Evaluation of the One Acre Fund project – Baseline Report

October 2025

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Evaluation of the One Acre Fund project – *Making 34,000 Coffee Farmers More Prosperous, Food Secure, and Climate Resilient by 2027*: Baseline Report

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LIST OF ABBREVIATIONS

CAGR	*Compound Annual Growth Rate*
CHP	*Coffee-holding plots*
CPA	*Coffee-planted area*
CTP	*Coffee Training Program*
DID	*Difference-in-differences*
FAQ	*Fair Average Quality*
FIES	*Food Insecurity Experience Scale*
GAP	*Good Agricultural Practice*
HRNS	*Hans R. Neumann Stiftung*
HWG	*HereWeGrow*
IPDM	*Integrated Pest and Disease Management*
KG	*Kilograms*
MAP	*Market Access Program*
OAF	*One Acre Fund*
PCA	*Principal Component Analysis*
PDI	*Productivity Diversity Index*
PPE	*Personal Protection Equipment*
PPP	*Purchasing Power Parity*
RHP	*Robusta-holding plots*
RPA	*Robusta-planted area*
RRP	*Rural Retail Program*
ToC	*Theory of Change*
UBOS	*Uganda Bureau of Statistics*
UGX	*Ugandan Shillings*
USD	*United States Dollar*
VSLA	*Village Savings and Loans Associations*

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Executive Summary

This Baseline Report presents the initial status of project participants within the *Making 34,000 Coffee Farmers More Prosperous, Food Secure, and Climate Resilient by 2027* project, implemented by One Acre Fund (OAF) in Uganda's Kassanda and Mubende districts. The project aims to improve the well-being of coffee farming households through four integrated programs: the Coffee Training Program, Rural Retail Program, Market Access Program, and Trees Program. The ultimate goals are to increase coffee income and yield, diversify income streams with new crops like chia and macadamia, reduce household food insecurity, and boost climate resilience.

This report serves as the foundational step of an evaluation that will use a quasi-experimental design (comparison without randomization) to assess the project's impacts. Its objectives are to: 1) describe the demographics and livelihoods of the participating farmers; 2) establish baseline values for key outcome indicators; 3) validate the research design by assessing the comparability of the cohorts; and 4) provide formative insights and recommendations for the project's implementation.

Evaluation design

Staggered Rollout Approach

- The project involves 45 parishes organized into three cohorts, with each cohort transitioning from a control group to a treatment group at a different time.
- The evaluation will leverage this staggered rollout to compare outcomes between treated and to-be-treated parishes, ensuring that all participants will receive treatment.
- The different starting points of the programs in three treatment cohorts, combined with a midline and endline evaluation, provides a framework for assessing different causal impact pathways of the diverse intervention.
- Cohort 1 began receiving interventions in 2025, Cohort 2 will begin in 2026, and Cohort 3 will begin in 2027.

Non-Random Assignment with Balanced Cohorts

- The assignment of parishes to cohorts was not random due to programmatic and budgetary constraints.
- However, a key finding of this Baseline Report is that the three cohorts are demographically well balanced across all key socio-demographic variables, strengthening the internal validity of future impact analyses.

Key Findings

Demographics and Farmer Characteristics

- **Household Composition:** The average household size is 6.1 members, with 16% being female-headed. The average age of the household head is 51 years, and 76% are literate.
- **Cohort Balance:** Across the three cohorts, there are no statistically significant differences in key demographic variables (age, household size, gender, education, literacy). This provides a strong foundation for the quasi-experimental evaluation design.
- **District Differences:** While cohorts are balanced, significant differences exist between Kassanda and Mubende districts. Mubende farmers manage larger farms, but the area dedicated to coffee is comparable. Kassanda farmers have more years of coffee farming experience and higher coffee tree density, while Mubende farmers are more likely to have received prior training. These differences will be controlled for in the final analysis.
- **Female-Headed Households:** Female-headed households are more socioeconomically disadvantaged than male-headed households, owning fewer assets and more often experiencing food insecurity.

Coffee Farm Characteristics and Productivity

- **Land Use:** The average farm size is 5.9 acres (2.4 hectares). Farmers allocate an average of 2.4 acres (1.0 ha) to Robusta coffee production. While no farmers currently produce chia, only one has macadamia trees, highlighting a significant opportunity for the project's crop diversification efforts.
- **Yields:** Tree-level yield analyses showed a median Robusta yield is 0.9 kg of dry cherries per productive tree per season. Yield is positively associated with desuckering, tree height, proper weeding, inorganic fertilizer use and the number of stems.
- **Input Use:** Inorganic fertilizer use has the strongest positive association with log yield (natural log of yield) at the farm-level (a 47% increase). However, only 15.5% of farmers have used it at all, with the main barrier being cost, and only 6% applied it in the correct way.
- **GAP Adoption:** Overall Good Agricultural Practice (GAP) adherence is low, with an average of 3.7 out of 12 GAPs correctly implemented. While almost all farmers correctly implemented desuckering (98%) and selective cherry-picking (87%), key GAPs with high yield potential like pruning (2%), composting (5%), and inorganic fertilizer application (6%) have very low adoption rates. The project has a significant opportunity to improve these practices.

Income and Market Access

- **Income:** The average coffee income is UGX 4.4 million (approximately USD 2,834, 2017 purchasing power parity [PPP]) per year, with a clear positive correlation between farm size and total income. However, smaller farms have higher per-acre income and higher coffee tree density, suggesting they use more intensive farming.
- **Sales Practices:** A large proportion of farmers (90%) sell their coffee through middlemen, while few use more direct channels such as processors (13%) or cooperatives (2%). This highlights a major area for the Market Access Program to improve farmers' bargaining power and prices.
- **Post-Harvest Handling:** A significant portion of farmers (31%) sell only fresh cherries, while 61% sell dried cherries and 12% sell FAQ. While FAQ fetches the highest price per kilogram, the price difference between fresh and dried cherries is minimal when adjusted for weight loss. This implies that the extra costs and risks of drying may not be economically beneficial without a better price for dried cherry.

Household Dynamics and Food Security

- **Food Security:** At baseline, 23% of households experience moderate or severe food insecurity, with female-headed households being disproportionately affected.
- **Disagreements:** The vast majority of household heads (87%) and spouses (84%) report that they rarely or never disagree on farming and spending decisions. However, discrepancies exist, particularly in desired spending, with spouses more often prioritizing investments in household items, businesses, and health.
- **Income Control:** There is a significant divergence in perceptions of who controls coffee income. While 51% of household heads claim to keep all coffee income, only 28% of spouses agree, with many spouses believing they keep all the income themselves. This highlights the risk of unintended negative consequences on intra-household dynamics if not managed carefully by the intervention.

Conclusions and Recommendations

This Baseline Report confirms that the OAF project is strategically positioned to address the key challenges faced by coffee farmers in Kassanda and Mubende districts. The non-random design is valid, as the three cohorts are largely balanced on observable characteristics. This provides a robust framework for confidently measuring the program's impact.

There are four key areas that emerge from the baseline data:

- **Targeted Training:** The Coffee Training Program should place particular emphasis on GAPs with low baseline adoption rates but high potential for yield improvement. These include proper inorganic fertilizer application and integrated pest and disease management, given the high prevalence of pests and diseases and the strong association between fertilizer use and higher yields.
- **Addressing Financial Barriers:** The low use of inorganic fertilizer is primarily driven by cost. The Rural Retail Program must successfully mitigate this financial barrier to

ensure that the agronomy training translates into real-world practice and improved productivity.

- **Improving Market Access:** The high reliance on middlemen highlights a critical need for the Market Access Program to establish reliable buy-back partners. This could improve sales prices and reduce the incentive for farmers to sell coffee prematurely.
- **Empowering Women and Monitoring Household Dynamics:** The project must actively address the disadvantages faced by female-headed households. The significant discrepancies in perceptions of income control and desired spending patterns also underscore the need for the intervention to monitor intra-household dynamics to ensure that project benefits are shared equally and do not inadvertently exacerbate gender inequalities or food insecurity.

These insights will be crucial for interpreting the midline and endline results and for refining the project to maximize its impact on all participating households.

1. Introduction

1.1 Background

The *Making 34,000 Coffee Farmers More Prosperous, Food Secure, and Climate Resilient by 2027* project is a three-year project in Mubende and Kassanda districts in Uganda, implemented by One Acre Fund and funded by HereWeGrow. This project works with smallholder coffee farmers, and aims to improve participating farmers' coffee income, help farmers diversify farm income streams, reduce the risk of food insecurity at the household level, and boost climate resilience of farms and households.

HereWeGrow commissioned Laterite to conduct an impact evaluation of this project, and this report presents the findings from the baseline study, with data collected from a sample of participating farmers in February 2025. Midline data collection for the evaluation will take place in February 2026, and endline data collection will take place in February 2028, in order to assess the impact of the project interventions, which are described in detail throughout this report.

The objectives of this report are to: (1) provide insights into the demographics, livelihoods, agricultural systems, and income-generating activities of the participating farmers; (2) assess the current state of play of the key outcome indicators; (3) validate the research design, including whether the constructed sampling methodology achieved balanced treatment cohorts; and (4) provide insights for project implementation.

1.2 Report structure

The report is organized as follows: Chapter 2 details the activities of the four programs and presents the Theory of Change that underpins them, along with a brief review of relevant literature. Chapter 3 outlines the research design, including a justification of the chosen evaluation method, as well as the selection and sampling processes. Chapter 4 presents the baseline analysis findings in relation to the research questions. Finally, Chapter 5 summarizes the conclusions and provides recommendations based on the baseline analysis.

2. Overview of the interventions and Theory of Change

The One Acre Fund Uganda (OAF) '*Making 34,000 Coffee Farmers More Prosperous, Food Secure, and Climate Resilient by 2027'* project (in short: OAF Project) consists of four program lines: the Coffee Training Program, the Rural Retail Program, the Market Access Program and the Trees Program. Jointly, these programs are intended to achieve the following outcomes:

- **Increase income from coffee** by USD 30 in year one and USD 70 per year in the following years
- **Increase income from chia** by USD 20 per year for farmers who adopt Chia
- **Increase coffee yield** by up to 20% per tree
- **Reduce the risk of food insecurity,** measured with the Food Insecurity Experience Scale (FIES)

In this chapter, the programs will be discussed in detail, and the hypothesized causal pathways of the OAF Project's Theory of Change, which are expected to lead to the final outcomes, will be further explored.

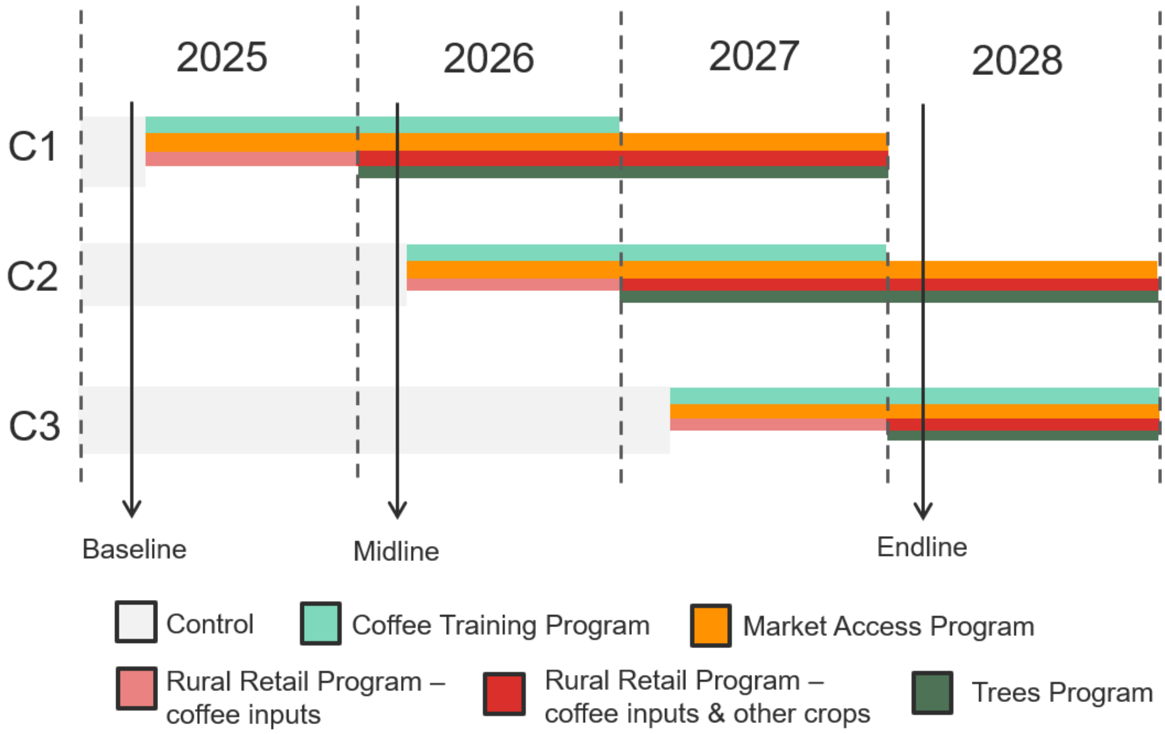
2.1 Details of each Program

This Baseline Report outlines the before-treatment status of the coffee farming households enrolled in One Acre Fund's (OAF) '*Making 34,000 Coffee Farmers More Prosperous, Food Secure, and Climate Resilient by 2027*' project (hereafter, the OAF project). This three-year project aims to improve participating farmers' coffee income, help farmers diversify farm income streams, reduce the risk of food insecurity at the household level, and boost climate resilience of farms and households. To achieve these objectives, OAF implements activities organized into the following four programs:

- **Coffee Training Program:** Extension program of on-site agronomy training teaching farmers Good Agricultural Practices (GAPs)
- **Rural Retail Program:** Provides access to high-quality agricultural inputs for coffee cultivation, as well as high-value crop seeds, seedlings and trees for farm income diversification
- **Market Access Program:** Connects farmers to 'buyback partners' through which they obtain fertilizer on credit in return for coffee supply
- **Trees Program:** Distributes tree seedlings for income diversification and improved agroecosystems

Participating farmers will receive agronomy training as part of the Coffee Training Program in project years 1 and 2. The Market Access Program supports farmers with selling their coffee for fertilizer in years 1, 2 and 3[1]. For all three cohorts, the Rural Retail Program will begin in year 1 with project implementation around coffee cultivation input access only, and will expand to macadamia tree and chia plant distribution in years 2 and 3, with complementary agronomy training for these crops. The Trees Program activities start in year 2 and continue throughout year 3. Figure 1 below shows the implementation schedule for each program by cohort, along with the timing of baseline, midline, and endline data collection.

Figure 1: Program implementation plan by cohort



2.1.1 Coffee Training Program

The Coffee Training Program (CTP) includes a series of coffee farming training sessions over the course of one year. Each training cycle covers one Good Agricultural Practice (GAP) category, namely Basic Routine Management (weeding, mulching, and desuckering), (Post-)Harvest Handling, Rejuvenation, Soil Fertility, Pest and Disease Management, and Farm Business Record Keeping. Each of the GAP categories is covered once. Participating farmers receive learning materials and regular support from OAF field staff to implement practices. Furthermore, each training is followed up by farm visits during which OAF's field officers support at least 15% of the farmers with GAP adoption (although OAF's internal objective is to reach 25% of the farmers).

[1] For Cohort 1 in year 1, only one parish, Mugungulu, receives treatment through the Market Access Program. The planned Market Access Program activities in the remainder of the project (2026-2028) are still under development. Updated information will be shared in the Midline Report.

2.1.2 Rural Retail Program

With the Rural Retail Program (RRP), OAF provides participating farmers with access to high-quality agricultural products. Products include coffee farming inputs – whose importance is covered during the Coffee Training sessions – and other cash crops such as chia seeds and macadamia seedlings. These products are sold to farmers at competitive market prices.

While coffee cultivation inputs are available at local input retailers, OAF believes that farmers face several constraints when accessing these products. A financial gap, preventing poorer farmers from accessing necessary products; an information or trust gap, possibly due to concerns that some locally sold products lack quality; and a physical gap, as the distance between farms and retailers can be far (creating transport – and therefore financial – barriers). OAF addresses these gaps through the RRP by ensuring the sale of high-quality inputs near farms and including a layaway finance option (i.e., payment in instalments up until distribution). The program is combined with the CTP, which ensures that farmers learn to apply the inputs in the correct manner. This maximizes the effectiveness of the inputs, generating more trust among farmers to invest in high-quality agricultural inputs.

As mentioned, OAF also provides access to other cash crops that are hypothesized to diversify farm income. The focus is on chia and macadamia trees. OAF guarantees to buy all chia harvests from farmers in the program against market prices. Farmers who decide to invest also receive continuous support and chia cultivation training. It is the farmer's decision whether to invest in chia, and by how much. This setup of the RRP is intended to remove existing transition risk barriers, as farmers are expected to convert land (partly) used for subsistence cropping to cash crop cultivation.

Similar to chia, farmers decide whether to invest in macadamia trees and receive support and training if they do so. Macadamia nuts are also seen as a high-value crop for diversifying farm income. Additionally, macadamia trees offer shade for coffee trees, have positive effects on soil structure and erosion prevention, and remain productive for 30 to 40 years, making them an economically and ecologically sustainable investment. The seedlings sold through the RRP are typically 14 to 18 months old and are sold at market prices.

2.1.3 Market Access Program

With the Market Access Program (MAP), OAF intends to facilitate more accessible and continuous coffee sales channels. OAF established a partnership with agro-input and coffee trader Ibero, who facilitate their 'fertilizer-credit-aggregation service' BLOOM wherein farmers obtain access to fertilizer on credit, which is repaid by coffee supply. Farmers need to show eligibility to the program by selling some dried coffee cherries (Kiboko) to Ibero in the first season. After that, eligible farmers receive fertilizer on credit, with an interest rate of 2% per month, which they repay with cash, dried cherries or FAQ. In Cohort 1's first year, only the parish Mugungulu receives treatment through the Ibero activities as part of the pilot phase in the MAP. If the pilot is successful, the BLOOM service will expand to other treatment parishes in 2026 and beyond. Additionally, farmers receive training on (post-)harvest handling as part of the MAP, to decrease post-harvest losses and increase the quality of harvested cherries.

2.1.4 Trees Program

With the Trees Program, OAF distributes 40 tree seedlings to farmers intended to increase soil fertility and income diversification. Farmers receive 10 *Faidherbia albida* seedlings, 10 *Albizia coriaria* seedlings and 20 *Grevillea robusta* seedlings. *Faidherbia albida* and *Albizia coriaria* have soil fertility enhancement and water infiltration qualities, making coffee plantations more resilient against drought and floods. Their timber can be used as firewood, medicine and construction material, and their leaves can be used as livestock fodder. *Grevillea robusta* is primarily beneficial for timber production. Farmers receive complementary training on transplanting, intercropping and maintaining their trees. OAF expects that 90% of the distributed seedlings will be planted and 35% survive 12 months after transplantation.

2.2 Causal pathways

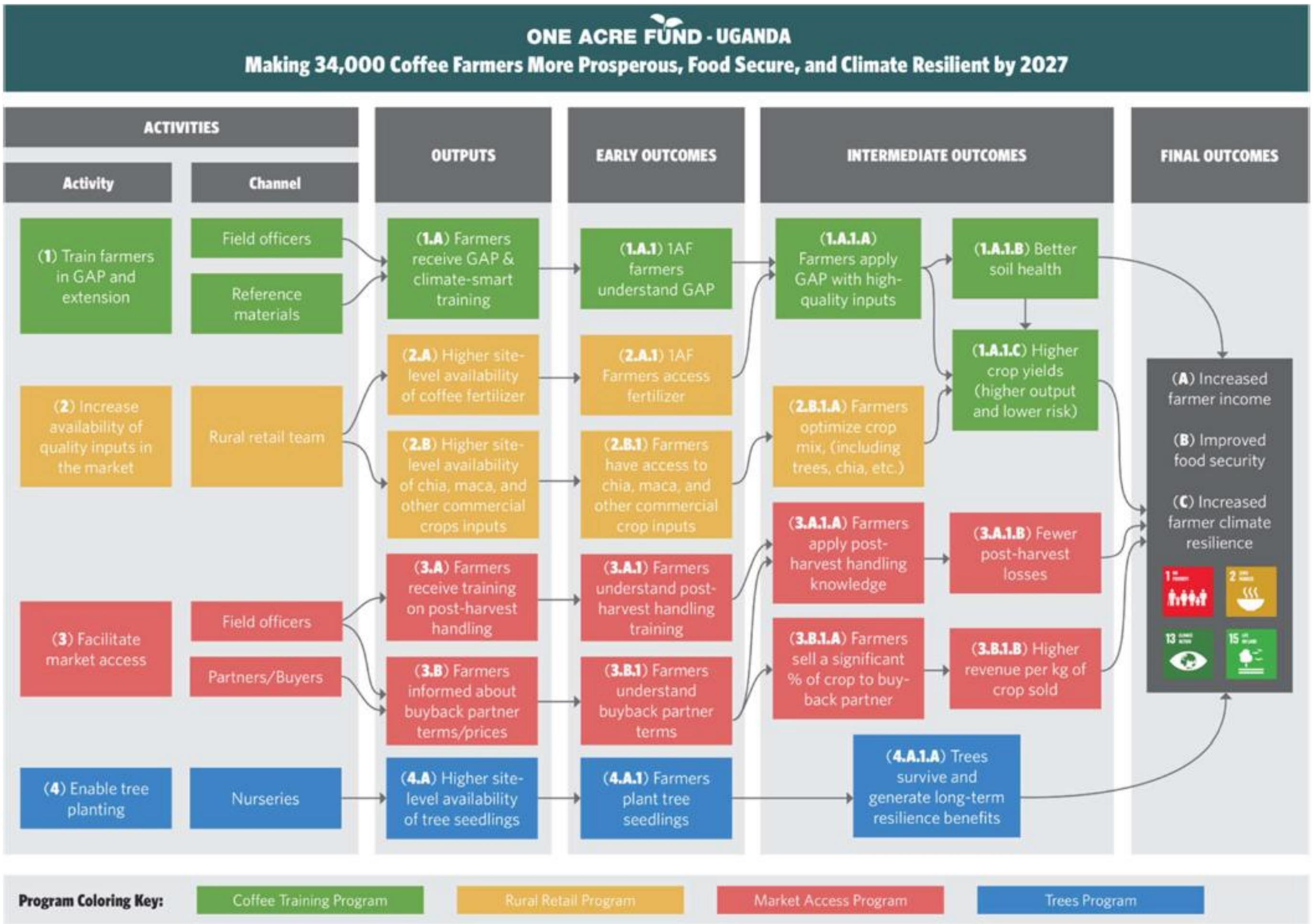
The four Programs are collectively expected to achieve the final outcomes of increased farm income, decreased food insecurity and increased climate resilience. The Project's Theory of Change (ToC) shown in Figure 2 below indicates the causal pathways to reach the final outcomes. In this section, the expected chain of causalities of these pathways are discussed. Each pathway relies on several assumptions, outlined in the section below.

In describing each of the sets of assumptions, we distinguish between whether we can test those assumptions in the Baseline Report, or whether they will be tested as part of midline or endline data collection analysis. For several assumptions, the baseline data allowed us to determine whether they hold true or not (for example, farmers' current knowledge of GAPs, or their baseline levels of crop diversification – necessary to test the assumption that baseline crop diversification is low and less profitable).

However, for certain assumptions about the causal pathways and, ultimately, project impacts, we will test them at midline once farmers have experienced some of the project activities leading to outputs. For example, whether farmers have attended training sufficiently, and whether they have access to sufficient resources to practically implement the GAPs.

Some of these assumptions – by necessity – relate to project implementation and behaviour of farmers throughout the implementation, so we will ask probing questions about these in the midline and endline surveys. For assumptions which we are able to test in the baseline survey, we report on findings throughout the report.

Figure 2: Theory of Change of the OAF Project



2.2.1 Coffee productivity

For the project to achieve its intended coffee productivity effect, farmers must understand and effectively adopt the GAPs introduced during the CTP training sessions. They also need to recognize the value of investing in high-quality fertilizers and have reliable, financially accessible supply. Successful uptake of GAPs and correct fertilizer application are expected to increase tree productivity by 20% compared to the counterfactual scenario. OAF aims to have at least 50% of farmers in the sample adhere to 6 to 12 GAPs properly[2], which is assumed to be sufficient to reach the 20% productivity increase. A crucial intermediate step between GAP uptake and increased (long term) yields is increased soil health. Measuring soil health (expressed in contents of soil organic carbon, soil organic matter and minerals, decreased soil erosion, soil water holding capacity) is not part of Laterite's evaluation.

Inorganic fertilizer uptake is expected to increase through the fertilizer-on-credit arrangement with Ibero as part of the MAP combined with inorganic fertilizer training

[2] Proper GAP adoption conditions are defined by Laterite, HWG and OAF and discussed and analysed in section 4.3.2.

as part of the CTP. The credit-component of the Program suggests that farmers mostly face credit or financial constraints that prevent them from investing more in fertilizers.

Furthermore, OAF expects that farms with trees that are obtained through the Trees Program have improved climate resilience and soil health. The *Faidherbia albida* and *Albizia coriaria* trees increase the soils water-holding capacity, making the soils more resilient against droughts – by keeping the soil moisturized during periods of little rain – and floods – by preventing water from washing away topsoil and annual crops in case of heavy rainfall. This will increase the coffee trees' capacity to maintain high coffee productivity during extreme weather conditions, which are becoming increasingly present in Uganda and posing a threat to coffee production (The World Bank Group, 2021).

Several key assumptions underpin the causal pathway to this outcome, which are addressed in this Baseline Report:

- **Low baseline GAP adoption:** Participating farmers currently possess limited knowledge of GAPs, suggesting potential for substantial improvement in uptake and understanding of their agrophysical effects on coffee trees.
- **Low baseline inorganic fertilizer use:** Use of inorganic fertilizer among these farmers is low at baseline and allows room for improvement.
- **Low inorganic fertilizer use due to credit constraints:** Farmers do want to invest in inorganic fertilizer but cannot access it because of financial barriers.
- **Potential GAP effect:** Applying GAPs simultaneously increases the growth and yield capacity of the coffee trees significantly.
- **Other barriers:** Barriers to optimal inorganic fertilizer use – including limited financial resources, lack of trust, low awareness, and insufficient application knowledge – can be mitigated through targeted Coffee Training and Rural Retail Program interventions.

Other crucial pathway assumptions, which will be tested in subsequent reports, are:

- **Process quality:** The quality of the training, learning materials, and reproducibility of GAPs learned are sufficient.
- **Buy-in**: Farmers are sufficiently motivated to participate in training and apply the GAPs acquired on their own farms.
- **Resource access:** Farmers have access to the necessary resources to implement GAPs.
- **GAP target potential:** Correctly implementing any mix of 6 to 12 GAPs has a significant effect on coffee productivity.
- **Controlled fertilizer use:** The schematic ToC (Figure 2) shows a pathway from "1AF farmers access fertilizer" to "Increased soil health," with the intermediate step "Farmers apply GAP with high-quality inputs as appropriate to context." This highlights the importance of appropriate fertilizer use. While synthetic fertilizers boost productivity quickly, they can be overused by farmers facing short-term financial pressures, leading to soil degradation if organic practices are neglected. Evidence shows that better fertilizer access without adequate training increases the risk of overuse. The assumption that GAP

training alone will ensure proper fertilizer use and protect soil health is therefore a strong one.

2.2.2 Coffee input access

The RRP is designed to complement the CTP. While the CTP tackles the knowledge barrier by teaching farmers about GAPs, the RRP focuses on enabling farmers to apply these practices through access to the right tools and inputs. To fully implement GAPs and maximize productivity, farmers need reliable access to high-quality agricultural inputs.

To achieve this, the program addresses three key barriers. First, inputs must be physically available near farmers. OAF's local field offices therefore serve as input providers, bringing high-quality products closer to farming communities and reducing logistical challenges and transaction costs. Second, many farmers face difficulties affording inputs. Although OAF does not sell inputs on credit or at subsidized prices, it promotes flexible payment options and ensures that inputs are sold at fair, market-reflective prices. This approach helps build market transparency and improves farmers' understanding of input pricing, reducing the likelihood of overpaying for lower-quality products elsewhere. Third, the quality of inputs available in local markets can often be low, discouraging farmers from investing. OAF guarantees high-quality inputs and, as a trusted partner, encourages farmers to purchase with confidence, reducing the risk of poor-quality inputs and improving adoption of GAPs overall.

One key assumption underpins the causal pathway to this outcome, which is addressed in this Baseline Report:

- **No financial constraints:** The ToC assumes that farmers' limited access to high-quality agricultural inputs is mainly due to the physical distance from reliable input retailers, rather than financial barriers. If finances were the main constraint, the program would have focused on improving financial access through credit or subsidies. It is therefore important to verify whether limited financial resources truly do not hinder input purchases, or whether financial constraints are modest enough that better pricing information alone can help overcome them. An exception to this is fertilizer, which is made available on credit through the MAP.

Another crucial pathway assumption, which will be assessed in subsequent reports, is:

- **IPDM products:** The Rural Retail Program focuses on improving access to fertilizer but does not address inputs for integrated pest and disease management (IPDM). This suggests either that improved access to IPDM products is not expected to significantly affect coffee productivity – despite pests and diseases being major threats to smallholder coffee in a changing climate – or that the organic and home-made IPDM solutions promoted in the Coffee Training are assumed to be sufficient for effective pest and disease control.

2.2.3 Crop diversification

Access to seedlings of high value cash crops is expected to increase farm income and to make the farmer more resilient against (climatic) shocks. Near-by purchasing access and proper information about the agricultural technicalities and economic benefits, combined with a guarantee that OAF buys the produce after harvest, are expected to convince farmers to invest in these cash crops. The focus lies on chia – a crop with relatively short cycles suitable for crop rotations and a rapidly growing global market[3], which is known for its resilience to droughts, heat and heavy rainfall (Silva et al., 2021; Bochicchio et al., 2015). With the RRP, OAF intends to generate an additional average farmer income of 20 USD for those farmers participating in chia cultivation.

Nevertheless, land for cash crops needs to be freed by substituting existing farmland used for subsistence cropping and crops for the local market. Farmers are very familiar with cultivating these existing crops, which might be part of their daily diet, and shifting land toward an unfamiliar crop not suitable for their own consumption may be hindered by other non-economic barriers. Farmers might already have diversified farms and little experience with income insecurity due to shocks that destroy coffee harvests, making the necessity for diversification less obvious.

While the global market for chia seeds is growing rapidly, driven largely by rising demand in North America and Europe, a rapid shift of farmland toward chia cultivation may pose significant risks for smallholder farmers in Uganda. Commodity markets that have grown suddenly due to trends might be prone to equally sudden downturns if consumer conceptions linked to health and environmental developments change as suddenly. Should such trends reverse, smallholders who have invested in chia could incur substantial losses. In addition, escalating global competition – particularly from more industrialized agricultural producers in Latin America – could intensify downward pressure on prices, making chia more vulnerable than established, locally traded crops (CBI, 2020). Furthermore, continuous access to quality extension services is essential during the early stages of chia production. Without ongoing support or appropriate agronomic practices, returns from chia may not exceed those from the crops it replaces. Lastly, if farmers begin the intervention period with diverse cropping systems and high rotation, large-scale substitution to chia risks reducing overall farm diversity. This loss of crop diversity could exacerbate the risks mentioned that are associated with the intervention.

In addition to chia promotion, OAF intends to distribute macadamia trees as part of the RRP. Like chia, the market for macadamia nuts is expected to grow significantly in the coming years for the same reasons related to health trends. There are indications, however, that young macadamia trees are less resilient to drought and heat levels that are not uncommon in Central Uganda (Kang et al., 2025; Rogiers et al., 2025). Since the macadamia tree does not produce nuts in the first 3-5 years, farmers—especially those dependent on annual harvests for their income and food consumption—might be less willing to invest in this long-term crop. Nevertheless, if OAF's extension services and trade agreements related to

[3] The global chia market size is expected to grow by 13.9% CAGR between 2024 and 2030 (Grand View Research, 2024).

macadamia production are adequate, farmers might be convinced to invest and increase their farm income in the long run through improved focus on cash crops and diversification.

Furthermore, with the Trees Program, OAF intends to diversify farm income even further by distributing free tree seedlings, which can be harvested for timber and livestock fodder after maturing. Timber production is still a viable economic activity for many farmers who can afford the initial investment and are able to wait for years before trees are mature. Timber is used as firewood for cooking and for construction in rural Uganda. Therefore, OAF distributes tree seedlings for free to avoid investment risks that might occur over the years when trees are maturing.

The crop diversification pathway relies on several assumptions that are addressed in the remainder of this report:

- **Sub-optimal cultivation at baseline:** Farmers currently cultivate a crop mix with low-income diversification, due to low crop diversity or low profitability from non-coffee crops.
- **Low transition barriers:** A substantial part of the cultivated farmland is allocated to crops with low profitability (non-coffee) and can be converted into a chia/macadamia production plot without significant transition barriers.

Other crucial pathway that will be tested in subsequent reports include:

- **Resource availability:** Farmers have sufficient resources to cultivate another cash crop alongside coffee.
- **Inclusivity:** Chia investment potential is not limited to larger farmers and is suitable for targeting smaller farmers as well.
- **Buy-in:** Farmers are positive that substituting part of their farmland toward chia and/or macadamia cultivation is economically beneficial. They are convinced that OAF is able to support farmers who invest in chia production to a level at which chia production is profitable.
- **Global market:** Chia and macadamia market prospects are economically beneficial in the medium to long run.
- **Trees buy-in:** Farmers are convinced that trees will provide them long-term financial benefits and ecological advantages to their soil and crop production.

2.2.4 Coffee market access

Beyond maximizing coffee productivity, OAF also intends to ensure better and more stable sales prices per kilogram of coffee through the MAP. This is achieved through two pathways. First, farmers are taught better (post-)harvest handling practices of coffee cherries during training sessions on (post-)harvest handling GAPs. Second, OAF and its farmers develop a buyback partnership with Ibero, through which farmers receive fertilizer on credit which is repaid by supplying coffee to Ibero.

The impact of the (post-)harvest handling GAPs depends on farmers' understanding and ability to implement them, as well as on their current understanding and practices. During these trainings, farmers learn to pick only ripe cherries, dry their coffee on an appropriate surface, and store their bags in a clean, moisture-free environment. These practices improve coffee quality and reduce post-harvest losses caused by mold or other infections. Additionally, it is expected that better drying practices improve the drying weight-loss ratios to the benefit of the farmer. OAF aims to have at least 50% of farmers in the sample adequately executing the (post-)harvest GAPs, resulting in a 10% post-harvest loss reduction.

However, there are other factors that influence farmers' harvesting behaviour and practices. For example, the significant rise of Robusta prices since the beginning of 2024 caused Ugandan farmers to increasingly often face thefts of their ripe produce from their trees (The Independent, 2024). Several farmers confirmed this problem during the survey conducted for this report. Also, with surging market prices, farmers that are short on cash might be tempted to sell their coffee prematurely or to middlemen that generally buy for lower prices (this practice was also confirmed anecdotally during field visits occurring after the baseline data collection).

The buyback partnership with Ibero is expected to encourage farmers to produce a certain amount of high-quality cherries, with which they are repaying their fertilizer credits. The expected outcome of this intervention is two-fold. First, farmers have increased access to fertilizer, which leads to increased yields. Second, farmers have lower necessity to prematurely sell their coffee in case of cash shortage when they need to buy fertilizer at the period in the season when fertilizer application is required. This means that farmers have more freedom to 'sit on their coffee' and wait until prices increase. The direct link to Ibero also skips the middlemen in the value chain, which likely increases the farmers revenue per kilogram of coffee sold.

Several assumptions underpin the causal pathway to this outcome and are tested in this report:

- **Low baseline harvesting knowledge:** Farmers have inadequate (post-)harvest handling knowledge and can improve their per-kilogram revenue and reduce their post-harvest losses significantly.
- **Drying equipment:** Farmers own, have access to, or are able to obtain tarpaulins for drying coffee
- **Processing benefits:** Drying and hulling coffee generates economic benefits over selling fresh coffee.
- **Program exclusion:** Most or all farmers are eligible for the MAP by being able to supply dried cherries to Ibero before accessing the fertilizer on credit.
- **Inadequate markets at baseline:** Current sales channels mainly consist of middlemen who pay relatively low and uncertain prices.

