

# **The content of macroelements and fractions of nickel in selected organic fertilizers**

**Zawartość makroelementów oraz frakcje niklu  
w wybranych nawozach organicznych**

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The aim of this study was to determine the content of organic carbon, nitrogen, phosphorus, potassium and total nickel and its fractions, separated by the BCR procedure in selected natural fertilizers. Swine, bovine and chicken (from broilers and layers) manures, from selected individual farms from the districts of Siedlce, Sokołów and Łosice in Mazowieckie province, were analyzed. The organic carbon was determined by the oxidation-titration method and total nitrogen content by the Kjeldahl method, after “wet” mineralization in concentrated sulfuric (VI) acid, followed by distilling off the ammonia. Total phosphorus, potassium and nickel content was determined by inductively coupled plasma atomic emission spectrometry (ICP-AES), after “dry” mineralization of materials in a muffle furnace at a temperature of 450°C, following dissolution of ash in 10% HCl solution. Sequential fractionation of nickel was made using the analytical procedure, in accordance with the methodology proposed by the European Community Bureau of Reference, in a modified version, abbreviated as a BCR method. The results were analyzed statistically using the STATISTICA 12PL (StatSoft, Tulsa, USA). In order to verify the significance of differences between the mean nickel content in analyzed organic materials and the amount of each of the element forms, an analysis of variance and post-hoc Tukey’s test were performed. Means were combined in homogeneous groups at  $\alpha < 0,05$  significance level. Correlation coefficients between the total content of nickel and macronutrients were also calculated. Analyzed organic materials were varied both in terms of content macroelements and nickel. The highest content of organic carbon and total nitrogen contained was found in swine manure, phosphorus and potassium in manure from layers, while manure from broilers contained the largest quantities of nickel. The lowest content of organic carbon and total nitrogen were determined in manure from broilers, phosphorus and potassium in bovine manure and nickel in swine manure. The total content of nickel in the analyzed fertilizers was negatively correlated with the content of organic carbon and total nitrogen. Distribution of nickel in the analyzed fractions depend on the origin of organic fertilizer. The swine, bovine and manure from layers contained the most oxidizable fraction, therefore forms of nickel associated with organic matter and sulfides, while the least reducible fraction. Differently, this fraction was dominated in the manure from broilers. In this organic material the smallest percentage accounted for exchangeable and easily soluble in an acidic environment forms. The content of macronutrients and nickel and its fractions distribution significantly diversify the origin of manure.