



Original Contribution

IRON CONTENT IN CHROMIC CAMBISOILS OF THE SARNENA GORA MOUNTAIN**

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ABSTRACT

An evaluation of iron content in chromic cambisoils from the Sarnena Gora Mountain was done and the results compared with the average values for the same soil type in the country. For this purpose, data on iron content of soil from the villages of Pastrovo, Kazanka, and Stara Zagora Municipality, were used. The soil samples were obtained from a depth of 0-20 cm and analyzed in Umweltinstitut, Stuttgart, Germany. The results showed that the iron concentration in soil samples from those villages was lower than the reported average values for the same type of soils within the country, and suggested no soil iron contamination of anthropogenic origin in the area of interest. It was proposed that the low concentration was due to specific mineral composition of soils and prevalence of minerals with low iron content.

Key words: Soil, Iron, Minerals.

INTRODUCTION

Iron, though in small amounts, is one of the minerals required by plants for a healthy growth. This mineral element is utilized by plants in the following forms: ferrous or Fe^{2+} , ferric or the Fe^{3+} and the chelated or conjugated type. Higher soil iron concentration could spell some harm, especially with the ferrous form of the element (1).

In plants iron is found bound mainly to various amino acids that form part of the plant proteins; it binds also to some other polymers. Iron is involved in the enzyme systems. For example, it actively participates in redox reactions of photosynthesis, respiration, biosynthesis of proteins and chlorophyll, biological binding of atmospheric nitrogen, and in the reduction of nitrates and nitrites (1).

Deficiency of iron in plants, especially in fruit trees, including grapes and roses, results in chlorosis. The mentioned agricultural crops are characteristic for the area of study.

In raspberries iron excess leads to, anthracnose.

Iron accumulates in extreme amounts in vegetative organs (leaves, stems, branches), in roots and, to a lesser extent, in reproductive organs (seeds, fruits).

With humans iron belongs to Toxic Group IV and shows a low toxic and low risk harmful effect (BSS 16608-87, 2).

No data on soil iron content in the Sarnena Gora Mountain and Stara Zagora District exist as of now. However, some information on soil heavy metal and metalloids contamination exist with respect to the Pastrovo and Kazanka villages in the Stara Zagora District.

Considering the importance of metal contamination to human and animal lives we therefore determined to set the goal of analyzing the iron content in the soils of the Sarnena Gora Mountain and to compare the results obtained with the average values for the same soil type within Bulgaria.

MATERIAL AND METHODS

To meet the goal of the survey, performed in the Stara Zagora Municipality, soil specimens from Pastrovo and Kazanka were analyzed for their iron content. Samples for analysis were collected as follows:

- Specimen No. 1: Area of Pastrovo, non-cultivated area;

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- Specimen No. 2: Lane in the area of Kazanka;
- Specimen No. 3: Park lane in the centre of Pastrovo.

Chromic cambisols and shallow undeveloped soils (partially or heavily eroded) prevail in the Sarnena Gora Mountain. Their chemical composition is relatively diverse and depends on the soil-forming rocks – mainly magmatic gneisses (metamorphic rocks originating from granite). The transformation ranges from biotite to muscovite-biotite gneisses. At some places they change into gneiss-schists and schists (3).

According to Dabovski *et al.* (4) magmatic gneisses occupy the northern slopes of Sarnena Gora situated between the village Alexandrovo and the town of Pavel Banya. Their profiles are well exposed on the southern flanks of the mountain, between the villages of Chehlare and Pastrovo. Data for a larger massive of xenolites, non-typical granites, are reported for the area of Kazanka and southwards from Rozovo.

Soils associated with granite rocks are rich in silica, potassium, and deficient in iron and aluminum (5).

The soils in the area of Kazanka are slightly eroded chromic cambisols. On the other hand, the soils in the region of Pastrovo are partially or heavily eroded chromic cambisols.

The soil specimens were collected in December 2002. The method of sampling, transportation and conservation were performed according to the requirements of the normative document 27B/2000, reference to ISO 5667/3/85, BM27B/2000. Following the requirements, single manual samplings were collected at a depth of 0-10 cm.

The active reaction (pH) of the soil samples was tested in an aqueous extract. The analyses of the iron content were done according to method EN ISO 11885 in Umweltinstitut laboratory – Stuttgart, Germany.

RESULTS AND DISCUSSION

The results of the Umweltinstitut laboratory analyses were reported in the protocols as total iron concentrations in mg/kg of dry soil.

Unification of the dimensions was necessary due to the fact that the iron content of Bulgarian soils in specialized literature in superficial layers (0-30 cm) and the soil layer of interest are reported in weight percentages.

Table 1 shows that the iron content in Specimen No. 1 and Specimen No. 3 (from the area of Pastrovo) is 0.37% and 0.56% respectively, whereas that in Specimen No. 2 (Kazanka) is 0.92%.

Table 1. Iron content of the soil specimens

Specimen No.	Iron content, %	pH (H ₂ O)
1	0,37	5.40
2	0,92	5.89
3	0,56	7.34

The lower soil iron content in the area of Pastrovo could be due to the higher degree of soil erosion, resulting in removal of a considerable part of the superficial soil layer.

According to Stanchev *et al.* (1), the iron content of Bulgarian soils ranges from 0.2% to 1.2%. According to the Atlas of the Soils in Bulgaria (5), the iron content of chromic cambisols varies from 2.46% and 3.26% in the upper 20-cm layer and it increases in depth. In B horizon (40-104 cm) it varies from 4.35% to 5.36%.

The comparative analysis showed that the iron content in the analyzed soil specimens from the areas of survey was within the known values for the country and for the particular soil type. The iron content in Specimens No. 1 and Specimen No. 2 was, respectively, 6.6 and 2.7 times lower than the upper limit of 2.46%, cited in the Soil Atlas of Bulgaria (5).

A soil pH values between 4 and 6 indicate the most favorable conditions for the plant iron supply. In our case, the observed reaction (pH) was within this range for Specimen No.1 and Specimen No.2. pH lower than 4 indicated increased iron mobility and in this case iron concentration could become toxic to plants.

For pH values of 6 and greater than 8 (1), the iron content is in the form of insoluble hydroxides and cannot be utilized by the plants (Specimen No. 3).

CONCLUSIONS

The results of the analysis of soil iron content from the Sarnena Gora Mountain – the villages of Pastrovo and Kazanka, reported by Umweltinstitut showed an iron content that was lower than the average reported for the same soil type within Bulgaria.

The comparative analysis with the available reference data does not suggest soil contamination with iron of anthropogenic origin.

The low iron concentration suggests related low mineral composition of soils, where minerals (biotite, muscovite-biotite gneisses and schists) with low iron content prevail.

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