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Monitoring the Carbon-Nitrogen Ratio in Soil for Sustainable Agriculture

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Abstract

In Europe, sustainable agriculture is a top priority, and the responsible use of natural resources is crucial. To preserve "healthy soils," it is essential to minimise soil organic matter degradation, which is a significant threat to farmland in the face of global climate change. To achieve balance in agroecosystems, it is highly recommended to incorporate safe and natural waste products, such as compost. Composts provide plants with the necessary nutrients and maintain the balance of elements in the soil. Our study aims to assess soil diversity in terms of current and exchangeable acidity, carbon, nitrogen, and their ratios and evaluate the effectiveness of compost materials in achieving system sustainability. To examine the ecological status of soils in Bulgaria, we utilised a national monitoring network with a grid of 16 to 16 km whole area. Periodic surveys of the monitoring network points provide valuable information on element balance. Cluster analysis of the macroelements has identified three clusters: the first comprises solely phosphorus, the second combines the C/N ratio, total carbon, and nitrogen, and the third includes both pH variants. We also developed maps of element content and C/N ratio using TOC and total nitrogen data. The C/N ratio in the surface layer (0-20 cm) ranges from 4.4 to 31.6; in the 20-40 cm layer, it varies from 4.4 to 32.7. Based on this data, the country's area can be divided into three zones according to C/N, directly related to land use practices. In the area with predominant grain production, the ratio is 4.4 to 14.4. The variation in areas with developed animal husbandry is 19.6-31.6, closer to the optimum. This information allows us to recommend differentiated applications of compost. It is crucial to test soil and compost for nutrients before application, and applying compost is highly dependent on land use practices. Excessive use of one type of compost can lead to an imbalance of macronutrients due to the accelerated assimilation of nitrogen and a relatively lower degree of accumulation of phosphorus and potassium. Applying compost

with a calibrated spreader ensures crop yield goals will be achieved and reduces the chance of pollution. Additionally, the volume reduction of composting manure can save producers money.

Keywords: Agroecosystems, Compost, Element balance, Macronutrients, Soil diversity

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