Tropentag, October 6-8, 2009, Hamburg

"Biophysical and Socio-economic Frame Conditions
for the Sustainable Management
of Natural Resources"

Losses of Carbon and Nitrogen from Ruminant Manure Storage in Urban Gardens of Niamey, Niger

Martina Predotova[1], Eva Schlecht[2], Andreas Buerkert[1]

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

[2] *University of Kassel / University of Göttingen, Animal Husbandry in the Tropics and Subtropics, Germany*

Abstract

Intensive vegetable production in urban agriculture of the West African Sahel is characterised by high fertiliser inputs, resulting in large positive nutrient balances. However, detailed knowledge about the pathways of carbon (C) and nitrogen (N) losses in these systems is missing. The aim of this study therefore was to quantify gaseous emissions of ammonia (NH_3), nitrous oxide (N_2O), carbon dioxide (CO_2) and methane (CH_4), and leaching losses of C, N, phosphorus (P) and potassium (K) from ruminant manure stored in vegetable gardens of Niamey. The cumulative gaseous N and C losses over 3 months were measured during the hot dry and rainy season with a closed-chamber system of a photoacoustic infrared multi-gas monitor. In the hot dry season N losses were with 0.11 g kg^{-1} manure DM highest ($p < 0.05$) in the uncovered control treatment (n=4) and accounted for 1.8 % of total N in the manure. Plastic shading (n=4) and plastic shading with addition of ground rockphosphate (333 g kg^{-1} manure DM; n=4) reduced total N losses to 72 % and 50 %, respectively. Carbon losses amounted to 73 g kg^{-1} DM in the control treatment and to 92 g kg^{-1} DM and 68 g kg^{-1} DM for the shaded heaps and the shaded heaps with rockphosphate, respectively. In the rainy season, C losses from the untreated control were highest ($p < 0.05$), averaging 164 g kg^{-1} manure DM. Losses were reduced to 77 % and 65 % of the control by shading and shading plus rockphosphate, respectively. During the rainy season leaching losses were only observed for the unshaded control and reached 2.1 g C, 0.05 g N, 0.07 g P and 1.8 g K kg^{-1} manure DM. The results show that coverage and addition of ground rockphosphate can significantly reduce nutrient losses from manure heaps and thus enhance resource use efficiency in UPA systems.

Keywords: Africa, gaseous emissions, nutrient leaching, rockphosphate, ruminant manure, urban agriculture

Contact Address: Andreas Buerkert, University of Kassel, Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics, Steinstraße 19, 37213 Witzenhausen, Germany, e-mail: tropcrops@uni-kassel.de