

Big Harvests  
*\$ impact*



Healthy Families  
*QoL impact*



Rich Soils  
*Long-term impact*



# Holistic Impact White Paper

2016 - 2019

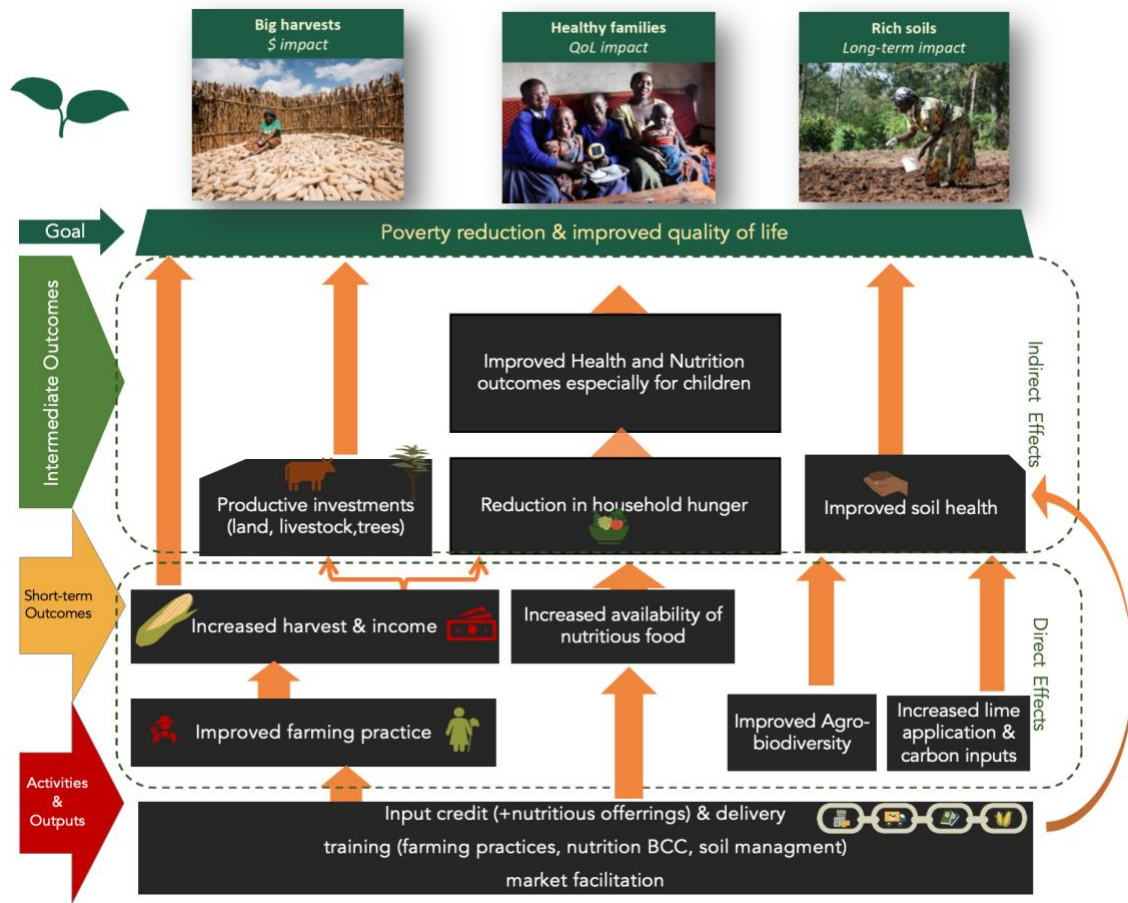


## WHY HOLISTIC IMPACT?

At One Acre Fund, we rigorously measure the outcome of our work on farmers' lives by continually testing program [impact](#) on yields and profits each year. It is important to us that farmers get a return on their investment. We use the \$ impact estimate to make strategic decisions across the organization – for example, we prefer to expand more aggressively in areas that show greater impact potential and slow growth, and focus on researching areas which struggle more to generate impact. We use the \$ impact numbers to calculate the [Social Return on Investment](#) (SROI) for each country, which allows us to compare the \$ impact to each donor dollar invested, to understand where we are getting the most “bang for our buck”.