Other crucial pathway assumptions include:

- **Benefits of avoiding post-harvest losses:** Implementing labour-intensive (post-)harvest GAPs is economically viable due to the beneficial effects on prices and post-harvest losses.
- **Proper drying diminished weight loss:** Adequate drying practices are expected to limit the weight loss of fresh cherries turning into Kiboko (dried cherries), which benefits the farmer's total sales weight.
- **Understanding of loan conditions:** Farmers understand the loan conditions and interest rates calculations.

2.2.5 Food insecurity experience

The Project's effect of increased and diversified farm income is hypothesized to decrease food insecurity in participating households. OAF expects that additional farm income – which includes the intended average annual 30 USD and 70 USD through coffee and an average 20 USD through chia cultivation – will be spent on currently inadequate or insufficient food consumption and bridges the food security gap significantly. This hypothesized impact pathway implies that farming families need to guarantee proper food availability at the household by either growing sufficient food for own-consumption, or by purchasing food with their increased income. The availability of high value cash crops makes it attractive to substitute parts of the farm used for subsistence cropping to cash cropping, posing a risk to household food security if harvests fail or additional income is not well managed.

Food insecurity is measured with the Food Insecurity Experience Scale (FIES). This scale developed by FAO (2016) represents the sum of the answers of eight yes/no-questions regarding the eating pattern and perspective of the respondent in the past 12 months. Based on the answers, the respondent is placed in one of the categories of "mild food insecurity", "moderate food insecurity", and "severe food insecurity". However, the FIES does come with limitations. For example, the questions use subjective terms open for interpretation of the respondent – such as "healthy food" or "few kinds of food" – and the answers are self-reported, meaning that the scale is highly subjective to the interpretation and perspective of the respondents. Also, most questions relate to quantitative food intake instead of the quality and diversity of the food, which means that the FIES does not capture all necessities for a healthy diet and food secure lifestyle.

The impact pathway of increased food security due to increased farm income relies on the following assumptions that are addressed in the baseline analysis in this report:

- **Low baseline food security:** A substantial number of sampled households have "moderate" or "severe" food insecurity.

- **Food insecure households require cash:** Household members wish to spend more on food consumption if the household experiences "moderate" or "severe" food insecurity.

Other assumptions that will be addressed in subsequent reports are:

- **Additional income is used on food:** Households that experience low food security at baseline spend additional income on (nutritious) food.
- **Own-consumption substitution:** The project aims to make coffee cultivation more profitable and convinces farmers to invest in other cash crops. As a result, farmers may be incentivized to shift portions of their land from subsistence to cash crop production. The assumption behind improved food security, therefore, is that this shift does not reduce the household's (nutritious) food intake, as long as higher disposable income from cash crops is expected to offset any loss in subsistence production.

2.3 Literature review

2.3.1 Good Agricultural Practices

Yield effects of GAPs

There is a substantial body of evidence that improved farm management practices could enhance Eastern African coffee yields. Smallholder coffee farmers in Eastern Africa typically grow significantly below their agronomic potential – a phenomenon known as the "yield gap". Improved farm management practices have the potential to bridge this gap to a great extent (Wang et al, 2015). Adequate implementation of GAPs such as pest and disease management (Wintgens, 2012), soil fertility enhancement (Nzeyimana, Hartemink & de Graaff, 2013; Maro et al., 2024), rejuvenation (Gebisa, 2023), intercropping with legumes (Tibasiima et al., 2023) and mulching (Nzeyimana et al., 2020) are proven to significantly enhance the coffee tree's productivity. However, financial and information constraints still drive poor coffee farm management practices. Abate et al. (2020) report low rejuvenation efforts in Ethiopia resulting in inadequate yields. Mbunduki (2024) shows poor adoption of fertility, rejuvenation and pest and disease management practices in Tanzania. And in Uganda, Kigozi and Mibulo (2023) note that farmers often fail to meet quality requirements for coffee beans due to poor post-harvest practices, while Liebig et al. (2016) report limited knowledge of pest and disease management among farmers.

Adequate farmer agronomy trainings in which multiple practices are handled, tend to have promising outcomes for bridging the yield gap. Synergistic effects are observed in Uganda by Mukasa et al. (2025) who used a stepwise approach of GAP training implementation as an extension service to coffee farmers. The practices of Step 1 – which consisted of the GAPs Weeding and Desuckering only – had 7% yield effect while Step 4 – which included a wide range of GAPs similar to those in OAF's Coffee Training Program – caused a 39% yield improvement. Synergistic effects likely occur due to the positive effect of simultaneous implementation of several 'climate-smart' practices on Soil Organic Carbon (SOC) contents (López et al., 2025). Furthermore, in a report with contributions from Laterite, Hoffmann et al. (2024) showed 4% and 11% yield effects in villages in Uganda where agronomy trainings were rolled out by the Hans R. Neumann Stiftung (HRNS) and TechnoServe respectively. Outside Uganda, an Agribusiness Training Program in West Java appeared to have significant effects on coffee tree productivity, whereas the Farmer Group Empowerment program showed even stronger effects on yield. The study did not measure yield directly, but instead measured 'productivity' by asking Likert-scale questions to farmers about their perceptions of current yields compared to previous yields. There were positive impacts of both projects on perceptions of yields – the ATP program had a positive coefficient of 0.227, and the FGE program had a coefficient of 0.519 (Ayesha, Harahap & Cahya, 2024). An analysis by Duflo et al. (2023) of a one-year Agronomy Coffee Training program for Rwandese coffee smallholders by TechnoServe showed a yield increase of 4.6%, but the effect was only statistically significant at the 10% significance level and mainly caused by *negative spillover* effects: non-treated farmers near treatment areas were negatively affected by increased competition over inputs and labour, decreasing their productivity. Given the density of coffee farms around the treatment areas in the OAF project, this is a realistic risk to consider. However, this evaluation does not include pure-control farms near pure-treatment farms, so while this risk is out-of-scope of the current evaluation, we do recommend OAF and HWG to consider this risk in future programming and evaluations. This could be partially understood by accessing district-level agricultural data, or conducting some spot checks in control areas – possibly by Key informant interviews with parish chiefs or agricultural extension officers to understand whether there have been any negative impacts.

GAP adoption

A crucial condition for GAP training to enhance coffee yield is actual farmer participation and subsequent GAP adoption. Hoffmann et al. (2024) observed that yield effects were much higher at 8% and 18% when only the trained farmers were considered, compared to the 4% and 11% increase observed at the treatment-village level; half of farmers failed to participate in the training sessions. Farmers were trained in person every month over a period of 26 months and were reminded of the training content through regular phone messages. This resulted in an uptake increase of 9 percentage points for GAP pest and disease management, 6 percentage points for tree nutrition, 5 percentage points for erosion control, and 3 percentage points for pruning (significant at the 10% significance level only).

A separate analysis conducted by Laterite as part of an agronomy training program led by TechnoServe found a notable increase in the adoption of GAPs over the two-year intervention period in Ethiopia. The project involved a participatory, farm-based training program focusing on 10 GAP topics. Farmers also received tools and regular support from extension services. This resulted in an increase in the mean number of correctly implemented GAPs from 1.5 to 2.3 out of a maximum of 7, which was the number of GAPs assessed. (Max und Ingeburg Herz Stiftung, TechnoServe & Laterite, 2023). GAP uptake increased for 6 out of 7 GAPs. However, the study did not include a counterfactual or control group, and thus the analysis assumes that, in the absence of the intervention, GAP uptake would have remained constant over time. This limits the causal interpretation of the observed changes. A study on a related intervention by TechnoServe in Uganda conducted between 2018 and 2020 showed an uptake increase from 2 to 4 GAPs out of 10 on average, with 9 out of 10 GAPs having a statistically significant increase (TechnoServe & Laterite, 2021).

Agronomy training typically increases GAP adoption rates, but effectiveness varies with different intervention characteristics. Abate et al. (2021) report an increase in tree stumping adoption rates of 19 percentage points due to agronomy training sessions held with small groups in demonstration farms owned by participating farmers – similar to the OAF Coffee Training Program method. Cai, Rodriguez, and Abbott (2014) show substantial effects on knowledge of bean planting among trained Ugandan women, which were amplified by combining on-farm training and video materials. In a systematic review of studies on the efficacy of Farmer Field Schools (FFSs), Waddington et al. (2014) concluded that farmers' existing levels of social capital and social networks, and the participatory nature of FFSs, were determining factors of GAP adoption, whereas curricula that were too complex, or an unintended pedagogic shift from a bottom-up to a top-down approach to training, lowered participation and GAP uptake.

2.3.2 Crop diversification

Reallocating land from subsistence cropping to cash cropping potentially improves the household's economic status, although this mechanism relies on several conditions. Von Braun and Kennedy (1994) studied the household-level effects of farm commercialization schemes in several African and non-African countries. They found that most of the smallest farmers – who rely heavily on a significant part of their land for food crops for self-consumption – are cautious in optimizing their land reallocation to the newly introduced cash crop. These farmers recognize failures in the local market that create investment risks for introducing the cash crop. Consequently, they commercialize their farms to a second-best extent compared to full market integration, keeping a significant part of their land for their own food production as insurance against cash crop market failure. Nevertheless, a key difference from the OAF project is that OAF farmers already allocate a substantial part of their land to the cash crop, coffee. These farmers will be introduced to a second cash crop.

Hashmiu, Agbenyega and Dawoe (2022) investigated the income and food security effects for cocoa farmers who diversified into the production of a second cash crop, cashew, and found that both income and food security increased. Cocoa production alone was not sufficient to meet food security demands, as cocoa production is seasonal and additional income was required during low seasons. Tea growers in Gatanga, Kenya, also benefited from a diversification effort into horticulture when tea revenues went down (Kanyuse, Waluse and Wairimu, 2015). Land access appeared to be a determining factor in the success of cash crop diversification; farmers in both studies had sufficient access to land to diversify into two cash crops, leaving part of their land still available for food cropping.

Favourable market conditions play a crucial role in the willingness and ability of smallholders to diversify into cash cropping. If land access is limited, diversification into different cash crops might be risky or infeasible – as seen in Orr's (2000) study on maize growers diversifying into tobacco in Malawi. Micheni, Gathungu and Muriithi (2024) also highlight farm size as well as access to extension services as key determinants of crop diversification in Kenya. The necessity for proper market conditions for farmers to diversify was confirmed by Angaw, Aweke and Abebe (2023), who investigated the diversification of Ethiopian coffee farmers into *khat* farming. They also noted farm income to be a determining factor, which underscores the risk of leaving smaller and poorer farmers behind when rural areas diversify into multiple cash crops.

2.3.3 Food insecurity and gender

Von Braun and Kennedy (1994) found that increased farm income resulting from commercialization (see above) led to higher calorie intake among household members. However, they also observed a decline in the proportion of income controlled by women. They found that female-controlled income is more likely to be allocated toward food purchases than male-controlled income, so this shift has important implications. Notably, the proportion of income managed by women was positively associated with more nutritious food consumption, highlighting the importance of female decision-making over household income if nutritious food is more important than calorie intake.

Other studies underscore the complex and sometimes contradictory effects of crop commercialization on food security vis-à-vis household dynamics. Rubhara et al. (2020) report a 62% increase in household dietary diversity among cash crop producers, attributed to increased household income. However, in this case, commercialization occurred organically with the development of local markets rather than through an external intervention. Similarly, Mujuru et al. (2020) found that South African farmers who received cash transfers and used them to expand farming activities experienced increased food expenditure. Kuma et al. (2019) also saw increased food security among Ethiopian coffee farmers who allocated about half of their land to coffee, compared to farmers only engaged in subsistence cropping.

On the other hand, not all transitions to cash crops yield positive food security outcomes. A collective shift from food crops to cashew production in Ghana was associated with reduced food security among participating households (Adjei, Anlimachie, and Ativi, 2020). Farmers struggled with volatile cashew prices during the lean season, and women in particular were negatively affected. Despite their reluctance to shift land toward cashew cultivation, women had limited decision-making power while carrying primary responsibility for household food provisioning. In Kenya, Chege et al. (2015) found that the food security impacts of cash cropping varied by context: while positive outcomes were observed in areas with favourable agroecological and market conditions, food security declined in more vulnerable regions where baseline food security was already low and market access was limited. Together, these studies highlight the importance of ensuring supportive market conditions when promoting cash crop production and of recognizing the central role of women in household food security and decision-making.

Hoffmann (2024) reported no significant changes in female decision-making as a result of the coffee agronomy training in Uganda. This could be explained by the fact that female decision-making power was already quite low, and the program also did not significantly increase coffee or total farm income. Land reallocation from food crops to coffee was also limited. Income and land allocation changes were not, in this case, drivers of changes in decision-making power. The analysis of the TechnoServe intervention in Uganda conducted by Laterite shows that women have more decision-making power over non-coffee income than coffee income. This suggests that if coffee income increases due to the agronomy training, relative decision-making power over overall income decreases.

2.3.4 Conclusion

The coffee yield gap in Eastern Africa could be closed to a large extent with adequate agronomy training. Better farming practices have been shown to improve yields, particularly when multiple GAPs are implemented together and generate synergistic effects. Agronomy training and extension services increase GAP adoption, especially when training sessions are participatory, farmers receive reminders about GAPs, and support for implementation is readily available. However, additional attention should be given to types of farmers that are less likely to adopt GAPs. Adoption rates vary significantly depending on the specific GAP, the farmer's socioeconomic status, and farm characteristics. Careful alignment between farmers' needs and extension services is essential to maximize both GAP adoption and yields. Attention should also be paid to non-participating farmers in treatment areas who might be affected by negative spillovers, as in Duflo et al. (2023).

Crop diversification into additional cash crops is correlated with increased household income and, in turn, greater food security – assuming market conditions are conducive. However, a rapid shift toward cash crop production in fragile local markets presents notable risks, including the potential for market failure triggered by failed harvest or significant price volatility, which may exacerbate food insecurity. Larger-scale farmers tend to be more likely to diversify into cash crops. In contrast, smallholder farmers may require additional support, such as tailored agronomic advice or improved market access, to optimize the productivity of smaller plots and achieve equitable benefits. Without such targeted interventions, smaller farmers may not experience the same gains in smoothed, year-round income. Additional challenges faced by smallholders engaging in cash cropping—including exposure to market dependency, elevated transaction costs, weak market integration, and insecure land tenure—are explored further in Achterbosch et al. (2014).

Additional income generated through cash cropping is likely to improve food security in regions with relatively well-functioning markets. However, it is important to consider the role of women in household decision-making. Evidence shows that women – who often prioritize household nutrition more than men – may have less influence over how income from crops like coffee is spent, as men typically maintain greater control over cash crop income. This dynamic can undermine women's ability to ensure adequate nutrition for all household members. Emphasis should be placed not only on increasing overall calorie intake but also on improving the diversity and nutritional quality of foods consumed.

3. Research design

This section provides an overview of the core aims of the research, and the subsequent methodology used to address those aims. We start by discussing the principal learning objectives and how they relate to the project intended outcomes, followed by discussing sampling methodology and data collection processes.

3.1 Project and Learning Objectives

The OAF project has four overall project objectives that are to be achieved through the four programs discussed in section 2.1. These project objectives are:

Table 1: One Acre Fund Project Objectives

Project Objective A	Increase coffee income by $30 per year in year 1, and $70 per year in year 2 and year 3 annually
Project Objective B	Increase Chia income by $20 annually
Project Objective C	Increase coffee yield by 20% per tree
Project Objective D	Reduce prevalence of moderate or severe food insecurity in the population, based on the FIES

Laterite's aim is to evaluate the achievement of the project objectives and to examine the causal pathways through which the project's activities are expected to achieve these objectives. In addition, Laterite will assess whether the economic benefits generated by the project are shared across the entire household, rather than concentrated with the household head, and whether any negative consequences arise at the farm-level from the programs. Laterite's Learning Objectives (LOs) are summarized in the table below:

Table 2: One Acre Fund Project Learning Objectives

Learning Objective 1	What are the effects of the project for direct project participants?
Learning Objective 2	What pursued pathways of change are the main drivers in delivering outcome and impact?
Learning Objective 3	Are all household members equally benefitting from the impacts of the project, and how?
Learning Objective 4 (previously LO 5)	Does the project have unintended negative consequences?

Based on the LOs, three main research questions and several sub-research questions were developed. While these will be answered at endline, the Baseline Report provides critical initial information to support a robust research design, enabling Laterite to adequately address the research and sub-research questions and achieve the LOs.

Table 3: Research questions and sub-research questions of the evaluation study

Research questions	Sub-research questions	Data source
1. Does the OAF Project increase the coffee production value of participating coffee farmers, and what are the identified impact pathways?	1A. Do coffee farmers who participate in the OAF project have increased tree productivity, and what are the individual effects of the different project interventions?	OAF Coffee Harvest Survey
	1B. Do coffee farmers who participate in the OAF project have increased income (revenue – cost) from coffee production, and what are the individual effects of the different project interventions?	Laterite Baseline Survey
	1C. Do coffee farmers who participate in the OAF project face any unintended negative consequences related to their coffee farms, caused by the project?	Laterite Baseline Survey
2. Does the OAF project increase agricultural income, and make it more diversified due to increased income through chia and macadamia production?	2A. Do coffee farmers who participate in the OAF project have increased income from Chia, and to what extent does this income stream contribute to increased total household income?	Laterite Baseline Survey
	2B. What is the current average crop mix for farmers who participate in the OAF project?	Laterite Baseline Survey
3. Does the OAF project improve participating farmers' households in terms of total income and food insecurity, and do all HH members equally benefit from an improved economic position?	3A. Do households that participate in the OAF project have increased total household income compared to households that don't participate?	Laterite Baseline Survey
	3B. Do households that participate in the OAF project (with improved household income) have improved food security, and are there any negative impacts on food security?	Laterite Baseline Survey
	3C. Do households that participate in the OAF project observe benefits from the project distributed equally among household members?	Laterite Baseline Survey
	3D. Do households members of households participating in the OAF project face any unintended negative consequences from the OAF project, relating to reinforced unequal household dynamics	Laterite Baseline Survey

3.2 Implementation schedule and evaluation design

The evaluation follows a quasi-experimental design, taking advantage of the staggered roll-out of the program across 45 parishes in Mubende and Kassanda districts over the three-year project lifecycle. Farming households were organized into three cohorts of 15 parishes each, and are surveyed at baseline in 2025, midline in 2026, and endline in 2028. Each cohort of farmers transition from control to treatment at different points in time, allowing for robust comparison across groups.

Our analysis will use the staggered roll-out, multiple comparison groups, and variation in exposure over time. The core components are:

- **Difference-in-Differences (DiD):** The primary approach will be a DiD model adapted to the staggered roll-out, comparing outcomes between treated and to-be-treated parishes. This accounts for fixed parish characteristics, time-invariant farmer traits, and common temporal trends. A critical assumption is parallel trends; deviations due to pre-trends, parish differences, or external shocks could bias estimates. We will test this assumption using pre-treatment data outlined in this Baseline Report, combined with multiple pre-treatment OAF data points on yields. Robustness checks (e.g., matching, difference-with-lag, covariate-adjusted DiD) will complement the main analysis if needed.
- **Time-to-Treatment Analysis:** To track how impacts evolve, we will compare short-term (first year of treatment) and longer-term (multiple years) effects, identifying whether impacts persist or fade.
- **Heterogeneity Analysis:** To assess differential impacts, we will test variation by subgroup characteristics such as demographics, farming characteristics, and baseline farming practices.

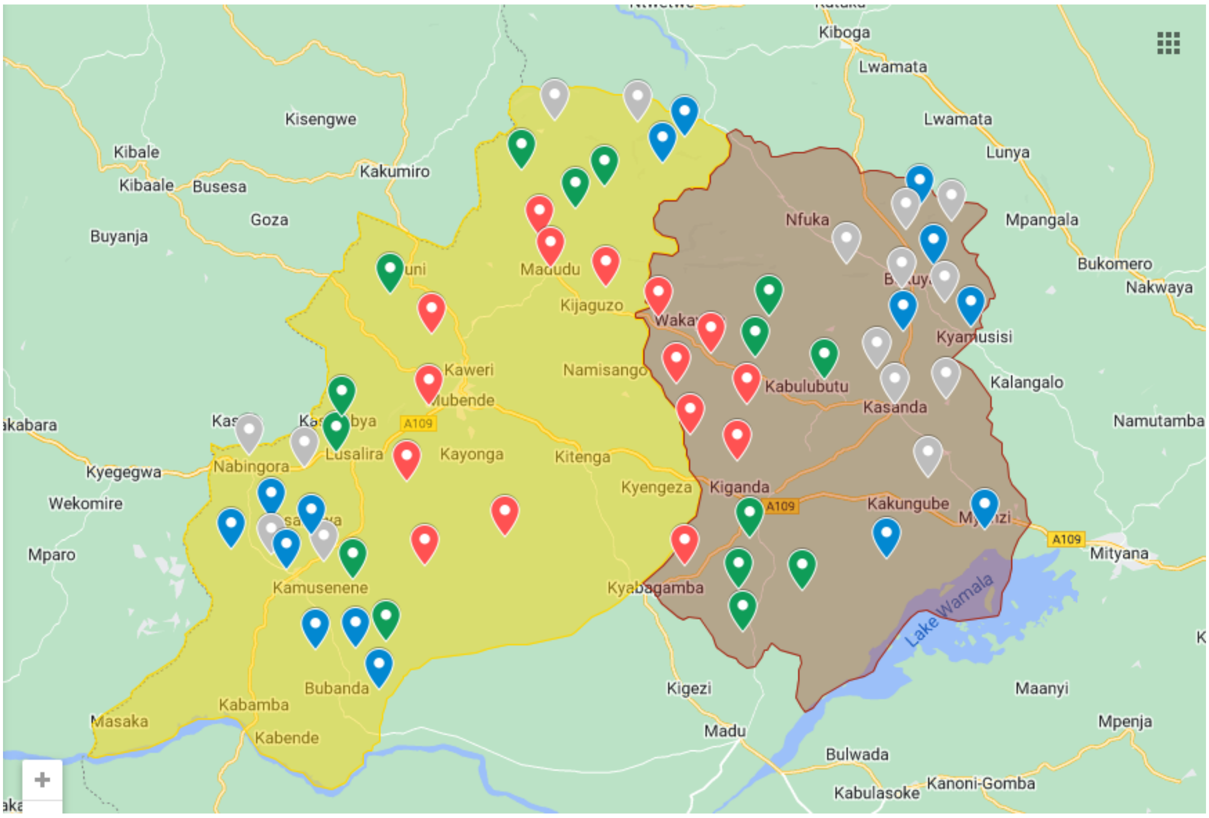
A key feature of the evaluation design is that participation in the program is voluntary, introducing the risk of self-selection. Farmers who choose to enrol may differ systematically from those who do not – such as being more motivated, better resourced, or more risk-tolerant – which limits the generalizability of the findings. As a result, the evaluation estimates the Average Treatment Effect on the Treated (ATT), capturing the impact of the program only for those who opt in, rather than the broader farming population. Given the program's multi-year structure, attrition presents another significant risk. Farmers may drop out of the program or the study for reasons related to the intervention itself (e.g., dissatisfaction with services or migration due to improved income), which could bias impact estimates if attrition is correlated with outcomes.

3.3 Selection and sampling strategy

Parish selection

Figure 3 presents the allocation of sites into program cohorts. Red sites represent Cohort 1, beginning implementation in 2025. Green sites (Cohort 2) will switch from control to treatment in 2026, while blue and grey sites will undergo treatment in 2027. Data collection for the evaluation will take place from year 1 in the red, green, and blue sites, covering 45 parishes in total. The grey sites are excluded from the evaluation.

Figure 3: Selected sites for the OAF intervention in Mubende and Kassanda districts



The allocation of sites to treatment and control in year one was designed to ensure geographic proximity, keeping the program footprint manageable. Out of 60 parishes initially identified as suitable for implementation across Mubende and Kassanda districts, 45 were selected for the evaluation: 25 in Mubende and 20 in Kassanda. The selection of the cohort 1 and cohort 2 sites was not random – cohort 1 sites were close enough to each other to travel easily within year 1, and cohort 2 sites were slightly further out but still within manageable travel districts. The remaining 30 sites (blue and grey) will all receive intervention in year 3. However, the evaluation budget could only accommodate 15 out of 30 year 3 parishes, so the study parishes for year 3 (blue parishes) were randomly selected.

Parishes were selected based on scoping data collected by OAF in the two districts. These data included indicators aligned with program eligibility, such as:

- Percentage of households without coffee training in the past two years.
- Average farmland acreage
- Percentage of households deriving more than half of their income from coffee.
- Average number of coffee trees per household.

- Percentage of households not applying fertilizer in the past two years.

Sampling strategy

The sampling strategy follows a two-stage cluster design. In the first stage, one village per parish was randomly selected, resulting in 45 village clusters. In the second stage, 18 households were randomly sampled within each village, for a total of 810 farming households included in the evaluation. The listing process and initial sampling included a list of 21 farmers per village (945 in total) to provide three 'backup' farmers in case of unavailability of respondents for the main baseline study.

Listing

To ensure the selection of suitable farmers for the evaluation, Laterite deployed enumerator teams to compile lists of eligible farmers across the 45 study sites. The listing process followed three steps:

- **Random selection of villages**: Because parishes are too large to cover all households, we randomly selected one village per parish using Uganda Bureau of Statistics (UBOS) data. A full list of the selected villages is provided in Annex 2 Table 1.
- **Engaging village leaders**: Laterite field coordinators met village leaders to obtain lists of all coffee-farming households in the selected villages without distinguishing by farm size (number of trees) to avoid introducing bias into the lists.
- **Household visits**: Enumerators visited households from these lists, selected at random using a random number generator (1–45). For each household a short survey to confirm eligibility and willingness to participate is conducted. The process continued until 21 eligible and willing households were identified per village. In some cases, the randomly selected villages did not have sufficient numbers of coffee farmers with over 200 trees, so the Laterite team combined two villages within a parish to reach the intended target of 21 farmers per village (including 'buffer' farmers)

Finally, analysis of parish-level population data shows that, although village-level population figures were unavailable, the average population per village in the selected sites is estimated at 709 residents—or about 140 households—based on parish populations, the average household size in Mubende and Kassanda districts, and the number of villages per parish. (Figures calculated by analysing UBOS data).

Data collection

Full data collection for the baseline survey (after the listing exercise was completed) took place between the 24th February and the 15th March 2025. The data collection was completed by a team of 30 enumerators in total, comprising two main teams – one for Mubende and one for Kassanda. Each district team included one field supervisor, supported by two field coordinators to oversee enumerator teams. Given that the sample was larger in Mubende, the Mubende team comprised 18 members and the Kassanda team comprised 14.

In total, the field team managed to successfully reach the target of 810 respondents within the allotted time frame. The breakdown of respondents for listing and full data collection is displayed in Table 4 below.

Table 4: Data collection targets and responses per district

District	Households listed	Sample Target	Completed surveys
Kassanda	420	360	360
Mubende	525	450	450
TOTAL	**945**	**810**	**810**

The data collection process itself did not present many significant challenges; a few points are highlighted below:

- **Farmer Availability:** A large number of potential respondents were unavailable for interviews during peak farming hours, which typically occur in the early morning and late afternoon. This led to delays in data collection as many farmers were occupied with planting, harvesting, or livestock management, leaving only a few hours for interviews.
- **Community Fatigue:** In several regions, community members expressed reluctance to participate in surveys due to a history of frequent data collection efforts that yielded no visible results or feedback. This survey fatigue has led to reduced trust in the process and a diminished willingness to share information.
- **Data Connectivity:** The process of uploading digital forms encountered significant delays in areas with poor mobile internet coverage. In some remote locations, connectivity issues meant that data collectors were unable to submit their data promptly, hindering overall data management efficiency.

Weighting

To ensure our survey results are representative of the target population, we apply survey weights that account for the multi-stage sampling design. At the village and household levels, selection probabilities are calculated, and the weights are derived as the inverse of these probabilities. By combining these weights, we adjust for unequal probabilities of selection and account for variations in sampling intensity across districts and cohorts. This ensures that when we generate tables, the counts represent the population rather than just the sample. Sampling weights assigned to the villages are in Annex 2 Table 1.

3.4 Tree-level yield measurement

To evaluate productivity increase of coffee trees, we use data collected by OAF from their Coffee Harvest Survey. Tree-level data is required to evaluate Program Outcome C;

an expected yield increase of 20% per coffee tree on average. Also, to investigate causal pathways that influence Program Outcome A (increased coffee-related income), tree productivity changes need to be assessed as one of the potential impact drivers next to improved sales prices and expanded coffee plots. Also, tree-level yield data combined with physical characteristics and tree-level GAP application information allows us to explore associations between GAP adoption and productivity changes.

OAF's yield data collection as part of the Coffee Harvest Survey took place after Laterite's baseline (BL) data collection in February 2025, during the harvest of the major season between April and July 2025. OAF enumerators randomly selected eight coffee trees per farm before the harvest started. Farmers were asked to store the cherries from each selected tree in a corresponding bag after sun-drying the cherries. Throughout the harvesting period, OAF enumerators collected and weighed the eight bags that corresponded to the eight selected trees. Enumerators recorded the weights of the bags on a continuous basis until all cherries were harvested and weighed. In addition to the coffee weights, OAF also recorded farmer characteristics and tree-level characteristics, such as physical aspects of the tree (e.g., height, leaf colour, weeds under the canopy, records of any pests and diseases) and GAPs applied to the tree in the past (e.g., the last time the tree was stumped, whether mulch has been applied).

However, involving all 810 sampled farmers in the Coffee Harvest Survey – and ensuring that they stored and recorded the harvest from all eight trees correctly – proved challenging. Out of the 810 farmers, 722 consented to participate. For 115 of these farmers, no tree-level yield data are available, either because harvesting had already begun before OAF's visit or because they were unable to follow the storage guidelines for all eight selected trees. Furthermore, 52 farmers have partial data: some trees are missing yield records, while the remaining trees show zero yield. These farmers are retained in the dataset, as their zero-yield trees may be young or recently stumped and are therefore expected to produce cherries in future rounds of data collection. Among the 607 farmers with at least one tree showing a non-missing, OAF successfully recorded yields for all eight trees in 200 cases. However, for 22 of the 200 farmers of whom OAF recorded non-missing yield for all eight trees, all trees had a yield of zero, because the farmer expected to harvest these trees in later seasons. For the remaining 407 farmers, some trees have missing or zero-yield data.

The initial evaluation plan included extrapolating the 8-tree average yields to the entire farm by multiplying the average with the farmer's estimated number of coffee trees. Since these estimates are self-reported, Laterite initiated a tree-counting exercise to assess potential biases in farmers' estimates and to explore the factors that may influence them. For this exercise, 48 farmers were randomly selected from the main sample, stratified by farm size to ensure a representative distribution. The number of trees on each selected farm was then counted and compared with the farmers' estimates to detect systematic biases. A detailed evaluation protocol and the results of this analysis are provided in *Annex 1: Coffee tree count*, and a brief summary is available in the Laterite Blog: Can farmers estimate their coffee tree count accurately?

Nevertheless, since the Coffee Harvest Survey provided yields for all eight trees for only 139 farmers, Laterite decided to drop the farm-level yield extrapolation. This means that in this report, we use data from Laterite's survey (minor and major seasons 2024) as a proxy for annual yield (section 4.4.1), and self-reported yield data from the OAF Coffee Harvest Survey as a one-season (major season 2025) yield estimate (section 4.3.1). This report also includes tree-level yield data obtained through the Coffee Harvest Survey, and associations between tree-level characteristics, farmer-level characteristics and tree-level yields is shown in section 4.3.1. For the next rounds of harvest data collection, Laterite will work closely with OAF and HereWeGrow (HWG) to improve the process, ensuring that the data can be used more effectively for analysis of yield outcomes.

4. Findings

4.1 Demographics

This section presents descriptive statistics on key household demographic characteristics for farming households in the sample. The socioeconomic variables reported include gender and age of the household head, education level, household size, literacy, and marital status. Insights into these variables are essential for understanding household profiles and ensuring that any observed differences in outcomes across cohorts are not driven by pre-existing demographic disparities. To this end, we assess the comparability of households across the three cohorts using balance tables.

Any variables that show statistically significant differences across groups will be controlled for in the endline analysis to minimize potential bias. The goal of this descriptive analysis is to evaluate the baseline comparability of the cohorts prior to the rollout of the training program.

Key findings:

Household characteristics

- 16% of the households are female-headed
- The average age of the household head is 51 years, and the median age is 50 years.
- The average household size is 6.1 members per household.
- The household head literacy rate is 76%
- On average, farm managers rate their current quality of life at 4.2 on a scale from 0 to 10 (according to the 'Cantrill ladder' question).
- 90% of respondents have attended at least some school, but just 39% have completed primary education or a higher level.

Comparisons

- Female-headed households own fewer assets from a predefined set of household and agricultural assets than male-headed households.
- There are no statistically significant differences in demographic variables across the cohorts.

The sample is characterized by predominantly male-headed households (85%) with an average head age of approximately 51 years with a median age of 50. The age of the household head's spouse is 41 years on average. Households consist of roughly six members on average, with a dependency ratio of 0.5 – suggesting that there are two working-age members for every dependent. Around 76% of household heads are literate, nearly 70% are married monogamously, half have attended some primary school as their highest level of education only (not completing primary school), and over 90% report their primary occupation to be self-employed in agriculture. The average household head has a moderate perception of their quality of life with an average of 4.2 on the Cantrill Ladder, ranging from 0 to 10. This value is similar to the national average as per the Gallup Poll in 2024 at 4.46 out of 10 (Helliwell et al., 2025). For 9.5% of the households, the person most responsible for the farm (i.e. the "farm manager") was not the household head; in 8.4% of the households the spouse of the household head is the farm manager, and in 1.1% of the households the coffee farm is managed by another relative or someone outside the family of the household head.

Overall, the three cohorts appear well balanced across all key socio-demographic variables. None of the differences across cohorts reach statistical significance at conventional levels (all p-values > 0.05), indicating strong comparability. For continuous variables such as age, household size, and dependency ratio, the Adjusted Wald test finds no significant differences. Similarly, for binary and categorical variables – including gender, literacy, marital status, education, and occupation — the Rao-Scott Chi-squared test also shows no significant variation. These results provide confidence that the cohorts are demographically comparable at baseline, reinforcing the internal validity of subsequent impact analyses.

Table 5: Balance table – Household demographics

	(1) Total	(2) Cohorts 1	(3) Cohorts 2	(4) Cohorts 3	(5) *p-value*
	N=810	N=270	N=270	N=270	
Household head is a female (%)	15.63	17.89	12.81	15.52	*0.453*
Age of household head	50.8 (49.7, 51.9)	51.3 (49.6, 53.0)	50.1 (47.5, 52.6)	50.9 (49.1, 52.6)	*0.733*
Household size[4]	6.1 (5.9, 6.4)	6.2 (5.9, 6.5)	6.0 (5.7, 6.3)	6.2 (5.6, 6.7)	*0.492*
Household dependency ratio[5]	0.5 (0.5, 0.5)	0.5 (0.5, 0.5)	0.5 (0.5, 0.5)	0.5 (0.5, 0.5)	*0.868*
Literacy (can read and write; %)	76.27	76.07	78.93	74.60	*0.547*
Cantrill Ladder[6]	4.2 (4.1, 4.4)	4.2 (4.0, 4.5)	4.3 (4.0, 4.5)	4.2 (3.9, 4.4)	*0.837*
Marital status (%)					*0.939*
Married monogamous	67.7	67.3	70.4	66.2	
Married polygamous	15.4	17.3	13.5	14.9	
Widowed	9.0	8.7	8.1	9.9	
Separated/divorced	6.4	5.5	6.2	7.5	
Never married/single	1.3	1.2	1.4	1.2	
Cohabiting	0.2	0.0	0.4	0.3	
Level of education of the household head (%)					*0.661*
None	10.2	10.4	9.1	10.8	
Some primary	50.8	50.8	56.5	46.8	
Primary completed	17.6	17.6	15.9	18.8	
Some secondary	9.6	8.0	8.3	12.0	
Lower secondary completed	5.9	5.1	6.4	6.3	
Advanced secondary completed	2.5	3.5	1.5	2.2	

[4] This number includes all members who have lived in the household for six months or more, and includes students who are in boarding school but depend on the household's income.
[5] The household dependency ratio corresponds to the number of dependents in a household (people aged below 15 and over 65) divided by the number of people in the working age population in that household.
[6] The Cantrill Ladder measurements indicate the average answer to the question "*Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you, and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?*".

