Rwanda | 2015A-2017A | Banana Variety Adoption

ONE ACRE FUND

Farmers First

PHASE:	(1) Research Station	(2) 50 – 500 farmers	(3) 500 – 20,000 farmers	(4) Full Scale

Introduction

Bananas are an important food security crop in Rwanda: 80% of farming households grow them, and with 436 kcal/day average consumption they represent the single most important energy provider in the country.[i] Yet banana yields in Rwanda are low and have significant room for improvement: current yields average 16 tons/ha, while the economic optimum yield is likely closer to 50 tons/ha. This should be achievable with improved varieties and better disease control.[ii]

In Rwanda there are three distinct types of bananas: those for beer-brewing, which account for 64% of land area in the country, cooking bananas (30%) and dessert bananas (6%).[iii] Beer bananas are dominant in Lake Kivu and Cyangugu zones while cooking varieties dominate near Kigali and in the East.[iv]

Since 2010, One Acre Fund has conducted side-by-side trials, both on a research station in the Nyamasheke district and on farmer fields across multiple districts, testing different improved banana varieties in comparison to local varieties and testing different fertilizer practices. Results have shown that variety has a much higher impact on yield than fertilizer, and that the highest-yielding variety tested is FHIA 17, due to its very high bunch weight. This variety has the further advantage of being multi-purpose: it can be used to make beer, prepared like a cooking banana, or eaten like a dessert banana.

In the 2015A season in Rwanda, One Acre Fund sold FHIA 17 tissue culture plantlets to farmers across all districts of our program, and these sales continued in 2016A and 2017A. In addition to the full-scale sales program for FHIA 17, we also conducted two smaller sales trials. In 2016A we offered tissue culture plantlets of four other banana varieties in several sites to determine the relative interest in these different varieties and to see if offering multiple choices increased total banana adoption. Then, in 2016B, we offered FHIA 17 plants for sale in several sites, in order to measure B season adoption and determine if we would want to consider wider B season sales in the future. We have also conducted various follow-up surveys to check on the survival rate, farmer satisfaction, and early harvest measures of the purchased bananas.

$87	**Impact of 5 FHIA 17 plants over 7 years, versus comparable local variety**
61%	**Satisfaction rate after 15 months for 2015A FHIA 17 adopters**
16,166	**Total clients who adopted FHIA 17 plants in 2015A-2017A**
3-25%	**Adoption of banana plants seen in first season of sales (varies dramatically by district)**

Objectives

- Determine adoption rates for FHIA 17 plants across several years.
- Use survey data to understand reasons for adoption and non-adoption.
- Determine the adoption rates for other promising varieties (Injagi, FHIA 25, Mpologoma, and Sugar Baby) compared to FHIA 17, and whether offering a catalog including multiple choices increases total adoption
- Determine the adoption rate for banana plants sold in B season.
- Determine plantlet survival rate, farmer satisfaction, and early indications of impact for the various banana plantlets sold.

- Organize supply and logistic systems and improve them over time to reduce cost per plant and increase survival rate.

Hypotheses

- FHIA 17 adoption will be lower in year 2 than year 1 of sales.
  - This is because early adopters will not yet have experienced harvests and so secondary adopters will not yet have observed their success.
  - This might have changed by season 3, however, as harvests begin and non-adopters see the impressive FHIA 17 bunches that their neighbors have.
- Varieties like Mpologoma and Injagi which are mainly for cooking will be most popular in the East and might have higher adoption than FHIA 17.
- Offering multiple varieties in the same catalog will allow farmers to make a choice personalized to their needs, so we will be able to attract more total adopters, and adoption will increase compared to when FHIA 17 are sold alone.
- Demand and adoption in B season will be much lower than in A season, and we will likely confirm that it is better not to sell bananas at scale in B season.
- Major reasons for non-adoption will include lack of appropriate land to plant additional bananas (due to climate or disease or small land-size) and price.

