

Does integrated soil fertility management improve the food security of Ethiopian farmers? Empirical evidence in the context of climate change



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Introduction

- Soil degradation and climate change threaten smallholder food security in Sub-Saharan Africa.
- Integrated soil fertility management (ISFM) can improve soil fertility, productivity and climate resilience (Bellwood-Howard, 2014).
- This study estimates whether adoption of core ISFM improves household food security among resource-constrained Ethiopian smallholders.



Fig. 1. Degraded or depleted soil

Source: CIRAD (2026)



Fig. 2. ISFM implementation

Source: Alliance of Bioversity International and CIAT (2025)

Data and Methods

Data: Ethiopian Socioeconomic Survey (ESS5) collected in 2021/22.

Sample: 990 small-scale rural households

Analysis: Endogenous switching regression model (ESR) estimated with full-information maximum likelihood (FIML) (Lokshin & Sajaia, 2004)

Exclusion restrictions: Training and distance to the input market

Key message:

ISFM adoption is associated with substantially higher food security—and the potential gains are even larger among current non-adopters.

Conclusions and Outlook

- ISFM adoption is positively associated with higher food consumption expenditure per adult equivalent and a greater probability of reporting no food-insecurity experience.
- The estimated treatment effect for current non-adopters is substantially larger, suggesting considerable unrealized food-security gains from adoption.
- Overcoming bottlenecks in credit, extension, input access, land tenure security and market connectivity is essential for scaling adoption.

Results and Discussion

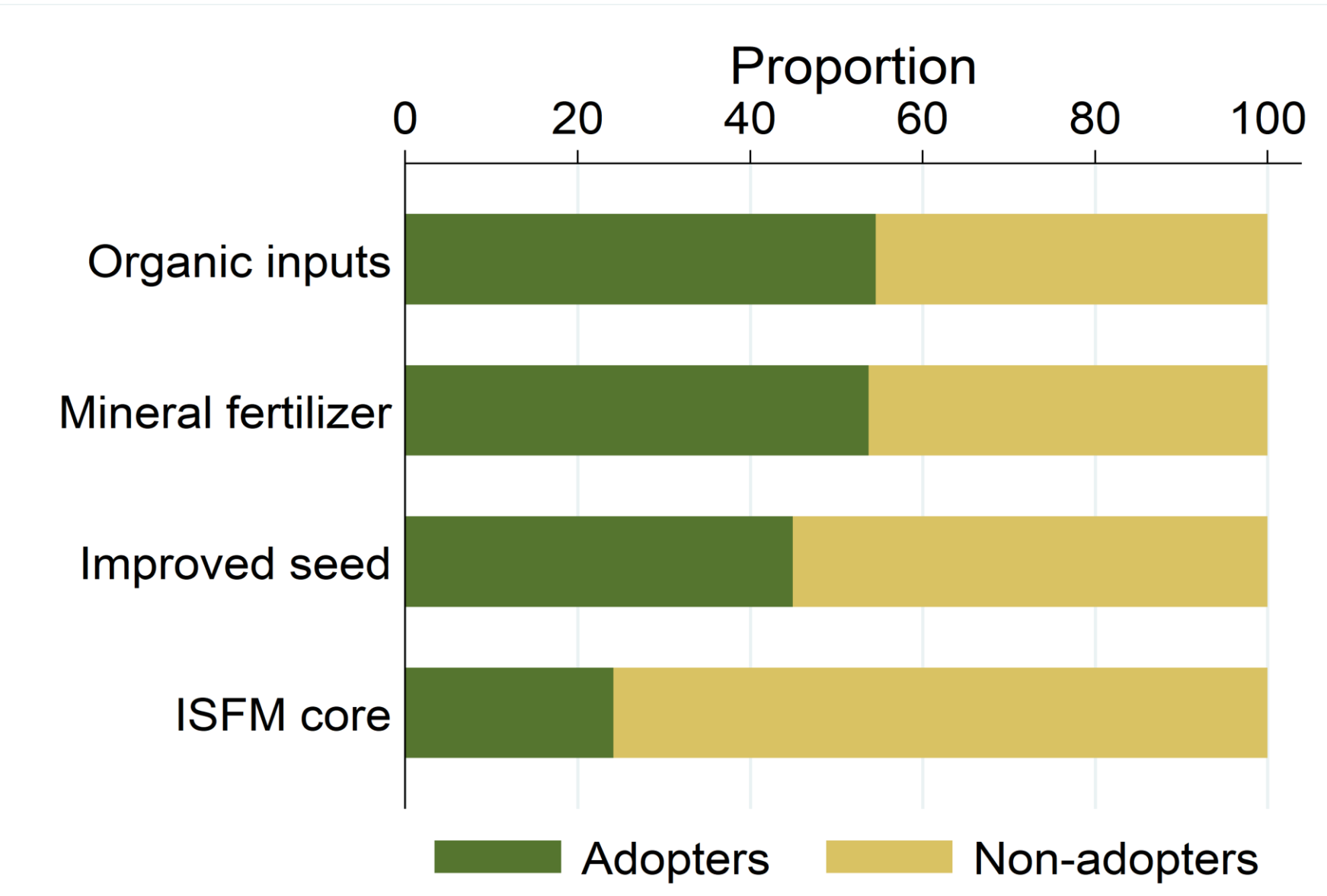


Fig. 3. Adoption status by practice.

Note: ISFM core adoption = joint use of improved seed, inorganic fertilizer, and organic fertilizer/manure on at least one plot during the production year.

