

EXECUTIVE SUMMARY

At One Acre Fund, we have found that measuring farm profit is surprisingly complicated, requiring a number of important assumptions. The purpose of this paper is to outline the major assumptions we have made and the rationale behind those assumptions. We want to share this information in an effort to: (1) transparently communicate how we calculate our farmer impact numbers; (2) be helpful to others who may need to make similar decisions about their measurement methodology; and (3) ideally initiate a sector-wide conversation in order to learn from our peers and hopefully to eventually contribute to greater standardization around how smallholder farm profit is measured.

To this end, we will present our point of view on the following issues related to measuring farm profit:

1. **The challenges of measuring farm profit:** Namely a lack of a standardized methodology, agricultural differences across geographies, and data quality issues.
2. **Our strategy for addressing these issues:** A unified, organization-wide methodology and the use of experiments to test our assumptions and constantly improve.
3. **Why we focus on farm profit as our core impact metric:** Principally to recognize the financial investment farmers make in our program and to facilitate comparison across multiple program offerings.
4. **Selecting the right measurement(s) of farm profit:** Choosing between per farmer and per acre estimates, but also how to measure change in profit (absolute dollar, % change, farmer ROI).
5. **The types of data we collect to ensure our estimates are accurate:** Covering a wide range of topics (demographics, farming costs, farming revenues, harvest market prices, and more).

While we have made significant progress in this area since our early days, we recognize we are on a learning journey with plenty of room for improvement.

Finally, one significant topic not covered in this paper is the issue of establishing an appropriate counterfactual (i.e., selecting a comparison group). To learn more about our thinking on this topic, we suggest consulting our white paper, [Getting the Counterfactual Right](#).

WHY IS MEASURING FARM PROFIT SO DIFFICULT?

Measuring farm profit, One Acre Fund's core impact metric, should be relatively straightforward. Find out how much maize a farmer grows one season, multiply it by the local market price, subtract the costs of farming, and voila, farm profit. In practice, however, there are several challenges that complicate this process.

1. Measurement challenges

- a. **No standard, agreed on methodology** has been established for measuring impact in the field of smallholder agriculture.
- b. **Obtaining self-reported data** on things like agriculture labor and input costs can be challenging. It is prohibitively costly to observe these activities directly, but it is also difficult for farmers (or anyone for that matter) to recall this information when asked.

2. Difficulty in cross-country comparisons

- a. **Agriculture varies across geographies.** The variety and number of crops grown can vary greatly across countries and regions, making comparison across geographies difficult. Additionally, markets for agricultural inputs and outputs may function differently (e.g., improved seed may not be available in some countries, or the strength of markets for harvested crops can vary from place to place).

Data quality varies across countries and time. For example, when calculating the opportunity cost of labor spent on more intensive (and more productive) agricultural techniques, data on appropriate local wages and employment rates could vary in their availability across countries.

HOW DO WE ADDRESS THESE ISSUES?

As an organization that now serves over 400,000 smallholder farmers (as of publication) across a number of different countries and contexts, One Acre Fund has certainly encountered the challenges mentioned above. Over our 10 years of experience measuring farm profit, we have learned a great deal on this topic by consulting the literature and through trial and error. This process has led us to two major strategies for tackling these issues:

1. **Aligning on methodologies to use organization-wide**, based on our experience and research. To implement this strategy, we have united monitoring and evaluation (M&E) in a single department under one centralized director.
2. **Using experiments to test our assumptions** when the literature and/or our own experience was less clear. We have also leveraged peer review in certain cases to land on a methodology. This paper shares several examples of such experiments.

WHY FARM PROFIT?

Before diving into the methodological decisions One Acre Fund has made, it is important to examine why we focus on farm profit as our primary metric. Agricultural interventions have the potential to generate impact in many areas of a smallholder farmer's life: household income, food security and nutritional diversity, access to education, health, housing, etc. While we recognize that many of these areas are critical to a farm family's well-being—and we are beginning to measure impact in a number of these areas—we use profit as our principle metric for impact. There are four main reasons for this.