Table 6 and Table 7 below represent information on asset ownership across the sample. Table 6 presents the percentage of households that own each of the 24 agricultural and household assets. These asset ownership indicators allow for comparison of relative asset levels between households. Asset ownership serves as a simplified proxy for relative wealth, which we use to compare wealth across groups and examine differences in outcomes by asset ownership category. We constructed such an asset index using Principal Component Analysis (PCA) based on ownership of the 24 household and agricultural assets. For the sake of interpretation, the PCA scores have been normalized to a 0-1 scale, in which 0 represents the lowest relative asset ownership and 1 the highest.

Table 7 shows the average index values disaggregated by the gender of the household head and by district. Comparison test outcomes indicate that male-headed households own more assets than female headed households ($p<0.001$). These outcomes are also reflected in the absolute number of assets owned per category, also presented in Table 7. In Annex 2 Table 2 asset ownership is compared across treatment cohorts and districts. No statistically significant differences are found between the cohorts and districts.

Table 6: Percentage of households that own agricultural or household assets

Agricultural asset	Percentage of households that own asset	Household asset	Percentage of households that own asset
Axe	76.3%	Improved charcoal/wood stove	33.3%
Pickaxe	76.3%	Bed + mattress	94.7%
Plough	2.5%	Sofa/couch	24.7%
Spade/spading fork	59.5%	Bank account	27.1%
Hoe	99.5%	Mobile Money account	91.4%
Chemical sprayer	66.3%	Table	65.1%
Pruning saw	13.9%	Radio	72.0%
Tarpaulin	78.4%	TV	35.3%
Wheelbarrow	23.4%	Refrigerator	2.9%
Secateurs	6.8%	Electric fan	0.5%
		Mobile phone	94.1%
		Bicycle	29.3%
		Motorbike	41.7%
		Car or truck	3.5%

Table 7: Assets owned and asset ownership index by household head gender

	Total	Male	Female	*p-value*
	N=810	N=683	N=127	.
Number of agricultural assets out of 10	4.5 (4.3, 4.7)	4.7 (4.5, 5.0)	3.3 (3.0, 3.7)	*<0.001*
Number of household assets out of 14	6.2 (5.9, 6.4)	6.4 (6.1, 6.6)	5.1 (4.7, 5.5)	*<0.001*
Number of total assets owned out of 24	10.7 (10.2, 11.1)	11.1 (10.6, 11.6)	8.4 (7.7, 9.1)	*<0.001*
PCA asset ownership index	0.42 (0.40, 0.44)	0.44 (0.42, 0.46)	0.31 (0.28, 0.34)	*<0.001*

Note: The table presents a comparison by household head gender of the absolute number of agricultural and household assets owned out of a pre-given list of 10 agricultural and 14 household assets, as well as the relative PCA asset ownership index. The groups are compared using Rao-Scott Chi-squared tests.

4.2 Coffee farm characteristics

This section outlines basic characteristics of coffee farms, as well as characteristics of farmers themselves in terms of experience, knowledge and attitudes towards coffee farming. This is to provide contextual information for the farmers included in our sample, and thus the OAF baseline. We also discuss current possible negative practices in terms of coffee farming that may be reinforced further by the OAF project.

Key findings:

Farm figures

- The average farmland is 5.9 acres (2.4 hectares). In Mubende, the average farm is much bigger at 7.2 acres than in Kassanda, where the average is 4.2 acres
- Farmers allocate around 2.4 acres to Robusta production on average. All 810 farmers in the sample grow Robusta coffee, and 47 farmers grow Arabica
- "Other" annual crops (20%), bananas (14%) and beans (12%) also take up a considerable amount of the sample's total cultivated area
- Farmers have around 1,028 coffee trees on average, of which 741 are productive[7] trees. Farmers manage 1,020 Robusta trees on average, and the 47 Arabica growers manage 118 Arabica trees on average
- The average coffee tree density is 280 coffee trees per acre of farmland and ranges from 343 coffee trees per acre for the smallest farm group, to 205 coffee trees per acre for the largest

[7] Productive coffee trees produced cherries or flowers in the season prior to the survey.

- Only one farmer owns macadamia trees, zero farmers produce chia

Farmer characteristics

- The farmers have 15 years of coffee farming experience on average
- 15% of farmers are a member of a cooperative or coffee association
- The attitude towards coffee farming is generally positive: 93% have a positive or very positive prospect of the future of coffee farming and 96% would be happy or very happy if their children become coffee farmers
- 31% has had coffee agronomy trainings in the past four years.

Comparisons

- There are no statistically significant differences across cohorts in terms of farm and farmer characteristics
- Mubende has bigger farms, but the average area allocated to coffee is comparable between the districts. The number of coffee trees managed is not statistically significantly different in the two districts
- Larger farmers have a slightly higher Productivity Diversity Index than smaller farmers

Methodology:

- The figures of land area sizes and percentages allocated to agricultural activities are derived from the survey questions on plot sizes and "10-stone questions". Farmers indicated the number of plots they manage and estimated the sizes. For each plot, they indicated what percentage of the plot is used for each land use activity using 10 stones they had to divide over the activities. This allowed us to compute total farm sizes and fractions of farmland allocated to each activity.
- We report coffee tree density figures in two ways; trees per acre of *coffee-planted area* and trees per acre of *coffee-holding plots.* Coffee-planted area is the area derived from the number of stones that farmers allocated to coffee. This metric strictly considers the land covered with coffee trees. Coffee-holding plots is the size of all plots combined on which coffee is present. This area is by definition at least as big, as it can also host intercrops and shade trees.
- The diversity of agricultural production activities is represented by the Productivity Diversity Index which is based on the relative size of each productive land use activity on the farm, using a variation of the Herfindahl-Hirschman Index. The relative size of an activity is again based on the 10-stone question.

4.2.1 Farm characteristics

Table 8 represents the average acreage of land allocated to each land use activity, and the number and percentage of farmers that practice this activity. The areas are calculated with the answers to the "stone questions", which ask the farmer to estimate how many stones out of 10 represent the size of the plot on which an activity takes place. Each stone therefore counts for approximately 10% of the plot surface. Note that not all farmers were able to estimate their plot sizes or allocated stones. These farmers are excluded from the figures in Table 8.

The average farmland is 5.9 acres (2.4 ha). All farmers in the sample are engaged in Robusta coffee production. The average area used for Robusta is 2.4 acres. Although 47 farmers stated that they grow Arabica, there are only 39 farmers with a significant share of their land allocated to Arabica production. These 39 farmers allocate 0.6 acres to this coffee species on average[8]. The average land allocated to all coffee species is therefore very close to the average Robusta coffee-planted area at 2.4 acres.

For farmers that use land specifically for livestock activities (18% of the sample), the area dedicated to livestock is 3.3 acres. Other large land use activities are annual crops (grown by 75% of sample) and timber (produced by 5%) with 1.7 and 1.4 acres to these activities respectively. Many farmers grew bananas (79%) and beans or other legumes (66%) and allocated 0.9 acres and 1 acre to these crops on average, respectively. Only 19 farmers (2%) in the sample allocated land to vegetable production, with an average area of 0.6 acres allocated to these crops.

District comparisons show that the average farm size in Mubende is significantly larger than in Kassanda (7.2 acres versus 4.2 acres, p<0.001). However, the absolute area allocated to coffee production does not differ across the districts, with 2.5 acres of coffee-planted area in Mubende and 2.3 acres in Kassanda. More farmers in Mubende grow beans (78% versus 53%, p<0.001) and other annual crops (83% versus 66%, p<0.001), and livestock farming is also more prevalent in Mubende (22% versus 13%, p=0.031). These farming activities also take place on larger areas. Bean production areas in Mubende are twice as large compared to Kassanda (1.2 acres vs 0.6 acres, p<0.001). Annual crop production takes 2.0 acres of farmland in Mubende and 1.2 acres in Kassanda (p=0.005). Dedicated livestock areas are as large as 4.5 acres for livestock holders in Mubende, compared to 0.8 acres in Kassanda (p=0.003). Only banana production is more prevalent in Kassanda (84% versus 76% of farmers, p=0.025), but the area dedicated to banana trees is again larger on the in general larger farms in Mubende (1.1 acres versus 0.7, p=0.016).

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[8] There is a discrepancy between the number of Arabica farmers for which we know the size of the farmland allocated to Arabica (n = 39 in Table 8) and those with available data on Arabica production and tree count (n = 47 in the remaining Results section). The difference of eight farmers comes from the fact that 6 of the Arabica growers allocate an insignificant part of their land to Arabica production – in some cases only a few trees – and 2 more Arabica growers had difficulties estimating the size of the farmland used for Arabica vis-à-vis the farmland used for Robusta.

Table 8: Land use activity and land use size by district

Land use activity	(1) Mean acreage	(2) Percentage of sample	(3) District mean acreages for each land use activity and comparison p-values	(4)	(5)	(6) Percentages of farmers engaged in activity and comparison p-values	(7)	(8)
	Total	Total	Kassanda	Mubende	*p-value*	Kassanda	Mubende	*p-value*
Total farmland	5.9 (5.0, 6.7)	N=808	4.2 (3.6, 4.9)	7.2 (5.8, 8.7)	*<0.001*	N=359	N=449	
Coffee	2.4 (2.1, 2.7)	100%	2.3 (1.9, 2.7)	2.5 (2.2, 2.9)	*0.356*	100%	100%	*0.363*
Robusta coffee	2.4 (2.1, 2.6)	100%	2.3 (1.9, 2.7)	2.5 (2.1, 2.8)	*0.414*	100%	100%	*0.428*
Arabica coffee	0.6 (0.4, 0.9)	6%	0.5 (0.1, 0.8)	0.7 (0.4, 1.0)	*0.249*	5%	7%	*0.191*
Bananas, plantain	0.9 (0.8, 1.0)	79%	0.7 (0.5, 0.9)	1.1 (0.9, 1.2)	*0.016*	84%	76%	*0.025*
Beans, other legumes	1.0 (0.8, 1.1)	66%	0.6 (0.5, 0.7)	1.2 (1.0, 1.4)	*<0.001*	53%	78%	*<0.001*
Other tree crops (avocado, mangoes, jackfruit)	0.4 (0.3, 0.5)	19%	0.4 (0.3, 0.5)	0.5 (0.3, 0.7)	*0.245*	25%	15%	*0.006*
Vegetables (eggplant, tomatoes, dodo)	0.6 (0.3, 0.9)	2%	0.6 (0.1, 1.2)	0.6 (0.2, 0.9)	*0.809*	2%	2%	*0.414*
Annual crops (maize, millet, potatoes)	1.7 (1.3, 2.0)	75%	1.2 (0.9, 1.4)	2.0 (1.5, 2.5)	*0.005*	66%	83%	*<0.001*
Livestock area	3.3 (1.5, 5.1)	18%	0.8 (0.3, 1.4)	4.5 (2.3, 6.8)	*0.003*	13%	22%	*0.031*
Wood/timber	1.4 (0.6, 2.2)	5%	0.6 (0.2, 0.9)	1.8 (0.7, 2.9)	*0.035*	4%	7%	*0.126*
Forage	0.3 (-1.9, 2.5)	0%	0.3 (-1.9, 2.5)	-	.	0%	-	-
Fallow land	1.0 (-0.2, 2.1)	0%	1.0 (-0.2, 2.1)	-	.	0%	-	-
Unused land	1.9 (,)	12%	0.2 (,)	1.9 (,)	.	0%	4%	*<0.001*

Note: The table presents the average acreage of farmland allocated to each agricultural land use type, as well as the percentage of farmers maintaining each land use type on their farmland. Average acreages are calculated only among farmers engaged in the land use type. The sample sizes indicate how many farmers are engaged in the activity. The percentages show the share of farmers in the total sample and in each district sub-sample who are engaged in the activity. Percentages may not precisely match unweighted shares because they are calculated with survey design weights. For comparisons of mean acreages between districts, we use an Adjusted Wald test. For comparisons of the percentages of farmers engaged in a land use activity, we use a Rao–Scott chi-squared test.

Figure 4 below shows the percentage of farmland allocated to each land use activity. The data in the figure and the table are presented in different ways. Figure 4 shows the percentage of farmland allocated to each activity for all farmers in the sample combined. This means, for example, that 20% of all the farmland combined in the sample was used for Annual crops. This is therefore an aggregate measure and demonstrates the overall land use by sampled coffee farmers across Mubende and Kassanda. The percentage shown for each activity represents the mean across all farmers, including those who do not practice the mentioned land use activity – who account for 0%. Therefore, some land use activities seem to be low compared to Table 8 data. In Annex 2 Table 6 we correct for the fact that not all farmers exercise all land use activities. It shows the percentage of farmland that is taken by each land use activity across the farmers who are engaged in this activity, so gives a better idea of average land use 'per individual farmer' compared to Figure 4.

Among the farmers who grow robusta coffee – which is the entire sample – 48% of their land is allocated to Robusta production, whereas the 39 Arabica growers[9] allocate only 12% of their land to Arabica. Farmers that grow annual crops (such as potatoes, ground nuts and maize) allocate 25.6% of their farm to these crops. As most farmers produce annual crops, the percentage of the sample's total farmland used for annual crops is also the second highest (after Robusta) in Figure 4 with 20%. Bananas (14%) and beans and other legumes (12%) also take a considerable percentage of the sample's total cultivated land (Figure 4). Bean growers allocate 17.4% of their land to bean production, and the slightly more present banana growers allocate a similar fraction to bananas with 17.4%. Livestock holders have an area dedicated to livestock of 21.3% of their land, whereas the fraction of livestock on the combined land surface only reaches 4%. Furthermore, no statistically significant differences are found between cohorts in terms of productive farmland portions of land activity allocations (Annex 2 Table 5).

Annex 2 Table 5 and Annex 2 Table 6 also present the average Productivity Diversity Index (PDI). Farms with a higher PDI have a more diversified productive farmland than farms with lower PDIs. The index is based on the relative area share of each productive land use activity (that is excluding unused land or fallow land) on the total productive farmland. It is computed using the normalized inverse Herfindahl-Hirschman Index:

$$PDI_i = 1 - \sum_{c=1}^{n_i} \left(\frac{a_{ic}}{\sum_{c=1}^{n} a_{ic}}\right)^2$$

In which:

- PDI_i is the productivity diversity index for farmer i
- a_{ic} is the acreage of land allocated to crop or land use activity c produced by farmer i
- n_i is the number of land use activities practiced by farmer i

[9] With a non-negligible proportion of their farm allocated to Arabica – see footnote 8 above

A Productivity Diversity Index (PDI) of 0 means that the farmer practices only one type of land use activity. A theoretical PDI approaching 100 is assigned to a farmer with an infinite number of land use activities, each with an equally small share of productive farmland.

We divided the farms into four farm size groups to observe heterogeneity in outcomes. The smallest group manages a farm smaller than 2.5 acres and includes 218 farmers. Farm size group 2 has farms between 2.5–5 acres and 267 farmers. Group 3 includes farms between 5–10 acres and has 203 farmers. The largest group has farms of more than 10 acres and consists of 120 farmers.

Smaller farms dedicate a larger portion of their land to Robusta coffee and bananas, as well as dedicating a smaller portion to livestock compared to larger farm size groups ($p<0.001$, $p<0.001$ & $p=0.003$ respectively). Farmland dedicated to beans and to annual crops also differ statistically significantly across the farm size groups. The smallest farm size group has the highest percentage of land allocated to beans (18.8%, $p<0.001$) and the 5-10 acres group allocates the most farmland to annual crops (29.7%, $p<0.001$).

Furthermore, smaller farms have a lower PDI than farms in larger groups ($p<0.001$), with the PDI ranging from 50.7 to 61.6 for the smallest and largest groups, respectively. Although the difference is statistically significant, it is relatively small, given that the average farm in the smallest farm size group is 1.5 acres and that of the largest group is 17.8 acres. The average number of productive farmland activities is 3.2 for the smallest group and 4.3 for the largest, indicating an average difference of only 1.1 land use activities between the smallest and largest groups.

Figure 4: Percentage of the total sample cultivated land used for each productive land use activity

Note: This figure shows the distribution of land use activities on the sample's total farmland combined. The percentages refer to the **share** of total farmland allocated to each land use activity, taking into account 0% for farmers who did not practice the activity. "Annual crops" refer**s** to maize, millet, groundnuts**,** and other annual non-vegetables**;** "Beans" refer**s** to beans and other legumes**;** "Other tree crops" **refers** to all non-coffee and non-macadamia tree crops**;** and "Wood" **refers** to timber production. The red bar below *Robusta, 48* represents the percentage of total cultivated land allocated to Arabica coffee, which does not exceed 1%.

The farmers manage 1,028 coffee trees on average, of which 741 are productive (trees that produced coffee cherries in the 12 months prior to the survey) and 307 are unproductive (trees that were too young, too old, sick or recently clean-stumped and did not produce any cherries in the 12 months before the survey, Table 9). Robusta growers have 1,020 Robusta trees on average, whereas the 47 Arabica growers only have 118 Arabica trees, of which 92 produced Arabica cherries. Note that these numbers are based on farmers' self-report during Laterite main survey. For the verification of the self-reported tree counts which Laterite executed as part of the Tree Count Survey, see *Annex 1: Coffee tree count.*

In terms of numbers of coffee trees and Robusta coffee trees, Mubende and Kassanda districts do not differ from each other. However, even though the farmland areas allocated to Arabica coffee are not significantly different (Table 8), Mubende Arabica growers have significantly more Arabica total and productive trees than in Kassanda (p=0.005 and p=0.012 respectively). Furthermore, numbers of coffee trees – for any species and productivity statuses – do not statistically significantly differ across treatment cohorts (Annex 2 Table 3).

Table 9: Number of coffee trees in total and of each species across districts

Species	Total	Districts	
		Kassanda	Mubende
All species			
Total (n=808)	1028 (892, 1165)	1029 (826, 1232)	1028 (843, 1212)
Productive (n=804)	741 (634, 848)	788 (617, 959)	703 (569, 837)
Unproductive (n=804)	307 (236, 378)	250 (199, 301)	354 (232, 477)
Robusta			
Total (n=808)	1020 (882, 1157)	1028 (825, 1231)	1013 (827, 1200)
Productive (n=803)	737 (630, 845)	789 (621, 958)	694 (557, 831)
Unproductive (n=804)	305 (234, 376)	248 (197, 300)	351 (229, 474)
*Too young**	267 (199, 336)	207 (163, 251)	317 (198, 436)
*Clean stumped**	17 (12, 21)	13 (7, 18)	20 (14, 27)
Arabica			
Total (n=47)***	118 (54, 181)	23 (4, 41)	172 (74, 269)
Productive (n=47)**	92 (30, 154)	13 (1, 24)	137 (44, 231)
Unproductive (n=47)	28 (6, 51)	13 (-9, 36)	37 (3, 70)

Note: The table shows the average number of coffee trees (and 95% confidence intervals) in total and by species for the whole sample and across the districts. Averages are calculated for farmers who were able to recall and estimate tree counts. Farmers who were unable to provide an estimate are excluded from the calculation. Therefore, the sample sizes are not equal across the species categories. Averages are compared between the two districts using Adjusted Wald tests, which account for the survey design. Asterisks indicate significance levels (* p<0.1, ** p<0.05, *** p<0.01).

Farmers have 479 coffee trees per acre of *coffee-planted area* on average, or 280 coffee trees per acre of *coffee-holding plots* (see *Methodology* at the start of section 4.2). Table 10 below shows that the tree density is highest at the smallest coffee farms in terms of number of total and productive coffee trees per acre of coffee-planted area and coffee-holding plots (p=0.006, p=0.001, p<0.001 & p<0.001). The larger number of coffee trees per acre using both metrics among small farmers indicates that small farmers have a higher coffee tree density (trees are planted closer together) and have coffee plots that are more dominated by coffee trees than other crops.

In Annex 2 Table 4 the number of coffee trees per acre are compared across treatment cohorts and districts. The tree density in Kassanda is higher than in Mubende. Kassanda farmers have 508 coffee trees per acre and 380 productive trees per acre of coffee-planted area compared to the 456 total and 311 productive trees per acre in Mubende (p=0.062 & p=0.017). Considering all coffee-holding plots, the farms in Kassanda have 319 total trees and 238 productive trees per acre, whereas this is 246 and 170 in Mubende respectively (p<0.001 & p<0.001). Differences across cohorts are not statistically significant.

Table 10: Number of coffee trees per acre across farm size categories

	Total	Farm size category			
		<2.5 acres	2.5-5 acres	5-10 acres	>10 acres
Coffee-planted area[1]					
Total trees per acre***	479 (451, 508)	547 (505, 589)	491 (436, 546)	434 (387, 481)	402 (310, 495)
Productive trees per acre***	342 (313, 371)	403 (364, 441)	347 (296, 397)	298 (260, 336)	295 (210, 380)
Coffee-holding plots[2]					
Total trees per acre***	280 (260, 299)	343 (313, 373)	286 (250, 321)	246 (216, 277)	205 (148, 262)
Productive trees per acre***	201 (183, 219)	256 (229, 284)	203 (174, 231)	169 (145, 193)	150 (104, 195)

Note: The table shows the average number of total and productive coffee trees per acre of coffee plantation. 95% confidence intervals are given in brackets. The trees per acre are compared across the farm size groups using an Adjusted Wald test, and asterisks indicate significance levels (p<0.1, p<0.05, p<0.01).
1: *Coffee-planted area* refers to the portion of a farmer's land specifically planted with coffee trees. If a farmer reported that a certain percentage of a plot is under coffee, this percentage was applied to the plot size to estimate the coffee-planted area.
2: *Coffee-holding plots* include all plots that contain any coffee trees, regardless of whether the entire plot is planted with coffee. These plots may also contain intercrops or other crops. The total area of coffee-holding plots is the sum of the sizes of all such plots managed by the farmer.

For 45 farmers in the sample who cultivate coffee plots that hold only Robusta trees and no intercrops or other vegetation, the tree density is 405 Robusta trees per acre on average (median=343). This suggests that at least a small sub-sample of farmers have a lower tree density than the recommended 450 trees per acre by the UCDA (n.d.). There may be an opportunity for OAF to encourage farmers to increase the tree density for increased yield while maintaining proper spacing. A prerequisite for this recommendation is proper pruning and stumping to allow sufficient air circulation and sunlight, and protection against pests and diseases that transfer easily from tree to tree.

Research question 2A refers to increased income through chia production and increased macadamia planting. However, at baseline, only one farmer in the sample had macadamia trees and no farmers had chia plants. Also, the one macadamia producer did not generate any yield or sales in the 12 months prior to the survey. Therefore, we do not include descriptive analysis for this indicator in this report.

4.2.2 Farmer knowledge, attitudes and experience

This section presents descriptive statistics on key characteristics related to coffee farming experience, prior agronomic training, farmer attitudes, and cooperative membership. These variables are important for understanding the professional profiles and motivations of coffee farmers in the sample, and to assess whether the three cohorts and the two districts in which the study is implemented are comparable at baseline. Any statistically significant differences will be accounted for in the endline analysis to reduce bias when estimating program effects. The goal of this section is to establish whether there are any baseline differences that might affect farmers' capacity to benefit from or respond to the training program.

On average, farmers in the sample report approximately 15 years of experience in coffee cultivation, with no statistically significant differences across cohorts (p=0.832). However, district-level variation is notable: farmers in Kassanda report significantly more years of experience (17.3 years) than those in Mubende (12.5 years), with a p-value<0.001. This difference will be accounted for in subsequent analysis, as farming experience may influence both adoption of good agricultural practices and productivity outcomes.

Cooperative or association membership is relatively low overall, with just under 15% of farmers affiliated with such organizations. Membership rates do not significantly differ across cohorts (p = 0.643), but are somewhat higher in Mubende (18.3%) than in Kassanda (10.3%), with a p-value of 0.084. If cooperative membership supports farmers in obtaining better input and sales prices (through economies of scale and collective bargaining power), then there is much room for improvement for the majority of farmers. This means that an effective Market Access Program has a potential to improve farmers' buying and selling activities among the large group of farmers that are not cooperative members.

Farmer attitudes toward the future of coffee cultivation are generally optimistic. Across the sample, more than 90% of farmers report a positive or very positive outlook. This trend is consistent across cohorts and districts, with no significant differences. Similarly, when asked about their views on their children becoming coffee farmers in the future, nearly all respondents expressed happiness or strong happiness. Although, it needs to be noted that coffee prices were increasing strongly since the start of 2024, likely improving the farmer's perspective on coffee farming. Responses differ significantly by district (p = 0.046), with farmers in Kassanda more likely to express strong enthusiasm about their children continuing in coffee farming than those in Mubende.

With respect to prior training, 30.5% of farmers report having received coffee-related training in the past four years. There are no significant differences across cohorts (p=0.699), but uptake differs significantly across districts: only 22.2% of Kassanda farmers report receiving training, compared to 37.4% in Mubende (p=0.015). Among the 240 farmers who have been trained, the most common topics were crop management (70.2%), selective harvesting (60.9%), and fertilization or soil improvement (57.4%). Notably, farmers in Kassanda were more likely than those in Mubende to have received training on post-harvest practices (58.8% vs. 44.0%, p=0.017) and rejuvenation techniques (61.2% vs. 46.6%, p=0.023).

Overall, while the cohorts are largely balanced across these key variables, certain district-level differences – particularly in farming experience and prior exposure to training – are statistically significant. We will control for districts in the final analysis. These findings offer a useful baseline picture of farmers' profiles before the intervention is implemented and help inform the interpretation of future changes in knowledge, attitudes, and practices.

Table 11: Coffee farmer characteristics

	Total	C1	C2	C3	*p-value*	Kassanda	Mubende	*p-value*
	N=810	N=270	N=270	N=270		N=360	N=450	
Years of experience	14.7 (13.8, 15.6)	14.7 (13.3, 16.1)	14.1 (11.7, 16.5)	15.1 (13.2, 17.0)	*0.832*	17.3 (15.9, 18.8)	12.5 (11.5, 13.4)	*<0.001*
Cooperative/association member (%)	14.6%	14.5%	11.4%	17.0%	*0.643*	10.3%	18.3%	*0.084*
Attitude towards future					*0.720*			*0.488*
Very negative (%)	0.1%	0.0%	0.0%	0.2%		0.0%	0.2%	
Negative (%)	1.1%	1.5%	0.2%	1.4%		1.1%	1.1%	
Neutral/don't know (%)	5.5%	6.1%	4.5%	5.7%		7.1%	4.3%	
Positive (%)	40.9%	41.3%	36.1%	43.8%		41.9%	40.0%	
Very positive (%)	52.3%	51.0%	59.2%	48.8%		49.9%	54.4%	
Attitude towards children becoming coffee farmers					*0.666*			*0.046*
Very concerned (%)	0.4%	0.0%	0.0%	1.0%		0.9%	0.0%	
Concerned (%)	1.3%	1.0%	1.2%	1.6%		1.6%	1.0%	
Neutral/don't know (%)	1.9%	2.9%	0.6%	1.8%		0.4%	3.2%	
Happy (%)	34.9%	30.3%	36.4%	38.2%		39.6%	31.0%	
Very happy (%)	61.5%	65.8%	61.8%	57.3%		57.5%	64.8%	
Had a training in the past 4 years					*0.699*			*0.015*
Don't know (%)	0.2%	0.0%	0.3%	0.4%		0.0%	0.4%	
No (%)	69.3%	70.9%	72.5%	65.6%		77.8%	62.2%	
Yes (%)	30.5%	29.1%	27.2%	34.0%		22.2%	37.4%	
Training topics learned (N=240)								
Pick coffee cherries with harvest (%)	60.9%	53.0%	62.1%	66.5%	*0.178*	68.0%	57.3%	*0.101*
Dry, store and sell coffee (%)	48.9%	50.0%	40.2%	52.9%	*0.346*	58.8%	44.0%	*0.017*
Crop management (%)	70.2%	66.0%	70.3%	73.4%	*0.546*	75.6%	67.4%	*0.350*
Rejuvenation practices (%)	51.5%	50.0%	47.0%	55.1%	*0.548*	61.2%	46.6%	*0.023*
Apply fertilizer, compost, manure and/or mulch (%)	57.4%	65.3%	44.9%	58.2%	*0.238*	67.6%	52.3%	*0.103*
Prevent and/or get rid of pests and diseases (%)	44.5%	46.6%	40.7%	45.1%	*0.813*	39.0%	47.3%	*0.283*
Other (%)	12.2%	12.1%	12.4%	12.2%	*0.999*	11.8%	12.4%	*0.885*

Note: The table shows the averages of different characteristics of coffee farmers. Continuous data are presented as means with 95% confidence intervals in parentheses. Categorical data are presented as percentages. The sample sizes indicate how many farmers answered the questions. For binary and categorical variables, the percentages refer to the farmers in the total sample and subsamples who selected the specific answer option. The percentages may not precisely match the fraction of farmers in the total sample because they account for the survey design and survey weights. For the comparison of means of continuous variables across cohorts and districts, the table reports the p-value from an Adjusted Wald test. For the comparison of means of binary and categorical variables across cohorts and districts, the table reports the p-value from a Rao-Scott Chi-squared test. Training topics on crop management include weeding and desuckering, and those on rejuvenation practices include stumping and pruning.

4.2.3 Current negative practices

This section presents descriptive statistics on two categories of current negative practices observed among coffee farmers in the sample: the involvement of underage children in farm work and unsafe environmental practices related to pesticide use and disposal. These practices are key risk factors that we will track over time. We assess their prevalence across farmer cohorts and by farm size to identify any systematic differences that could influence training needs and program responsiveness. In this report, we count a child as ‘underage’ if the child is younger than 18 years old.

Child Labor Practices

A high proportion of farmers (87%) reported that underage children had worked on their coffee farms in the past 12 months, with no statistically significant differences across cohorts or farm size groups. While this figure does not necessarily indicate hazardous or exploitative labour, it suggests that child work on family farms is widespread. More concerningly, around 8.5% of farmers indicated that children had missed school due to farm work. Again, there were no significant differences across cohorts or farm sizes.

Among the subset of households where children did miss school, the child who missed the most school days was reported to have missed an average of 8.8 days over the previous year. This average ranged from 5.9 days in the smallest farm size category to 11.8 days among farms larger than four hectares, although these differences were not statistically significant ($p = 0.087$). These findings highlight the need for sensitization around appropriate child involvement in farm work and the importance of prioritizing education.

Environmental Practices and Use of Hazardous Chemicals

Environmental risks related to pesticide use and chemical disposal practices are also prominent. About one-third (32.4%) of farmers reported using chemical pesticides on their coffee trees in the past 12 months, and 21.1% reported using chemical fungicides. Usage did not differ significantly across cohorts, but varied by farm size: use of chemical fungicides increased with farm size, ranging from 12.9% among the smallest farms to 27.7% among the largest ($p = 0.008$).

None of the 266 farmers who used pesticides applies pesticides that are prohibited by Ugandan law, or that are on the prohibited list by GCP’s Coffee Sustainability Reference Code (2023). However, many of the ingredients in pesticides used are on the GCP “phase-out list” for the years 2026 and 2030 because of carcinogen risks, other chronic health hazards or environmental harm. For example, 130 farmers used “Striker”, a pesticide with the active ingredients Lambda-cyhalothrin – a bioaccumulative substance – and Thiamethoxam, which is known to be very harmful to ecosystems. Other mentioned products are “Rocket”, which contains other environmentally harmful ingredients and is used by 105 farmers, and Dudu Cyper and Dudu Accelamectin, each mentioned by 17 farmers and containing bioaccumulative substances and GHS Category 2 ingredients.

Use of personal protective equipment (PPE) remains limited. On average, farmers reported using fewer than two PPE items when applying pesticides. Only 3.4% of farmers reported using a full set of PPE (defined as mask, gloves, spray suit, hat, boots and goggles), with no significant variation by cohort or farm size. Among individual PPE items, boots were the most commonly used (82%), followed by masks (47%) and gloves (17%). Use of goggles, spray suits, and hats was below 20% across the board.

Chemical container disposal practices reveal both promising and concerning trends. The most common disposal method was burning (59.3%), which is considered an acceptable practice. However, a substantial share of farmers reported unsafe methods: 25.9% threw containers into their fields or compounds, and 5.9% disposed of them in pit latrines or toilets. Notably, improper toilet disposal was significantly more common among the largest farm size group (15.9%, p=0.018). Only 1.6% of farmers reported returning containers to the source for proper disposal—a best practice that remains largely absent.

Overall, these findings underscore the prevalence of key harmful practices at baseline, both in terms of child involvement in farm work and the handling of chemical products. While differences across cohorts are minimal, several farm-size-based variations—particularly in fungicide use and disposal—emerge. We will control for farm size in the endline analysis. These insights will inform the targeting and tailoring of the training intervention, particularly in areas where risks to child welfare or environmental safety are most pronounced.

Table 12: Child work and child labour across cohorts and by farm size

	Total	Cohorts			*p-value*	Farm size category				*p-value*
		1	**2**	**3**		**<2.5 acres**	**2.5-5 acres**	**5-10 acres**	**>10 acres**	
Underaged children working on farm in past 12 months (n=712; %)	87.%	85.8%	87.0%	88.2%	*0.719*	82.5%	86.3%	90.6%	90.5%	*0.132*
Underaged children missed school due to farm work (n=618; %)	8.5%	7.5%	10.4%	8.3%	*0.682*	8.2%	12.1%	6.1%	5.3%	*0.165*
Child with the highest number of school days missed in household due to work (n=59)	8.8 (5.8, 11.7)	8.5 (3.1, 13.9)	10.3 (5.1, 15.4)	7.6 (3.1, 12.1)	*0.735*	5.9 (2.5, 9.2)	10.2 (4.7, 15.7)	7.0 (3.6, 10.5)	11.8 (7.9, 15.7)	*0.087*

Note: The table represents the percentage of farmers with children who had to work on the coffee farm, and the extent to which they missed school due to farm work. The sample sizes refer to the number of farmers with children in the first row (n = 712), the number of farmers with underage children working on the farm in the second row (n = 618), and the number of farmers with children who missed school due to farm work in the third row (n = 59). Continuous data are presented as means with 95% confidence intervals in parentheses. Categorical data are presented as %. Note that the percentages do not precisely match the fraction of the number of farmers out of the total sample. This is because the percentages are calculated with respect to the survey design and survey weights. For the comparison of means of continuous variables across farm size quintiles, the table reports the p-value from an Adjusted Wald test. For the comparison of means of binary and categorical variables across farm size quintiles, the table reports the p-value from a Rao–Scott chi-squared test.