Over time, we have [expanded our concept of impact](#) to move beyond immediate farmer profit, and into areas that are not easily monetized but which bring meaningful changes in farmers' lives. Specifically, we work towards ensuring that farmers in our program not only get big harvests but also have healthy families and rich soils. We focus primarily on nutrition and soil health because our program has a reasonable chance of impacting those areas, and because better nutrition and improved soil health help ensure longer-term success.

### *Our Theory of Change*






This paper describes multi-year (2016-2019) results of holistic impact measurements to showcase impact across three domains for each of our countries of operation using the impact scorecard. The scorecard groups impact into three categories: **profit and asset**, **hunger and nutrition**, and **sustainable farmland management**.

Each year, as we assess the impact of our program, we learn how to improve the effectiveness of our interventions. Unlike farm profit, whose impact we have reliability impacted and measured for years, nutrition and sustainable farmland management are newer areas of focus. We do not yet foresee dramatic improvements in these areas, and neither are our impact metrics perfect, but we expect to see recent efforts beginning to deliver modest impact. In the past two years, we have conducted dietary diversity training, piloted biofortified crops, introduced lime and trained on its application, and scaled up the provision of trees to our clients. We expect these interventions to increase family nutritional status and improve soil health in the long run.

## HOW WE MEASURE HOLISTIC IMPACT

We employ quasi-experimental approaches, including matching techniques, to estimate program impact. As noted above, we have regularly rigorously measured program impact on harvests and profit through extensive surveys of participating and non-participating farmers each year (further described below). To understand our impact on other dimensions, we have layered on survey modules asking farmers about their hunger experiences, diet, and farming practices. We have conducted these surveys for several years now and, in this report, we take a multiple year average of impact and only include those impacts in which  $p < 0.1$ <sup>1</sup>. The methodology related to each impact area is further described below.

### Metrics Summary

Impact Category	Metrics (% improvement 1AF vs. control; multi-year average)
 <b>Profit &amp; Assets</b>	<b>\$ Impact</b> (gain in profits and asset value for products we offer)
	<b>Asset value</b> (value of all tradable and productive household assets)
 <b>Hunger &amp; Nutrition</b>	<b>Household Hunger Scale</b> <sup>2</sup> (composite past-30 day hunger metric; uses FANTA tool)
	<b>Individual Diet Diversity Score</b> (# of food groups consumed among young children)
 <b>Sustainable Farmland Management</b>	<b>Agro-biodiversity</b> (acres devoted to different crops; uses Simpson's Index)
	<b>Lime application</b> (self-reported lime application amounts (kg) per hectare)
	<b>Soil Organic Matter</b> (self-reported compost/manure/residue amount per hectare)

<sup>1</sup> $p < 0.1$  is weakly stat sig, but we often lack the sample sizes required to detect small effects with greater precision. However, we do this analysis over multiple years, thus reducing the risk of a Type 2 error.

<sup>2</sup>[FANTA](#) seems not to be the best barometer for hunger in our contexts. It focuses on meal skipping and substitution of less desirable foods rather than abject and extreme hunger, like that seen in famine situations. Therefore we are using the [Food Insecurity Experience Scale](#) (FIES) in 2020.

### Profit and Assets

**Profit:** To measure profit impact, our enumerators collect a full range of input cost data, including renting land, fertilizer, seed, labor, plowing, pest management, interest, and program fees from both One Acre Fund farmers as well as their non-participating counterparts. We then physically weigh harvest yields and conduct regular market price surveys to assess selling prices of produce, following which we match One Acre Fund farmers and their non-participating neighbors who are subject to the same weather and agronomic conditions, through a statistical technique called propensity score matching to estimate differences in their harvests. These results are inputted

into an impact calculator that builds-in factors such as input costs, selling price, insurance payments, and the degree to which overall land size is affected by program participation.

