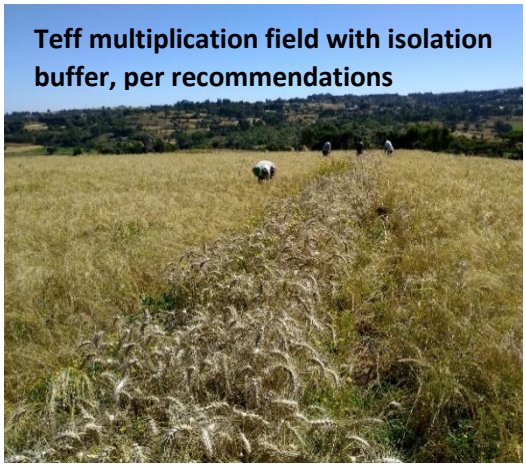
Ethiopia 2018 Teff Seed Project Report

Farmers First

Background & Justification


Teff multiplication field with isolation buffer, per recommendations

Prior to the start of this project, One Acre Fund (1AF) Ethiopia conducted a 3-year project focused on increasing farmer adoption of row planting. We found major difficulties in getting farmers to adopt row planting because of its labor-intensive nature and relatively small effects on yields increases. But in the course of that project we also learned that a major problem facing teff production was a reported lack of good quality seed.

In a survey conducted with 300 farmers in 2017, 1AF found that 51% reported lack of quality seed as a major constraint to their teff production. From BoA aggregated reports of demand and supply for the 2017 season, only 54% of the estimated demand for improved C1 teff seed was actually made available, and of that total 39% was from Federal sources, so only 61% came from multiplication inside Amhara. Strangely, though the available supply was far below estimated demand, only 87% of the seed made available was actually purchased and planted by farmers. Anecdotally we were told that the explanation lies in the fact that not all C1 certified seed is actually of excellent quality; sometimes farmers refuse to by the seed which the government provides, stating that it is mixed up with weed seeds or other varieties. Also, farmers tend to demand certain varieties of teff seed, in particular Quncho, but the C1 teff provides if often of other, less popular varieties. All this evidence suggests that 1AF could help make positive impacts by supporting on stricter C1 teff seed multiplication within Amhara to increase the total quantity of available C1 teff seed of Quncho and other popular varieties, and to increase the quality of that seed as well, beyond just achieving nominal certification.

1AF Ethiopia started a new pilot project set run from April 2018-April 2020, for which we signed a government agreement for 2 years, with the goal of increasing the amount of good quality teff seed available in the Amhara Region of Ethiopia. To this end we planned to partner with Producer Cooperative (PC) multiplier organizations in two different woredas (Yilmana Densa in West Gojjam and Dejen in East Gojjam), to support on land selection, quality input seed supply, training, field follow up, rule enforcement, proper warehouse receipt and organization, seed cleaning and bagging and produce quality teff seed for sale to farmers in the next season. In our theory of change we hoped to make positive impacts on the multipliers and PC partners themselves in the first year and generate impacts on downstream farmers as well who would get access to our seed.

Trial Set-up & Objectives

Dejen work set-up:

- This woreda is a high potential teff area with yields higher than other parts of Amhara, around 16 Qt/ha on average, and with lower risks of pests, diseases and lodging. They have heavy clay,

black vertisol soils that are generally not used for many crops other than teff, so getting rotation of crops from year to year (nominally necessary for seed multiplication) is difficult.

- In our original Seed Agreement with the Amhara Region, we planned to multiply 936 Qt of C1 teff in Dejen. But by the time we worked out more detailed we had changed this to:
    - 300 Qt C1 Kora variety teff, on 20 ha of land, with around 40 farmers
    - 900 Qt C1 Quncho variety teff, on 60 ha of land, with around 120 farmers


Weekly field visit by 1AF Seed Agonomist

- In this woreda we partnered with an organization called Ghion Union that is not itself a PC, but that partners with different kebele-level PCs, with their main activity being to collect and resell grain of teff and other crops. Ghion Union agreed to partner with us to try out seed multiplication, collection and reselling as well. They promised to run official lab tests, do warehouse pick-ups and organization, run seed cleaning and bagging and sell the seed to BoA.
- Ghion Union and its member PCs did not engage in teff seed multiplication before 2017, when 1AF worked with it for the first time to set up seed multiplication work, albeit at a very small scale (only 32 farmers and 15 ha). This was the second year working with Ghion Union as a partner.
- One Acre Fund hired two Seed Agronomists (PG 2 level staff) to lead trainings and oversee the multiplication field work in Dejen. They were remotely managed by the Seed Coordinator (PG 8 staffer) based in Bahr Dar, which was about a 6-7 hours drive away.
- Kebeles included in the project were:
    - Seed Agronomist 1:
        - Yetnora and Tiq kebeles, both coordinated through Yetnora PC because Tiq has no PC
        - We worked with these kebeles in the previous small project and the Seed Agronomist also returned to work with us again after that first year
        - We only chose to multiply Quncho in these kebeles
    - Seed Agronomist 2:
        - Workhamba kebele and PC
        - Shebshengo kebele and PC
        - These areas were new to 1AF work and seed multiplication as a whole this season
        - We chose these areas because there was interest in multiplying the Kora variety of teff, not just Quncho, and the woreda experts advised us that it would do well in these kebeles
        - We multiplied both Quncho and Kora in these kebeles
        - The Seed Agronomist was also new
- The One Acre Fund support in this project included:

