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“Development on the margin”

Nutrient Balances and Gaseous Emissions of Nitrogen in Urban Vegetable Gardens of Bobo Dioulasso, Burkina Faso

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Abstract

In sub-Saharan Africa urban and peri-urban agriculture (UPA) is an important livelihood strategy for the urban poor and contributes to meeting increasing demands for food in the rapidly growing cities. Although in recent years many research activities have been geared towards enhancing the productivity of this land use system, little is known about the efficiency of UPA. The aim of our study therefore was to investigate nutrient management practices in urban vegetable gardens of Bobo Dioulasso. A nutrient-balance approach was used to determine nitrogen (N), phosphorus (P) and potassium (K) fluxes and balances from March 2008 to March 2009 for two production systems classified as: the commercial gardening + field crops and livestock system (cGCL) and the commercial gardening and semi-commercial field crop system (cGscC). Simultaneously, ammonia (NH₃) and nitrous oxide (N₂O) emissions from the respective soils were measured during the coolest and the hottest periods of the day using a closed chamber system. Our results show that N, P and K input rates in both systems exceeded the rates recommended by the National Extension Service by 236 %, 33 % and 187 % for N, P and K, respectively. This resulted in annual positive balances reaching 1,153 kg N ha⁻¹, 339 kg P ha⁻¹ and 76 kg K ha⁻¹ for the cGCL system and 711 kg N ha⁻¹, 334 kg P ha⁻¹ and 82 kg K ha⁻¹ for the cGscC system. The highest emission rates occurred during the hot mid-days and the peaks were observed after fertiliser applications reaching fluxes of up to 1,140 and 154 g ha⁻¹ h⁻¹ for NH₃-N and N₂O-N, respectively. The estimated total annual losses of N reached 419 and 347 kg ha⁻¹ for cGCL and cGscC systems. This accounted for 36 % and 49 % of the N surpluses in cGCL and cGscC. NH₃ accounted for 73 % and 77 % of the total estimated N losses for the cGCL and the cGscC. The study indicates that nutrient management practices in UPA vegetable production in Bobo Dioulasso would greatly benefit from better synchronising nutrient input rates with crop demand and adjusted fertilisation techniques to mitigate N losses.

Keywords: Closed chamber system, horizontal and vertical nutrient fluxes, urban agriculture, West Africa

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