Methodology

2015A:

- We offered FHIA 17 tissue culture plantlets for sale on contracts to all clients in One Acre Fund Rwanda except for Nyamagabe district, a high-altitude Congo Nile zone where we worried that bananas might not survive well.
- Clients had to choose either a bundle of 5 plants or 0 plants, there were no other options.
- The price was 660 FRw/plant before the 19% interest was applied, or 785 FRw/plant with interest.
- The FHIA 17 catalog page used in marketing emphasized large bunch size, the three uses of the bananas, and the fact that the plants came from a laboratory and were therefore disease-free at planting.
- Plants were all purchased from FAIM Africa, a Rwanda-based company.
  - They produce banana, passion fruit, pineapple, and other fruit plants in a laboratory in Rubona using tissue culture multiplication techniques.
  - They grow the plants out and harden them off in a nursery in Rwamagana.
  - They take mother plants for multiplication from healthy, very high-producing plants in Rwanda, scouted by their agronomists.
  - One Acre Fund contracted FAIM to produce a batch of FHIA 17 plantlets of set size parameters so that together with their sachet of soil they would fit inside a plastic beverage crate for easy transport.
- One Acre Fund built nurseries of our own at our regional warehouse hubs:
  - Plants were transported from FAIM to these central nurseries, then distributed from there over the course of several weeks.
  - Management involved checking plants for disease or other issues each day and removing any found to have problems, watering the plants each day, and trimming down large leaves if needed to facilitate crate stacking during transport.
  - Any plants brought out on trucks for distribution but not taken were returned to the nursery and kept separate; we did not send any of those out again for later distributions.
- We distributed the bananas separately from our normal fertilizer distribution:
  - The timeline was late September through early October.
  - Clients were separately mobilized by Field Officers.

- Only clients who made a minimum pre-payment prior to the banana distribution (could have been on the normal inputs distribution day) or on the day of the banana distribution were allowed to pick up their plants.
- A truck generally carried plants for 2-6 sites in the same sector, depending on order size.
- Because of low orders in some areas we used very few large trucks and instead relied primarily on pick-up trucks and even motorcycles in some cases to reduce transport expenses.
- During transport we were careful to cover bananas with mesh shade cloth, to reduce wind and sun damage without holding in too much heat (as would happen with a normal tarp).
- We trained all relevant staff on proper banana handling, including use of a peg board to remove the plants from the crates and to always carry the plants from the sachet rather than by the leaves or stem, to avoid damaging the plants.

2016A:

- Full program sales operated in the same manner as described above, with a few small changes:
  - We sold bananas to all districts in the program, adding Nyamagabe and also two completely new districts, Ngororero and Ngoma.
  - We allowed clients to choose the quantity that they would buy, between a minimum of 5 and a maximum of 25 plants.
  - A larger proportion of plants were very large and needed to have leaved trimmed back prior to distribution than in 2015A.
- We also did a special sales trial of multiple varieties this season, in a few sites
  - Field Officers in those sites received a different banana catalog page than those in other sites. The page showed the 5 different varieties instead of FHIA 17 alone and provided comparative information on average bunch size, use, and disease resistance, plus included photos of all the varieties.
  - New varieties were offered under the same price and with the same minimum and maximum rules.
  - Varieties sold alongside FHIA 17 were:
    - FHIA 25: A variety with large bunches similar to FHIA 17 but which is used only for beer making (much less sugar than FHIA 17).
    - Injagi: the most popular local cooking variety in Rwanda; the difference in this product is that it is disease-free tissue culture, whereas farmers can usually only buy local suckers which might be diseased.
    - Mpologoma: a cooking variety similar to Injagi but with a shorter plant stature and potentially slightly higher yields.
    - Sugar Baby: a dessert variety with small banana fingers; it is comparable to the popular local Kamaramasenge banana but unlike Kamaramasenge is supposed to be resistant to fusarium wilt.
  - The sites in the trial were concentrated in 3 sectors, as shown below:

District	Sector	Number sites	Altitude	Agro-ecological zones	% client banana adoption in 15A
Bugarama	Rwimbogo	4	1400-1800 m	Cyangugu	6%
Gisagara	Ndora	4	1400-1800 m	Central Plateau, Mayaga-Bugesera	1%
LWH East (Rwamagana)	Karenge	4	1400-1600 m	Eastern Ridges	18%

2016B:

- In this season we did a small trial to sell FHIA 17 banana plants in B season (marketing November-December, distribution January-February) for the first time.
- The price, ordering rules and marketing materials were the same as in 2015A and 2016A.