- Detailed field selection surveys to select appropriate fields for program enrollment and measure land size
- Purchase of high quality basic seed, lab tested before distribution, packaged into personalized units for farmers based on land size, supplied to farmers without any payment needed, with the plan that they would pay Ghion Union back in-kind at the end of the season
- Central training sessions for farmers that included: a) planting and general rules of multiplication, b) top dress and weeding, c) rouging of off-types + pest and disease control, d) proper harvesting and threshing recommendations and rules
- Weekly field visits conducted by seed agronomists to monitor fields and work with farmers to correct any problems found
- Strict assignment of seed per field to "risk level" categories and support to keep these separated at seed collection, warehouse storage, lab testing, cleaning and bagging. The ideas was that maybe those with higher risk level would fail certification but those with lower risk level could still pass
- Overall, the intervention in Dejen was only 1 type, not several different trial arms like in Yilmana Densa, and it was most directly comparable to the "T2" trial arm

Yilmana Densa work set-up:

- Although this is also a woreda with common teff production, yields on average are much lower than in Dejena, around 12 Qt/ha, due to climate and soil differences. There is higher disease pressure because of rainfall patterns, and there are more "red" and "mixed" soils and less of the pure black vertisol soil which is the best type for teff
- For the work in this area we partnered with Avola Goshiye Seed Producer Cooperative, a PC which had been active in seed multiplication of teff and other crops for over 8 years.
  - We felt it would be good for us to work with them as they had a quick capacity for high scale and we could simultaneously learn from them while offering support
  - At the same time, we saw clear value adds we could bring.
    - For example, they showed us an expensive seed cleaning machine they had purchased with help from another NGO 2 years previously but never operationalized, and we wanted to help them operationalize it and realize the value of that previous investment.
    - Also, in the 2017 season Avola Goshiye's teff had failed certification for the first time, so it was clear that their practices were not perfect and could be improved
    - They told us that their major need was Seed Agronomist support and if we provided it they thought that they could double their multiplication capacity
  - Because this PC was better-known and established, it had built up a reputation in the past as capable of going a special type of multiplication, 1 generation earlier than most community-based seed multipliers: pre-basic to basic seed multiplication. This requires adherence to stricter rules on isolation distance, crop rotation, off-type control, etc. 1AF decided to work with them again in this season to support this type of multiplication, with the goal of getting basic seed that could be used for the larger program in the following year. This was not a possibility in Dejen, since the PC partner there was new

and inexperienced, and since in Dejen it is difficult to be strict on the crop rotation rule which is crucial for Basic seed multiplication.

- In the Regional Seed Agreement we set forth the following scale and production goals for Yilmana Densa:
    - 2,800 Qt of C1 certified teff, from 220 ha and 960 farmers
    - 520 Qt of Basic teff seed, from 40 ha and 150 farmers
    - 1,000+ Qt of that seed cleaned and bagged and sold directly by PC to BoA, instead of going through middle men
- The 1AF project divided its support across three different "treatment arms" in Yilmana Densa, so that we could compare different levels of intervention and determine what we would do in the future:
    - Common interventions between T1, T2 and T3:
        - Detailed field selection surveys to select appropriate fields for program enrollment and measure land size
        - Purchase of high quality basic seed, lab tested before distribution, packaged into personalized units for farmers based on land size, supplied to farmers who were required to pay in cash on the day of seed distribution
    - Treatment 1 (T1)
        - This included all farmers who got pre-basic seed to plan and were trying to multiply basic seed
        - Only fields with no teff in the previous 12 months were eligible
        - We originally tried to get only Quncho seed, but there was not enough Quncho pre-basic supply, so we also experimented with a new variety called Dagem that some EARI researchers told us was promising and suitable for Yilmana Densa
        - In the end we enrolled 108 farmers and 29 ha in this trial arm, with 9 ha in Dagem and 20 ha in Quncho
        - The support provided by 1AF was almost identical to that for T2, described below, except that Seed Agronomists were told that if there were ever a schedule conflict in supporting or visiting a T1 versus a T2 farmer that T1 always should get the priority
    - Treatment 2 (T2)
        - This was a randomly-chosen subset of all the farmers (921 total) who were enrolled in Basic to C1 Quncho teff multiplication in Yilmana Densa
        - 285 farmers were chosen to be in this group, on 69 ha
        - Note that these treatment assignments happened after the initial field measurement and enrollment survey, assignment of seed quantity and distribution of seed to the farmers, so the seed support was identical between T2 and T3
        - Special features of the program for T2 over T3 included:
            - Central training sessions for farmers that included: a) planting and general rules of multiplication, b) top dress and weeding, c) rouging of off-types + pest and disease control, d) proper harvesting and threshing recommendations and rules

- Weekly field visits conducted by seed agronomists to monitor fields and work with farmers to correct any problems found
- Strict assignment of seed per field to "risk level" categories and support to keep these separated at seed collection, warehouse storage, lab testing, cleaning and bagging. The idea was that maybe those with higher risk level would fail certification but those with lower risk level could still pass

  - Treatment 3 (T3)
    - This was the other 636 farmers from the total enrolled in Quncho C1 multiplication in Yilamana Densa, randomly assigned not to receive the intensive T2 intervention. Their land totaled 153 ha
    - On the day of seed distribution, the treatments already started to diverge, as the plan was for DAs to train these farmers on seed planting rules, not the 1AF Seed Agronomists
    - After the seed distribution day, the Seed Agronomists were instructed not to do any additional support for these fields. The farmers were not mobilized to come to subsequent trainings, Seed Agronomists were not supposed to visit them in their fields, etc.
    - However, we do know there was some spillover between T3 and T1/T2, because in some cases the same farmer had different fields enrolled in multiple trial arms, and also because if a T3 farmer showed up for a training or asked directly for assistance the Seed Agronomist generally tried to help them, in violation of the planned protocol