1. **Farmers make an economic investment in One Acre Fund**, so we feel compelled to ensure that it pays off financially. Additionally, simply measuring increased farm yields – the most direct outcome of agriculture interventions – could be misleading if it required significant additional labor or input costs to generate increased yields.
2. **Monetizing impact allows us to compare across various program offerings.** Profit allows us to compare across countries (programs may vary slightly country-by-country) and across products (e.g., the impact of a solar light versus the impact of improved maize seed). Analyzing the incremental profit created by each activity or country program allows us to compare and make decisions about resource allocation and future areas of investment. Furthermore, this is also how a farmer makes her investment decisions. She'll likely use some of the surplus crop to feed her family and sell some to fund expenditures, further investment, or savings. We believe farmers have the right to spend their surplus how they like, and monetization recognizes this.
3. **Focus on one metric leads to rigor.** By devoting the majority of our M&E mindshare and resources to getting this single metric right, we can be increasingly confident in its accuracy.
4. **Other outcomes are often secondary effects of improved income.** Other desirable impacts, such as access to education and housing, are closely tied to our core metric of profit. That said, as mentioned above, we also care deeply about these additional outcomes and are beginning to measure some impacts beyond profit.

SELECTING THE RIGHT MEASURE FOR FARM PROFIT

While focusing on the farm profit metric simplifies impact measurement significantly, we must also consider a few more variables. These include the unit of analysis (per acre vs. per farmer), how we measure change in profit (\$ gain, % gain, or farmer ROI), and social return on investment (SROI).

1. **Per acre estimates** allow us to assess the profit on each acre planted in our program, compared with land in a comparison farmer's field, to gauge the relative benefit of the program on each acre of land. Farmers often buy One Acre Fund inputs and apply this on a portion of their land. Looking at the impact on only the land planted with One Acre Fund inputs lets us see our impact per acre of land as well as make calculations about the potential profit a farmer could make if she were to plant more of her land with our program.
2. **Per farmer estimates** allow us to understand the impact of program involvement as the individual farmer experiences it for the crops she plants with One Acre Fund. For this measurement, we look at the costs and revenue over her entire farmland devoted to One Acre Fund crops, compared to the costs and revenue of a comparison farmer. This measurement therefore captures any benefit of One Acre Fund training to the full amount of land our clients plant, with and without our inputs. It also allows us to measure profit increases from incremental existing farmland that the farmer is able to plant because of One Acre Fund. Finally, per farmer estimates enable us to capture the dollar impact of any non-farm products (solar lights, cookstoves, etc.).

Because they each provide useful insights, *internally*, we use both per acre and per farmer impact to drive decision-making and program evaluation. *Externally*, we rely on per farmer estimates, because they reveal how our program affects the average farmer, and they capture the impact of the full range of activities and products supported by One Acre Fund.

Once we have settled on the unit of measure (per acre or per farmer), there are three separate ways to measure the impact or change in profit. Example calculations for each metric can be found in Figure 1.

1. **\$ gain in farmer profit** (or absolute dollar impact) is the difference between profit per One Acre Fund farmer and profit per comparison farmer.

