- BASELINE REPORT-

EVALUATION OF THE JIMMA COFFEE PROJECT COHORT 2023 IN ETHIOPIA

FOR

HEREWEGROW

CENTER FOR EVALUATION AND DEVELOPMENT (C4ED)

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This report documents the baseline phase of an impact evaluation of the Jimma Coffee Project Cohort 2023 in Ethiopia. In particular, it describes the evaluation objective, the evaluation design, the selection of the study population and delves into the results from the baseline sample, focusing on differences between the Gera and Gomma Woredas.

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EXECUTIVE SUMMARY

Despite the importance of coffee to the Ethiopian economy, its productivity remains below the potential for reasons such as old coffee trees, poor grading, processing, and marketing skills, as well as poor farm management and agronomic practices. To alleviate these constraints and improve coffee productivity, TechnoServe (TNS), with financial support from HereWeGrow (HWG), launched a Coffee Farm College (CFC) program that aims to train farmers on various agricultural practices and business skills in two cohorts, namely Jimma Coffee Project (JCP) C2022 and JCP C2023.

Under the JCP C2023, incentives to encourage farmers to stump (rejuvenate) their old coffee trees will be provided. In addition to the CFC program, TNS offers incentives to motivate farmers to rejuvenate their aging coffee trees through stumping. This practice, while temporarily reducing coffee yield, is essential for long-term productivity enhancement. To support farmers during the interim period of reduced coffee output, TNS also offers knowledge on alternative income-generating activities, with a particular emphasis on apiculture. Finally, TNS also intends to extend the training to coffee washing stations (CWS) to improve their efficiency, quality, and sustainable coffee processing practices. The ultimate goal of these interventions is to elevate the production and market value of the farmers' coffee and honey, thereby increasing their income. This project is currently being implemented in the Gera and Gomma Woredas in the Jimma Zone, Ethiopia.

To understand the extent to which this project achieves its intended (or unintended) effects, HWG contracted the Center for Evaluation and Development (C4ED) to conduct an impact evaluation study. This study will employ a randomized control trial design, assigning farmers by Kebeles to either the treatment group (beneficiaries) or the control group (non-beneficiaries), to rigorously determine the project's effects. Additionally, a qualitative analysis will be integrated to deepen the understanding of both the intended and unintended consequences. In preparation for this assessment, C4ED has conducted a baseline survey in February and March of 2023, involving 2,160 households selected through random sampling. The purpose of this survey is to collect baseline data, enabling a characterization of the study regions. This information will facilitate a comparison of the treatment and control areas before the project's implementation.

This report presents the baseline findings from the JCP C2023, offering a comparative analysis of socio-economic indicators between households in Gera and Gomma Woredas. The analysis includes coffee plot attributes, adoption rates of agricultural best practices (BPs), and principal intended outcomes such as coffee production and consumption patterns, coffee-related income, beekeeping experiences, and the status of farm and household assets. Furthermore, the report highlights several significant disparities between the two project Woredas.

Figure 0.3.1.1 summarizes the average income households earn from various sources in the two Woredas. In both Gera and Gomma, coffee generates more income than any of the other activities, and beekeeping (Gomma) or income from other crops (Gera) generates the least.[1] In terms of

[1] Total income here is defined as gross income of the households stemming from coffee, beekeeping, crops (besides coffee) and non-farm income activities of the household. Gross income is basically money earned from the sales of

other sources of income, Gera outperforms Gomma in crop revenue. In the case of off-farm activities (enterprise and wage labor), however, Gomma has a slight edge over Gera. Although only relevant for extended questionnaire (asked only from 18% of the sample) - and not represented in this graph, livestock ownership and sales of livestock and by-products are higher in Gera than Gomma.

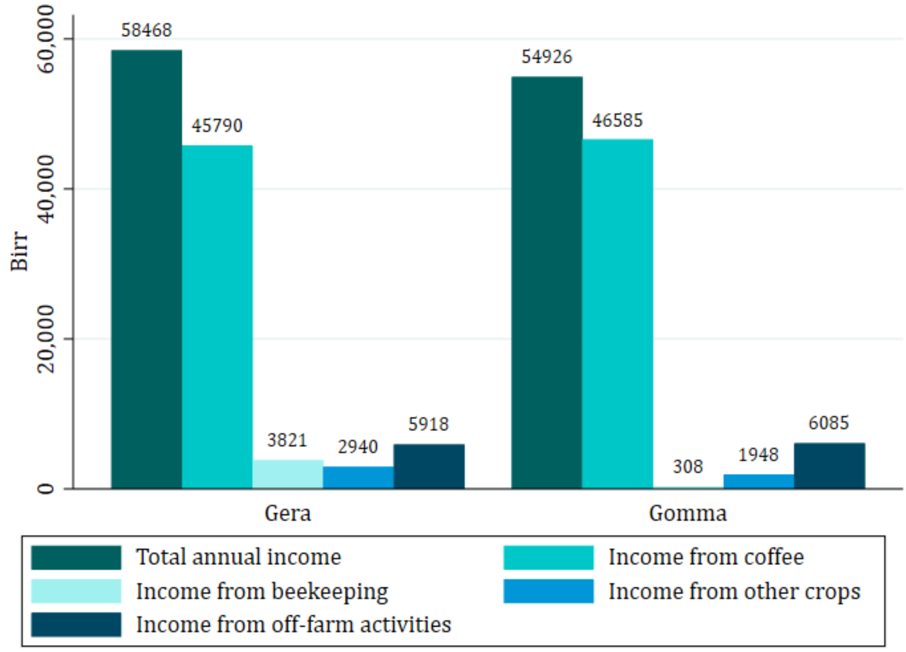


Figure 0.3.1.1: Income from various sources in Gera and Gomma Woredas (Full Sample)
Source: Baseline data collected by C4ED.

Regarding coffee production and use, households in Gera allocate more land to coffee than their counterparts in Gomma (mean- 1.5 ha and 0.7 ha, respectively). The median values for the same indicators are 1.5 ha and 0.75 ha for Gera and Gomma, respectively. Even though the per tree production is higher in Gera, the overall harvest from one hectare of land is higher in Gomma than in Gera. This is mainly because there are more trees per hectare in Gomma than in Gera (about 3,360 in Gomma vs. 3,050 in Gera). In both Woredas, most coffee is sold as red cherry, followed by storage of dried cherries/Jenfel, and finally, sales in dried cherries/Jenfel.

Most (~60%) of households in both Woredas sell their coffee at the local market where the per kg prices are about 53 Birr (0.96 USD) in Gera and 48 Birr (0.87 USD) in Gomma for red cherries, and 72 Birr and 75 Birr (~ 1.35 USD) in Gera and Gomma, respectively for dried cherries/Jenfel. While prices are higher for red cherries in Gera compared to Gomma, local collection centers tend to

harvest of the good (whether it be coffee beans, honey, teff or other crops). For coffee, we asked for the market price and multiplied this by the harvest that was sold (for red and dried cherries). To calculate the coffee income, it was agreed between HWG and C4ED to also added the cost of stored cherries (for future income from sales of coffee beans) since the actual sales for the past production season would not be reflected correctly if only current value from sales were included, since the baseline took place before the end of the sales season. For crops and honey, we asked for the income earned from sales of these goods (processed and unproceesed for honey and for three versus all crops produced in the last season for crops). No costs were subtracted from the income earned from sales, which is why this is considered gross income instead of net income. Traditionally, the income is generated based on harvest and not sales, but this was not asked in the case of the short questionnaire. For off-farm income, the income derived from wage employment, other sources and from enterprises was aggregated.

offer the highest prices in both Woredas, compared to other outlets such as coffee washing stations and local markets. Farm gate prices or local market prices are the lowest for red and dried cherries both. Households in Gera earn 31,200 Birr (567.3 USD) less income (per hectare) from coffee than those in Gomma (who earn 80,745 Birr or 1,048 USD per ha, although without the hectare normalization both earn similar amounts in total coffee income.

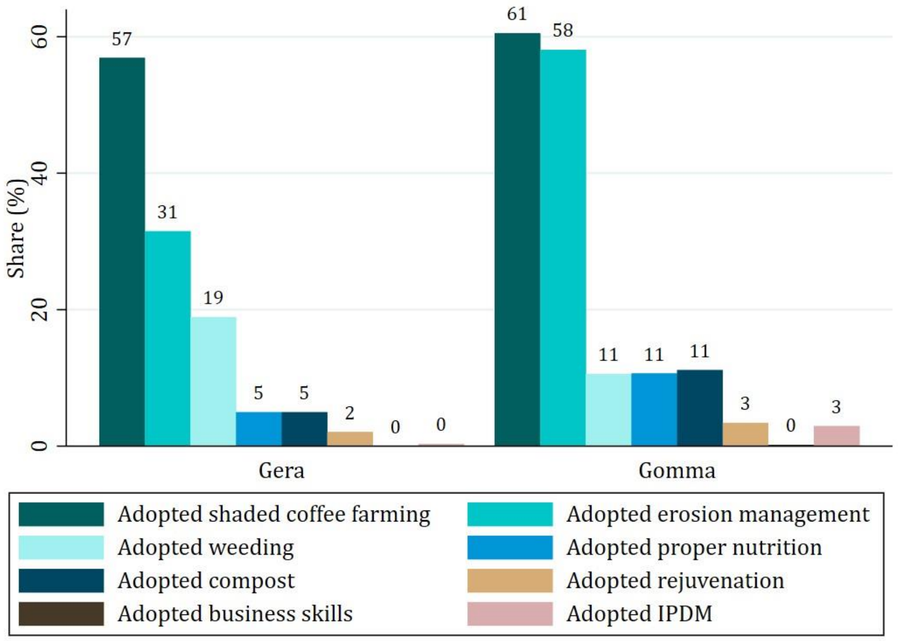
About 51% of households in Gera and 35% in Gomma have some beekeeping experience. Moreover, a larger percentage (approximately 13%) of interested farmers in Gera have also received some training in beekeeping, whereas this figure drops to about 3% in Gomma. In terms of hive ownership, beekeeping households in Gera own, on average, significantly more hives (around 10) than households in Gomma, driven mostly by the higher number of traditional hives in Gera versus Gomma. Honey production and income from beekeeping also vary across the two Woredas: honey-producing households in Gera produce about 79 kg of honey, five times their counterparts in Gomma (16 kg). However, households in Gera also incur considerably higher costs associated with beekeeping than those in Gomma, with 2,989 Birr (54 USD) and 1,548 Birr (28 USD), respectively. The five times higher honey production in Gera, when combined with the lower prices received there, implies that gross income from beekeeping/honey for households in Gera (13,048 Birr/237 USD) are only about 2.5 times higher than for those in Gomma (5,254 Birr/90 USD).

For assets and housing, households in Gera own (slightly) more agricultural assets. In the case of all assets (productive and household), however, the number is (slightly) lower in Gera compared to Gomma. The overall housing quality in Gomma is also much better than that in Gera, with a higher percentage of households having finished roofs, walls, and floors.

Regarding agricultural extension services, the main source of agricultural information is friends and neighbors where about 43% in Gera and 46% in Gomma mentioned it as their main source of extension services. The second most important source is development agents (44% in Gera and 41% in Gomma) and the third important source is the Radio (11% in Gera and 21% in Gomma. While only about **9% of farmers in Gera mentioned TNS as their main source of coffee extension services, about 23% in Gomma have mentioned TNS as their main source of extension services**. It is important to mention that at the time of baseline, TNS had conducted one round of training in Gera and Gomma already, and it targets proportionally more households in Gomma versus Gera. While the number of Kebeles are 5 and 9 in Gera and Gomma, respectively, the number of households registered (i.e. having attended at least one training session) as of December 2023 is 3,129 and 13,417, respectively, implying a more than double outreach level in Gomma.

The best practices (BPs) considered at baseline are **compost, proper nutrition, weeding, erosion control, rejuvenation, shade, pest and disease control, and business skills**.

Figure 0.3.1.2: GAP adoption rates in Gera and Gomma



Source: Baseline data collected by C4ED.

The average number of BPs adopted is 1.2 in Gera and 1.6 in Gomma. The project goal is to have at least 40% of trained households adopt at least two additional BPs. The two Woredas are also different in their adoption of these practices where Gomma usually has higher adoption rates of the practices (except weeding. Figure 0.3.1.2 summarizes adoption rates in both Woredas). The project goal, with respect to compost adoption, is to increase compost from 15% to 50%, however, compost adoption at baseline is much lower at only 5% in Gera and 11% in Gomma. As for weeding, the project envisions to increase it from 40% to 70%. However, adoption of weeding at baseline is 19% in Gera and 10% in Gomma. With respect to rejuvenation, the project goal is to have 60% of trained households to stump at least 50 trees and 40% stump 200 trees in three seasons. At baseline, only 2% in Gera and 3% in Gomma adopted rejuvenation practices (for plot level).[2]

Overall, there are several differences between the profiles of the two Woredas. Table 0.3.1.1 presents a summary of some of the aforementioned characteristics where the two Woredas differ from one another.

Table 0.3.1.1: Summary of characteristics of Gera and Gomma Woredas

Gera
Own more land and allocate a larger land area for coffee cultivation (or for foraging, wood/forest or leaving fallow)
Have more coffee trees overall (productive and unproductive) and higher coffee productivity per tree (for red cherries)
Produce more honey and earn more overall income from beekeeping
Produce and earn more income from selling other crops besides coffee
Have more livestock and earn more income from livestock
Gomma
Have more coffee plots with higher coffee tree density, productivity (per ha) and overall coffee income

[2] The plot level differs from the household level, in that for each household, one plot was visited to check for best practices that would be applied and are currently being adopted by the household. These indicators are denoted as plot level in their labeling. All other indicators were asked for all plots used by the household (which we consider household level).

Have more stumped trees (overall and per ha)
Have better housing conditions (roofs, walls, floors, electricity, etc.)
More likely to face non-food inflation or low coffee yields related shocks
Use Jenfel and crops as savings, compared to livestock; less likely not to have savings
Have better access to extension services; a larger proportion of farmers receive extension services from TNS (and radio)

Source: Baseline data collected by C4ED.

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ABBREVIATIONS

BP	Best Practices
C2022	Cohort 2022
C2023	Cohort 2023
C4ED	Centre for Evaluation and Development
CAPI	Computer-Assisted Personal Interviews
CFC	Coffee Farm College
CSP	Coffee Service Provider
CWS	Coffee Washing Stations
DG	Development Groups
DiD	Difference-in-differences
ECX	Ethiopian Commodity Exchange
EQ	Evaluation Question
FFG	Focal Farmer Group
FGD	Focus Group Discussion
FOB	Free on Board
FT	Farmer Trainer
GAP	Good Agricultural Practices
GPS	Global Positioning System
HFC	High Frequency Check
HWG	HereWeGrow
ICC	Intra-Cluster Correlation
IFPRI	International Food Policy Research Institute
IGA	Income Generating Activities
ITT	Intention To Treat
JCP	Jimma Coffee Project
KII	Key Informant Interviews
MDES	Minimum Detectable Effect Size
TNS	TechnoServe
ToC	Theory of Change
TVET	Technical and Vocational Education and Training

Notes on conversion factors:

- At the time of writing this report, the exchange rate from USD to Ethiopian Birr was around 55 Birr.
- The cherry to jenfel conversion in this report assumes that the weight of jenfel is three times lower than that of the red cherry.

1. INTRODUCTION

Coffee has a very important place in Ethiopia's economy. Cultivated by over 4 million smallholder farmers (SCIP, 2017) and with an annual production of 448,500 tons in 2019/20 (USDA, 2021), Ethiopia is the fifth-largest producer of coffee in the world (Caro, 2020) and the biggest exporter of arabica coffee in Africa (Minten et al., 2019).

Despite coffee production playing a vital role in sustaining the livelihoods of about 15 million Ethiopians and contributing significantly to the national economy, coffee productivity is low at 0.7 tons of dried cherries per hectare (Minten et al., 2019). This is attributed to factors such as unproductive and aged coffee trees, poor farm management, and agronomic practices. Most coffee trees currently grown in Ethiopia were planted over two to three decades ago (Abate et al., 2021) and almost 80% of unproductive coffee trees are not trimmed often enough (World Bank, 2021). Factors such as the lack of high-yielding coffee varieties and poor extension services also contribute to low yields (Diro et al., 2019; Minten et al., 2019; Tadesse et al., 2020). Evidence shows that 70-80% of overall coffee produced is sun-dried (unwashed), while washed coffee preparation accounts for 20-30% (USDA, 2021). Yet, the latter can fetch a higher price in the international market (Tamru & Minten, 2018). Additionally, climate change is contributing to lower yields and an increasing risk of pests and diseases of coffee trees (Chemura et al., 2021). One potential avenue to enhance income for farmers is through the provision of better market information and the development of improved market chains that prioritize coffee quality. This could result in higher market prices for farmers, improved productivity, and, ultimately, reduced production costs (Diro et al., 2019).

To increase coffee productivity and coffee farmers' income, it is important to improve farmers' knowledge of yield-enhancing agronomic practices and diversify their production. For this reason, TechnoServe (TNS), in collaboration with the Max and Ingeburg Herz Foundation (MIHS)/ HereWeGrow (HWG), has been implementing various projects in Sidama and Jimma, Ethiopia.

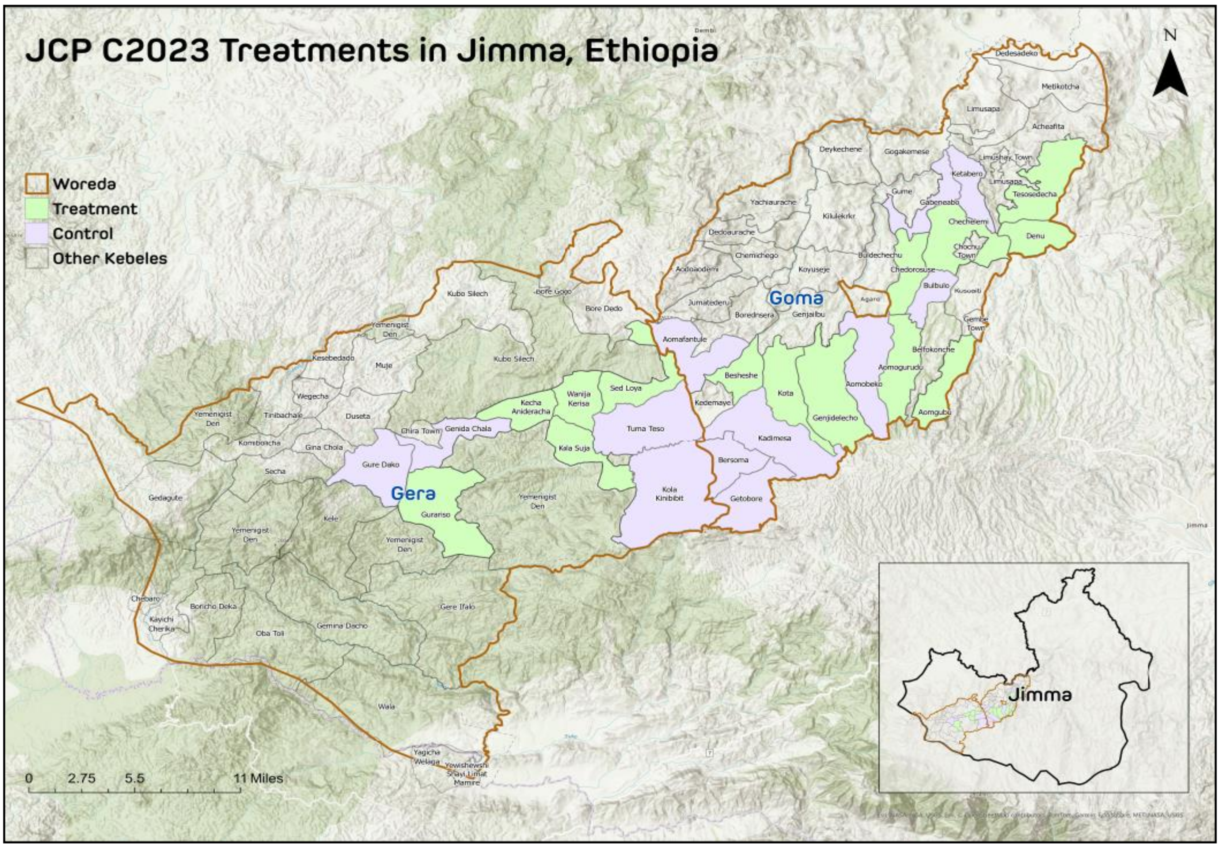
The Jimma Coffee Project (JCP) aims to enhance the productivity of coffee trees sustainably by providing tailored training through coffee farm colleges (CFC). This project includes two cohorts, one initiated in 2022, and a second, referred to as JCP C2023, which started in January 2023. The JCP C2023 interventions are to be implemented over 27 months in 14 Kebeles, randomly selected from the Gera and Gomma Woredas as shown in Figure 3.1.1.[3] Through the CFCs, farmers are educated on agricultural best practices (BPs), also referred to as good agricultural practices (GAP), such as coffee tree rejuvenation and composting. Additionally, the CFCs aim to promote the adoption of GAPs, specifically rejuvenation through stumping, by providing incentives, in the form of tools.[4] In order to substitute income lost through stumping, farmers are encouraged to take up beekeeping, training for which will also be given to farmers that are part of the program and interested in beekeeping activities. The component also seeks to improve farmers' market linkages

[3] The randomization was performed by HWG, by using an optimization process. For the selection of treatment and control kebeles, the entire list of kebeles were split using an optimization process in Excel Solver. In the process, two criteria were imposed. The first was to split all kebeles such that the difference in total number of households between both groups is minimized. Secondly, attention was paid to ensure both groups were equally sized and at least 4 kebeles from Gera were included per group. After optimization, either the group with more households or the group with more Kebeles in Gera (in case of equally sized groups) was denoted as the treatment group.