- There was also a multiplication program sponsored by the Ethiopian Seed Enterprise (ESE), in which that multiplier also sought to work with Avola Goshiye members to multiply additional seed on other land. Since this was happening in same kebeles and concurrently with our program it gave use a good "natural" experiment, and we collected some data on ESE results as well to compare head to head with the 1AF results
- 1AF supported work with 3 total field staff: 2 Seed Agronomists (PG2) and a Seed Expert/field manager (PG5) all based in Yilmana Densa, and with frequent visits and close support from the Seed Coordinator (PG 8) based out of Bahir Dar. Yilmana densa is only about 1.5 hours away from Bahir Dar HQ so close support was much easier to offer
- 1AF worked in 3 different kebeles for this season:
  - Seed Agronomist 1: Goshiye kebele. As the location of the SPC warehouse, this kebele has the highest number of registered SPC members. The majority (580) of enrolled fields and farmers came from this kebele.
  - Seed Agronomist 2: Gube and Konche kebeles. These kebeles bordered Goshiye and also included some SPC members, but a higher proportion were non-members who enrolled in the seed multiplication work anyway. They would pay lower fees but also get a smaller cut of the final SPC profits at the end of the year
  - Note that the T1, T2 and T3 treatments as well as the ESE control all had fields spread across the 3 different kebeles.

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Program Objectives and Critical Questions:

- Achieve the quantitative targets per woreda and seed type listed in the Regional Agreement, or at least no less than 75% of the original goals. If achievement was lower, then this was supposed to be a proof point not to expand in the future
- Quantify total projected impact for multipliers themselves + projected end users of produced seed, compare to 1AF total costs to calculate Social Return on Investment (SROI). The goal was to achieve an SROI of 10+ ideally, but at least 7 to consider future scale-up
- Determine whether there is a clear effect of the more intensive follow-up (T2 vs. T3) on program results including yields, total seed collected and certified, farmer satisfaction, SROI. Is it justified to offer such a high level of support?
- Measure yields for the three different trial arms in Yilmana Densa, and compare to ESE control yields, to determine if the 1AF program has any positive effect on multiplier yields and compare the effect of different factors on yields
- Compare 1AF seed utilization ratios for the pre-basic and basic seed inputs to our output seed, versus these ratios for other multipliers. Try to understand if 1AF is competing for this seed with others and if so are we justified in taking the limited seed or not
- Determine the relative impact of different project components to determine what should be included in future iterations of the program vs. dropped. Are there any system improvements which could increase SROI as we scale up?
- Learn more about the potential opportunities and risks of scaling up seed multiplication in terms of partner (PCs and government) interest and support, issues with inputs (especially basic seed and cleaning machine materials) available, ease of enrolling new farmers and fields, ease or difficulty of selling produced seed, etc.

Project Results

As shown in the Aggregated Results table on the next page, One Acre Fund managed to produce, collect, clean, bag and obtain certification for a total of 2,207 Qt of teff seed through this project. This represented 22% of the total certified and packaged production in Amhara in this season, and the Quncho seed specifically made up 38% of all Quncho seed in Amhara.

However, only 1,774 Qt of the 1AF-supported seed (80%) was actually purchased as seed by BoA or directly by farmers. All of the seed actually successfully sold by 1AF partners was the Quncho variety, and most was C1 Quncho. There was a much lower demand than expected (or perhaps problems coordinating to match supply with demand) for basic seed and for C1 Kora.

Collected seed, sampled by lot for quality testing

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Simple Aggregated Results

Woreda + Seed Type	Ha enrolled	% fields passed field inspection	Total seed collected (Qt)	% seed turned in out of expected production	Seed cleaned and bagged (Qt)	% Collected seed lots passed certification	Seed Utilization Ratio: output of certified, bagged seed / input seed	Seed purchased by BoA or farmers in program (Qt)
YD T1- Basic Dagem*	9	100%	63	72%	57	100%	25.2	0
YD T1- Basic Quncho*	20	100%	175	62%	136	100%	27.2	56
YD T2- C1 Quncho	70	98%	462	59%	440	100%	25.1	440
YD T3 – C1 Quncho	153.4	99%	1,119	52%	1,036	100%	27.0	1,036
Dejen C1 Quncho	54.6	100%	620	73%	595	100%	43.6	242
Dejen C1 Kora	26.7	98%	314	75%	142	68%	21.2	0
CONTROL: ESE C1 Quncho in YD	167.3	100%	99	4%	0	0%	0.0	0
CONTROL: ASE C1 Quncho in Shebel berenta*	197.9	100%	2,943	82%	2,001	100%	40.4	Not yet known
TOTAL 1AF, Quncho	298	99%	2376.1	57%	2,207	100%	29.6	1,774
TOTAL Amhara, Quncho	977	98%	7,632	48%	5,946	98%	24.3	Not yet known
TOTAL 1AF, all varieties	333.7	99%	2,754	58%	2,405	95%	28.8	1,774
Non-1AF multipliers, all varieties	1699	87%	12,200	53%	8,707	98%	20.50	Not yet known
TOTAL Amhara, all varieties	2034	89%	14,827	29%	10,796	98%	21.2	Not yet known

*Both the Dagem and Quncho Basic seed produced by Avola Goshiye which was not successfully sold to BoA or farmers as basic seed was sold as high quality grain on the market around August 2019