- Distribution of the ordered plants took place at the same time as normal agricultural input distribution, with banana crates just added into the truck with other inputs.
- The sites in the trial were selected from multiple sectors across the Eastern region, in both the Eastern Savannah and Eastern Ridges agro-ecological zones.
    - We chose to concentrate on the East because generally that is where demand was highest in 2015A and 2016A.
    - Details characteristic of sites from that trial are shown below:

District	Sector	Cell	Altitude	Agro-ecological zones	% Banana adoption in 15A
Gatsibo	Gitoki	Karubungo A	1400-1700 m	Eastern Savannah	N/A
	Rugarama	Matare A	1400-1600 m	Eastern Savannah & Eastern Ridges	13%
	Kiziguro	Matunguru A	1400-1700 m	Eastern Savannah	N/A
	Kiramuruzi	Nyabisindu B	1600-1800 m	Eastern Ridges	9%
LWH East (Rwamagana)	Karenge	Bicaca B	1400-1600 m	Eastern Ridges	15%
	Gatsibo	Nyabicwamba A	1400-1600 m	Eastern Savannah	19%
	Karenge	Nyabubare A	1500-1700 m	Eastern Ridges	7%

- During the 2016B distribution period One Acre Fund surveyed over 2,500 clients to learn about reasons for adoption and non-adoption of banana plants, as well as to get estimates of client satisfaction and current plant health for 2015A and 2016A adopters.

2017A:

- We again offered FHIA 17 plants for sale across all One Acre Fund districts in Rwanda, though in 2017A this also included new districts Nyagatare and Kayonza for the first time.
- Farmers could choose any number of plants to order between the minimum of 5 and the increased maximum of 100.
- We planned to distribute the banana plants together with normal agricultural inputs, in the same trucks, for the first time during an A season.
- Since this would have dramatically reduced transport and staffing costs, we decided to lower the banana price to 590 FRw/plant before interest (which would have been around 700 FRw/plant after interest).
- Marketing materials were similar to those used in 2015A and 2016A, except that we put an increased focus on testimonials from 2015A adopters who had already harvested their plants, and the decrease in price.
- There were supply issues that meant we only were able to pick up 7,000 plants by late October. We sent those plants to priority sites identified by the Field Operations team, in Nyagatare and Kayonza, and had to cap clients at 5 plants each. We were forced to drop the orders for the remaining districts and cells.
- For the purpose of adoption analysis below, however, we will still look at original orders on contracts, since this is a better reflection of demand.
- It is not completely comparable to the 2015A-2016A orders, though, because those orders reflect actual pick-ups.

Results & Interpretation

2015A-2017A Full Scale Sales Adoption Results

Region	District	% FHIA 17 adoption			Plant/adopter		
		2015A	2016A	2017A	2015A	2016A	2017A
E	Gatsibo	15%	5%	3%	5	7.7	12.5
E	Kayonza	N/A	N/A	22%	N/A	N/A	9.4
E	LWH East	16%	3%	1%	5	8.1	9.2
E	Ngoma	N/A	15%	6%	N/A	7.7	9.1

E	Nyagatare	N/A	N/A	25%	N/A	N/A	10.2
S	Gisagara	3%	1%	1%	5	9.3	12
S	Huye	5%	1%	1%	5	9.1	8.8
S	LWH West	7%	0%	0%	5	7.1	17.1
S	Nyamagabe	N/A	5%	2%	N/A	7.3	7.7
S	Nyanza	24%	5%	5%	5	12.5	13
S	Nyaruguru	10%	4%	6%	5	7.8	7.6
SW	Bugarama	9%	2%	2%	5	9.7	11.4
SW	Giheke	6%	1%	1%	5	8.4	13.6
SW	Kibogora	10%	3%	3%	5	9	8
SW	Rusizi	5%	1%	3%	5	8.6	6.6
W	Karongi	6%	2%	0%	5	7.4	16.2
W	Mugonero	8%	2%	1%	5	8.5	8.3
W	Ngororero	N/A	6%	4%	N/A	9.3	7.8
W	Nyamasheke	10%	1%	2%	5	11.2	12.9
W	Rubengera	6%	1%	1%	5	8	8.2
W	Rutsiro	8%	1%	1%	5	7.8	8.9
TOTAL		**8%**	**2%**	**3%**	**5**	**8.6**	**9.8**

