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THE EFFECT OF LONG-TERM USE OF PHOSPHATE FERTILIZERS ON THE CONTENT OF EXCHANGEABLE BASES IN VERTISOL

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Abstract

A long-term use of mineral fertilizers affects many soil properties, including the content of exchangeablecations. The study has been conducted to determine the effect of a thirty-year use of phosphate fertilizers on major agrochemical properties of Vertisol in leaching (pH, Y1, organic matter content, total N, total P, total K, available P, and available K) and the concentration of exchangeable base cations: K^+, Na^+, Ca^{2+} and Mg^{2+}. During the experiment, two doses of phosphorus were continuously applied, a lower one, with which phosphorus has been applied every year in the amount of 80 kg P ha^{-1} and higher than 160 kg P ha^{-1}. Both doses of phosphorus were combined with a constant amount of nitrogen (120 kg N ha^{-1}) and potassium (80 kg K ha^{-1}) The research has been carried out on a stationary model farm in Kragujevac in central Serbia. The thirty-year use of mineral fertilizers has caused an additional acidification of Vertisol. However, continuous use of phosphate fertilizers has provided a smaller effect on the acidification of the surface layer of Vertisol than nitrogen and potassium fertilizers. At the same time phosphate fertilizers has significantly contributed to the increase in total and available phosphorus, the increase in the concentration of exchangeable K^+, and the reduction in the concentration of exchangeable Na^+, Ca^{2+} and Mg^{2+}.

Keywords:*long-term fertilization, Vertisol, phosphate fertilizer, content of exchangeable bases*

Introduction

A reasonable use of mineral fertilizers in a longer period of time can maintain or improve the soil quality, and its production capacity (Belay et al., 2002). One of the best ways to evaluate the effect of fertilization with mineral fertilizers on fertility and other soil properties is the use of long-term experiments (Michell et al., 1991) that provide information on the sustainability of agricultural systems. One of solutions for possible harmful effects of a long-term and unilateral use of fertilizers is the implementation of fertilization management, which takes care of the input and output of nutrients and crop rotation, thus preventing a negative effect of applied fertilizers on some chemical soil properties (Hirzel et al., 2011).

A long-term continuous use of phosphoric fertilizers (MAP, superphosphate, triple superphosphate) can significantly affect numerous soil properties. Their effect can be observed from several aspects, of which two are most prominent. The first is a small utilization of phosphorus by plants, which, in conditions of constant implementation, leads to an inevitable accumulation of this element in the soil, especially its available forms (Berti and Cunningham, 1997; Pizzeghello et al., 2011). The second refers to the fact that phosphoric fertilizers are produced from raw materials containing microelements (Ricchards et al., 2011), as well as some potentially hazardous trace elements, and they remain as impurities in the fertilizer after