**Shebel berenta is borders Dejen to the East and is very similar to Dejen in terms of Ag zone, soil and other physical characteristics

Main text written by: Kaitlyn Smoot

Last updated: December 2, 2019

We fell short of our production goals for all seed types in both Yilmana Densa and Dejen, but we exceeded our goal in terms of the amount of seed to help Avola Goshiye clean and bag and sell directly. The main reasons for this were:

- Much lower % seed delivered than expected, at least for all except C1 Quncho in Dejen. We think this happened because:
    - In Yilmana Densa, farmers were not paid any money at all on the day of delivery and were asked to wait 3+ months for payment. This was in contrast to the situation in Dejen, where farmers were paid the seed price on the day of collection at the warehouse, and it caused many of the Yilmana Densa farmers to prefer to sell their seed as grain on the market for immediate cash in hand
    - In Dejen for the C1 Kora seed, farmer deliveries were actually just as high as for the Quncho seed, but the PCs refused to accept much of this seed. There was some mixed up communication between Ghion Union and Quarantine and Ghion Union believed that the Kora was supposed to be Basic not C1 and didn't meet the standards for Basic, so they rejected it. This was a mistake, but 1AF could not get them to reverse the decision.
- Ghion Union delays in seed cleaning and bagging, and poor oversight of that system to ensure it went well and confirm actual loss rates, resolve machine problems, etc.
    - Ghion Union ran this work directly and 1AF just observed, and we had no control over making them go faster or properly monitoring their work
    - They didn't complete the cleaning and bagging process and invite Quarantine to do inspections until the beginning of June, which was very late to actually get BoA to purchase the seed. By contrast, in Avola Goshiye the seed cleaning and bagging process was finished by end of April, and we were able to successfully sell all C1 seed to BoA.
    - This same problem (delayed cleaning = no sales made to BoA) had happened in 2017 for the small seed project and so 1AF staff pushed Ghion Union very hard to go faster, but they still did not make it a priority
- Lower enrollment of ha than originally planned for basic seed: 29 ha of basic planted versus 40 ha planned; this happened because there was low interest in planting the Dagem seed variety and we didn't have enough Quncho pre-basic seed to cover all planned hectares

The Aggregate Results table shows not just total 1AF seed production results, but also compares them to teff production in Amhara as whole and to a few specific "control" multiplier who also produced C1 Quncho seed. A few points of note in this comparison:

- The Quarantine field inspection pass rate was quite high for all seed, but generally higher for 1AF (99%) than for Amhrara multipliers as a whole (89%)
- Seed collected out of expected seed was actually also lower for Amhara as a whole (29%) than for 1AF (58%) even though this was our major obstacle. Some multiplication projects, like the ESE C1 Quncho in Goshiye highlighted in the table, did every poorly here (4%), but a few

projects, like ASE C1 Quncho in Shebel berentel did very well (82%), though this was only slightly better than the rate 1AF got in Dejen (75%)

- The rates of collected seed passing Quarantine lab tests was generally high across the region, though 1AF did slightly better than average for its Quncho seed (100% versus 98%) and slightly worse overall, because of problems with the Kora (95% versus 98%).
    - Generally, though, the results show that Quarantine lab testing is not a major source of loss. By the time seed is actually turned in and accepted by the PC, much of the problematic seed is already eliminated
    - This is intriguing because it suggests there is an informal mechanism to reject bad seed at play other than the Quarantine field inspections and lab tests. For example, we were told verbally that the ESE seed in Goshiye was rejected, which is why only 4% was turned in, but in official Quarantine documentation is was not rejected by Quarantine itself. This still might merit additional investigation
- Seed utilization ratios (Final certified seed/original input seed) are higher for 1AF than for Amhara as a whole: 29.6 versus 24.3 for Quncho, and 28.8 versus 21.2 for all varieties. However, one highlighted alternative multiplier, ASE in Shebel berenta, managed to get higher reported rates of 40.4.
    - Because on average 1AF is still higher than other multipliers, this suggests allocation limited pre-basic or basic seed to 1AF might be a decent choice
    - But it also suggests that 1AF is not "the best," and we should investigate what made the ASE project in Shebel berenta so successful.
    - But also, when you just look at the seed utilization ratio for 1AF's C1 Quncho in Dejen it is even higher than the ASE project, at 43.6.
    - This suggests that the keys to getting high ratio might be:
        - Multiplying in a woreda with higher yields, since Shebel berenta and Dejen are similar, and higher than Yilmana Densa
        - Finding a buy-back scheme that incentivizes farmers to bring their seeds to the warehouse quickly, as they will not have to wait a long time for payment
- We found no significant difference in certification and seed utilization rates for the T2 (intensive support) versus the T3 (no support other than seed) interventions in Yilmana Densa, suggesting that the extra resources we put into T2 were not necessary.
    - However, we have a hypothesis that part of the reason T3 did well was because of spillover from T2, so we don't necessarily want to cut all support in the future, perhaps just reduce it
- These aggregated results do not capture quality differences that might exist across different certified seed lots
    - In theory, because Quarantine applies the same strict standards to all, there should not be differences
    - However, in practice we know that in past years farmers have complained that their certified C1 seed contained off-types and weed seeds
    - We were not able to do any type of sampling of other C1 seed from other multipliers to compare to seed supported by the 1AF project, though this might be something important to consider in the future

- If it turns out there is a quality difference, then a lower seed utilization ratio might actually be correlated with higher quality and thus be a positive indicator, because it means the program was strict and managed to catch and reject bad seed

Estimated Impact & SROI

From inception of this project in late 2017, through decisions-making doing into the 2019 season (which started in April 2019) and then through the time of writing this report, in December 2019 we have worked on several different iterations of the impact model and SROI calculations. The different versions can all be examined in close detail Seed Impact Models folder (see Appendix for more description of the various models). For the purpose of this report we will look at the results of just two versions of this impact model.

