

Tissue Culture FHIA Banana Roll-out- Decisions Meeting Guide

I. Summary of Kaity's Recommendations

**Note: these are my personal thoughts and not representative of Innovation as a whole, i.e. Jesse)*

1. Offer FHIA 17 and FHIA 25 plants for sale in all districts program-wide in 2015A
2. Tell FOs to market the banana product primarily among large existing banana producers, and have a strict pre-payment requirement to limit those who choose to adopt to those who really want bananas (and are thus likely to take better care of the plants without a lot of follow-up).
3. Sell the bananas at a price of 3,000 FRw per 5 pack (pre-19% interest price) and either require or at least strongly encourage up-front cash payment rather than charging the additional 19%.
4. Set a maximum number of ten 5 packs that a farmer can adopt (this would be 3 ares of bananas).
5. Have a big marketing push starting at the end of April when we have scheduled our banana training already anyway, and run this training both in Ihuriros and at umuganda.
5. Run distribution during the month of September, meaning that there would be 3 separate distributions during 15A. The Logistics department says it would be too burdensome to distribute bananas and fertilizer at the same time, but bananas must not be distributed later than September to allow for planting by the end of October.
6. Put together and train a special team of 1-3 banana experts (depending on the size of the district) to help FOs with follow-up, which would involve weekly field visits to all banana clients during the first 3 months after distribution.

II. Product summary

1. Tissue-culture plants, guaranteed disease-free at distribution, supplier states that they will mature faster and have higher yields than suckers of the same variety
2. FHIA 17: multi-purpose banana (cooking, beer and sweet), 60 kg average bunch size, slower to mature and few bananas per year than equivalent local banana (Poyo). Alone FHIA 17 is not adequate for beer production, needs to be mixed with non-sweet variety like FHIA 25, Mazizi or Bavumba.
3. FHIA 25: beer banana variety, 50 kg average bunch size, slower to mature and few bananas per year than equivalent local banana (Mazizi).
4. FHIA 17 and 25 are also resistant to Fusarium wilt and Black Sigotoga, two important banana diseases in Rwanda.
5. Injagi: local variety, for cooking; most popular, currently imported in large numbers. Suckers are easy to find locally but we would offer a tissue culture version of this variety.
6. We could small plantlets in small sacks with soil; there are a few options of ages and sizes, though as explained in the packaging options section.

III. Projected impact summary

Yield and Revenue Comparisons with Closest Local Banana Varieties

	kg / bunch	harvest / mat / yr	Price / bunch	Price / kg	Revenue / mat / yr	Revenue / are	tons / ha
FHIA 25	25.3	0.80	2,336	92.33	1,881	30,092	32.38
Mazizi	11.3	0.80	870	76.99	696	11,136	14.46

	kg / bunch	harvest / mat / yr	Price / bunch	Price / kg	Revenue / mat / yr	Revenue / are	tons / ha
FHIA 17	53.0	0.65	8,745	165.00	5,750	92,000	55.70
Poyo	27	1.30	5,724	212.00	4,250	68,000	32.00

- FHIA 17 bananas were consistently found to have the highest bunch weights, higher than comparable local varieties and FHIA 25
- Both FHIA 25 and 17 have fewer harvests per year than local varieties, though our data for the most comparable local variety to FHIA 25, Mazizi, showed the same number of harvests per year.
- The average bunch weight used for FHIA 25 here is lower than what we saw in a number of other sources, where it was 40-50 kg on average. These data were used because they provided the most direct comparison to Mazizi.
- These comparisons are used in the impact calculations below, and they suggest fairly conservative impact, because when you compare the FHIA varieties to the average local banana or to replacing maize or beans with bananas then the profit difference is actually higher.
- Additionally, there are many additional suspected benefits which have not yet been confirmed by our trials and thus are not included in these impact calculations: FAIM TC plants should produce for harvest more rapidly than other plants (within 12 months on their farm), number of bunches per year should be higher for TC FHIAs than for the FHIAs we previously tested; suckers could be sold to neighboring farmers for up to 500 FRw/sucker;