This table shows that adoption is fairly low for bananas, at only 8% in the 2015A and even lower in subsequent years. Demand is generally highest in the first season that banana plants are offered in a given area, and then it tapers off in season 2 and 3. Also, demand is higher in the Eastern districts, followed by a few other areas like Nyanza, Nyaruguru and Kibogora. The number of plants/adopter has increased over time, even as total adoption has gone down, probably largely because of the increase in the maximum number of plants that a farmer can order.

2016A Multiple Variety Sale Trial Results

District	Sector	16A Clients	% banana adoption	bananas/ adopter	bananas/ client	% of orders accounted for by each variety				
						FHIA 17	FHIA 25	Injagi	Mpolo-goma	Sugar Baby
Bugarama	Rwimbogo	509	2%	12.5	0.3	17%	0%	40%	20%	23%
Gisagara	Ndora	581	10%	8.6	0.9	23%	7%	21%	8%	41%
LWH East	Karenge	818	6%	9.4	0.5	33%	11%	5%	6%	45%
Total in Trial		1,908	6%	9.3	0.6	26%	8%	17%	9%	40%
Bugarama	Rwimbogo	87	1%	20.0	0.2	100%	--	--	--	--
Gisagara	Ndora	811	1%	11.4	0.1	100%	--	--	--	--
LWH East	Karenge	764	2%	6.1	0.1	100%	--	--	--	--
Total not in Trial		1,662	1%	8.5	0.1	100%	--	--	--	--

The 2016A trial on multiple varieties showed that offering multiple choices did substantially increase total banana adoption in a given area, from around 1% to 6% in the sectors of this trial. It also shows that the most popular new variety was Sugar Baby, with demand even higher than FHIA 17. Injagi also had substantial demand, though it was not as high as that for FHIA 17, except in Bugarama.

2016B Sales Trial Results

District	16B Client	16A Adoption	16B Adoption	16A bananas / adopter	16B bananas / adopter	Bananas / adopter Change
Gatsibo	474	3%	5%	7.3	6.4	-12%

LWH East	275	6%	3%	11.8	5.0	-58%
TOTAL	749	4%	4%	10.1	6.1	-40%

The 2016B sales trial showed that there is some existing demand for banana plants in B season. It was substantially lower in Land Husbandry, Water Harvesting, and Hillside Irrigation (LWH) East in 2016B than in 2016A, but the opposite was true for Gatsibo, so it is hard to draw clear conclusions overall on whether adoption would be much lower in the full program if we sold bananas during the B season. However, in both districts the number of plants purchased per adopter was lower in B season, probably because farmers are afraid of dry conditions and are thus less willing to invest in large numbers of plants.

2016B Survey: Adopters reasons for ordering bananas

Season of adoption	Sample size	High production	3 different uses	High market demand	Plants from laboratory	Plants disease-free at delivery	Saw variety in neighbor's field	Other
2015A	196	79%	48%	16%	22%	11%	8%	6%
2016A	203	69%	67%	9%	10%	6%	4%	4%

2016B Survey: Non-adopters reasons for not ordering bananas

Sample size	Didn't know OAF sold bananas	Don't like FHIA 17	Price too high	Wanted to see neighbor harvest first	Already have FHIA 17	Can get FHIA 17 free	Don't grow bananas	Don't have land for new bananas	High BXW disease in cell	Other
2,227	7%	1%	30%	4%	6%	9%	13%	23%	14%	11%