[4] The incentives are provided as two types of packages. Households having stumped between 50 and 149 trees receive the smaller incentive package, comprising a saw, zappa/jembe and a secateur. Those having stumped 150 or more trees receive the larger incentive package, consisting of a wheelbarrow or a transitional beehive. The total cost for the small package is about USD 34, while the cost of the larger package ranges between USD 76 and USD 113.

by providing training to both farmers and Coffee Washing Stations (CWS) in areas such as business management and sustainable coffee processing.

Figure 3.1.1. Map of the treatment and control Kebeles



The training is provided to a small group of farmers in their respective villages. The farmer groups are self-organized into 'Focal Farmer Groups' (FFGs) which usually consist of 25 to 30 farmers each. TNS believes that such a bottom-up and voluntary organization of FFGs (as opposed to TNS creating the groups) will improve self-governance and enable the active participation of trainees in discussions.

For the training, TNS recruits Farmer Trainers (FTs) of both sexes who have at least a high-school education or, preferably, are graduates of a technical and vocational education and training (TVET) college. These FTs are trained in coffee agronomy and the pedagogy of adult education, initially for ten days, but continue to receive refresher training at least once a month. The training is conducted in the local language (Afan Oromo). In the first year of the project, each FT is expected to train one topic to 10 FFGs over a one-month period, where each class lasts for 2 hours. The farmers' training will continue with the next training topic after the FTs receive their refresher training. Refresher courses will be delivered to the farmers in the second year, following a similar structure to the first year, covering one topic per month. Besides theoretical input, the farmers' training is mainly practical and are held in demonstration plots. See Table A.1.1 and Table A.1.2 in the Appendix for the detailed training curriculum.

Another component of the project involves providing stumping incentives, which will be accessible to all farmers in the designated treatment areas. Similar to previous cohorts where stumping incentives were available to all treatment farmers, TNS anticipates that approximately 60% of farmers will adopt stumping. The implementation of these incentives was such that farmers receive inputs (tools) that can be used for stumping, upon verification that they are stumping a sufficient number of trees.[5] TNS will monitor farmers' adoption by sending out Farmer Trainers to farmer's fields to check the adoption rate and collect data by taking pictures and GPS coordinates.

Lastly, the project will also support coffee washing stations (CWS) with the aim of enhancing the quality of their coffee (targeting Q1-3 tiers)[6], their business performance (by reducing unnecessary costs), increase their awareness with regards to payments to farmers as the share of Free on Board (FOB) price (the target is to get the share of the FOB price that farmers receive for their coffee to 75%), reduce their environmental footprint (by reducing their water usage and disposal of waste from coffee processing), and improve their market linkages so that they can generate higher prices for farmers and, ultimately, increase their income. The support to CWS involves advisory services to build the capacity of managers on business management, and to sensitize them on social and environmental sustainability issues. TNS will audit the compliance of the CWS with sustainability and quality processing standards and provide each CWS with an action plan that will guide it to improve its sustainability and quality scores. The theory of change for the project can be found in Appendix A.2.

[5] Based on a survey TNS conducted, the most preferred type of incentive is cash, followed by tools, and livestock (sheep and goats). However, the Government of Ethiopia has been prohibiting the use of cash to incentivize stumping and hence TNS has to resort to providing tools as the next best option. However, TNS is still considering that the Government of Ethiopia might change its policy about cash, in which case, cash will be used as the stumping incentive.

[6] Coffee is graded from 1 to 5 where 1 being the highest quality and 5 being the lowest. Grade 1 is also known as specialty coffee, Grade 2 premium coffee, Grade 3 exchange grade coffee, Grade 4 below standard, and Grade 5 off-grade. See the link (https://coffeeaffection.com/coffee-grades/) for detailed explanation on the grading process.

2. RESEARCH OBJECTIVES AND EVALUATION QUESTIONS

Box 1. Objectives of the evaluation

Quantitative data

- Estimate the effects of CFC on the adoption of good agricultural practices.
- Estimate the effects of CFC on coffee productivity.
- Estimate the effects of CFC on coffee farmers' income.
- Estimate the effects of stumping incentives on adoption and intensity of coffee tree rejuvenation.
- Examine whether the effects vary across farmers with different demographic and socio-economic conditions.
- Examine the effects of stumping on coffee yield.

Qualitative data

- Examine the positive or negative spill-over effects on other coffee growing households in both target and neighboring communities as well as examine the transmission channels.
- Examine the effects of business advisory services on CWS' coffee marketing and its effect on income of farmers that use services provided by CWS.

The evaluation of JCP C2023 will adopt a partially sequential mixed-method design, placing a greater emphasis on quantitative methods. The primary objectives of the evaluation, organized according to the main data sources, are outlined in Box 1.

There will be sequential waves of data collection, with a quantitative baseline and then a qualitative midline data collection, and two parallel qualitative and quantitative data collections at endline. This integrated approach blends the strengths of both quantitative and qualitative methodologies and aims to combine the advantages of each method while mitigating their respective limitations.

Overall, this evaluation seeks to address the following evaluation questions (EQ):

EQ1. What are the effects of the CFC on the key outcome and impact indicators of participating households? How do treatment effects differ by demographics, main income source of the household, initial land, and asset endowment?

EQ2. What are the effects of stumping incentives on adoption rates of stumping as well as stumping intensity? What are the effects on long-term impact measures?

EQ3. What are the positive or negative spillover effects on other coffee-growing households in target communities or neighboring communities? What are the transmission channels for spillovers?

EQ4. What are the average yield benefits of stumping a coffee tree after trees become productive?

EQ5. What is the effect of the project on CWS coffee marketing and additional income for project households through selling via CWS?

This evaluation aims to contribute to the literature by providing rigorous evidence on the impact of more tailored and crop-specific Agricultural Extension Services (AES) on productivity and income. Beyond informing policymakers and stakeholders of the JCP2023 about the role of AES in improving coffee farmers' income in the Jimma area, the findings will be informative for other practitioners in the coffee sector and the Ministry of Agriculture. These insights can inform both forthcoming and existing AES. The results of this study will provide insights on the role of CFCs in the adoption of GAP and its impact on coffee productivity while also highlighting key obstacles and facilitators. Furthermore, this study differs from the existing evidence primarily because it employs a randomized controlled trial (RCT) in combination with various qualitative approaches to study the effects of an AES provided via CFCs. Methodologically, this approach contributes to a robust evidence base while enhancing knowledge of contextual and infrastructural barriers through the qualitative analysis.

3. METHODOLOGY

The JCP C2023 evaluation will use **experimental quantitative methods** to isolate the effects of the project on target coffee farmers and provide a rigorous measurement of the causal impacts of the JCP C2023 project. We use counterfactual impact evaluation methods to measure the average impact of the JCP C2023 interventions on key indicators of interest. We take advantage of the randomized selections of project Kebeles and rely on an Intention-to-Treat (ITT) analysis to estimate the effect of the JCP C2023. This approach compares the outcomes of coffee farmers from treatment Kebeles with those of control Kebeles, assuming project implementation went as planned. This simple comparison allows us to estimate the causal effects of the JCP C2023.

As part of the project, participants are expected to receive additional activities to the CFC (i.e. beekeeping training, stumping incentives). It is important to note that we will not be able to identify the sole causal effect of the CFC. Instead, the CFC and other project activities will be evaluated together as a package. Nevertheless, C4ED will explore the respective effect of CFC indicatively by using a regression approach.

Finally, our ability to detect changes in outcomes related to beekeeping will depend on the actual participation of the project participants in this new training module. Nevertheless, we will provide descriptive statistics on the characteristics of households taking up this module and explore the correlations between the adoption of coffee GAP and beekeeping good practices.

The **qualitative component** will strategically focus on two field research phases: midline and endline. This allows us (a) to build on the quantitative baseline data in selecting respondents and locations and in designing the interview tools to shed light on issues that have emerged as more relevant or unexpected during baseline, (b) to explore first experiences with and processes and early effects of the intervention at the midline to provide guidance for further implementation, and (c) to analyze the intervention and its effects in depth at endline.

This baseline report mainly employs *descriptive statistics* for analysis along with tests for statistical comparability of the two Woredas. In the Appendix, we also provide balance tests between treatment and control groups for the main variables of interest. In addition to comparing the two Woredas across various characteristics, the *report also studies the determinants of good agricultural practices* according to less strict criteria (called GAP adoption in this report) and stricter criteria (called GAP adoption plus in this report). For this exercise, a simple ordinary least squares regression of the following form is used.[7]

$$Y_{i,j} = \delta_j + \beta_{i,j} X_{i,j} + \varepsilon_{i,j}$$

where, $Y_{i,j}$ indicates the outcomes of interest j indicating the different GAPS (compost, nutrition, erosion management, rejuvenation, weeding, shade, and business skills) and the number of GAPs adopted for individual i; $X_{i,j}$ indicate the variables/characteristics of farmer i; and $\beta_{i,j}$ show the coefficients; and $\varepsilon_{i,j}$ the idiosyncratic error term.

[7] Usually when probabilities are not very extreme, then an OLS (or rather Linear Probability Model) model works just as well and is much better for interpretability (as opposed to odds ratio or margins). Consequently, we choose to stick to the LPM in our analysis. For further information, please see the following aritcle: https://academic.oup.com/biometrics/article/65/3/937/7331805.

Finally, to understand the **status and intensity of implementation** (particularly in the sample) C4ED will obtain attendance data during the second and third training in the first year of implementation (2023) through independent attendance lists.

During the project span, TNS collects detailed information on the implementation of its activities, notably on the CFCs. Specifically, TNS records attendance information of up to two household members by training, and on the visits of the farmer trainers (FTs) to the farm. Taking advantage of this data, we can inform on the extent of participation of the quantitative sample of project participants by matching monitoring data with the household baseline survey. However, HWG confirmed that the matching rate during the previous round of JCP (previous cohort) was too low (about 45%).[8] To deal with this issue, besides matching the TNS monitoring data on attendance, C4ED provided a list of 20 sample and non-sample farmers for TNS to collect attendance data during each round of training in a pre-filled attendance sheet.[9] The additional non-sample farmers were included in order to blind the participants of the survey from implementation and avoid any (subconscious) bias in terms of training or reporting. Moreover, ethically, this would also ensure that C4ED does not disclose the exact sample households to stakeholders. After collecting the attendance data from the TNS, the C4ED evaluation team matched the attendance data and baseline data.[10] Through this matching, the share of baseline households that are either known to the group but not part of the training, or are participating in training, are both determined. This TNS ID will then be used to track the individuals through till endline, to understand their training status.

Therefore, through the TNS database, the status of trainings, as well as the participation of baseline households will be ascertained across the duration of the JCP2023. The main reason behind the two sources of checking attendance is to obtain accurate monitoring data for the sample.

3.1. SAMPLING

The evaluation team determined the final sample size based on i) power calculations allowing for a minimum detectable effect size (MDES) on coffee income that is as small as possible, and ii) budget considerations.[11] As a result, a sample of 2,150 households has been determined to be interviewed at both baseline and endline. These 2,150 households are randomly selected from 252 development groups across the 26 total Kebeles. Based on our current assumptions, a sample of 2,150 households will allow us to detect an increase of 10.1% or higher in the rate of stumping adoption and of 29.5% or higher in coffee income.

For the sample of treatment households, we use the 14 Kebeles randomly selected in the project. However, for the sample of control households, we used 12 of 14 initially randomly selected Kebeles (we completely exclude 2 Kebeles that were moved from the control to the treatment

[8] Matching on farmers names caused errors in previous survey rounds and resulted in low matching rates. However, during the time of writing this report, C4ED learned from HWG that the JCP2022 matching rates have increased to about 76%.

[9] In the pre-filled attendance sheet, we included all farmer names but also prepared instructions on filling out the attendance sheet to reduce any errors and ease the matching process. Based on the instructions, the farmer trainer (FT) called out the names on the list provided by C4ED and marked "X" in the "Farmer identified" column if the farmer was present in the training. If the farmer was not attending the training, the FT asks farmers present at the training if they know the farmers from the unmatched household. If an unmatched farmer from the list is known, either by the FT, the Focal Farmer, or any farmer present at the training, the FT marked "Y" in the last column "Farmer known". The attendance form template (in English) is attached in Appendix A.4.

[10] The attendance forms were not delivered on field for the first round of training in January/February. Hence, the attendance data was collected for the second round in March and third round in May..

[11] This corresponds to the initial MDES targeted by the terms of reference of this study.

group in November 2022).[12] In both treatment and control Kebeles, we conducted a listing exercise to obtain a complete sampling frame of development groups (DGs).[13] Out of this full list of DGs, the C4ED team randomly selected 252 DGs for a second round of listing, stratified by Kebele.[14] For the selected DGs, the listers were sent to zone/DG leaders to obtain the complete member's list, which serves as a final sampling frame for control and treatment DGs.[15]

Within each of these 252 lists, between eight and nine households were randomly selected to form the total sample of 2,160 households for the household survey.[16] These included 1,054 treatment and 1,106 control households. We further randomized five-twenty households per list to serve as replacements for those households that attrit from the main household survey sample during the data collection.[17] Finally, within each DG between one and two households were randomly selected to take part in the extended income section of the questionnaire. Therefore, from the total

[12] Given loss of two control Kebeles after initial random selection, we randomly selected a greater number of DGs from the control Kebeles than treatment Kebeles to compensate for this.

[13] There were two factors that were useful to verify the lists of coffee farmers within the DGs. First, during listing we were informed that the DGs include most of the coffee farmers in the various Kebeles by the local leaders. Later, three of these lists were corroborated by revising the Kebeles, where a high overlap of over 95% of the included households being found was noted. Since the DGs were randomly picked, there should not be any bias in terms of representativeness being added. Therefore, the sample should be a rather representative sample of the Kebeles.

[14] Specifically, we randomly selected nine groups from each of four Gera control Kebeles, 11 groups from six Gomma control Kebeles and 12 from two Gomma control Kebeles, to total 126 control DGs. From all 14 treatment kebeles, nine DGs were randomly selected, summing to another 126 treatment DGs.

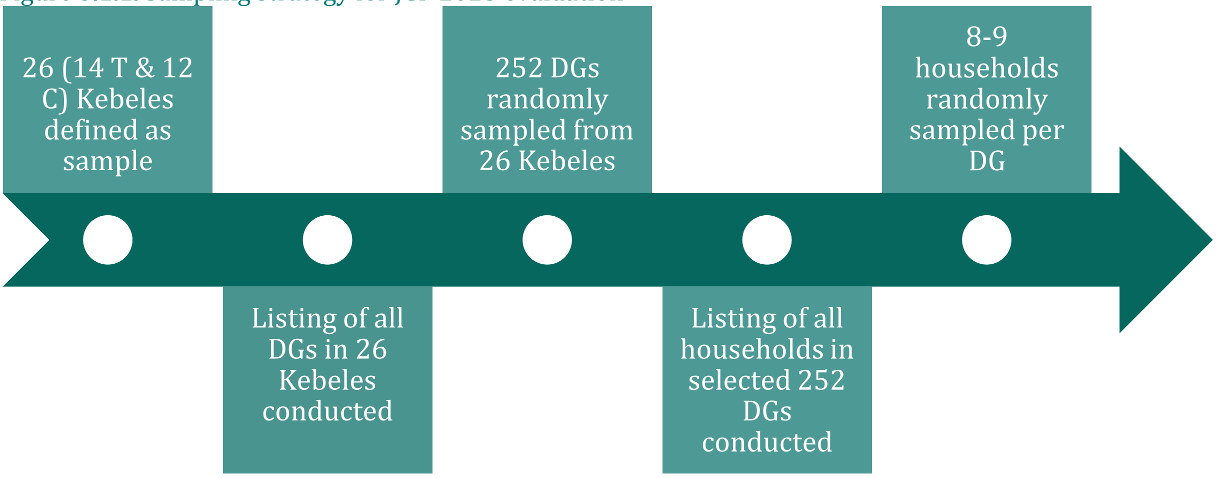
[15] Only households that grow coffee (which is one of the criteria to be part of the DGs) were included. During data collection there were still some households that claimed that they did not have coffee plots and were thereafter replaced from the replacement list sample.

[16] Due to the nature of random sampling, we ended up reaching out to slightly more respondents than the initial plan of 2,150, 2,178 to be exact. However, 18 respondents revoked their consent which left us with a final sample size of 2,160. This sample also does not include households that did not consent to the interview in the first place. Moreover,due to the differential rates in revoking consent (already prior, the varying size of DGs, and the replacement being from other larger DGs, the overall sample did not always imply 8-9 households from each DG as originally planned. In fact, there are 23 DGs where the number of households exceed 10. Total of 8 DGs have 7 households.

[17] In some cases, due to the inavaibility of certain households in the main replacement list, additoinal replacement lists had to be generated.

sample, 388 households were asked for more details on income and costs. Figure 3.1.1 depicts a flow chart describing the sampling process.

Figure 3.1.1. Sampling strategy for JCP 2023 evaluation



3.2. ETHICAL PRINCIPLES

Ethical clearance was obtained from the Ethiopian Society of Sociologists, Social Workers and Anthropologists (ESSSWA) (Reference number: ESSSWA/L/AA/0341/2023), dated on January 11, 2023. In addition to the support letter obtained from the Oromia regional government, this ethical clearance was presented to the relevant Woreda and Kebele administrators to obtain permission to conduct the fieldwork. The research tools and consent form were also prepared both in English and local languages (Afan Oromo).

3.3. BASELINE SAMPLE OVERLAP WITH TNS MONITORING DATA

Table 3.3.1 shows the result of the matched households from the second and third round training attendance. Overall, 87% of the total 1,054 sample households in treatment areas for which TNS checked attendance were identified as having attended the TNS training. This statistic is similar regardless of the region, indicating a high overall compliance rate. Overall, the attendance was higher in training round 2 (wave 1)- around 75%, compared to round 3 (wave 2) - 69%. The lower attendance is largely noticed in the Gera sample. Comparing the attendance in the TNS dataset, we find similar rates in both Woredas as well.

Furthermore, 92% of the treatment sample farmers were identified as known by either FT, focal farmer, or other farmers attending the training. As a result, only 8% of farmers were identified as unknown, implying that the listing exercise accurately captures the farmers in the development groups. The accuracy of the listing by Woreda is likewise closely similar, with 90% and 94% attendance compliance for Gomma and Gera, respectively.

Table 3.3.1. Baseline sample overlap with monitoring attendance data[18]

	Overall TNS		Overall C4ED		(C4ED) Gomma		(C4ED) Gera	
	N	%	N	%	N	%	N	%

[18] Although the overall treatment sample size is 1,088, the attendance data contains only 1054 sample households. This is because the remaining 34 household farmers were only included in the baseline survey as replacement from the additional reserve sample households that were not in the 20 households per DG sample households shared with TNS.

Farmer was present in either training	20,755	100	921	87	472	88	449	87
Farmer attended training- wave 0 (Training 1)	15,800	100	-	-	-	-	-	-
Farmer attended training- wave 1 (Training 2)	19,002	74	789	75	396	74	393	76
Farmer attended training- wave 2 (Training 3)	20,782	69	727	69	405	76	322	62
Farmer is known in either training	-	-	970	92	484	90	486	94
Farmer is known by FT or other farmers- wave 2 (Training 3)	-	-	970	92	484	90	486	94
Farmer is known by FT or other farmers- wave 1 (Training 2)	-	-	722	69	349	65	373	72
Overall observations	29,846		1,054		535		519	

Source: C4ED baseline and attendance forms data, and TNS attendance data.

4. RESULTS

This section presents the descriptive results of various socio-economic characteristics, adoption of various agronomic practices, beekeeping practices and income, assets, crop and livestock income, savings, exposure to shocks, and agricultural extension sources that were collected at baseline. Box 2 provides a brief explanation of how we compare groups using statistical tests.

Box 2: Statistical tests and interpretation

The analyses presented in this report include statistical tests that show whether the two Woredas are different in statistically meaningful ways. The appendix also presents similar analyses showing whether treatment and control groups are statistically different from each other for certain outcomes. These tests are done by calculating p-values, which show the probability of obtaining a test result at least as extreme as observed, assuming there is no difference between groups. If the p-value is very small, we reject the hypothesis that the observed difference is due to random chance. Researchers set different thresholds for the p-values, commonly used thresholds in the social sciences are 0.01, 0.05, and 0.1, corresponding to 99%, 95%, and 90% confidence levels.

4.1. DEMOGRAPHIC CHARACTERISTICS

Table 4.1.1 presents the demographic characteristics of the sample. Overall, the households in Gera and Gomma differ regarding the gender of household heads. On average, fewer households in Gomma (89%) are headed by men, as opposed to 95% of the sample households in Gera. At 47 years, household heads in Gomma are significantly older than household heads in Gera (about 45 years). A statistically significant difference is also observed in the marital status of the household heads, with around 93% being married in Gera, compared to 84% in Gomma.

Examining the educational indicators, the household heads have similar education profiles. The largest differences noted are that 48% of the household heads in Gera and 43% in Gomma have no formal education, while 40% in Gera and 36% in Gomma have completed primary education. There are no differences in the share of households with heads having completed higher education or vocational education and only a marginal difference for completed secondary education (around 1% higher in Gomma). On average, both Woredas exhibit an approximate household size of six members.