FHIA 25: Impact per adopter

100% Adoption	5 year total, FRw	ROI, 5 year total	Avg Impact / year FRw	5 year total USD	Avg Impact / year USD	Total PDV (FRw)	Total PDV (USD)
5 plant adopter (no suckers transplanted)	17,141	571%	3428.1	\$26.37	\$5.27	6,517	\$10.03
5 plant adopter (1 sucker/plant/year transplanted)	39,651	1322%	7930.1	\$61.00	\$12.20	20,933	\$32.20

FHIA 15: Impact across all clients

23% Adoption	5 year total	Avg Impact / year	5 yr total	Avg Impact / year	5 year total PDV (FRw)	5 year total PDV (USD)
Impact across all clients (no suckers transplanted)	3,942	788	\$6.07	\$1.21	1,499	\$2.31
Impact across all clients (1 sucker/plant/year transplanted)	9,120	1,824	\$14.03	\$2.81	4,815	\$7.41

FHIA 17: Impact per adopter

100% Adoption	5 year total, FRw	ROI, 5 year total	Avg Impact / year FRw	5 year total, USD	Avg Impact / year USD	Total PDV (FRw)	Total PDV (USD)
5 plant adopter (no suckers transplanted)	22,500	750%	4500	\$34.62	\$6.92	8,890	\$13.68
5 plant adopter (1 sucker/plant/year transplanted)	66,000	2000%	13200	\$101.54	\$20.31	25,565	\$39.33

FHIA 17: Impact across all clients

15% Adoption	5 year total, FRw	Avg Impact / year FRw	5 year total, USD	Avg Impact / year USD	Total PDV (FRw)	Total PDV (USD)
5 plant adopter (no suckers transplanted)	3,375	675	\$5.19	\$1.04	1,333	\$2.05
5 plant adopter (1 sucker/plant/year transplanted)	9,900	1,980	\$15.23	\$3.05	3,835	\$5.90

- These calculation assume a post-19% price of 600 FRw per plant, or 3,000 FRw for a 5-pack.
- The ROI calculated from nominal impact of the FHIA varieties over 5 years and the nominal cost of 3,000 FRw per 5-pack suggests very high returns for both FHIA 25 and FHIA 17.
- When the impact is converted, using a 25% discount rate, into present day value terms the impact appears much lower but still positive in all cases.
- If farmers harvest suckers from their bananas to transplant and enlarge their plantation then this increases the impact. We have included this rather conservatively, assuming only 1 sucker is transplanted per year per plant, when in reality farmers are more likely to see at least 5 suckers per year.
- Farmers also have the option of selling their suckers to neighbors for direct profits, though in our field trials no farmer had yet reported selling a sucker. If they can sell the suckers then they maybe be able to earn up to 500 FRw for one, according to qualitative evidence.
- Per adopter the ROI and the total impact, both in nominal terms and present day value, is higher for FHIA 17 than for FHIA 25.
- However, from the marketing survey adoption seems to be higher for FHIA 25 than FHIA 17, and the total impact per Tubura client thus seems to be higher for FHIA 25.

IV. Projected demand

- Banana sales roll-out trial yielded 15% adoption in a cell in Karongi and 27% adoption in a cell in Nyamsheke. This was at a price of 800 FRw per plant.
- Adoption appeared to be higher in a marketing survey conducted in December 2013. In this survey farmers did not actually have to place an order, so adoption might be exaggerated. However, the price suggested was only 600 FRw/plant, so you would expect adoption to be higher than in the roll-out trial.

- There are several different ways to rank demand in the various districts, shown in the tables below. But generally the results show that the highest-priority districts would be: Rusizi, Bugarama, Karongi, Nyamasheke, Mugonero, Nyaruguru, and LWH West.

Adoption Rates for FHIA plants (FHIA 17 or FHIA 25, aggregated)

	Adoption Rate	5-packs ordered/adopter	Plants ordered/all clients	Total clients in cells under 2000 m	Total plants ordered
LWH West	44.3%	1.4	3.2	1,196	3,823
Nyaruguru	40.6%	1.6	3.2	1,249	3,982
Mugonero	31.8%	1.7	2.7	3,291	9,046
Rusizi	31.4%	1.6	2.5	10,706	26,677
Bugarama	31.0%	2.4	3.7	3,147	11,656
Average	26.5%	1.9	2.5	179,725	452,684
Huye	26.0%	1.7	2.2	4,720	10,184
LWH East	24.9%	2.3	2.9	3,343	9,730
Nyamagabe	23.7%	1.2	1.4	0	0
Gisagara	22.2%	2.6	2.9	1,490	4,375
Rutsiro	21.3%	1.8	1.9	4,765	8,964
Nyamasheke	19.4%	2.4	2.3	6,716	15,570
Nyanza	17.1%	1.1	1.0	1,059	1,033
Karongi	16.5%	3.1	2.6	5,754	14,742

