Tropentag, September 17-19, 2013, Stuttgart-Hohenheim

"Agricultural development within the rural-urban continuum"

Nutrient Uptake, Biomass Production and Quality of Soybean Grown on Technosols of the Gatumba Mining District, Western Rwanda, Using Different Fertiliser Combinations

Rodrigue V. Cao Diogo[1], Alain Ndoli[2], François Naramabuye[2], Rolf Nieder[3], Daniel Thomas Rukazambuga Ntirushwa[2], Andreas Buerkert[1]

[1] *University of Kassel, Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics, Germany*

[2] *National University of Rwanda, Dept. of Soil and Environmental Management, Rwanda*

[3] *Technische Universität Braunschweig, Institute of Geoecology, Germany*

Abstract

Mine soils are increasingly used for agricultural production in many parts of Rwanda. This study was conducted on degraded tantalum sites to (1) evaluate the fertiliser combinations that promote soybean growth on pegmatite versus a pegmatite-lixisol Bt mixture and (2) assess toxic element contaminations with soybean grains. The treatments used were (i) an unamended control, (ii) *Tithonia diversifolia* biomass (T:5t dry matter (DM) ha^{-1}), (iii) Tithonia+Minjingu phosphate rock (T+MPR:5t DM ha^{-1} +50 kg P ha^{-1}), (iv) Tithonia+triple super phosphate (T+TSP:5t DM ha^{-1} +50 kg P ha^{-1}), (v) Tithonia+MPR+Ammonium sulphate (T+MPR+AS:5t DM ha^{-1} +50 kg P ha^{-1} +50 kg N ha^{-1}), (vi) T+MPR+TSP:5t DM ha^{-1} +50 kg P ha^{-1}. The experiment was laid in a RCBD with 3 replications per treatment. The results indicated that soybean performed well on pegmatites than on the soil mixture. The T+TSP yielded higher ($p < 0.05$) nutrient in roots with 12.2 kg N ha^{-1}, 2.58 kg P ha^{-1}, 15.4 kg K ha^{-1}. In contrast, shoot nutrient accumulations averaged 19.5 kg N ha^{-1} and 16.7 kg K ha^{-1} in Tithonia. This was significantly more ($p < 0.05$) than in the other treatments, while P uptake was with 6.41 kg ha^{-1} significantly higher ($p < 0.05$) in T+TSP. Likewise, root (RDM) and shoot dry matter (SDM) was highest on pegmatites with 875 kg RDM ha^{-1} in T+MPR+AS, and 1,625 kg SDM ha^{-1} in T+TSP. This also explains the higher grain yield determined on pegmatites ($p < 0.05$) than on mixed soils with 1.5t ha^{-1} in T+MPR+AS. Due to their higher pH H_20 which for pegmatites range from 6.7–7.3 versus 5.0 for the soil mixture Al toxicity was reduced and P availability increased. Pegmatites could thus be used as a valuable substrate to enhance soybean growth in tantalum mined sites. Toxic element concentrations determined in soybean seeds on pegmatite were: 16.7mg Cu kg^{-1} DM, 64.4mg Zn kg^{-1} DM, 0.03mg Cd kg^{-1} DM, 0.03mg Pb kg^{-1} DM and 0.10mg Cr kg^{-1} DM. The respective values on the soil mixture were: 21.0mg Cu kg^{-1} DM, 70.1mg Zn kg^{-1} DM, Cd below detection level, 0.01mg Pb kg^{-1} DM, and 0.10mg Cr kg^{-1} DM. These data were, however, below the threshold values and thus do not seem to present a risk to human health.

Keywords: Food safety, Mined soil, Mineral fertiliser, Pegmatite, Rock phosphate, Soybean, Tithonia

Contact Address: Rodrigue V. Cao Diogo, University of Kassel, Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics, Steinstraße 19, 37213 Witzenhausen, Germany, e-mail: diogo@uni-kassel.de