Table 4.1.1. Demographic characteristics

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of male-headed households (%)	88.9 (31.4)	95.0 (21.7)	-6.1*** (0.00)	2,160
Age of household head (in completed years)	46.9 (13.6)	44.8 (12.9)	2.1*** (0.00)	2,160
Share of households with married head (%)	83.8 (36.9)	93.2 (25.1)	-9.5*** (0.00)	2,160
Share of household heads with no formal education (%)	42.8 (49.5)	47.9 (50.0)	-5.1** (0.03)	2,160
Share of household heads with elementary education (1-6 grade) (%)	35.9 (48.0)	39.7 (49.0)	-3.8* (0.08)	2,160
Share of household heads with middle education (7-10 grade) (%)	19.0 (39.2)	11.0 (31.4)	7.9*** (0.00)	2,160
Share of household heads with secondary education (11-12 grade) (%)	1.7 (13.1)	0.8 (9.1)	0.9* (0.09)	2,160
Share of household head with higher education (degree or above) (%)	0.3 (5.3)	0.0 (0.0)	0.3 (0.15)	2,160
Share of household heads with other education (vocational) (%)	0.3 (5.9)	0.6 (7.4)	-0.2 (0.49)	2,160
Household size	5.5 (2.3)	6.0 (2.3)	-0.5*** (0.00)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.2. COFFEE PLOT CHARACTERISTICS AND FARMING SYSTEMS

This section provides an overview of land ownership and usage in Gera and Gomma. As Table 4.2.1 shows, households in Gera, on average own approximately 2.3 hectares of land, more than twice the average of about 1.1 hectares in Gomma.[19] Likewise, the total cultivated land per household in Gera is nearly double the size of that in Gomma, 2.2 hectares and 1.1 hectares, respectively. With an average of 1.5 hectares allocated to coffee production in Gera, total land under coffee is considerably higher than in Gomma, where it stands at about 0.7 hectares.

Table 4.2.1. Land ownership, use, and coffee density

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Total land owned by household (ha)	1.1 (1.0)	2.3 (2.5)	-1.3*** (0.00)	2,160
Total land managed by household (ha)	1.1 (1.0)	2.2 (2.3)	-1.1*** (0.00)	2,160

[19] All values here winsorized at 99 percentile. The median values for the same indicators are 1.5 ha and 0.75 ha for Gera and Gomma, respectively.

Land used for wood and forest (ha)	0.1 (0.2)	0.4 (0.7)	-0.3*** (0.00)	2,160
Total land for coffee (ha)	0.7 (0.7)	1.5 (4.3)	-0.8*** (0.00)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Figure 4.2.1 shows that Gomma and Gera also vary in their coffee farming practices. On average, households in Gera have fewer coffee trees per hectare of land. Gera also shows a lower count of productive and stumped coffee trees per hectare of land than Gomma. Conversely, households in Gera demonstrate a higher count of newly planted and other non-productive coffee trees per hectare.[20]

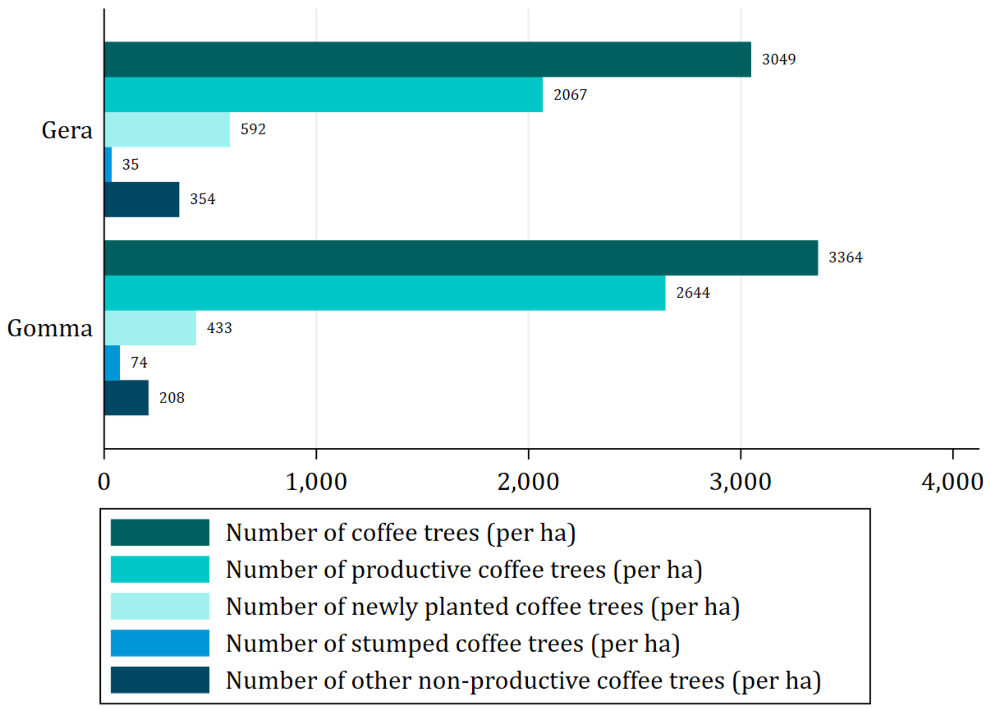


Figure 4.2.1. Coffee tree density in Gera and Gomma

Source: Baseline data collected by C4ED.

Table 4.2.2 presents coffee plot characteristics in Gera and Gomma. The average number of plots are higher in Gomma, at 2.4 plots, compared to Gera, at 2.1 plots. Inversely, plot sizes in Gera are nearly double the size of those in Gomma, averaging about 0.5 hectares compared to approximately 0.3 hectares in Gomma. On average, farmers in Gera spend around 17 minutes walking to

[20] Unproductive trees are trees that have been uprooted or are infected with disease. The question was "How many other, unproductive trees (e.g. uprooted, coffee with disease) does the plot have?" and in this case we are unable to distinguish between trees that are uprooted (partially or fully) versus diseased.

their plots, slightly longer than the approximately 15 minutes taken by farmers in Gomma. Therefore, farmers in Gera have fewer but larger plots, which also tend to be further away from home, on average. Additionally, the average number of trees per hectare is significantly higher in Gomma (3,364 trees) than in Gera (3,049 trees), implying that plots in the former Woreda are cultivated more intensely. However, when comparing the share of plots where the distance between trees is 1 and 2 meters (another measure for tree density— this attribute is found nearly universally (98%), and the difference between the two Woredas is negligible. The trees in Gomma are also reportedly older by 9 years than the trees found on the plots in Gera.

In terms of the types of trees, plots in Gera have, on average, more productive, but also newly planted, and unproductive trees per plot[21] The share of productive trees is higher in Gomma (nearly 79%) as compared to Gera (68.5%). However, the difference in the number of stumped coffee trees per plot is not statistically significant.[22]

Table 4.2.2. Coffee plot characteristics

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Number of coffee plots	2.4 (1.2)	2.1 (0.9)	0.3*** (0.00)	2,160
Average age of trees on plot	21.5 (16.2)	12.1 (11.6)	9.4*** (0.00)	2,160
Plot distance in walking minutes	15.4 (16.5)	17.0 (28.0)	-1.6** (0.01)	4,920
Plot size (ha)	0.3 (0.3)	0.5 (0.6)	-0.3*** (0.00)	4,920
Number of coffee trees	902.7 (925.1)	1,568.8 (1,760.0)	-666.1*** (0.00)	4,889
Number of productive coffee trees	712.3 (772.7)	1,074.9 (1,344.9)	-362.7*** (0.00)	4,889
Number of newly planted coffee trees	109.5 (197.3)	262.3 (442.2)	-152.8*** (0.00)	4,889
Number of stumped coffee trees	16.4 (55.9)	13.8 (60.2)	2.6 (0.14)	4,889
Number of unproductive coffee trees	59.9 (138.6)	180.0 (330.2)	-120.1*** (0.00)	4,889
Number of coffee trees (per ha)	3,363.5 (1,465.7)	3,048.8 (1,560.5)	314.7*** (0.00)	4,889
Share of plots where distance between coffee trees is between 1 and 2 meters (%)	98.3 (13.0)	98.0 (14.0)	0.3 (0.53)	4,920

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Table 4.2.3 presents the coffee plot characteristics for a visited plot and the remaining plots, separately displayed for the Gera (Panel A) and Gomma (Panel B) Woredas. During the baseline data

[21] All farmers were asked, for each of their plots, the number of total, productive, new planted (last two years), unproductive and stumped trees (last two years). Since the survey took place in February and March 2023, the last two years likely include the early numbers from 2023 as well.
[22] The coffee tree values have been winsorized at the 99% percentile.

collection, one plot was selected to be visited per household based on the farmers' reported application or intention to apply best practices or good agricultural practices (GAP). In instances where farmers expressed no intention of applying best practices, the team visited the plot identified by the farmer as their 'main' plot. This comparison aims to assess the differences between visited plots and those that haven't been visited, evaluating whether farmers typically tend to the plot closest to their house or the largest plot, among other characteristics.

Table 4.2.3. Plot characteristics for visited and non-visited plots

Panel A: Gera	(1) Visited	(2) Non-visited	(3) (1)-(2) (p-value)	(4) N
Plot distance in walking minutes	8.9	24.6	-15.6***	1,507
	(11.1)	(35.8)	(0.00)	
Plot size (ha)	0.5	0.6	-0.0	1,507
	(0.6)	(0.6)	(0.29)	
Number of coffee trees	1,507.4	1,625.9	-118.5	1,500
	(1,720.9)	(1,794.8)	(0.19)	
Number of productive coffee trees	1,046.9	1,101.0	-54.1	1,500
	(1,328.1)	(1,360.6)	(0.44)	
Number of newly planted coffee trees	268.8	256.3	12.5	1,500
	(419.5)	(462.5)	(0.58)	
Number of stumped coffee trees	22.5	5.7	16.8***	1,500
	(77.3)	(36.3)	(0.00)	
Number of unproductive coffee trees	154.5	203.7	-49.2***	1,500
	(293.1)	(359.9)	(0.00)	
Number of coffee trees (per ha)	3,035.1	3,061.6	-26.5	1,500
	(1,540.1)	(1,580.1)	(0.74)	
Share of plots where distance between coffee trees is between 1 and 2 meters (%)	98.8	97.3	1.4**	1,507
	(11.1)	(16.2)	(0.05)	
Panel B: Gomma	**(1) Visited**	**(2) Non-visited**	**(3) (1)-(2) (p-value)**	**(4) N**
Plot distance in walking minutes	10.1	19.3	-9.1***	3,413
	(9.3)	(19.3)	(0.00)	
Plot size (ha)	0.3	0.3	0.0***	3,413
	(0.3)	(0.3)	(0.00)	
Number of coffee trees	977.6	848.1	129.4***	3,389
	(948.9)	(903.7)	(0.00)	
Number of productive coffee trees	770.8	669.6	101.3***	3,389
	(795.8)	(752.8)	(0.00)	
Number of newly planted coffee trees	111.8	107.9	3.9	3,389
	(197.6)	(197.1)	(0.57)	
Number of stumped coffee trees	26.2	9.3	17.0***	3,389
	(68.4)	(43.2)	(0.00)	
Number of unproductive coffee trees	63.7	57.1	6.6	3,389
	(143.0)	(135.2)	(0.17)	
Number of coffee trees (per ha)	3,309.2	3,403.1	-93.9*	3,389
	(1,390.9)	(1,517.0)	(0.07)	
Share of plots where distance between coffee trees is between 1 and 2 meters (%)	98.5	98.1	0.3	3,413
	(12.3)	(13.6)	(0.45)	

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the visited and non-visited plots, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the visited and non-visited plots. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Based on the results presented in Table 4.2.3 **farmers are likely to consider the closer plots as their main or GAP plots.** The number of stumped trees is considerably higher in the visited than in the non-visited plot. As can be seen in Panel A, for Gera, the visited plot takes only about 9 minutes to reach, while the average for non-visited plots is about 25 minutes (as reported by the farmer). The distance of non-visited plots is also twice as high compared to visited plots in Gomma (19 versus 10 minutes, respectively).

In both Woredas, **plot characteristics of the visited and non-visited plots are, on average, similar**. For Gera, the number of coffee trees and the number of productive and newly planted coffee trees do not differ statistically significantly across visited and non-visited plots. The number of stumped trees is reported to be higher in the visited plots. Farmers, on average, also report a higher number of unproductive trees in the non-visited plots. Both of these variables may indicate the intention of farmers to implement GAP in these plots (having received stumping training before the baseline already) or pay greater attention to the visited plots (over the non-visited ones). For Gomma, this appears to be even more apparent. Visited plots are reported to have a higher number of trees, productive trees, and stumped trees compared to non-visited plots. No statistical difference is observed in the number of newly planted or unproductive trees between visited and non-visited plots. The share of plots where the distance between coffee trees is between 1 and 2 meters is very high (98%) across both Woredas and across visited / non-visited plots.

4.3. ADOPTION OF AGRICULTURAL BEST PRACTICES

This section presents and discusses the adoption of the agronomic practices listed in Table 4.3.1.[23] The concept of adoption is assessed through two distinct criteria: adoption and adoption plus. The adoption criteria are derived from the official definition of adoption as outlined by TNS. Additionally, adoption plus extends the TNS criteria by introducing a stricter definition of adoption.

Table 4.3.1. GAP Criteria JCP C2023

Practice	Official adoption criteria	Adoption plus criteria
List of practices used in project monitoring and evaluation	*The official adoption criteria from TNS*	*A stricter criterion that can be equally measured in an evaluation. Meeting it should be suitable for delivering change in coffee productivity. This criterion is* ***in addition*** *to the official adoption criteria.*
Business Skills	Adopted if the farmer has a record card and has records of either coffee income, expenses such as hired labor, or both.	N/A
Compost	Adopted if the farmer has a compost or manure heap or pit.	Adopted if farmer produces sufficient compost to apply 4 to 5 kg of compost per season and coffee tree stumped in the last two seasons. Compost heaps are turned regularly (at least every month). If compost is a pile of manure, it has matured for at least 8 to 12 weeks before being applied to the field.

[23] Text marked in italics are those criteria that were not included due to lack of data collected at baseline in 2023. This data will be collected at endline.

Nutrition	Adopted if nearly all leaves are dark green and healthy and at least 1 of the below nutritional products was used on the coffee in the previous 12 months. Fertilizer options: compost, manure, gypsum, lime, worm tea.	For trees stumped in the past two years: 1) compost or matured manure applied to most or all trees in the last season 2) at least 4.5 kg of compost or matured manure is applied per tree and year. For all other productive trees: Compost or matured manure applied to at least some trees in the last season (regardless of amount). Fertilizer is applied according to TNS recommendations (under the tree canopy).
Erosion Control	Adopted if at least 1 erosion control method seen.	For plots with no slope: at least one recommended practice applied (*or sufficient leaf litter in semi-forest or forest coffee*). For plots with medium or steep slopes: cover crops or mulch is applied (*or sufficient leaf litter in semi-forest or forest coffee*) and one additional recommended practice *AND the plot has not been dug before the start of the rainy season.*
Rejuvenation[24]	Adopted if the farmer had stumped any coffee tree in 2023, 2024, or 2025 (2020-2022 at baseline) Stumped trees have no more than four main stems for the most recent year in which they stumped.	Adopted if farmer stumped in total at least 15% of all coffee trees on reference plot in 2023, 2024, and 2025 (2020-2022 at baseline)
Weeding	Adopted if the farmer: 1. Weeds twice or more per year – (2 and higher) and 2. Has no or few weeds under the canopy and 3. Weeds are less than 30cm tall and *4. Farmer has not dug under the canopy.*	*The farmer starts weeding before weeds are 30cm high and before weeds have started flowering.*
Integrated Pest & Disease Management (IPDM)	*Preventive: Adopted if the farmer uses any 3 general*	Specific: Ask for the most common pests & diseases in the plot in the past two years. Per pest/disease, ask what the farmer has done to tackle it. If the answer is correct, classify it as adoption. If no pest/disease outbreaks are reported and observed by the enumerator, classify it as adoption.

[24] The C4ED team collected information on stumping in two ways. Firstly, the team asked how many trees were stumped in each coffee plot in the past two years (without specifying the year, which given the time of the baseline could also include the first month of 2023). Secondly, for the visited plot, the team asked whether farmers stumped any coffee trees since 2020, and then asked for the number of stumped trees for the specific years, i.e., in 2020, 2021, 2022, or 2023. Since the training on stumping had begun prior the baseline data collection, this exact information would ensure that we have data on the effect of the training in 2023 (as opposed to the previous years). Due to the precision in reporting in the second method, we chose to present the rejuvenation indicator based on the visited plot, and not for the entire farm. The indicator considers a farmer as an adopter if they have stumped any number of trees from 2020-2022, in the visited plots. Later we also present the yearly rejuvenation adoption rates.

	methods to reduce pest or disease incidence.[25]	
Shade	Adopted if there is 20% shade or more or there is less than 20% shade but *shade trees have been planted in the last 2 years*.	N/A

Source: HWG's adoption indicators description. Italicized criteria are missing in the data (as noted in footnote 23).

Panels A and B in Table 4.3.2 show the extent of adoption of agronomic practices in Gera and Gomma using the adoption and adoption plus criteria, respectively. The results for adoption plus indicators expectedly show a very low adoption rate and will therefore not be discussed within the baseline report.

For the adoption criteria, the results show low adoption for most practices, except erosion management and shading. Shade adoption is around 60% for both Woredas. However, adoption of erosion management practices is 31% in Gera, and nearly double at about 58% in Gomma. This difference in adoption is found across all but the shading and business skills criteria, where there is no large difference between the two Woredas. When comparing the two Woredas, overall, adoption seems to be higher in Gomma over Gera. Except for weeding (where it is 19% in Gera and 11% in Gomma), all other criteria appear to be more frequently adopted in Gomma. Other large differences in adoption are those for compost and nutrition criteria, both reported at 5% in Gera and 11% in Gomma. Based on the results presented in Table 4.3.2, the number of best practices adopted according to the GAP adoption criteria is on average, about 1.2 practices in Gera and around 1.6 in Gomma. The incidence of GAP adoption in both Woredas is provided in Figure 4.3.1. It confirms the higher adoption in Gomma, where the majority of the households (36%) have adopted two practices, compared to over 40% of the population in Gera adopting only one practice.

Table 4.3.2. GAP adoption and adoption plus

Panel A: GAP adoption	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Number of agronomic practices adopted by the household[26]	1.6 (1.0)	1.2 (1.0)	0.4*** (0.00)	1,773
Share of households that adopted business skills (%)	0.2 (4.6)	0.0 (0.0)	0.2 (0.22)	2,160
Share of households that adopted compost or manure (%)	11.1 (31.5)	5.0 (21.8)	6.2*** (0.00)	2,160
Share of households that adopted proper nutrition (%)	10.7 (30.9)	5.0 (21.8)	5.7*** (0.00)	2,160
Share of households that adopted erosion management practices (%)	58.1 (49.4)	31.5 (46.5)	26.6*** (0.00)	2,160

[25] Instead of asking all farmers about pest management, the survey asked farmers if they encountered and pests or diseases in the past year. Only if they confirmed pest or disease incidence, were they asked about which type and what practices were used. Therefore, for this GAP, the sample is restricted only to farmers that have encountered any pest or disease, limiting the sample to 1,773 households. The total number of BPs adopted were then also calculated only for this subsample of 1,773 households.

[26] Sample restricted to all households that reported having faced pests and disease in the last year, used to create the IPDM BP variable.

Share of households that adopted weeding (%)	10.6 (30.8)	18.9 (39.2)	-8.3*** (0.00)	2,160
Share of households that adopted integrated pest management methods (%)	2.9 (16.9)	0.3 (5.7)	2.6*** (0.00)	1,773
Share of households that shaded main coffee farm: 20% and above (%)	60.5 (48.9)	56.9 (49.6)	3.6 (0.11)	2,160
Share of households that adopted rejuvenation (plot) (%)	3.4 (18.2)	2.1 (14.3)	1.3* (0.08)	2,160
Panel B: GAP adoption plus[27]	**(1) Gomma**	**(2) Gera**	**(3) (1)-(2) (p-value)**	**(4) N**
Number of agronomic plus practices adopted by the household[28]	0.9 (0.7)	0.9 (0.8)	0.0 (0.73)	452
Share of households that adopted plus activities under compositing (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2,160
Share of households that adopted proper nutrition (plus) - missing if not stumped (%)	3.8 (19.2)	1.7 (12.9)	2.1 (0.25)	540
Share of households that adopted erosion management practices (plus) (%)[29]	6.5 (24.7)	6.5 (24.7)	0.1 (0.96)	2,160
Share of households that adopted IPDM plus (%)	2.7 (16.1)	0.3 (5.7)	2.4*** (0.00)	1,773
Share of households that adopted rejuvenation plus (plot) (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

[27] Business skills and shade are absent in adoption plus mainly because the definitions are similar across the two criteria. Weeding, on the other hand, is not reported in adoption plus because of a lack of data on the specific dimensions (i.e., "farmer starts weeding before weeds are 30cm high and before weeds have started flowering").
[28] Number of agronomic plus practices includes business skills and shade management (8 taught practices minus weeding adoption plus). Sample restricted to all households that reported having faced pests and disease in the last year, used to create the IPDM BP variable, and households that reported having stumped trees to follow nutrition BPs.
[29] As noted in the Table 4.3.1, the information on the type of plot (garden, forest, semi-forest, etc.) was not used, implying that regardless of plot type, only slope relevant information was used to determine the uptake of erosion managament plus practices. This implies, for flat slopes, either mulching or cover crops were considered as adoption. For steep slopes, at least one additional practice (on top of cover crops or mulching) was required.