Districts Rankings under Various Criteria

Rankings by adoption rate		Rankings by plants/adopter		Rankings by total plants	
Rank	District	Rank	District	Rank	District
1	LWW	1	KRG	1	RSZ
2	GRU	2	GIS	2	NYM
3	MUG	3	NYM	3	KRG
4	RSZ	4	BUG	4	BUG
5	BUG	5	LWE	5	HUY
6	HUY	6	RUT	6	LWE
7	LWE	7	MUG	7	MUG
8	GAB	8	HUY	8	RUT
9	GIS	9	RSZ	9	GIS
10	RUT	10	GRU	10	GRU

*Districts in blue appear in top 5 under more than one criterion

V. Current supplies and projected competition

Current Banana Planting Material Supplies- Marketing Survey

Way of acquiring germplasm	% respondents
Get free from neighbors	33.4%
Save own suckers	59.3%
Buy TC plants from a supplier	2.6%
Buy normal suckers locally	3.5%
Cooperative	0.3%
Government	0.9%
Grand Total	

If purchase bananas, where?	% respondents
Agrodealer	2.4%
Cooperative	4.0%
Government	5.6%
Other Farmers	88.1%
Grand Total	

Other TC and FHIA Plant suppliers

- In general, the supplies of FHIA plants and specifically of Tissue Culture plants are still relatively low throughout the country.
- This is the first year that the supplier we will work with, FAIM Africa, has offered tissue culture plants for sale. They expect to sell around 400,000 plants in 15A, including our order.
- In the past the Government of Rwanda has purchased FHIA tissue culture plants from abroad and multiplied some in their own lab at Rubona, and these plants were given to large multipliers.
- Farmers have generally only had access to suckers of FHIA 17 and 25, produced by the multipliers in their areas and distributed through their cell offices. However, only 5.6% of the farmers in our marketing survey reported receiving plants from the government, so the reach of this program is fairly limited.
- The largest program to supply FHIA plants in the country is actually in Karongi, where in 14B the government pushed for the planting of 150 ha of these varieties. However, the effect on supplies to average farmers will not be seen immediately but in the next several years.
- Currently the largest markets for purchasing banana plants, including tissue culture plants, are in LWH West and Gisagara, as shown in the table below, based on our marketing survey data.

Organization	Where they Operate	Scale	Other details
World Vision	2 sectors RUT, 3 sectors KRG, some sectors in GAB, HUY, NRU, GAT, RWM + 8 other districts	60,000 total plants	Work through lead farmers
ADRA	Various locations in country, including RSZ, KRG, GAT, Bugesera	100,000 total plants (projection)	80% sold, 20% free, to poorest farmers
Caritas	Parishes throughout the country; have a branch in Rubengera, already have several large FHIA fields (we have purchased from them)	Undecided	Bought 20,000 passion fruit plants from FAIM, said they might be interested in bananas
FAIM Africa	Based in RWM, sell to organizations	Expect total orders of around	Our supplier, also selling to all others on this

	throughout the country	400,000 total plants	list; might sell directly
RAB/MINAGRI	Major banana program focused in Karongi	In KRG 150 ha FHIA planted in 14B, but no plans for 15A Have not purchased from FAIM in past, used to have own lab which is now closed; have initiated discussion with FAIM to have a regular annual purchase order in future	Give plants free to farmers willing to plant 0.5 ha or more; RAB officer in charge of program still says there is unmet demand for FHIA plants even with their supply push

District	% buy normal suckers	% buy TC	% Total Buy plants
LWH West	21.2%	15.2%	36.4%
Gisagara	19.7%	4.9%	24.6%
Bugarama	5.7%	3.4%	9.2%
Rutsiro	4.3%	4.3%	8.6%
Nyamasheke	1.7%	4.8%	6.5%
TOTAL	3.4%	2.6%	6.0%
Huye	4.9%	1.0%	5.8%
Rusizi	2.9%	1.7%	4.6%
Nyanza	0.0%	3.3%	3.3%
Mugonero	1.2%	0.6%	1.8%
Nyamagabe	0.0%	1.8%	1.8%
LWH Eat	0.0%	1.2%	1.2%
Karongi	0.0%	0.0%	0.0%
Nyaruguru	0.0%	0.0%	0.0%