Impact Analysis Version 1: From March 2019, for 2019 Program Decision making

The table below shows the estimates of impact and SROI calculated at the time of decisions making in March 2019. It uses total improved seed produced and then projects out the number of downstream farmers and ha likely to be served, and uses an estimate of the marginal yield and price increase for farmers growing grain with improved Quncho compared to local seed, from an older M&E harvest box survey with a large sample size. This model assumes we do not need to compare our seed multiplication results with those of other multipliers, because there is enough basic seed for many multipliers to do this work without competing, and there is a sizeable shortfall between supply and demand, so any additional C1 grown represents pure farmer impact.

2018 Seed Program Impact and SROI estimations, as of March 2019

Project component	Quintals expected to be certified & sold	% enrolled farmers who delivered seed	Estimated total next-season farmer beneficiaries	Estimated total impact (USD)	Estimated Impact per beneficiary	SROI
Basic teff seed, YD	218	67%	12,797	$706,015	$55	56.8
C1 teff seed, YD, multiplication alone	1,418	55%	11,023	$669,858	$60	18.4
C1 teff seed, YD + cleaning/bagging	1,418	55%	11,023	$1,089,383	$99	16.6
C1 teff seed, Dejen	777	70%	4,011	$365,360	$93	13.5

As you can see from this chart, estimates of all the different components were over 10, suggesting that the program is exceeding its goals and should be expanded in the future. Some other comments on the results, and how they shaped our 2019 program decisions include:

1. For teff, not all the seed that was produced on enrolled fields was collected and purchased by the PC partners. The major reasons for failure to deliver were:
    a. Farmers did not pass quality certification (both Dejen and Yilmana Densa)

   b. Payment date was not same as delivery or even announced and farmers didn't want to wait for payment (Yilmana Densa only)
   c. 1AF's partner refused to accept the seed for arbitrary reasons that 1AF disagreed with, mostly because they had already reached their planned quota of seed to buy (Dejen only)
2. In order to project impact for farmers buying the produced C1 teff seed, we used:
   a. **Yield impact:** 1.4 Qt/ha yield increase for Quncho seed over local seed, from a 2016 M&E harvest box survey with 909 fields
   b. **Price impact:** 52 ETB/Qt of Quncho grain over local variety grain, from a 2017 M&E team survey of 705 farmers. Note that this is more conservative than the 199 ETB/Qt price bonus we found in a market price check in April 2019
3. Basic seed multiplication has by far the highest theoretical SROI because it is multiplied across 2 future years, with increasing number of farmers served for the same initial costs
   a. Because of this, we would have liked to increase the portion of Basic seed multiplication if there was adequate suitable land for it and also clear demand for the resulting seed
   b. However, there is a major shortage of suitable land since Quarantine is strict for this type of seed and will only accept land that did not have teff for previous 12 months. A shortage of such land led us to reduce the 40 ha plan to 29 ha in 2018, and this constraint will only get worse over time, unless we consider moving to a new geographic location
   c. Also, we failed to sell any of the Dagem basic seed and only sold 68% of the Quncho basic seed in 2018, and that which was sold went directly to the program for 2019 for new basic > C1 fields. We had heard that there was a lot of competition for Basic seed, so this was surprising. It might have been a temporary coordination problem instead of a permanent constraint, but it doesn't give us confidence to significantly scale up the basic seed multiplication
   d. For 2019 and the near future, we should try to limit basic seed production just to the seed we know 1AF partners will want to use themselves directly for the next year of the program. If we know we will scale up C1 production to a new area the subsequent season we can plan in advance and try to scale up Basic multiplication the previous year
4. The SROI for the Yilmana Densa seed multiplication work is 18.4, but this was 7.2 for the "high touch" model and 42.6 for the "low touch" model, so in future we would like to use a model that is closer to the "low touch" version. In 2019 this entails:
   a. Seed enrollment visits to calculate field area and cluster fields together for group contracting and shared work
   b. Distribution of seed measured out for each farmer's land, combined with a general multiplication rules + planting + early management training
   c. 1 Field visit per field during the first 2 months to check on planting rule compliance, catch and correct problems
   d. 1 Field visit per field during the next 2 months, and before harvest, to check on field management work, catch and correct problems, reject very problematic fields in advance
   e. Oversight at harvest and threshing only of problematic fields
   f. Leveraging cluster leads to check on the end of threshing and ensure farmers do not cheat and top-up with grain, inform 1AF if this happens, coordinate with 1AF and PC warehouse

manager to share threshing date and total bags so numbers and be checked at the warehouse and rejected if cheating is evident

5. When we added in the additional layer of supporting in Yilmana Densa on seed cleaning and bagging, not just multiplication, the SROI decreases to 16.6 although the impact per beneficiary increases from $60 to $99. This is because the money 1AF paid to set up the machine and bagging process was very high. If we support on seed cleaning and bagging in future years, like with Yetnora PC, we will find ways to do it more cheaply. In Dejen, for example, it is possible to rent out machines provided by other companies, and we could simply facilitate the PC partner to do this and cover most of the costs themselves.