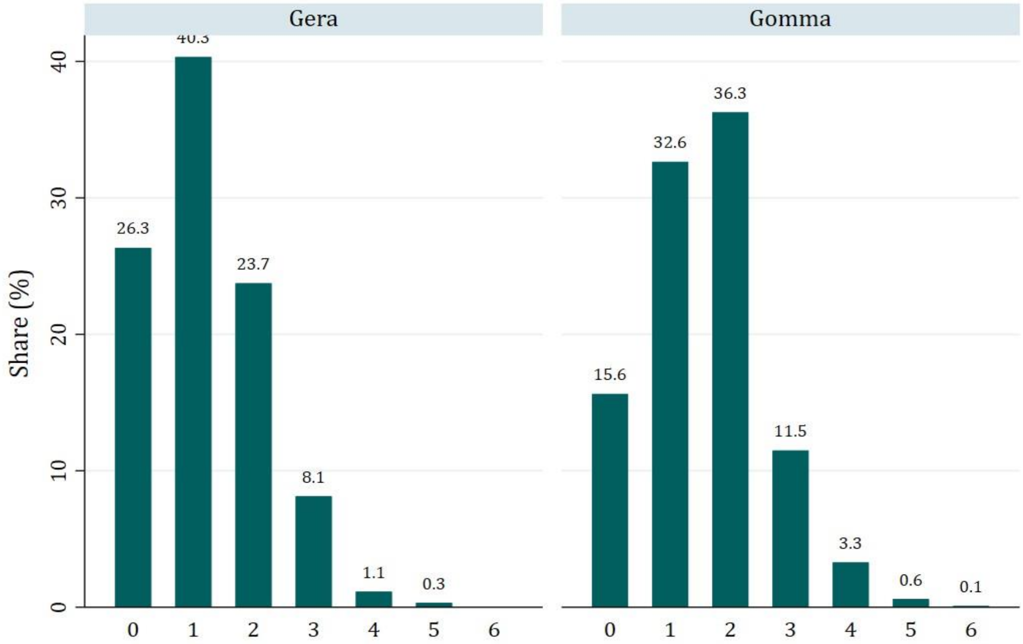


Figure 4.3.1. Share of households adopting 0-6 GAPs

Table 4.3.3 presents the rejuvenation adoption rates for the visited plot, disaggregated by the year that the farmer adopted the practice. As can be seen from the results, rejuvenation adoption is very low (both GAP and GAP plus) in the two Woredas.[30] Observing the trend over time, while it appears to go up in 2021 and then down in 2022, it shows a massive spike in 2023, likely attributed to the training on rejuvenation that took place before the baseline.[31] Rejuvenation plus adoption is not found to be present in the data for all years, besides 2023, where the stumping training took place.

Table 4.3.3. Yearly rejuvenation adoption according to GAP and GAP Plus

	(1) Gomma	(2) Gera	(3) (2)-(3) (p-value)	(4) N
Adopted rejuvenation in 2020 (plot) (%)	0.8 (8.7)	0.4 (6.4)	0.4 (0.34)	2160
Adopted rejuvenation in 2021 (plot) (%)	1.0 (10.2)	1.2 (11.1)	-0.2 (0.68)	2160
Adopted rejuvenation in 2022 (plot) (%)	1.7 (12.8)	0.6 (7.4)	1.1** (0.03)	2160
Adopted rejuvenation in 2023 (plot) (%)	0.8 (9.1)	0.7 (8.3)	0.1 (0.72)	2160
Adopted rejuvenation plus in 2020 (plot) (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2160
Adopted rejuvenation plus in 2021 (plot) (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2160
Adopted rejuvenation plus in 2022 (plot) (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2160
Adopted rejuvenation plus in 2023 (plot) (%)	0.1 (2.6)	0.1 (3.7)	-0.1 (0.62)	2160
Observations	2,160	2,160		

[30] For stumping (plus) additionally we considered
[31] It must be noted that the current sample include both the treated and control groups for both Woredas, implying that the actual stumping rates for the treated group in both Woredas might be even higher.

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Figure 4.3.2 depicts stumped coffee trees (a), as well as erosion management through leaf litter (b) on plots visited by the C4ED team.

(a) Stumped coffee trees (b) Coffee plot with leaf litter

Figure 4.3.2. Stumped coffee plot and coffee plot with leaf litter

Source: Baseline data collected by C4ED

4.3.1. Potential determinants and mechanisms behind (non-) adoption of best practices

To examine the infrequent adoption, we also check each of the criteria that are required for the practice to have been adopted well. For **business skills**, the overall adoption is only about 0.1%. However, this is largely due to the very low share of households (2.7% or 58 households) that report having a record card in the first place. Of those that have one and allowed the enumerator to check them (15 households), only 13% (amounting to 2 total households in 2,160 households) appear to have a record of coffee-based income or labor costs in there. Therefore, the first step towards improving the adoption of business skills is to understand why ownership of a record card is so sparse. If awareness is the barrier, then educating households on the uses and benefits of a record card is key before any training on appropriate recording in these cards can be considered beneficial.

Table 4.3.4. Record card usage within households

Variable	N	Mean
Share of households that adopted business skills (%)	2,160	0.1
Share of households that have a record card (%)	2,160	2.7
Record card has records of coffee income (%)	15	13.3
Record card has records of hired labor (%)	15	13.3

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.
Source: Baseline data collected by C4ED.

For **compost** adoption, the low rate is purely the few farmers (196) who reported making compost in the last 12 months (9% overall). Of these 196 households, production was mostly limited to around 1 pit, with 61 farmers having no pit on their farms. The average amount of compost produced by the sample was around 21 kg.[32] When restricted to only households that have pits (135 households), the average compost produced is 335 kg, which would fulfil the adoption criteria for about 84 stumped trees per farm. The sample-wide average share of compost per stumped tree yields only about 0.1 kg of compost per tree.[33] This is much lower than the required 4 kg (for fulfilling the adoption plus criteria). Therefore, many households would either have to produce or buy nearly 40 times the compost currently being produced on their plots, in order to adhere to the recommended practices.

Table 4.3.5. Composting practices of households

Variable	N	Mean
Share of households that adopted compost or manure during a year (%)	2,160	9.1
Average number of composts pits, heaps, or piles prepared on farm by household that produce compost/manure	196	1.2
Average number of composts pits, heaps, or piles prepared on farm by household having pits that produce compost/manure	135	1.7
Compost and manure produced by farmer (kg) - with assumptions	2,160	20.9
Compost and manure produced by farmer having pit (kg) - with assumptions	135	334.8
Average preparation time for compost pits (months)	135	8
Share of households that turn compost pits (at least every other month) (%)	2,160	6
Share of households having pits that turn compost pits (at least every other month)	135	66.3
Kg of compost for each stumped tree- with assumptions	2,160	0.1
Kg of compost for each stumped tree- with assumptions (for households having pits)	135	1.7
Enough (4 kg at least) compost produced in household (%)	2,160	0.7
Enough (4 kg at least) compost produced in household having pits (%)	135	11.9

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.
Source: Baseline data collected by C4ED.

For **rejuvenation**, between 2020 and 2022, households reportedly stumped a total of 8 trees on the visited plot, making the share of stumped trees lower than 1% on average. However, of those that stumped trees at baseline (plot level), the average number of stumped trees is around 46 trees, comprising 5% of the coffee trees on that plot.

Table 4.3.6. Stumping and rejuvenation-related activities of households

Variable	N	Mean
Share of households that adopted stumping (plot) (%)	2,160	3
Total trees stumped at baseline (plot)	2,160	7.7
Total trees stumped at baseline (plot) for those who stumped	360	46.4
Share of stumped trees (plot) (%)	2,160	0.8
Share of stumped trees (plot) for those who stumped (%)	359	5
Total number of stumped coffee trees on farm	2,160	35.4
Share of stumped trees (farm) (%)	2,160	1.8

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.
Source: Baseline data collected by C4ED.

[32] The assumption is that per pit, 200 kilos of compost is produced (50 kilos, and 4 times per season, for one coffee season).
[33] For the 540 households that reporting stumping trees, the average is still only 0.4 kg, implying that households must produce more than 10 times what they are currently producing, while nearly 75% of the sample is not producing any compost at all.

Closely linked to composting are the **nutrition** practices followed by the household. While nearly 87% of the households have healthy coffee trees (with less than 5% yellow leaves), this isn't a result of recommended fertilizer usage. Only around 10% reportedly used fertilizer of the recommended type. In addition to the low use of (recommended) fertilizer, on average, 0.2 kg of compost is applied per stumped tree on the visited plot, yielding a very low share of 8.8% of households that reportedly follow proper nutrition practices. Within the 540 households that stumped trees, the average adoption of nutrition practice is marginally higher (at 12%). A higher production of fertilizer may improve the adoption of this practice.

Table 4.3.7. Nutrition practices of households

Variable	N	Mean
Share of households that adopted nutrition practices (%)	2,160	8.8
Share of households that have healthy coffee trees: less than 5% yellow leaves (%)	2,160	87
Share of households that use fertilizers of recommended type (%)	2,160	9.8
Average compost applied per stumped coffee tree (kg/tree)	2,160	0.2
Average compost applied per stumped coffee tree – if stumped trees (kg/tree)[34]	540	0.3
Share of households that applied compost to all coffee trees (%)	2,160	2.1
Share of households that adopted nutrition practices- if stumped trees (%)	540	12.4

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.
Source: Baseline data collected by C4ED.

In terms of GAP adoption, **erosion control** appears to be a more prevalent practice in Jimma, reported as adopted by nearly half the sample. The methods used are largely restricted to terracing (39%) and mulching (11%). Cover crops, another recommended method, are reportedly used only by 1.2% of the sample, and is the least reported method.

Table 4.3.8. Erosion control practices in households

Variable	N	Mean
Share of households that adopted erosion management practices (%)	2,160	49.2
Households use mulching for erosion control (%)	2,160	10.8
Households use terrace for erosion control (%)	2,160	38.9
Households use barrier for erosion control (%)	2,160	1.6
Households use water traps for erosion control (%)	2,160	4
Households use cover crop for erosion control (%)	2,160	1.2
Households use grass for erosion control (%)	2,160	8.8
Number of erosion control methods used by household	2,160	0.7

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.
Source: Baseline data collected by C4ED.

Weeding is another practice where the overall adoption is low, at around 13% for the sample. This largely stems from the low number of households that reportedly weed their coffee trees twice a year (around 34%).[35] Nonetheless, around 49% of households appear to have no or few weeds under the coffee canopy, and even 77% of households have less than 30 cm tall weeds on their coffee plots.

[34] This is the reported amount of compost applied per stumped tree by the household, as opposed to the section on compost, which is the reported amount of composed produced, which is then divided by the number of stumped trees on the farm.
[35] The number of households that reported not weeding at all are 8 in total (.4% of the sample).

Table 4.3.9. Criteria for the adoption of weeding by households

Variable	N	Mean
Share of households that adopted weeding during a year (%)	2,160	13.4
Share of households that weed coffee at least twice a year (%)	2,160	33.7
Share of households with no or few weeds under coffee canopy (%)	2,160	49
Share of households with coffee field with less than 30cm tall weeds- if weed found under canopy (%)	1,059	77.1

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.
Source: Baseline data collected by C4ED.

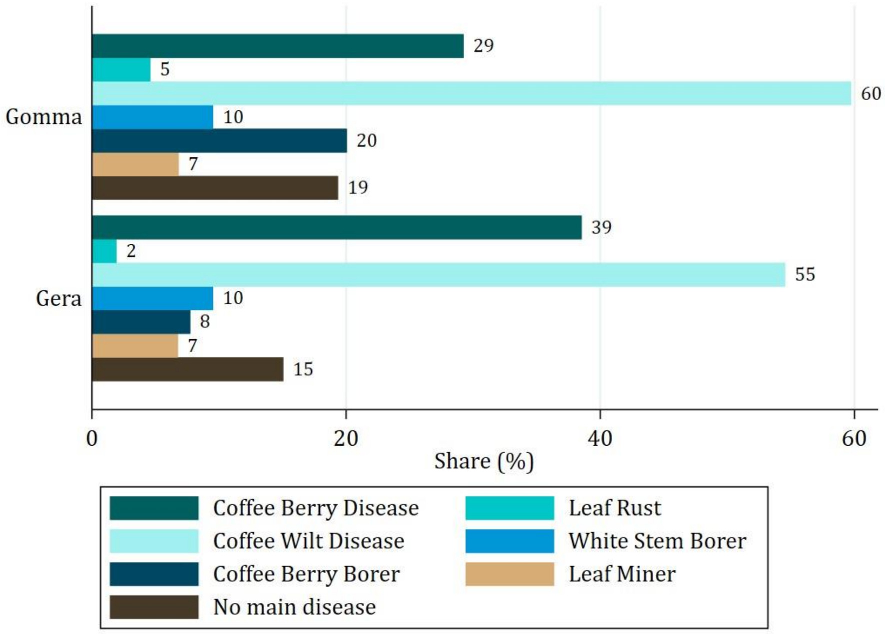


Figure 4.3.3. Most prevalent diseases or pest faced by households
Source: Baseline data collected by C4ED.

Finally, around 82% of the households (1,773 households) reportedly faced threats from one **pest or disease**. Figure 4.3.3 depicts the main diseases and pests reported by the household. Coffee Wilt disease (55% and 60% in Gera and Gomma, respectively) and Coffee Berry Disease (39% and 29% in Gera and Gomma, respectively) are the main reported diseases in the sample, while Leaf Rust is least prevalent. Despite the wide prevalence of these diseases and pests, in total, only 2% households apply adequate measures to reduce the harmful consequences of these pests or diseases.[36] Here, households often reported not knowing what method to use to manage these threats.

Table 4.3.10. Criteria for IPDM adoption

Variable	N	Mean
Share of households that experienced either a disease or pest (%)	2,160	82.1
Share of households that adopted integrated pest management methods (%)	1,773	2
Number of diseases or pests faced by household	1,773	1.5

Notes: The mean presents the sample means and sample proportions when % is shown in the variable name or in the table.

[36] It must be noted that the smaller sample stems from the fact that only households that reported facing pests or diseases were asked about their practices to prevent the same.

Source: Baseline data collected by C4ED.

To understand the reason for the low adoption of good practices, we attempt to establish their correlation with various household characteristics. To do this, we regressed various household characteristics on the best practices to establish whether a negative or positive correlation exists between each of the characteristics. Table 4.3.11 shows the determinants of the practices and the number of GAPs adopted. An orange arrow indicates a negative (and significant) correlation, and a green arrow represents a positive (and significant) correlation, as long as the significance level is below 10%. A missing arrow (a dash) implies that the household characteristic appears to not be significantly correlated with the respective practice. The results show that a higher diversity in household assets (Margalef index)[37] appears to positively (and significantly) correlate with the adoption of many of the best practices. Not surprisingly, a more educated and trained household head also leads to better adoption. However, more well-off farmers (based on asset ownership) are less likely to adopt these best practices. This is indicated by the negative (and significant) correlation between high asset ownership (indicated by the agricultural and household asset index) and the total hectares of land used for coffee production with most of the best practices. The characteristics of the other household members (such as the size of the household or their attending school) do not seem to influence the adoption of best practices. The findings of a similar analysis of the GAP plus criteria are largely consistent.

[37] See Box 5 for additional information about Margalef index.

Table 4.3.11. Determinants of GAP adoption

Characteristics	GAPs								
	Business Skills	Compost	Proper nutrition	Erosion management practices	Rejuvenation	Weeding	Integrated pest management methods	Shaded coffee farming	Number of GAPs adopted
Age of household head	-	-	-	-	-	↓	-	↑	-
Male household head	-	-	-	-	-	-	-	↓	-
Household head is educated	-	-	↑	-	-	-	-	↑	-
Household size	-	↓	-	-	-	↓	-	-	-
Household members attend school	-	-	-	-	-	-	-	-	-
Plot distance in walking minutes	-	-	↓	↑	-	-	-	↑	↑
Total land for coffee (ha)	-	-	↓	↓	↓	↑	↓	↓	↓
Household head or member took agronomy training	-	-	↑	-	↑	-	-	↑	↑
Margalef diversity index – all assets	-	↑	↑	↑	-	-	↑	↓	↑
Agricultural and household asset index	-	-	↓	↓	-	-	↓	↑	-
Observations	2,159	2,159	2,159	2,159	2,159	2,159	1,772	2,159	1,772

Source: C4ED's calculations. Notes: Dashes indicate no significant correlation, above and equal to 10% significance level. Upward green arrows indicate positive correlation and downward orange arrows indicate negative correlation, with anything below 10% significance level indicated through the arrows. A household head is classified as educated if they have completed elementary education or attained a higher level of education, including other / vocational education.

4.4. COFFEE PRODUCTION AND USE

This section compares the production and market characteristics of coffee in Gera and Gomma. Figure 4.4.1 and Figure 4.4.2 provide visual representations of the per-hectare and per-tree productivity distribution, respectively, allowing for an overview of the average harvest.

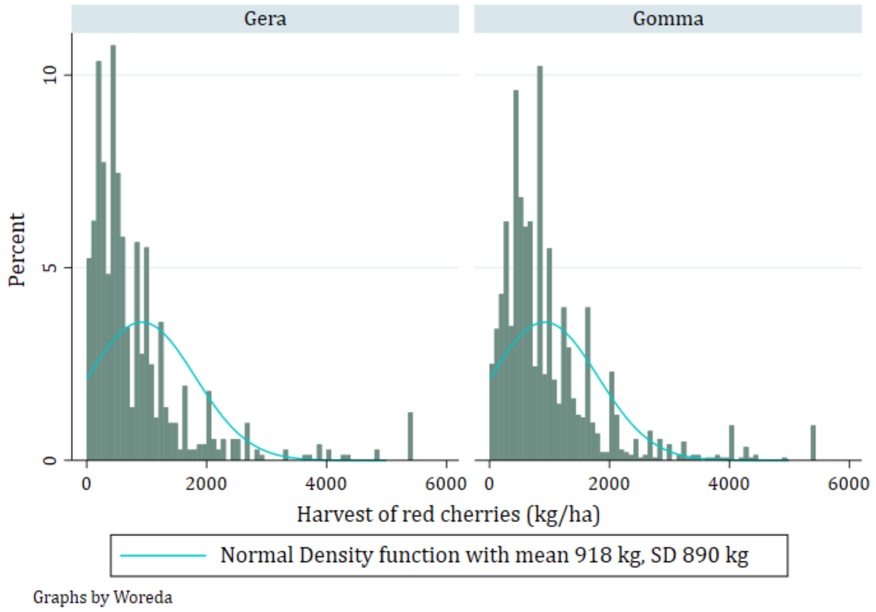


Figure 4.4.1. Distribution of coffee productivity per hectare

Source: Baseline data collected by C4ED.

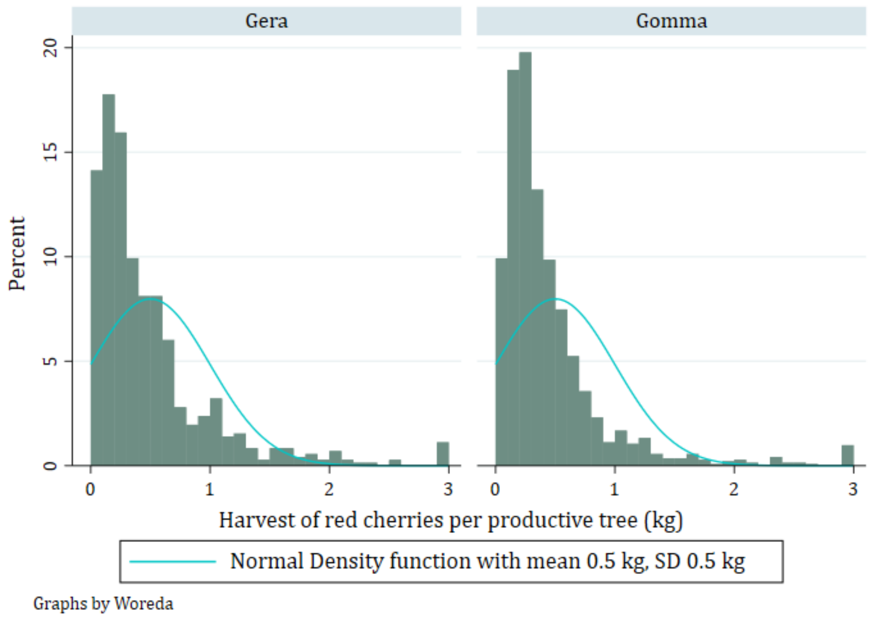


Figure 4.4.2. Distribution of coffee productivity per tree
Source: Baseline data collected by C4ED.

Table 4.4.1 presents the results that compare Gera and Gomma in coffee production. According to the results, the total harvest in Gera is about a third higher than in Gomma, though the difference is not statistically significant because of huge standard deviations (the absolute difference is over 400 kg- higher in Gera). However, the average yield of red cherries is lower in Gera, about 805 kg per hectare, compared to 974 kg per hectare in Gomma, again indicating the more intense cultivation in Gomma. However, when considering the higher absolute number of productive trees per plot in Gera, the total red cherry harvest amounts to about 0.5 kg per productive tree in Gera and 0.4 kg per productive tree in Gomma.[38] Consequently, although farmers in Gomma have more productive plots, this is largely due to the much higher tree density, whereas the per tree productivity is 25% higher in Gera. Farmers in Gera report storing around 250 kgs (21%) of their total harvest, much lower than the 417 kg (50%) reportedly stored by the farmers in Gomma.

