Tropentag, September 16-18, 2026, hybrid conference

"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

Combining nature-based soil fertility management practices enhances vegetable productivity under tropical conditions

Peter Mageto[1], Milka Kiboi[2], Monicah Mucheru-Muna[3], Felix Matheri[4]

[1]*Kenyatta University, PO Box 43844-00100, Nairobi, Kenya, Department of Environmental Sciences and Education, Kenya*
[2]*Research Inst. of Organic Agriculture (FiBL), Dept. of Intern. Coop., Switzerland*
[3]*Kenyatta University, PO Box 43844-00100, Nairobi, Kenya, Department of Environmental Sciences and Education,*
[4]*International Centre of Insect Physiology and Ecology (icipe), Kenya*

Abstract

Vegetable production in Sub-Saharan Africa greatly contributes to food security and rural incomes but face persistent soil degradation, pest pressure, and climate variability. These constraints reduce soil fertility, limit water retention, and weaken ecological functions that support stable production. We evaluated sustainable ecological management practices within a cabbage-garden pea cropping system in crop rotation cycles in the upper midland agroecological zone of Central Kenya. Four treatments were assessed, including Botanicals, Intercrop, Intercrop + Botanicals, and a sole crop control. The experiment was based on a randomised complete block design, under field conditions across ten consecutive seasons from 2020 to 2024. Soil properties and crop performance were measured to examine changes in soil fertility and productivity. The Intercrop + Botanicals treatment recorded higher soil nitrogen (0.5 %), organic carbon (5.28 %), and available phosphorus (45.49 ppm). As a result, the improvements were associated with increased cabbage head size (185.9 mm) and marketable yield (1.8 Mg ha ^{1}), as well as higher garden pea height (64.8 cm) and grain yield (2.7 Mg ha ^{1}) in the same treatment. In contrast, the sole crop treatment recorded lower soil carbon and phosphorus and lower crop performance. Our results show that crop diversification combined with nature-based inputs can strengthen soil functions and support more stable vegetable-legume production under variable rainfall conditions. This approach contributes to soil conservation, improved water retention through increased organic matter, and enhanced on-farm biodiversity through diversified cropping. Our results provide a practical solution for developing multifunctional agroecosystems that sustain productivity while maintaining ecosystem services in smallholder landscapes.

Keywords: Agroecological practices, Nature-based solutions, Nutrient cycling, Soil fertility, Water retention

Contact Address: Peter Mageto, Kenyatta University, PO Box 43844-00100, Nairobi, Kenya, Department of Environmental Sciences and Education, 43844-00100 Nairobi, Kenya, e-mail: pmageto25@gmail.com