How do Farmers Learn from Extension Services

Evidence from Malawi

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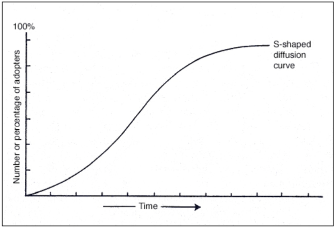
Extension in Sub-Saharan Africa

- Relieve farmer information constraints, encourage adoption and increase yields and incomes (Birkhauser et al. 1991, Picciotto and Anderson 1997, Anderson and Feder 2007, Davis 2008)
- Malawi: agriculture employs 70% of the population
- Effectiveness of (government) extension services varies widely (Birkhauser et al. 1991, IEG 2011)
- How do we structure extension services to get the most 'bang for our buck'?

A learning perspective

- Adoption of a new agricultural technology takes the shape of S-shaped curve



Rogers, Diffusion of Innovations, 2007

- Farmers learn about new agricultural technologies through experimentation, from other farmers and from 'experts' (Foster and Rosenzweig 1995, Munshi 2004 and Conley and Udry 2010)
- We know less about learning from experts: This is what we'll study

A learning perspective

- Range of extension models employed, e.g. training-and-visit, demonstration plots and field-days
- Returns to agricultural technologies are heterogeneous - depend on soil and climatic conditions (Marenya and Barrett 2009, Duflo et al. 2008, Suri 2011)

$\Rightarrow$ farmers are more likely to learn something "useful" about the profitability of a new technology when the context is similar and known

- To maximize profit one needs to alter input use among many dimensions (Beaman et al. 2013, Mponela et al. 2016)
- Learning about many dimensions might be cognitively demanding (Schilback et al. 2016, Lichand and Mani 2017, Hanna and Mullainathan 2014)

$\Rightarrow$ farmers are more likely to learn about production processes if this learning is made easy/and or they "want" to learn

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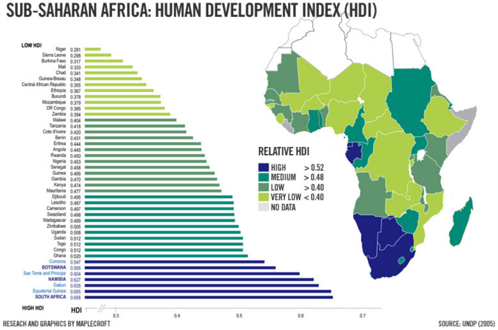
- Adoption remains low **(**Wossen et al. 2015**)**

This study (cont.)

- Empirical challenges when establishing the effects of extension:
  - Areas that receive extension services and farmers that seek them might not be 'representative'
  - Learning outcomes often not documented in standard surveys
- Meet these challenges:
  - Combine (partial) Randomized Controlled Trial with repeated qualitative and quantitative interviews

Our setting: Rural Malawi

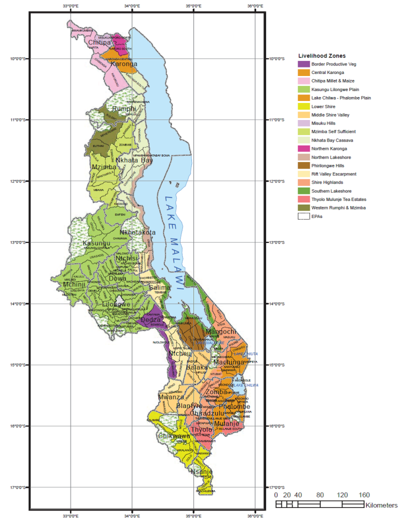
- Among the poorest countries in the world, with up to 70% living in poverty
- 80% of population rural; depend mostly on subsistence agriculture on <2 acre plots



Our setting: Rural Malawi (cont.)

- Smallholder farmers:
  - Frequent droughts and plant pests: Income uncertainty
  - Few options for formal insurance, some informal insurance
- ISFM technologies have the potential to decrease vulnerability

Sample and randomization



NB: This map shows the pre-2002 EPA boundaries. These old EPA boundaries are still used by the MVAC for longitudinal comparison reasons. This map in no way implies endorsement by the MVAC or any of its members of any boundary or geographical entity.

- Clinton Development Initiative (CDI)
- 2014: 250 villages from: Mtumthama in Kasungu district and Chibvala in Dowa district
- Divided this set randomly into treatment and control
- 125 villages in the treatment group were introduced to CDI's extension program and invited to form farmer clubs
- baseline survey among 2500 farmers
- farmer clubs were invited to farmer field-days and 17 were strategically selected (by CDI) for demonstration plots
- 2015: endline survey among 1000 farmers

CDI's extension program

Pictures taken with permission of participants

- Maize, soy, groundnut and common beans demonstration plots
- Set-up in a central location in the village on a good quality field in November 2014
- CDI agents provide guidance and visit the plot regularly; farmer clubs manage the plot on a day-to-day basis and share output
- Field-days: end of the growing season (April/May 2015) on two "successful" demonstration plots
- Farmer clubs are invited to attend and transportation covered by CDI

Data collected

Knowledge and adoption data

20 questions about ISFM at endline - examples:

- When mixing inoculant, how many table spoons of sugar should you add to the inoculant bag?
- Which chemical is the best for controlling soya rust?
- What is the recommended number of rows per ridge for groundnuts?
- How many weeks after planting should you apply urea fertilizer for maize?
- Should the leaves of the fertiliser tree be exposed to the sun after harvesting?

