Rwanda Agronomy:
Best Practices and Attendance Analysis for Technoserve

April 2012
The Coffee Industry in Rwanda

- Coffee is a major export crop for Rwanda, contributing a large share of the country’s foreign exchange earnings.
- Small producers dominate – roughly 400,000 across the country, with 225 trees each, on average.
Motivation I: Farming Risks

- Rwandan coffee harvesters face numerous risks, particularly if they do not follow agricultural best practices
  - Weather, pests, diseases, soil care
- Best practices are often costly to implement, but lack of information also limits take-up
  - In 2002, less than 10% of Rwandan coffee farmers used fertilizer; 14% did not know fertilizers were useful
- Need to improve farm productivity and reliability of harvests
Motivation II: Training Organizations

- Training processes can be expensive, time consuming, and “success” is not always easy to measure
- Empirical studies with rigorous evaluations of “extension programs” for farmers are in short supply
Motivation III: Information Diffusion

- Information flows not only from trainers to farmers, but also between farmers and their friends, relatives, neighbors.
- We do not yet understand which information channels are most effective at transmitting agricultural knowledge.
  - New methodologies in social network mapping allow us to design research that analyzes these channels.
- If information diffuses rapidly and effectively within networks, can increase efficacy by altering targeting/reach.
Research Questions

• What are the impacts of farmer training programs in terms of agricultural practices and harvest outcomes?
• Is there a learning spillover effect if some farmers in a community are trained while others are not?
• Do farmers “talk shop” with others? How does information about agricultural practices diffuse within social networks?
Our Intervention

• Field experiment based on an agronomy training program (covering various best practices) run by TechnoServe (TNS) Coffee Initiative

• The evaluation sample is composed of the 1600 farmers (from 27 villages in one sector, Nyarubaka) who signed up for TNS’s agronomy trainings

• These households were randomly assigned to a treatment (50%) or comparison (50%) group after receiving a baseline survey

• Villages in the treatment group were also randomly assigned to different intensity levels: in some villages ¼ of registered households received treatment (i.e. ¾ comparison), others ½, and others ¾.
Our Intervention (cont’d)

- Farmers in the 1600 farmer sample are surveyed every few months to gather data on their coffee yields (2010, 2011 and 2012 harvests), sales and practices, as well as the fraction of time and land that they allocate to coffee relative to other crops.
  - Collection of 2012 data is currently in the field

- Coffee farming and social network data was collected for the 1,600 sampled farmers and an additional 1,400 farmers in the surrounding area (Nyarubaka sector, south of Kigali)
  - Building a comprehensive database of farmer relationships

- Take-up and diffusion of the agronomy practices taught in the trainings is monitored closely through bi-yearly plot and tree inspections for all coffee farmers in Nyarubaka (1,600 sample farmers and 1,400 “non-sample” farmers)
The Best Practices adoption results which follow were computed using three rounds of data, the baseline survey (December 2009) and two follow-up (post-treatment) surveys:

- First follow-up round collected in April/May 2010 (“First Monthly” survey)
- Second round collected in June/July 2011 (“Sixth Monthly” survey)

Baseline data comes entirely from farmer reporting (enumerators did not perform plot or tree inspections in the baseline survey)

The two post-treatment rounds of data come from plot and tree inspections performed by trained surveyors

Baseline data is included in this analysis when possible, but comparability with monthly survey data is limited due to the self-reported nature of the baseline data

An additional round of plot and tree inspections was recently carried out in January and February 2012 (eighth monthly sample survey), but this data is currently in the process of being cleaned before it can be used for further analysis.

Analysis includes sample (treatment and control) households only
Best Practices – Summary of Results (I)

- The results show that awareness of coffee agronomy best practices is higher among treatment farmers.
- In particular, self-reported data (collected via household questions) suggests that knowledge of integrated pest management methods and awareness of which fertilizers are particularly effective for coffee are significantly higher among treatment farmers (see slides 14-19).

→ This suggests that notions of what can be done to improve yields through best agronomic practices are assimilated by at least some of the farmers who attend the trainings.
Best Practices – Summary of Results (II)

• Treatment effects on *actual* application of the practices (measured in the plot and tree inspections) are somewhat less consistently detected and vary across the different types of practices:
  
  • Tree inspections data reveals that trees of treated households receive better nutrition (1\textsuperscript{st} monthly), but we find no effects of the trainings on the adoption of pruning techniques in either round of follow-up data

→ At this stage, the data suggests that, although the trainings do make the farmers more knowledgeable about best agronomic practices, there is a gap between awareness of the practices and their actual implementation

• Slides 12-21 detail the adoption results for each agronomic practice
Record Keeping / Compost Heap (I)

- Highly significant treatment effects on bookkeeping habits and keeping a compost heap

