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Beyond awareness: Structural barriers to regenerative agriculture adoption among smallholder bean farmers in Embu county, Kenya

Francis Oduor[1], Esther Mado[2], Johana Jenny Gallo Franco[2], Kennedy Gina[3]

[1] *University of Nairobi, Dept. of Food Environment and Consumer Behaviour, Kenya*
[2] *The Alliance of Bioversity International & CIAT, Kenya*
[3] *The Alliance of Bioversity International & CIAT, United States*

Abstract

Common bean (*Phaseolus vulgaris* L.) is a critical food and income crop for smallholder farmers in East Africa, yet productivity remains constrained by biophysical, socioeconomic, and management factors. Understanding the diversity of current farmer practices is essential for designing context-appropriate pathways toward multi-functional, climate-resilient agro-ecosystems, particularly as regenerative agriculture gains traction as a framework for sustainable intensification.

This study documents the farming practices, knowledge, attitudes, and perceptions of bean producers in Embu County, Kenya. A mixed-methods approach combined a quantitative survey of 200 smallholder farmers with in-depth key informant interviews (n=6). The farming practices questionnaire used the Periodic Table of Food Initiative (PTFI) metadata framework, covering 48 practices across 13 management categories. Six lead farmers hosted Mother demonstration plots with four treatments: T1 control (no inputs), T2 conventional (DAP, tillage, inorganic pesticides), T3 regenerative monocrop (organic manure, reduced tillage, mulch), and T4 regenerative intercrop (maize-bean, same regenerative management). Baby demo farmers replicated one or two of treatments T2–T4 on their own fields. Key informant interviews (KIIs) were conducted after harvest.

Surveyed farmers were predominantly women (69 %), experienced (78 % with over ten years of farming), and low-income (70 % earning under USD 80/month). High adoption of diversification practices – intercropping (80 %), crop rotation (71 %), and agroforestry (86 %) – indicates an existing foundation for multi-functional agro-ecosystems, yet this coexisted with dominance of conventional tillage (72 %), chemical pest control (78 %), and mineral fertilisation without crop-specific guidance (80 %).

Key informant interviews revealed sophisticated farmer decision-making. Farmers valued regenerative practices for long-term soil health but found DAP-fertilised plots more resilient under severe drought due to faster early establishment. A clear "double standardëmerged: mineral fertilisers for market-oriented production, organics for household consumption – reflecting rational optimisation rather than lack of awareness. Labour and transport of organic inputs were the primary structural barriers, compounded by knowledge gaps in organic pest management and absent organic value chains.

These findings offer a replicable, mixed-methods approach for characterising smallholder farming systems, demonstrating that scaling regenerative agriculture requires structural interventions – labour-saving technologies, organic pest control, and market linkages – rather than awareness campaigns alone.

Contact Address: Francis Oduor, University of Nairobi, Dept. of Food Environment and Consumer Behaviour, College of Agriculture and Veterinary Sciences, 823 - 00621 Nairobi, Kenya, e-mail: f.oduor@cgiar.org

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