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"Competing pathways for equitable food systems transformation: Trade-offs and synergies"

How do composting materials and duration impact compost evolution and quality in the tropics?

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Abstract

Compost plays a crucial role in sustainable agriculture as a rich source of organic matter, nutrients, and biota that improve soil health. Materials like *Lantana camara* and *Tithonia diversifolia* are readily available in the tropics to supplement nutrients in cattle manure during composting. There is however limited information on the succession of nutrients and microbes in compost as influenced by these materials. Moreover, prior data from the long-term farming system comparison trials in Kenya has shown significant mass and nutrient losses in compost. Compost emits GHGs which may be attributable to the nature of feedstock, duration of composting, and poor composting practices. This study sought to enumerate the contribution of composting material and duration on biological and nutrient succession in manure. A field experiment was conducted involving treatments based on grass clippings, *Lantana*, and *Tithonia* twigs with data collection every 21 days over 84 days. Other materials used in combinations were; fresh cow-dung and dry maize stalk in a ratio of 4:2:1 against the treatment material as per farmer practice. Our study showed significant losses of GHGs and nutrients during the early stages of composting with stability of these elements recorded towards the end of the composting period. However, significantly higher microbial populations were recorded at this stage but more diversity was observed at the latter stages of composting. *Lantana*-based compost had the highest microbial diversity, yet the lowest abundance among all compost treatments, implying the need for specialised microbes to break down this complex material compared to other sources. This makes it suitable for the introduction of diverse microbes to degraded soils and ecosystems but unsuitable in ecosystems requiring a rapid increase in microbial populations. Overall, the study showed that composting days had an overarching influence on nutrient evolution. We recommend mitigation measures to reduce nutrient losses at the early stages of composting.

Keywords: Biological stability, compost quality, composting duration, GHGs, green materials, nutrient losses

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