Table 13: Usage of hazardous pest and disease products PPE

		Cohort				Farm size category				
	Total	1	2	3	*p-value*	<2.5 acres	2.5-5 acres	5-10 acres	>10 acres	*p-value*
Chemical pesticide was used on coffee trees in past 12 months (N=810; %)	32.4%	36.3%	28.7%	31.3%	*0.525*	24.9%	33.4%	35.9%	37.7%	*0.092*
Chemical fungicide was used on coffee trees in past 12 months (N=810; %)	21.1%	22.7%	23.1%	181%	*0.475*	12.9%	21.9%	25.1%	27.7%	*0.008*
Number of PPE items used when applying pesticides (N=266)	1.8 (1.6, 2.0)	1.8 (1.6, 2.1)	1.7 (1.2, 2.2)	1.9 (1.6, 2.3)	*0.693*	1.7 (1.3, 2.1)	1.9 (1.6, 2.2)	1.6 (1.3, 2.0)	2.1 (1.7, 2.6)	*0.302*
Farmer used proper set of PPE when applying pesticides or fungicides (N=266; %)	3.5%	3.59%	2.15%	4.24%	0.840	4.03%	5.03%	1.46%	2.99%	0.676
Wore a mask (%)	47.2%	46.1%	44.6%	50.0%	*0.808*	53.3%	51.0%	35.9%	50.9%	*0.245*
Wore gloves (%)	16.8%	13.9%	14.9%	21.2%	*0.448*	15.9%	17.4%	13.8%	21.9%	*0.729*
Wore boots (%)	81.7%	82.8%	78.0%	82.9%	*0.703*	76.9%	79.5%	79.9%	94.3%	*0.107*
Wore goggles (%)	9.4%	9.0%	4.6%	12.8%	*0.341*	7.3%	11.7%	6.8%	11.7%	*0.606*
Wore a spray suit (%)	19.1%	21.5%	17.3%	17.5%	*0.766*	10.4%	23.4%	15.6%	26.8%	*0.103*
Wore a hat (%)	9.5%	9.1%	10.1%	9.5%	*0.982*	7.1%	8.9%	11.0%	9.3%	*0.890*
Farmer disposes of chemical containers in the appropriate way (N=266; %)	61.6%	65.7%	54.5%	61.8%	*0.397*	60.5%	57.2%	68.6%	62.0%	*0.551*
Containers washed and re-used for other purposes (%)	4.6%	7.0%	4.2%	2.1%	*0.233*	2.8%	5.9%	1.6%	6.4%	*0.313*
Containers thrown on fields/compound (%)	25.9%	21.8%	29.1%	28.3%	*0.514*	30.8%	28.7%	22.4%	20.7%	*0.635*
Containers thrown into rubbish pit (%)	13.6%	14.4%	11.6%	13.9%	*0.892*	20.4%	9.2%	13.7%	14.1%	*0.443*
Containers returned for disposal (%)	1.6%	0.7%	0.0%	3.5%	*0.137*	0.0%	1.8%	3.4%	0.0%	*0.475*
Containers destroyed by burning (%)	59.3%	64.3%	52.3%	58.3%	*0.341*	60.5%	55.4%	63.5%	60.2%	*0.760*
Containers taken away by contractor (%)	1.1%	0.7%	2.2%	0.9%	*0.651*	0.0%	0.0%	2.9%	1.9%	*0.230*
Containers buried (%)	4.6%	5.3%	3.3%	4.8%	*0.834*	4.2%	4.2%	5.3%	5.3%	*0.990*
Containers thrown in Pit latrine/Toilet (%)	6.0%	5.1%	7.6%	5.9%	*0.784*	1.5%	3.1%	6.9%	15.9%	*0.018*

Note: This table represents the percentage of farmers who used inorganic fungicides and pesticides and the extent to which they handled the products appropriately. Continuous data are presented as means with 95% confidence intervals in parentheses. Categorical data are presented as %. Note that the percentages do not precisely match the fraction of the number of farmers out of the total sample, because the percentages are calculated with respect to the survey design and survey weights. For the comparison of means of continuous variables across farm size quintiles, the table reports the p-value from an Adjusted Wald test. For the comparison of means of binary and categorical variables across farm size quintiles, the table reports the p-value from a Rao–Scott chi-squared test. The proper set of PPE includes a mask, gloves, and goggles. The appropriate ways of disposing of chemical containers are returning them to the source for disposal, burning them, or giving them to a contractor

4.3 Coffee yields and GAPs

Section 4.3 highlights the results of the tree-level yield data analysis and provides a detailed description of baseline levels of GAP adherence. In 4.3.1, the results of a model which links tree-level yield data (obtained from the OAF Coffee Harvest Survey) to tree-level characteristics and farmer-level covariates are shown. The model indicates which variables are associated with increased or decreased coffee yields. The tree-level characteristics and farmer-level covariates include variables that indicate to what extent farmers adhere to GAPs as prescribed in the training materials of OAF's Coffee Training Program. These GAP variables are further explained in more detail in 4.3.2. Section 4.3.2 describes the level to which farmers adhere to GAPs at baseline.

Key findings:

Tree-level yield

- Farmers who participated in the OAF Coffee Harvest Survey had an average yield per productive coffee tree of 1.12 kilograms dry weight (Kiboko) in the major harvest season of 2025 (April-July), and a median of 0.9 kilograms. This figure is based on the tracked production of 2,603 trees across 429 farms.
- At the tree-level, tree height, a lack of weeds, and the number of stems were positively associated with tree productivity, while recent stumping was associated with lower yield. At the farm-level, these tree-level associations remained, and inorganic fertilizer use and de-suckering were also a significant predictor of tree-level yields, as well as farming household's socio-economic status. Farms in the highest asset ownership quartiles had significantly higher tree-level yields.

Good Agricultural Practices (GAPs)

- The average number of GAPs that farmers adequately adhered to during the past two seasons is 3.7 out of 12.
- Desuckering (99%), Selective Cherry Picking (88%), and Intercropping (43%) are the three most-executed GAPs. Pruning (3%), Composting (4%), and Inorganic Fertilizer Application (6%) are the least-executed GAPs.
- There are no statistically significant differences in GAP adoption between the cohorts at baseline.

Methodology:

- For tree-level yield estimations and associations, we analyse data from 2,603 Robusta trees nested within 429 households, combining tree-level information (physiology, GAP adoption, pest incidence) collected through the OAF Coffee Harvest Survey with farmer-level characteristics (demographics, assets, experience, and management practices) from Laterite's baseline survey. Given the hierarchical structure of trees within households, we estimate linear mixed-effects models with household-level random intercepts. Models are fit using maximum likelihood estimation, with results reported as log-point coefficients and statistical significance assessed at the 5% level.
- To estimate the baseline level of farm-level GAP adherence as described in the Coffee Training Program's manual, we constructed binary GAP-indicators which are calculated based on a farmer successfully meeting a set of criteria for each GAP (explained in more detail below). Adhering to all criteria results in a positive GAP-indicator. The GAP-indicators are the leading indicators for showing GAP adherence and are expected to be positively associated with increased yield.

4.3.1 Tree-level yield, physiology and GAP adoption

Objective

An advantage of the current study is that OAF has collected additional information on a number of individual trees for participants in the baseline study of this report. We used this data to study associations between coffee-yield at the (productive) tree-level, measured in KGs of dry cherry collected during last season, and tree-level characteristics including tree physiology, GAP adoption and individual pests and diseases. We also link this tree-level dataset to our BL survey, and include farmer-level characteristics, GAP adoption and agronomic and coffee-related training and experience.

Figure 5: The average tree physiology (height, stems, and dry cherry output)

Data

The tree-level dataset consisted of 3,621 coffee trees nested within 607 households out of the 810 farmers in the total sample. The 607 households were those where at least one tree out of the eight had a non-missing yield, which implies a non-response rate of 25%. However, the effective sample size for the model was further reduced, because of the 607 households, some farmers were not included in the Laterite baseline, and some farmers had missing values for the 'coffee type' variable, which was required to filter out Robusta-only growers. We further excluded farmers that were not Robusta-only growers, so as not to compare yields across different coffee species.[10] This left 2,603 Robusta trees nested within 429 households for the analysis.[11] We winsorized coffee yield (121 trees), with the 95th percentile being 4kgs. From these 2,603 trees, 361 have zero yield, as the farmer mentioned to plan to harvest the tree in a later season.[12]

There is evidence that the non-response is not at random in observable covariates, including household head gender (female-led households less likely to respond) and literacy (literate-led households more likely to respond), district (Mubende more likely than Kassanda to respond), farm size (smaller household farms less likely to respond). We adjusted survey weights to account for tree-survey non-response. This partially addresses issues of bias, although it is not completely ruled out and results should be interpreted with caution.

The average number of trees surveyed per household is 6.8 trees, with a minimum of 1 and a maximum of 8 trees per household. Table 14 shows the summary statistics for the tree-level data and variables. All tree-level data in this section is obtained through the OAF Coffee Harvest Survey, whereas the farmer-level data comes from Laterite's main baseline data collection survey.

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[10] Unfortunately, the OAF harvest data does not include tree-level information about coffee species. To be conservative, we excluded all trees from any households which stated that there was anything other than Robusta coffee on their plantation. The 'coffee species' variable was taken from the One Acre Fund survey, which asked 'Which type of coffee trees are present on your plantation?' This is slightly different from the Laterite survey which asked 'Which type of coffee species do you grow'. Likely due to this difference in phrasing, there are more farmers included in the One Acre Fund survey than the Laterite survey who cite something other than Robusta on their farms, because there may be 'legacy' trees leftover from years ago, which the farmers are not actively growing.

[11] Of the 607 households with at least one non-missing tree, some households had missing values for the 'coffee type' variable, meaning we cannot include them in the analysis as they may have non-Robusta trees. Of these 607 households, a further portion were included in the One Acre Fund harvest data, but not in the Laterite baseline sample (because they were from the broader 'listing' sample). This means they were not included in the farm-level analysis in the model and therefore the sample size for the final model is reduced. There were 124 farmers who said that there was another type of coffee species on their farm (other than Robusta), so they were also excluded from the analysis

[12] This is important as 0s cannot be modelled as logarithms, restricting the analysis to non-zero observations for the main results.

Table 14: Summary statistics of the tree-level data from OAF Coffee Harvest Survey

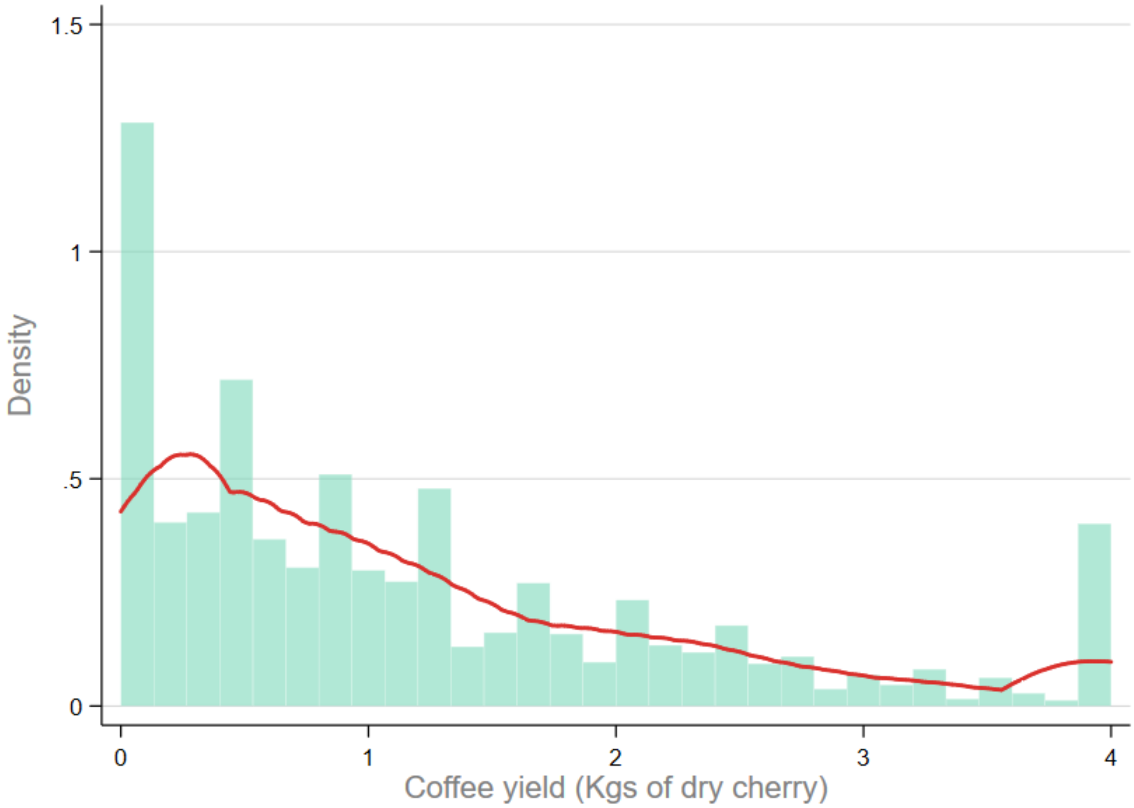
Variable	Category	Mean (SD) / Num (%)	N
Coffee yield (kgs of dry weight cherry) (O)		1.12 (1.10) Median = 0.90	2,603
Number of stems (O)		3.48 (1.74) Median = 3.00	2,603
Height (m) (O)		2.11 (0.45) Median = 2.27	2,568
Leaf colour (O)	All green	1,748 (67.2%)	2,603
	Mostly green	758 (29.1%)	
	Mostly yellow	85 (3.3%)	
	All yellow	12 (0.5%)	
Stumped category (SR)	Not stumped	2,121 (81.5%)	2,603
	Stumped in 2025	15 (0.6%)	
	Stumped in 2024	138 (5.3%)	
	Stumped in 2023	124 (4.8%)	
	Stumped before 2023	205 (7.9%)	
Currently mulched (O)		395 (15.2%)	2,603
Currently has suckers (O)		1,956 (75.1%)	2,603
Currently properly weeded (O)		1,934 (74.3%)	2,603
Currently affected by pest or disease (O)		1,503 (57.7%)	2,603
Pest/disease type (O)	Black Cof. Twig Borer	1,004 (38.6%)	2,603
	Cof. Berry Borer	283 (10.9%)	2,603
	Cof. Berry Disease	202 (7.8%)	2,603
	Cof. Leaf Rust	389 (14.9%)	2,603
	Red Blister Disease	157 (6.0%)	2,603
	Cof. Mealybugs	211 (8.1%)	2,603
	Cof. Wilt Disease	128 (4.9%)	2,603

Note: The table represents the summary statistics of tree-level data. The information is either observed by the OAF enumerator (O) or self-reported by the farmer (SR).

From 2,603 trees assessed the typical coffee tree is relatively short and tri-stemmed. Yields are modest, with a median of 0.9 kg of dry cherries per tree (mean 1.12, SD 1.10). Trees have a median of three stems (SD 1.74) and reach an average height of 2.11 m (SD 0.45). Most foliage is healthy: 67% of trees are entirely green and 29% mostly green, with only minor signs of yellowing.

Stumping is relatively rare: 82% of trees have not been stumped, and only a small proportion were stumped in the past year. Mulching is observed on 15% of trees, suckers are present on 75% (despite the vast majority of farmers adhering to the desuckering agricultural practice – see section 4.3.2– suggesting that desuckering may not be being applied correctly), and 74% of trees have been properly weeded at the time of the survey. Current pest and disease pressure is led by Black Coffee Twig Borer (39%) and Coffee Leaf Rust (15%), while other problems occur less frequently.

Figure 6: Tree-level coffee yield distribution (kgs of dry cherry) with red Kernel density line



The model links tree-level yield to tree-level characteristics (physiological features, GAP information and pests and diseases), and farm-level characteristics. Figure 6 shows that the distribution of yield is highly right-skewed. We therefore transform it to its logarithm form to make the modelling more robust to outliers and the shape of the distribution. We include a comprehensive set of farmer-level covariates to account for household characteristics, location, experience, and management. Specifically, we control for household head age, household size, total household and agricultural asset quartile (derived from Principal Component Analysis), cohort, district, and years of coffee experience. We also include indicators for key farm-level GAP practices coming from the Laterite BL survey: weeding, desuckering, mulching, IPDM, pruning, compost use, manure use, inorganic fertilizer use, intercropping, coffee training (last 4 years), and cooperative membership, as well as farm structure variables: total number of coffee trees, productive diversity index, and farm size.

Methods

Given the hierarchical structure of trees within households, we estimated linear mixed-effects models with a random intercept at the household level:

$$\ln(y_{ij}) = \mathbf{X}_{ij}^{\text{tree}}\boldsymbol{\beta} + \mathbf{Z}_{j}^{\text{farmer}}\boldsymbol{\gamma} + u_j + \varepsilon_{ij},$$

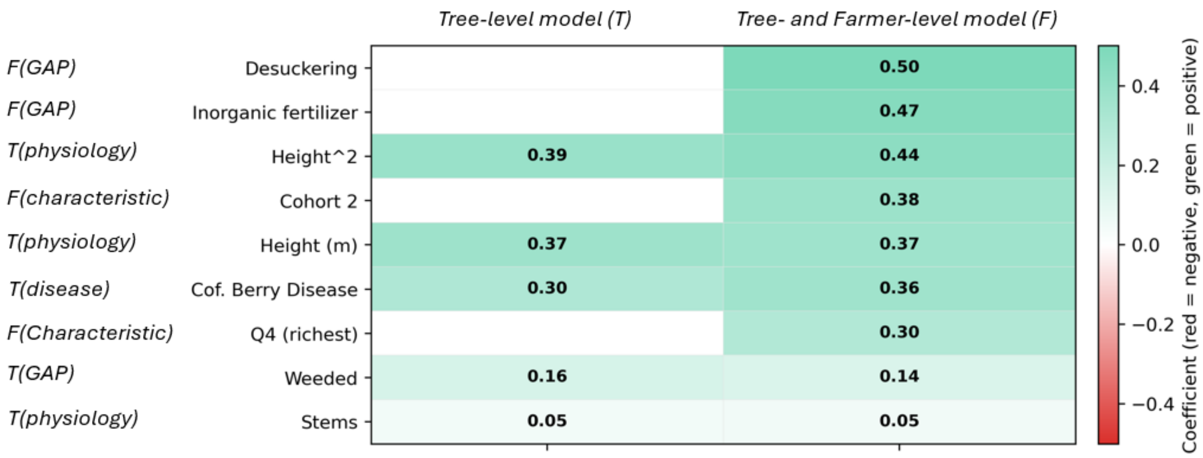
Where *i* indicates trees and *j* households, u_j is the household level random effects and ε_{ij} is a normally distributed, zero mean error term. **X** corresponds to a vector of tree-level covariates and Z is a vector of farmer level covariates.

Results are presented as log-point coefficients, since the logarithmic transformation makes them more robust to outliers and the skewed distribution of the non-logged yield. However, we present the logarithmic results as the main findings, as both specifications produced consistent results. For presentation in the report, we visualize statistically significant coefficients with a heat map that shows sign and magnitude.

Results

A simple heat map of coefficients in log points is given in Figure 7 below. Each row represents a covariate. Tree-level covariates (from the OAF Coffee Harvest Survey) are indicated with a T-prefix, and farm-level covariates (retrieved from Laterite's main BL survey) have an F-prefix. The two columns represent the two different models; the left column shows the model with only tree-level covariates, whereas the right column shows the model with both tree-level and farm-level covariates. In the map, statistically significant coefficients are highlighted with colour indication: red means a statistically significant negative association between yield and the covariate at the 5% significance level, and green for positive. The coefficients are in logarithm points and can be roughly translated to a percent change. For example, inorganic fertilizer use at the farm-level is associated with an average yield that is 47% (0.66 kg of dry cherry) higher than the yield of trees on farms where no inorganic fertilizer is used, keeping all other variables constant. We also see that desuckering at the farm-level is associated with an average yield of 50% higher than yield of trees on farms where desuckering is not practiced. However, given that desuckering was not statistically significant at the tree-level, this association is possibly spurious and may be linked to unobserved covariates that are strongly correlated with yield.

Figure 7: Heat map of statistically significant coefficients from modelling (ln yield)[13]



[13] Models were fit in Stata 15 using the '*mixed'* command. Estimates were obtained by maximum likelihood, and statistical significance is assessed at the 5 percent level. To describe clustering strength, we report the residual intraclass correlation coefficient (ICC) using the '*estat icc'* command. We use tree-level survey non-response correction in survey weights.

In the tree-level model, tree height (39% or 0.45 kg of dry cherry per additional meter), and its squared term, weeding (16% or 0.17 kg of cherry) and the number of stems[14] (5% or 0.06 kgs of cherry) were positively associated with yield. For height, the quadratic relationship is not as clear, since there are very few trees in the lower ends of the height distribution, the downward sloping relationship has large confidence intervals. The point at which the relationship becomes positive is 1.5m of height. The increase of a 1m growth after the 1.5m threshold is 0.42 kgs of dry cherry per additional meter of growth. See Annex 2 Figure 1 for more detail.

Furthermore, the model shows that trees affected by the Coffee Berry Disease have on average 30% more yield than those without the disease. This is likely due to the inclusion of trees that were not harvested during the season. Some of these trees might not have produced berries and therefore cannot be affected by the Coffee Berry Disease. Earlier versions of the model, which excluded trees without yield, did not show statistically significant effects of the Coffee Berry Disease.

All covariates that were statistically significant in the tree-level model remained statistically significant in the farmer- and tree-level model. At farmer-level, proper inorganic fertilizer use is associated with a 47% (0.54 kg of dry cherry) yield increase[15], and 37% (0.42 kgs) higher for Cohort 2. Furthermore, farmers in the highest asset-ownership quartile have statistically significantly higher yields than farmers in the other quartiles. See Annex 2 Table 7 for the full model specifications for both models, including the coefficients and significance levels for all included covariates.

Interestingly, desuckering at farm-level is associated with 50% higher yields, while the tree-level 'desuckering' indicator was not statistically significantly correlated with higher yields. This is likely due to the difference in obtaining data on desuckering between the tree-level OAF Coffee Harvest Survey and the farm-level Laterite survey. At tree-level, OAF observes the tree and checks for the presence of 'suckers', while at farm-level Laterite asks for self-reported desuckering during the 12 months prior to the survey. Farmers that practiced desuckering well on their farm might have not been able to desucker trees properly during harvest months when OAF visited.

Two additional model specifications are added to observe associations between yield and GAPs and pest and disease infestation in general, rather than the associations with individual GAPs or pests and diseases. In the GAP model specification, we replaced the farmer-level GAPs with a discrete variable that represents the number of GAPs that farmers mentioned to have executed on the farm out of a total of 12 GAPs. This variable had a

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[14] The quadratic term of number of stems is negatively associated with yield, suggesting that there is an optimal number of stems beyond which yields drop. In the model, this optimal number of stems is 3.7, which is in line with OAF's recommendation of keeping the number of stems at three to four. However, the negative correlation between the quadratic term of the number of stems and yield is not statistically significant. The model will be re-analyses with larger number of trees (i.e. higher statistical power) in subsequent reports. See Annex 2 Figure 2 for the prediction of the logarithmic term of yield across number of stems.

[15] The variable used for inorganic fertilizer is the GAP-indicator for inorganic fertilizer. This indicator is a binary with a value 1 if the farmer *properly* applied inorganic fertilizer, and with a value of 0 if the farmer did not apply in a proper manner. GAP-indicators go beyond the question whether the farmer did or did not do the GAP but also include information on whether it has been done in the correct manner. GAP-indicators are calculated for each GAP and explained in detail in 4.3.2.

significant positive association with yield and a coefficient of 0.06 log points. This implies a 6% (0.07 kgs of dry cherry) yield increase on average when the number of GAPs applied increases by 1. The tree-level pest and disease binary variable (indexing 1 if the tree has currently been affected by any pest or disease) replaced all individual pest or disease binaries, but the coefficient was not statistically significant.

The residual ICC at the household level is 0.14 with a 95 percent confidence interval from 0.072 to 0.271. This means that after accounting for the covariates in our tree-level model, about 15% of the remaining variance in the outcome is due to differences between households rather than differences between trees within the same household. In practical terms trees from the same household look quite similar on the residual scale, so household clustering is advised. This justifies the use of multilevel models, or at least household level clustering.

Limitations

This analysis has several limitations. First, the data are cross sectional, so we cannot make causal claims about the effects of practices or conditions on yield. Second, endogeneity is likely because unobserved household or plot factors may influence both management choices and yield, which can bias the coefficients. Third, reverse causality is possible. For example, farmers may weed or apply fertilizer more on trees that already look productive, so management can respond to expected yield rather than cause it. Fourth, tree height has measurement error. Enumerators recorded height using a relative method based on their own height and assumed mid points, which can attenuate the height coefficient and distort the curvature term. Fifth, tree age has not been asked in the survey, meaning that we couldn't correct for tree age when yield effects of tree size. Together these issues mean the estimates should be read as associations. Where possible, future work should add panel data or instruments, improve direct measurement of tree attributes, and include richer household and plot level controls.

Conclusions

Our analysis identifies a small and consistent set of correlates of higher yield at the tree-level and the farmer level. Inorganic fertilizer shows the largest positive association with log yield. Tree height is also positive and its squared term is positive over the observed range, which indicates that taller trees perform better in this sample. The number of stems has a small positive association. Weeding (at the tree-level) and de-suckering (at the farm-level) are GAPs associated with increased yield.

The pattern is robust across the two model variants that include only tree variables and those that add farmer covariates. Household and context variables such as Cohort 2, asset quartile Q4 are also positive, which suggests that household resources and local conditions matter alongside tree physiology and practices. The residual ICC of about 0.14 indicates strong within-household similarity after controls, which supports the use of multilevel models and points to household-level factors that are not fully captured.

These findings are associative rather than causal. The cross-sectional design, potential endogeneity, possible reverse causality, and measurement error in height mean that coefficients should be interpreted as relationships rather than impacts. As next steps, panel data, improved direct measurements, and richer household and plot covariates would strengthen inference and help test whether the same signals persist over time. Finally, as mentioned earlier, there is evidence of non-random non-response for the tree-level survey. We adjusted survey weights to account for the tree-level survey non-response, but this does not rule bias completely, especially on characteristics we cannot observe. This means that the results should be taken with caution and should not be generalized to the full study population.

Self-reported yield

With the Coffee Harvest Survey, OAF also collected self-reported coffee yield estimates of the 2025 major season for 488 Laterite-sample farmers[16]. These 488 farmers all produced Robusta coffee only. Table 15 below shows the average yield and yield per tree for the 488 farmers and by-cohort estimates. It shows that on average, farmers self-reported a Robusta yield of 606 kilograms of dry weight cherries in the major season, while the median is 334 kilograms. Per productive Robusta tree, farmers produced 1.8 kilograms on average with a median of 1.0 kilograms per tree. These averages somewhat correspond to the tree-level yield data discussed earlier in this section, which showed an average of 1.12 kilograms dry weight per investigated tree and a median of 0.9. Table 14 shows that there are no statistically significant differences in Robusta yield and yield per tree between the cohorts.

Table 15: Self-reported Robusta yield in kg dried cherry from 2025 major season OAF Coffee Harvest Survey

	Total	Cohort			*p-value*
	N=454	*1 (N=135)*	*2 (N=264)*	*3 (N=155)*	
Robusta yield (95% CI)	605.6 (499.6, 711.7)	730.8 (550.1, 911.4)	576.3 (445.0, 707.5)	509.0 (327.6, 690.3)	*0.202*
Robusta yield per tree (95% CI)	1.8 (1.5, 2.1)	2.0 (1.3, 2.7)	1.8 (1.4, 2.2)	1.6 (1.3, 1.9)	*0.592*
Robusta yield per acre RHP (95% CI)	180.5 (157.5, 203.5)	188.8 (151.0, 226.7)	202.1 (169.3, 234.9)	155.5 (114.2, 196.8)	*0.230*
Robusta yield per acre RPA (95% CI)	316.6 (277.6, 355.6)	356.7 (285.4, 428.0)	324.3 (276.3, 372.3)	272.1 (213.2, 330.9)	*0.178*

Note: This table shows the average and by-cohort Robusta yield in total (kilograms dried cherry) and per productive tree (in kg dried cherry/tree). Yields in kilograms were converted from fresh and FAQ weight to dry weight Robusta. In this report, we assume a weight loss rate from fresh coffee cherries to dried 'Kiboko' cherries of 60%, and from dried cherries to FAQ of 42% (FAO, 2004; Niyibigria, 2019). This corresponds to 1 kilogram of red Robusta cherries equals 0.4 kilogram of dried Robusta cherries, and 1 kilogram of dried Robusta cherries equals 0.58 kilogram of FAQ.
'RHP' refers to *Robusta Holding Plots*, which means the total size of all the farm's plots that hold Robusta trees. 'RPA' refers to *Robusta Planted Area,* which is the area of the farm strictly dedicated to Robusta trees, calculated by multiplying the percentage of the plot allocated to Robusta trees (estimated with the 10-stone question on how the crops and vegetation of the plots are divided) by the surface area of the plot in acres.
Comparisons across cohorts are done with an Adjusted Wald test which allows for a survey design.

[16] Of the 722 Laterite-farmers interviewed as part of the OAF Coffee Harvest Survey, it is known for 504 farmers that they produce Robusta only. Of these 504, 16 farmers were unable to provide adequate estimations of their yields. This leaves us with a sample of 488 farmers for whom we estimate their self-reported Robusta yield.

4.3.2 Good Agricultural Practices

This section highlights the level of GAP adherence of the farmers at baseline. This is of critical importance to the OAF project, as the agronomy training is perhaps the principal intervention within the program. The Baseline Report describes the current level of adherence to GAP guidelines as described in the training material, which we can use as a benchmark to determine which GAPs may need more focused or tailored training sessions, and where we may expect to see the biggest improvements in terms of knowledge and practices.

Each of the twelve GAPs has a set of conditions that the farmer must fulfil to execute the GAP adequately. The adequacy of GAP adherence is represented in twelve GAP-indicators, which inform on the percentage of farmers that adhere to the GAP's conditions. For example, for the GAP 'Weeding', the farmer must have (1) weeded their trees in the 12 months prior to the survey, (2) weeded by hand under the tree canopy, (3) have no weeds on the coffee plantation, or (4) have weeds smaller than 30cm. If the farmer adheres to all of these conditions, the GAP 'Weeding' is practiced adequately. The GAP-indicator of Weeding subsequently tells us that 14% of farmers complied with these Weeding conditions for adequate GAP adherence.

Figure 8 ranks the GAPs by the percentage of farmers who met the indicator conditions for adequate implementation. Nearly every farmer (99%) carried out desuckering correctly, and 87% met the picking conditions. On the other hand, adequate inorganic fertilizer use was at 6%, composting at 4%, and pruning at 3%. The average number of GAPs adhered to is 3.7 out of 12 (median = 4), ranging from 1 GAP (1.5% of the sample) to 7 GAPs (1.9%). Figure 9 the distribution of the number of GAPs that the farmers executed adequately. It shows that most farmers only met the conditions for three or four GAP-indicators.

Figure 8: Percentage of farmers with adequate implementation of each GAP

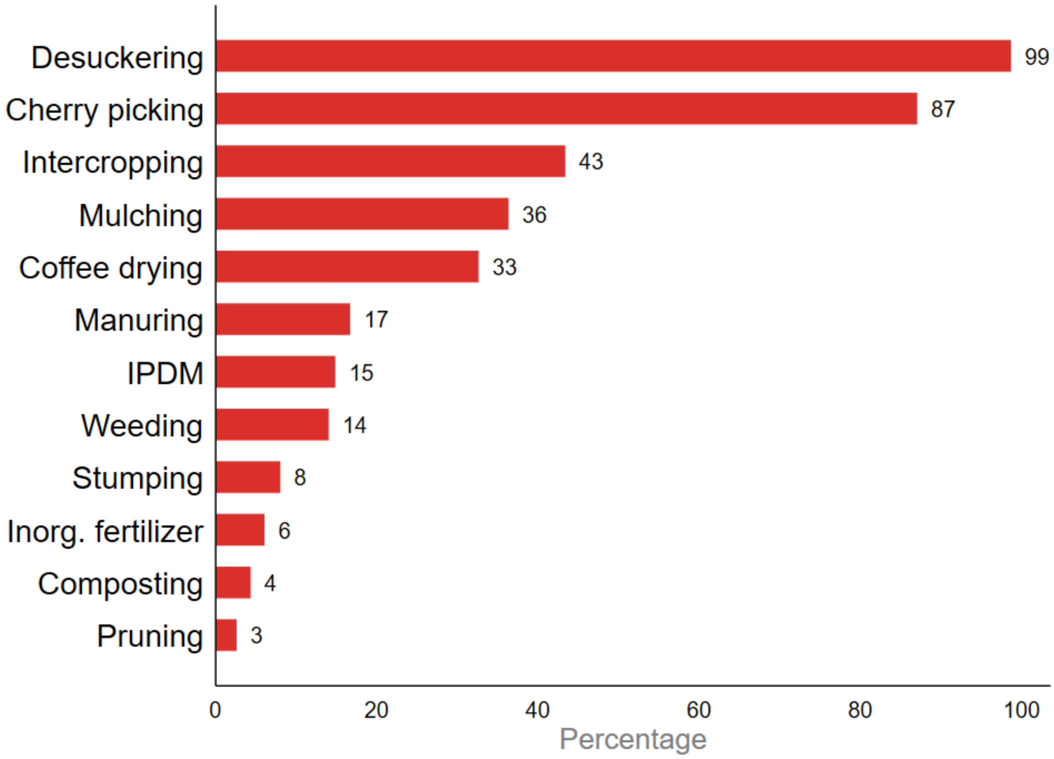
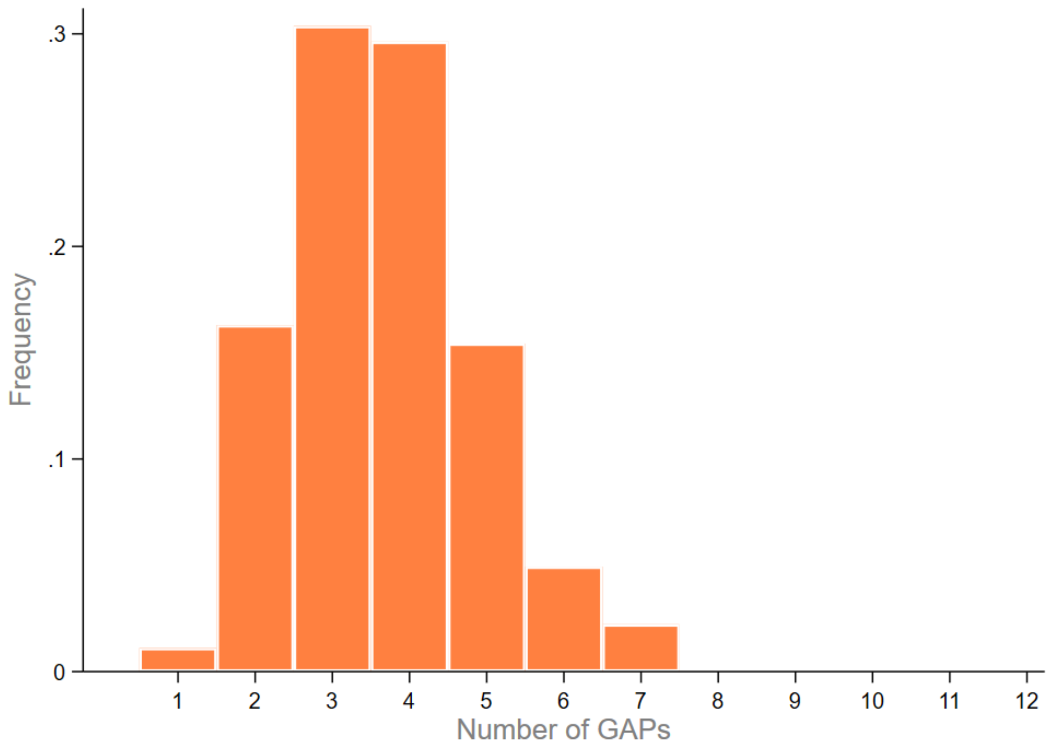


Figure 9: Frequency distribution of the number of adequately executed GAPs across the sample



In the remainder of this section, we dive deeper into the baseline status of the adoption rate of each GAP. Below, for each GAP category, we discuss the conditions of each GAP that farmers must comply with for a positive GAP-indicator, as well as condition-level statistics. A GAP category corresponds to a training module, namely: Basic Routine Management; Rejuvenation; Soil Fertility; (Integrated) Pest and Disease Management (IPDM); and (Post-Harvest Handling).

Basic Routine Management

The GAPs covered in the Basic Routine Management training are Weeding, Desuckering, and Mulching. Farmers weed properly if they used hand weeding under the canopy; as other methods such as digging, slashing, or spraying could harm the tree trunk. Furthermore, for a subset of 513 farmers, the coffee plantation was checked for weed intensity and size (enumerators observed these factors on the farm). Farmers with visibly many weeds around the trees, or with weeds larger than 30 cm, were not assigned a positive GAP indicator for weeding.

The GAPs Desuckering and Mulching have fewer demanding conditions for positive indicators. Both GAPs are labelled positively if the farmer indicated that they practiced them in the 12 months prior to the survey (with this being the only necessary condition). In Table 16 below the conditions for positive GAP-indicators for the Basic Routine Management practices are shown.