- a. **Pros:** Reveals the amount of new resources available to farmers as a result of joining our program. It also allows us to capture the dollar impact of add-on products such as solar lights, cookstoves, and health products, in addition to the impact of agricultural programs.
 - b. **Cons:** Absolute dollar impact is influenced by the starting point of a farmer, especially how much land she has. For example, our average client in Rwanda has almost a half-acre less land to grow on than the average client in Kenya. Additionally, the size of the economy can influence \$ gain. To illustrate, say farmer profit with our program is \$50. That \$50 increase in profit is much more significant in a country where the farmer's baseline is \$25 than in a country where the baseline is \$100. Looking at \$ gain alone doesn't reflect this.
2. **% gain in farmer profit** is the difference between One Acre Fund and comparison farmer profit divided by comparison farmer profit.
- a. **Pros:** This reveals the magnitude of change, even if absolute impact is small. For example, in 2014 the average impact per farmer in Burundi was \$67, smaller than any other country of operation. However, percent change in profit was nearly 100%, by far the largest of any country.
 - b. **Cons:** % gain does not facilitate comparison of One Acre Fund's impact to other ways farmers might invest and metrics such as "cost to serve," which help us understand our efficiency. This metric also does not reveal how much additional money a farmer has in her pocket to spend (e.g., Increasing profit from \$1 to \$2 is a 100% gain, which sounds great, but having an extra \$1 may not be very significant).
3. **Farmer return-on-investment (ROI)** tells us the additional profit a farmer generates by investing one more dollar in One Acre Fund services.
- a. **Pros:** Farmer ROI allows us to compare the impact of our services with other investments a farmer might make.
 - b. **Cons:** While ROI allows us to compare investment opportunities from a farmer's perspective, it does not tell us about the absolute size of the impact. For example, we can imagine a product that might offer a very high ROI, but the maximum absolute dollar impact could still be very small.

Finally, the **social return on investment (SROI)** allows us to examine and report on how efficient we are with the philanthropic funds we raise. While we have a revenue stream and aspire to full financial sustainability in our core program, we do require donor funds to fill the gap between program costs and program revenues, which we call the "donor subsidy." Calculating donor ROI, which is dollar gain in farm profit per farmer divided by the donor subsidy per farmer, lets donors understand the direct impact of their dollar invested. It also allows donors and policy makers to make sensible comparisons among investment options for combatting global poverty and hunger. To learn more about SROI, and how One Acre Fund measures and thinks about it, see our [article](#) from the Stanford Social Innovation Review.

To learn more about One Acre Fund's historical impact results, you can visit the [Impact page](#) of our website, read our [annual reports](#), or review our first ever [comprehensive impact report](#).

Figure 1. Sample impact calculator (illustrative)

| | Comparison (a) | Program (b) |
|--|----------------|--------------|
| (1) Acres planted with program inputs | N/A | 0.35 |
| (2) Acres planted without program inputs | 0.68 | 0.45 |
| (3) Total harvest (90kg bags) | 9.3 | 13.9 |
| (4) Average sale price (per 90kg bag) | \$30 | \$30 |
| (5) Total revenue = Average sale price (4) * Total harvest (3) | \$279 | \$417 |
| (6) Cost per acre on land planted w/ program inputs | N/A | (\$150) |
| (7) Cost per acre on land planted w/o program inputs | (\$101) | (\$106) |
| (8) Total cost = [Cost per acre planted w/ 1AF inputs (6) * Acres planted w/ 1AF inputs (1)] + [Cost per acre planted w/o 1AF inputs (7) * Acres planted w/o 1AF inputs (2)] | (\$69) | (\$100) |
| (9) Profit per farmer per year | \$210 | \$317 |
| (10) \$ gain in farmer profit = Profit for program farmer (9b) - Profit for comparison farmer (9a) | | \$106 |
| (11) % gain in farmer profit = [Profit for program farmer (9b) - Profit for comparison farmer (9a)] / Profit for comparison farmer (9a) | | 50.6% |
| (12) Farmer return on investment = Incremental profit per farmer (10) / Total cost for program farmer (8b) - Total cost for comparison farmer (8a) | | 338% |

DATA WE CAN TRUST

In order to have confidence in the metrics discussed above, it is critical that we have thorough, consistent, and high-quality data. Outlined below are the major categories One Acre Fund has identified as crucial to calculating farm profit. The following data are collected for program and comparison farmers.

