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ASSESSMENT OF SOIL FERTILITY IN THE AREA OF MINING WASTE DEPOSITS

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Introduction

Contaminated sites with hazardous materials are a common global problem. Different types of contaminated soils, especially from the non-ferrous mining industry and chemical industry, contain many pollutants. The deposited industrial wastes lead to the migration of pollutants into the soil and causes in some cases significant pollution problems to both soil and groundwater. Contamination of the soil in the adjacent area of the abandoned industrial sites requires considerable attention, because the pollution can directly affect the physical-chemical properties of the soil, the surrounding environment and human health.

The low organic carbon content in the soil affects soil fertility, water retention capacity and soil compaction resistance. The soil degradation reduces water infiltration capacity, nutrient solubility, and productivity and thus reduces the soil's ability for carbon sequestration. Increasing surface water flow can lead to soil erosion, while lack of soil cohesion can increase the risk of wind erosion. Other effects of low organic carbon content are reduced biodiversity and an increased sensitivity to acidification or alkalization. In addition to the negative impact on soil quality, the loss of soil organic matter can lead to carbon dioxide emissions into the atmosphere and thus have a negative impact on the EU's carbon reduction targets. According to the humus content, the soil is considered poor when it has 2-3%, moderate at 3-5% and rich at 5÷7.5%. A soil with 3-4% humus content can provide, during the vegetation period, 20-30 kg of nitrogen in dry years and 80-100 kg in rainy years. The annual humus mineralization coefficient is 2.5÷3% in sandy soil, 1.8÷2.5% in loamy-sandy soil and 0.8-1.3% in clay soil.

Nitrogen is one of the main elements used for plant nutrition. Insufficient nutrition with nitrogen slows down the growth and development of plants. The main forms of nitrogen in the soil are organic compounds with nitrogen, the NH_4^+ and NO_3^- ions. The soil inorganic nitrogen represents only a small fraction of the total nitrogen; most nitrogen quantities being bounded with organic compounds. The nitrogen reserve forms can be subjected to various soil transformation processes

(mineralization, immobilization and nitrification because of the formation of NH_4^+ and NO_3^- ions), and becoming available to plants. The assessment of the nitrogen supply level of the soil can be done with the help of the nitrogen index (IN). IN values less than or equal to 2 value shows a low level of nitrogen supply of the soil, values in the range 2.1 to 4.0 indicate a medium supply, between 4.1 and 6.0 means a good supply, and values higher than 6.0 shows a very good supply of the soil.
Sulphur is needed for many plant growth functions. Like nitrogen, it is an essential component of proteins, with a close relationship between the amounts of nitrogen and sulphur in crops. The total sulphur content of the soil is quite varied. Depending on the soil conditions, inorganic forms can be deposited on elemental sulphur or different types of oxidized forms (sulphides, sulphates, thiosulfate, etc.). The mineral form of sulphur is only 10-20% of its total content in soils.

Materials and methods
The studied area included some villages and Valea Calugareasca locality, the sampling points being located in the adjacent areas of two pyrite ash storage dumps. Twenty-two soil samples were collected in plastic containers from 11 locations brought to the laboratory, air-dried, milled and sieved using 2 mm sieve.
The humus content was determined with the Walkley and Black method (modified Gogoasa), by oxidation with concentrated sulphuric acid and potassium dichromate. Total nitrogen (Nt) was determined using Kjeldahl method after digestion of the soil sample with concentrated sulphuric acid in the presence of selenium catalyst. The cations and anions concentration were determined from soil: water (1:5) extract solution using ion chromatographic technique ($NaHCO_3/Na_2CO_3$ eluent for anions and methansulfonic acid for cations). Soluble sulphur was estimated from SO_4^{2-} concentration.

Results and conclusions
Analysing the values of humus content in terms of organic matter supply, the soils in the studied area were as follows: 63.6% (0.85÷2.93) - very low and low content; 18.2% (3.06÷4.22) – moderate content. The reduction of organic matter could be caused by the accelerated rate of decomposition due to the change of anthropogenic factors.
The pH values in the aqueous extracts were between 5.3÷6.7, 18% of the soil samples analysed showed moderate acidity.
The nitrate concentration values ranged between 57 mg/kg and 190 mg/kg with an average of 94.8 mg/kg. As result of intensification of the nitrification processes, nitrate ions and surfaces of clay-humus particles negatively charged, could be easily leached with water drainage or could be absorbed by different terrestrial organisms.
Soluble S values indicated a range between 18.4 and 195 mg/kg in the analysed soil samples. Twenty-seven percentage of the analysed soil samples had high concentrations of sulphur; the samples were situated around the pyrite ash deposits, as result of precipitation leached. Chloride concentrations varied between 10.2÷17.3 mg/kg. The nitrogen index varied between 0.43÷2.58, 54.5% of the analysed samples indicated a low level of supply the soil with nitrogen.
The values of the agrochemical parameters indicated a reduced to moderate fertilization of the soil, and as result, a reduction in crop productivity in the areas affected by pollution.