Table 16: GAP adoption indicator conditions for Basic Routine Management

GAP	Conditions for positive indicator
Weeding	1. Farmer weeded in past 12 months 2. AND Farmer did not use digging AND slashing under the canopy 3. AND farmer did not use spraying under the canopy 4. AND Number of weeds under canopy are none or few, if observed[1] 5. AND Size of weeds is smaller than 30cm, if observed
Desuckering	1. Farmer desuckered in past 12 months
Mulching	1. Farmer applied mulch in past 12 months

1: Weeding conditions 4 and 5 have been observed by enumerators if they were able to observe the coffee plantation. This has been done for 513 farmers out of the 804 that mentioned that they applied weeding. The other questions that are used for the GAP-indicator conditions are self-reported by farmers and have not been verified by the enumerators.

Table 17 below shows to what extent the farmers adhered to each of the conditions for the Basic Routine Management GAPs. It shows that almost all farmers (99%) weeded their plantations in the previous two coffee seasons. Also, for the 513 farmers whose coffee plantations have been observed, most farmers appeared to have weeded well. 94% had no or few weeds under the coffee tree canopies, and 91% had no weeds or weeds that are smaller than 30cm[17]. However, only 15% of farmers used appropriate methods for weeding under the canopy, meaning that the remaining 85% of farmers who weeded used methods

[17] Farms were observed in February 2025 which marks the end of the dry season in Central Uganda. Weeds might be more present and taller towards the end of the rainy season.

that could harm the coffee tree trunk. The GAP-indicator for adequate practice of weeding is therefore only 14% of the entire sample.

44.0% of the farmers who weeded their farm used herbicides. While OAF advises farmers to only use herbicides as a last-resort method when weeds are too persistent, only 18.6% of the farmers who used herbicides mentioned to have used it for this reason. 74.5% of the farmers who used herbicides found other weeding methods too time consuming, and 29.7% found other methods too expensive, and therefore decided to use herbicides (see Annex 2 Table 11). This suggests that herbicides use might remain relatively high when farmers are not convinced that applying herbicides could harm the soil in the long run, and manual weeding – either with or without labour – remains expensive and time-consuming.

Furthermore, almost all farmers desuckered their trees in the 12 months prior to the survey, but only 38.3% reported applying mulch on their farm. Differences in relevant practices for Basic Routine Management between cohorts were not statistically significant at the 5% significance level (Annex 2 Table 9). Interestingly, only 6% of farmers indicated to own secateurs (scissors used for desuckering), indicating that farmers appear to not need to own secateurs to properly desucker their trees.

Table 17: GAP adoption indicator for Basic Routine Management practices across districts

	Total	District	
		Kassanda	Mubende
Weeding			
Farmer weeded in past 12 months	99.3%	99.6%	99.0%
Farmer weeded by hand under canopy (n=804)***	15.2%	8.5%	20.9%
No or few weeds under the canopy (n=513)	93.7%	94.9%	92.6%
Weeds are not present or smaller than 30cm (n=513)	90.9%	94.0%	87.9%
Weeding GAP-indicator*	14.3%	8.4%	19.3%
Desuckering			
Farmer desuckered in past 12 months**	98.4%	99.7%	97.4%
Mulching			
Farmer applied mulch in past 12 months	38.3%	36.1%	40.1%

Note: The table represents the percentage of farmers that adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated differently with the sample size in brackets next to the condition. Comparison tests across districts are done with a Rao-Scott Chi-squared test, incorporating the weights created due to survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

Annex 2 Table 10 presents the average adoption intensity for each Basic Routine Management Good Agricultural Practice (GAP). Adoption intensity is defined as the proportion of the total coffee farm area or number of coffee trees on which a specific GAP was implemented. It is important to consider adoption intensity as well as overall adherence to the GAP, because the purpose of the intervention is to increase overall yield. If farmers understand how to apply a GAP correctly, but are only implementing it on a small proportion of their farm, then the impact on yield will be minimal. For GAPs that tended to have low adoption intensity at baseline, OAF could dive into what challenges farmers face in applying these GAPs at a larger scale. GAP intensity rates are left out of the GAP indicator calculation as we acknowledge that farmers who start to adopt a GAP might try out the GAP on a small scale. At baseline, we therefore need to assess whether a GAP has already been adopted to be able to compare the increased GAP adoption – albeit on a small scale – at midline or endline.

Among farmers who reported practicing weeding, weeding was applied to an average of 84.1% of their coffee farmland. The intensity figures for desuckering and mulching were lower at 73.5% and 42.8%, respectively. No statistically significant differences in adoption intensity were observed between the cohorts at the 5% significance level for any of these practices.

In Annex 2 Table 8 the frequency of mentioned reasons for not applying a GAP are given. It shows that the predominant reason for not using mulch is that farmers don't have sufficient materials for mulching. This reason was given by 70% of the farmers who did not use mulch. Other reasons were given less frequently; 16% mentioned to not have the time to collect materials (which is related to not having sufficient materials at the farm), 12% did not have time to apply, 4% does not see the benefit of mulching and 2% prefer other soil fertility practices.

Rejuvenation

Table 18 presents the Rejuvenation practices evaluated in this study namely, Pruning and Stumping. For Pruning, a farmer is assigned a positive GAP-indicator if they have both pruned their coffee trees in the past 12 months and disinfected their pruning tools after use. Disinfecting pruning saws is critical to prevent the spread of diseases such as Coffee Wilt Disease from one tree to the next.

For Stumping, we assess only those farmers who have trees over eight years old. We assign a positive stumping GAP-indicator to a farmer who reports having carried out stumping on those trees and routinely leaving exactly one "breather" (main stem) on each tree. Leaving one breather ensures optimal regrowth of other stems and coffee flowers, which is why we filter for this specific GAP.

Table 18: GAP adoption indicator conditions for Rejuvenation

GAP	Conditions for positive indicator
Pruning	1. Farmer has pruned in past 12 months 2. AND farmer disinfected tools to prevent diseases
Stumping	For farmers with trees that are more than 8 years old: 1. Farmer stumped trees 2. AND Farmer typically leaves 1 breather

In Table 19 below, farmers' adherence to recommended GAPs for pruning and stumping is presented. For pruning, 87.7% of all farmers reported having pruned their trees in the past twelve months. However, very few of the farmers have mentioned that they disinfected their pruning tools after use. This means that while pruning itself is widespread, disinfecting pruning tools is almost entirely neglected, which may negate the positive impact of pruning. Similar to secateur ownership and desuckering, very few farmers own a pruning saw; 13% have mentioned to own one.

For stumping, 680 farmers (83.9% of the sample) overall have trees that are eight years or older. Among these 680 farmers, 72.2% reported having stumped their trees in the past 12 months. Yet only 11.6% of stumping farmers adhere to the recommendation of leaving one breather branch after cutting, while others leave no or too many stems. This pattern indicates that although most eligible farmers attempt stumping, very few adhere to the full set of GAP conditions that promote good stumping. There were no statistically significant differences in the GAPs across cohorts at the 5% level (Annex 2 Table 12). The main reason given for not stumping and pruning among farmers who did not practice these rejuvenation GAPs, is that farmers think their trees do not require pruning and stumping (68% and 72% respectively, Annex 2 Table 8).

Table 19: GAP adoption indicators for Pruning and Stumping across districts

	Total	District	
		Kassanda	**Mubende**
Pruning			
Farmer pruned in past 12 months**	87.7%	91.9%	84.2%
Farmer disinfected pruning tools before pruning (n=707)	2.7%	2.5%	2.8%
Pruning GAP-indicator	2.3%	2.3%	2.3%
Stumping			
Farmer has trees that are eight years or older (n=810) ***	83.9%	89.3%	79.3%
Farmer has stumped (among farmers who have trees older than eight years) (n=680)	72.2%	75.6%	69.1%
Farmer usually leaves one breather after stumping (n=498) ***	11.6%	5.7%	17.8%
Stumping GAP-indicator*	8.4%	4.3%	12.3%

Note: The table represents the percentage of farmers who adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated otherwise with the sample size in brackets next to the condition. Comparisons across districts use a Rao-Scott Chi-squared test that accounts for the survey design. Asterisks indicate significance levels (p<0.1, p<0.05, p<0.01).

Annex 2 Table 13 reports on the intensity with which farmers applied the two Rejuvenation practices. Pruning was carried out on 55.5% of trees among the 705 farmers who pruned their trees. Stumping was done to a lesser extent. The 497 farmers with trees older than eight years who stumped, did so on 13.5% of the trees. There were no by-cohort differences in adoption intensity for these practices that were statistically significant at the 5% level.

Soil fertility

Table 20 defines the four Soil Fertility practices and the criteria a farmer must satisfy to be assigned a positive GAP-indicator. For compost, a farmer must have applied compost in the past 12 months, have a compost heap or pit, and – if possible – enumerators verified its existence, that is they found the heap or pit on inspection[18]. Finally, the compost must have been covered after application. For manure, a positive indicator requires that the farmer applied manure in the past 12 months and allowed the manure to decompose for at least six weeks. For inorganic fertilizer, the farmer should have dug a furrow around each tree, and applied it in the furrow only before the rain. Finally, for intercropping, farmers have a positive indicator value by intercropping legumes among their coffee trees.

Table 20: GAP adoption indicator conditions for Soil Fertility

GAP	Conditions for positive indicator
Compost	1. Farmer applied compost in past 12 months 2. Farmer has compost heap/pit 3. Compost heap/pit is found by enumerator if they were able to verify (n=97) 4. Compost has been covered after it has been applied
Manure	1. Farmer applied manure in the past 12 months 2. Farmer let manure decompose for at least six weeks
Inorganic fertilizer	1. Farmer applied inorganic fertilizer 2. AND farmer dug a furrow around tree for applying 3. AND farmer applied before the rains only
Cover cropping	1. Farmer has legumes as intercrops

Table 21 shows to what extent the farmers adhered to each of the conditions for Soil Fertility practices. Compost adoption is low with about 20.8% of farmers reporting that they applied compost in the past 12 months. 67.0% of these farmers have a compost station, yet only 60.6% of those stations were confirmed on inspection by an enumerator – for other farmers the station was confirmed to be absent by the enumerator. 26.3% of the farmers mentioned to have covered the compost after application. These figures lead to a Composting GAP uptake of 4.5% across the sample. There are no significant by-cohort differences for the Composting GAP-indicator. 42% of the farmers who did not use compost mentioned that they don't know how to obtain it, 30% mentioned that they can't access it near the farm, and 27% find it too expensive (Annex 2 Table 8).

Proper manure application was also relatively low across the sample. Just 39.4% of farmers applied manure in the last 12 months, and among those who did, 44.5% let it decompose for at least six weeks before application. 17.6% of farmers across the sample adhered to the Manure GAP to a satisfactory extent. By-cohort differences in the Manure GAP-indicator were not statistically significant. Among the 498 farmers who did not use manure the

[18] Farmers get the "benefit of the doubt" if enumerators were unable to inspect the farm for the presence of a compost station. They only received a negative indicator if the farmer inspected the farm and did not find a compost station.

most given reason not to use it was because it is too expensive (71%) and because it is not available near the farm (26%).

Inorganic fertilizer was the least adopted practice with only 15.5% of all farmers applying inorganic fertilizer in the past 12 months. Of the farmers who used inorganic fertilizer, 59.4% placed the fertilizer in a furrow around the tree and 57.3% applied the fertilizer before the rains. This is important to note, as over 40% of farmers who use inorganic fertilizer are not applying it correctly, meaning they are spending money on the product but not maximising its use or attaining its benefits. One Acre Fund should place extra emphasis on the correct use of fertilizer in its fertilizer training. Due to this incorrect application, only 6% of farmers received a positive GAP-indicator for inorganic fertilizer application. Differences in the Inorganic Fertilizer GAP indicator level between cohorts are statistically significant at the 10% significance level only (Annex 2 Table 14).

Interestingly, organic and inorganic fertilizer use rates are very similar to a recent study by Alela et al. (2024), who evaluated "integrated soil fertility management" (ISFM) practices in Oyam and Nwoya districts in Mid-Northern Uganda. They found a 15.8% inorganic fertilizer use rate and a 49.5% organic fertilizer (which they define as manure and compost use) use rate, while the percentage of farmers using either compost or manure in Laterite's sample is 48.6%.

Intercropping is the most widespread soil fertility practice, with 84.2% of farmers reporting a cover crop in the past 12 months, and 50.2% used legumes for intercropping. This results in a positive Intercropping GAP-indicator for 42.3% of the sample. Other intercrops mentioned were banana trees (68% of farmers with intercrops), potatoes and other root crops (16%), and maize and/or sugarcane (10%). Among the farms with intercrops, on average 36% of the coffee plantation was covered with intercrops. This was slightly higher when only coffee plantations with legumes are considered at 43% of the plantation, and slightly lower with banana trees at 34%. There are no significant by-cohort differences for the Intercropping GAP-indicator.

Table 21: GAP adoption indicators for Soil fertility across districts

	Total	District	
		Kassanda	Mubende
Compost			
Farmer applied compost in past 12 months***	20.8%	14.6%	26.1%
Farmer has compost station (n=162)	67.0%	60.7%	70.0%
Compost station is observed by enumerator (n=97)	60.6%	62.6%	59.3%
Farmer has covered all the compost after applying (n=162)***	26.3%	9.9%	34.0%
Compost GAP-indicator*	4.7%	1.4%	7.5%
Manure			
Farmer applied manure in the past 12 months	39.4%	38.5%	40.1%
Farmer let manure decompose for at least six weeks (n=312)*	44.5%	37.1%	50.5%
Manure GAP-indicator*	17.6%	14.3%	20.4%
Inorganic fertilizer			
Farmer applied inorganic fertilizer in the past 12 months**	15.5%	11.0%	19.3%
Farmer applied fertilizer in furrow around tree (n=121)	59.4%	66.6%	55.9%
Farmer applied fertilizer before the rain came (n=121)	57.3%	58.2%	56.9%
Inorganic fertilizer GAP-indicator	6.0%	4.5%	7.2%
Intercropping			
Farmer has had cover crops in the past 12 months (n=808)*	84.2%	87.0%	81.7%
Farmer used legumes for cover/intercropping (n=678)	50.2%	51.5%	49.1%
Intercropping GAP-indicator	42.3%	44.8%	40.1%

Note: The table represents the percentage of farmers who adhered to each condition for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless otherwise indicated with the sample size in brackets next to the condition. Comparisons across districts are done with a Rao-Scott chi-squared test, which accounts for the survey design. Asterisks indicate significance levels (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

Section 4.3.1 showed that an increase in adequate use of inorganic fertilizer was associated with an 47% increase in yield. The fact that only 6% of farmers are currently correctly adhering to this GAP shows that there might be large potential gains for most participating farmers – even though the models in 4.3.1 are limited and do not reflect causation. However, access to fertilizer is limited due to cash constraints. 83% of the 689 farmers who did not use fertilizer in the year prior to the survey mentioned that inorganic fertilizer is too expensive for them. This is by far the main reason given among the farmers who did not use inorganic fertilizer (Annex 2 Table 8). Other reasons for not applying were no availability or access (6.4%), not seeing the benefits of it (6.1%), doesn't know how to apply (5.8%), doesn't know where to get it (5.4%), and thinks the fertilizer is of bad quality (4.9%). This shows that while the potential of fertilizers might be large, training farmers into how to apply it adequately is not effective as long as the project does not address the financial constraints of fertilizer access.

For farmers who applied compost, an average of approximately 33% of their plantations received this treatment (Annex 2 Table 15). Manure was applied to around 32.9% of plantation area. Intercropping, while widely practiced overall, covered only about 37% of coffee plantations on average. There are no significant differences between cohorts regarding the intensity of Soil Fertility GAP applications.

Most farmers (78%) bought fertilizer at agricultural input retailers. Other sources such as purchasing at local markets (10.1%), receiving fertilizer in-kind (7.5%), and other miscellaneous sources (6.0%) were less frequently used. Inorganic fertilizer sources were balanced across cohorts, as no statistically significant differences were found (Annex 2 Table 16).

Notably, four farmers mentioned Ibero as a source from which they bought fertilizer from. Ibero is an agro-input company and a future OAF project partner. They will play a role in the efforts to improve access to high-quality farm inputs, as part of the Market Access Program. Even though only four farmers mentioned Ibero in this question, it is still noteworthy, as they mentioned the company themselves whereas they could have selected one of the multiple-choice options. Other farmers that also bought from Ibero might have selected one of the answer options instead, leaving the possibility that Ibero is present in a few parishes.

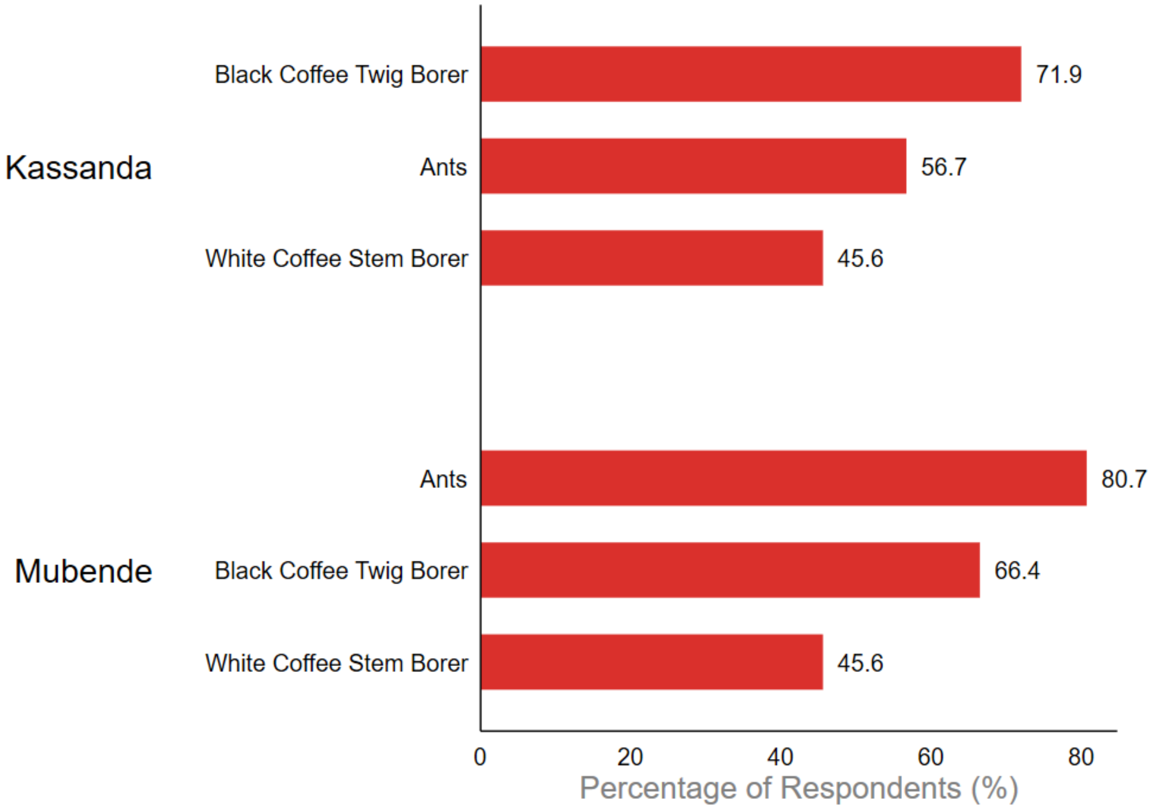
(Integrated) Pest and Disease Management

The yield analysis in section 4.3.1 shows that trees that are currently affected by a pest or disease have a 9% lower yield on average. The section below shows that pest and diseases are widespread in the main sample. Therefore, it is crucial that OAF's Coffee Training Program pays close attention to the pest and disease management module and follows up closely with farmers to ensure they are correctly implementing these practices.

98% of the farmers in the sample reported pest infestation the 12 months prior to the survey. Prevalence of pests was consistently high across all cohorts (98-99%, p=0.630, Annex 2 Table 18). Among the pests, Ants and Black Coffee Twig Borer are the most prevalent, affecting approximately 69% and 67% of farms respectively.[19] The White Coffee Stem Borer also significantly impacts farms (44.2%). Less common pests include the Coffee Root Mealybug (33.7%), Nematodes (23.6%), Coffee Berry Borer (21.2%), and Green Scale Insect (20%), each affecting roughly one-quarter or fewer farms. Differences in pest infection between cohorts were not statistically significant. There were no statistically significant differences in pest prevalence for all considered pests between the cohorts (Annex 2 Table 18). Figure 10 below presents the three most common pests affecting farms in Kassanda and Mubende, and the proportion of farmers impacted by each pest.

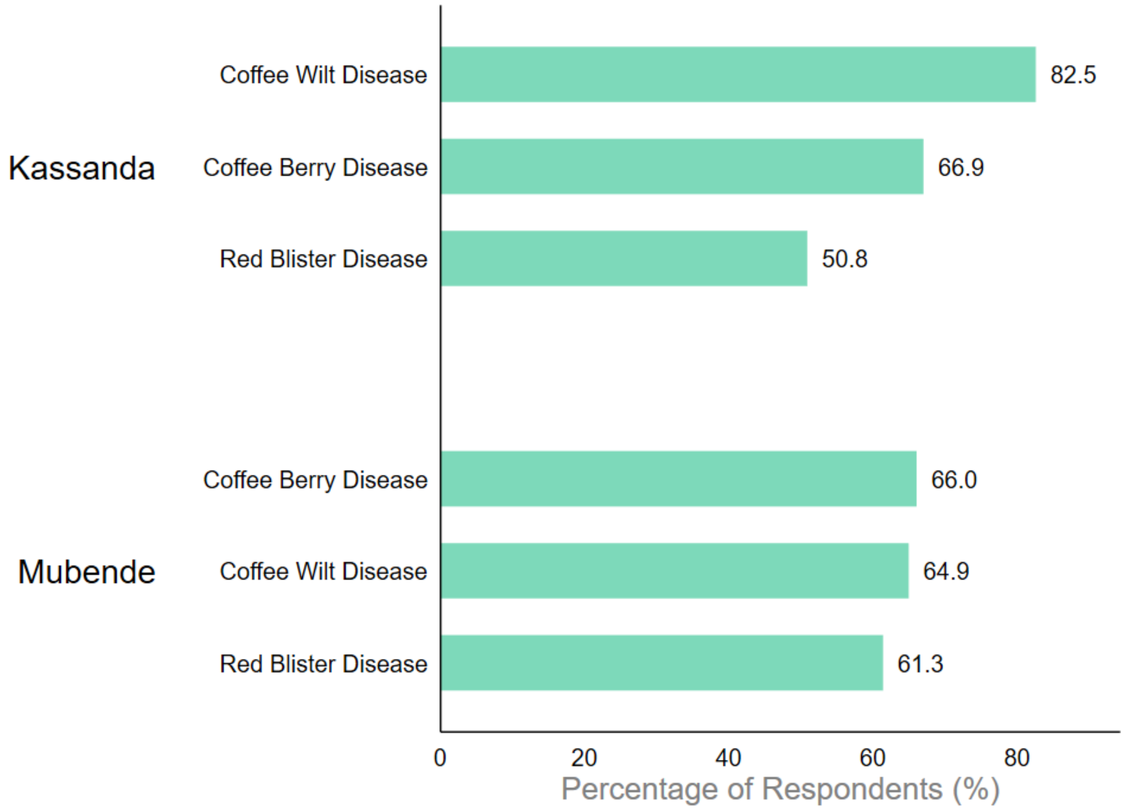
[19] For conciseness and reporting purposes, we are reporting ants as 'pests', but note that ants can also be predators of the coffee borer, for example, so may play a positive role to some extent on certain farms. In Newson, Vandermeer and Perfecto (2021), for example, a description of the effects of ants as biological control of the coffee berry borer is given. However, ants can also decrease the yield of coffee indirectly by hindering coffee berry collection through its sting (Getachew, Negeri & Daba, 2015).

Figure 10: The three most common pests affecting coffee trees in Kassanda and Mubende



Disease incidence is also very high overall, with 95.3% of farmers reporting at least one disease, consistently high across all cohorts (94.2% to 95.9%, p=0.591, Annex 2 Table 19). The most widespread disease is Coffee Wilt Disease, affecting 72% of farms. Coffee Berry Disease also significantly impacts farms (65.8%). Other common diseases include Red Blister Disease (56.5%) and Coffee Leaf Rust (34.5%). The Coffee Brown Eye Spot is relatively less prevalent, affecting about 29.4% of farms. Figure 11 shows the three most reported coffee diseases in Kassanda and Mubende districts.

Figure 11: The three most common diseases affecting coffee trees in Kassanda and Mubende



Annex 2 Table 17 provides details on the severity of pest and disease impact, measured as the average percentage of all coffee trees affected on farms where the pest was present during the 12 months prior to the survey. Among pests, ants infested the largest proportion of the coffee trees, affecting approximately 48% of trees on the 566 farms with ants. Other pests that affect substantial proportions of coffee plantations include Black Coffee Twig Borer (27.3% among 557 trees), Coffee Stem Borer (18.1%), Nematodes (20.1%), and Coffee Berry Borer (16.6%). Notably, Nematode infestation significantly differed across cohorts (p=0.015), being highest in Cohort 1 (26.9%) and lowest in Cohort 2 (11.8%).

For diseases, the proportion of trees affected among farms where the disease was present was generally lower than with pests. The most severe diseases included Coffee Leaf Rust (15.3% of the coffee trees on average), Red Blister Disease (12.4%), Coffee Brown Eye Spot (12.1%), and Coffee Wilt Disease (11.9%). Among these, Coffee Brown Eye Spot showed statistically significant variation across cohorts (p = 0.047), with Cohort 3 having a notably lower proportion of their farm impacted (9.2%) compared to Cohorts 1 and 2.

Table 22 defines the IPDM GAP-indicator. A farmer is assigned a positive indicator when they apply at least three preventive disease measures and have applied at least one pest control method – if they had pests on the farm, and the farmer must likewise have implemented at least one remedial method to control diseases – if they have reported being affected by a disease.

Table 22: GAP adoption indicator conditions for Integrated Pest and Disease Management (IPDM)

GAP	Conditions for positive indicator
IPDM	1. Farmer applied at least three methods for preventing diseases 2. If a farmer has had a pest, they have applied at least one method to control it 3. If a farmer has had a disease, they have applied at least one method to control it

Table 23 shows farmers' adoption to the IPDM GAP-indicator. Overall, just 15.2% of respondents reported using at least three distinct disease prevention methods. Among the farmers who experienced pests, 80.1% applied at least one control method, and among those who had disease outbreaks, 88.3% applied a disease control method. None of the comparisons across cohorts showed statistical significance at the 5% level.

Table 23: GAP adoption indicators for IPDM across districts

	Total	District	
		Kassanda	**Mubende**
IPDM			
Farmer applied at least three methods for preventing diseases**	15.2%	18.8%	12.2%
Farmer has had pest and applied at least one method to control it (n=795)	80.1%	80.1%	80.1%
Farmer has had disease and applied at least one method to control it (n=773)	88.3%	90.1%	86.7%
IPDM GAP-indicator*	14.7%	17.9%	12.0%

Note: The table represents the percentage of farmers that adhered to each of the conditions for positive GAP adoption indicators. The IPDM GAP-indicator is positive if the farmer has applied at least three disease-preventing methods (out of *planting disease-resistant coffee types, sporadic tree inspections, good basic routine management, not using coffee husks as mulch, pruning, removing black cherries from trees and soil, not harming the tree when weeding, disinfecting tools,* and *regularly harvesting ripe cherries*), at least one disease control method if the farmer has had a disease (out of *removing and burning infected parts of the tree, disinfecting farm tools that were used on the tree, applying chemical fungicides* and *applying organic fungicides*), and at least one pest control method if the farmer has had a pest (out of *sporadic tree inspections, control shade areas, using self-made traps, using self-made organic pesticides,* and *using chemical pesticides*). Comparisons across districts are done with a Rao-Scott Chi-squared test which allows for a survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

(Post-)Harvest handling

Table 24 outlines the GAP adoption conditions related to harvesting and post-harvest handling, specifically on harvesting and drying methods. To receive a positive GAP-indicator for harvesting, a farmer must meet two criteria. They must report picking only red cherries and using a selective picking method. For drying, farmers must have dried all their coffee during the previous two harvest seasons (12 months), and the drying must have taken place on a proper surface – being on a tarpaulin or on a clean storage bag.

Table 24: GAP adoption indicator conditions for post-harvest handling

GAP	Conditions for positive indicator
Harvesting	1. Farmer says to pick red cherries only 2. Farmer does selective picking
Drying	1. Farmer dried all his coffee last season 2. Farmer dried coffee on the correct drying surface

Table 25 presents farmers' adherence to post-harvest handling GAPs for harvesting and drying practices by district. For harvesting, the majority of farmers reported following best practices with 90.8% stating that they only pick red cherries, and 92.9% confirmed that they use the selective-picking method. However, of the subset of 185 farmers that Laterite enumerators managed to observe a harvest in, only 70.8% had red cherries only in their harvest. The discrepancy suggests farmers could be overestimating their accuracy in harvesting red cherries. These practices were consistently high with no statistical significance at the 5% level across cohorts (Annex 2 Table 21).

For drying practices, only 263 farmers (32.5% of the sample) reported drying all their coffee in the last season. Despite this, 97.7% of the 553 farmers who dried at least part of their harvest reported using an appropriate drying surface. The drying GAP indicator was 32.0%, with differences in the drying GAP indicator across cohorts statistically significant at the 10% level (p=0.090). While only 67.9% of farmers indicated to have dried at least part of their coffee, 79% have mentioned to own a tarpaulin, suggesting that even without the distribution of tarpaulins drying practices could increase.

Table 25: GAP adoption indicators for post-harvest handling across districts

	Total	District	
		Kassanda	Mubende
Harvesting			
Farmer says to pick red cherries only (n=809)**	90.8%	87.3%	93.7%
Farmer does selective picking**	92.9%	89.9%	95.4%
Harvesting GAP-indicator*	86.9%	81.0%	92.0%
Drying			
*Farmer dried at least part of their coffee last season (n=808)**	*67.9%*	*74.0%*	*62.9%*
Farmer dried all their coffee last season (n=808)***	32.5%	42.1%	24.4%
Farmer dried coffee on the correct drying surface (n=553)	97.7%	97.3%	98.0%
Drying GAP-indicator*	32.0%	41.2%	24.2%

Note: The table represents the percentage of farmers that adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated differently with the sample size in brackets next to the condition. The variable indicating which percent of farmers dried at least part of their coffee yield is not used for the calculation of the Drying GAP-indicator. The drying surface indicator has a sample size of 553, as this question was asked to all farmers who at least dried part of their yield. Comparisons across districts are done with a Rao-Scott Chi-squared test which allows for a survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

4.4 Income

This section highlights the details of the coffee-related income streams for the households in the sample. It focuses on the key outcome variable of coffee income and analyses the income components of revenue and production costs, as well as the sales quantities and prices per kilogram. These factors are explored to investigate causal pathways of increased income. Income changes when any of these factors change. To assess the impact of OAF programs on income, we need an understanding of baseline values for these factors to compare with endline values after treatment.

Key findings:

Coffee sales

- Farmers sold, on average, 844 kg of dry-weight Robusta in the 12 months prior to the survey. Arabica growers sold an additional 142 kg of dry-weight Arabica on average. Per acre of Robusta-planted area, farmers sold 434 kg per acre. This was 255 kg per acre when considering the total acreage of Robusta-holding plots. Female-headed farming households sold lower quantities of Robusta than male-headed households, both in absolute terms and per acre.
- 69% of farmers dried at least some of their Robusta cherries, and 12% sold FAQ beans. 65% sold at least some of their harvest as fresh cherries, meaning that 35% dried all their Robusta cherries. 31% did not dry cherries at all[20]. FAQ sales were lower in Cohort 1 than in Cohorts 2 and 3, with statistically significant differences at the 10% level.
- Farmers received on average around 2,500 UGX[21] per kilogram of fresh Robusta cherries, 5,800 UGX per kilogram of dried cherries, and 11,200 UGX per kilogram of FAQ. The average sales prices for Robusta were slightly higher in Mubende than in Kassanda. When the weight loss of drying cherries is considered, the differences in prices per kilogram of dry weight between fresh and dried cherries are minimal. However, FAQ beans generated more income than dried or fresh cherries when corrected for weight loss.
- 90% of the farmers sold their coffee through middlemen, 13% sold coffee directly to a processor, and 4% and 2% of the farmers used an agro-input dealer and their cooperation for marketing coffee respectively. Middlemen were more often used by smaller farmers but differences are not statistically significant.

[20] These figures are based on farmers' self-reported sales in the 12 months prior to the survey, which may differ from the self-reported drying practices of the yield in the 12 months prior to the survey as sales seasons and harvesting seasons may not entirely overlap.
[21] In this report, where we write out a UGX figure such as 2,500, we are referring to a rounded estimate, meaning in this instance the exact rate was between 2,450 and 2,549

- Households earned 9.6 million UGX (6,182 2017 USD PPP) of revenue (farm revenue plus income from other non-agricultural activities, unadjusted for farming costs). Female-headed households earned significantly less than male-headed households, and households in cohort 3 earned significantly more than the households in the other cohorts.

Coffee income

- On average, farmers generated a coffee sales revenue of 5.1 million UGX (~3,285 USD 2017 PPP[22]) with a median of 3.0 million UGX. Coffee revenue averages vary from 2.9 million UGX (~1,868 USD 2017 PPP) for the smallest farmers (<2.5 acres) to 9.8 million UGX (~6,312 USD 2017 PPP) for the largest farmers (>10 acres ha). Corrected for coffee production costs, farmers earned an average income of 4.4 million UGX (~2,834 USD 2017 PPP), with a median of 2.5 million UGX. The smallest farm group earned 2.9 million UGX (~1,868 USD 2017 PPP) of coffee income and the largest farm group earned 8.3 million UGX of coffee income (~5,346 USD 2017 PPP)
- On average, farmers generated UGX 2.9 million (USD 1,848 2017 PPP, median is 1.9 million UGX) per acre of coffee farmland in revenue and UGX 2.5 million (USD 1,610 2017 PPP, median of 1.5 million UGX) per acre in income. Farmers in the smallest farm size category generated the highest revenue and income per acre of coffee farmland compared to the other farm size categories, and the largest farm size category had the lowest per acre revenue and income.
- The 121 farmers who applied inorganic fertilizers spent UGX 311,000 per acre of coffee farmland on average (median=UGX 97,000), making it the most expensive cost item. 554 farmers hired labour for coffee farming and spent UGX 190,000 per acre on average, making labour the second most expensive coffee production cost item. In total, 761 farmers reported expenditures on coffee production and spent UGX 331,000 per acre (median=UGX 223,000).

4.4.1 Quantities sold

The farmers sold 844 kilograms (median=518) of dry weight Robusta on average in the 12 months, or two harvest seasons, prior to the survey[23]. Farmers who also sold Arabica coffee, sold 142kg dry weight on average. Farmers in the smallest farm size category sold 489kg (median=336), while the largest farmers sold 1,539kg (median=1,173) of dry weight

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[22] In this report, we use a conversion rate of 1,000 UGX in 2024 equals 0.644 USD 2017 PPP. This rate is constructed through the average inflation in Uganda between 2017 and 2024 according to World Bank ($CPI_{2024/2017}$ = 124.0 (WorldBank, n.d.)), and the exchange rate of UGX to international dollar in 2017 of 1251.63 UGX/int$ (UN Data, n.d.).

[23] In this report, we assume a weight loss rate from fresh coffee cherries to dried 'Kiboko' cherries of 60%, and from dried cherries to FAQ of 42% (FAO, 2004; Niyibigria, 2019). This corresponds to 1 kilogram of red Robusta cherries equals 0.4 kilogram of dried Robusta cherries, and 1 kilogram of dried Robusta cherries equals 0.58 kilogram of FAQ. If the farmer sold fresh cherries or green beans, we convert the mass accordingly to obtain a comparable dry weight. We maintain the same conversion rates for Robusta and Arabica cherries.

Robusta. Farming households with a female head sold substantially less than male-headed coffee farming households (506kg compared to 907kg respectively, p<0.001). There are no statistically significant differences in quantities sold between cohorts (Annex 2 Table 22).