![Bar chart showing the comparison between control mean and treatment mean for bookkeeping habits and compost heap maintenance over time.](chart.png)
Record Keeping / Compost Heap (II)

- Treatment farmers were 82.6 percentage points (ppts) more likely to keep record books than control farmers in the 1st Monthly, and 71.5 ppts more likely in the 6th Monthly

  - Since the sample of farmers that keeps notebooks is very different in treatment and control the comparison about which farmers keep them “well” is not causal (it is not part of the experiment as not everyone keeps record books)

- Treatment farmers are also significantly more likely to keep a compost heap (7.2 ppts more likely in 1st Monthly, 8.8 ppts for 6th Monthly)
Method Awareness (I)

- Treated households are statistically more aware of most practices in First Monthly (7.4 ppts average increased awareness) and all practices in Sixth Monthly (5.9 ppts average increased awareness)*

* Note: All subsequent references to percent differences in treatment and control are in terms of percentage points.
Method Awareness (II)

Pest Control Method Awareness (II)

Control Mean  Treatment Mean

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<td>Squash Antestia</td>
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<td>Berry Borer traps</td>
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<td>Smoothed barks</td>
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Probability
Method Usage (I)

- Treatment households are 7.4 ppts more likely to report having used a TNS method for pest control (6th)
- Treatment effects exist for several methods including beneficial insects (5.7 ppts, 1st), and keeping trees fed/healthy (10.7 ppts, 1st)
- Significant negative treatment effect for pesticide spraying (-11.7 ppts, 1st, and -6.6 ppts, 6th)
Method Usage (II)

- Significant treatment effects for several methods including removing berries (4.6%, 1st and 4.0%, 6th) and squashing Antestia (3.2%, 1st and 3.8%, 6th)
Pesticides and Pests

- Reported pesticide use is declining over time and treated households are less likely to use pesticide (-6.0%, 1st)
- Treated households using pesticides are significantly more likely than control households to report having used them to combat Antestia (11.8%, 1st and 7.2%, 6th)

* Baseline data reflects self-reported pesticide use over the 12-month period preceding the survey.
Fertilizers

- Treated households are more likely to report NPK as a good fertilizer for coffee (4.8%, 1st and 5.4%, 6th), as well as zinc/boron (4.0%, 6th)
Tree Inspections (I)

- Trees of treated households are less likely to exhibit yellowing (-2.7%, 1st) and curling (-1.1%, 1st), and more likely to show signs of mulching (4.9%, 1st)
- Trees of treated households are 3.6% more likely to be weeded (6th)

![Tree Inspections Graph](image)
Tree Inspections (II)

- No treatment effects detected for pruning techniques

**Tree Inspections: Pruning Techniques**

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<tr>
<th>Method</th>
<th>Control Mean</th>
<th>Treatment Mean</th>
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<tr>
<td>Dead Branches Removed</td>
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<td>Branches touching ground removed</td>
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<td>Centers opened</td>
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<td>Unwanted Suckers Removed</td>
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Heterogeneous Treatment Effects (I)

- Treatment effects may vary based on the concentration of treated farmers (25%, 50% or 75%) within a village, because of “spillover” and network effects.
- However, data collected to date does not provide evidence of statistically different treatment effects by village treatment concentration.
- Below are examples of heterogeneous treatment effects for some best practices variables.

![Treatment Coefficients by Village Group](image)

Note: Village groups defined by concentration of treated farmers within the village (25%, 50%, or 75%).
Note: Data is from the Sixth Monthly Survey, unless otherwise indicated.
Heterogeneous Treatment Effects (II)

- Treatment effects may increase with treatment concentration for highly visible best practices like weeding and mulching.
- For example, based on 1st Monthly survey data, the mulching treatment coefficients were 0.6%, 4.7% and 7.2% for the 25%, 50%, and 75% treatment villages, respectively.
- The treatment coefficients for the 50% and 75% treatment villages are significant at the 5% level, but they are not statistically different from one another or from those for the 25% group.

Note: Village groups defined by concentration of treated farmers within the village (25%, 50%, or 75%).
Note: Data is from the Sixth Monthly Survey, unless otherwise indicated.
Attendance – Meetings

Average number of 15 unique best practices meetings (including 4 review sessions) attended by at least one member of treatment households.

- Meetings took place between February 2010 and May 2011
Attendance – Household Level

Percentage of treatment households with at least one household member attending a meeting, by meeting (includes the 4 review meetings)

Note: Shaded region represents household attendance in 25% treatment villages, +/- 1 standard error.
Attendance – Head/Spouse

Percentage of treatment households with a head or spouse attending a meeting, by meeting (includes the 4 review meetings)

Note: Shaded region represents household attendance in 25% treatment villages, +/- 1 standard error.