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Manure and Charcoal Effects on Soil Faunal Activity in Irrigated Vegetable Gardens in South-West Madagascar.

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Abstract

Nutritional provisioning is a central Ecosystem Service (ESS) in agriculture. Especially in the tropics and subtropics the amount and timing of nutritional provisioning are essential. Unlike in temperate regions here rapid nutrient turnover can become problematic as the availability of organic matter is often severely limited and seasonally heavy rainfall might lead to severe leaching losses of released nutrients. As the soil fauna is a key driver for this ESS effective soil management presupposes understanding and quantifying of decomposer processes and decomposer communities. In this study we investigated the effect of different soil treatments on soil faunal activity in irrigated vegetable gardens on the Mahafaly plateau in south-western Madagascar. The Mahafaly plateau is part of a semi-arid region, characterised by harsh climatic conditions with a long dry season, poor sandy soils and a poor, fast growing population. An experimental irrigation vegetable garden was installed to develop effective improved land management schemes to enhance the productivity and to have an additional food resource without threatening the natural soil biodiversity. Thus, the effects of manure and charcoal treatments on feeding activity of soil fauna was compared in irrigated vegetable gardens. Nine different treatments with four replications for each were used totaling 36 plots. To evaluate feeding activity of the soil fauna, bait-lamina tests were used. As expected activity was higher in the manure treated plots with (10 t ha⁻¹ and 20 t ha⁻¹) and in charcoal treated plots with 2 t ha⁻¹ compared to the control plots. However, in the elevated rate charcoal treated plots (5 t ha⁻¹) a decreased feeding activity was observed compared to the control plots. Consequently, feeding activity of soil fauna in irrigated vegetable gardens was controlled by the charcoal rate in the soil. The use of a suitable rate of charcoal between 2 t ha⁻¹ and 5 t ha⁻¹ mixed with manure (10 t ha⁻¹ or 20 t ha⁻¹) stopped rapid organic material decomposition by the soil organisms and fostered longer organic material availability in the irrigated vegetable gardens.

Keywords: Bait-lamina technique, feeding activity, irrigate vegetable garden, Madagascar, Mahafaly plateau, manure and charcoal treatments, soil fauna