For per-acre averages we use two definitions for an acre of Robusta farmland. The average dry weight Robusta sold per acre of 'Robusta-planted area' is 437kg/acre, and 255kg per acre of 'Robusta-holding plots'[24]. Again, female-headed farming households sold less Robusta compared to their male-headed counterparts: female-headed households sold 369kg/acre of Robusta-planted area or 222kg/acre of Robusta holding plots, while male-headed households sold 450kg/acre of Robusta-planted area or 260kg/acre of Robusta holding plots (p=0.022 & p=0.040 resp.). This indicates that while female-headed households have smaller farms in general, their productivity per acre is also lower. From the data itself, it is not immediately clear why this is the case, but it could be that female farmers are otherwise occupied with tasks that traditionally fall on women, therefore have less time to focus on their farms. For analysis of the midline data, we will place emphasis on whether female- and male-headed households observe any differences in productivity changes after one year of implementation. Farmers in smaller farm size categories sold more Robusta per acre than larger farmers (p<0.001 & p<0.001). There are no statistically significant differences in quantities sold per acre between the three cohorts (Annex 2 Table 22).

Benchmarked against current data of productivity of Ugandan coffee farmers by the UCDA (n.d.), these figures are rather low. According to these statistics, the average Robusta grower produces an average of 400-800 kilograms of dried cherries (Kiboko) per acre[25]. Interestingly, the tree density according to the UCDA is somewhat similar to our Robusta-planted area density, at 450 trees per acre (our findings show 479 trees per acre). This implies that the coffee farmers in the sample have less productive trees than the Ugandan average.

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[24] See the 'Methodology' section of 4.2 for the definitions of *coffee-planted area* and *coffee-holding plots*. We use the same method for distinguishing between Robusta-planted area and Robusta-holding plots here. In short, the Robusta-planted area refers to the part of the farmland that is covered with Robusta trees specifically, while the Robusta-holding plots refers to the entire plots on which Robusta trees are standing.

[25] UCDA (n.d.) reports 600-1,200 kilograms of green Robusta coffee per hectare. This is equal to 240-480 kilograms of green coffee per acre. Assuming a weight loss of 42% going from Kiboko to green coffee, this corresponds to 413-826 kilograms of Kiboko per acre.

Table 26: Average and median Robusta dry weight sold in total and per acre

	KG sold (median)	KG/acre RPA (median)	KG/acre RHP (median)
Total	844 (518)	437 (329)	255 (180)
Female-headed households	506 (350)	369 (299)	222 (174)
Male-headed households	907 (578)	450 (333)	260 (183)
P-value	*<0.001*	*0.022*	*0.040*
Farm size category 1 (<2.5 acres)	489 (336)	544 (378)	339 (261)
Farm size category 2 (2.5-5 acres)	688 (440)	434 (325)	255 (178)
Farm size category 3 (5-10 acres)	1,041 (720)	396 (317)	217 (165)
Farm size category 4 (>10 acres)	1,539 (1,173)	316 (226)	162 (91)
P-value	*<0.001*	*<0.001*	*<0.001*

Note: The table represents the average and median dry weight of Robusta sold in total and per acre of 'Robusta-planted area' (RPA) and per acre of 'Robusta-holding plots' (RHP) in the 12 months prior to the survey. Averages are given for the total sample, and by gender of the household head and farm size category. The categorical groups are compared using an Adjusted Wald test, which accounts for the survey design.

4.4.2 Sales prices

Sales prices per kilogram of coffee are key outcome variables to determine causal effects of a project with as many facets as the OAF project. The project's main objective is increased coffee-related income, which can be achieved through larger sales volumes or better sales prices, or both. While volumes can be expanded by proper GAP adoption and input investments, sales prices can be affected by improved market access, market information and quality assurance. These are important elements of OAF's MAP. Investigating kilogram-prices at baseline and distinguishing between prices for different stages of coffee (fresh, dried, or FAQ) allows us to determine the effect of the MAP and the importance of sales price improvements in achieving increases coffee-income, vis-à-vis increased coffee-tree productivity.

In the two seasons prior to the survey, around one third of farmers sold both fresh and dried Robusta cherries, one third sold only dried cherries and one third sold fresh cherries only. 61.2% of farmers sold dried Robusta cherries and 11.6% sold FAQ. 64.6% sold fresh cherries, meaning that 35.4% dried and/or hulled all their yield. However, 31.2% did not dry any of their harvested Robusta cherries, indicating that there is still room for improvement concerning drying practices. Table 27 below shows the percentages of farmers that sold fresh, dried and FAQ cherries by district. It shows that Mubende farmers are much less likely to have sold FAQ beans than Kassanda farmers. Mubende farmers are also less likely to sell processed coffee altogether, as 37% of the Mubende farmers sold fresh cherries only, while this is 24% for Kassanda farmers. This suggests that any encouragement efforts for selling processed coffee needs to be targeted in Mubende in particular. Table 28 shows the percentages of the total dry weight quantities sold that is sold in fresh, dried and FAQ stages corrected for weight loss throughout the processing stages.

Table 27: Percentage of farmers that sold each type and species of coffee, in total and by district

	Total	District		*p-value*
		Kassanda	Mubende	
State of Robusta sold (n=809)				
Fresh cherries	64.6%	64.4%	64.8%	*0.959*
Fresh cherries only**	31.2%	23.8%	37.3%	*0.018*
Dried cherries	61.2%	65.4%	57.6%	*0.172*
FAQ beans***	11.6%	16.9%	7.2%	*0.006*
State of Arabica sold (n=43)				
Fresh cherries	54.2%	48.1%	57.8%	*0.626*
Dried cherries	45.8%	51.9%	42.2%	*0.626*

Note: This table shows the percentage of Robusta and Arabica growers who sold fresh, dried, and FAQ for both species. The percentages are reported and compared across the districts. For comparison, Rao-Scott chi-squared comparison tests, which account for the survey design, are conducted. Asterisks indicate significance levels (* $p < 0.1$, ** $p < 0.05$, *** p < 0.01). Farmers who grow Arabica coffee did not sell more than one state of Arabica and did not sell FAQ Arabica.

Table 28: Percentage of Robusta dry weight kilogram sold in fresh, dry and FAQ stage

	Total	District		*p-value*
		Kassanda	Mubende	
% Fresh	42.1%	36.6%	46.6%	*0.105*
% Dry	51.8%	54.1%	49.9%	*0.500*
% FAQ	6.1%	9.3 %	3.5%	*0.008*

Note: The table represents the percentages of the total dry weight of Robusta sold in fresh, dried and FAQ stages. For comparison between the districts, an Adjusted Wald test is conducted, which allows for survey designs. Asterisks indicate significance levels (* $p < 0.1$, ** $p < 0.05$, *** p < 0.01).

Dried cherries and FAQ beans generate a higher price per kilogram of produce than fresh cherries. However, these processing steps reduce the weight of beans. This needs to be considered when comparing kilogram prices of produce. Table 29 below shows that prices per kilogram approximately double with every processing step from fresh red cherries to dried cherries to FAQ beans.

Farmers received 5,800 UGX per kilogram of dried Robusta in the two seasons of 2024 (Table 29). This falls in the lower end of the price range of 2024, which increased from 5,500-5,800 UGX per kilogram in June to 6,000-7,000 UGX per kilogram in December (UCDA, June 2024; UCDA, December 2024). Red, green and dried Robusta prices differed marginally but statistically significantly between Kassanda and Mubende, with farmers in Mubende receiving 300 UGX more for dried Robusta (p=0.005), 200 UGX more for red Robusta cherries (p<0.001) and 800 UGX more for Robusta cherries sold in green state (p=0.003, meaning the difference is statistically significant, although n=43 only for those who sold cherries in early green stages). FAQ prices were also higher in Mubende, but the difference is not statistically significant. Annex 2 Table 24 covers the different prices across treatment cohorts and shows that there are no statistically significant differences in all kilogram prices between cohorts at a 5% significance level.

Table 29: Coffee sales prices per kilogram in 1,000 UGX across two districts

	Total	Districts	
		Kassanda	Mubende
Robusta			
Green cherry***	2.1 (1.8, 2.4)	1.6 (1.1, 2.0)	2.4 (2.2, 2.7)
Red cherry***	2.5 (2.4, 2.6)	2.4 (2.2, 2.5)	2.6 (2.5, 2.7)
Dried cherry (Kiboko)***	5.8 (5.7, 6.0)	5.7 (5.4, 5.9)	6.0 (5.9, 6.1)
FAQ	11.2 (10.4, 12.1)	10.9 (10.0, 11.8)	11.8 (10.2, 13.4)
Arabica			
Red cherry	2.0 (1.6, 2.3)	2.3 (1.7, 2.8)	1.8 (1.5, 2.2)
Dried cherry	5.6 (5.1, 6.2)	5.5 (4.6, 6.4)	5.7 (5.0, 6.4)

Note: Means and 95%-confidence intervals of the sales prices per kg for each state of Robusta and Arabica were sold in the previous 12 months in UGX 1,000. Averages are compared between the two districts using Adjusted Wald tests, which account for the survey design. Asterisks indicate significance levels (* p<0.1, ** p<0.05, *** p<0.01).

However, Table 29 does not account for weight loss of produce with every processing step. Since there is no uniform consensus about the correct conversion rates – which is also related to the fact that conversion rates depend on the farmer's drying practices – we provide the average sales prices of each coffee type per sold kilogram of the considered type in Table 29.

When kilogram prices are adjusted to account for processing-related weight loss using the conversion rates outlined above, the average price per kilogram of dried Robusta does not exceed that of fresh red cherries, whereas a kilogram of FAQ Robusta commands a higher price than a kilogram of dried cherries. Table 30 presents average and median sales prices for different processing stages at which Robusta (and Arabica) is sold. It includes fresh cherry and FAQ bean prices converted to dry weight equivalent prices. The dry weight equivalent of the average fresh cherry price exceeds that of the average dry weight price (6,250 UGX versus 5,800 UGX), indicating that, corrected for weight loss, fresh cherries were more profitable than dried cherries. However, FAQ beans generated higher converted per-kg sales prices than dried cherries and fresh cherries (6,500 UGX). It is important to note that this comparison is highly sensitive to the conversion rate assumptions and methodologies applied, which may not fully reflect the realities of all Ugandan coffee farms. Given that the average converted prices are very close to the average dried cherry price, we cannot conclude that selling dried cherries instead of fresh cherries results in lower revenues for farmers. Rather, the assumption that revenue increases with additional processing steps needs to be critically reviewed, especially because we did not include additional processing costs (such as storage and hulling services) in these conversion calculations.

The possibility that drying coffee does not actually yield higher prices per kilogram of fresh weight has implications for the project's implementation. It cannot be taken for granted that drying practices improve farmers' economic outcomes; in fact, they may reduce them. Drying cherries introduces considerable risks: the process must be managed to prevent contamination by pests, dirt or mould, while theft of cherries left to sun-dry in public spaces is a common challenge in Uganda. If dried and fresh Robusta generate comparable per-kilogram profits, the additional costs and risks of drying mean that farmers who dry their cherries may earn less than those who sell fresh cherries directly. OAF should therefore place strong emphasis on ensuring that, where drying is required by buyback partners, farmers are equipped with proper drying methods and prices for dried coffee clearly exceed the equivalent value of red cherries on a fresh weight basis.

Table 30: Sales price comparison for different cherry types

Robusta type	Average (median) price per kilogram in UGX	Conversion rate
Dried cherries (Kiboko)	5,800 (6,000)	
Fresh red cherries	2,500 (2,500)	1kg dry cherries corresponds to 2.5kg fresh Robusta cherries
Fresh red cherries in dry weight equivalent	6,250 (6,250)	
FAQ	11,200 (12,000)	1kg FAQ coffee corresponds to 1.72kg dry Robusta cherries
FAQ in dry weight equivalent	6,500 (7,000)	

Note: This table shows the average and median sales prices for Robusta in different cherry stages. The used conversion rates are derived from FAO (2004) and Niyibigria (2019), in which a 60% weight loss is maintained going from fresh to dried cherries, and a 42% weight loss going from dried to FAQ beans.

Almost 90% of farmers sold their coffee through middlemen. Many less farmers sold through other sales channels. 12.6% sold coffee directly to the processing or milling station, 3.7% sold to the local input dealer of agricultural inputs, and only 2.4% sold to their cooperative or coffee growers association (although cooperative membership rate is only 15% - Table 11 in section 4.2.2). This is in line with the finding that only 3.6% of the farmers indicated to have sold at least part of their coffee sales jointly through VSLAs or cooperatives, while 96% sold their coffee individually and were not able to benefit from bulking.

The distribution of sales channels does not differ strongly across the districts and does not differ across cohorts. Kassanda has a slightly lower percentage of farmers that sold to middlemen and higher percentage that sold through the other sales channels, but only the difference in the percentage of farmers selling to processors and millers is statistically significant at the 5% significance level (Annex 2 Table 25). Annex 2 Table 26 shows that sales channel frequencies did not statistically significantly differ across cohorts.

Table 31 shows the distribution of coffee sales channels across farm size groups. The only statistically significant differences are among the percentage of farmers that sold to processors and millers; larger farmers are more likely to have used this sales channel than smaller farmers (p=0.017). The other differences are not statistically significant at the 5% significance level, but do suggest that selling through middlemen is more prevalent among small farms, and using other sales channels is more often used by larger farms.

Table 31: Proportion of farmers using different sales channels to sell coffee by farm size

Coffee is mainly sold through	Total	Farm size category				*p-value*
		<1 ha	1-2 ha	2-4 ha	>4 ha	
Middlemen	89.8%	93.2%	88.6%	90.3%	85.6%	*0.169*
Directly through processor/miller	12.6%	7.2%	11.8%	16.6%	17.8%	*0.017*
Agro-input dealer	3.7%	1.6%	5.7%	3.5%	3.3%	*0.135*
Cooperative/ association	2.4%	1.5%	2.5%	2.5%	3.5%	*0.670*

Note: The table indicates the percentage of farmers that who sold their coffee through each of the sales channels. It shows the average percentages across the sample and by farm size category. Farmers were allowed to mention more than one sales channel if applicable. The by-farm size group averages are compared using a Rao-–Scott Chi-squared test, which accounts for the survey design.

4.4.3 Coffee revenue, income and production costs

The average farmer in our sample generated around 4.4 million UGX (2,834 2017 USD PPP) of coffee income (revenue minus costs) in the 12 months prior to the survey (median=2.5 million UGX), but income figures vary greatly across different farm sizes. The smallest farms – those with a total farmland of smaller than 1 hectare (2.47 acres) – generated around 2.9 million UGX (1,868 2017 USD PPP) with coffee sales on average, of which 2.6 million UGX (1,675 2017 USD PPP) remained after costs deduction. On the other hand, the largest farms – those with a total farmland of more than 4 hectares or 10 acres – generated a coffee sales revenue of 9.8 million UGX (6,312 2017 USD PPP) on average, which boiled down to an average of 8.3 million UGX of coffee related income (5,346 2017 USD PPP). There are no statistically significant differences between income, revenue, and total production costs across the treatment cohorts (Annex 2 Table 27).

Table 32: Coffee revenue, costs and income in 1,000 UGX

	Total	Farm size category			
		<2.5 acres	2.5-5 acres	5-10 acres	>10 acres
Coffee revenue (n=805)	5,133 (4,381, 5,885)	2,946 (2406, 3487)	4,150 (3070, 5230)	6,161 (5,041, 7,281)	9,780 (8,121, 11,438)
Total costs for coffee production (n=810)	713 (612, 814)	316 (213, 420)	525 (428, 622)	819 (654, 985)	1,684 (1,464, 1,903)
Coffee income (n=805)	4,436 (3,727, 5,144)	2,630 (2117, 3143)	3,602 (2583, 4621)	5,337 (4,308, 6,367)	8,258 (6,559, 9,956)

Note: The table shows the average revenue, income, and costs associated with coffee farming in the 12 months prior to the survey for all farmers and compared across four different farm size categories. The farm sizes in the farm size groups refer to the total acreage of the farm, of which only a portion is used for coffee production. The averages are calculated for all farmers and therefore consider expenditures of zero UGX for farmers who indicated to have no expenditures for all cost items.

Adjusted for coffee production associated costs, farmers earned approximately 2.5 million UGX (median=1.9 million UGX) per acre of coffee plantation on average (Table 33 below). Coffee production costs per acre averaged 311,000 UGX across for all farmers in the survey, including those without any coffee production costs. Comparing these figures across farm size categories shows that particularly the smallest farm sizes have higher per-acre income and revenue than other groups, with differences statistically significant at the 5% (for revenue) and 10% (for income) significance level. Per-acre income, revenue and production costs differences are not statistically significantly different across cohorts at the 5% significance level (Annex 2 Table 28).

Households with a smaller farm had higher coffee incomes and revenues per acre than those with larger farms, with the average income and revenue decreasing with each larger farm size group (p=0.076 & p=0.031 respectively). The differences are mainly caused by a higher sales per acre, as per-acre production costs do not differ across the farm size groups (Table 33 below). This suggests that households with smaller landholdings more intensively use land for coffee production, as they might rely more heavily on additional income through coffee production than larger farmers. This aligns with the findings shown in Table 10 in section 4.2.1, showing that smaller farmers have higher tree densities than larger farmers.

Income per acre averages are relatively low compared to country-wide averages from the UCDA (n.d.). They report gross income averages of 3.5 million UGX per acre for a young coffee farm, increasing to more than 13 million UGX per acre for coffee farms older than 6 years.

Table 33: Coffee revenue, costs and income per acre allocated to coffee production in 1,000 UGX

	Total	Farm size category			
		<2.5 acres	2.5-5 acres	5-10 acres	>10 acres
Coffee revenue per acre (n=803)**	2,941 (2,510, 3,372)	4,016 (3,041, 4,991)	2,673 (2,142, 3,203)	2,444 (2,017, 2,871)	2,402 (1,585, 3,220)
Total costs for coffee production per acre (n=808)	311 (279, 343)	321 (246, 396)	289 (250, 329)	306 (258, 354)	343 (282, 403)
Coffee income per acre (n=803)*	2,512 (2,111, 2,913)	3,356 (2,469, 4,243)	2,325 (1,802, 2,848)	2,120.0 (1,722, 2,518)	2,049 (1,267, 2,831)

Note: The table shows the average coffee related revenue, income and costs per acre of coffee-planted area for the total sample and by farm size category. 95% confidence intervals are provided in brackets. Averages are calculated only for farmers that were able to recall sales, costs and acreage of coffee-planted areas. Farm size category averages are compared using an Adjusted Wald test and asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01)

Table 34 breaks down the costs associated with coffee production in total and per acre of coffee-planted area. It also highlights what percentage of farmers had the expense in the 12 months prior to the survey. It shows that most farmers spent money on tools purchases (84% of the farmers), other inputs beside inorganic fertilizers (71%) and labour (66%). Far fewer farmers had inorganic fertilizer costs (15%), whereas this was the costliest item per acre of coffee-planted area (311,000 UGX per acre)[26]. By cohort comparisons show that there are no statistically significant differences in cost items across cohorts, except for land rent costs per acre, but this comparison has a substantially small number of observations (n=13) (see Annex 2 Table 27 and Annex 2 Table 28).

[26] Note that Table 34 shows cost averages among only the farmers who have spent money on the indicated cost item, making the total cost-averages slightly different from those in Table 32 and Table 33

Table 34: Cost item in total and per acre in 1,000 UGX

Cost item	Total costs (95% CI)	Costs per acre (95% CI)	Percentage of sample
Rent costs	304 (-24, 633)	135 (77, 192)	2%
Tools expenditures	150 (128, 172)	72 (66, 79)	84%
Inorganic fertilizer expenditures	641 (454, 828)	311 (204, 419)	15%
Other input expenditures	268 (235, 302)	117 (106, 129)	71%
Labour costs	460 (409, 511)	190 (173, 207)	66%
Total costs and expenditures to coffee production	760 (657, 862)	331 (298, 365)	94%

Note: This table shows the average costs and expenses related to coffee farming in total and per acre of coffee-planted area. The percentages in the third column indicate the percentage of farmers that had the considered expense. The averages are therefore calculated only for the farmers who had that expense.

4.4.4 Total household revenue

The households in the sample earned on average 9.6 million UGX (6,182 2017 USD PPP) through farm revenue and non-agricultural income generating activities (median=5.6 million UGX, 3,606 2017 USD PPP) throughout the 12 months prior to the survey[27]. Cohort 3 households earned statistically significantly more than the households in the other cohorts (p=0.049). Also, female-headed households earned much less than male headed households. Female-headed households averaged a household revenue of 4.9 million UGX (median=3.0 million UGX), versus 10.4 million UGX for male-headed households. Household income differences across districts were small and not statistically significant.

Revenue averages are low compared to the living income benchmark in the rural areas of the 'Lake Victoria Basin' (rural districts around capital Kampala) in 2025 as calculated by the Global Living Wage Coalition (2025). Their estimates show that a family of five with 1.78 earners need 928,500 UGX per month (11.1 million UGX per year). Considering that our income calculations do not correct for agricultural expenses – which means that disposable income is even lower than the calculated total household revenue – and that the average household has 6.1 household members (median=6 members), the mean and especially median income figures in Table 35 indicate that achieving a living wage is not plausible for many households.

The median revenue of 3,606 2017 USD PPP for an average household size of 6.1 corresponds to 591 2017 USD PPP per person per year, which corresponds to 1.62 2017 USD PPP per day. This is far below commonly used poverty lines of 2.15 or 3.65 2017 USD PPP per person per day, suggesting that the vast majority of household members in the sample's households live below the poverty line.

However, it needs to be noted that our revenue calculations do not correct for crop cultivation for self-consumption. Also, our 10-stone method to estimate household revenue

[27] Agriculture production costs for non-coffee crops were not asked in the survey. Therefore, these figures do not present total disposable income for the household, as no farm costs are deducted.

relative to coffee revenue relies on questionable and simplistic assumptions and is too reductive to yield comparable figures.

Table 35: Total household revenue in 1,000 UGX

	Total household revenue	Median
Total	9,566 (8,308, 10,824)	5,625
Cohort 1	9,818 (8,017, 11,619)	5,474
Cohort 2	7,683 (6,395, 8,971)	5,162
Cohort 3	10,644 (8,237, 13,050)**	6,307
Female-headed	4,909 (3,714, 6,105)	3,028
Male-headed	10,436 (9,010, 11,861)***	6,279
Kassanda	9,786 (7,784, 11,789)	5,373
Mubende	9,379 (7,802, 10,956)	5,755

Note: The table represents the average and median total household revenue (defined as total farming revenue plus income from non-agricultural income generating activities, unadjusted for farm related costs) in 1,000 UGX total, by cohort, by household head gender and by district. Total household revenue is calculated by asking the relative share of coffee revenue out of the total household cash income and remittances (excluding farming costs) using the 10-stones method. Group averages are compared using an Adjusted Wald test and asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

4.5 Household dynamics

This section explores the impact of the project on non-coffee-related income, expenditure, and discusses baseline values for intra-household disagreements so we can measure over the course of the project whether there are any unintended negative consequences of the project on households – particularly around household decision-making. We measure baseline values for the food insecurity experience scale FIES and describe current revenue management between household heads and spouses. This allows for a comparison of disagreements and spending decisions from baseline to midline and endline.

This section provides baseline findings to answer research questions 3A to 3D.

Key findings:

Food insecurity

- 77% of households do not experience or experience mild food insecurity. 19% experience moderate food insecurity, and food insecurity is severe for 4% of the households. At households in the lowest asset-ownership quartiles, no or mild food insecurity is experienced by 59% of households, while 33% of households experience moderate food insecurity and 8% experiences severe food insecurity.
- Female-headed households are more likely to experience moderate or severe food insecurity. They are more represented in the moderate food insecurity group than male-headed households by 3 percentage points, and by 4 percentage points in the severe food insecurity group.
- 40% of the lowest asset-ownership group experience moderate or severe food insecurity, compared to only 9% for the highest asset-ownership group.
- There are no statistically significant differences between the cohorts in terms of food insecurity experience.

Household income and spending

- Households spent the highest proportion of their coffee revenue on education, followed by "essential household items," and "property or land." There was broad agreement between household heads and spouses on what they spent their coffee revenue on.
- The most common item on which households would like to spend more of their coffee revenue, was "property or land," followed by education.
- There were some discrepancies in '"desired spending categories'" between household heads and spouses, with more spouses than household heads wanting to spend more revenue on '"education'", '"essential household items'", '"business investments'", and '"health expenses." The only category in which more household heads than spouses said they wanted to increase spending, was '"luxury household items'."

- Within households, both household heads and spouses tended to believe they rarely disagreed on key matters related to coffee and agriculture. Spouses tended to have a marginally higher disagreement score, on average, than household heads.
- There were discrepancies between household heads and spouses, in terms of views on who managed revenue from coffee farming. 28% of spouses said they keep all the coffee income, while only 12% of household heads said that their spouses keep all the income. 51% of household heads said that they keep all coffee income, while 44% of spouses agreed with that.

Methodology:

- The Food Insecurity Experience Scale (FIES) is a tool developed by the FAO to measure households' access to adequate food. It consists of eight standardized questions that capture a range of experiences associated with food insecurity, from worrying about food availability to going without eating for a whole day. Respondents answer whether they have encountered these experiences in the past 12 months[28]**.** The questions are rather subjective to the experience and interpretation of the respondent, but provide a useful oversight of plausible food insecurity in the sample. Responses are analysed using the Rasch model to generate a continuous score of food insecurity, and categorized into different severity levels: mild to no food insecurity, moderate food insecurity and severe food insecurity.
- To determine current and desired spending patterns of coffee income, we asked 213 household heads and their spouses to estimate how the household spends its coffee income using a list of 11 spending categories and 10 stones to divide over the categories. We also asked them which of the categories they wished to spend a larger proportion of their coffee income on. We asked these questions to both the head and the spouse in private and compare the answers in this section.
- For decision making and conflicts, we asked the 213 couples to estimate how often they disagreed on four decisions related to spending coffee income and farm practices using a Likert scale. We also asked them which of the two they thought makes the final decision on how to spend coffee income. Again, these questions were asked in private and the answers are compared in this section.

4.5.1 Food insecurity experience scale

The FIES is one of the main outcome indicators (Final Outcome B in the M&E log-frame) and is expected to indicate lower food insecurity due to improved economic situation in farming

[28] Households are placed in the "mild to no" food insecurity category if they answered three or less questions affirmatively, in the "moderate" food security category if they answered four to six answers affirmatively and "severe" food insecurity if they answered seven or eight questions affirmatively.

households as a result of OAF's interventions. Therefore, a brief overview of baseline FIES distributions across different socioeconomic groups is given below in

Table 36.

Female-headed households are more likely to experience food insecurity than male-headed households (p = 0.028). 7.9% of female-headed households experience severe food insecurity compared to 3.2% of male-headed households, and 21.0% experience moderate food insecurity compared to 18.2% in male-headed households. More male-headed than female-headed households experience no or mild food insecurity, with a difference of 7.6 percentage points. There are no statistically significant differences in the distribution of food insecurity categories across the treatment cohorts (p = 0.428).

Households in higher asset ownership quartiles are less likely to experience moderate or severe food insecurity than households in lower quartiles (p < 0.001). While around 90% of households in the two higher quartiles experience no or mild food insecurity, this is 70.3% in quartile 2 and 59.5% in the lowest quartile. 32.5% of households in the lowest quartile experience moderate food insecurity, and 8.0% experience it severely. For households in quartile 2, this is 24.0% and 5.6%, respectively. These figures imply that a substantial share of the sample's farming households require additional attention in terms of food security.

Table 36: FIES category broken down demographics

		FIES category		
		Mild/None	Moderate	Severe
Total		77.4%	18.7%	4.0%
Gender of household head	Male	78.6%	18.2%	3.2%
	Female	71.0%	21.0%	7.9%
p-value	*0.028*			
Asset ownership quartiles	Quartile 1	59.5%	32.5%	8.0%
	Quartile 2	70.3%	24.0%	5.6%
	Quartile 3	89.2%	9.9%	0.9%
	Quartile 4	90.9%	7.9%	1.2%
p-value	*<0.001*			
Treatment cohorts	Cohort 1	78.8%	19.2%	2.0%
	Cohort 2	75.3%	20.4%	4.3%
	Cohort 3	77.5%	17.0%	5.5%
p-value	*0.428*			
District	Kassanda	82.0%	14.7%	3.3%
	Mubende	73.5%	22.0%	4.5%
p-value	*0.103*			

Note: The table shows the distribution of households across the FIES categories by gender of the household head, asset ownership quartiles, and treatment cohorts. The groups are compared using Rao-Scott Chi-squared tests, which allow for survey design in categorical variable comparisons.

4.5.2 Household income and spending

To investigate how households currently spend their revenue from coffee, and whether household heads and spouses believe they have the same spending patterns, the survey included a series of questions on current spending, desired spending, household disagreements, decision-making, and revenue management. These questions can be used to assess whether additional cash crop income benefits the entire household instead of the household head alone. Additionally, this analysis feeds into the investigation of the causal factors behind expected reductions in food insecurity.

The main survey was conducted with the farm manager – i.e. the household member most responsible for the coffee farm – where possible. In addition, the part of the survey related to spending patterns, disagreements and decision making was conducted with both the main respondent and their spouse if they were available. 605 respondents indicated that they have a spouse who lives at the same household. Of the 605 respondents with a spouse at the house, 213 (35%) respondents agreed to conduct this part of the survey with their spouse in private without the main respondent being around. For the remaining respondents, their spouse was either not available (60%) or they preferred the enumerator not to speak with their spouse (5%). This section of the survey was conducted with the 605 respondents who live with their spouse at the house and with the 213 spouses who answered the same set of questions as their 213 counterparts. Therefore, this section only regards the 213 couples who both answered this set of questions. We ran a series of t-tests across a range of socioeconomic indicators to determine whether there were any differences between the restricted group where the spouse was available.[29] The only indicator where there was any significant difference was in the 'total number of agricultural and household assets owned', where households where the spouse was not available owned a slightly higher number of assets on average than the households where the spouse was available. However, this was only significant at the p=0.1 level (p=0.093). This suggests that the findings below are comparable to the rest of the dual-headed households where the spouse was not available for an interview.

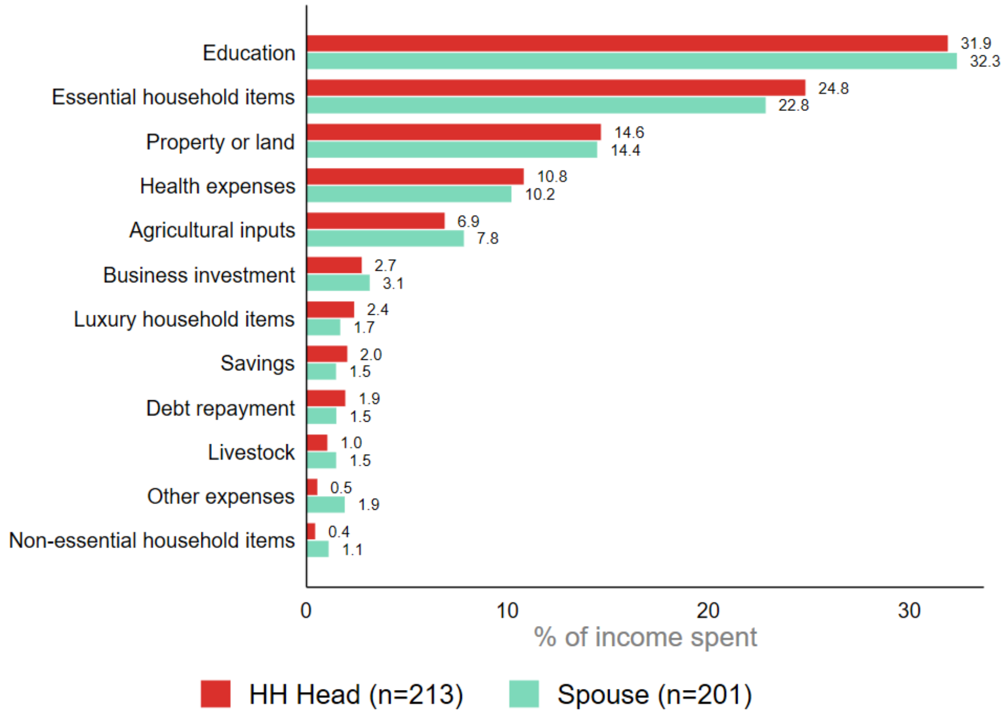
Spending patterns of coffee income

With the OAF project's intended goal of increasing coffee income, the baseline values for current spending categories are useful to observe any changes that increased income may bring. The baseline questionnaire asked both household heads and their spouses to break down the proportion of their coffee income that they spent on different categories. The respondents were given ten stones, and asked to estimate roughly how many stones were spent on each of the categories displayed in Figure 12 below. The figure indicates that the largest part of the coffee income is spent on education purposes (32%), followed by "essential household items" – which includes food, cleaning products, essential clothes and family affairs – with 23-24% and by purchasing or renting property and land (14.5%). Note that for this question module, an additional 5 spouses preferred not to answer the questions, and

[29] Socioeconomic indicators included were: Total coffee-growing area; Whether household head is literate; Total agricultural land area; age of household head; Robusta revenue in past 12 months; Total household revenue; Total household revenue minus coffee production costs and land rent costs; FIES score; Number of assets owned

7 spouses were unable to answer the questions properly, leaving the subsample of spouses at 201 instead of 213. Even though the differences between the averages spent on each category seems small, the average difference between within-household perceived spending patterns can be much bigger. Annex 2 Table 29 indicates the variance or difference in percentage points between household heads' and spouses' perceived spending patterns on each item.

Figure 12: Current spending patterns of coffee according to household heads and spouses

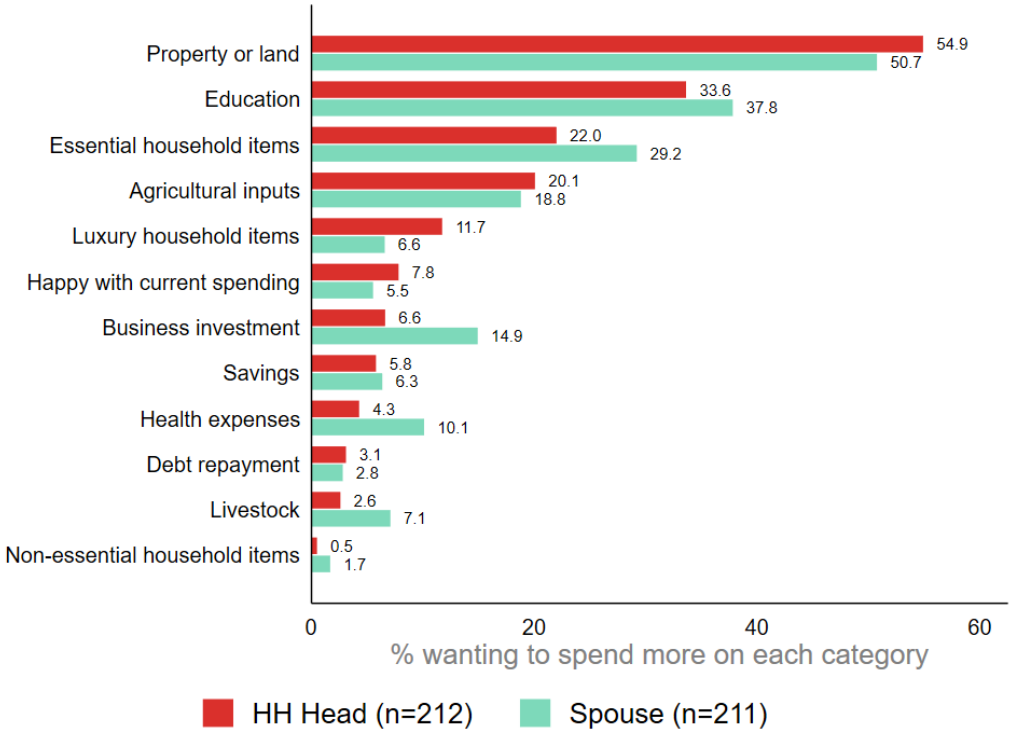


Note: The chart shows the average distribution of how household heads and spouses estimate coffee income is spent in the household. Each respondent was asked to divide ten stones over the categories, representing the spending pattern of coffee income. Five spouses refused to answer this question, and seven spouses were unable to provide a valid answer, leaving the sample size of spouses at 201 instead of 213. Essential household items include food, essential clothing, and family affairs such as burials. Luxury household items include cars, mobile phones, watches, and similar items. Non-essential household items include alcohol, tobacco, gambling, beauty items, and similar items.