VI. Scale of roll-out options

1. One District

A. Pros:

- To serve as a test for marketing, logistics, follow-up which may be labor-intensive and expensive
- Could focus where demand is highest, to have higher density of plants/cell, so follow-up work is more justified
- Could focus where expected costs are lowest because the FO team is strong, client density already high, logistics costs lower, etc.
- Could focus where other supplies are lowest, i.e.: not in the East, LWH West, Gisagara, so as to have the highest marginal effect.
- Up-front costs lower; smaller amount of this year's budget used.
- Wait on a larger roll-out after we get our field trial data, giving us greater confidence in the product before we increase the scale.

B. Cons

- In districts which don't get banana roll-out this year they won't be able to get them again until 16A

- Adoption is probably going to be lower in year 1 and higher in future years in a given location. If no bananas sold in a given district then this process for moving along the adoption curve is delayed by an entire year.
- Trainings and FO Instructions will need to be dramatically different for districts with bananas, meaning that meeting prep, communication to field teams, etc. might be more complicated and time-consuming.
- Demand is high everywhere, so why not give all our farmers what they want?
- Success (i.e.: bananas help to increase enrollment) or failure (lower than expected adoption, high plant death) in the district chosen might not be representative of what we could see in a full-scale roll-out and might not be that useful in preparing for a later full roll-out.
- Even if we wait for the field trial data this won't give us great information, since we have only one site to test FHIA 17 and the plants used in those trials are not the same ones we would buy for this roll-out (sourced from RAB and not FAIM, many suckers and not TC plants). Doing a larger roll-out with M&E follow-up would probably give us more accurate information for making future decisions.

2. One entire region (W, SW, E, or S: 2-6 districts)

A. Pros

- Still serves as a test case to work out kinks in logistics, follow-up, marketing for the future, without the cost of a full-scale roll-out, but reaches more people
- Also provides us more varied information on successes and challenges, making the lessons learned for full roll-out planning more representative and useful.
- Within a region all the communication, meetings, trainings could be the same for the full field team.
- Easier to get the proper motivation, marketing spirit when a larger part of the team is involved in a new product roll-out

B. Cons

- Up-front costs/budget will be higher
- Burden on logistics will be higher
- Still misses a lot of clients who want bananas in other regions, and delays the adoption process in those areas
- There will still be a need create different trainings, instructions, etc. for the test region and the other regions, which could reduce efficacy and synergy of HQ work, FD meetings, M&E follow-up program wide, etc.
- Successes and challenges in one region might still not tell us much about how the product would do in the other regions.

3. Full program

A. Pros

- All clients have access to a product which is in high demand and has a high long-term impact without having to wait another full year, so by 16A they might start to see impacts on their incomes and welfare instead of 17A or later.
- An additional year in all areas of operation for the impact multiplier effects to begin: snowballing adoption spread of FHIA plants to neighbors through gifts or sales of suckers.

- Reduced complication and higher efficiency in terms of material preparation, since instructions, trainings, timing for distributions, and use of FO time will be the same across districts.
- We would get a full picture of all successes, challenges and lessons-learned in all regions in order to comprehensively correct all these things before 16A.
- If the roll-out is big and everyone is involved then the energy placed on marketing and follow-up will be higher, which might go a long way to increasing the success of the roll-out.
- With higher stakes we would all work harder to anticipate all possible problems and devote time, effort and resources to preventing them. This might be more difficult to do with a smaller roll-out run by only a few people.
- FAIM Africa, our supplier, offers a discount (425 FRw/plant instead of 500 FRw/plant) for an order of at least 100,000 plants. Also, in future years this price is likely to increase.