2019 Seed Program Decisions

1. Program Elements & Scale:
    a. Yilmana Densa
        i. Continue Basic teff seed multiplication, at the maximum level possible given suitable land and available seed. Likely the same number of ha as in 2018, or slightly less, so around 70 people
        ii. Continue C1 teff seed multiplication, at same or slightly expanded land area when compared to 2018, but with a few changes:
            1. 1AF will not cover seed cost, Avola Goshiye will buy it themselves with revolving fund money, though we will help to check quality and ensure distribution of exact needed quantities
            2. 1AF will provide a medium-low level of support (closer to low-touch than intensive model) for all the enrolled farmers, likely around 1,000 people
        iii. For all teff seed, push Avola Goshiye to purchase the seed at grain price on the day of delivery and then provide the seed bonus after certification
            1. In 2018 they did not have adequate capital for this, but after seed sales in May 2019 they expect to earn $70,000 in profits and can use this to help finance purchases earlier next year.
            2. 1AF will not provide monetary support here, only do finance trainings and help set contract terms
    b. Dejen
        i. Continue C1 teff seed multiplication, but also change the model to be the medium-low level of support just like recommended in Yilmana Densa
        ii. Work only in Yetnora and Tiq kebeles and partner with Emga PC based in Yetnora instead of Ghion Union.
            1. We made this decision because of the many problems faced in Dejen in 2018 which we believe were the fault of Ghion Union, who did not take their MoU promises seriously (severely delayed warehouse pick-ups, delayed cleaning and bagging, mixing up seed by risk level, etc.)
            2. We think that Emga SPC will focus more on seed (versus Ghion Union who only cares about grain trading) and follow the rules better, incentivized by

the fact that they will earn a much larger share of the final seed sales profits than they earned previously. It will also be good to have those profits going to the PC instead of the Union because they are made up of and much closer to the farmer members.

3. Increase the number of enrolled farmers and hectares in those kebeles, to 90 ha and 180 farmers from 41 ha and 87 farmers in 2018 (this would still be more than we had in 2018 total between all 4 kebeles)
4. Use only 1 full Seed Agronomist for this work, but hire 1-3 low-level assistants at busy times of the year

iii. Drop the work in Shebshengo and Workhamba kebeles and end control for the Seed Agronomist working there.

iv. As part of the first-year partnership with Emga PC, to help them get set up for the first time as an independent seed producing cooperative, provide the following support:

1. Continuing to fund a Seed Agronomist to work directly with them on field selection, training, some follow-up visits of fields, monitoring quality of collected seed, overseeing seed cleaning and bagging.
2. Facilitating paperwork and coordination with Quarantine and BoA to get registered as an official Seed Producing Cooperative
3. Financing and running the set-up and operation of a seed quality testing lab
4. Cover the costs of seed bags and tags and sewing machines, while the PC covers the cost of renting a machine for seed cleaning and providing fuel and labor for operation
5. We estimate that this will cost an additional $4,000, based on the costs we spent on these things in Yilmana Densa for the 2018 project

v. For the seed purchases, change the way farmers are paid:

1. In 2018 Ghion Union paid the full amount (grain price + seed bonus) on the day of delivery, which incentivized farmers to cheat and turn in seed mixed with grain
2. In 2019 we propose moving to a model that is hallway between the 2018 Dejen and Yilmana densa models—pay farmers the grain price on the day of and then pay them the seed bonus 1 month+ later, if and when the seed gets certified
3. We will also try to work with Yetnora PC on the contract terms with farmers and get them a higher share of the margin on the seed (in 2018 farmer earned 400 ETB/Qt extra for seed and Ghion Union earned 600 ETB/Qt)

Impact Analysis Version 2: Update in December 2019, 1AF versus Control Multiplier focus

At the time of 2019 decision making, the CD and some other stakeholders suggested a desire to shift the way we looked at seed impact to make it more of a comparison between One Acre Fund's multiplication results versus what would have happened if the same input seed had been used by the average current

multiplication companies operating in Amhara. This analysis required waiting until the end of all seed collection, processing, bagging and certification so that we could get final Quarantine office data and compare. We tried to get the data earlier by speaking directly to the other multipliers, but most of them were not interested in cooperating and sharing data with us, so that was tricky.

In July 2019 when we received the data from Quarantine we did an initial analysis of seed utilization ratios at that time and a quick impact model to see how many more farmers 1AF served than others. But then when more time was available we made one final impact model, the "Holistic Seed Impact model" which will be presented here. The idea is that it captures all the different components that can cause impact to decrease and allows those to vary if we have new information or change the program. This includes many of the parameters shown in the Aggregated results earlier in this report, like yields for the multiplication fields, % seed passes in-field inspection, % seed actually delivered by farmers, % losses during cleaning, % seed lots rejected during lab tests, etc. It is also set up in a way that you can compare a specific intervention to a Control of non-1AF multipliers to determine the marginal impact and the SROI. You can put in actual scale (Ha enrolled) for a given year, or projected scale, or set a normalized scale that is the same for the Control and all interventions to see the comparison more clearly

As of the time of writing this report we have only had time to put in the Control and two interventions, Quncho C1 multiplication in Yilmana Densa and Dejen. But this can be easily populate this with the other 2018 interventions in the coming weeks, and then in future years we can easily update this with new information for both the 1AF interventions and for the control. It could also be used for other crops and perhaps other "out of the box" seed interventions.