Desired spending of coffee income

The survey also asked both respondents to consider what they would choose to spend a higher proportion of their income on, if the decision was solely down to them. Respondents could pick as many categories as they wished, and were not asked about specific percentage increases in spending, just on which categories they would increase. Figure 13 below shows the proportion of household heads, and the proportion of spouses that stated they would like to spend more of their coffee income on the different categories. It shows that investing in property or land is the most desired spending category for both household heads and spouses, followed by education purposes which is the largest current spending category for the households according to Figure 12 above. 7.8% of the household heads and 5.5% of the spouses are happy with the current spending pattern. Notable differences are found in some categories on which more spouses want to spend a larger part of their coffee income on than household heads, including essential household items (29.2% versus 22.0%), business investments (14.9% versus 6.6%), health expenses (10.1% versus 4.3%) and livestock spendings (7.1% versus 2.6%). However, more household heads want to spend additional income on luxury household items compared to their spouses (11.7% versus 6.6%). In general, household heads tended to be less likely to want to spend more on any particular item than spouses, across all items. Annex 2 Table 30 provides more information in what spending desires partners agree and disagree with.

Figure 13: Percentage of respondents wanting to spend more of coffee income on item



Note: The chart shows the percentage of household heads and spouses that wish to spend a larger part of coffee income on any of the categories. Contrary to Figure 12, the values indicate the percentage of respondents that mentioned that they want to spend more on the item in binary (yes or no). Therefore, the values cannot be compared to those in Figure 12. One household head and two spouses refused to answer the question, hence the reduced sample sizes.

Spouses indicated a stronger preference than household heads to allocate larger part of coffee income toward care-related items and expenditures that benefit other household members. However, they also express greater interest in investing in household businesses and livestock, suggesting that many spouses not only contribute through caregiving but also operate income-generating activities, such as small side-businesses and livestock rearing, possibly including the sale of livestock products. Since the project aims to ensure that all household members benefit equally, it is critical to support both essential household expenditures – particularly food security where this is at risk – and the capacity of spouses to contribute to these complementary income-generating opportunities. We therefore recommend OAF to ensure that the household's focus doesn't shift away from these activities towards cash crop investments only, by emphasizing female empowerment and meaningful participation in household livelihoods.

4.5.3 Intra-household decisions and conflicts

Disagreement on farming decisions

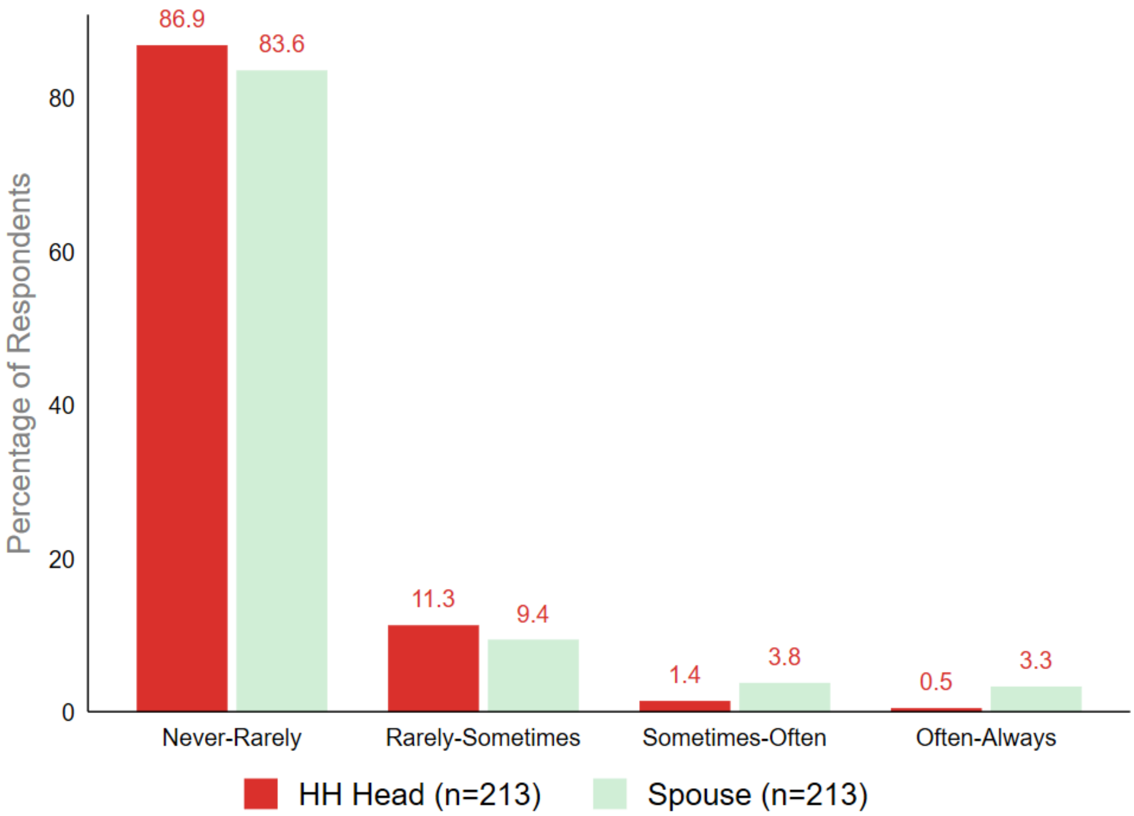
Alongside asking household heads and spouses what they spent their revenue on and what they would like to spend more of their revenue on, the survey contained questions about levels of disagreement on particular decisions about farming. Both household heads and spouses were asked the following four questions, each with a five-point Likert scale as a response option ranging from ‘never’ to ‘always’ (with ‘never’ representing ‘1’ and ‘always’ representing ‘5’):

How often would you say you and your spouse disagree about decisions related to:

- Management of revenue from farming (all crops)
- Management of revenue from farming (coffee)
- Time spent by each partner labouring on the farm
- Which agricultural practices to pursue on the farm

Respondents were then given an average ‘disagreement score’, which is calculated by simply taking the mean of responses to the four statements. If their disagreement score was 1, it meant they believed they never disagreed about any of the above statements, whereas if the disagreement score was 5, it meant they believed they always disagreed on each of the four topics. Figure 14 shows the proportion of both household heads and spouses that fall into different disagreement score groups, comparing average scores between household heads and spouses.

Figure 14: Distribution of average disagreement scores according to household heads and spouses



Note: The categorical variables are calculated as follows: never–rarely is a mean disagreement score of 1–2; rarely–sometimes is 2–3; sometimes–often is 3–4; and often–always is 4–5.

The vast majority of both household heads and spouses indicated they rarely disagreed, with 87% of household heads and 84% of spouses having a mean disagreement score between 1 and 2 ("Never" and "Rarely"). Spouses were slightly more likely to believe they disagreed with their partner more often than vice versa, with 3.8% of spouses and 1.4% of household heads having a disagreement score of 3–4 ("Sometimes" to "Often"). Just 3.3% of spouses and 0.5% of household heads had the highest category of disagreement score.

While the majority of the couples indicate to rarely or never disagree about farming matters, 13% to 16% of the household heads and spouses respectively mention that there are at least a few topics on which disagreements may arise. One of the core learning objectives of the evaluation for the OAF project is to determine whether the project may cause any unintended negative consequences. If the average disagreement scores increase for either household heads or spouses, this may be due to tricky decisions about what to spend increased coffee revenue on (or additional revenue from chia and macadamia). In the midline and endline survey, follow-up questions will be asked to learn in more detail about any increased conflict.

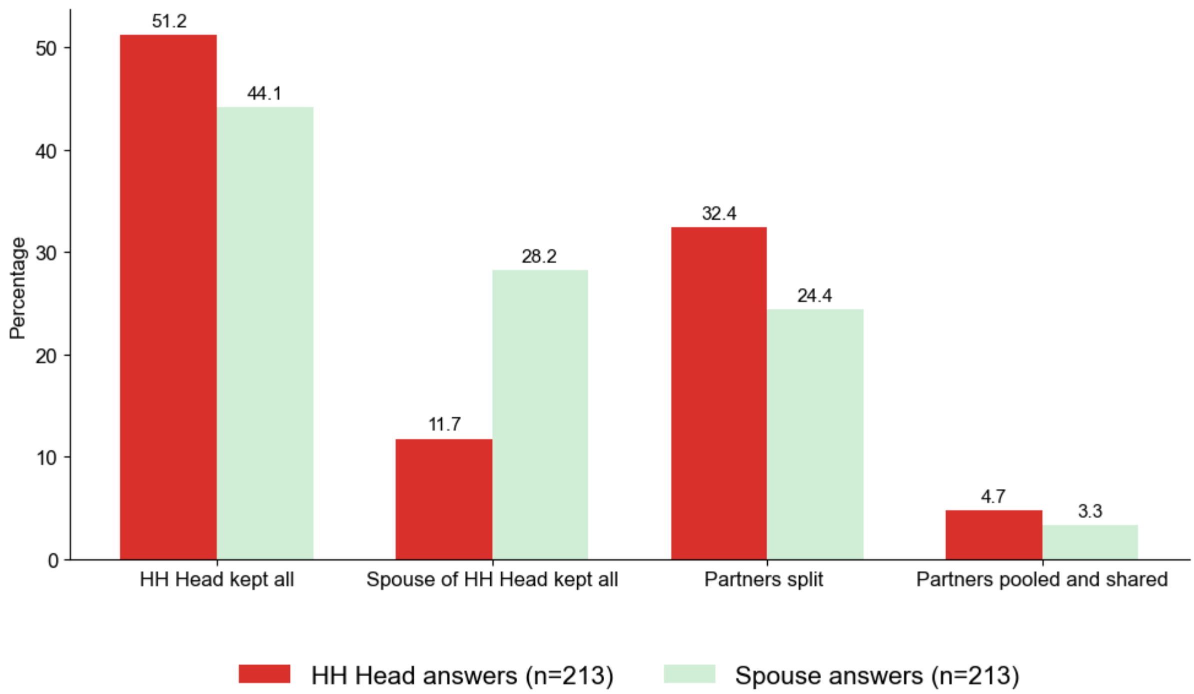
Distribution of coffee income in the household

Another potential source of conflict is the decision on which member of the household keeps the revenue from coffee—related to the second of the four questions above used

to create the average disagreement score. The survey asked both household heads and spouses, “who usually received and kept the money from coffee sales during the previous harvest season?” This indicates whether the money is managed jointly, solely by the household head, or by the spouse, and allows a comparison between responses from the household head and spouse to check whether they share an understanding of income distribution.

Figure 15 below shows the distribution of answers given by the household heads and the spouses on the question ‘who usually received and kept money from coffee sales?’. It shows that in the majority of households, the household head is the one that receives and keeps coffee sales income: 51% of the household heads and 44% of the spouses think this is the case. Surprisingly many spouses think that they are the ones receiving and keeping all the money (28% of spouses), while far fewer household heads agree (12% of household heads). This might imply that incoming cash through coffee sales is not always shown or communicated to partners. A substantial part of the partners split the sales income after it has been received (24-32%), while very little partners maintain a method in which they pool the money and discuss how to spend it (3-5%).

Figure 15: Perceived sharing of coffee income between partners according to household heads and spouses



Note: The chart shows the percentages of answers given by the household head (left bars in red) and the spouse (right bars in green) to the question “*who usually received and kept the money from coffee sales during the previous harvest season?*”

5. Conclusions and recommendations

Characteristics and impact on research design

Across the three cohorts, we found that key demographic and agricultural characteristics were generally balanced, even though parishes were not selected randomly. Critical exemptions to this were tree-level coffee yield from the OAF Coffee Harvest Survey data – wherein Cohort 2 had statistically significantly higher tree-level coffee yields than trees in Cohort 1 and 3 – and Cohort 3 households reported higher total household revenue than the two other cohorts.

Although Cohort 2 shows higher yields among the eight randomly selected trees, this does not indicate a problem with our cohort setup. The cohorts were defined using geographic rings for logistical reasons, not by randomizing individual farmers, and all farmer-level characteristics – including demographics, farm practices, and the quantities of coffee sold – are statistically the same across cohorts. The difference in tree yields is also not explained by missing data patterns, since the number of missing trees and zero-yield trees does not differ across cohorts, and the result holds even when looking only at non-zero yields. Because the eight sampled trees represent only a small subset of each farm's trees, chance variation in which trees were selected can lead to differences between cohorts even when farmers themselves are comparable. Overall, the balance checks support that the cohorts are comparable, and the higher tree-level yields in Cohort 2 likely reflect normal variability rather than true differences in farm productivity.

The fact that differences between cohorts are not systemic is encouraging, as it strengthens our ability to detect differences between cohorts attributable to the intervention. Nevertheless, because this is not a randomized experiment, we cannot make fully causal claims.

The project's implementation design also requires careful consideration in the analysis stage. As outlined in Section 3.1, Cohorts 1, 2, and 3 receive a mix of interventions at different points in time. At midline, Cohort 1 will have received one year of intervention, while Cohorts 2 and 3 will not yet have been exposed. By endline, however, Cohort 1 will have received three years of intervention, Cohort 2 two years, and Cohort 3 one year. Importantly, Cohort 2 and Cohort 3's exposure to the Market Access Program is likely broader than Cohort 1's in their first year, as the Ibero-pilot only covered one parish in Cohort 1 in the first year.

Recommendation: Proceed with the current research design, but interpret comparisons across cohorts with caution, especially at midline and endline. Pay close attention to the timing and content of interventions for each cohort, and apply regression analysis to identify key causal pathways and drivers of impact.

Coffee farm characteristics

Baseline data also highlighted several risks related to negative practices with potential environmental and social harm. A small but notable proportion of farms exhibited practices linked to environmental degradation and child labour. These issues should be explicitly addressed in OAF's training programs. The use of personal protective equipment (PPE) was also very limited. Besides wearing boots, forms of PPE were rarely used when applying chemical inputs. The presence of pests and diseases was statistically significantly associated with decreased yields, meaning that effective IPDM is likely to increase yields. However, greater emphasis on IPDM should be accompanied by clear and comprehensive communication to farmers about the risks associated with pesticide and fungicide use. We believe OAF has a responsibility not only to ensure that farmers are well-informed, but also to promote and reinforce the responsible use of these products, including the consistent use of appropriate PPE.

Yield – OAF data and GAPs

Exploratory analysis of OAF's yield data revealed associations between adoption of some GAPs and tree-level yields. In particular, the use of inorganic fertilizer was strongly positively associated with yield, while correct weeding showed a weaker but still positive association. Simultaneously, baseline data show very low adoption of inorganic fertilizer and very high levels of pest and disease incidence. This suggests considerable scope for improvement, particularly in promoting correct application of inorganic fertilizer and effective IPDM.

At the same time, the majority of farmers reported that inorganic fertilizer is too expensive, which indicates that the main barrier to fertilizer access is financial. The inclusion of interventions such as the Ibero pilot, alongside OAF's own strategies for improving input and credit access, will be critical for supporting farmers.

Recommendation: OAF should place emphasis on improving adoption of inorganic fertilizer, building on existing training materials while ensuring close follow-up and targeted support. However, the strong association between inorganic fertilizer application and yield should not be taken as an argument to focus solely on this GAP. The benefits of inorganic fertilizers are maximized only when they are combined with long-term soil fertility practices, such as using organic fertilizers, intercropping, and following proper basic agronomic routines. Moreover, excessive use of inorganic fertilizers can degrade soil health over time and is financially unsustainable for most farmers.

Income and revenue

Our analysis suggests that OAF should further investigate the economic mechanisms of coffee processing steps such as drying and hulling. When adjusted for weight loss, farmers appeared to receive similar prices per kilogram for fresh and dried coffee. At the same time, 90% of farmers sold to middlemen and 96% of farmers did not bulk with other farmers, suggesting that farmers who sold dried coffee generally did not enjoy higher sales prices selling jointly. The reasons behind similar prices for fresh and dried coffee will be further investigated in future analyses. If these findings appear to be robust across current years of high coffee prices, this raises questions about whether placing heavy emphasis on drying is the most effective use of farmer effort, particularly when its financial benefits remain uncertain.

Also, our analysis found an average coffee income of 2,834 USD 2017 PPP. It showed that the farmers in the sample earn relatively little compared to the average Ugandan Robusta growers according to data used for benchmarking. If OAF based its objectives on the current income and yield of the average Ugandan Robusta growers, then achieving those objectives with relatively less productive farmers at baseline could be challenging.

Recommendation: Prioritize further analysis of processing practices to establish value to farmers to estimate how farmers could benefit most from additional processing steps.

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ANNEXES

Annex 1: Coffee tree count

A1.1 Rationale for tree counting exercise

As discussed in Section 3.4, Laterite conducted a tree-counting exercise to investigate whether farmers have a systematic bias when estimating the number of coffee trees they manage, and what factors might influence such biases. The results of this exercise were initially intended to inform the extrapolation of tree-level yields to farm-level yields, by correcting the calculation that multiplies the 8-tree yield average by the estimated number of trees. If no systematic biases were found – consistent across different farmer types – no correction would be required, as estimation errors could be expected to cancel out in a larger farmer sample. However, as explained in section 3.3, the results of the tree-counting exercise are not used in this Baseline Report, because the extrapolation from tree-level to farm-level yields was dropped due to the limited number of farmers with yield data for all eight trees. However, if the extrapolation had proceeded, we determined that we would have maintained the farmers' self-reported tree counts, because we found no systematic bias in estimates that could have resulted in a model to improve accuracy.

48 farmers were selected from the main sample for a tree-count verification. At these farms, Laterite enumerators counted the number of productive coffee trees, clean-stumped coffee trees (trees of which all stems were cut off), and unproductive (young, old, or sick) coffee trees. The recorded numbers were compared with the farmers' estimates from the main data collection one week prior to the tree-counting exercise.

This tree-counting exercise was exploratory. While the findings may inform future studies that rely on self-reported tree-count estimates, they cannot provide firm conclusions or strategic implications. The sample size of 48, with limited variation across certain demographic variables, is too small to allow more than indicative insights.

A1.2 Sample selection

For logistical reasons, 12 parishes (six in Kassanda and six in Mubende) were randomly selected, with four farmers chosen from each parish. Farmer selection was random, using stratification into five farm-size categories based on farmers' tree-count estimates from the main data collection. Because the design required exactly four farmers per parish, the stratification needed to remain flexible. The stratified randomization in Stata resulted in the following distribution of estimated farm sizes:

Farm size bin (estimated number of coffee trees)	Kassanda farmers	Mubende farmers
<300	2	1
300 – 500	6	3
500 – 800	5	11
800 – 1,200	5	6
>1,200	6	3
Total	24	24

A1.3 Counting protocol

Trees were counted using coloured ribbons tied to their branches. Three ribbon colours were used to classify trees as productive, clean-stumped, or unproductive. Each farm visit consisted of two rounds: a tying round and a verification round. Before the tying round, enumerators recorded the number of ribbons taken to the farm. They then tied ribbons according to the tree classification and counted the remaining ribbons after all trees had been marked. During the verification round, a second team of enumerators removed all ribbons from the trees and counted them once no ribbons remained on the trees. This second count also captured any trees missed during the tying round. We found that in some cases, there were large discrepancies between the first and second round, although differences reduced as the field team continued with the exercise, likely due to improved comprehension and accuracy. Both the initial and verification counts were entered into the SurveyCTO form. For analysis, we used the verification-round counts as the primary measure, as they were cross-checked and less prone to error by design.

A1.4 Results

The analysis of the tree counts involves three variables of interest:

- A dummy variable indicates whether the farmer under- or overestimated the number of trees managed.
- Percentage Bias measures the difference between the counted and estimated number of trees and can be interpreted as the magnitude of the bias.
- Percentage Error is a non-negative measure of the absolute difference between the counted and estimated number of trees and can be interpreted as the magnitude of the error irrespective of the direction of the bias.

The percentage variables are symmetric, which means that the magnitude of the bias in case of overestimation is the same as the magnitude of the bias in case of underestimation. These variables are calculated as follows:

$$\text{Percentage Bias} = \begin{cases} \dfrac{\text{Estimation} - \text{Counted}}{\text{Counted}} * 100\%, \text{if Estimation} > \text{Counted (overestimation)} \\ \dfrac{\text{Estimation} - \text{Counted}}{\text{Estimation}} * 100\%, \text{if Estimation} < \text{Counted (underestimation)} \end{cases}$$

$$\text{Percentage Error} = |\ \text{Percentage Bias}\ |$$

By applying distinct formulas for cases of overestimation and underestimation, we ensure that a misestimation of X trees corresponds to the same percentage bias of Y%, regardless of the direction of the error. This approach eliminates asymmetry in measurement and prevents disproportionately larger bias values for overestimation compared to underestimation. As a result, the bias metric provides a balanced and comparable measure of estimation accuracy for both types of errors.

A1.4.1 Overestimation versus underestimation

Of the 48 farmers in the sample, 26 overestimated the number of trees they manage (54%). A simple Z-test that determines whether the Overestimation binary variable has an average significantly different from 0.5, resulted in a Z-statistic of 0.554 and a corresponding two-sided p-value of 0.58. This implies that there is no evidence for systematic over- or underestimation at a 5% significance level.

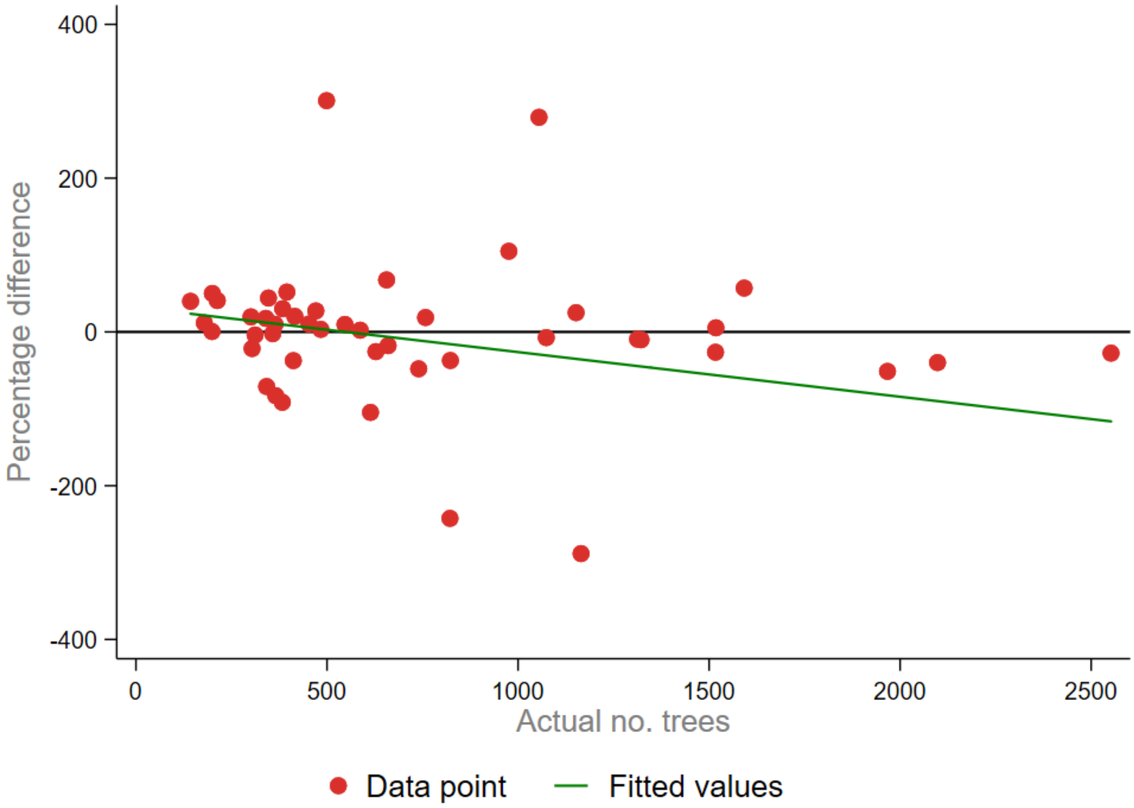
Overestimation occurred among 6 out of 16 farmers in both the ‘Big’ and ‘Medium’ farm size quantiles (with counted trees ranging from 823–2,608 and 395–822, respectively), while 10 out of 16 farmers in the ‘Small’ quantile (fewer than 384 trees) overestimated their tree counts. Gender differences were minimal, with 56% of female respondents and 53% of male respondents overestimating. Education showed a slight pattern: 47% of farmers with at least primary education overestimated, compared to 57% among those without formal education. A logit regression indicated that only the number of counted trees significantly predicts overestimation ($p = 0.028$), meaning that farmers with a lower number of trees overall were more likely to **overestimate** their total tree count.

A1.4.2 Percentage Bias

The average Percentage Bias in the sample is -6.1% and the median is +2.7%. Given the standard deviation of 130 percentage points, these numbers are very close to zero. A z-test yields a two-sided p-value of 0.74 ($z = -0.33$), meaning that the Percentage Bias is not statistically significantly different from zero. This implies that there is no evidence for a systematic bias, although this conclusion is based on a z-test with a very small sample size and relatively large variation. We sampled only 48 farms due to budgetary and logistical constraints, but in a larger sample it may be possible to observe a more systematic bias in either direction, as well as differences across socioeconomic characteristics.

The higher tendency of smaller farmers to overestimate is also illustrated in Annex Figure 1. This chart plots the percentage differences between estimated and counted coffee trees (as defined by the Percentage Bias formula above) against the actual number of trees. The fitted values line slopes downward and drops below zero, indicating that larger farmers are not only more likely to underestimate as shown above, but also that their average bias is lower. However, a multiple regression of the Percentage Bias on the counted trees, gender, years of farming experience and education level showed no statistically significant associations, meaning that while larger farmers are more likely to underestimate, their bias is not significantly different from the more positive bias of smaller farmers.

Annex Figure 1: Estimation error percentages versus the actual (counted) number of trees



A1.4.3 Percentage Error

As mentioned, the Percentage Error is the absolute value of the Percentage Bias, which allows us to investigate which factors influence the size of the errors that farmers make when estimating their trees irrespective of directional biases. The plotted values in Annex Figure 1 seem to remain around the 0% axis as farms become bigger – apart from a few outliers that incorrectly estimated their trees with extreme errors, with biases of over 200% – suggesting that the error remains somewhat constant when farm sizes increase.

Nevertheless, results from multiple regressions of Percentage Error on gender, years of farming experience, household head status, the counted number of coffee trees, and education suggest that non-household heads have significantly larger estimation errors than household heads. However, only three non-household heads were included in the sample of 48 farmers, which is too few to support meaningful conclusions. Therefore, we excluded non-household heads from the analysis. After this adjustment, the regressions revealed no statistically significant associations between the remaining variables and Percentage Error. This implies that higher Percentage Errors among larger farmers were mainly driven by estimates from non-household heads at two large farms.

A1.5 Conclusion

The exploratory tree-counting exercise conducted with 48 farmers suggests that, on average, farmers do not exhibit a systematic bias in estimating the number of coffee trees they manage. While 54% of farmers overestimated their tree counts, a z-test indicates that this proportion is not statistically significantly different from 50% ($z = 0.554$, $p = 0.58$). Similarly, the average Percentage Bias across the sample was -6.1%, with a large standard deviation of 130 percentage points, and a z-test confirms that this is not significantly different from zero ($z = -0.33$, $p = 0.74$). These results imply that there is no strong evidence of directional bias in tree-count estimates among the sampled farmers.

Given the time and budgetary considerations required for this exercise, we would need to carefully consider whether it is worth repeating with a larger sample size. We suspect that there may be some more conclusive results with a larger sample, but the exercise takes quite a lot of time. We would recommend firstly investigating whether any technological innovations could be used to count trees – such as satellite imagery, or a combination of manual enumerator testing with apps – before proceeding with another full manual count.

The analysis suggests some patterns related to farm size. Smaller farmers were slightly more likely to overestimate, while larger farmers tended to underestimate, although multiple regression analyses show that these tendencies are not statistically significant when accounting for other variables such as gender, education, and years of farming experience. Similarly, differences in Percentage Error across farmers appear minimal, with no significant predictors identified after excluding non-household heads. It may be that non-household heads—particularly on large farms—have difficulty approximating the number of coffee trees managed by the household; follow-up research is necessary, as these indications are anecdotal.

Overall, these findings indicate that estimation errors are largely random rather than systematic. However, due to the small sample size, limited variation in some demographic characteristics, and large variability in individual estimates, these results should be interpreted with caution. While they provide useful indicative insights for future studies that rely on self-reported tree counts, they do not allow for firm conclusions or strategic decisions regarding bias correction in farm-level yield extrapolations.

Annex 2: Tables and Figures

Annex 2 Table 1: Sample locations and number of households per village in listing and in sample

Village	Parish	District	Households selected	Households in listing	Assigned weight
Binikira Central	BINIKIRA	KASSANDA	18	21	0.704934537
BULEGA	KAKENZI	MUBENDE	18	24	0.876132965
BULONZI A	KASAMBYA WARD	MUBENDE	6	7	0.339879155
BUSINGYE EAST	MUGUNGULU	MUBENDE	18	21	1.022155046
Busirimu	MANYOGASEKA	KASSANDA	18	21	1.28398788
BUTAWATA WEST	KIGANDO	MUBENDE	18	21	1.384692907
Bweyongedde	BWEYONGEDDE	KASSANDA	18	21	0.730110765
KABAJOKI	MIJUNWA WARD	MUBENDE	18	21	0.876132905
Kabakonjo	MAYIRIKITI	KASSANDA	18	22	1.339375615
Kabuga	KYABALANZI	KASSANDA	18	21	0.684793532
KABULAMULIRO	KABULAMULIRO	MUBENDE	18	22	1.127895355
KABWEYAKIZA	KANSAMBYA	MUBENDE	18	21	1.661631346
KALINGO	KIJJOJOLO	MUBENDE	18	21	1.022155046
KANOGA	KABALUNGI	MUBENDE	18	21	0.861027181
KANYOGOGA	KANYOGOGA	MUBENDE	18	21	0.881168127
Kasaazi 'B'	KASSAAZI	KASSANDA	18	21	1.039778471
KASAMBYA A	KASAMBYA WARD	MUBENDE	9	10	0.241691858
KASOLO	LUSIBA	MUBENDE	18	21	2.258307934
KATONGOLE	KIYONGA	MUBENDE	18	21	1.53575027
KIBALAGAZI	KITUULE	MUBENDE	18	21	0.604229629
Kibanyi	NALUTUNTU	KASSANDA	18	21	1.384692907
Kibasi	DDALAMBA	KASSANDA	18	21	1.329305053
KIFUMAMBOGO	KYEZA	MUBENDE	18	21	0.755287051
KIMWANYI A	KASAMBYA WARD	MUBENDE	3	6	0.453172207
Kiryajjobyo A	KIRYAJJOBYO	KASSANDA	18	21	0.742698908
KISIITA B	MUGOLODDE	MUBENDE	18	23	0.996978879
KISIZIRE A	KISIZIRE WARD	MUBENDE	18	21	0.302114815
KISOJO	KISAGAZI	MUBENDE	18	21	0.584088624
KISOMBWA	KISOMBWA	MUBENDE	18	21	0.674723029
Kisweera	MYANZI	KASSANDA	18	21	1.384692907
Kitamirwa	NAKIDUDUMA	KASSANDA	18	21	0.730110765
KITAYIZA B	KAMUSENENE	KASSANDA	18	21	0.604229629
KIYINJA	KASOLOKAMPONYE	MUBENDE	18	21	0.805639505
Kizibaawo	KIZIBAWO	KASSANDA	18	21	2.265861273
KWEZIKUMWE	KACWAMANGO	MUBENDE	18	23	1.53323245
Kyakitanga A	MYALIRO	KASSANDA	5	6	0.657099664
KYENTULEGE	KASASA	MUBENDE	18	21	1.022155046
Lubanyi C	BUCOOCO	KASSANDA	18	21	0.969284952
LUGAZI A	NDYANGOMA	MUBENDE	18	21	0.553877175

Lwabazza	LWABAZZA	KASSANDA	18	21	1.228600144
Lwangiri B	NAKATEETE	KASSANDA	18	21	1.852970839
Lwemitongole	KAWAAWA	KASSANDA	8	9	0.328549862
LWEMIYAGA	KIBALINGA B	MUBENDE	18	21	1.193353415
Lwenkalabo	KAWAAWA	KASSANDA	10	12	0.271903336
MABAALE	KIJJOMANYI	KASSANDA	18	21	0.85599196
Myaliro B	MYALIRO	KASSANDA	13	15	0.18301186
Nabutiti	KABOSI	KASSANDA	18	21	0.830815732
NALUKOKO A	NKINGA	MUBENDE	18	21	1.168177247
NALUSOMBA	BUTUUTI	MUBENDE	18	21	0.415407866

Annex 2 Table 2: Asset ownership indices and number of assets owned by households across cohorts and districts

	Cohort			*p-value*	District		*p-value*
	1	2	3		Kassanda	Mubende	
	N=270	N=270	N=270	.	N=360	N=450	.
Number of agricultural assets out of 10	4.7 (4.3, 5.0)	4.5 (4.3, 4.7)	4.4 (4.0, 4.8)	*0.510*	4.5 (4.3, 4.7)	4.6 (4.2, 4.9)	*0.668*
Number of household assets out of 14	6.3 (5.9, 6.8)	6.1 (5.8, 6.5)	6.0 (5.5, 6.5)	*0.695*	5.9 (5.5, 6.3)	6.3 (6.0, 6.7)	*0.154*
Number of total assets owned out of 24	11.0 (10.3, 11.7)	10.6 (10.1, 11.1)	10.4 (9.6, 11.2)	*0.564*	10.4 (9.9, 10.9)	10.9 (10.2, 11.5)	*0.267*
PCA asset ownership index	0.44 (0.40, 0.47)	0.42 (0.40, 0.44)	0.41 (0.37, 0.45)	*0.536*	0.41 (0.38, 0.44)	0.43 (0.40, 0.46)	*0.295*

Annex 2 Table 3: Number of coffee trees in total and by species, compared across cohorts

	Cohort			*p-value*
	1	2	3	
All species				
Total (n=808)	1142 (956, 1327)	941 (732, 1150)	985 (724, 1246)	*0.334*
Productive (n=804)	795 (659, 931)	643 (516, 769)	760 (529, 992)	*0.254*
Unproductive (n=804)	346 (258, 435)	355 (135, 576)	236 (184, 288)	*0.069*
Robusta				
Total (n=808)	1129 (942, 1316)	938 (730, 1145)	976 (712, 1240)	*0.367*
Productive (n=803)	786 (649, 923)	649 (518, 780)	753 (522, 985)	*0.346*
Unproductive (n=804)	343 (255, 432)	355 (135, 575)	233 (179, 286)	*0.069*
Too young	308 (222, 394)	315 (102, 528)	196 (149, 242)	*0.050*
Clean stumped	20 (12, 28)	14 (7, 20)	15 (8, 22)	*0.504*
Arabica				
Total (n=47)	165 (-3, 333)	75 (9, 140)	96 (20, 172)	*0.603*
Productive (n=47)	125 (-32, 283)	59 (-8, 127)	78 (5, 151)	*0.741*
Unproductive (n=47)	40 (-6, 86)	23 (-27, 73)	21 (-4, 47)	*0.778*

Annex 2 Table 4: Number of total and productive trees across treatment cohorts and districts

	Cohort			p-value	Districts		p-value
	1	2	3		Kassanda	Mubende	
Coffee-planted area[1]							
Total trees per acre	473 (435, 512)	466 (429, 503)	495 (432, 557)	*0.740*	508 (469, 546)	456 (417, 495)	*0.062*
Productive trees per acre	335 (295, 375)	320 (284, 357)	364 (300, 428)	*0.513*	380 (336, 423)	311 (275, 346)	*0.017*
Coffee-holding plots[2]							
Total trees per acre	273 (240, 307)	282 (252, 312)	284 (242, 326)	*0.915*	319 (298, 341)	246 (219, 274)	*<0.001*
Productive trees per acre	195 (161, 229)	193 (166, 220)	212 (175, 248)	*0.719*	238 (217, 260)	170 (145, 194)	*<0.001*

Note: The table shows the average number of total and productive coffee trees per acre of coffee plantation. 95% confidence intervals are given in brackets. Trees per acre are compared across cohorts and districts using an Adjusted Wald test, and asterisks indicate significance levels (p<0.1, p<0.05, p<0.01).
1: *Coffee-planted area* refers to the portion of a farmer's land specifically planted with coffee trees. If a farmer reported that a certain percentage of a plot is under coffee, this percentage was applied to the plot size to estimate the coffee-planted area.
2: *Coffee-holding plots* include all plots that contain any coffee trees, regardless of whether the entire plot is planted with coffee. These plots may also contain intercrops or other crops. The total area of coffee-holding plots is the sum of the sizes of all such plots managed by the farmer.

