



# Innovative agroecology practices improve maize and bean yields in nutrient-deficient sandy soils of Makueni, Kenya



Peter Bolo<sup>1\*</sup>, Hezekiah Korir<sup>2</sup>, Beatrice Adoyo<sup>3</sup>, Anne Kuria<sup>3</sup>, Lisa Elena Fuchs<sup>1</sup>

<sup>1</sup>International Center for Tropical Agriculture (CIAT), Nairobi, Kenya

<sup>2</sup>International Institute for Tropical Agriculture (IITA), Nairobi, Kenya

<sup>3</sup>Center for International Forestry Research and World Agroforestry (CIFOR–ICRAF), Nairobi, Kenya

[p.bolo@cgiar.org](mailto:p.bolo@cgiar.org)\*

## INTRODUCTION

Agroecology is a sustainable approach with potential to support food system transformation in both low and middle-income countries.

Innovative agroecology practices are key in improving crop yields, soil quality and health, livelihoods and agrobiodiversity.

## QUESTIONS

- i) How do selected co-designed agroecology practices for soil, water and pest management influence maize and bean grain yields?
- ii) What are the monetary gains for smallholder farmers on maize and bean income arising from the implementation of the agroecology practices?

## METHODOLOGY

The study was conducted in 30 on-farm trials in sandy soils of Makueni, Kenya, in 2023. The study tested the effects of three treatments/interventions on maize and bean yields:

- Application of biopesticide (neem extract) for integrated pest control,
- Application of farmyard manure (FYM) for improved soil management,
- Improved terraces (with Napier grass planted on the edges) for water management.

These were implemented under 2 plots per farm: **Test (with intervention) and control (without intervention)**. Each plot measured 5m x 6 m.

Maize and bean grain yields were determined after harvest and their monetary equivalents determined based on the prevailing local price (\$41.53) per 90-kg bag.

## RESULTS AND DISCUSSIONS

### Maize and Bean Yields ( kg per hectare)

Practice	Test	Control	Increase (%)
<b>Maize</b>			
Biopesticide	4250 <sup>a</sup>	4151 <sup>a</sup>	99 (2.39)
FYM	4027 <sup>a</sup>	3831 <sup>a</sup>	196 (5.12)
Terraces	4002 <sup>a</sup>	3729 <sup>a</sup>	273 (7.30)
<b>Beans</b>			
Biopesticide	598 <sup>a</sup>	548 <sup>a</sup>	50 (9.01)
FYM	<b>479<sup>b</sup></b>	<b>407<sup>b</sup></b>	<b>72 (17.71)*</b>
Terraces	516 <sup>ab</sup>	484 <sup>ab</sup>	32 (6.59)

Maize and **bean yields** were **higher** under **test plots compared to control** plots across the three treatments. Specifically, bean yields were **significantly higher** under test plots than control plots of **FYM treatment**

Across the three treatments, the **highest maize and bean yields** were observed under biopesticide than other treatments, reflecting multifunctionality of the biopesticide for pest management, and potentially, fertilizing effect.

Bean yields **increased more** (6.6-17.7%) than maize across the treatments (2.4-7.3%).

### Maize and Bean Grain Prices ( USD per hectare)

Practice	Test	Control	Increase (%)
<b>Maize</b>			
Biopesticide	1961 <sup>a</sup>	1916 <sup>a</sup>	45 (2.39)
FYM	1859 <sup>a</sup>	1768 <sup>a</sup>	91 (5.12)
Terraces	1847 <sup>a</sup>	1721 <sup>a</sup>	126 (7.30)
<b>Beans</b>			
Biopesticide	485 <sup>a</sup>	445 <sup>a</sup>	40 (9.01)
FYM	<b>389<sup>b</sup></b>	<b>331<sup>b</sup></b>	<b>58 (17.73)*</b>
Terraces	419 <sup>ab</sup>	393 <sup>ab</sup>	26 (6.61)

Derived **income** was **higher** under **test plots** than control plots, showing that higher yields lead/translate to higher income.

**Highest income** were attained under **biopesticide** than other treatments, implying the vital role of pest management on crop yields.

FYM **test plots** conferred a **significant increase in bean yields and prices** compared to **control plots**, reflecting the significance of agroecology interventions on food availability and income.