B. Cons

- High up-front costs, larger part of the budget needed.
- Higher burden on logistics—would likely have only 1 week between fertilizer distribution and banana distribution
- Higher burden on ops?? (I don't think this is true; the burden per district with the roll-out will be the same whether we do 1 or 12, and the marginal burden for those coordinating at a high level will be reduced because things will be the same everywhere)
- If there is a major problem then it could be very costly. Several possibilities include:
 - i. High plant death in transit because transport and packaging not properly organized
 - ii. High plant death after planting because of poor training and follow-up
 - iii. High plant death due to factors like climate or Kiribiranya infection
 - iv. Lower than expected impact, which might cause the costs to outweigh the benefits
 - v. Farmers place orders but do not pick up plants on distribution day, so we are stuck with extra inventory which we cannot store for long, leading to major monetary losses.
 - vi. FOs are burnt out after fertilizer distribution and aren't able to do a good job mobilizing clients for banana distribution, so we see a lot of drops + other work suffers like Ihuriro meetings, follow-up for planting of field crops, and repayment collection
 - vii. The new banana plants increase credit sizes without increasing incomes in the first year and so we see a drop in repayment

4. All districts but limited by cell

- We would also not do sales in cells with high rates of Kiribiranya
- All cells about 2000 m could be eliminated, since bananas are not expected to do well in these higher altitudes

A. Pros

- All the same benefits as for full-scale roll-out, plus risk is somewhat reduced because plants have higher chance to succeed

B. Cons

- Could overly-complicate meetings, since some FOs won't need the banana trainings and discussing banana marketing will be irrelevant to them, etc.

- Could great discontent among the team or among clients because they think it is unfair that some sites get the product and others do not

5. All districts but limited by farmer

- Instead of or in addition to limiting the roll-out by cell, we could also only allow farmers to purchase the banana plants if they are already banana farmers with a certain minimum area
- We might be able to limit sales to these farmers naturally by requiring a minimum purchase or at least 10 plants, or by requiring farmers to pay for the product in cash prior to delivery.
- We could also give instructions to FOs doing marketing to target the big banana farmers in their sales only when they promote the product.

A. Pros

- Could reduce the need for extensive follow-up, since all those purchasing bananas would already know how to care for them.
- Would likely increase the % of plant survival, leading to both higher impact per adopter and higher interest in adoption among others in 16A.
- If we do impose a difficult requirement like the need to pay cash up-front then this would also help to avoid the risk of extra inventory.

B. Cons

- Very difficult to monitor and control; not realistic to very strictly limit it to large banana farmers.
- If we do impose the requirement to pay in advance this might reduce adoption significantly; perhaps no one would want to buy the plants under these conditions.
- Only wealthier, relatively well-off farmers would be able to afford the option, so we would not be helping the most at-risk farmers (though they could be helped indirectly by gaining access to local FHIA suckers)

VII. Packaging, storage and transport

- We propose a model whereby plants are transported from FAIM to one of the hubs (Giheke, Rubengera or Save) and then onward to the cells.
- Banana plantlets can be purchased at a range of sizes. We needed both a size that would help us to reduce transport costs but still require minimum work between distribution to the farmer and planting.
- One element to reducing transport costs is the use of plastic crates, which would permit easy loading and unloading of the plants as well as permit stacking. Another option would be to construct wooden shelving in trucks, to enable stacking without crates, but this would be very time consuming for loading and unloading.
- The plastic crates widely available in Rwanda (for beer and soda) do not exceed 25 cm in height, so we need a plant that is shorter than this. FAIM initially proposed plants of 45 cm in height, which would be hardier but would not permit easy stacking of the crates
- In discussions with FAIM we determined that a plant of 20 cm in height, in a small plastic basket measuring 5 cm x 5cm, could still be planted immediately and directly by the farmers, though it will need some shade and extra watering after planting. The transport cost savings are significant for the smaller versus the larger plants, so this seems to justify going with the smaller size.

- Our calculations are based on the use of crates of 39 cm x 39 cm x 25 cm, which can be purchased for 6,000 FRw at a market in Kigali. We will continue looking into suppliers and can probably find some for even less expensive.
- In hubs plants will be unloaded and stored in a protective structure with shade and guarded at all times during the 3-4 weeks of distribution. We added these costs to the total cost calculations using 2,000 FRw/day pay for guards for 28 days and 300,000-450,000 FRw needed to construct the shade covering, plus adding a cost for the labor of unloading and loading the crates in the trucks.
- The following table is the summary of all cost calculations, broken down into the two transport legs and the time in-hub, by district and showing the weighted average for all districts.
- The districts are in descending total transport cost order; Gisagara, LWH East, Nyaruguru, Karongi and Mugonero were found to have the lowest transport costs, while LWH West, Nyanza and Nyamagabe have very high transport costs.