**Asset** improvement is assessed through surveying farmers about their possessions and comparing newly enrolled farmers to farmers who have experienced at least one year of program impact. We ask farmers to tell us how many of each asset (e.g., cows, chickens, farming implements, phones, etc.) they have, and then we estimate a \$ value for each. The comparison group is One Acre Fund farmers who have just joined the program but have yet to harvest, who we compare with farmers who have been in our program before (“veterans”). Both of these groups volunteer into the program, which helps mitigate self-selection bias.

### Hunger and Nutrition

We have traditionally measured **Hunger** using the FANTA/Household Hunger scale. This is a six-question module developed by USAID and FAO to understand extreme hunger. For example, farmers are asked whether, in the previous month, they worried about food insufficiency, inability to eat preferred foods, eating a limited variety of foods, eating foods they did not want to eat, eating inadequate quantities of food, having fewer meals in a day, having no food at all, and going to sleep hungry or staying hungry for a whole day and night because there was not enough food and resources to obtain it. The comparison groups are newly enrolled One Acre Fund farmers who have yet to experience harvest, and farmers in our program who have already had (a) harvest(s).

While we have relied on FANTA for years, this index was primarily designed to understand extreme hunger, like that seen in the wake of natural disasters or conflict, rather than meal skipping and substitution of less desirable foods, which is more common in our program contexts. After a careful review of the most appropriate hunger measurement strategies, in 2020 we have decided to switch to the Food Insecurity Experience Scale (FIES). [FIES](#) measures access to food at both individual and household levels based on responses to questions about constraints to accessing adequate food. It consists of a set of eight short yes/no questions about food-related behaviors and experiences associated with increasing difficulties in accessing food due to resource constraints. The construct of the FIES comprises three domains of the food insecurity experience namely: uncertainty or anxiety, changes in food quality, and changes in food quantity. While this report presents results from FANTA, future reports will use the FIES to report hunger.

**Dietary diversity** has been often been assessed using the Household Dietary Diversity Scale (HDDS). However, in 2019, we switched to the Individual Dietary Diversity Scale (IDDS) for children under five years in the household, as it is a leading indicator for childhood malnutrition. The comparison groups are One Acre Fund farmers and Non-One Acre Fund farmers, and we



control for demographic differences and location effects using OLS regression<sup>1</sup> (we cannot compare newly enrolled farmers and veteran farmers because even newly enrolled farmers will have had some nutrition training exposure at the time of the survey). The purpose of the IDDS survey is to document the number of different foods or food groups consumed over the past 24 hours by children 6 – 59 months from farmer households. This reflects the nutrient-intake of the target child over the reference period and is a good measure of their health and nutrition status. The IDDS informs One Acre Fund’s evidence-based nutrition and health programming towards “a future in which every farmer raises a family free of child malnutrition.”

## Sustainable Farmland Management

**Agro-biodiversity** is assessed using the Simpson’s Index of Diversity – a measure of diversity which takes into account the number of crops present (richness), as well as the relative abundance of each crop (evenness of spread). As species’ richness and evenness increase, so does the diversity score. The final variable is between 0 and 1, where 1 represents the highest crop diversity and 0 when no crops are grown. Farmers submit self-reports on the size of land dedicated to different crops.

**Newer soil health indicators:** In 2019, we began to measure **lime application (to improve pH, a measure of soil acidity)** and **total carbon inputs (kg C/ha)** through farmer self-reports. Total carbon inputs include the application, in kg, of manure and quality of compost, as well as kg of crop residue from the previous season. We then convert these measurements into a Carbon/Ha (carbon/hectare) variable. The comparison groups for all sustainable farmland management measurements are One Acre Fund farmers and non-participating farmers. Lime application and total carbon inputs measures were only recently introduced, so we only have a year of data, and we are actively refining our measurement strategies to improve estimations of these two parameters. It is worth noting that the percentage change for some of these measures may look quite high, but that is dependent on other factors – such as the fact that the baseline use of lime is very low. It is important to consider the context of each country and the need to improve soil carbon and pH alongside these estimates.




