Adopt or Dis-adopt Push-Pull Technology? Insights from Discrete-Time Proportional Hazard Models and Machine Learning-based Survival Analysis in East Africa

Denis Waiswa, Beatrice Wambui Muriithi, Alice Warukira Murage, Dave Mwangi Ireri, Fredah Maina, Fahri Yavuz
dwaiswa@icipe.org or **waiswadenis2@gmail.com**

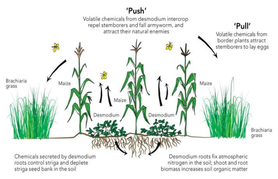
INTRODUCTION

Among the most devastating biological constraints to maize production in Sub-Saharan Africa (SSA) are:

- **Striga weed** – causes annual maize yield losses worth US$ 2.4 billion
- **Stemborers** – contribute to annual losses of about US$ 1.5 billion
- **Fall Armyworm (FAW)** – leads to an estimated US$ 6.25 billion in maize losses each year

Solution: Push-Pull Technology (PPT) introduced by ICIPE and partners
PPT involves the use of:

- **Desmodium intercrop** → suppresses Striga and improves soil fertility
- **Trap grasses (Napier/Brachiaria borders)** → attract and trap stemborers & FAW



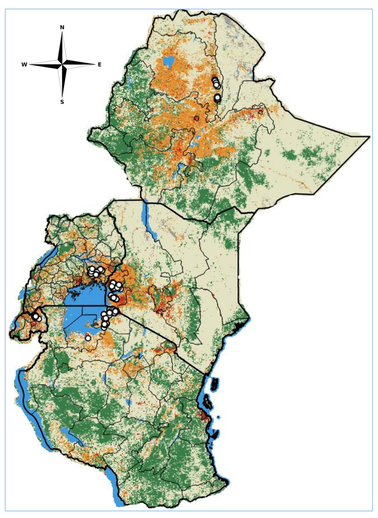
METHODS

Datasets: UPSCALE baseline and midline survey datasets.
Conducted in Kenya, Uganda, Tanzania, Rwanda, and Ethiopia

- ✓ Baseline 2021 → 1556 HHs
- ✓ Midline 2023 → 1237 HHs

Models:

1. Discrete-time proportional hazard model
2. Extreme Gradient Boosting (XGBoost)



IMPACT

- Faster uptake when farmers trust PPT effectiveness against major pests and weeds.
- Stronger social networks and extension access accelerate adoption and help sustain use.
- Diverse information channels (icipe, government, NGOs, media, universities) are critical in scaling.
- Training intensity matters – repeated, well-structured training reduces dis-adoption.
- Country context is decisive – adoption and sustainability differ across East Africa.

CONCLUSION

- PPT shows strong potential to address striga, stemborer, and FAW.
- Adoption is driven by perceived effectiveness, social networks, and diverse information sources.
- Sustained use depends on training quality, continuous support, and country-specific contexts.
- Policies must move beyond initial uptake to ensure long-term adoption and reduced dis-adoption.

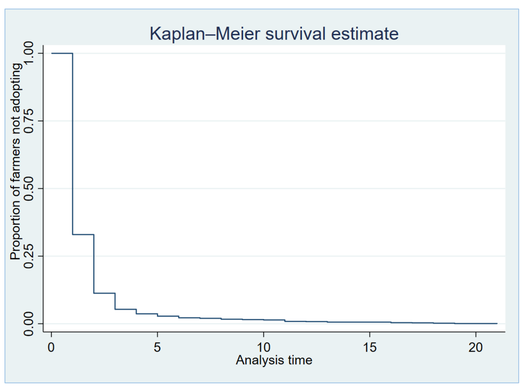
STUDY OBJECTIVE

- Despite its benefits and extensive promotion, the adoption of PPT remains slow
- **Examine the timing and speed of PPT adoption and dis-adoption** across Kenya, Uganda, Tanzania, Rwanda, and Ethiopia using household panel data.

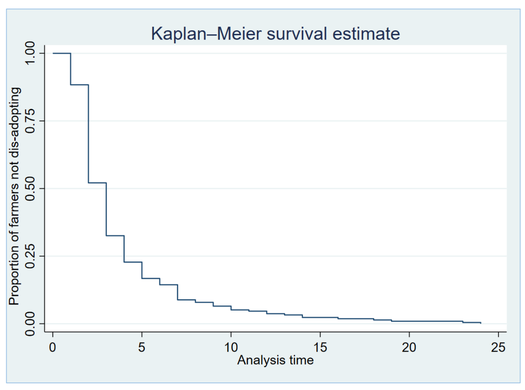
RESULTS

- **Adoption curve:** Most farmers adopt PPT within the first 2 years; late adoption is rare.
- **Dis-adoption curve:** Many farmers exit within 5 years, but long-term users tend to sustain PPT.

a. Adoption



b. Dis-adoption

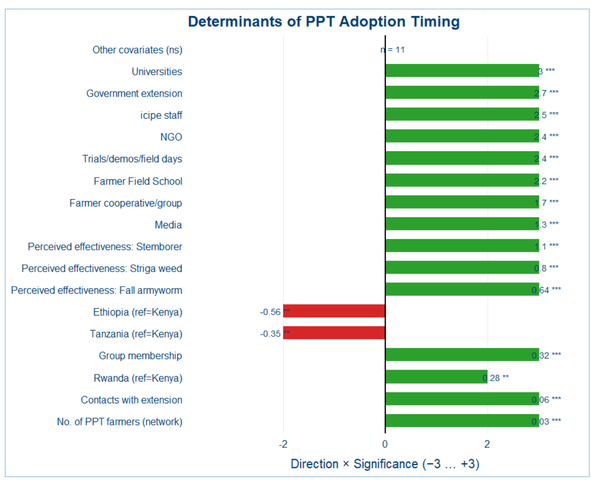


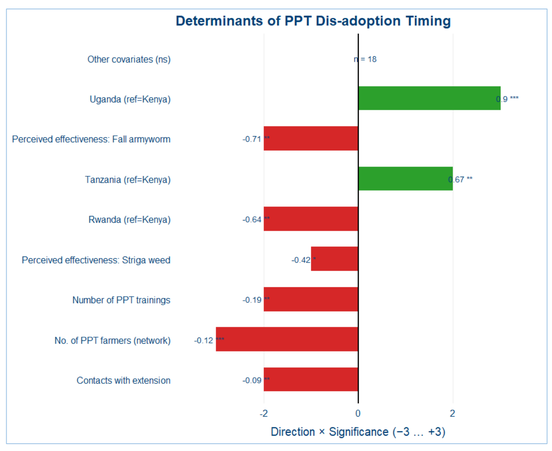
Drivers of adoption

- Perceived effectiveness (Stemborer, Striga, FAW) ↑
- Social networks & extension ↑
- Info sources (icipe, govt, NGOs, media, univ.) ↑
- Rwanda ↑; Tanzania & Ethiopia ↓ relative to Kenya

Drivers of dis-adoption

- Lower perceived effectiveness (Striga, FAW) ↑
- Networks & extension ↓
- More training ↓
- Uganda ↑; Tanzania ↑; Rwanda ↓ relative to Kenya





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International Centre of Insect Physiology and Ecology
P.O. Box 30772-00100, Nairobi, Kenya
Tel: +254 (20) 8632000. E-mail: icipe@icipe.org