1. **Demographic Information:** We aim to collect, at a minimum, some basic demographic information such as age, gender, highest level of education attained, number of household members, and 2-3 poverty indicators. This data serves two purposes. It helps us create reliable comparison groups (since 2015, this includes propensity score matching when possible – learn more [here](#)), and it allows us to analyze data by sub-group, to understand which types of clients we might be underserving and to make programmatic adjustments accordingly.
2. **Costs:** One Acre Fund attempts to be as comprehensive as possible in identifying the costs associated with farming. Capturing all direct and indirect costs is particularly important for agriculture intensification programs like ours (which may increase the costs of farming), in order to ensure that revenues increase more than farming costs. We include the following costs:
 - a. **Land rentals** (per farmer).
 - b. **Fertilizer.** This data is known for our clients (based on how much they take with our program), but we collect self-reported data for comparison farmers.
 - c. **Seed.** Data collection is the same as for fertilizer (above).
 - d. **Farm-related labor** (paid and unpaid). To calculate unpaid labor (e.g., family members), we use total people labor days (total days multiplied by the number of people working). We calculate this for as many seasonal activities as possible (field preparations, planting, top dress fertilizer application, weeding, harvesting, etc.). An appropriate daily wage in the local labor market is applied, discounted by the rural unemployment rate to account for the likelihood that not all unpaid laborers would be able to find paid work for the full number of hours worked. Unpaid labor includes members of a farmer's group (the farmers they borrow, repay, learn, and farm alongside as One Acre Fund clients).
 - e. **Interest and program fees** charged by One Acre Fund.
 - f. **Crop insurance payments.** As of the end of 2016, all operating countries, except Burundi, offered crop insurance (weather-, yield-based, or a combination). We count the cost to farmers of crop insurance (a small portion of what they pay One Acre Fund) because we also count payouts in revenues.
 - g. **Transportation costs.** We collect data on the costs incurred to procure seed and/or fertilizer. One of the principle benefits of working with One Acre Fund is our delivery of inputs to within walking distance of farmers' plots.
 - h. **Additional country-specific input costs.** For example, plowing and pest management are common in Tanzania, while bean poles are commonly used in Rwanda and Burundi.
3. **Harvest Measurement:** The correct measurement of harvest yields is one of the most critical ways to ensure we accurately calculate farmer profit, and don't erroneously ascribe to our program any impact we cannot rightly take credit for. For this reason, we physically weigh the harvests of program and comparison farmers, rather than rely on self-reported data, which could be inaccurate and biased. When measuring harvests, there are four major factors to consider:
 - a. **Selecting the right crops.** We evaluate only crops our program directly affects. For example, in Kenya in 2013, we offered fertilizer along with improved seed and planting guidance for 5 different crops, so we only measured harvests (and ultimately profits) of these five crops across our clients and comparison farmers. In Rwanda, conversely, we offer seed and fertilizer on a few crops, but now provide planting guidance on over a dozen. To cope with the scale, we only collect data on the 5 most popular crops across our program.

