Overcoming Barriers to Fertilizer Use in Kenya

Researchers:

Arun Chandrasekhar

Esther Duflo

Michael Kremer

Pugliese

Jonathan Robinson

Frank Schilbach

Sector(s): Agriculture

Fieldwork: Innovations for Poverty Action (IPA)

Location: Western Province, Kenya

Sample: 26,856 small-scale maize farmers

Initiative(s): Agricultural Technology Adoption Initiative (ATAI)

Target group: Farmers Rural population

Outcome of interest: Technology adoption

Intervention type: Fertilizer and agricultural inputs Information Social networks Subsidies

AEA RCT registration number: AEARCTR-0001306

Partner organization(s): Gates Foundation, UK International Development

When used correctly, chemical fertilizer can substantially raise agricultural yields and increase productivity. Researchers conducted a randomized evaluation to test the impact of offering coupons, facilitated discussion groups, and measuring spoons on fertilizer usage, fertilizer knowledge, and agriculture-related discussions amongst farmers. While discussion groups alone had no impact on fertilizer use, coupons and spoons both increased fertilizer use and led to more knowledge-sharing among farmers.

Policy issue

When used correctly, chemical fertilizer can substantially raise agricultural yields and productivity.[1], However, fertilizer usage in farming practices remains low in many parts of the world, including in Kenya. Past studies suggest that changing farmer behavior to use fertilizer is difficult given that farmers face off-season income constraints, farmers have limited information on the benefits of using fertilizer properly, and knowledge about the benefits of fertilizer is not shared between farmers.[2], Technological innovations and information are often slow to spread in agricultural settings, possibly due to the cost of communicating or because of social norms around spreading reliable information. A previous randomized evaluation in the same context as this study found that a savings-based fertilizer coupon program was effective in increasing fertilizer use. Can a combination of fertilizer coupons and other low-cost approaches to promote technological adoption and knowledge-sharing amongst farmers effectively change farmer behavior towards fertilizer use?

Context of the evaluation

Most households in Western Kenya are engaged in small-scale maize farming. Kenya's Ministry of Agriculture recommends that maize farmers utilize fertilizer to increase their yields. Previous research in this area has shown that when used correctly, "top-dressing" fertilizer (which is applied to crops during the growing season) can increase yields by about 48 percent, amounting to a 36 percent rate of return over a few months.[3] However, only 33 percent of farmers in 2011 reported having used top-dressing fertilizer in the previous 12 months.

The research team conducted a pilot beginning in July 2000 and lasting for three seasons, consisting of six trials that took place at small test plots on farmers' fields. In the first few trials, one plot received top-dressing fertilizer and the second plot received a page of hybrid seeds and different fertilizer types, while the third plot received nothing. In later trials, farmers were instructed to apply amounts of top-dressing fertilizer ranging from one-quarter of a teaspoon to one teaspoon. Results from the pilot showed that applying one-half of a teaspoon of top-dressing fertilizer only was most profitable for farmers.

The study began in 2010. Participating farmers were between 43 and 44 years old on average and had between 6 and 7 years of education. Agriculture was the primary source of income for over 78 percent of participants.



Small maize field in Kenya.

Photo Credit: Jessica Hoel

Details of the intervention

Researchers conducted a randomized evaluation to test the impact of a three-pronged intervention on fertilizer usage, fertilizer knowledge, and agriculture-related discussions among farmers. This intervention builds off the design of a previous randomized evaluation in Western Kenya aimed at increasing fertilizer use. The evaluation took place across a region served by 184 rural

primary schools and began when 26,856 adult family members of students attended meetings at the schools that their children attended hosted by the surveyors. Following the meetings, schools were randomly divided into one of four groups:

1. *Cooperatives:* (8,263 farmers) Farmers formed discussion groups as part of the meetings at the schools. The research team coordinated the first meeting and encouraged farmers to discuss topics related to agricultural practices, but did not engage in the discussions or provide any agricultural information.
2. *Discount Coupons:* (7,897 farmers) Farmers received a coupon for a 15 percent discount on 25 kilograms of fertilizer. The coupons could be redeemed at local fertilizer shops for up to three weeks during the harvest season. Information on the coupons was distributed in a school meeting that also explained the benefits of fertilizer.
3. *Coupons + Cooperatives:* (5,306 farmers) Farmers participated in both the coupon scheme and the cooperatives.
4. *Comparison:* (5,390 farmers) Farmers attended meetings where topics unrelated to fertilizer or agriculture, such as food safety and waste disposal, were discussed.

In parallel, a randomly selected 15 percent of farmers at each school received a separate technology-and-information intervention aimed at increasing fertilizer use.

1. *Blue spoons:* (4,253 farmers) These farmers received half-teaspoon measuring spoons, painted blue to make them more easily identifiable, in addition to a second meeting that shared information with farmers about the returns to using this amount of fertilizer per plant. Farmers also received ten information sheets explaining where to buy the spoons to share with their friends and neighbors.
2. *Comparison (22,603 farmers):* The remaining 85 percent of farmers at each school did not receive a blue spoon. However, the spoons were also available for farmers to purchase for KSH 5 (US$0.05 at the time of the intervention) in the same local shops that accepted the discount coupons.

