI PRODUSE FURAJERE DIN ZONA IAȘULUI

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Abstract. Agricultural land pollution induces contaminants accumulation and determine the conversion to risk for food safety hazard. This paper presents results on lead and cadmium concentration in fodder and feed derived plant determined by SAA as part of a research project that proposes monitoring food safety in Iasi area for the whole circuit soil-plant-animal. Investigation was focused both on the area of a farm situated on the outskirts of Iasi, near the plant that provides heat for the city and on that of a farm located about 100 km from Iasi. Cadmium concentration ranged from 15.76 to 270.38ppb, below the maximum allowed limit (1000ppb) while lead content ranged from 304.06 to 893.78ppb, very significantly lower ($p < 0.001$) compared to maximum allowed concentration (10000ppb) according legislation. Monitoring cadmium and lead concentrations allowed to appreciate the forage capacity to translocate and accumulate contaminants depending on variety, soil type, climate and distance from the source that generates pollution.

Key words: Cadmium and lead concentrations, feed plant, Iași

Rezumat. Poluarea solurilor agricole induce acumularea contaminanților și determină transformarea pericolului în risc pentru siguranța alimentului. Lucrarea prezintă rezultatele determinării concentrației plumbului și cadmiului în plante furajere și furaje derivate prin SAA ca parte componentă a unui proiect de cercetare ce propune monitorizarea siguranței alimentului în zona Iașului pentru întreg circuitul sol-plantă-animal. Investigațiile au vizat arealul unei ferme situată la periferia Iașului, în vecinătatea centralei ce furnizează agentul termic pentru oraș, respectiv al unei ferme situată la aproximativ 100 km de Iași. Concentrația cadmiului a variat între 15,76-270,38 ppb, sub limita maximă admisă (1000ppb), iar conținutul în plumb a variat între 304,06-893,78 ppb, fiind foarte semnificativ scăzut ($p < 0,001$) comparativ cu concentrația maxim admisă (10000 ppb) de legislația în vigoare. Monitorizarea concentrației cadmiului și plumbului a permis aprecierea capacității plantelor furajere de a transloca și acumula contaminanții în funcție de soi, tipul de sol, factorii climatici respectiv distanța față de sursa care generează poluare.

Cuvinte cheie: cadmiu, plumb, plante furajere, Iași

INTRODUCTION

Agricultural soil and water pollution is the main reason that induces accumulation of various toxic metals (Gomes C. et al., 2007, Pârvu Gh., 1992, Vries W.

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et al., 2007) and convert the danger in food safety risk. This paper aims to determine Pb and Cd concentrations in various plant and derived feed by AAS method as part of the food chain circuit monitoring soil-plant-animal in the Iasi area.

MATERIAL AND METHOD

Feed samples were collected from two farms, drive D (dairy farm) located on the outskirts of Iasi, near the plant that provides heat for the city and drive R (sheep farm) located about 100 km from Iasi. Samples from 1 to 12 are from farm D and 13 to 23 are from farm R. The cadmium and lead concentration were expressed in ppb (mg Cd/kg, or mg Pb/kg.)

RESULTS AND DISCUSSIONS

Cadmium and lead content in analyzed feed samples are shown in table 1.

Table 1

Mean Cd and Pb concentrations(ppb) in feed samples from farm D

Crt Nr.	Sample	Cd	Pb
		Max. 1000 ppb	Max. 10000 ppb
1	Corn silage(Aron Vodă Area)	24.25	572.86
2	Corn silage(Securitate Area)	15.76	607.73
3	Grass Sudan(Chirița Area)	83.25	430.32
4	Green soybean(Securitate Area)	46.39	378.46
5	Prepared corn sillage(Farm, platform)	67.88	517.93
6	Alfalfa, 3rd harverst (Aron Vodă Area)	40.47	536.63
7	Green alfalfa(Bazin Area)	45.88	503.04
8	Corn grains	99.45	415.05
9	Silage (grasses 20% leguminouses 80%)	60.55	511.44
10	Alfalfa hay wrapped	45.72	433.47
11	Hay wrapped	130.98	572.37
12	Barley straw	171.63	893.78
13	Green corn silage (Canal 2 Area)	33.00	403.15
14	Green corn silage –(Cotul Beșlegii Area)	36.78	393.93
15	Green alfalfa 3 harverst (Pump station Area)	103.71	289.44
16	Green alfalfa 1 harverst-(Pump station Area)	88.27	347.97
17	Alfalfa hay-Botoșani, 2007	95.42	304.06
18	Alfalfa hay-2007	80.50	481.68
19	Hay , 2007	56.58	483.54
20	Hay, 2006	234.65	382.12
21	Bramus hay, 2007	37.24	428.63
22	Corn silage, 2006	149.35	560.26
23	Complex (flour+bran+sunflower meal)	270.38	861.55

Analysis of the data presented in table 1 showed cadmium concentrations below the maximum (1000 ppb) allowed according legislation in force (***, 2002) with variations between 15.76 to 270.38 ppb. Lead content in the feed samples analyzed ranged from 304.06 to 893.78 ppb, complying with legal norms (***, 2002) to admit a maximum of 10 000 ppb Pb. Interpretation of the results showed a 30% maximum accumulation of cadmium and lead up to 8% of the maximum allowed level (MAL) under current legislation.