- i. If 100% of farmers planted 100% of crops we offer, we could just sum the profits of each crop. However, because not all farmers adopt all crops offered, we have to weight the profits by adoption.
 - ii. Therefore, our unit of analysis is the crop, across a group of program and comparison farmers.
 - iii. To weight profits, we measure average acres devoted to each crop, average harvests, average costs, and average selling price for a randomly selected group of farmers who planted that crop. We then weight the profit for that crop based on the share of land devoted to each crop.
 - iv. In countries like Rwanda and Burundi, we measure the crops to which farmers dedicate nearly 90% of their inputs. For the remaining 10%, where we are unable to physically weigh the harvests of all crops supported by our program, we estimate our impact on non-measured crops as the average profit per acre of all measured crops. This average is applied to the acreage planted with crops that are supported but not directly measured by One Acre Fund.
 - b. **Harvest boxing.** Rather than measure the full harvest of every farmer surveyed, which would be prohibitively expensive and time-consuming, we harvest two, randomly selected 8 by 10 meter areas for each crop measured. The weight of the harvest is measured on site with a portable hanging scale. If the area measured is, say, 1/10 of the total land planted with the crop in question, the harvest will be multiplied by 10 to arrive at an estimate for the full area planted. If there are obstacles in the harvest box (trees, rocks, other plants), we subtract out the surface area of the obstacles and adjust our per-acre averages accordingly.
 - c. **Wet vs. dry measurements and conversion rates.** Harvests can be weighed wet (shortly after harvesting) or dry (after being laid out to dry for a period of time). Measuring wet is easiest, as it can be done in the same visit as harvesting box plots, but dry weights are more appropriate, as this is the weight that would be used to sell surplus at market.
 - i. **Harvest once. Measure twice.** Our M&E staff in primarily maize-growing countries (Kenya, Tanzania, Malawi and Uganda) measure the wet weight and return at a later date to measure dry weights of the harvest. This is resource-intensive, but in these countries our clients have better access to improved seed varieties than non-program farmers. It is possible that different varieties of seed (for the same crop) have different conversion rates, so applying one standard conversion rate to all farmers (program and comparison) could result in inaccurate and biased results.
 - ii. **Conversion weight.** The simplest method for dealing with the dry vs. wet weight issue is to apply a standard “conversion rate” to the wet weight of harvests to obtain an estimate of the dry weight. This eliminates the need to revisit clients to obtain a dry weight later. This method is used in countries in which we measure multiple crops, like Rwanda, and we do not have the resources to devote to separate harvest visits. The conversion rate is based on experimental data.
 - d. **Intercropping.** Measuring harvests of intercropped crops depends on the planting technique. When the spacing of the main crop being measured is unaffected by the intercropping (e.g., if both crops are planted in the same hole), general best practice is that the second crop can be ignored, as it does not “interfere” with the surface area dedicated to the main crop. However, if the intercropped crop is in a space which would otherwise be planted with the main crop, it should be treated as an “obstacle,” and be subtracted from the total surface area of the box plot to calculate a comparable harvest yield per acre.
4. **Revenue.** There are two principle sources of agriculture-related revenues for farmers.
 - a. **Harvest selling price.** An appropriate prevailing price in local markets, collected from local market surveys, is used to calculate total revenue for each crop supported by our program. In some countries, such as Kenya, we provide training (e.g., how to save harvests for longer to receive a higher price) that could increase the average price received by One Acre Fund farmers. When there is evidence that our

clients receive a higher price than comparison farmers as a result of our programming, we can apply this higher price when calculating revenue for our clients.

- i. *Note:* Understanding the rate at which program and comparison farmers consume/sell crops would allow us to identify more precise market prices. Here we have to weigh the costs and benefits of undertaking such “consumption rate” studies. While more accurate data is valuable, this study is incredibly resource-intensive and would delay impact results by several months. As a compromise, we intend to conduct these surveys roughly every three years.
- b. **Insurance payouts.** As mentioned previously, most One Acre Fund clients are covered by crop insurance, which compensates farmers for input costs in the event of adverse weather. When there is a payout, this is counted as farmer revenue (albeit a relatively very small portion of total revenue).

5. Land size.

- a. **Total yields.** In order to calculate total farmer yields (not just yield/acre), we want to know the total amount of land planted *and* the amount of land allocated to each crop.
- b. **Which client lands to measure.** When measuring client harvests, we look at both land planted with One Acre Fund inputs *and* land planted without our inputs, for crops we support. We measure both, as our training impacts even land not planted using our inputs.
- c. **Measured vs. self-reported land size.** Land sizes are self-reported by farmers. It can be difficult for farmers to estimate their plot sizes, so we train enumerators to help them make these estimates. In addition, we have run studies in most of our core countries comparing self-reported estimates of land and measured estimates (either with GPS data or, with small plots, measuring string). In these studies we have found that farmers are not always very accurate but that One Acre Fund and comparison farmers are equally imprecise and there is no bias in terms of land size estimates. Therefore, we feel it is reasonable to continue to rely on self-reported data given the difficulties of directly measuring land size over our massive impact samples.
- d. **Equalizing land size.** In some countries, One Acre Fund farmers have larger land sizes for One Acre Fund-supported crops than comparison farmers, on average. There are two possible explanations, and corresponding strategies for dealing with them.
 - i. Selection/pre-existing differences in land size: Farmers who select into our program may be more likely to have more land. In land-constrained countries like Rwanda or Burundi, land-size differences are probably systematic (and not a result of our programming). Therefore, we “equalize” per farmer impact calculations by “grossing up” the profit of comparison farmers to what it would be if they farmed as much land as the average program farmer. To illustrate this, imagine program farmers earn an additional \$100 in profit, on average, but comparison farmers plant 70% as much land. We would reduce the impact estimate for program farmers to \$70.
 - ii. Increased land size resulting from joining One Acre Fund: Farmers who join our program may plant additional land (usually existing land that was previously left fallow, occasionally renting or purchasing more land to plant) as a result of greater access to credit, inputs, and training. So larger average land sizes could be an outcome of our program – because it includes credit, which should allow farmers to purchase more inputs than otherwise – rather than a pre-existing characteristic of One Acre Fund clients. This is more likely in countries like Kenya and Tanzania, where land is more abundant. In a hypothetical scenario where 100% of the difference in land sizes between One Acre Fund and comparison farmers was due to One Acre Fund’s program, we would not equalize land sizes at all.
 - iii. A combination of both: Oftentimes we see that One Acre Fund farmers have more land partially because of pre-existing difference and partially because our program has enabled them to plant additional land. To test the explanatory power of each factor, we can run a difference-in-