The school meetings took place between July 2010 and August 2011, the timing corresponding with when most farmers were harvesting crops planted in the previous season. At the end of the initial meetings at the schools, surveyors conducted a brief survey on farmers' harvest times and initial fertilizer use habits. Surveyors also asked 25 percent of the participants to provide the names and contact information of three people outside of their households with whom they frequently discussed agriculture. Between June 2011 and January 2012, researchers conducted two endline surveys to collect information about participants' knowledge and use of fertilizer, as well as other agricultural topics and demographic information. Researchers also collected information from stores on how many fertilizer coupons were redeemed and what types and quantities of fertilizer farmers purchased.

Results and policy lessons

Both the coupons and the blue spoons increased fertilizer use and knowledge-sharing among farmers, while participation in the discussion cooperatives had no impact on farmers' fertilizer use and decreased the likelihood that farmers participated in discussions about fertilizer. The blue spoons were most effective in encouraging discussions about agricultural topics, and farmers who received the blue spoons or knew others who received them were more likely to identify the correct amount of fertilizer to use.

Take-up: Farmers in the cooperatives group were nearly twice as likely to participate in a discussion cooperative than farmers in the comparison group, with participation increasing from 31 percent to 59 percent over the course of the intervention. However, farmers in the cooperative group were no more likely to attend meetings at least weekly relative to the comparison group. Similarly, 79 percent of the farmers who received the spoons at the schools owned a spoon by the end of the evaluation, relative to the 24 percent of comparison farmers who had the opportunity to purchase the spoons from the local store (a 229 percent

increase). However, few farmers who received coupons during the initial meetings redeemed them. Only 18 percent of the coupons were redeemed in the first season of the intervention and only 12 percent in the second season. Researchers suggest that farmers with more experience using fertilizer may have wanted to use smaller amounts of fertilizer than what could be redeemed with the coupons, or that the discount may not have been enough to encourage them to buy more, which could have contributed to the low coupon redemption.

Fertilizer use: Farmers in both the coupons and blue spoons groups were more likely to use fertilizer than those in the comparison group. While only 64 percent of farmers in the comparison group reported using fertilizer after the intervention, the number of farmers in the blue spoons group and the coupons group who reported that they had used fertilizer during the previous season increased by 8 percent and 16 percent, respectively (increasing to 69 percent of farmers in the blue spoons group and 74 percent of farmers in the coupons group. In contrast, the discussion cooperatives had no impact on farmers' fertilizer use. Farmers in the blue spoon groups were also 83 percent (10 percentage points) more likely to correctly identify the recommended amount of fertilizer to use after the intervention, while neither the coupons nor discussion cooperatives had an impact.

Agricultural knowledge sharing: Farmers who received the blue spoons were 21 percent (12 percentage points) more likely to report having a conversation about top-dressing fertilizer during the previous year, compared to 58 percent of comparison group farmers. Farmers in the blue spoons group were also 8 percent (5 percentage points) more likely to have conversations about other fertilizer-related topics, compared to 64 percent in the comparison group, and 7 percent (5 percentage points) more likely to have conversations about seeds and storage, compared to 72 percent in the comparison group. Similarly, farmers who received fertilizer coupons were 6 percent (4 percentage points) more likely to discuss fertilizer-related topics and 4 percent (3 percentage points) more likely to discuss seeds and storage but were only 5 percent (3 percentage points) more likely to talk about top-dressing fertilizer. In contrast, farmers in the discussion cooperatives were less likely to talk about top-dressing fertilizer and were no more likely to discuss any other agriculture-related topics. Researchers suggest that farmers in the discussion groups may have been concerned about spreading false information in an open setting, which could be a reason that they had fewer conversations. The blue spoons could have alleviated this concern, as farmers could use them to spur conversations, and given that the spoons came with clear instructions, farmers would not be as concerned about spreading false information or being misunderstood.

Information spread: The percentage of farmers who owned a blue spoon increased from 12 percent to 25 percent among those whose friends or neighbors received a blue spoon, and the percentage of farmers who had heard about the blue spoons increased from 26 percent to 41 percent among the same group. Farmers were also more likely to correctly identify the recommended amount of fertilizer to use per planting hole if they knew members in the blue spoons group (21 percent) than if they did not (11 percent). In contrast, farmers who had friends or neighbors receive coupons or participate in the discussion cooperatives were no more likely to own a spoon or identify the correct amount of fertilizer to use than those who did not know anybody who participated in any intervention. Researchers suggested that because the blue spoons were easy to identify, use, and explain to others, it was easy for farmers to adopt them.

The results suggest that simple, transparent, and easy-to-use technologies may allow information to spread more effectively than through public forums or social networks alone. If farmers are worried about accidentally spreading misinformation, access to an easy-to-understand piece of equipment may lend farmers credibility and help spur discussions, leading to the spread of useful ideas. Simple, low-cost technologies could be an efficient way to both spread information and allow people to act on it.

---

1. Duflo, Esther, Michael Kremer, and Jonathan Robinson. 2008. "How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya." American Economic Review: Papers and Proceedings, 98(2): 482–88.

2. Duflo, Esther, Michael Kremer, and Jonathan Robinson. 2008. "How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya." American Economic Review: Papers and Proceedings, 98(2): 482–88. p. 487.

3. Duflo, Esther, Michael Kremer, and Jonathan Robinson. 2008. “How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya.” American Economic Review: Papers and Proceedings, 98(2): 482–88. p. 485.