Table2

Feed with high content of cadmium and lead				
Nr. crt.	Metal	Concentration Level	Percent of feed sample	Feed type
1	Cd	Cd concentration 15-30% MAL (1000 ppb)	13%	Straw barley Hay 2006 Complex (flour+bran+sunflower meal)
2	Pb	Pb concentration 8-10%MAL (10000 ppb)	8.7%	Straw barley Complex (flour+bran+sunflower meal)

The results in table 2 shows that 87% of the feed samples analyzed present a cadmium concentration below 15% of the maximum permissible and 13% of the feed samples analyzed show a concentration of cadmium between 15-30% of the maximum permissible. In the case of lead, 91.3% of the samples shows a concentration of up to 6% of the maximum permissible, and 8.7% of feed samples analyzed show a concentration of lead of 6-8% of the maximum permissible.

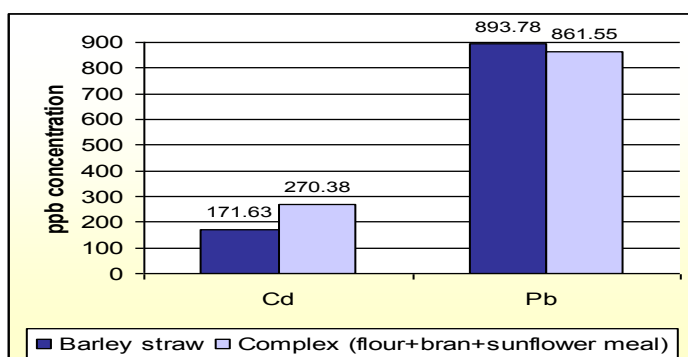


Fig. 2 - Concentration level in the feed samples with high contents of cadmium and lead

There is significant by simultaneous concentration of cadmium and lead (fig. 2) samples of barley straw and complex meal (mixed bran, meal, flower), which highlights the increased capacity of these feed plants to translocate and accumulate contaminants from the soil. Diversity of forage samples collected and analyzed induced a large number of variable factors considered difficult to perform statistical analysis To ensure correct interpretation of data, statistically Student t test calculation took into account the feed taken from the two farms, derived from corn and alfalfa.

Table3

Cadmium and lead concentration in feed derived from corn			
Nr crt	Proba	Cd	Pb
		Max. 1000 ppb	Max. 10000 ppb
1	Corn green silage,D	34,89±1.33	590,29±24.65
2	Corn green silage,R	20,00±6.00	398,54±6.51
3	Corn silage,D	149.35±10.2	560.26±117.4
4	Corn silage, R	67.88±4.4	517.93±62.0
5	Corn, grains, D	99.45±9.0	415.05±32.2
6	Corn, grains, R	72.21±6.6	464.52±40.4

According to data from table 3 the significant concentration ($p < 0.01$) of cadmium and lead in the samples (corn silage and corn green silage) from farm D can be due to noxious pollutants resulted from burning fuel to produce heat, a conclusion supported by other similar studies (Avarvarei I. et al., 2010, Kirkham M., 2006).

Table 4

Cadmium and lead concentration in feed derived from alfalfa			
Crt Nr	Sample	Cd	Pb
		Max. 1000 ppb	Max. 10000 ppb
1	Green lucerne ,D	95,99±10.91	519,835±23.75
2	Green alfalfa,R	43,175±1.91	318,705±41.38
3	Alfalfa hay,D	80.50±6.2	481.68±37.4
4	Alfalfa hay, R	45.72±4.0	433.47±32.2
5	Hay, D	130.98±7.3	572.37±34.0
6	Hay, R	46,91±4.4	456,08±40.2

High concentrations (table 4) showed feed derived from alfalfa (green alfalfa, hay and naturally alfalfa hay)- highly statistically significant ($p < 0.001$) respectively for cadmium and statistically significant ($p < 0.01$) for lead (green alfalfa hay and naturally alfalfa hay) in case of the samples from the farm D compared with the samples from farm R.

CONCLUSIONS

1. Investigations were conducted to measure cadmium and lead content in various feed plants in order to assess the ability of forage plants translocated and accumulate contaminants depending on variety, soil type, climate, distance from that area of industry that generates pollution.

2. Cadmium concentration in the analyzed feed samples was below the maximum (1000ppb) permitted limit by current legislation, with variations ranging from 15.76 to 270.38 ppb.

3. Lead content in the analyzed feed samples ranged from 304.06 to 893.78 ppb and was according to legal rules that allowed a maximum of 10 000 ppb .

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