

# Crop productivity improvement in organic agriculture through a system-based approach

## Long-term farming systems experiment in Kenya



David Bautze<sup>1</sup> Felix Matheri<sup>2</sup> Edward Karanja<sup>2</sup> Noah Adamtey<sup>1</sup>  
<sup>1</sup> Research Institute of Organic Agriculture (FiBL), Switzerland  
<sup>2</sup> International Institute of Insect Physiology and Ecology (icipe), Kenya



Figure 1: The long-term farming system experiment at Thika in the Central Highlands of Kenya

### Introduction

- Knowledge gap of comparative performance between organic and conventional farming systems in tropics
- Research Institute of Organic Agriculture (FiBL) started two long-term experiments in Central Highlands of Kenya in 2007/2008
- Two long-term experiments located at Chuka and Thika with different soil fertility and weather conditions
- Adaption of system-approach after four crop rotations mostly in high input systems (e.g., push-pull, home-made botanicals, nutrient management)

### Methodology

- Maize-based crop rotation with grain maize, babycorn, vegetables, legumes and potatoes
- Comparison of organic (Org) and conventional (Conv) system at two input levels: high inputs (High) representing export-oriented, large scale production and low inputs (Low) representing smallholder production mainly for domestic use
- Conventional systems received mostly synthetic fertilizer and pesticides; organic systems used organic fertilizer and bio-pesticides
- Differences between input levels were the amount of nutrients supplied and supplementary irrigation

### Results

- Yields first to fourth crop rotation*
- Grain maize as well as babycorn show generally similar yields in organic and conventional system within each input level
  - Cabbage and kale yields were generally higher in conventional systems (up to +75 %) compared to organic
  - French bean yields were mostly higher in conventional systems compared to organic (up to +50 %); common beans yielded either similar (sole crop) or were higher in organic (+25 %, intercrop)
  - Potato tuber yields were higher in conventional system compared to organic system within each input level (up to +75 %)

- Yields in fifth crop rotation - System approach*
- Maize crops showed similar yields in organic and conventional
  - Decrease of yield gap between organic and conventional systems in cabbage at both sites (+15-30%), in French beans at Chuka (+25%), and potatoes (+30%)
  - Higher yields of organic compared to conventional in French beans at Thika (+30%) and potatoes at Chuka (+15%)

### Discussion

- Yield differences can mostly be explained by nutrient, pest and disease and water management of systems
- Substitution of inputs in organic systems was not successful - inclusion of adapted pest and disease, and nutrient management resulted in higher yields
- However, approach has to be tested additional seasons and needs to be further improved as yields gaps are not closed in all crops and input systems

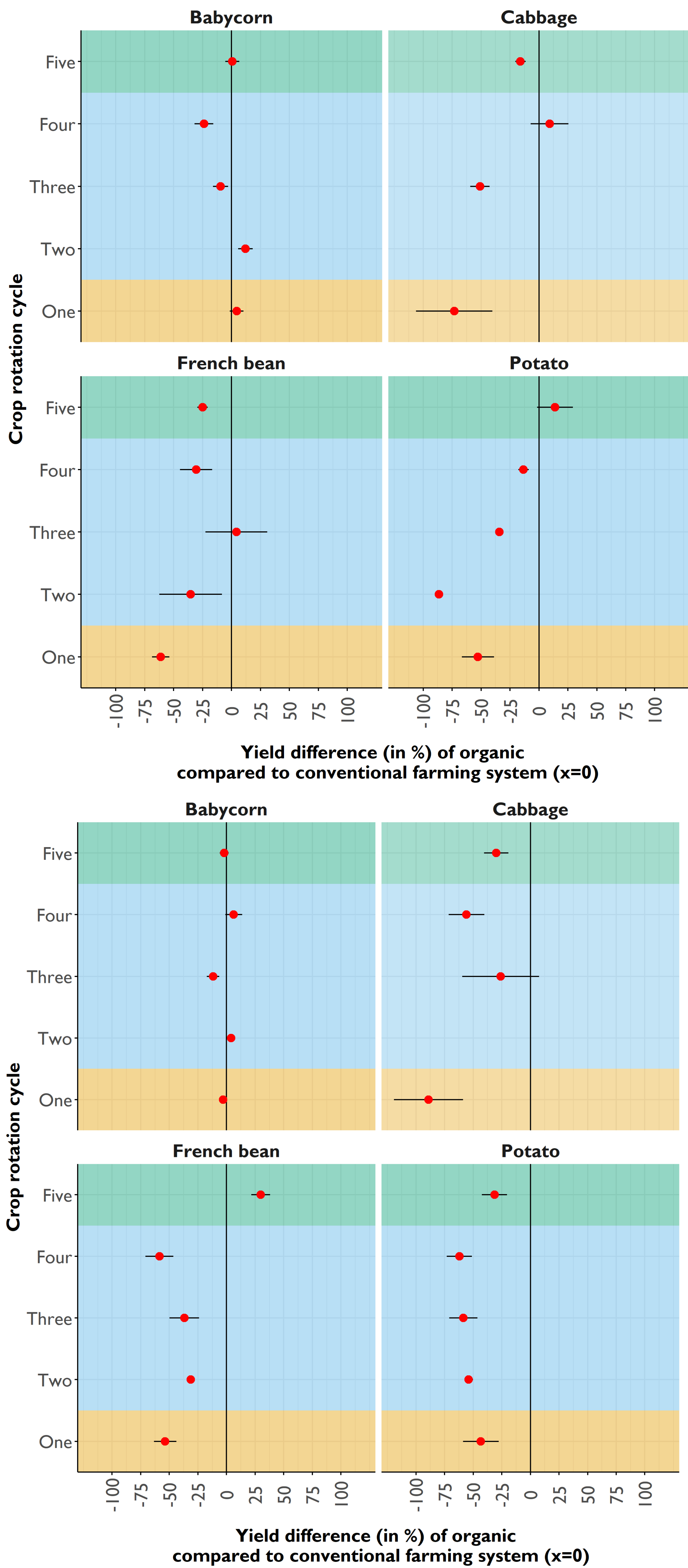


Figure 2 Crop yield difference between organic and conventional high input system at Chuka (top) and Thika (bottom)

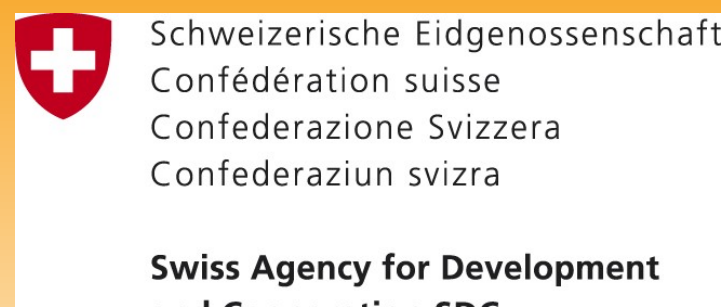
### Conclusions/Recommendations

- The amount and quality of nutrient applied, the type of water management, and the effectiveness of pest and disease management were the major factors driving productivity
- Organic system already perform better with regards to environmental and human health
- However, organic farming systems need adapted system approaches to close yield gaps to conventional system and reach full potential
- Recommendation to invest in a) capacity building of farmers and extensionists, and b) research on innovations for organic/ agroecological systems

### Partners



### Donors



This project is supported by the Coop Sustainability Fund.



systems-comparisons.fibl.org