difference analysis, looking at how much extra land a farmer plants during a season with our program relative to a prior season without it, minus how much extra land a comparison farmer plants in that same season relative to a prior season (both seasons without our program). In 2015 we ran such a study and found that, conservatively, 50% of the larger land size in Kenya and 20% in Tanzania appeared to be a result of joining One Acre Fund. We would take this into account in adjusting impact based on differences in land size (i.e., we would equalize only an appropriate portion of the land sizes). In countries where we have not yet run this analysis, we take the conservative approach and assume that all land size difference is due to selection (and not a result of our program) and equalize land sizes, as in the first bullet above.

- iv. **Illustration:** To illustrate this concept, see Table 1 below. This shows the results of a difference-in-difference study in Tanzania, which suggests that farmers who were not with the program in 2015, but joined in 2016, farmed ~.10 acres more land on average than farmers who never joined, suggesting effects related to One Acre Fund’s program were responsible for that difference. On average, in 2016, One Acre Fund clients farmed .47 acres more than comparison farmers. Given the results of the difference-in-difference, we can assume that .10 acres of the .47 acre difference (or ~21%) is a result of One Acre Fund’s program. We use 20% to be conservative.

| Table 1. Tanzania 2015-2016 difference-in-difference results (Excludes those with changes of more than three acres) | | | | | |
|--|----------------------|----------------------|---------------------|------------|---------|
| | 2015 total land size | 2016 total land size | Sample | Difference | P-Value |
| Did not join 1AF | 2.34 | 2.54 | 535 | 0.20 | |
| Joined 1AF | 2.86 | 3.17 | 582 | 0.31 | |
| | | | Diff-in-Diff | 0.10 | 0.052 |

6. **Other considerations.**

- a. **Monetizing yield.** One Acre Fund’s impact calculation monetizes all yield that is grown, since when an incremental bag of maize is eaten by the family, it displaces a bag of maize they would have had to purchase.
 - i. However, we do know post-harvest loss, from pests and mold, ‘consume’ some of the surplus yield that is grown. As of the writing of this paper, we are in the process of estimating this effect, but because One Acre Fund provides training and products (e.g., hermetically-sealed storage bags) that control farmers struggle to access, we think it is very likely that our reported % gain in profit will increase once we factor this in (\$ gain in profit could move in either direction depending on the magnitude).
 - ii. One Acre Fund farmers may also give surplus crops away to family members, neighbors in need, etc., but we presume the families who receive these crops generate at least the same utility as

the One Acre Fund farmers who gave them away, and hence do not ‘penalize’ the impact calculation for this.