13 questions about adoption of ISFM at base and endline - examples:

- This year, on plot X, did you plant fertilizer trees and if so, which ones?
- Are you planning on cultivating soy this year? If so, provide details on the variety and inoculation and how long you have been doing these practices.

- Technologies included: seed treatment, seed selection, plot lay-out (intercropping, rotation, fallow, etc.), fertilizers (inorganic, organic and fertilizer trees), pesticide, herbicide, fungicide

Descriptive statistics

(At baseline, of the sample of 1000)

Variable description	Mean	St. Dev.
Gender of household head (0=male; 1=female)	0.18	0.38
Age of household head (years)	42.45	15.01
Education of household head (years of education)	4.59	3.43
Land (in acres, owned)	4.62	6.75
Experienced declining soil fertility (no=0; yes=1)	0.82	0.34
Experienced soil erosion (no=0; yes=1)	0.47	0.44
Experienced nutrient depletion (no=0; yes=1)	0.57	0.45

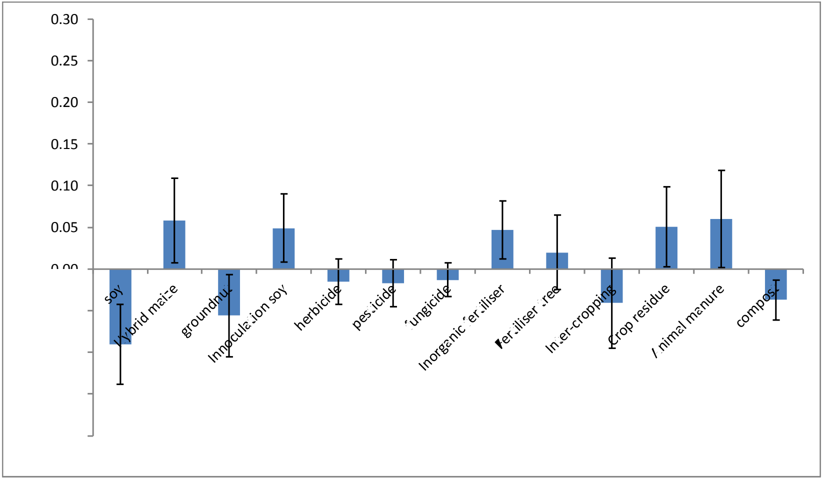
Analysis and results

Impact on adoption

- Use a farmer fixed-effects approach: do before-after comparison for farmers in three different groups: farmers who ran a demonstration plot, farmers who were invited to attend a farmer field day, and farmers who did neither
- All farmers adopt more ISFM technologies at endline compared to baseline
- However, farmers who run a demonstration plot increased more than both control farmers and farmers who were invited to attend field days
  - Counting up to 13 ISFM practices, they adopt 10% more technologies compared to the two other groups

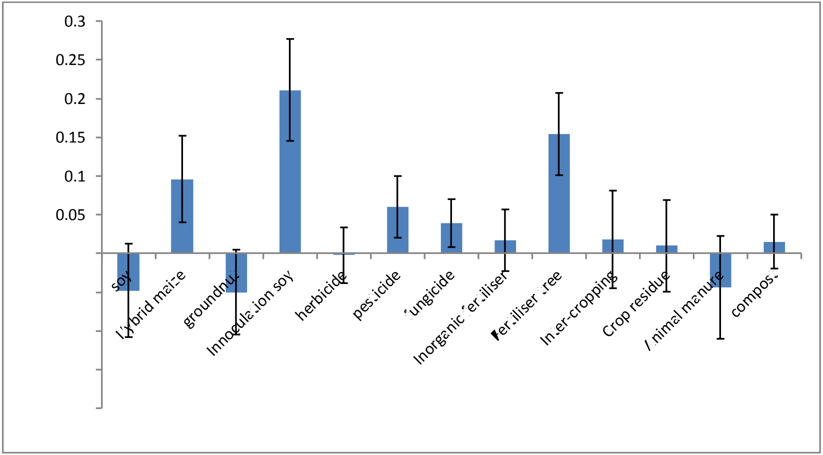
Analysis and results

Impact of field-day on adoption (cont.)



Analysis and results

Impact of demonstration plots on adoption (cont.)



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- Field-day participants are impressed by potential yields and indicate the importance of "modern" inputs (unable to recall the production process)
- Costly but rational multi-stage learning process

Analysis and results

Impacts on knowledge

- Use a propensity matching approach: controlling for the fact that the villages selected for demonstration plots might be different compared to the ones that were not selected, compare farmers who ran demonstration plots, with those who were invited to attend field days and those who did neither
- Counting up to 20 correct answers, farmers who ran demonstration plots have a 30% higher score compared to the two other groups.
- Among the farmers who were invited to attend field days, those who are credit-constrained are more likely to learn about labor-intensive technologies (such as optimal plant spacing) and less likely to learn about credit-intensive technologies (such as pesticides) compared to those who are not credit-constrained

Conclusion

- Smallholder farmers in Malawi have low and declining soil fertility
- ISFM technology would be beneficial
- But learning process is constrained

Implications for extension:

- Facilitate learning during field days
- Match field days with participants on the basis of growing conditions
- Re-couple with credit/input interventions: Malawi's Input Subsidy Program