Table 4.4.1. Coffee production

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Harvest of red cherries per hectare	974.3	804.7	169.6***	2,160
	(883.6)	(889.6)	(0.00)	
Harvest of red cherries per productive tree (kg)	0.4	0.5	-0.0*	2,146
	(0.5)	(0.5)	(0.05)	
Total harvest of red cherries (kg)	828.1	1235.8	-407.7	2,160
	(4723.6)	(8578.9)	(0.15)	
Total dried/Jenfel in storage (kg): red cherry equivalent	417.0	254.8	162.2***	2,160
	(468.3)	(358.2)	(0.00)	

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

In terms of costs of production, reported in Table 4.4.2, farmers in Gomma appear to incur higher transportation (46 Birr) and coffee processing costs (123 Birr), but lower costs (56 Birr) for other inputs such as fertilizers and manures, than their counterparts in Gera.[39] The higher costs for transport and processing are not surprising, since Gomma has higher overall coffee production. However, it is unclear why their input costs are lower— although this may explain the lower per tree productivity. The overall labor costs (per hectare) - calculated only for the extended questionnaire sample - are lower (by 154 Birr) in Gomma (although not statistically significantly). Looking at the total coffee input costs (except labor), farmers in Gera incur higher costs per hectare than those in Gomma (113 Birr), although these are not statistically significantly different.

Table 4.4.2 Costs in coffee production

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Total transport cost in the last main season (Birr/ha)	171.9	126.1	45.8**	2,160
	(438.2)	(362.2)	(0.02)	
Total coffee processing cost in the last main season (Birr/ha)	434.9	312.0	122.9*	2,160
	(1,764.8)	(1,218.2)	(0.09)	

[38] The median farmer harvest of red cherries is 533 kg and 752 kg in Gera and Gomma, respectively. For both Woredas the median productivity is 0.3 kg per productive tree.
[39] These are costs related to compost, fertilizers and pesticides. At the time of writing this report, the exchange rate from USD to Ethiopian Birr was around 55 Birr.

Total other input cost in last main season (excluding labor) (Birr/ha)	111.5 (585.2)	167.5 (689.5)	-56.0** (0.05)	2,160
Total labor cost in the last main season (Birr/ha) (Extended questionnaire)	1,576.6 (3,932.4)	1,730.9 (3,977.1)	-154.3 (0.72)	388
Total coffee input cost in the last main season - excluding labor (Birr/ha)	718.2 (1,976.6)	605.6 (1,575.7)	112.6 (0.18)	2,160 2,160
Share of households with transport cost in the last main season (%)	23.7 (42.5)	22.0 (41.4)	1.7 (0.37)	2,160
Share of households with processing cost in the last main season (%)	6.4 (24.5)	10.5 (30.7)	-4.1*** (0.00)	2,160
Share of households with input related cost in the last main season (%)	11.5 (31.9)	12.0 (32.5)	-0.5 (0.72)	2,160
Share of households with labor cost in the last main season (Birr/ha) (Extended	19.1 (39.4)	23.5 (42.6)	-4.3 (0.32)	388
Share of households with input cost in the last main season - excluding labor (%	33.8 (47.3)	33.4 (47.2)	0.3 (0.87)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.4.1. Coffee sales and markets

Table 4.4.3 presents the overall sale quantities and the proportion of farmers selling their coffee (red and dried) at different market outlets: CWS, local markets, coffee collection centers, and farm-gate. While average sale quantities are reported over the entire sample, the sales at markets are only shown for those households that report those sales.

At first glance, two conclusions may be drawn: shortly after the harvest, households appear to make most of their sales in red cherries (535 kg) compared to dried cherries (30 kg, or 90 kg in red cherry equivalent), and the majority of the households report sales of red cherries (2,061 households) as opposed to dried cherries/Jenfel (759 households). However, given the stored dried cherries (as reported in Table 4.4.1) Gomma may sell nearly the same amount of dried cherries (including the 417 kgs in storage) as red cherries, while Gera stores about half as much for sales later.

For red cherries, Gera and Gomma are not significantly different from each other in terms of the proportion of households that sell at CWS (14%) and are only marginally different for coffee collection centers (24%). However, the majority of red cherry sales take place in the local markets (over 50%), where 7% more households in Gera sell, compared to Gomma. Gomma households tend to sell red cherries more often at their farm gate (10% more households).

In terms of dried cherries, the majority of the sales take place at the local market (75%) as opposed to other venues. Again, a larger share of households in Gera (by 13%) prefer selling at local markets, compared to Gomma. This difference is driven by the 16% more households in Gomma that sell at their farm gates, as opposed to only 4% of the households in Gera.

In terms of dried or red cherries, a larger share of Gomma households tend to sell at the farm gate, while Gera households prefer the local markets more. The reason for this preference might lie in the higher transportation costs reported by Gomma households. Therefore, to be more competitive or to reduce their costs, they might prefer to sell at the farm gate, instead of the local markets.

Table 4.4.3. Coffee sales and markets

Panel A: Red cherries	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Total red cherries sold (kg)	503.8 (532.9)	597.6 (623.8)	-93.9*** (0.00)	2,160
Share of households that sold red cherries at CWS (%)	15.1 (35.9)	14.6 (35.3)	0.6 (0.73)	2,061
Share of households that sold red cherries at local market (%)	48.8 (50.0)	55.9 (49.7)	-7.1*** (0.00)	2,061
Share of households that sold red cherries at coffee collection center (%)	23.1 (42.1)	26.5 (44.2)	-3.4* (0.09)	2,061
Share of households that sold red cherries at farm gate (%)	12.9 (33.5)	3.1 (17.2)	9.8*** (0.00)	2,061
Panel B: Dried cherries	**(1) Gomma**	**(2) Gera**	**(3) (1)-(2) (p-value)**	**(4) N**
Total dried/Jenfel cherries sold (kg)	38.7 (59.9)	13.8 (39.7)	24.9*** (0.00)	2,160
Share of households that sold dried cherries/Jenfel at CWS (%)	0.6 (7.9)	2.4 (15.5)	-1.8* (0.05)	758
Share of households that sold dried cherries/Jenfel at local market (%)	71.2 (45.3)	84.6 (36.3)	-13.4*** (0.00)	758
Share of households that sold dried cherries/Jenfel at coffee collection center (%)	8.3 (27.7)	8.9 (28.7)	-0.6 (0.83)	758
Share of households that sold dried cherries/Jenfel at farm gate (%)	19.8 (39.9)	4.1 (19.8)	15.8*** (0.00)	758

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Table 4.4.4 presents coffee prices per kg at the different markets, disaggregated by red and dried cherries. For red cherries, the results show that prices are higher by around 3 to 5 Birr/kg in Gera in all markets. While the per kg prices range between 52 to 54 (0.9-1 USD) Birr in Gera, the range in Gomma is between 47 and 49 Birr (0.8-0.9 USD). Over both Woredas, the average price of selling red cherries at CWS is comparable to the average price at local markets, indicating that farmers do not receive a price premium when selling at CWS.

For dried cherries, the prices are reported higher in coffee collection centers for Gomma (by 7 Birr/kg), but similar to red cherries and lower in the local markets (by around 4 Birr/kg).

Table 4.4.4. Coffee prices at various markets

Panel A: Red cherries	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Price of red cherries at CWS (Birr/kg)	48.6 (6.7)	51.6 (9.2)	-3.0*** (0.00)	308
Price of red cherries at local market (Birr/kg)	47.8 (5.3)	52.5 (6.5)	-4.7*** (0.00)	1,055
Price of red cherries at coffee collection center (Birr/kg)	49.2 (5.5)	53.8 (7.2)	-4.6*** (0.00)	499
Price of red cherries at farm gate (Birr/kg)	46.9 (6.5)	52.0 (5.1)	-5.0*** (0.00)	198
Panel B: Dried cherries	**(1) Gomma**	**(2) Gera**	**(3) (1)-(2) (p-**	**(4) N**

			value)	
Price of dried/Jenfel cherries at local market (Birr/kg)	75.4 (12.1)	71.7 (15.4)	3.7*** (0.01)	556
Price of dried/Jenfel cherries at coffee collection center (Birr/kg)	78.2 (10.5)	85.5 (13.9)	-7.3* (0.05)	64
Price of dried/Jenfel cherries at farm gate (Birr/kg)	75.5 (11.5)	75.0 (16.6)	0.5 (0.93)	131

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.4.2. Coffee income

Table 4.4.5 presents the normalized (by hectare) total coffee income, as well as disaggregated value of sales from red cherries and dried/Jenfel cherries. Overall, coffee income per hectare is much higher in Gomma than in Gera. Gomma has higher sales of dried/Jenfel cherries. These are also reflected in the value of sales: while farmers in Gera earn, on average, about 34,600 Birr (629.1 USD) from red cherries, their counterparts in Gomma generate about 41,300 Birr (750.9 USD) per hectare. In contrast, farmers in Gomma, on average, earn about 6,600 Birr (120 USD) from dried/Jenfel coffee (sold and stored) but their counterparts in Gera earn only about 1,500 Birr (27.3 USD) per hectare. Notably, in both Woredas farmers state high levels of stored dried/Jenfel cherries.[40] Overall, **farmers in Gomma Woreda earn about 31,200 Birr (567.3 USD) more from coffee per hectare than those in Gera.**

Table 4.4.5. Coffee income and value from sales from the 2022 coffee harvest season

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Total sales value of red cherries (Birr/ha)	41,306.6 (38,155.2)	34,556.4 (36,090.0)	6,750.2*** (0.00)	2,160
Total sales value of dried/Jenfel cherries (Birr/ha)	6,569.4 (10,858.2)	1,472.3 (5,431.0)	5,097.1*** (0.00)	2,160
Estimated sales value of stored dried/Jenfel cherries (Birr/ha)	32,176.6 (34,320.7)	13,009.6 (19,322.6)	19,167.0*** (0.00)	2,160
Total income from coffee (Birr/ha)	80,744.8 (61,811.6)	49,527.7 (48,419.5	31,217.1***(0.00)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.5. BEEKEEPING

This section presents the beekeeping activities in Gera and Gomma. As illustrated in Figure 4.5.1, the average number of hives over the full sample of households in Gera is 7, contrasting with about 1 hive in Gomma. Households in Gera have, on average, a higher count of traditional hives (6)

[40] To estimate the sales value of stored dried/Jenfel cherries we use the market prices provided by the household and impute with the median price if no value is available. The sales value for stored cherries is important since the “season” was not over by the time the baseline took place. Therefore, the sales value for future sales (which take place as and when households need money or when they find better prices) are included into total income from coffee for the last production season.

compared to Gomma (1). The number of modern and transitional hives are also higher in Gera (0.6 and 0.1, respectively) than in Gomma (0.3 and 0, respectively).

Figure 4.5.1. Number of hives owned in Gera and Gomma (Full Sample)
Source: Baseline data collected by C4ED.

Table 4.5.1 shows beekeeping activities in Gera and Gomma.[41] As with many of the previously discussed characteristics, the two Woredas look dissimilar in their beekeeping activities. For example, around 51% of households in Gera have some beekeeping experience but only about 35% of their counterparts in Gomma report the same. Compared to their experience, the numbers in terms of engagement in beekeeping declined in both Woredas (15% in Gomma and 40% in Gera). Moreover, a larger percentage (approximately 13%) of farmers that affirm to be interested or currently practice beekeeping in Gera have also received some training in beekeeping, whereas this figure drops to about 3% in Gomma. In terms of hive ownership, for households that engage in beekeeping (627 households), households in Gera own significantly more hives (by 10) than the households in Gomma, driven mostly by the higher number of traditional hives in Gera versus Gomma (15 versus 4 hives, respectively). However, there's no statistical difference between the two Woredas regarding the average number of transitional and modern hives.

Table 4.5.1. Beekeeping Profile

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of households that have some beekeeping experience (%)	34.6 (47.6)	50.8 (50.0)	-16.3*** (0.00)	2,159
Share of households that harvested any honey in the last 12 months (%)	15.2 (35.9)	40.1 (49.0)	-24.9*** (0.00)	2,159
Share of interested households that received training (%)[42]	2.7 (16.1)	12.6 (33.2)	-9.9*** (0.00)	1,830

[41] One household reported more than 2,000 hives, the observation is dropped for the remainder of this section.
[42] Asked only to those households that said they were interested or engaged in beekeeping.

Average number of hives owned by the households engaged in beekeeping (12 months)	5.5 (5.4)	15.2 (20.5)	-9.7*** (0.00)	627
Average number of traditional hives owned by the household engaged in beekeeping (12 months)- owning traditional hives	3.9 (3.6)	15.0 (20.8)	-11.1*** (0.00)	492
Average number of transitional hives owned by the household engaged in beekeeping (12 months)- owning transitional hives	1.2 (1.3)	5.6 (13.3)	-4.4 (0.23)	33
Average number of modern hives owned by the household engaged in beekeeping (12 months)- owning modern hives	3.5 (3.9)	4.0 (4.0)	-0.6 (0.29)	225

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Given the larger number of hives in Gera, other beekeeping-related indicators are also vastly different between the two Woredas. As can be seen in Table 4.5.2, for households that reported honey harvesting, honey production per beekeeping household is five times higher in Gera (by 69 kg). Similarly, the total cost of beekeeping is also higher in Gera (by 1440 Birr or 26 USD). Honey productivity depends on the type of hive used. Households in Gera produce about 5 kg of honey from traditional hives, compared to approximately 4 kg in Gomma, implying a greater hive productivity. This productivity gap persists in the case of modern hives, where households in Gera produce about 11 kg per modern hive, and those in Gomma only produce about 6 kg. Similarly, with transitional hives, households in Gera harvest about 11 kg, and their counterparts in Gomma harvest only about 6 kg per hive. The very few observations in the case of transitional hives imply that the statistically significant difference in production in this case are purely a statistical coincidence.

Table 4.5.2. Honey production and beekeeping cost

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Total honey production in last main season (kg)	15.9 (23.9)	78.7 (123.0)	-62.8*** (0.00)	627
Honey production per traditional hive (kg)	3.7 (6.5)	5.4 (4.8)	-1.6*** (0.00)	471
Honey production per transitional hive (kg)	5.7 (4.3)	11.1 (8.0)	-5.4* (0.06)	28
Honey production modern per hive (kg)	6.0 (5.8)	11.2 (15.3)	-5.2*** (0.00)	210
Total beekeeping cost (Birr)	1,548.5 (2,598.0)	2,989.0 (3,044.6)	-1,440.5*** (0.00)	370

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Figure 4.5.2 presents the primary constraints to beekeeping that are encountered by households that confirmed to be owning hives in the last production cycle. The top three constraints prevalent in both Woredas are the migration of bees, the death of bees caused by agrochemicals, and the prevalence of pests and diseases. Lack of training or shortage of bee colonies are not noted as the first constraints, which may imply that even if the households are trained in beekeeping and are given the hives, the main issues preventing them from profiting from beekeeping may persist and make this a less attractive alternative over time.

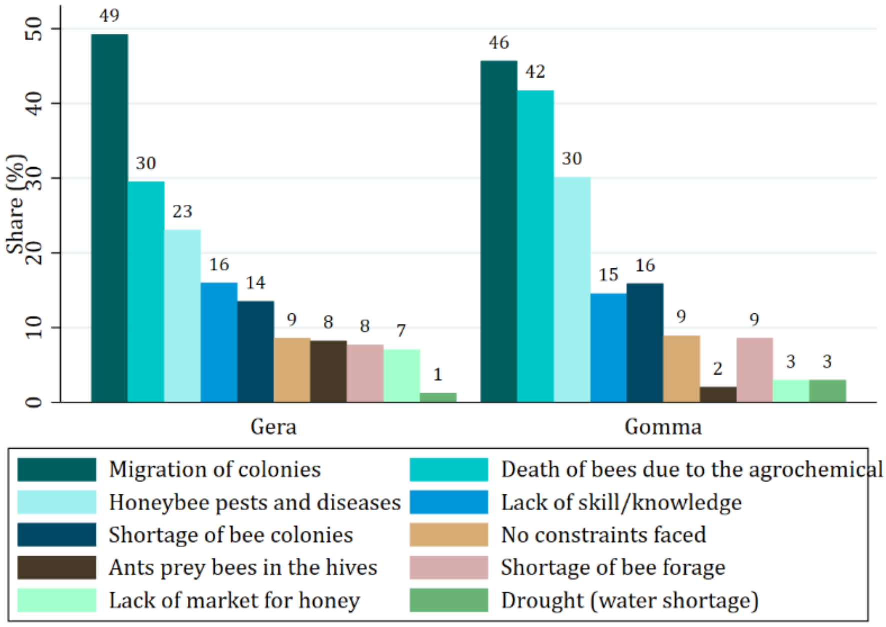


Figure 4.5.2. Constraints faced during beekeeping activities
Source: Baseline data collected by C4ED.

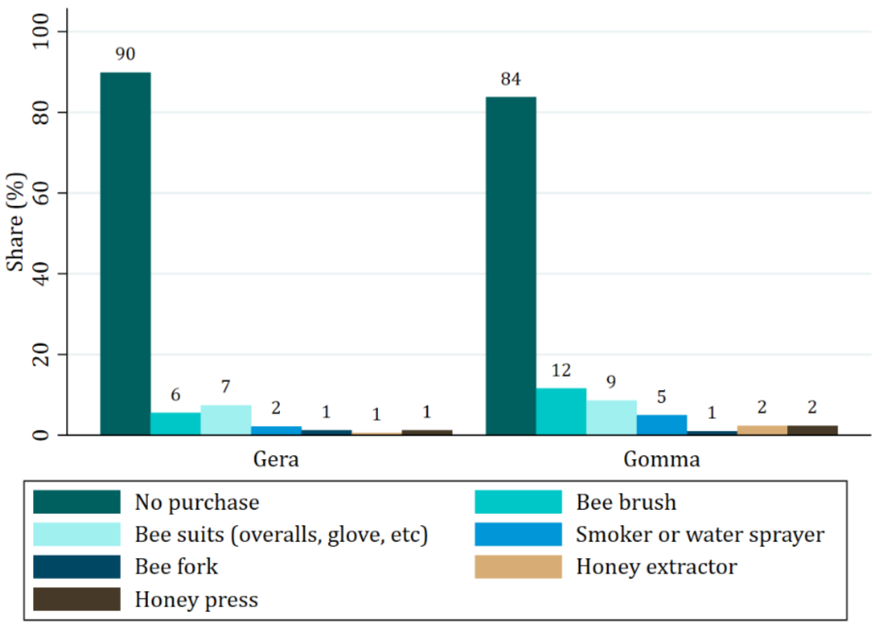


Figure 4.5.3. Tools purchased in the main production season (2022)
Source: Baseline data collected by C4ED.

Figure 4.5.3 presents the share of households that purchased various equipment needed for beekeeping. While over 80% of the households have done no additional purchases, the two most purchased equipment in both Woredas are bee brushes and bee suits (or other protective equipment).

The two Woredas also differ in honey consumption and sales, with Gera consistently outperforming Gomma. As illustrated in Table 4.5.3, a larger percentage of households in Gera (40%) harvested any honey compared to Gomma (15%). Additionally, 29% of households in Gera sold honey, whereas only 5% did so in Gomma. Farmers in Gera sold approximately 83 kg of processed and 86 kg of unprocessed honey per the last main production season, whereas those in Gomma sold only about 32 kg of processed and 22 kg of unprocessed honey.[43]

Interestingly, for processed honey, households in Gera received lower prices for their honey compared to Gomma. While Gera sold a kilo at about 146 Birr (approximately 2.4 USD), Gomma sold theirs at about 217 Birr (around 3.9 USD). This price disparity might be due to the difference in the quantity produced and sold, an aspect that needs to be further explored in the endline study. For unprocessed honey, the difference is not statistically significant.

Lastly, **households in Gera earn more from honey (on average 13,000 Birr (236 USD)) than their counterparts in Gomma, who earn around 5,200 Birr (90 USD), with consideration given only to households that have actually sold honey.** These include processed and unprocessed honey sales.

Table 4.5.3. Honey use and income

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of households that harvested any honey (%)	15.2 (35.9)	40.1 (49.0)	-24.9*** (0.00)	2,159[44]
Share of households that sold any honey (%)	4.7 (21.3)	29.0 (45.4)	-24.3*** (0.00)	2,159
Share of beekeeping households that sold any honey (%)	22.5 (41.8)	64.6 (47.9)	-42.1*** (0.00)	627
Total amount of processed honey sold during the main season (kg)	29.8 (31.7)	82.7 (96.9)	-52.9*** (0.00)	116
Total amount of unprocessed honey sold during the main season (kg)	13.7 (22.0)	86.3 (99.5)	-72.6*** (0.00)	188
Average price for unprocessed honey (Birr/kg)	126.3 (106.8)	135.9 (42.2)	-9.6 (0.39)	188
Average price for processed honey (Birr/kg)	217.4 (71.1)	146.0 (50.1)	71.4*** (0.00)	116
Total income from beekeeping (Birr)	5,254.5 (8,832.3)	13,048.3 (17,502.5)	-7,793.7*** (0.00)	296
Total income from beekeeping (Birr): full sample	307.6 (2,457.2)	3,820.8 (11,167.2)	-3,513.2*** (0.00)	2,159

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

[43] Note that some households may buy honey from other households and process and sell it together with their own production and this could be why we have larger amount in processed and sold than in total production.
[44] One outlier dropped from this sample.