- b. **Spillovers.** As we continue to improve the rigor of our impact calculations, we have begun to see evidence that our programming has spillover effects on clients who leave the program (temporal) and on our clients’ neighbors (geographic). While we’re very excited about the potential for our work to benefit even those outside our program, if spillovers do exist, this could cause us to understate our impact by raising the average profits of comparison farmers. There are two channels through which spillovers could occur.
 - i. **Geographic.** Geographic spillovers occur when our practices are adopted by neighboring farmers. We have [some analysis](#) showing that non-program farmers in areas of longer program duration do harvest more than farmers in areas of new program involvement, controlling for differences both in farmers’ characteristics and geography. When we have firm evidence of program spillover, we adjust our annual impact estimates to account for this. In 2015, we had such evidence in Kenya, and this adjustment increased our estimated impact by ~5%.
 - ii. **Temporal.** It is possible that ex-clients have retained some program benefits in terms of improved farming practices and thus have higher yields than they would otherwise. However, clients might exit the program for reasons (like finding other employment), which also influence their yields. Therefore it is difficult to know how much of subsequent yields are due to program participation. As of this writing, we remove all former clients from comparison groups, so temporal spillovers should not affect our impact estimates at this time, but we will continue to study this issue.
- c. **Full farm profit.** One Acre Fund currently only measures impact on activities directly supported by One Acre Fund (crops for which we offer inputs and/or training plus non-ag products like solar lights). The major limitation to this approach is that we don’t have good insight into how our program might be affecting other farm activities. For instance, it is possible that our program is encouraging farmers to substitute away from more profitable and/or nutritious crops and into less profitable and/or nutritious crops supported by One Acre Fund, in which case we could be over-estimating our impact. It is also possible that our trainings have positive spillovers into the agriculture techniques applied to crops not supported by our program. This is another case in which we have to consider the trade-offs, and there are several reasons why we don’t typically measure full farm profit.
 - i. Measuring full farm profit with the same rigor we apply to crops we support would be prohibitively expensive. It would be incredibly resource-intensive to regularly measure harvests of every crop in a statistically large-enough sample size. Additionally, many crops, like tomatoes, are continually harvested, making it extremely labor intensive to measure over a given year. Self-reported data in this area is particularly unreliable, as our clients could have an incentive to inflate their estimates.
 - ii. We are also confident that the crops we support and measure are the most significant for food security in the areas in which we work.
 - iii. Finally, our studies in Kenya have provided evidence that the share of land devoted to each crop is not significantly different between program and comparison farmers, in most cases. This suggests that One Acre Fund is not encouraging any major substitution away from other crops and into crops we support. We do intend to occasionally undertake such studies to test our assumption that we are not negatively shifting crop mix. For more detail, see the crop mix section of our [comprehensive impact report](#).
- d. **Comparing scale and impact.** For a given year, we report scale as the number of farmers enrolled on December 31 of that year, which we understand to be common convention in the nonprofit world.

We report impact as the weighted average impact of harvests that take place during that calendar year. In countries where planting and harvesting in a given farming season actually take place in two different calendar years, we report scale of the current season with impact of the prior season, since we do not want to wait the extra 6+ months for harvest data in the current season to be collected. To illustrate, 2015 closed with 17,000 clients in Tanzania, however nearly half of these enrolled and planted for the first time in December 2015 and will not have their first harvest until later in 2016, so the \$86 average impact reported for 2015 harvests would not apply to the 17,000 2015 clients, but to the 9000 clients who planted and enrolled at the end of 2014 (and harvested during 2015). While this can be somewhat confusing, using harvest data from the previous season generally results in understating impact, as farmer profits tend to increase over time.