Estimated Impact of 2018 Seed Interventions with Holistic Model, normalized to 400 ha scale

Intervention	Scale (ha)	Total quantity of certified seed sold by PC (Qt)	Number of farmers will plant certified seed next season	TOTAL Profits: Multipliers + PC + downstream farmers (ETB)	Total profits per supplied Basic seed (ETB/Qt)	Total costs to 1AF per Qt input seed (ETB/Qt)	SROI #1 for 1AF program: Total profits/costs	T vs. C Impact: 1AF - Control profits, per Qt input seed	SROI #2: T vs. C impact per Qt/ 1AF costs, per Qt basic seed
Control-other multipliers	400.00	1,525	17,076	24,656,959	246,570	n/a	n/a	n/a	n/a
1AF Quncho C1 in Dejen	400.00	3,775	25,365	60,997,801	609,978	40,134	15.2	363,408	9.1
1AF Quncho C1 in YD	400.00	2,540	28,448	40,054,803	400,548	19,587	20.4	153,978	7.9

The results of this chart show that if Dejen and Quncho multiplication interventions received the same scale (Ha and input seed) the impact in Dejen would be 363,408 ETB higher per Qt of seed than the Control, and in Yilmana Densa it would be 153,978 ETB higher. This corresponds with a Treatment vs.

Control SROI of 9.1 in Dejen and of 7.9 in Yilmana Densa, which is very respectable. It doesn't meet our ideal goal of 10, but it exceeds our minimum goal of SROI of 7 in order to scale up.

Overall Learnings & Conclusions

- Generally we think that teff seed multiplication still has enough promise in terms of impact and SROI to continue and scale up slightly, maybe adding 1-2 new PC partners in 2020, but with a few caveats
- It will still be important to start moving to diversify the crop mix, while we still maintain some teff multiplication support to keep the scale
    - One big obstacle we are running into is lack of land that has not been planted in teff in the previous year. This technically means Quarantine should reject the seed (though they turn a blind eye to be pragmatic) and it increases disease pressure, which has become a sizeable problem in Yilmana Densa. Switching to a portfolio with some multiplication of other crops and less teff would reduce this problem somewhat
    - Teff demand vs. supply shortfall is not actually that large, and the difficulty selling all the seed shows that perhaps there is not really a shortfall at all. By contrast some other crops, especially chickpea and other legumes, have a very huge gap between demand and supply and we could offer a lot of value by helping to close it
    - We have struggled to ensure that our own team and the farmers they serve take all the teff multiplication rules seriously, which means we spend a lot of effort on a lower added value in terms of behavior change. This is likely related to the fact that teff is so common and everyone has strong opinions about how to cultivate it and what is necessary or not. If we worked in a newer, less common crop then we might have more luck getting farmers and our team to take the rule enforcement more seriously
    - In terms of yield gaps for improved vs. local seed, the gap for teff is not actually that large, but it is much larger for chickpea, wheat, potato and some other new crops we are considering. So SROI potential is higher for those crops
    - Likely any new crop that we move into will be on a small number of hectares in the first 1-2 years, nothing close to the scale we have been working on in teff
- Likely it is best to focus just on multiplying Quncho, not other teff varieties
    - We struggled with farmer enrollment for Dagem and Kora, and we could not find markets for these other varieties
    - BoA aggregate results suggest that Quncho production currently is not a very high portion of total Amhara seed production even though this variety is so popular
    - We can consider helping to propogate new varieties again in the future if there is a very promising variety with adequate basic seed and farmer interest, but this does not need to be an urgent goal
- Marketing of teff at the end of the season needs special attention and planning

  - Right now we rely on BoA to buy everything, but we need to be more proactive working with them. This could include learning why they would ever eject Amhara seed and still buy from Federal sources, how they estimate "demand" and whether it is overstated or accurate, the deadline by which if they have not received Quarantine results they will not take the seed, how important they think Quncho is versus other varieties, etc. Then some strategies could be developed based on the findings
  - Also, we likely need to be more deliberate and clear (including getting on the same page with government stakeholders) on our plan to only every multiply Basic seed for our own project consumption, and work out plans for the C1 multiplication 2+ years in advance to use to also plan the Basic seed production properly.
  - We should also talk to BoA and other about whether Direct Seed Marketing will be reconsidered for teff again at some point, when that might be and what the implications would be. If DSM or some version of it is possible, then we might want to consider more traditional marketing interventions like efforts to convince buyers that our seed if of better quality than the status quo
- We should try to work in woredas with high teff yields as much as possible
  - A big driver of impact is the quantity produced per unit input, and this will be larger when teff yields are higher due to climate
  - We could consider working in more places in Dejen and also in surrounding woredas in the high teff-yield areas of East Gojjam
- We need to continue to deepen our understanding of impact by:
  - Gathering wider information on "control" multipliers, including making sure the numbers we do have are accurate, checking on how they do work in the field and warehouse, and looking at the quality of their C1 versus 1AF C1, to see if there are differences
  - Working cooperatively with Program team, M&E and CD to refine and finalize a single impact model that we agree to use going forward
  - Considering the question of our seed quality versus other multipliers from multiple angles, maybe including more side by side trials with many sources of C1 seed and focus groups with farmers to examine seed samples and rank and discuss quality
- It is still unclear exactly what our true "value add" is, and we need to do more to trace the theory of change and compare it to control multipliers to figure this out
  - Based on the fact that high-intensity support T2 did not outperform T3, this showed that many trainings and visits might not be necessary
  - We scale back in 2019 to a medium-touch program, but we could think more in the future of scaling back the interventions even further, just picking the most crucial activities and limiting our work to those. This might enable us to get a higher ratio of farmers per Seed Agronomist and reduce costs as we scale
  - Similarly to the staffing cost question, we also need to do some more research, possibly structured trials, to figure out the most cost-effective but still impactful way to support on seed cleaning and bagging
  - Finally, it will be important to think through the design of how year 1 supporting a PC partner should look different than future years, and also possibly determine a timeline of when 1AF should phase out support

