THE EFFECT OF DIGESTATE FROM AGRICULTURAL BIOGAS PLANT ON SELECTED SOIL PROPERTIES UNDER PERENNIAL INDUSTRIAL CROPS

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Abstract

Digestate from agricultural biogas plants is a source of organic matter and valuable nutrients for plants. The aim of this study has been to analyse the impact of digestate applied to soil in the liquid, dried or torrefied (biochar) form on selected physical, chemical and biological properties of soil under fields cropped with Virginia fanpetals (*Sida hermaphrodita Rusby L)* and giant miscanthus (*Miscanthus x giganteus* J.M.Greef & M.Deuter). The digestate doses were balanced relative to the dose of nitrogen at a level of 85 kg N ha^{-1}

The study included an evaluation of the intensity of mineralisation of digestate in soil, based on changes in total and labile carbon, pH, available macronutirents, activity of soil microorganisms and respiratory processes in soil. The short-term prediction of subsequent effects, inclusive of seasonality of changes over the research years, results of soil tests made during the application of digestate doses and the verification of foreseen results with empirical data from soil determinations carried out in the first year after digestate application to soil was discontinued.

Regardless of the plant grown, the highest total carbon content in soil was determined in experimental treatments fertilised with torrefied digestate, while liquid digestate ensured the highest labile carbon concentration. Simultaneously, the application of torrefied digestate resulted in lower losses of nitrogen from soil and higher soil pH values, which can be attributed to the dose of torrefied digestate with a high load of organic substance and the lowest ammonia nitrogen content of all the types of digestate tested. An increase in the soil richness in available phosphorus, potassium and magnesium compared to unfertilised soil was determined to occur under the influence of all digestate types, and regarding the concentrations of phosphorus and magnesium the results obtained were significantly higher than the ones produced by mineral fertilisation. Seasonal variation in soil properties was evidenced, which to a large extent depended on the properties of organic matter added to soil together with digestate. All types of digestate significantly differentiated the concentration of soil microorganisms, including bacteria and fungi, with torrefied digestate producing an unambiguous, prevalent positive effect. The lower rate of mineralisation of torrefied digestate in soil compared to the other types of digestate implicates the significant potential of biochar produced from digestate originating from a biogas plant in the biosequestration of carbon in soil.