- e. **Two-season farmers.** Countries like Rwanda and Burundi have two roughly equal length planting seasons per year that we support. In these countries, some farmers participate in both seasons and some in only one season. In these cases, our reported overall average impact per farmer (across all countries) adjusts for farmers that participate in only one season, but our reported country-level impact is for two-season farmers. Currently only 10% of farmers fall into the bucket of one-season clients in two-season countries.
7. **Data cleaning.** In general, One Acre Fund's M&E methods follow standard best practices for cleaning data. However, there are some specific decisions and techniques that are unique to measuring farm impact.
- a. **Illogical harvest data.** Crops have a predetermined maximum productivity, called genetic yield potential, which indicates the maximum harvest weight that a given land area planted with that crop can yield. When we see harvest data that surpass these yield potentials, as identified by our in-house crop and soil scientist, it is safe to assume that there is a mistake, and the observation should be dropped if the correct figure cannot be found.
 - b. **Weighting.** In general, we aim to collect a representative sample of clients from each geographic sub-region (or "district"); in other words if 10% of all clients in a country are in one district, 10% of harvest surveys should come from that district. However, this sometimes is not possible, and so we weight our impact estimates. To do this, we will take the district-level average land size devoted to each crop and multiply it by the client population of that district. This will give us an estimate of the total number of acres devoted to each crop in each district. To calculate the weight of each district, we divide the district's total number of, say, maize acres by the total number of maize acres in the country. This will give us the weight we should apply to the district-level impact figure when calculating country-level impact (e.g., if district x accounts for 10% of all maize acres in country A, and district x clients saw an average impact of 1700 kg of maize harvested, then district x would contribute 170 kg of maize to the country-level impact estimate).

CONCLUSION AND TAKEAWAYS

While the above is not intended to be an exhaustive and highly technical guide to measuring impact for agriculture-focused, income-oriented programs, we do hope to have touched on some of the more pressing issues that we face and for which there is currently not agreed-upon best practice in the industry. Below are a few key lessons we have identified over the last 10 years of regularly refining our approach to impact measurement, which could be helpful to our peers.

- **Understanding the costs and benefits of more rigorous M&E.** In general, more and more accurate M&E data is better, however it is important to weigh these benefits against the costs of more resource-intensive practices or an undue time burden on clients.

- **Combining standardization and flexibility.** Standardization of M&E practices across programs or geographies increases our ability to compare data and our confidence in the quality of data collected. However, it is also important to balance this with a flexibility that accounts for programmatic nuances or logistical hurdles that may vary across countries.
- **Focusing on a limited number of metrics allows for deeper rigor.** Any organization or program could easily measure a dozen different impact indicators, but to do so well and with confidence in the accuracy of the data, it is crucial to hone in on one or two. That said, there are certainly tradeoffs to understand when focusing on one metric at the expense of others, and One Acre Fund has diversified our portfolio of metrics over time (as we've built capacity to expand M&E efforts – more detail available [here](#)).
- **Comprehensive cost accounting.** In the early days of impact measurement, we didn't include enough of the costs farmers face when participating in our program (e.g., additional labor/time costs). It's not unusual for impact estimates to fall as costs are accounted for more rigorously.
- **Accurate harvest measurement.** When measuring the impact of agricultural programs, it is important to go beyond self-reported harvest data, which can be misleading. As we saw above, measuring harvests involves making a number of decisions which can impact the final results (e.g., picking the right crops, physically weighing harvests, collecting dry weights, adjusting for obstacles, etc.).
- **Making sure the price is right.** The price for staple crops can be highly volatile, necessitating great attention to selecting the right price for calculating dollar impact of improved farming. The wrong price can distort impact. To find an appropriate price, it is important to understand the selling patterns of farmers, and to use a price (or prices) that match these selling patterns. For example, using the market price right after harvest may be the simplest, but if farmers save some or all of their harvest to sell at a later time, that price can be very misleading and result in inaccurate impact estimates.
- **Continuous improvement.** Good measurement leads to continuous improvement in programming, but it is also important to continuously improve measurement. While we are satisfied with our progress on this front, we recognize there is room to continue growing. As described within, a few new initiatives we are now tackling in measuring farm profit include:
 - Harvest selling and consumption rates
 - Post-harvest loss rates
 - Testing our assumption about whether or not our program encourages farmers to cultivate more land (i.e., undertaking more difference-in-difference studies, such as those in Kenya and Tanzania, in other countries)
 - A quality of life study to understand how farmers spend additional income and how program participation impacts other aspects of life