For households that have an interest to engage in (or continue to practice) beekeeping,

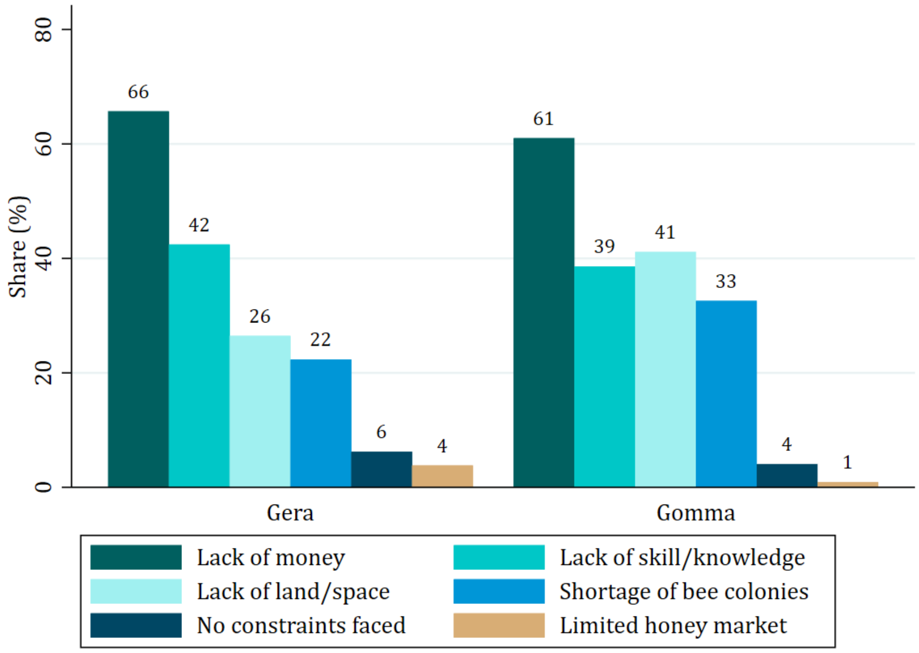


Figure 4.5.2 presents the primary constraints households perceive. The top three constraints that prevent households from engaging in beekeeping (or they report while involved in beekeeping) include a lack of financial resources, insufficient skills, and limited access to land.

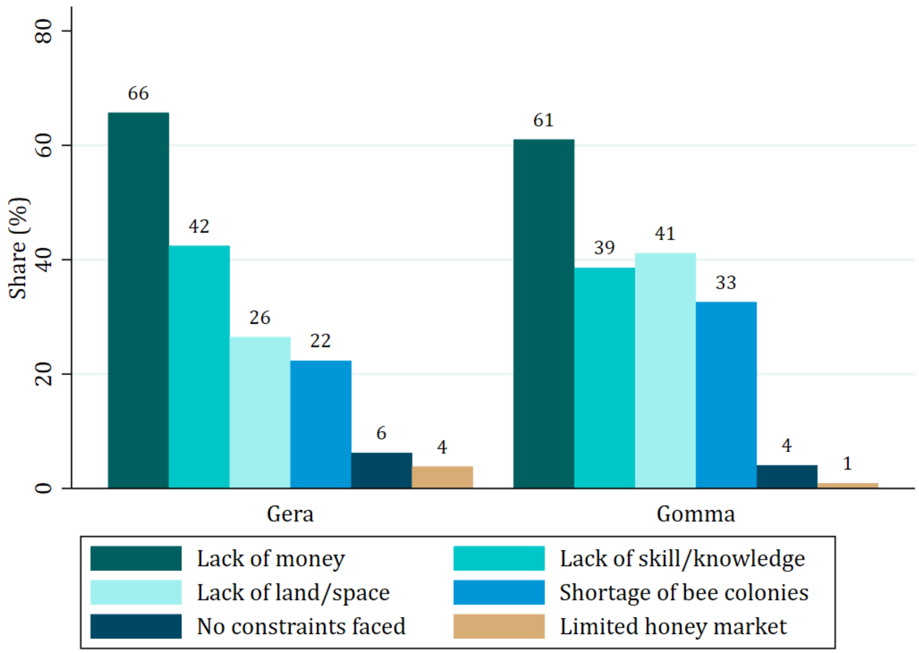


Figure 4.5.4. Main constraints preventing households from engaging in beekeeping
Source: Baseline data collected by C4ED.

4.6. OTHER LIVELIHOOD ACTIVITIES AND INCOME

This section presents statistics on alternative income sources of farmers in the baseline survey. Income from crops – other than coffee, ownership of livestock and non-farm activities are discussed. The section closes with an overview of the total income including all previous categories.

4.6.1. Crop income and productivity

As illustrated in Figure 4.6.1, farmers in Gera and Gomma cultivate a variety of crops, including maize (63% in Gera and 61% in Gomma), teff (45% in Gera and 12% in Gomma), chat (21% in Gera and 32% in Gomma), and wheat (13% in Gera and 3% in Gomma).

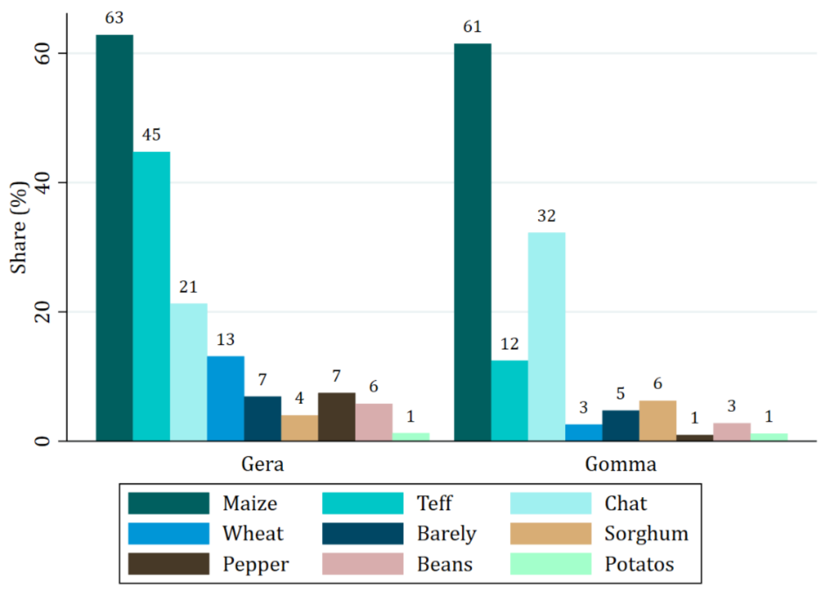


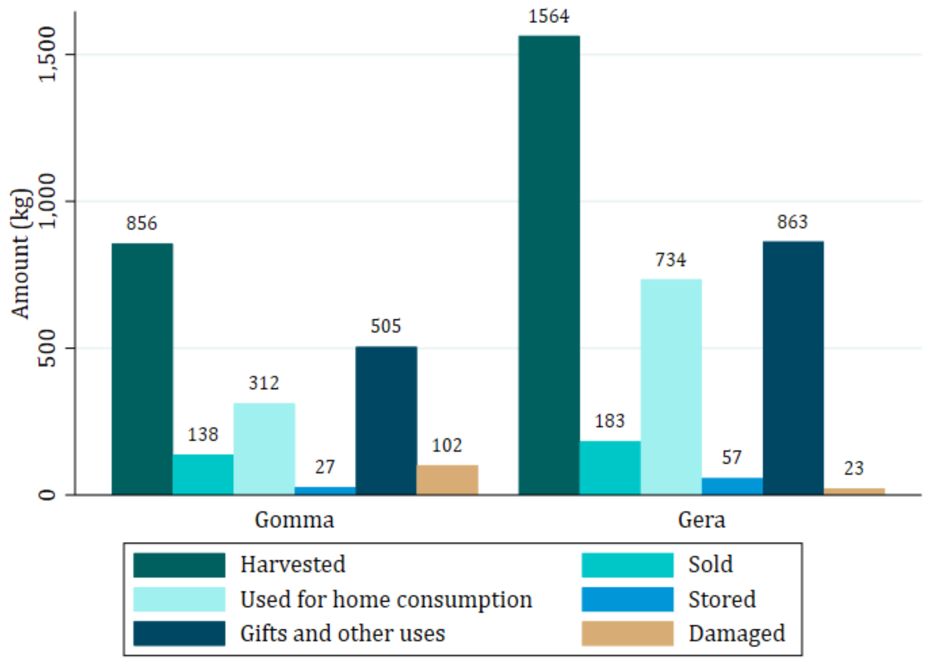
Figure 4.6.1. Types of crops grown by farmers in Gera and Gomma
Source: Baseline data collected by C4ED.

Figure 4.6.2 and Figure 4.6.3 present crop production, value, and utilization in the two Woredas. This section was mostly asked as part of the extended income questionnaire, administered to a smaller sample of 388 households only. The average harvest of crops other than coffee is reported to be 605 kg per main season in Gera and 391 kg per main season in Gomma, when considering the shorter questionnaire. However, in the extended questionnaire, households in Gera harvested 1,564 kg of other crops, while those in Gomma reported a harvest of 856 kg. This difference may purely be due to the design of the questionnaire, since the shorter version only asks for the top three crops, and only for the last production season compared to all crops in the last year in the extended version.[45] On the higher harvest in Gera, it must be noted that, on average, plot sizes are also larger in Gera, implying that Gera does not necessarily have a higher yield. Given the higher harvests in Gera, the total value of sales from crops is also higher, at 7,820 Birr (142 USD), compared to 4,389 Birr in Gomma (79 USD). For the shorter questionnaire, the value of sales from crops is 1,504 Birr in Gera (27 USD) and 1,574 Birr in Gomma (29 USD). On average, households in Gera sold 183 kg of crops and those in Gomma sold 138 kg. In both Woredas, a substantial portion of the crops (36% and 47% in Gomma and Gera, respectively) are allocated for either home

[45] Moreover, the extended questionnaire asked many more question on the sale, own consumption, storage, and other uses of the crop. Details on the costs related to crop production were also only asked in the extended questionnaire.

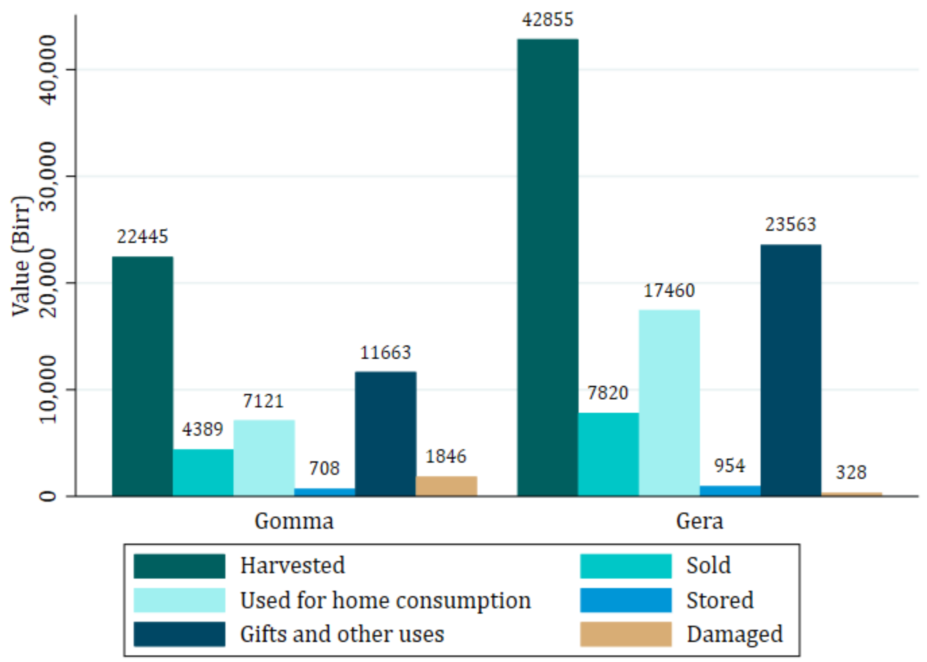
consumption or storage, nearly three times of the amount that is sold in the case of Gera (and double in Gomma).

Figure 4.6.2 Crop production and uses (Extended questionnaire)



Source: Baseline data collected by C4ED.

Figure 4.6.3 Crop production and uses, valued at market rates (Extended questionnaire)



Source: Baseline data collected by C4ED.

Table 4.6.1 shows the reported costs involved in crop production besides coffee. The biggest cost for crops is fertilizer and pesticides, where households in Gera spend 7,340 Birr (130 USD) and those in Gomma spend 2,857 Birr (25 USD), in line with the higher crop production in the former.[46] However, the costs for hired labor is not statistically different between the two Woredas (despite the difference in production). In total, the average crop production-related costs are 11,066 Birr (201 USD) in Gera and 5,418 Birr in Gomma (99 USD), where the per kg costs are much higher in Gera (182 Birr per kg of crops) compared to Gomma (14 Birr per kg). This appears to be another big difference in costs between the two regions.

Table 4.6.1. Crop production costs (Long Questionnaire)

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Cost of seeds/seedlings for crops (Birr) (Extended)	1,612.3 (4,183.6)	2,640.3 (4,867.4)	-1,028.1* (0.05)	318
Cost spent on fertilizers and pesticides for crops (Birr) (Extended)	2,857.4 (44,68.1)	7,339.4 (18,253.7)	-4,482.0*** (0.00)	318
Cost spent on labor for crops (Birr) (Extended)	934.1 (2,579.8)	1,086.5 (2,338.9)	-152.3 (0.61)	318
Other crop production costs (Birr) (Extended)	14.1 (152.9)	0.0 (0.0)	14.1 (0.35)	318
Total input cost of production for crops, other than coffee (Birr) (Extended)	5,417.9 (8,559.6)	11,066.2 (20,352.6)	-5,648.3*** (0.00)	318

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.6.2. Livestock income and ownership

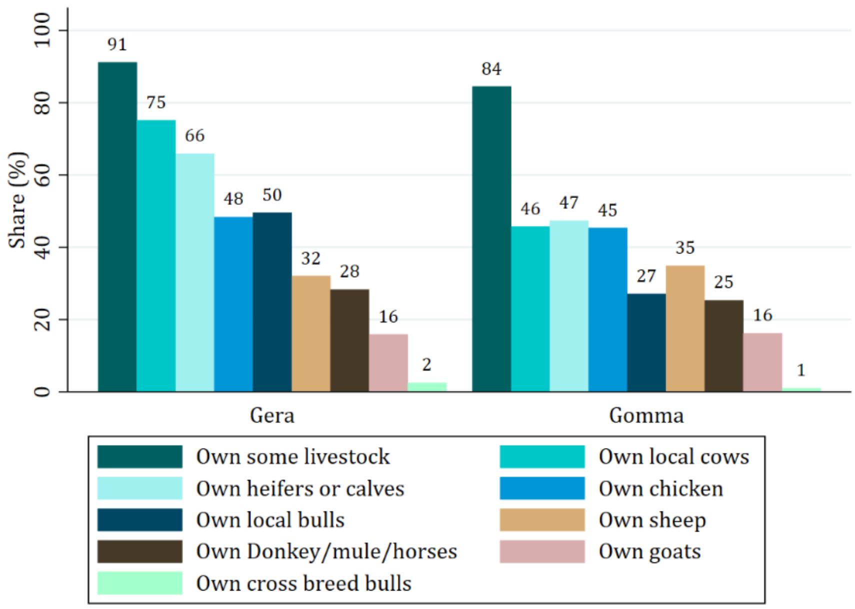


Figure 4.6.4. Share of households that own various livestock
Source: Baseline data collected by C4ED.

[46] Note that some crops might be intercropped with coffee so fertilization, pesticides costs might be shared, and this might be doubling some of the costs from the coffee section.

Figure 4.6.4 shows that 91% of households in Gera and 84% in Gomma own some kind of livestock. The top three livestock that are owned by households are local cows, heifers and/or calves, and local bulls in Gera and chicken in Gomma.

Table 4.6.2 presents the average livestock ownership of the sampled farmers. The two Woredas differ significantly in various livestock ownership indicators, except for the number of goats and sheep. In Gera, households, on average, own 1.8 chickens, 0.4 donkeys, mules, and/or horses, 1 local breed bull and/or oxen, nearly no cross-bred bulls and/or oxen, 1.8 local breed cows and/or steers, and 1.5 heifers and/or calves. This amounts to approximately 3 tropical livestock units (TLU) per household in Gera. Households in Gomma generally owned fewer units of each animal group than their counterparts in Gera. Households in Gomma owned, on average, 1.5 chickens, 0.3 donkeys, mules and/or horses, 0.4 local breed bulls and/or oxen, nearly no cross-bred bulls and/or oxen, 0.8 local breed cows and/steers, and 0.8 heifers, and/or calves. This translates to approximately 1.5 TLU per household in Gomma. Therefore, in terms of livestock ownership, households in Gera are much more well-off.

Table 4.6.2. Livestock ownership by households

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Number of chickens owned	1.5 (2.4)	1.8 (2.6)	-0.3** (0.01)	2,160
Number of goats owned	0.4 (1.0)	0.4 (1.2)	-0.0 (0.51)	2,160
Number of sheep owned	0.9 (1.6)	0.8 (1.4)	0.1 (0.22)	2,160
Number of donkeys, mules and/or horses owned	0.3 (0.5)	0.4 (0.7)	-0.1*** (0.00)	2,160
Number of local breed bulls and/or oxen owned	0.4 (0.7)	1.0 (1.3)	-0.6*** (0.00)	2,160
Number of cross breed bulls and/or oxen owned	0.0 (0.2)	0.0 (0.2)	-0.0* (0.09)	2,160
Number of local breed cows and/steers owned	0.8 (1.1)	1.8 (1.9)	-1.0*** (0.00)	2,160
Number of heifers, and/or calves owned	0.8 (1.1)	1.5 (1.7)	-0.7*** (0.00)	2,160
Total livestock owned (TLU)	1.6 (1.8)	3.1 (3.0)	-1.6*** (0.00)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Figure 4.6.5 presents the combination of the three mostly owned livestock: local cows, heifers and calves, and chicken. According to the graph, the combination most frequently owned by households is local cows, heifers and calves, reported by 62% of households in Gera and 37% in Gomma. Additionally, the share of households owning all three of the most common livestock is 34% in Gera and 21% in Gomma.

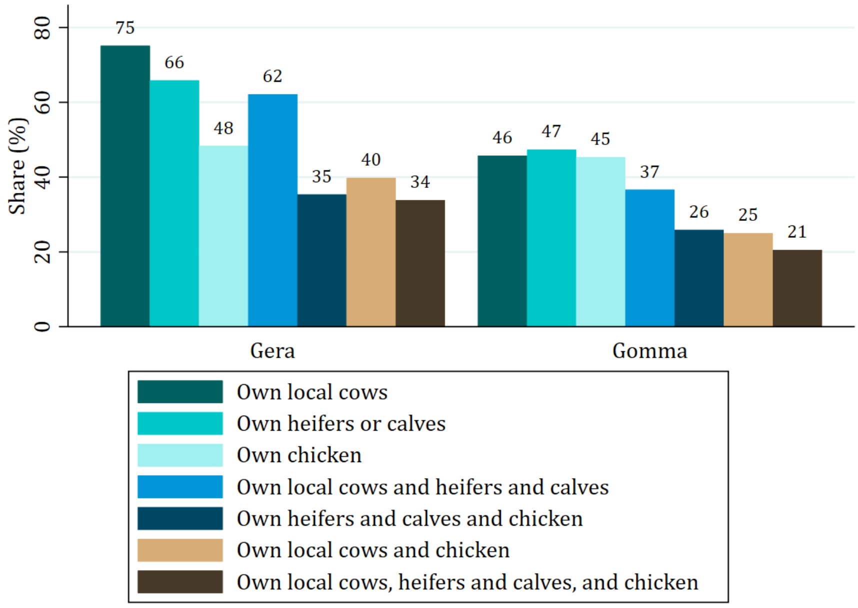


Figure 4.6.5. Combinations of top three types of livestock
Source: Baseline data collected by C4ED.

Based on data from the extended income questionnaire subset, Table 4.6.3 presents the income from livestock and livestock products in the past 12 months. Despite the higher number of TLU in Gera, they only have marginally (but not statistically significantly) higher livestock related costs. Consequently, households in Gera earn a much higher total income from livestock than their counterparts in Gomma: on average, households in Gera generate about 5,961 Birr (108 USD) and those in Gomma only generate 1,900 Birr (35 USD). Additionally, the value of sales of livestock products are also nearly four times higher in Gomma (by 590 Birr or 11 USD). Considering the higher livestock income in Gera, their share of livestock income in overall income (excluding coffee) is also higher (41%) than Gomma (28%).