## HOW WE IMPROVED HOLISTIC IMPACT

The table below is a summary of the impact scorecard showcasing key results by impact category and country. Growth countries refer to those still in relatively early phases of growth, with an average of five years of operation or less. These include Malawi, Tanzania, Uganda, and Zambia.

*Key: Darker shades represent better results*

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<sup>1</sup> A smaller sample size makes the use of propensity score matching techniques less advisable for this analysis.

IMPACT CATEGORY	METRICS	KENYA			RWANDA			BURUNDI			GROWTH COUNTRIES (Avg.)		
		Comparison	Impact	% Improvement	Comparison	Impact	% Improvement	Comparison	Impact	% Improvement	Comparison	Impact	% Improvement
	\$ Impact	\$291	\$136	47%	\$140	\$116	83%	\$146	\$73	50%	\$221	\$51	36%
	Asset value	\$1,618	\$151	9% <sup>1</sup>	\$466	\$233	50%	\$304	\$0	0%	\$1,083	\$74	7%
	HH Hunger Scale	0.37	0.12	32%	0.66	0.09	14%	0.46	0.10	22%	0.285	0.035	19%
	% Reporting Hunger	11%	4%	33%	37%	10%	28%	25%	6%	22%	10%	2%	15%
	Diet Diversity Score	6.87	0.04	0.5%	5.25	0.15	2.9%	5.5	0.04	0.7%	5.77	0.005	0%
	Agro-biodiversity	0.2	1%	7%	0.55	4%	7%	0.68	0.04	6%	0.36	0	0%
	Lime application <sup>3</sup>	0,01	5.02	Infinite <sup>2</sup>	5.2	6.3	121%	No Data	No Data	No Data	0	0	0%
	Soil Organic Matter	120	166	138%	664	-154	-23%	No Data	No Data	No Data	187	Mixed <sup>4</sup>	Mixed

<sup>1</sup>A longitudinal quality of life study shows material asset gains in KE for a subset of farm families in the program for 3+ years, see asset impact results table below.

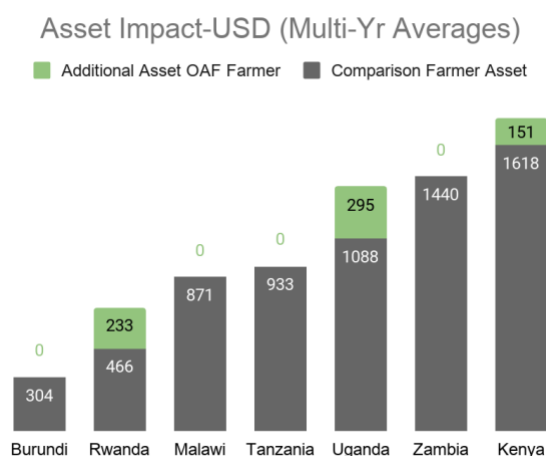
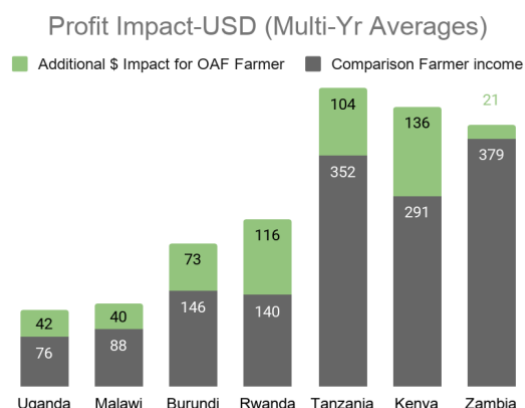
<sup>2</sup>Control farmers apply near-zero quantities of lime

<sup>3</sup>Lime application result: a pH level of 5.5 is about the minimum expected for optimal maize production