Factors influencing ISFM adoption

- Economic:** Credit access (+), off-farm activities (+)
- Institutional and infrastructural factors:** Land tenure (+), extension services and training (+), distance to input markets (-)
- Social:** Participation in community watershed activities (+)
- Farm structural factors:** land fragmentation (+)

Table 1. Treatment effects

Outcome variable	Adopters (ATT)	Non-Adopters (ATU)
Food consumption in AE (ln)	0.34*** (+40.5)	0.68*** (+97.4%)
Food secure (FIES = 0)	0.141*** (+14.1 pp)	0.593*** (+59.3 pp)

Note: Food secure = 1 if the household reports zero food insecurity experience scale items; otherwise 0, AE = adult equivalent, ln = natural logarithm, pp = percentage point, *** p < 0.01

- ISFM adoption is associated with improved household food security across both outcome measures.
- Among adopters, it is associated with 40.5% higher food consumption expenditure per adult equivalent and a 14.1-percentage-point higher probability of being food secure.
- Current non-adopters could gain even more under adoption: 97.4% higher food consumption expenditure and a 59.3-percentage-point higher probability of being food secure.
- However, barriers are preventing non-adopters from adopting, despite them having the highest potential gain in food security.

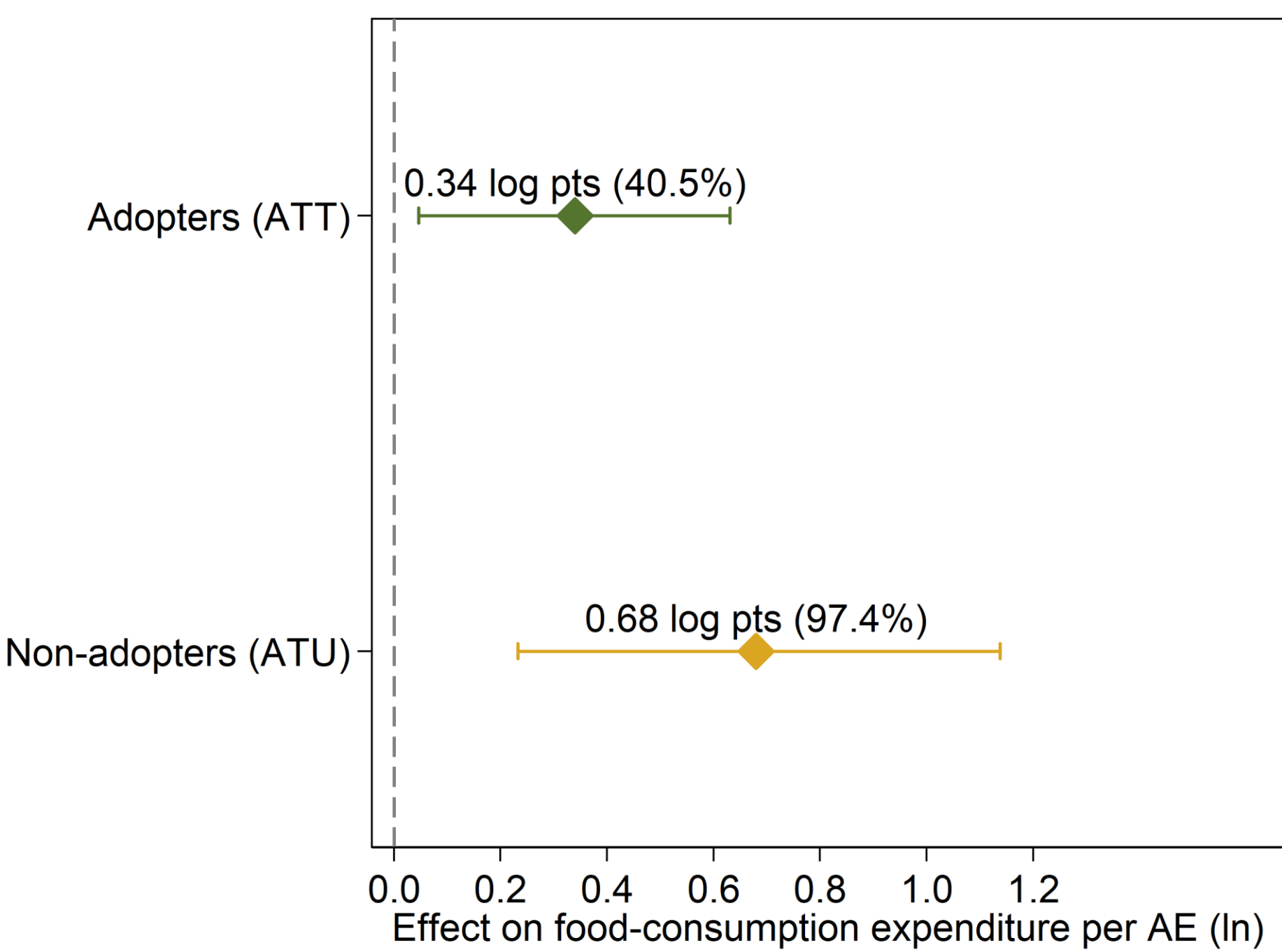


Fig. 4. Treatment effects of ISFM adoption on food consumption (ATT and ATU)

Note: ATT and ATU point estimates with 95% confidence intervals, Percentage changes are calculated as $100[\exp(\text{effect})-1]$.

References

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