Table 4.6.3. Income from livestock and livestock products (Extended income Questionnaire)

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Total income from livestock, including own consumption (Birr) (Extended)	2,179.0 (5210.5)	6,056.0 (11197.8)	-3,877.0*** (0.00)	388
Total sales value of livestock sales (Birr) (Extended)	1,714.5 (4,943.7)	5,196.6 (10,521.2)	-3,482.1*** (0.00)	388
Total sales value of livestock product sales (Birr) (Extended)	227.5 (750.4)	819.8 (1,744.3)	-592.3*** (0.00)	331
Estimated value of consumption of livestock products (Birr) (Extended)	279.7 (1,256.1)	95.5 (321.7)	184.2* (0.10)	388
Costs included in livestock production (Birr) (Extended)	1,064.4 (1,649.9)	1,292.2 (2,502.0)	-227.8 (0.28)	388
Total income from livestock, excluding own consumption (Birr) (Extended)	1,899.3 (5,090.7)	5,960.5 (11,164.3)	-4,061.2*** (0.00)	388
Share of livestock income from total household income excl. coffee (Extended) (%)	28.4 (41.5)	40.8 (43.0)	-12.3** (0.02)	279

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column

(3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.6.3. Non-farm income

The survey also collected data on households' participation in non-farm income-generating activities in the past 12 months. Based on the results presented in Table 4.6.4, 15% of households in Gera and 11% in Gomma reported that at least one member of the household participated in salary or wage employment in the past 12 months. Households obtained 2,446 Birr (44 USD) from salary and wage employment in Gera and 1,526 Birr (28 USD) in Gomma. Conversely, a higher percentage of households in Gomma operated businesses in the last 12 months, with a reported 17% as compared to 12% in Gera. However, households in both Woredas earn comparable profits from operating non-farm businesses (2,669 Birr (48 USD) in Gera and 2,319 Birr (42 USD) in Gomma) and total income from non-farm activities (5,917 Birr in Gera (108 USD) and 6,084 Birr (110 USD) in Gomma).

Table 4.6.4. Participation and income from non-farm economic activities

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of households with member salary or wage employed in last 12 months (%)	11.2 (31.6)	14.5 (35.2)	-3.3** (0.03)	2,160
Share of households that operated business in last 12 months (%)	16.6 (37.3)	12.3 (32.9)	4.4*** (0.01)	2,160
Income earned from salary or wage employment (Birr)	13,781.8 (13,081.7)	16,865.3 (14,339.9)	-3,083.5* (0.07)	264
Income earned from salary or wage employment (Birr) (Full Sample)	1,526.0 (6,128.4)	2,445.9 (8,055.9)	-920.0*** (0.00)	2,160
Profit earned from operating non-farm business (Birr)	14,110.9 (14,622.7)	20,898.3 (35,532.0)	-6,787.4** (0.02)	325
Profit earned from operating non-farm business (Birr) (Full Sample)	2,319.1 (7,898.2)	2,569.0 (14,171.1)	-249.9 (0.60)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.6.4. Total Income

Figure 4.6.6 summarizes the total household income by the two Woredas (including income from coffee and beekeeping[47]). Coffee plays an important role as an income source in both Woredas.

[47] Since the income from livestock was only collected in the extended questionnaire, this category is excluded from the total income value.

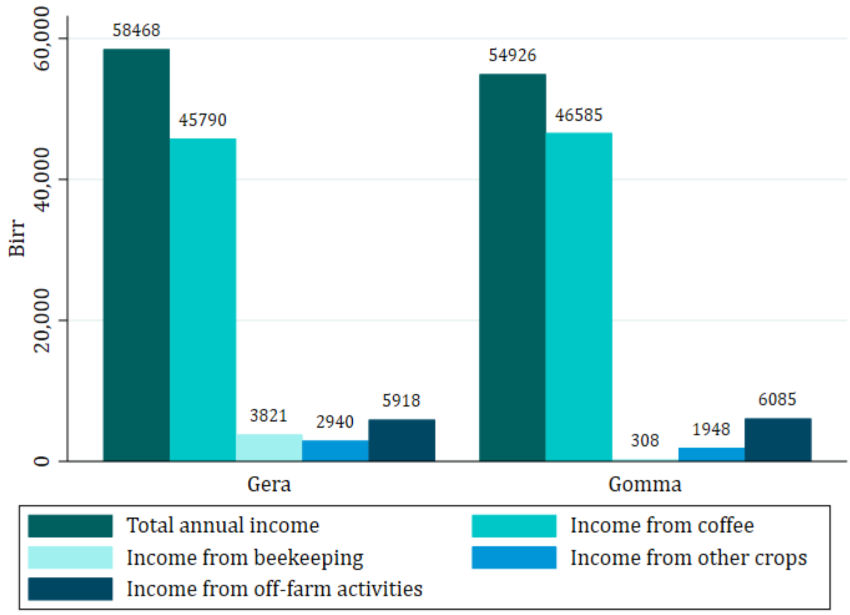
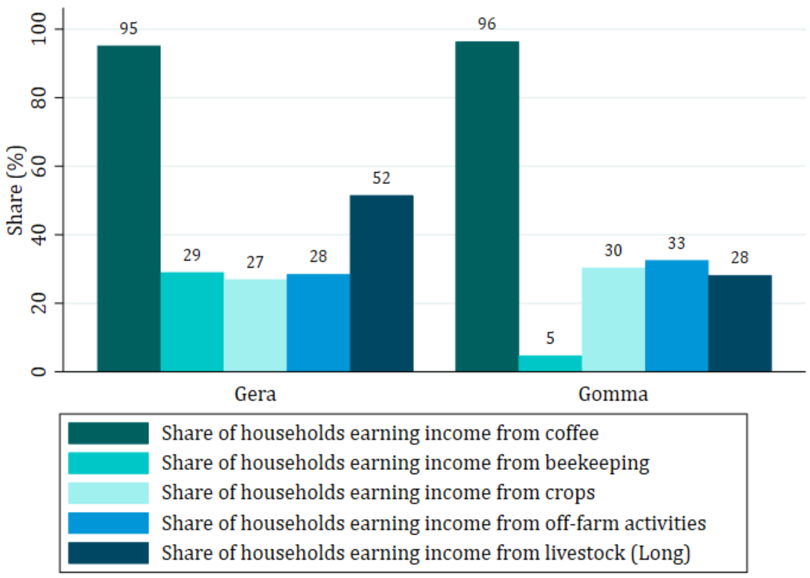


Figure 4.6.6. Distribution of total annual household income by Woreda
Source: Baseline data collected by C4ED.

The total annual income is about 58,468 Birr (1063 USD) in Gera and 54,926 Birr (999 USD) in Gomma. Dividing these numbers gives us a daily nominal income of about 2.9 USD in Gera and 2.7 USD in Gomma. In terms of purchasing power parity (PPP), using the latest (2022) PPP rates from The World Bank (19.18), households in Gera earn a daily income of 7.78 USD and those in Gomma earn a daily income in PPP of 7.84 USD.[48]

Figure 4.6.7. Share of households generating income from various income sources



Source: Baseline data collected by C4ED

Comparing the sources of income, according to Figure 4.6.7, a large share of households generate income from coffee in both Woredas (95% in Gera and 96% in Gomma). In Gera, about 29% of

[48] https://data.worldbank.org/indicator/PA.NUS.PRVT.PP?locations=ET

households generate income from beekeeping but the share of households that generate income from beekeeping in Gomma is only 5%. The share of households in Gomma that generate income from off-farm activities and crop production is also higher than Gera at 33% and 30%, respectively (as opposed to 28% and 27%, respectively).

4.7. ASSETS AND HOUSING

Table 4.7.1 illustrates the distribution of household (productive) assets in Gera and Gomma. In Gera, households tend to own more pickaxes, ploughs, spades, and chemical sprayers compared to those in Gomma. Conversely, ownership of axes, hoes, pruning saws, and pruning scissors is higher in Gomma than in Gera. The ownership of wheelbarrows shows no significant difference between the two areas.

The most commonly owned farm assets in both Gera and Gomma are axes (88% vs. 93%), hoes (70% vs. 75%), and ploughs (67% vs. 46%). Notably, the ownership of assets crucial for rejuvenation purposes is relatively low in both regions. For instance, 21% of households in Gera and 32% in Gomma own pruning saws, whereas ownership of pruning scissors is substantially lower, with only 3% in Gera and 6% in Gomma. Moreover, wheelbarrow ownership is limited, with only 1% of households possessing them in both areas. Given the low ownership of these assets, these may indeed serve as a valid incentive for stumping.

Table 4.7.1. Share of households that own various farm assets

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of households that own axes (%)	92.8 (25.8)	88.1 (32.4)	4.7*** (0.00)	2,160
Share of households that own hoes (%)	74.9 (43.4)	69.8 (46.0)	5.2** (0.01)	2,160
Share of households that own pickaxes (%)	9.0 (28.6)	13.7 (34.4)	-4.7*** (0.00)	2,160
Share of households that own ploughs (%)	46.4 (49.9)	66.6 (47.2)	-20.1*** (0.00)	2,160
Share of households that own spades (%)	34.8 (47.7)	45.2 (49.8)	-10.3*** (0.00)	2,160
Share of households that own sprayers (%)	10.4 (30.6)	18.6 (39.0)	-8.2*** (0.00)	2,160
Share of households that own pruning saws (%)	32.1 (46.7)	20.6 (40.5)	11.5*** (0.00)	2,160
Share of households that own pruning scissors (%)	5.7 (23.2)	2.9 (16.8)	2.8*** (0.00)	2,160
Share of households that own wheelbarrow (%)	1.3 (11.4)	1.1 (10.5)	0.2 (0.67)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

The data from Table 4.7.2 shows differences in non-farm assets between households in Gera and Gomma. In Gera, a larger share of households owns improved stoves, traditional blankets (gabi), electric fans, and mobile phones compared to households in Gomma. The reverse is true regarding the proportion of modern beds, sofa couches, modern chairs and tables, radios, televisions, refrigerators, and motorbikes, where the share of ownership is higher in Gomma compared to Gera. Considering the higher ownership of larger assets (bikes, televisions, refrigerators, sofas and couches), Gomma appears to be more well-off than Gera.

Table 4.7.2. Share of households that own various household assets

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of households that own improved stoves (%)	6.5 (24.6)	11.9 (32.4)	-5.4*** (0.00)	2,160
Share of households that own kerosene stoves (%)	0.8 (8.7)	0.6 (7.4)	0.2 (0.57)	2,160
Share of households that own modern beds (%)	73.1 (44.3)	65.2 (47.7)	7.9*** (0.00)	2,160
Share of households that own sofa couches (%)	13.0 (33.6)	4.1 (19.9)	8.8*** (0.00)	2,160
Share of households that own gabi/blankets (%)	85.2 (35.6)	91.9 (27.4)	-6.7*** (0.00)	2,160
Share of households that own modern chairs (%)	28.4 (45.1)	15.2 (35.9)	13.2*** (0.00)	2,160
Share of households that own modern tables (%)	20.8 (40.6)	13.1 (33.8)	7.7*** (0.00)	2,160
Share of households that own radios (%)	50.9 (50.0)	37.3 (48.4)	13.6*** (0.00)	2,160
Share of households that own televisions (%)	25.6 (43.6)	19.3 (39.5)	6.2*** (0.00)	2,160
Share of households that own refrigerators (%)	2.9 (16.9)	1.1 (10.5)	1.8*** (0.01)	2,160
Share of households that own electric fans (%)	0.7 (8.3)	2.6 (16.0)	-1.9*** (0.00)	2,160
Share of households that own mobile phones (%)	85.8 (34.9)	91.3 (28.2)	-5.5*** (0.00)	2,160
Share of households that own bicycles (%)	1.7 (13.1)	1.2 (11.1)	0.5 (0.38)	2,160
Share of households that own motorbikes (%)	10.6 (30.8)	6.4 (24.4)	4.2*** (0.00)	2,160
Share of households that own car or trucks (%)	1.0 (10.2)	0.4 (6.4)	0.6 (0.13)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * $p \leq 0.1$, ** $p \leq 0.05$, *** $p \leq 0.01$.
Source: Baseline data collected by C4ED.

Based on the extensive list of farm and non-farm assets owned by households, we generated aggregated indicators on the type of assets owned by households, the number of asset categories owned, and asset diversity using the Margalef richness/diversity index. The explanation and methodology of the Margalef richness/diversity index are detailed Box 3. Additionally, we created asset indices using factor analysis and principal component factors. Both methods enable the researchers to descriptively characterize and compare the diversity of the population by constructing a proxy for the farmer's wealth. The outcomes outlined in Table 4.7.3 show that the study Woredas do not differ across many of the asset-based indicators.

Box 3: Margalef richness index

The index is often used to measure biodiversity richness (Margalef, 1958). We used this concept to measure the asset diversity of smallholder farmers. The index (d) is calculated at the household level using the following formula:

$$d = (S\text{-}1)/\log(N),$$

where S is the number of species (type of assets), and N is the total number of individuals (units) in the sample (sample size) (Gamito, 2010).

The average farmer in Gomma has a similar level of Margalef agricultural and all asset diversity compared to farmers in Gera (close to 0.2 and 0.6 in both). Farmers in Gera own, on average, a marginally higher number of total agricultural assets (4.7) than their counterparts in Gomma (4.5). This observation is reversed for the average number of all agricultural and household assets owned. Households in Gomma own on average 12.1 assets and households in Gera, 11.6.

The asset indices constructed using factor analysis, also show that farmers in Gera have a similar level of agricultural asset index compared with Gomma. The overall (agricultural and household asset) indices do not statistically differ between the two Woredas either.

Table 4.7.3. Asset Ownership Index

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Margalef diversity index - Agricultural assets	0.2 (0.2)	0.2 (0.2)	-0.0*** (0.00)	2,160
Agricultural assets index	0.3 (0.2)	0.3 (0.2)	-0.0* (0.08)	2,160
Number of total agricultural assets owned	4.5 (2.8)	4.7 (3.2)	-0.2* (0.08)	2,160
Number of different asset types owned	7.2 (2.6)	6.9 (2.7)	0.3** (0.03)	2,160
Margalef diversity index - all assets	0.6 (0.3)	0.6 (0.3)	0.0** (0.03)	2,160
Agricultural and household assets index	0.3 (0.2)	0.3 (0.2)	0.0 (0.17)	2,160
Number of agricultural and household assets owned by household	12.1 (6.2)	11.6 (6.8)	0.6* (0.06)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.

Source: Baseline data collected by C4ED.

Table 4.7.4 further shows disparities in housing quality between the two Woredas. We employed the analytical framework outlined in USAID (2016) to establish indicators focusing on the primary construction materials utilized for walls, roofs, and floors. A detailed explanation of this methodology is provided in Box 4.

Box 4: Housing quality (USAID, 2016)

We followed the guidelines established in USAID (2016) when developing indicators related to housing quality. Specifically, a finished roof includes construction materials such as metal, wood, calamine/cement fibber, ceramic tiles, cement, or roofing shingles. For finished exterior walls, it includes walls constructed using materials like cement, stone with lime/cement, bricks, cement blocks, covered adobe, or wood planks/shingles as the primary construction material. Additionally, as per the guide, a finished floor is categorized when the primary material used for floor construction consists of Parque or polished wood, vinyl or asphalt strips, ceramic tiles, cement, or carpet.

Overall, it appears that Gomma fares (marginally) better than Gera on most housing quality indicators. Based on the classifications outlined in Box 5, the results show that 87% of households in Gera and 95% in Gomma have finished roofs. However, ownership of finished walls and floors is notably low in both Woredas, with only 2% in Gera and 4% in Gomma having finished walls, and 2% in Gera and 5 % in Gomma having finished floors.

Regarding access to electricity, 30% of households in Gera and 57% in Gomma have direct access to electricity from the mainline or grid. Additionally, of the households without direct access, approximately 35% in Gera and 32% in Gomma have access to electricity from solar panels.

Table 4.7.4. Housing characteristics of households by Woreda

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Share of households with finished roof (%)	94.8 (22.1)	86.9 (33.8)	8.0*** (0.00)	2,160
Share of households with finished walls (%)	3.8 (19.2)	1.9 (13.8)	1.9** (0.02)	2,160
Share of households with finished floors (%)	5.1 (22.0)	2.3 (15.2)	2.7*** (0.00)	2,160
Share of households with access to electricity directly from main line/grid (%)	57.3 (49.5)	29.7 (45.7)	27.6*** (0.00)	2,160
Share of households that have electricity from solar panels (%)	31.7 (46.5)	35.3 (47.9)	-3.6 (0.27)	1,218

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

4.8. SAVINGS

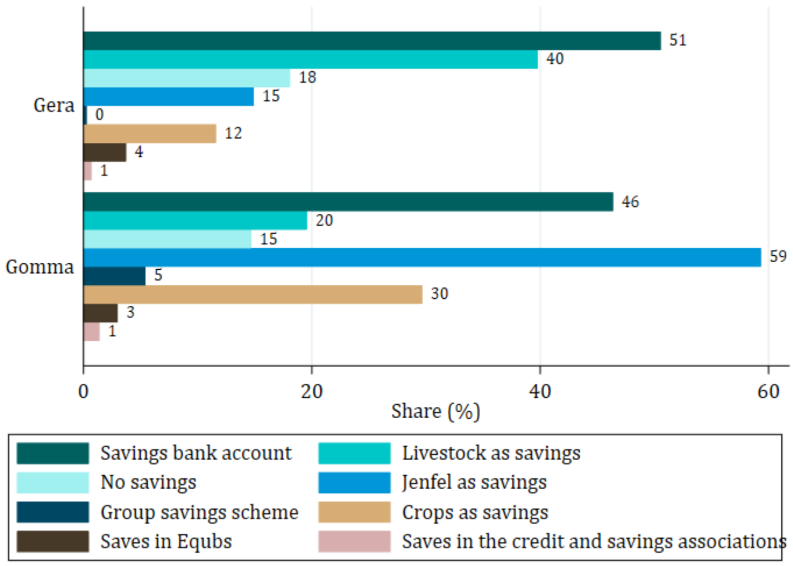


Figure 4.8.1 illustrates that banking institutions represent the primary choice for savings in Gera. On the contrary, savings in Jenfel are most prevalent within the Gomma region, followed by livestock and then banks. Conversely, alternative saving mechanisms such as group savings schemes, Equbs and credit and savings associations show lower popularity levels across both Woredas.[49]

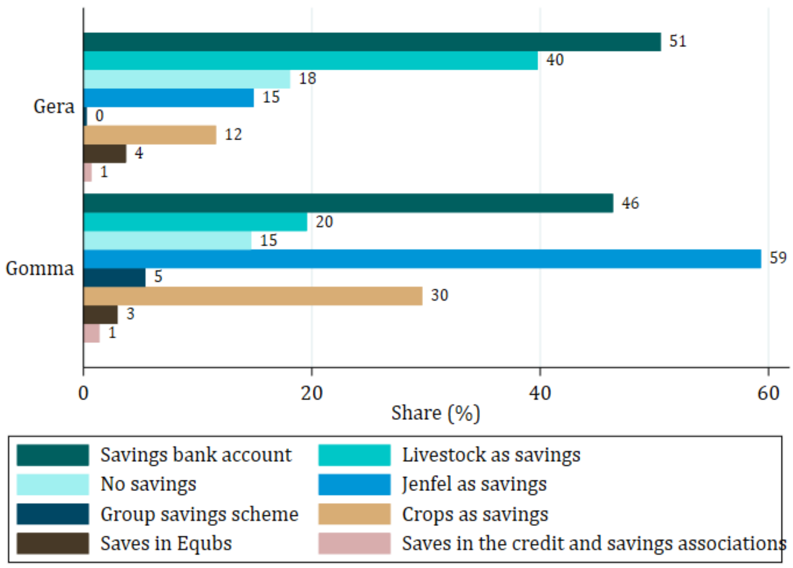


Figure 4.8.1. Savings sources
Source: Baseline data collected by C4ED.

4.9. SHOCKS

This section presents the shocks households faced that led to a serious reduction in the farmers' asset holdings, causing the household income to fall substantially, or resulted in a significant reduction in food consumption.

[49] Equbs are informal savings and rotating credit associations.

Overall, about 62% of respondents in Gera and 69% in Gomma have experienced some type of shock. Figure 4.9.1 illustrates the primary shocks faced by households in both Woredas. Among the primary challenges reported by households, food price inflation and low coffee yield were reported most often. Specifically, 46% of participants in Gera and 50% in Gomma highlighted facing food inflation as a significant issue.

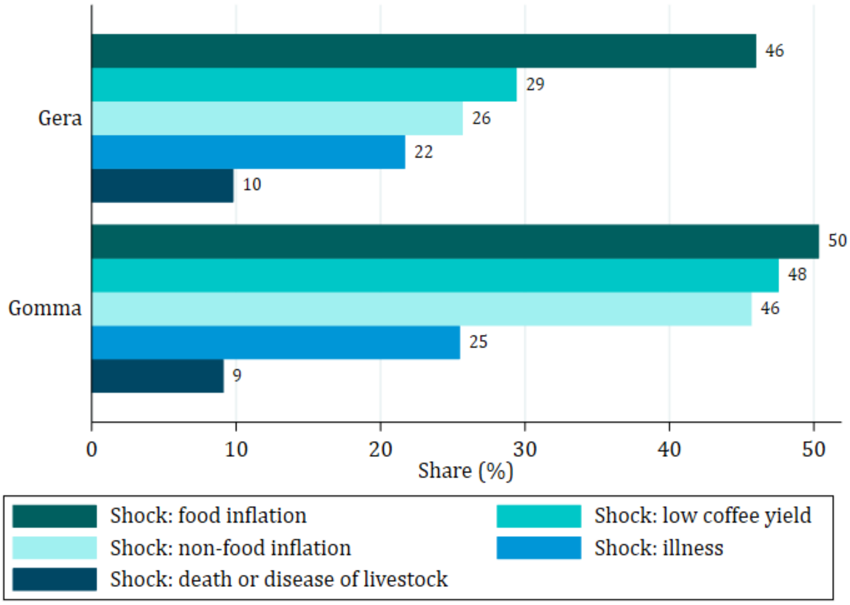


Figure 4.9.1. Top five shocks in Gera and Gomma

Source: Baseline data collected by C4ED.

