

## SELENIUM IN WHEAT PLANT AND SOIL FROM SOUTH-EASTERN PART OF ROMANIA

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### Abstract

*Selenium is an essential microelement for animal and human nutrition, being involved in many metabolic processes, especially antioxidants, owing to its presence in composition of the glutathion peroxidase enzyme, seems to be the most important. Selenium occurs in thyroidian hormones homeostasis, in the immunity and fertility processes, besides the antioxidant role. Selenium can be present in soil such as selenates, elemental selenium, pyritic selenium and organic compounds of selenium whose composition is unknown. The organic compounds of selenium and selenates are the most available for uptake by plants. Its presence in soil over a certain level (seleniferous soil) can lead to increase of selenium content in plants who grows on respective soil, and in conclusion if we are consume these plants, it can appears toxicological phenomenons – acute or chronic at human body and animals (selenosis).*

*This paper is focused on the South-Eastern part of the Romanian Plain, Central and South Dobrogea, where a study was done regarding low level of selenium in soil and plant, these areas being characterized by a natural handicap, selenium deficient. For this purpose, data regarding selenium total content in soil and plant (wheat), as well as mobile content selenium from soil, contents determined through investigations chemical methods and analytic techniques, are presented.*

### INTRODUCTION

Selenium is an essential micronutrient for humas and animals. As a trace element, selenium belongs to the trophic chain circuit plant-animal-human, playing a important role as well as the other micro-elements present in human nutrition [2, 7, 14, 16, 17, 21]. Plants growned on soils deficient in selenium leads through consumption at deficiency of this trace and those growned on selenifereous soil and introduced in food goes to selenosis, with consequences on human health.

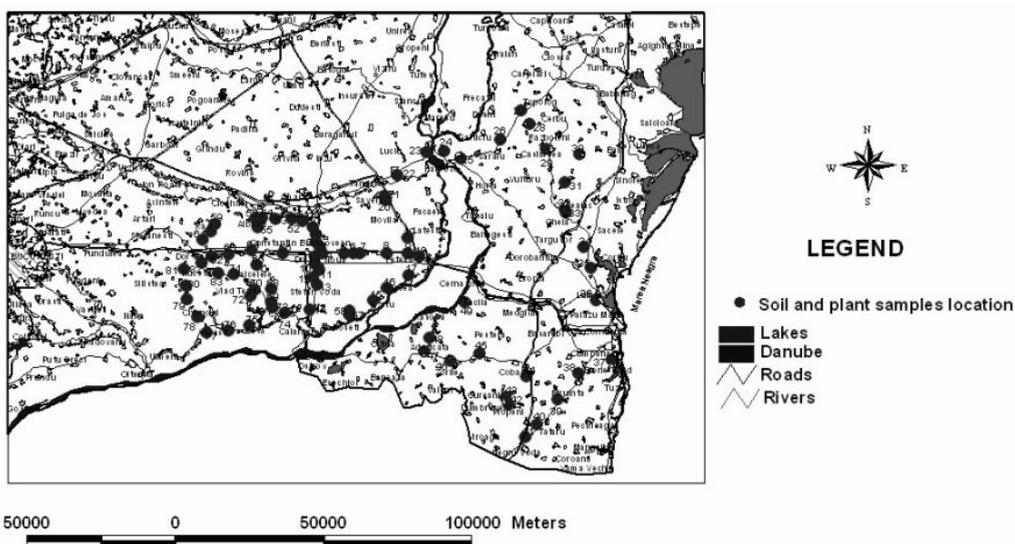
Generally, the selenium content is 0.1-0.3 mg kg<sup>-1</sup> for the diets of various animals, but a selenium content of 3-15 mg kg<sup>-1</sup> can be considered an excess causing toxicity [14, 19]. The uptake of Se by plant roots depends on some soil propesties such as: oxidation state, pH, chemical and mineralogic composition, and the concentration of Se and competing anions such as sulfate and phosphate in solution

[3]. In soil, selenium is found in various forms, namely: selenides (-2), elemental selenium (0), selenites (4) and selenates (6) in the inorganic selenium and -2 valence in the organic selenium. Between them, selenate is the most soluble Se species and can be taken up by plants and leached through the soil profile [4,5]. Distribution of selenite and selenate between the solid and solution phases within soil is a function of pH and mineral species present.

The purpose of this paper is to survey the data regarding selenium level from soil and plant in the south-eastern part of Romania, Central and South Dobrogea, its uptake by plant transfer.

## MATERIAL AND METHODS

Location of plant and soil points covers the south-eastern part of the Romanian Plain, central and south Dobrogea. Plant samples were collected from the same points with soil samples. Soil samples were collected on the 0-20 cm depth. To the plant samples it were collected aeriian parts with the waist of 20-30 cm, and wheat grains were collected when they reached maturity. Map location of soil and plants samples points is shown in Figure 1.



