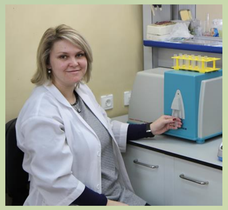
DETERMINATION OF THE CONCENTRATION OF SELENIUM IN THE SOIL OF VARIOUS REGIONS OF THE KALININGRAD REGION BY THE HYDRIDE GENERATION ATOMIC ABSORPTION SPECTROMETRY (HGAAS) AFTER THE PRESSURE DIGESTION

Authors:



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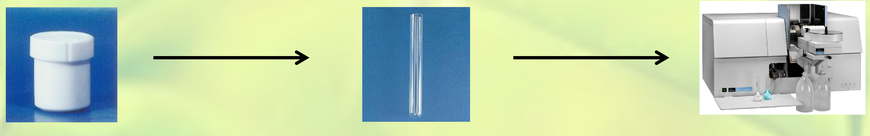
Introduction:

Selenium is an essential microelement for human and animal nutrition. However, the effect of selenium on a body depends, first of all, on its dose. In high concentrations selenium is extremely toxic.
The concentration of selenium in plants, animals and man are determined to a greater extent by the level **of concentration of this microelement in the soil**.
Since the **natural Se concentrations** in soil samples are **usually low**, it is necessary to apply sensitive analytical methods in order to measure it. One of such methods is atomic absorption spectroscopy with flow-injection generation of hydrides.
The purpose of this work was to determine the content concentration of selenium in agricultural soils in different zones of the Kaliningrad region, as well as to reveal the correlation between the content of selenium in the soil, its physico-chemical properties and the level of this trace element in fodder plants.

Materials and Methods:

Samples of soils were selected from the arable layer of the land of 8 agricultural enterprises located in various zones of the Kaliningrad region. Selenium was also determined in forage plant samples from these zones. The cereals and legumes were analyzed separetly.
Before the analysis, the samples was dried, homogenized and sieved to grain size <2.0 mm.
For the mineralization of the samples, an **autoclave decomposition method under pressure** was used.



Samples
+ HNO_3 – 10 min
+ H_2O_2 - 180°C, 2 h

+ HCl (Se(VI) to Se (IV))
+ Amidosulfonic acid
(remove Nitrite)
70°C, 1 h

FI-HG-AAS

The **atomic-absorption determination** of selenium with the generation of hydrides is based on reduction of the selenium ion by sodium tetrahydroborate to H_2Se, followed by atomization in a quartz cuvette. A 0.2% alkaline solution of sodium tetrahydroborate was used as the reducing agent. The flow rate of the inert gas (argon) was 200 ml / min, the temperature of the quartz cell was 900° C. The intensity of light absorption was measured at a wavelength of 196.0 nm relative to a 3% solution of hydrochloric acid.

Results and discussion:

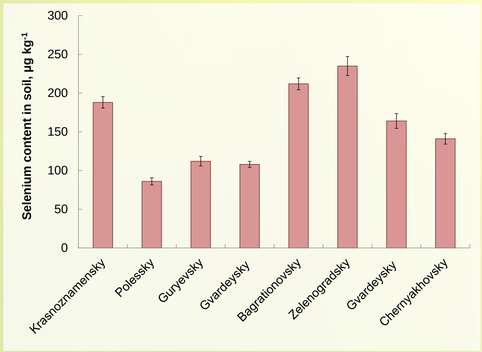


Fig.1. Selenium content in soils from various zones (districts) of the Kaliningrad region.

The average selenium content in soils:
Kaliningrad region:155 µg kg^{-1}
Poland: 270 µg kg^{-1} [1]
Germany: 127 µg kg^{-1} [2]
Lithuania: 164 µg kg^{-1} [3]
World's average: 330 µg kg^{-1}

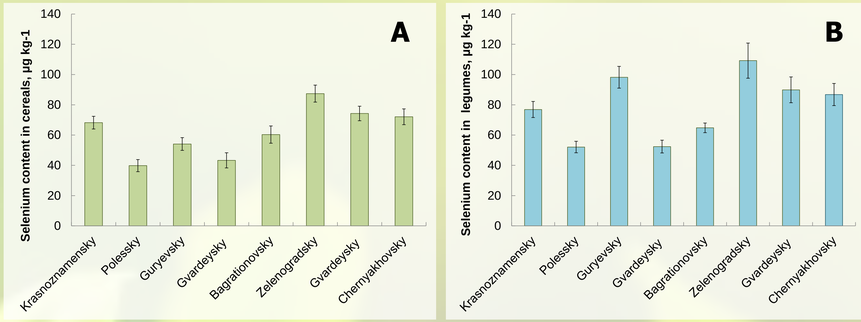


Fig. 2. Selenium content in cereals (A) and legumes (B) plant collected from various zones of the Kaliningrad region

According to literary information, in order to prevent selenium deficiency in human and animal organisms, a **minimum content** of selenium in grain and fodder crops should be **100 µg kg^{-1}**, but it should **not exceed 2000 µg kg^{-1}**. It is necessary to emphasize that selenium content in vegetative food considerably differs depending on the on it's concentration in soil from region of plants growth.

Conclusion:

It was shown that the average concentration of selenium in the soils of the Kaliningrad region is 155 µg kg^{-1} and varies in the range from 86 to 235 µg kg^{-1}.
These values allow the Kaliningrad region to be classified as a **selenium-deficient** region.

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