2016B Survey: Adopter vs. Non-Adopter Comparison

Client Type	Sample size	Grow banana	Land area in banana (ares)	Aware of FHIA 17	Know 3 uses FHIA 17	Want to buy banana in 17A	Variety farmer wished to buy in 2017A				
							FHIA 17	FHIA 25	Injagi	Sugar Baby	Mpologoma
Adopter 15A or 16A	384	98%	17.0	99%	81%	40%	22%	28%	62%	58%	9%
Non - adopter	2,227	68%	10.7	84%	48%	26%	43%	20%	62%	53%	11%

2016B Survey: Follow-up Results for 2015A Banana Adopters

Sample size	Survival rate of plants	Plants with fruit as of Feb 2016	Fruits larger than local	Fruits harvested as of Feb 2016	Bunch weight of FHIA 17 harvests	Satisfied with FHIA 17 purchase	Would recommend FHIA 17 to others
196	89%	11%	89%	10	53 kg	61%	94%

The 2016B survey results showed that:

- Farmers who chose to adopt FHIA 17 plants in 2015A or 2016B were attracted primarily by the high production and the multiple uses of the variety.
- Observing FHIA 17 plants in a neighbor's field did not play a large role in attracting adopters, contrary to our hypotheses.

- The top reasons for non-adoption of FHIA 17 plants were the price, lack of land for growing bananas, high disease (BXW) in the cell, and the fact that the client did not grow bananas at all.
- We found that adopters were much more likely be already cultivating bananas than non-adopters, that they were more aware of FHIA 17 marketing messages, and that they were also more likely to purchase banana plants in future seasons.
- The most popular reported varieties to purchase in the future, if there were a choice, were Injagi and Sugar Baby. Preferences were generally the same between the past adopters versus non-adopters, except that non-adopters had a much higher preference for buying FHIA 17 plants in the future than past adopters, probably because adopters already had the variety and did not feel that they needed more.
- Generally survival rate of the FHIA 17 plants from 2015A was high, at 89%, and farmer satisfactions was mixed but generally high—only 61% said they were satisfied, but 94% said that they would recommend purchasing the plants to a neighbor.
- By February 2016, a full 15 months after purchase and planting, only 11% of plants had fruits and a very tiny fraction had been harvested. Those which were fruiting had larger bunches than local (89%) and those that had been harvested weighed 53 kg on average, in line with phase 1 and 2 trial weights.

Next Steps

- Continue to sell FHIA 17 plants across all districts in 2018A
  - We should so this because in 2017A total plants ordered was sizeable, and demand was especially high in Nyagatare and Kayonza, but we were not able to fulfill those orders.
  - We would expect most of those farmers who ordered in 2017A but who did not get their plants to order again in 2018A.
  - We will again try to sell at a lower price, of 700 FRw/plant, and to deliver the plants at the same time as regular ag input distribution
- Run a new survey in February, 2017 to check on harvests from the 2015A plants again, plus the 2016A plants, and to calculate a new estimate of farmer satisfaction and impact
- Consider sales of new varieties:
  - Use phase 2 trial data from a new side-by-side trial planted in 2015A of the different varieties of tissue culture plants to estimate impact figures for Injagi, Sugar Baby, FHIA 25 and Mpologoma tissue culture plants for the first time.
  - Check on satisfaction and early harvests of the varieties in the cells from the 2016A sales trial.
  - If the impact figures for Sugar Baby and Injagi are promising, include them in the 2018A banana catalog, since we saw such strong demand for those varieties in 2016.
  - Depending on impact numbers we could also consider selling FHIA 25 and/or Mpologoma, but these are less likely due to the lower demand seen in 2016A trials.
- Take efforts to guarantee banana supplies so that we do not have to drop orders again like we did in 2017A.
  - Sign an early contract with FAIM, probably at a higher purchase price.
  - Monitor FAIM's multiplication work closely via regular visits to the lab.
  - If supplies are expected to be lower, either cap orders at a lower maximum than 100 or consider marketing the bananas in a limited number of districts, perhaps only Nyagatare and Kayonza.

References

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