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"Solidarity in a competing world — fair use of resources"

Climate-Smart Manure Management Practices in Smallholders Crop-Livestock Systems

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Abstract

Among endogenous resources in smallholder farming systems, animal manure has a remarkable potential to improve farm nutrient cycling efficiencies (NCE) and soil fertility. However, major challenges are encountered to reduce nitrogen losses through direct and indirect greenhouse gas emissions (GHG) during manure handling processes. The objective of our study is to identify those affordable manure management practices which improve manure quality while reducing GHG emissions in the Central Highlands of Kenya. We combined social and natural science methods in order to: 1) Characterize manure management systems in the Central highlands of Kenya; 2) Quantify NCE and GHG emissions through a field experiment mimicking the systems of the area; 3) Identify and discuss the main barriers for climate-smart practices adoption. Four manure management systems (MMS) were identified among 107 farms in Murang'a County: Unmanaged systems (UNM), heaps (HEAP), pits (PIT) and biodigestors (BIO). The collection phase, or manure retention time in the cowshed, ranged from 1 ± 0.5 days in BIO to 59 ± 36 days in UNM. The storage phase or heaping process ranged from 36 ± 30 days in BIO to 80 ± 50 days in HEAP. The use of concrete as an improved cowshed floor increased from UNM (0 %) to BIO (100 %). On the other hand the use of bedding followed an opposite trend with a higher number of farmers performing this practice in UNM than in PIT, HEAP or BG systems. The field experiment showed a higher dry matter loss in the solid storage forms (UNM and HEAP) than in the liquid forms (PIT and BIO). Affordable treatments such as covering the manure with banana leaves reduced these losses significantly. However, manure storage time was the only variable affecting both N conservation and GHG emissions in the form of nitrous oxide (N_2O). Lastly, high costs of sophisticated technologies such as biodigestors, knowledge gaps on manure handling and labour demand are identified as main barriers for adoption of climate-smart practices. The emergence of low-cost affordable options and improved extension mechanisms may bring a shift to the accessibility and embracement of best manure management practices.

Keywords: Affordable options, climate-smart agriculture, greenhouse gas, Kenya, manure management systems, smallholder farming systems

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