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Soil Phosphorus Availability in Manganese-Rich Waste Amended Soils

Mohammed Abdalla Elsheikh[1,4], Khatab Abdalla[2,4], Louis Titshall[3], Pardon Muchaonyerwa[4]

[1] *University of Khartoum, Inst. of Desertification and Desert Cultivation Studies, Sudan*
[2] *University of Bayreuth, Agroecology, Germany*
[3] *South African Sugarcane Research Institute (SASRI), South Africa*
[4] *University of KwaZulu-Natal, School of Agricultural, Earth and Environmental Sciences, South Africa*

Abstract

Mining, processing and smelting activities could pollute soil and groundwater resources with heavy metals, which could seriously affect the environment and ecosystems functioning. Land application of industrial and mining waste could increase supply and availability of essential nutrients for plant growth; however, it is negative consequences on plant growth, through toxicities of pollutant elements is well-known. In this regards, the interactions of the constituent elements in the soil with applied nutrients could reduce the effectiveness of fertilisers. Understanding the behaviour of phosphate in Manganese rich-wastes amended soils, will be a key for sustainable phosphorus management in the soils, e.g. optimisation of phosphorus fertilisers inputs for crop production on manganese waste treated soils. Therefore, the objective of this study was to determine the effects of phosphorus sources (i.e. phosphate rock and KH_2PO_4) and application rate on phosphorus and manganese relationship in a soil amended with manganese-rich waste. To achieve this purpose, an incubation experiment under room conditions was carried out. The changes in phosphorus, manganese, electrical conductivity and pH were determined at 0, 30 and 60 days of the incubation time. The results of this research showed that phosphorus concentrations were decreased in sandy soil for the highest application of manganese by 31.1, 40.2, and 41.9 % for 0, 30, and 60 days of incubation, respectively. While, the reduction in clay soil was 16.5, 27.0, and 42.0 % for 0, 30, and 60 days of the incubation period, respectively. Addition of phosphorus to rich- manganese amended soil works better under sandy soil, while clay soil has better performance concerning the reclamation of Manganese rich-waste. Manganese -rich waste reduced available soil phosphorus concentrations, meaning low efficiency of phosphorus fertilisation and less plant productivity. Further research is needed to mitigate manganese concentration in the soil, phytoremediation technique could be an option.

Keywords: Heavy metals, Manganese rich-wastes, soil pollution

Contact Address: Khatab Abdalla, University of Bayreuth, Agroecology, Universitätsstraße 40, 95447 Bayreuth, Germany, e-mail: khatab.abdalla@uni-bayreuth.de