District	FAIM to Hub	In Hubs + Loading	Hub to Cells	Total
GIS	37	10	31	78
GAT	37	0	49	86
RWM	37	0	49	86
NRU	37	10	45	92
KRG	37	9	49	95
MUG	37	9	49	95
BUG	42	10	49	101
RSZ	42	10	49	101
NYM	42	10	54	106
RUT	37	9	63	109
HUY	37	9	63	109
GAB	37	10	80	127
NYZ	37	10	86	133
LWW	37	9	89	135
Weighted Average of Districts	39	9	53	101

VIII. Training and follow-up

1. Survival rate for FHIA plants in the sales trial was 81% after 12 months.
2. This was with one training on banana care provided at distribution and essentially now field visits to follow-up on banana care, aside from the administration of surveys in April 2013 (6 months after planting) and December 2013 (14 months after planting).
3. We expect that plant survival will depend on the following factors:
 - i. Quality of plantlet received (strong plantlets received from FAIM, not damaged in transport or storage)
 - ii. Time of planting (before the end of October)
 - iii. Proper planting (depth of hole, organic matter added)
 - iv. Mulching and weeding in the first 2-3 months

- v. Adequate water received in first month (water if no rain for 3+ days)
 - vi. Climatic factors (not above 2000 m, not too cold in first month after planting, well-drained soil)
4. We can attempt to increase plant survival by:
- i. Signing contract with FAIM requiring only quality plants, sending someone to monitor.
 - ii. Providing training prior at distribution (possibly prior and after as well, which was done in Kenya roll-out trial).
 - iii. Requiring FOs to do field visits 1 time per week with all banana clients during the first 2-3 months after distribution.
 - iv. Collecting KPIs on planting, compost application, mulching, weeding and plant survival during the first 2-3 months.
5. Clearly the big question is whether our FOs have enough time to devote to these tasks to make them successful, or whether the time needed for good follow-up would be in conflict with other required tasks.
6. There are a few options for structures which could help with follow-up:
- i. Hire (or just re-allocate) 1-3 “experts” per district who will be trained in-depth on banana care and can do field visits and provide support to FOs and FMs for banana clients.
 - ii. Add the follow-up support as an additional task for existing Innovation officers, M&E Officers, FMs, AFDs, Solar Warranty officers.
 - iii. Focus mainly on FO-level follow up, with big push in terms of KPIs, multiple trainings, and communication during meetings.

7. Pricing options

- The impact calculations made above as well as the adoption projections were based on a price of 600 FRw per plant after the 19% service fee, or 500 FRw per plant prior to the fee.
- Of course, this might not be the ideal pricing option to offer. We can use the 21% adoption rate found in our roll-out trial at 800 FRw/plant to impute adoption percentages at various prices.
- The following chart lays out four potential price options with the margin, adoption and impact calculations per price.
- This analysis suggests that Impact as a percentage of the cost to Tubura is highest with a large distribution and a lower price, though the margin earned by Tubura per plant is clearly higher at a higher price, even with the drop in adoption that comes with a higher price.

Cost to Tubura (small distribution)		595		
Cost to Tubura (large distribution)		526		
Price options before 19%	500	550	600	700
Price options with 19%	595	654.5	714	833
Margin after 19%, small distribution	0	60	119	238
Margin after 19%, large distribution	69	129	188	307

Expected Adoption Under Each Price	39.0%	30.0%	22.0%	17.0%
Impact in Year 2 for FHIA 25 at each price	2369	2315	2255	2136
Margin weighted with adoption, small distribution	0	17.85	26.18	40.46
Margin weighted with adoption, large distribution	26.91	38.55	41.36	52.19
Impact for total clients (weighted by adoption)	923.91	694.35	496.1	363.12
ROI per client	155.3%	106.1%	69.5%	43.6%
Impact/cost to Tubura, small distribution	155.3%	116.7%	83.4%	61.0%
Impact/cost to Tubura, large distribution	175.6%	132.0%	94.3%	69.0%