<sup>4</sup>Zambia is negative, Uganda positive, Malawi & Tanzania =0

## Profit and Assets

Over the years, One Acre Fund clients have consistently experienced significant improvements in harvests compared to non-participating farmers; however, these harvest improvements vary according to weather patterns and soil conditions. The resulting profit increases across countries range from 36% to 83% (\$51 - \$136)<sup>2</sup>, with five of the seven countries attaining 46% or greater improvement in profit for farmers. The percentage impact was highest in Rwanda (83%), mostly because the baseline profit there is relatively low. Participating farmers also experienced a significant increase in assets – farmers in Rwanda, Uganda, and Kenya had 50%, 27%, and 9% (\$233, \$295, and \$151) increases in assets, respectively. When we conducted a secondary analysis that considered asset-based impact increases with duration of enrollment (up to three or more years), we found significant differences in assets between newly enrolled and older veteran clients in Kenya and Rwanda, our oldest programs (see asset impact results table below). We, therefore, expect the asset-based impact to increase for long-term clients in our growth countries in the next couple of years.



## Asset Impact Results (Veteran vs. newly enrolled farmers)

Asset Measures	Kenya			Rwanda <sup>1</sup>		
	Veteran Client 3+yrs	Newly enrolled	Change	Veteran Client 3+ yrs.	Newly enrolled	Change
Sample size	955	625		322	98	
Total estimated assets (USD) (physical, livestock, financial)	\$2,090	\$1,799	16.20%***	\$238	\$135	76.61%***

<sup>2</sup> These estimates are averages from the growth countries (Tanzania, Uganda, Malawi and Zambia).



Total physical (non-livestock) assets (USD)	\$1,107	\$956	15.80%***	\$19	\$19	1.48%
Total livestock assets (USD)	\$930	\$798	16.56%***	\$219	\$116	88.87%***
Total financial assets (USD)	\$54	\$45	20.23%	Not collected		
Asset diversity (total categories of assets owned/ total possible asset category in the survey)	0.57	0.54	5.19%***	65.66%	58.33%	12.57%
Agricultural asset diversity (total categories of agricultural assets owned/ total possible asset category in the survey)	0.30	0.28	7.26%***	Not collected		

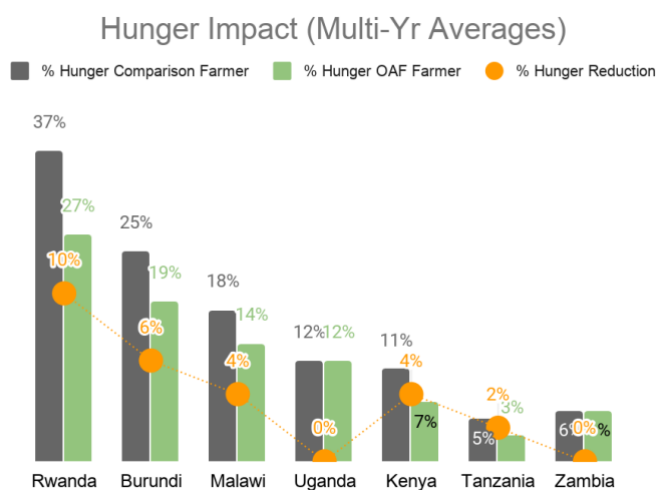
Source: Longitudinal Quality of Life Scan 2015-2019

1. Assets were collected over a narrower category of options in Rwanda in 2019, so they are not directly comparable to Kenya

\*\*\* Statistically significant at p<.01. i.e., highly statistically significant.

## Hunger and Nutrition

One Acre Fund’s theory of change is that improved harvests not only increase profit but also drive down hunger and, subsequently, an improve nutrition for farming families. The FANTA-based household hunger scores were quite low overall, depicting little prevalence of *extreme or crisis* hunger across our program areas. However, there was a marked difference in hunger reports between veteran and newly enrolled farmers with 4% to 10% fewer farmers reporting hunger, in four of our countries of operation. For instance, 37% of newly enrolled comparison farmers in Rwanda reported hunger due to lack of food in the last 30 days compared to 27% of veteran 1AF farmers. These differences account for 32%, 28%, 22%, and 15% improvements in hunger impact in Kenya, Rwanda, Burundi, and growth countries, respectively. As noted above, future hunger reporting will draw from the Food Insecurity Experience Scale, which we hope will provide an even more nuanced understanding of hunger in our program areas.