**Fig. 1. Soil and plant location (n = 83)**

Selenium total and mobile content from soil samples, as well as selenium content in wheat green plants were determined in our laboratory.

A mixture of minerals acid (nitric acid and chlorhydric acid) and perhydrol was used for the digestion of soil samples to determine total selenium. During the digestion, selenium was passed through selenite ( $\text{SeO}_4^{2-}$ ), then it was reduced with

sodium borohydride ( $\text{NaBH}_4$ ), when it is resulted selenium hydride ( $\text{H}_2\text{Se}$ ), which was dosed through flame atomic absorption spectrometry coupled with hydride generator. Mobile content of selenium in the soil was determined by extraction using a common extractant (ethylene diaminetetraacetic and ammonium acetate solution at pH 7, after Lăcătușu and al., 1987 [12]).

Plant samples were calcined at a temperature of  $450^\circ\text{C}$  and the ash obtained was dissolved into a hydrochloride solution, in which selenium total was dosed using the method used to determine selenium total and mobile in soil [8, 13, 15, 22].

Total content, selenium mobile from soil and selenium content of wheat plants were determined on a total of 83 soil and plant samples from central and south Dobrogea, and south-eastern of Romania.

## RESULTS AND DISCUSSION

The data regarding the selenium content in the Romanian soils was found in several papers, that had shown the level of selenium in mountainous soil and alluvial deposits from the northern area of Oriental Carpathians [1,10], but also in soils of Dobrogea [6,9,11,18,20]. Recently, research was performed referring to selenium content in soils of the south-east Romanian Plain, central and south-eastern Dobrogea (Lăcătușu and al., 2008, 2009). Arithmetic averages of total and mobile content selenium values in soil, as well as plant content for the studied samples are presented in Table 1.

*Table 1*

**Arithmetic average of total content, mobile soil selenium values ( $\text{mg} \cdot \text{kg}^{-1}$ ) and content of plant for soils which were grown wheat in agricultural years 2007/2008 and 2008/2009**

Arithmetic mean of total content $x_1$ , mobile content $x_2$ in soil, wheat plant content $x_3$ samples number=83	South-east of Romanian Plain 1 (2007-2008)	Central and south Dobrogea (2007-2008)	South-east of Romanian Plain 2 (2008-2009)	South-east of Romanian Plain total
$x_1$	0.189	0.143	0.270	0.237
$x_2$	0.006	0.004	0.020	0.014
$x_3$	0.023	0.022	0.050	0.039

1 Slobozia – Călărași – Fetești – Țândărei area

2 Slobozia – Orezu – Lehliu – Mănăstirea – Călărași area

The average contents of total selenium from the soil samples collected from the upper horizon (0-20 cm) of Romanian Plain soils are 0.189 mg/kg for the soils from the Slobozia - Călărași - Fetești - Țândărei perimeter and 0.270 mg/kg for the

soil samples from the perimeter bordered by Slobozia - Orezu - Lehliu - Mănăstirea - Călărași, the average of these areas from south-east Romanian Plain being 0.237 mg/kg.

For central and south area of Dobrogea, the average content of total selenium from soil collected samples is 0.143 mg/kg.

The average content of mobile selenium in the soil collected samples from same depth of the south-east Romanian Plain soils is 0.006 mg/kg for soils in the perimeter bordered by Slobozia – Călărași – Fetești – Țândărei area (1) and 0.020 mg/kg for soils of Slobozia – Orezu – Lehliu – Mănăstirea – Călărași area (2). Central and south Dobrogea soils presents an average content of mobile selenium at 0.004 mg/kg, lower than the average content of mobile selenium which is 0.014 mg/kg for these two perimeters (1, 2) from the south-eastern part of Romanian Plain.

It were determined average values of selenium content of 0.023 mg/kg for Slobozia – Călărași – Fetești – Țândărei area (1) and 0.050 mg/kg for Slobozia – Orezu – Lehliu – Mănăstirea – Călărași area (2) in wheat green plants collected from same points with soil samples.

For central and south Dobrogea area, wheat plants presents an average content of selenium of 0.022 mg/kg, while the value of 0.039 mg/kg is representative for plant samples of these two perimeters from south-east Romanian Plain (1, 2).

## CONCLUSIONS

1. The averages contents of selenium total and mobile in soil, but those content of green wheat plant from south-east Romanian Plain are higher than those similareous from Dobrogea, observing a discordance between these researched areas.
2. A deficit level of selenium is showed in wheat plants grown on central and south Dobrogea soils.

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