Annex 2 Table 5: Percentage of productive farmland allocated to agricultural activity and Productivity Diversity Index by cohort

	Total	Cohort			p-value
		1	2	3	
Robusta (n=807)	48.3%	46.9%	47.4%	50.2	*0.710*
Arabica (n=39)	12.0%	9.4%	24.0%	11.3%	*0.501*
Bananas (n=641)	17.4%	16.3%	16.4%	19.0%	*0.118*
Beans (n=540)	17.4%	17.9%	17.8%	16.8%	*0.837*
Other tree crops (n=147)	8.4%	8.7%	7.6%	8.5%	*0.450*
Vegetables (n=19)	10.7%	9.7%	13.2%	9.7%	*0.557*
Annual crops (n=610)	25.6%	27.0%	27.2%	22.9%	*0.173*
Livestock (n=145)	21.3%	22.8%	17.3%	23.9%	*0.480*
Wood/timber (n=41)	13.4%	19.5%	10.3%	7.8%	*0.158*
Forage (n=2)	10.2%	2.0%	20.0%	-	-
Productivity Diversity Index	57.3	57.9	57.1	56.9	*0.926*
Number of productive land use activities	3.7	3.8	3.7	3.7	*0.838*

Annex 2 Table 6: Percentages of land allocated to land use activity by farm size

	Total	Farm size category				*p-value*
		<2.5 acres	2.5-5 acres	5-10 acres	>10 acres	
	N=808	*N=218*	*N=267*	*N=203*	*N=120*	
Robusta (n=807)	48.3%	58.9%	47.9%	42.4%	39.3%	*<0.001*
Arabica (n=39)	12.0%	8.3%	12.7%	19.2%	9.9%	*0.133*
Bananas (n=641)	17.4%	21.5%	17.4%	15.0%	14.0%	*<0.001*
Beans (n=540)	17.4%	17.1%	18.8%	17.8%	13.6%	*<0.001*
Other tree crops (n=147)	8.4%	9.4%	8.5%	7.8%	7.2%	*0.215*
Vegetables (n=19)	10.7%	11.7%	13.4%	9.7%	8.1%	*0.770*
Annual crops (n=610)	25.6%	22.0%	25.7%	29.7%	22.6%	*<0.001*
Livestock (n=145)	21.3%	11.1%	12.2%	17.6%	34.2%	*0.003*
Wood/timber (n=41)	13.4%	9.7%	19.9%	12.4%	11.7%	*0.734*
Forage (n=2)	10.2%	20.0%	2.0%	-	-	-
Productivity Diversity Index	*57.3*	*50.7*	*58.1*	*60.9*	*61.6*	*<0.001*
Number of land use activities	*3.7*	*3.2*	*3.7*	*3.9*	*4.3*	*<0.001*

Note: The table presents the percentages of productive farmland (defined as owned land on which agricultural and forestry production takes place) allocated to each activity. The PDI in the bottom row indicates the extent to which productive farmland has diversified agricultural use. A PDI of 0 means no diversification (farmland is used for one activity only) and a PDI of 100 means total diversification. Percentages, the PDI, and the number of land use activities are compared across farm size categories using an Adjusted Wald test, which allows for the survey design.

Annex 2 Table 7: Outcomes of linear regressions of ln(yield) on tree-level covariates and tree- and farmer-level covariates using mixed effects modelling

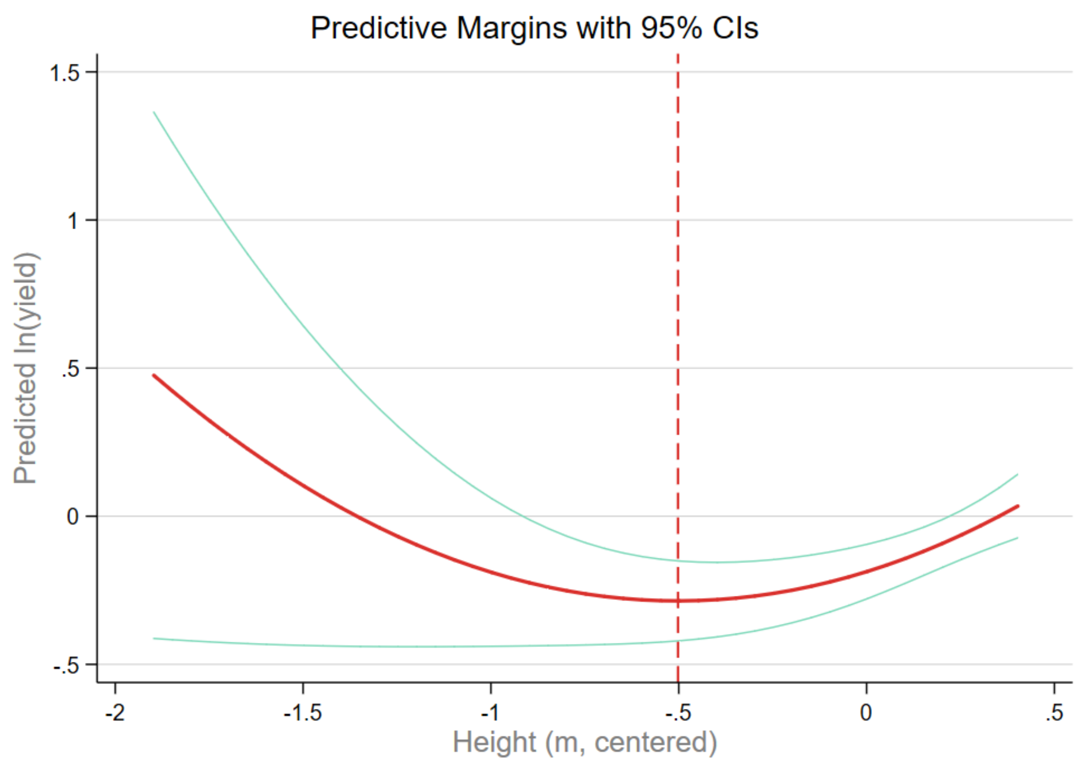
	(1) ln(yield) + tree	(2) ln(yield) + tree + farmer
ln(yield)		
Number of stems	0.05***	0.05***
	(0.00)	(0.00)
Number of stems squared	0.00	0.00
	0.01	0.01
Height in m	0.37***	0.37***
	(0.00)	(0.00)
Height in m squared	0.39**	0.44***
	(0.01)	(0.01)
Leaf colour		
All green (ref.)	0.00	0.00
	(.)	(.)
Mostly green	0.11	0.10
	(0.12)	(0.20)
Mostly yellow	0.01	-0.09
	(0.97)	(0.56)
All yellow	-0.42	-0.45
	(0.26)	(0.22)
Not stumped (ref.)	0.00	0.00
	(.)	(.)

Stumped in 2025	-0.48* (0.06)	-0.51* (0.07)
Stumped in 2024	0.08 (0.58)	0.01 (0.94)
Stumped in 2023	0.09 (0.46)	0.04 (0.74)
Stumped before 2023	0.04 (0.67)	0.02 (0.82)
Currently mulched	-0.04 (0.66)	-0.05 (0.57)
Currently has suckers	-0.05 (0.42)	-0.08 (0.16)
Currently properly weeded	0.16** (0.04)	0.14** (0.07)
Affected by pests and diseases	-0.03 (0.77)	-0.05 (0.54)
Black Cof. Twig Borer	-0.04 (0.61)	-0.04 (0.64)
Cof. Berry Borer	0.02 (0.84)	-0.00 (0.99)
Cof. Berry Disease	0.31*** (0.01)	0.38*** (0.00)
Cof. Leaf Rust	0.03 (0.71)	0.00 (0.97)
Red Blister Disease	-0.05 (0.62)	-0.06 (0.58)
Cof. Mealybugs	-0.15 (0.18)	-0.18 (0.10)
Cof. Wilt Disease	-0.09 (0.47)	-0.07 (0.61)
HH head age		0.00 (0.73)
HH size (def.-adj)		0.01 (0.49)
Asset ownership quartiles		
Q2 (ref. = Q1 (poorest))		0.17 (0.15)
Q3 (ref. = Q1 (poorest))		0.12 (0.32)
Q4 (richest) (ref. = Q1 (poorest))		0.30** (0.02)
Treatment cohort		
Cohort 2 (ref. = Cohort 1)		0.38*** (0.00)
Cohort 3 (ref. = Cohort 1)		0.10 (0.37)
Mubende (ref. = Kassanda)		0.15

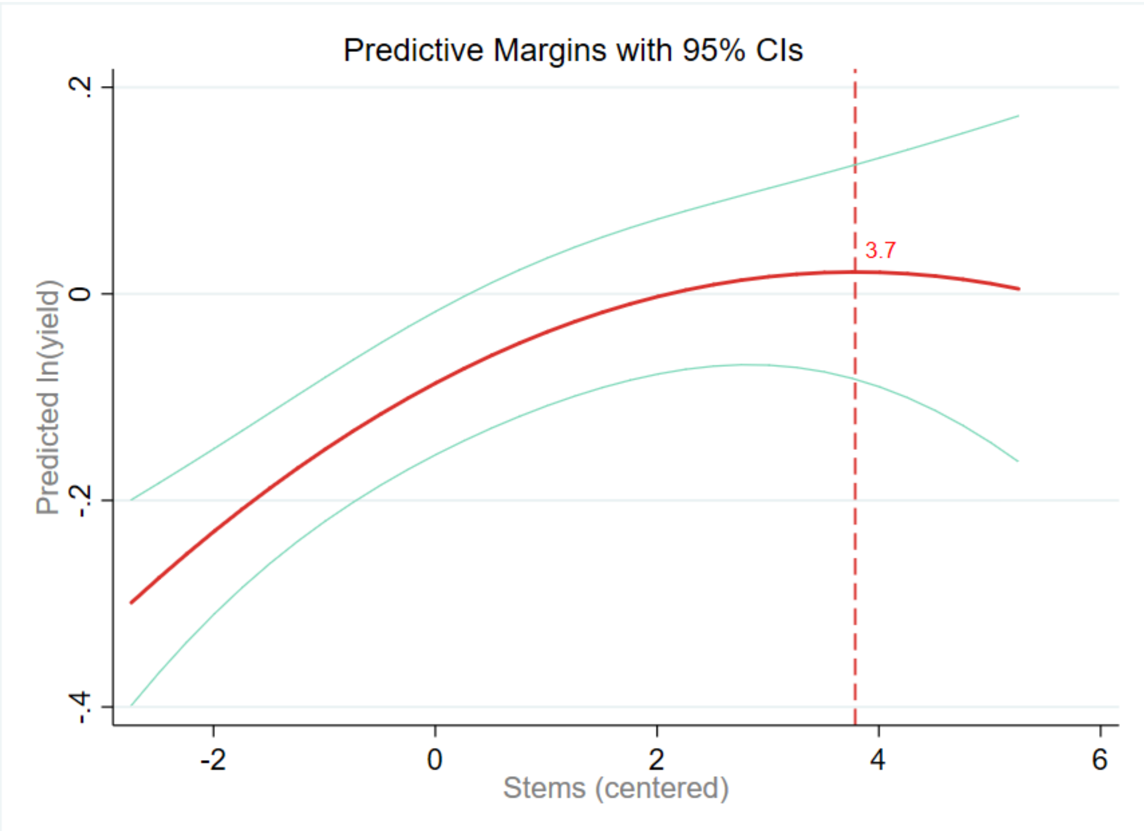
		(0.13)
Years of coffee farming experience		0.00
		(0.87)
Farm-level GAP-indicator		
Weeding		0.06
		(0.55)
Desuckering		0.50***
		(0.00)
Mulching		0.05
		(0.56)
IPDM		0.03
		(0.77)
Pruning		0.22
		(0.28)
Composting		-0.24
		(0.25)
Manure		0.04
		(0.73)
Inorganic fertilizer use		0.47***
		(0.00)
Intercropping		-0.06
		(0.46)
Coffee training		0.12
		(0.20)
Cooperative member		-0.18
		(0.14)
Coffee trees (total)		-0.00
		(0.44)
Productivity Diversity Index		0.00
		(0.45)
Farm size		-0.01
		(0.81)
Constant	-0.76***	-0.91***
	(0.00)	(0.00)
Observations	2045	2033

Note: The table presents results from mixed-effects linear regressions of the logarithm of tree-level yield on tree-level covariates in column 1 and on tree- and farmer-level covariates in column 2. The rows include coefficients, with standard deviations in brackets. Asterisks indicate significance levels (p<0.1, p<0.05, p<0.01). The tree-level variables are obtained from the OAF Coffee Harvest Survey, and the farmer-level variables come from Laterite's main baseline data collection.

Annex 2 Figure 1: Predicted logarithm of yield over height (centred at the mean) and the 95% CI



Annex 2 Figure 2: Predicted logarithm of yield over number of stems (centred at the mean) and the 95% CI



Annex 2 Table 8: Reasons for not implementing GAPs

	Weeding	De-suckering	Mulching	Pruning	Stumping	Compost	Manure	NPK fertilizer
	n=6	*n=11*	*n=516*	*n=102*	*n=257*	*n=648*	*n=498*	*n=689*
I did not have time	50.0%	36.6%	-	17.7%	8.4%	-	-	-
I don't see the benefits	26.0%	23.1%	4.4%	9.4%	8.9%	1.7%	2.1%	6.3%
I did not have the required tools	0%	9.3%	-	1.0%	4.7%	-	-	-
I did not have enough labourers	0%	8.1%	-	3.0%	2.0%	-	-	-
Too expensive	24.0%	0%	-	1.9%		26.8%	71.0%	83.3%
My trees did not require	0%	20.0%	-	67.7%	72.0%	-	-	-
I did not have time to apply	-	-	12.3%	-	-	-	-	-
I did not have time to collect materials	-	-	16.2%	-	-	-	-	-
I prefer other practices	-	-	2.2%	-	-	-	-	-
I don't have sufficient materials	-	-	70.4%	-	-	-	-	-
I don't know how to obtain	-	-	-	-	-	42.3%	8.1%	5.0%
I don't know how to apply	-	-	-	-	-	19.8%	2.8%	6.0%
I can't access/not available	-	-	-	-	-	30.2%	25.7%	6.0%
Available product has too poor quality	-	-	-	-	-	0.4%	0%	4.8%

Note: The table shows the frequency of reasons given to the question *"Why did you not apply [GAP]?"* among the farmers who indicated to not have applied the GAP. The total numbers of farmers who did not implement each GAP are given in the second row indicated by "n". Cells remain empty if the reason was not one of the answer options to the question.

Annex 2 Table 9: GAP adoption indicator for Basic Routine Management practices across cohorts

	Total	Cohort		
		1	2	3
Weeding				
Farmer weeded in past 12 months	99.3%	99.5%	99.5%	98.9%
Farmer weeded by hand under canopy (n=804)	15.2%	15.5%	12.7%	16.7%
No or few weeds under the canopy (n=513)	93.7%	93.3%	93.7%	94.1%
Weeds are not present or smaller than 30cm (n=513)	90.9%	89.5%	92.6%	91.0%
Weeding GAP-indicator	14.3%	14.7%	11.7%	15.9%
Desuckering				
Farmer desuckered in past 12 months*	98.4%	99.6%	96.8%	98.5%
Mulching				
Farmer applied mulch in past 12 months	38.3%	42.7%	32.4%	38.3%

Note: The table represents the percentage of farmers that adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated differently with the sample size in brackets next to the condition. Comparisons across cohorts are done with a Rao-Scott Chi-squared test which allows for a survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

Annex 2 Table 10: Proportions of coffee plantations on which the GAP was practiced by cohort

	Total	Cohort		
		1	2	3
Weeding				
Percentage of coffee plantation weeded in past 12 months (n=803)	84.1%	83.4%	84.2%	84.7%
Desuckering				
Percentage of coffee trees desuckered in past 12 months (n=799)*	73.5%	70.7%	76.9%	73.7%
Mulching				
Percentage of coffee plantation mulched (n=294)	42.8%	41.0%	42.7%	44.7%

Note: The table represents the intensity rates of the GAP application across the total sample and by cohort, among the number of farmers who mentioned to have adopted the GAP. Comparisons across cohorts are done with a Rao-Scott Chi-squared test which allows for a survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

Annex 2 Table 11: Herbicide use and reasons for using herbicides, by district

	Total	Kassanda	Mubende	P-value
Used herbicides (n=804)	44.0%	52.9%	36.4%	0.005
Reason for using herbicides (n=352)				
Weeds are too persistent	18.6%	22.4%	13.9%	0.094
Cheaper than manual weeding	29.7%	36.4%	21.6%	0.015
Other methods are too time consuming	74.5%	73.2%	76.1%	0.725
Other reason	4.0%	1.8%	6.7%	0.024

Annex 2 Table 12: GAP adoption indicators for Pruning and Stumping across cohorts

	Total	Cohort		
		1	2	3
Pruning				
Farmer pruned in past 12 months	87.7%	84.4%	87.1%	91.2%
Farmer disinfected pruning tools before pruning (n=707)	2.7%	2.2%	4.0%	2.2%
Pruning GAP-indicator	2.3%	1.8%	3.5%	2.0%
Stumping				
Farmer has trees that are eight years or older (n=810)	83.9%	81.0%	81.5%	88. 3%
Farmer has stumped (among farmers who have trees older than eight years) (n=680)	72.2%	69.5%	71.5%	75.0%
Farmer usually leaves one breather after stumping (n=498) *	11.6%	16.8%	6.5%	10.8%
Stumping GAP-indicator	8.4%	11.7%	4.6%	8.1%

Note: The table represents the percentage of farmers who adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated otherwise with the sample size in brackets next to the condition. Comparisons across cohorts use a Rao-Scott Chi-squared test that accounts for the survey design. Asterisks indicate significance levels (p<0.1, p<0.05, p<0.01).

Annex 2 Table 13: Proportions of coffee plantations on which Rejuvenation GAPs were applied

	Total	Cohort		
		1	2	3
Pruning				
Percentage of coffee trees pruned (n= 705)	55.5%	51.1%	54.6%	59.8%
Stumping				
Percentage of coffee trees stumped among farmers with trees older than eight years (n= 497)*	13.5 %	12.1%	14.9%	13.8%

Note: Comparisons across cohorts use a Rao-Scott Chi-squared test that accounts for the survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, **p<0.01).

Annex 2 Table 14: GAP adoption indicators for Soil fertility across cohorts

	Total	Cohort		
		1	2	3
Compost				
Farmer applied compost in past 12 months	20.8%	21.2%	16.1%	23.7%
Farmer has compost station (n=162)	67.0%	66.9%	55.8%	72.5%
Compost station is observed by enumerator (n=97)	60.6%	53.4%	52.3%	70.7%
Farmer has covered all the compost after applying (n=162)	26.3%	22.8%	23.4%	30.6%
Compost GAP-indicator	4.7%	4.8%	1.8%	6.6%
Manure				
Farmer applied manure in the past 12 months***	39.4%	36.7%	38.0%	42.8%
Farmer let manure decompose for at least six weeks (n=312)	44.5%	45.0%	53.8%	38.3%
Manure GAP-indicator	17.6%	16.7%	20.4%	16.4%
Inorganic fertilizer				
Farmer applied inorganic fertilizer in the past 12 months	15.5%	22.4%	9.3%	13.3%
Farmer applied fertilizer in furrow around tree (n=121)	59.4%	58.7%	48.5%	65.7%
Farmer applied fertilizer before the rain came (n=121)	57.3%	59.3%	54.5%	55.5%
Inorganic fertilizer GAP-indicator*	6.0%	9.1%	2.7%	5.4%
Intercropping				
Farmer has had cover crops in the past 12 months (n=808)	84.2%	86.0%	79.6%	85.7%
Farmer used legumes for cover/intercropping (n=678)	50.2%	50.1%	55.4%	47.0%
Intercropping GAP-indicator	42.3%	43.1%	44.1%	40.3%

Note: The table represents the percentage of farmers who adhered to each condition for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless otherwise indicated with the sample size in brackets next to the condition. Comparisons across cohorts are done with a Rao-Scott chi-squared test, which accounts for the survey design. Asterisks indicate significance levels (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

Annex 2 Table 15: Proportion of the coffee plantation on which soil fertility GAPs are applied

	Total	Cohort		
		1	2	3
Compost use Percentage of plantation on which compost is used (n=162)	33.1%	34.0%	31.7%	33.0%
Manure use Percentage of coffee plantation on which manure is applied (n=312)	32.9%	29.6%	40.5%	30.7%
Inorganic fertilizer Percentage of coffee plantation on which inorganic fertilizer is applied (n=121)	53.9%	53.7%	56.3%	53.0%
Cover cropping Percentage of coffee plantation covered with cover crops (n=676)	36.7%	33.2%	37.6%	39.4%

Note: Comparisons across cohorts use a Rao-Scott Chi-squared test that accounts for the survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, **p<0.01).

Annex 2 Table 16: Percentage of mentioned sources where farmers obtained their inorganic fertilizer

	Total	Cohort			*p-value*
Inorganic fertilizer source (n=121):		**1**	**2**	**3**	.
Agri-input dealer	78.0%	81.4%	76.8%	73.2%	*0.530*
Bought at the market	10.1%	10.3%	9.9%	9.9%	*0.998*
Received in-kind	7.5%	5.4%	11.7%	8.7%	*0.546*
Other	6.0%	3.0%	11.0%	8.2%	*0.367*

Annex 2 Table 17: Percentage of the coffee trees affected by each pest and disease by cohort

	Total	Cohort			*p-value*
Average Percentage of coffee trees affected by Pest:		1	2	3	
Black Coffee Twig Borer (n=557)	27.3%	25.8%	27.8%	28.3%	*0.688*
Coffee Berry Borer (n=179)	16.6%	15.1%	18.0%	17.4%	*0.497*
Coffee Root Mealybug (n=273)	13.7%	16.0%	12.1%	12.7%	*0.411*
Coffee Stem Borer (n=368)	18.1%	17.3%	20.4%	17.1%	*0.368*
Green Scale Insect (n=160)	13.0%	14.0%	13.6%	11.7%	*0.638*
Nematodes (n=193)**	20.1%	26.9%	11.8%	17.7%	*0.015*
Ants (n=566)	47.7%	46.8%	50.6%	46.7%	*0.535*
Average Percentage of coffee trees affected by Disease:		1	2	3	
Coffee Wilt Disease (n=537)	11.9%	12.7%	12.4%	10.9%	*0.269*
Coffee Leave Rust (n=284)	15.3%	16.3%	15.6%	14.4%	*0.771*
Red Blister Disease (n=458)	12.4%	10.8%	13.4%	13.2%	*0.175*
Coffee Berry Disease (n=588)	10.9%	10.3%	11.1%	11.2%	*0.745*
Coffee Brown Eye Spot (n=229)**	12.1%	14.1%	13.5%	9.2%	*0.047*

Note: Percentages presented show the average proportion of trees that were impacted by each pest or disease. The percentages are calculated for farmers who mentioned that their farms have been affected by the corresponding pest or disease, hence the varying sample sizes. Comparisons across cohorts are done with a Rao-Scott chi-squared test, which accounts for the survey design. Asterisks indicate significance levels ($p < 0.1$, $p < 0.05$, $p < 0.01$).

Annex 2 Table 18: Percentage of farmers that were affected by coffee tree pests, in total and by cohort

	Total (n=810)	Cohort		
In the past 12 months, the farmer has been affected by		**1**	**2**	**3**
Any coffee tree pest	98.1%	97.5%	97.8%	98.8%
Black Coffee Twig Borer	67.3%	65.8%	67.9%	68.3%
Coffee Berry Borer	21.2%	24.9%	22.4%	16.9%
Coffee Root Mealybug	33.7%	33.9%	35.3%	32.3%
White Coffee Stem Borer	44.2%	40.1%	47.2%	45.9%
Green Scale Insect	20.0%	18.5%	22.1%	19.9%
Nematodes	23.6%	27.4%	21.0%	21.9%
Ants	68.8%	69.3%	66.2%	70.0%

Note: The table presents the percentage of farms that have been affected by each coffee tree pest for the entire sample and by cohort. Comparison tests suitable for the survey design detected no statistically significant differences between cohorts for each reported pest.

Annex 2 Table 19: Percentage of farmers that were affected by coffee tree diseases, in total and by cohort

	Total (n=810)	Cohort		
In the past 12 months, the farmer has been affected by		**1**	**2**	**3**
Any coffee tree disease	95.3%	94.2%	95.8%	95.9%
Coffee Wilt Disease	72.0%	69.7%	72.3%	74.1%
Coffee Leave Rust	34.5%	33.4%	30.7%	38.1%
Red Blister Disease	56.5%	54.5%	53.8%	60.2%
Coffee Berry Disease	65.8%	64.6%	65.4%	67.1%
Coffee Brown Eye Spot	29.4%	28.0%	31.3%	29.5%

Note: The table presents the percentage of farms that have been affected by each coffee tree disease for the entire sample and by cohort. Comparison tests suitable for the survey design detected no statistically significant differences between cohorts for each reported tree disease.

Annex 2 Table 20: GAP adoption indicators for IPDM across cohorts

	Total	Cohort		
		1	**2**	**3**
IPDM				
Farmer applied at least three methods for preventing diseases	15.2%	12.9%	19.8%	14.2%
Farmer has had pest and applied at least one method to control it (n=795)	80.1%	83.1%	79.6%	77.7%
Farmer has had disease and applied at least one method to control it (n=773)	88.3%	88.5%	89.3%	87.3%
IPDM GAP-indicator	14.7%	12.3%	19.5%	13.6%

Note: The table represents the percentage of farmers that adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated differently with the sample size in brackets next to the condition. Comparisons across cohorts are done with a Rao-Scott Chi-squared test which allows for a survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

Annex 2 Table 21: GAP adoption indicators for post-harvest handling across cohorts

	Total	Cohort		
		1	2	3
Harvesting				
Farmer says to pick red cherries only (n=809)	90.8%	91.8%	91.6%	89.3%
Farmer does selective picking	92.9%	94.6%	92.9%	91.3%
Harvesting GAP-indicator	86.9%	89.2%	87.2%	84.6%
Drying				
*Farmer dried at least part of their coffee last season (n=808)**	*67.9%*	*63.8%*	*68.4%*	*71.5%*
Farmer dried all their coffee last season (n=808)	32.5%	30.4%	27.0%	38.2%
Farmer dried coffee on the correct drying surface (n=553)	97.7%	96.8%	97.0%	98.8%
Drying GAP-indicator*	32.0%	29.4%	25.7%	38.7%

Note: The table represents the percentage of farmers that adhered to each of the conditions for positive GAP adoption indicators. The figures are based on questions asked to all farmers, unless indicated differently with the sample size in brackets next to the condition. Comparisons across cohorts are done with a Rao-Scott Chi-squared test which allows for a survey design. Asterisks indicate significance levels (*p<0.1, **p<0.05, ***p<0.01).

Annex 2 Table 22: Dry weight Robusta sold in total and per acre by cohort

	Cohort 1	Cohort 2	Cohort 3	*p-value*
KG sold	823	742	935	*0.383*
KG/acre RPA	406	401	492	*0.258*
KG/acre RHP	228	241	289	*0.349*

Note: The table shows average sales quantities in the three cohorts. 'kg sold' is the total kilograms of Robusta sold; 'kg/acre RPA' is kilograms of Robusta sold per acre of Robusta-planted area; and 'kg/acre RHP' is kilograms of Robusta sold per acre of Robusta-holding plots. Cohort averages are compared using an Adjusted Wald test, which accounts for the survey design.

Annex 2 Table 23: Percentage of farmers that sold each type and species of coffee

	Total	Cohorts		
		1	2	3
State of Robusta sold (n=809)				
Fresh cherries	64.6%	68.7%	58.0%	65.5%
Fresh cherries only	31.2%	38.1%	29.1%	26.2%
Dried cherries	61.2%	58.5%	60.9%	63.8%
FAQ *	11.6%	6.3%	13.8%	15.0%
State of Arabica sold (n=43)				
Fresh cherries	54.2%	52.0%	16.7%	67.9%
Dried cherries	45.8%	48.0%	83.3%	32.1%

Note: This table shows the percentage of Robusta and Arabica growers who sold fresh, dried, and hFAQ for both species. The percentages are reported and compared across the cohorts. Rao-Scott chi-squared comparison tests, which account for the survey design, are conducted. Asterisks indicate significance levels (* $p < 0.1$,** $p < 0.05$, *** $p < 0.01$). Farmers who grow Arabica coffee did not sell more than one state of Arabica and did not sell FAQ Arabica.

Annex 2 Table 24: Coffee sales prices per kilogram in 1,000 UGX sold for different species and types across the treatment cohorts

	Total	Cohort			*p-value*
		1	2	3	
Robusta					
Green cherry	2.1 (1.8, 2.4)	2.0 (1.6, 2.4)	2.0 (1.5, 2.5)	2.2 (1.5, 2.8)	*0.933*
Red cherry	2.5 (2.4, 2.6)	2.5 (2.4, 2.6)	2.5 (2.3, 2.6)	2.5 (2.4, 2.6)	*0.897*
Dried cherry (Kiboko)	5.8 (5.7, 6.0)	5.9 (5.8, 6.1)	5.7 (5.4, 5.9)	5.9 (5.6, 6.1)	*0.228*
FAQ	11.2 (10.4, 12.1)	11.7 (10.2, 13.2)	9.8 (8.1, 11.5)	12.0 (11.0, 12.9)	*0.086*
Arabica					
Red cherry	2.0 (1.6, 2.3)	2.1 (1.2, 3.0)	2.5 (1.4, 3.6)	1.8 (1.6, 2.1)	*0.494*
Dried cherry	5.6 (5.1, 6.2)	5.4 (4.8, 5.9)	5.5 (4.6, 6.3)	6.0 (5.1, 7.0)	*0.481*

Note: Means and 95%-confidence intervals of the sales prices per kg for which the states of Robusta and Arabica coffee have been sold in the previous 12 months in 1,000 Ugandan Shillings. Averages are compared between the three cohorts and the two districts using Adjusted Wald tests which account for the survey design.

Annex 2 Table 25: Proportion of farmers using different sales channels to sell coffee by district

	Total	Districts		*p-value*
Coffee is mainly sold through		Kassanda	Mubende	
Middlemen	89.8%	87.5%	91.8%	*0.131*
Directly through processor/miller	12.6%	16.2%	9.5%	*0.041*
Agro-input dealer	3.7%	5.1%	2.6%	*0.154*
Cooperative/ association	2.4%	3.4%	1.5%	*0.285*

Note: The table reports the percentage of farmers who sold their coffee through each sales channel. It shows average percentages for the full sample and by district. Farmers could report more than one sales channel, if applicable. The by-district averages are compared using a Rao-Scott chi-squared test, which accounts for the survey design.

Annex 2 Table 26: Proportion of farmers using different sales channels to sell coffee by cohort

	Total	Cohort			*p-value*
Coffee sold mainly through		1	2	3	
Middlemen	89.8%	91.9%	91.1%	86.9%	*0.261*
Agro-input dealer	3.7%	1.3%	4.1%	5.6%	*0.128*
Cooperative/ association	2.4%	1.6%	1.7%	3.6%	*0.380*
Directly through processor/miller	12.6%	9.5%	12.8%	15.2%	*0.327*

Annex 2 Table 27: Coffee revenue, costs and income in 1,000 UGX across treatment cohorts

	Cohort			*p-value*
	1	2	3	
Coffee revenue (n=805)	4982 (3819, 6146)	4288 (3447, 5130)	5861 (4423, 7299)	*0.182*
Coffee income (n=805)	4165 (3079, 5251)	3650 (2815, 4485)	5234 (3905, 6563)	*0.157*
Land rent costs (n=13)	139 (71, 207)	166 (-68, 400)	487 (-75, 1049)	*0.445*
Tools expenditures (n=679)	146 (109, 182)	146 (121, 171)	156 (112, 201)	*0.918*
Inorganic fertilizer expenditures (n=121)	721 (437, 1005)	461 (135, 786)	604 (306, 902)	*0.467*
Labour costs (n=555)	490 (399, 581)	442 (371, 513)	444 (356, 531)	*0.682*
Other inputs (n=577)	315 (261, 370)	256 (219, 293)	231 (168, 293)	*0.104*
Total costs (n=763)	884 (711, 1056)	675 (559, 791)	703 (519, 888)	*0.138*

Note: The table represents the average revenue, income and expenditures related to coffee farming compared across the treatment cohorts. Adjusted Wald comparison tests, which account for the survey design, are conducted. Asterisks indicate significance levels (* $p < 0.1$,** $p < 0.05$, *** $p < 0.01$).

Annex 2 Table 28: Revenue, income and costs figures per acre of coffee farmland by treatment cohort

	Cohorts			*p-value*
	1	2	3	
Coffee revenue per acre (n=803)	2513 (2085, 2942)	2644 (1800, 3488)	3546 (2695, 4398)	0.113
Coffee income per acre (n=803)*	2043.5 (1576.9, 2510.1)	2173.4 (1530.9, 2815.8)	3184.4 (2377.6, 3991.2)	0.065
Land rent costs per acre (n=13)**	118 (59, 178)	60 (23, 98)	177 (102, 253)	0.038
Tools expenditures per acre (n=678)	66 (59, 72)	73 (59, 87)	78 (67, 90)	0.159
Inorganic fertilizer expenditures per acre (n=121)	329 (178, 481)	229 (52, 406)	324 (121, 527)	0.638
Labour costs per acre (n=554)	178 (159, 196)	188 (146, 231)	203 (175, 231)	0.340
Other input expenditures per acre (n=576)	128 (115, 140)	116 (101, 131)	108 (83, 134)	0.280
Total costs per acre (n=761)	324 (293, 355)	290 (229, 350)	314 (249, 378)	0.586

Note: The table represents the average revenue, income and expenditures related to coffee farming per acre of coffee planted farm area, compared across the treatment cohorts. Adjusted Wald comparison tests, which account for the survey design, are conducted. Asterisks indicate significance levels (* $p < 0.1$,** $p < 0.05$, *** $p < 0.01$).

Annex 2 Table 29: Variance in perceived percentual spending of coffee income on each category by household head and spouse

Category	Absolute difference in percentage points
Education	17.6
Essential household items	14.6
Property or land	11.8
Health expenses	10.6
Agricultural inputs	7.8
Business investments	3.1
Luxury household items	3.1
Savings	2.7
Other expenses	2.5
Livestock	2.3
Debt repayment	2.0
Non-essential household items	1.3

Note: The table presents the average absolute differences in perceived household spending on each item between household heads and spouses. For each item, the non-negative difference between the percentages given by household heads and spouses is summarized and divided by the sample size, so the variances do not have a positive or negative sign but simply highlight the average disagreement overall. Since only 201 spouses were able to answer the questions properly, this table shows the averages of 201 pairs.

Annex 2 Table 30: Agreement and disagreement over spending desires for household heads and spouses

Category	(1) Agree	(2) HH Head wants to spend, Spouse not	(3) Spouse wants to spend, HH Head not
Non-essential household items	97%	0%	2%
Debt repayment	94%	3%	3%
Savings	90%	4%	6%
Livestock	89%	2%	8%
Health expenses	89%	3%	8%
Luxury household items	83%	11%	5%
Agricultural inputs	79%	10%	9%
Business investment	79%	7%	14%
Essential household items	71%	11%	17%
Education	69%	13%	17%
Property and land	66%	19%	15%
	Both agree	HH Head agrees, Spouse does not	Spouse agrees, HH Head does not
Happy with current spending	90%	5%	4%

Note: The table indicates the percentage of partners who gave agreeing or conflicting answers to whether they want to spend a larger share of the coffee income on the mentioned items. Column 1 shows the percentage of partners who agreed (either both wanting to spend more on this item or both not wanting to spend more). Column 2 shows the percentage of partners where the household head wants to spend more on the item and the spouse does not; Column 3 shows the reverse.

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