Reducing hunger is not enough, as many One Acre Fund farm families still do not get adequate nutrition, which stymies growth and development and makes children more susceptible to

illness. We have improved dietary diversity (a leading indicator for childhood malnutrition) marginally in a few countries thus far, with statistically significant improvements of less than 3% in Kenya, Rwanda, and Burundi respectively – we have had a materially greater focus on nutrition in these three countries with more years to develop, implement and learn. In our growth countries, we do not have full-fledged nutrition programs and instead offered more basic training to encourage farmers to grow and eat nutritious crops, so the limited impact was anticipated. We, however, expect our ramped up nutrition efforts to yield even better results in the future.

### **Sustainable Farmland Management**

The third pillar of our theory of change that is critical to long-term sustainability is soil health. Here, we focus on increasing crop diversity, tailoring planting recommendations to each local context, promoting compost use, and encouraging the addition of acidity-reducing lime to soils. We've also expanded our agroforestry programs, which help sequester carbon in the soil, prevent erosion, and increase nutrient levels in the soil. There was a 7% improvement in agro-biodiversity in Kenya and Rwanda, and a 4% improvement in Burundi, with no change reported in other countries that have generally yet to launch large programs promoting diverse crop systems and agroforestry.

Lime application to mitigate soil acidity in Kenya and Rwanda is exponentially higher among clients, with non-participating farmers in Kenya applying near-zero lime. pH levels are, however, higher than the 5.5 minimum requirement in most of our countries of operation except Rwanda and Burundi at 5.28 and 5.45, respectively. Soil organic carbon results are mixed with only Kenya demonstrating a positive impact of 138% – however carbon content was only 1.2%, below the 2% optimum rate for productive agricultural soils. All other countries reported lower carbon inputs than comparison farmers. As earlier stated, we have only introduced soil health practices in the past year, with each of our countries introducing priority soil health practices (carbon inputs addition, lime application, or erosion control). We are also refining our measurement strategies to improve these estimations.

## **OUR ROADMAP TO INCREASING HOLISTIC IMPACT IN 2020**

We are already achieving significant impact in profits and assets in most of our countries of operation. To further increase impact and better insulate farmers from the uncertainties of weather and price shocks, we will increase our focus on crop diversification, improve crop insurance and explore opportunities to connect smallholder farmers to commercial markets. We will also continue to promote hybrid seed maize, improve planting practices, and expand our whole market strategy approach in our more mature countries of operation.

We have achieved decent results with respect to reducing hunger; there is, however, still a need to improve farmer nutrition with a mix of both nutrition-sensitive and nutrition-specific interventions. We anticipate that it will take years of concerted effort to see strong results in this regard. However, our immediate interventions include training farmers on healthy diets, including a new series of flipbook training that likens crop growth to child growth. We will also drive the supply and adoption of biofortified crops, including iron-rich beans, Vitamin A-biofortified orange-fleshed sweet potatoes, orange maize, and maize flour. We will continue to offer a more diverse and flexible catalog of products, including a mix of nutritious vegetables as well as a marketing and behavior change campaigns aimed at encouraging healthy diets and joint decision-making between spouses.

We are just starting to realize some improvement in soil health, but there is more work to be done. We project to pilot and scale a number of interventions in this area including community-level training and behavior change campaigns around erosion control for improved soil health, testing of new marketing and behavioral strategies to improve adoption of lime in the most acidity-prone areas, and an assessment of options for drought-resistant crops. We will continue to train on composting and intercropping and offer lime to help improve soil acidity.

Combined, these efforts promise to increase farmer profits, reduce their vulnerability to price fluctuations on any one crop while also allowing for improved farmer family nutrition, reduce the pest and disease load, and create sustainable farmlands in the coming years. We, however, know from experience that early-stage One Acre Fund programs can risk the achievement of our most central impacts (on profits and hunger) if they try to address all of the holistic impact areas all at once. As a result, we prefer that growth countries prioritize healthy families and rich soil indicators that are most important in their context to improve on in the coming years. We also understand that even with such prioritization, it may take many years of concerted effort to measure any real impact. As a result, it is unlikely that we will see strong results in every category on the chart in every market.