- Related to the above, it is worth thinking about the intervention we want to have related to head smudge control
    - In 2018 we found that a large portion of our Yilmana Densa seed was infected with low levels of head smudge. Technically according to Quarantine rules this should have caused the seed to be rejected. But when we informed Quarantine they did not choose to reject the seed, and we did our own additional research into head smudge transmission rates and got the seed tested to find out the precise level. It seemed that with the low levels we were seeding there was not very high risk for downstream farmers
    - However, there is likely a better strategy we can pursue for dealing with head smudge in the future. This might include some or all of the following:
        - Be stricter on testing input seed in advance for head smudge, and do not accept anything that is infected
        - Check field history more rigorously and never work in a field that had head smudge in the past 2 years, possibly be stricter on the rule that teff should not have been grown at all in the past year in the field.
        - To do this it might be necessary to stop working in Yilmana Densa and only work in areas with low head smudge pressure and/or more fields that are not in teff every year
        - Support Quarantine to make disease testing a more official part of their certification process and push/support them to be stricter in actually rejecting infected seeds
        - Connect with ARARI researchers to help propagate information and possibly distribute chemicals if and when they finish their current research into fungicides to treat head smudge and if they release any official new recommendations

Appendix

Potentially Useful Reference Documents

Document	Brief descriptions of contents, potential use	Link
Amhara BoA Seed Supply vs. Demand charts	*Shows teff but also other crops, compares estimated "demand" (gathered from DAs) versus seed collected and certified and supplied to farmers from various sources (current Amhara production, Federal, stock from last year)	ANRS Excel files in Supply vs. Demand folder
Seed Needs Survey	*Questionnaire and results of survey conducted in Dejen mostly in 2017, which asked about different crops and what needs farmers had for seed supply to grow them, if any	Seed Need survey folder
Crop Prioritization Chart	*Work done by Yibeltal + Hillary in 2017, to get large aggregate information for major crops in Amhara, determine current yield gap and drivers, rank them in terms of potential for 1AF intervention	Crop Prioritization work folder
2016 M&E Teff seed survey	*Survey done by M&E team during the row planter project, involved taking harvest boxes from 750+ fields in 5 woredas. Survey included question about type of seed planted, so it was	2016 Teff harvest box data

	possible to do a targeted analysis of the difference in yields for Quncho vs. Local with these data	
Regional Seed Agreement	*Regional Agreement signed in April 2018 to support the 2 season project running through April 2020 * Word summary of interventions and goals + Excel tables showing budget and physical plan by quarter	Regional Agreement folder
Regional Seed Agreement Quarterly Reports	*Reports showing the actual physical achievement and budget utilization by quarter compared to the plan, plus comments on major achievements, challenges faced and lessons learned by quarter	Quarterly reports folder
2018 MoUs with PCs	*Outline of seed multiplication scale goals, responsibilities of 1AF vs. the PC, and other plans for the season *There is one for Avola Goshiye and another for Ghion Union *In the case of Ghion Union an addendum is included when we tried to help with warehousing (though that fell through, we paid and they never used it)	MoU and Contract folder
2018 Critical Questions list	*A list of the different major questions we sought to answers using 2018 results in March to make decisions for the 2018 season project launch in April/May *Most of the questions include answers, which were updated as of end March and use for the 2019 decisions, though they could be updated again in the future as some are still valid for the 2019 season and 2020 decisions as well	Critical questions tab inside 2018 Seed Decisions dashboard
2018 Burden of Proof analysis	*A dashboard set up of different "proof points" that we had to meet to consider scaling up or continuing to trial an intervention *This is central place to summarize what both quantitative and qualitative findings are and what they mean for our decisions *This was last updated in March and as already used to make 2019 season decisions. Going into 2020 decision it would be a good idea to use this final report to update the BoP results, where something has changed, to better guide 2020+ thinking	BoP 2018 Results tab inside 2018 Seed Decisions dashboard
2018 Farmer Season end survey	*Survey of 286 multipliers in program areas, with questions about level of satisfaction with program, desire to enroll next year, what part of the program was most helpful, if they didn't turn in their seed why not, etc	Farmer survey folder
2018 Harvesting and Threshing Survey data + analysis	*Detailed harvest + threshing combined database for 312 fields after cleaning, with representation from all the different treatments and seed varieties, also compared to ESE control *Includes yield estimates as well as some self-reported and observational data on production practices	Teff Multiplication results 2018-19 folder
Stakeholder debriefs	*Questions and answers from discussions with PC or Union leaders, woreda officials, and DAs by woreda *Includes discussion of the major accomplishments and problems in 2018, what improvements are needed, what are the most valuable elements of the program that we should be sure to keep in future	Qualitative Debrief notes folder

Seed cleaning & Bagging results	*Lists each seed lot per woreda, raw seed, the amount of cleaned and bagged seed produced from it, shows the time frame	Cleaning & Bagging KPIs
Different Seed Impact model versions	*Seed Intervention Analysis from before 2018 project started, with teff but also other crop impact model and theory of change *Long-form version of total impact calcs (not versus Control multiplier) made in March 2019 for 2019 season decisions. Includes not just teff but also estimates for potato multiplication, seed cleaning machine, DLS for potato *Impact model looking only at implications of different seed utilization rates, done in July 2019 *Holistic Impact model, a new and easier to follow way of calculating seed impact and SROI, with a stand-alone and a versus control multiplier line in the same model	Seed Impact Models folder