However, besides food-inflation, the prevalence of the next two frequently reported shocks differed between the two Woredas. Notably, low coffee yield and non-food inflation affected around 29% and 26% in Gera, respectively, but close to half the households in Gomma (48% and 46%, respectively).

Shocks from non-COVID 19 related illnesses or death/disease of livestock affected households in both Woredas similarly. While 22% in Gera and 25% of the households in Gomma reported the former, about 10% and 9% report livestock morbidity and mortality in Gera and Gomma, respectively. Other less prevalent shocks, such as drought, floods, reduced remittances and support, accidents, COVID-19-related illness and death, high temperatures, divorce, armed conflicts, and family disputes, were experienced by fewer than 5% of the households.

4.10. EXTENSION SERVICES

Table 4.10.1 presents the agricultural extension sources for coffee in Gera and Gomma. The primary source of agricultural information appears to be friends and neighbors, cited by approximately 43% of the households in Gera and 46% in Gomma. Following closely, the second most important source are development agents, reported by about 44% of the households in Gera and 41% in Gomma. Radio is the third most significant source, selected by 11% of households in Gera and 21% in Gomma.

Table 4.10.1. Sources of extension services for coffee

	(1) Gomma	(2) Gera	(3) (1)-(2) (p-value)	(4) N
Extension source: Newspaper (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2,160
Extension source: Radio (%)	21.0 (40.7)	10.6 (30.9)	10.3*** (0.00)	2,160
Extension source: Television (%)	7.5 (26.3)	5.2 (22.3)	2.2* (0.05)	2,160
Extension source: Development Agents (%)	41.0 (49.2)	44.1 (49.7)	-3.0 (0.18)	2,160
Extension source: Research stations (%)	0.8 (9.1)	2.8 (16.4)	-1.9*** (0.00)	2,160
Extension source: Cooperatives (%)	5.1 (22.0)	2.1 (14.3)	3.0*** (0.00)	2,160
Extension source: Traders (%)	6.5 (24.6)	1.5 (12.2)	5.0*** (0.00)	2,160
Extension source: Processors (%)	0.0 (0.0)	0.0 (0.0)	0.0 (.)	2,160
Extension source: ECX (%)	0.1 (2.6)	0.1 (3.7)	-0.1 (0.62)	2,160
Extension source: Friends and neighbors (%)	46.0 (49.9)	43.4 (49.6)	2.6 (0.25)	2,160
Extension source: TNS (%)	23.1 (42.1)	8.6 (28.0)	14.5*** (0.00)	2,160
Extension source: None (%)	6.9 (25.3)	12.4 (33.0)	-5.5*** (0.00)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woredas. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

An interesting finding here is that while about 9% of farmers in Gera mentioned TNS as one of their main sources of coffee extension services, about 23% of farmers in Gomma mentioned TNS.[50] Furthermore, it's worth noting that a higher percentage of farmers in Gera admitted having no specific extension service source compared to their counterparts in Gomma, 12% versus 7%, respectively.

Figure 4.10.1 indicates the frequency of use of the top five extension sources for each Woreda. Most of the top five extension sources are reportedly used only sometimes or rarely. Notably, for TNS and for TV respondents, a larger share of respondents in Gomma (30%) reported using those as sources of extension services always or often, while in Gera less than 5% answered the same.

Figure 4.10.2 presents the farmers' assessment of the quality of extension services for the three main sources of information: Friends and Neighbors, Development Agents, and Radio. For both Woredas, the distribution of the quality of extension is similar, with most of the respondents rating the three sources as either good or average in quality. In Gera, approximately 15% of the farmers who use Friends and Neighbors as an extension source consider them as a bad source. Generally, less than 10% of the farmers rate the respective source as bad, in either Woreda.

[50] Most of the respondents with knowledge of TNS are from the treatment group (33%), compared to 3% in the control group.

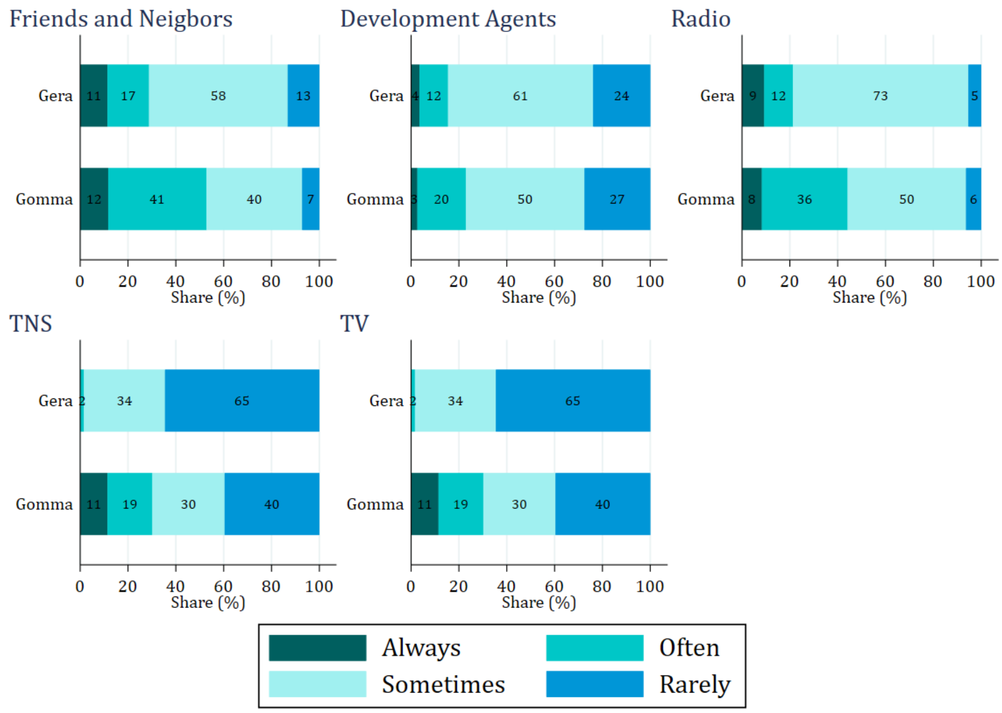


Figure 4.10.1. Frequency of use of top five extension sources
Source: Baseline data collected by C4ED.

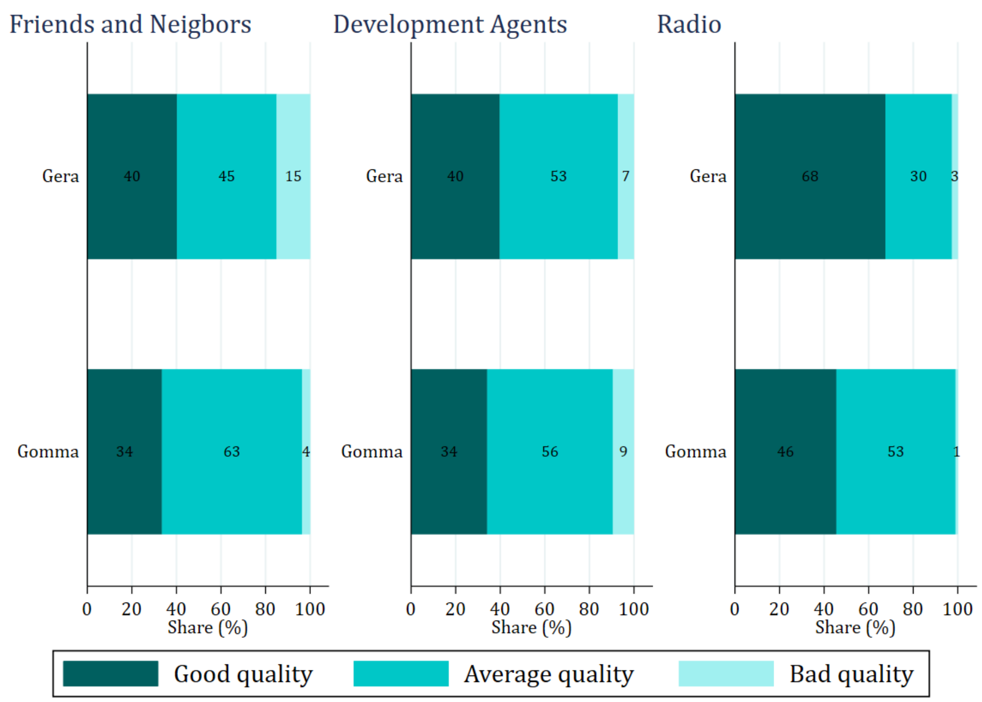


Figure 4.10.2. Farmers' assessment of the quality of extension services
Source: Baseline data collected by C4ED.

5. NEXT STEPS FOR EVALUATION

The next step is the endline qualitative and quantitative data collection in the first quarter of 2026.

Table 4.10.1: Key steps, deliverables, and timeline

Study Implementation Phase	*Key step*/Deliverable	Timeline
Inception	*Inception meetings with HWG and TNS*	November 2022
	1. Inception report	30th November 2022
	2. Draft tool for the quantitative baseline survey	30th November 2022
	3. Final inception report and tool for the quantitative baseline survey	30th December 2022
Baseline preparation	*Application for ethical clearance*	December 2022
	4. Pre-analysis plan for baseline and endline data	30th December 2022
	Data collection and training preparation, including listing	December 2022-January 2023
	5. Final pre-analysis plan	31st January 2023
Baseline data collection	*Training and data collection* *Updates on progress*	February 2023
End of the baseline phase	*Inputs to the implementation strategy of stumping incentives*	During 2023
	6. Baseline report	December 2023
	~~7. Report presentation (online)~~	
	~~8. Contribution to action plan~~	
	9. Final baseline report	May 2024
	10. Raw and final quantitative baseline data with do-files	May 2024
Endline preparation	11. Pre-analysis plan for endline data	February 2025
	12. Final pre-analysis plan for endline data	March 2025
	13. Draft protocol and survey tool for full harvest measurement	29th August 2025
	14. Final protocol and survey tool for full harvest measurement	30th September 2025
	15. Draft qualitative tools and sampling strategy	29th August 2025
	16. Final qualitative tools and sampling strategy	30th September 2025
	Qualitative data collection and training preparation	October 2025
	17. Draft tools for endline quantitative survey	December 2025
	18. Final tools for endline quantitative survey	January 2026
Endline data collection	*Full harvest measurements* *Updates on progress*	October 2025 – January 2026
	Training and endline qualitative data collection *Updates on progress*	November-December 2025
	Training and endline quantitative data collection *Updates on progress*	February 2026
End of endline phase	19. Draft final report	30th June 2026
	20. Report presentation	July 2026
	21. Contribution to action plan	July 2026
	22. Final report	31st July 2026
	23. Raw and final quantitative endline data with do-files	31st July 2026

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APPENDICES

A.1. TRAINING CURRICULUM

Table A.1.1. Coffee agronomy training curriculum

Months	Coffee agronomy training topics	Other
January, 2023	Preparation and start of pruning and rejuvenation year 1	
February, 2023	Pruning and rejuvenation year 1	
March, 2023	Composting year 1 and intercropping	
April, 2023	Coffee planting 1 – hole preparation and back-filling, Turn Compost	
May, 2023	Coffee planting 2 and Turn compost	Business Skills 1 – Financial Planning
June, 2023	Weeding, sucker selection, and Turn compost	
July, 2023	Nutrition – applying compost	
August, 2023	Soil erosion control	
September, 2023	Record keeping	
October, 2023	Disease Management	
November, 2023	Coffee Harvesting	
December, 2023	FTs on Vacation	

Table A.1.2. Beekeeping training curriculum

Months	Training modules topics	What farmers will learn – Objectives
January 2023	• Introduction to beekeeping and its importance • Apiary site selection, stand, and shade management	• Define Beekeeping • Understand and appreciate the importance of beekeeping • Identify a good apiary site • Hive placement and orientation- demonstrate hive hanging and placing • Factors to consider while selecting the best Apiary site • Apiary site management
February 2023	• Transitional hives- Features and Construction • Colony transfer and transport	• Describe the transitional hive • Construct a transitional hive using locally available materials – Chefeka • Bee colony transfer – Why it is important for backyard beekeeping • Understand Season/time of transferring • Practical transfer with a few farmers (at night)
March 2023	• Bee Biology • Inspection of the bee colony	• Discuss the life cycle of bees • Bee forage - How to feed bees • Know, why, when, and how to inspect a colony • Understand the important steps in hive inspection • Carry out systematic hive inspection- inspect the colony from outside and from inside after opening the hive- late in the evening/night • Keeping apiary record
April 2023	• Bee products markets and market linkage • Expansion of bee keeping business	• Different bee products and uses • Market access and infrastructure • Honey and wax marketing system - market linkage

May - June 2023	• Early harvest season - Honey and wax harvesting, processing, and storage	• Identify when honey is ready to be harvested • How honey is harvested, extracted, and processed • Extract and process beeswax from combs • How handle and keep the quality of honey and wax.
July - August 2023	• Honeybee diseases, pest and predators' management	• Identify different bee pests, predators and diseases • Learn effects of pests, predators, and diseases on beekeeping • Methods to control various bee pests, predators, and diseases

A.2. THEORY OF CHANGE

Given that the program has two interlinked components targeting two separate entities–CFC and CWS–we present separate ToC for each component. Each ToC presents the chain of activities from the program side (inputs, activities, and outputs) and the causal chain from outcomes to impacts. Figure A.2.1 presents the ToC for the CFC, stumping incentives, and training on beekeeping components of the program. Accordingly, the main activities that will be undertaken by the program are delivering training to farmers on the theory of coffee agronomy, providing on-farm coffee agronomy training to farmers, providing stumping incentives to farmers who adopt stumping, and providing training on beekeeping. The training is expected to increase farmers' knowledge about the best agronomic practices (also known as good agricultural practices - GAP) as well as increase their knowledge of other IGA, specifically beekeeping. Such knowledge is expected to help farmers implement/practice it, for example, by applying the best agronomic practices in their coffee and honey production, by being encouraged to stump old coffee trees because the corresponding income loss is (partly) offset by the stumping incentives and expanding their sources of income by venturing into beekeeping business. Consequently, farmers are expected to increase the productivity of their coffee plants and increase their honey production, which will increase their revenue and ultimately their income and wealth. Higher wealth will enable farmers to cope with shocks and make them resilient. The main assumptions behind the causal chain in this component of the program are as follows. Firstly, it is assumed that there is a lack of knowledge on the application and returns to stumping and best coffee production practices, which represent major constraints to the adoption of these practices (project's relevance). Secondly, it is assumed that the inability to cope with temporary income loss is one of the main constraints to the adoption of stumping and that farm households would use the stumping incentives and income from beekeeping to compensate for the income loss due to stumping and hence will not have to reduce their consumption. It is also assumed that farmer groups work well, farmers are willing to start beekeeping and that they will have market access for their honey at a price that is higher than their marginal cost of production.

Figure A.2.3 presents the ToC for the other component of the program which is providing advisory services to CWS so that they can improve their profits and reduce their environmental impact. The project activities under this component are conducting quality and sustainability audits at CWS, conducting cost benchmarks, training CWS on operations and quality control, business planning and management, and social and environmental sustainability standards, supporting local exporters /coffee service providers (CSP) in continuous capacity development to CWS, and building the profile of CWSs and distributing them to potential buyers. These program activities aim to increase CWS awareness of their operation and possible ways to reduce their costs, increase CWS know-how on applying quality control, improve management and governance styles, as well as sustainable coffee processing standards. They also aim to expand their market access. This new knowledge is then expected to lead CWS to apply quality management and sustainable processing standards, reduce their operating costs, improve coffee quality, and reduce their water consumption and pollution from pulp waste. Consequently, CWS will receive higher prices and increase their profit. Additionally, they will be able to pay higher prices to coffee farmers (hence also increasing farmers' income) and the CWS will operate in an environmentally friendly manner. The assumptions behind this second component of the program are as follows. Firstly, the coffee service provider (CSP) is interested in providing continuous capacity development to CWS. Secondly, higher coffee quality will generate higher prices and the CWS/traders are willing to forward the price differentials to farmers.

Figure A.2.1. Theory of Change of the CFC and stumping incentives

HWG and TNS Inputs	Activities	Outputs	Outcomes	Impact
- CFC **- Stumping incentives** **- Training on other income generating activities (IGA) (beekeeping)**	- - TNS recruits and trains FTs - - TNS forms FFGs - - FTs deliver coffee agronomy training to farmers organized in FFGs - - FTs verify the number of stumped trees and distribute stumping incentives to farmers (tools) - - FTs provide beekeeping training to coffee farmers	- - Farmers know how to apply taught best practices (BPs)/Good Agricultural Practices (GAP) in coffee production - - Farmers observe GAP benefits on demo-plots - - Farmers are aware of stumping incentives - - Farmers know how to apply taught BPs in additional IGA (beekeeping)	- - Farmers adopt BPs in coffee and honey production - - - Farmers stump old coffee trees and acquire stumping incentives - - Households start beekeeping as an additional IGA	- - Increased productivity of coffee trees - - Increased coffee and honey production - - Increased revenues from coffee and honey production - - Increased household income from coffee and honey production - - Increased wealth - - Reduced vulnerability to coffee related shocks

Figure A.2.3. Theory of Change of CWS advisory service

HWG and TNS Inputs	Activities	Outputs	Outcomes	Impact
CWS advisory service	- TNS Business Advisors (BAs) conduct quality and sustainability audits at CWS - BAs conduct cost benchmarks at CWS - BAs conduct training in operations and quality control, business planning and management, social and environmental sustainability standards to selected CWS - BAs support local exporter/coffee service provider (CSP) in continuous capacity development to CWS - BAs create CWS profiles and distribute them to potential buyers	- CWS are aware of potential for improvement in operations and cost reductions - CWS know how to apply quality, management/governance, and sustainability processing standards - CWS have access to expanded network of potential buyers	- CWS apply quality management/governance and sustainability processing standards - Reduced operating costs of CWS - Improved coffee quality - Reduced water use and pollution from coffee processing waste (pulp)	- CWS receive higher prices - Increased profits of CWS - Farmers receive higher prices - CWS operate in an environmentally sustainable manner

A.3. POWER CALCULATIONS

We estimated the MDES obtained with this sample. The MDES is calculated with the following formula:

$$MDES = (t_{1-\kappa} + t_{\alpha})\sqrt{\frac{1}{P(1-P)}}\sqrt{1+\rho(m-1)}\sqrt{\frac{\sigma^2}{N}}\sqrt{1-R^2}$$

where $t_{1-\kappa}$ and t_{α} are t-statistics representing the required power and level of statistical significance, P represents the proportion in one of the two compared groups (allocation ratio), ρ is the ICC, m is the number of individuals per cluster, σ^2 is the variance of the outcome of interest within our population, N is the total sample size (here, 2150) and R^2 represents the extent to which baseline characteristics predict the endline outcome.

The MDES was estimated for a power of 80% and a level of statistical significance of 5%. For bilateral comparison between one treated group and one control group, an equal allocation ratio maximizes statistical power and hence reduces the required sample size. As such, we choose a value of P equal to 50%. The baseline value of agricultural outcomes and of income tend to be strong predictors of future agricultural outcomes and income values. As a result, we assume that baseline characteristics will explain up to 30% of the variation in the outcomes of interest (i.e., $R^2 = 30\%$).

We calculated the MDES on two key impact indicators of interest for HWG and TNS, that stumping adoption and coffee income. To approximate the baseline value of these indicators, we used baseline data on the mean and standard deviation of these indicators from a nearby Woreda (Gumay) that was shared by HWG for coffee income and calculated using the C2022 baseline data for stumping adoption. These values allow us to determine the σ^2 parameter of our equation.

Despite randomization at the level of Kebeles, we consider the farmer development groups in control areas and the FFGs in treated areas as the relevant unit of the clusters. Based on discussions with HWG, the FFGs tend to be highly correlated with farmer development groups. Farmers of the same training group are likely to belong to the same development group, in which they may share knowledge and face more similar geographic characteristics than farmers of other development groups or FFGs. Furthermore, these farmers are expected to be in closer proximity to each other than with other development groups, affecting the external environment and constraints they may face in their activity (e.g., access to buyers). The extent of similarity between farmers of the same development group or FFG in comparison with farmers of other development groups or FFGs is measured by the ICC. Based on C2022 baseline data, we estimated an ICC of 10.1% (i.e., ρ=0.101) for stumping adoption and 20.6% (i.e., ρ=0.206) for coffee income. When the ICC is different than zero, we gain more statistical power by interviewing the same number of farmers, but across more clusters, than more farmers from fewer clusters. Hence, ideally, we will interview between 8 and 9 farmers per cluster (i.e., $m = 8.53$).

A.4. ATTENDANCE FORM TEMPLATE (IN ENGLISH)

2023C HWG FARMER TRACING FORM ETHIOPIA – JIMMA
INSTRUCTIONS FOR FARMER TRAINERS.

1. THIS FORM SHOULD BE COMPLETED AFTER THE MAIN ATTENDANCE FORM HAS BEEN COMPLETED, WHILE THE FARMERS ARE STILL PRESENT AT THE TRAINING.

2. CHECK AND CORRECT INFORMATION: Make sure the Kebele name, Zone name and Development group name are shown and spelled correctly on this form. If shown incorrectly, please make clear corrections.

3. ENTER AND VERIFY TRAINING INFORMATION: ENTER the training date (Date of training) and module name (Topic of training). VERIFY your name (Name of Farmer Trainer) and the Focal Farmer group name at the right columns in the sheet.

4. COMPARE THE LIST WITH THE MAIN ATTENDANCE FORM: Go through the list of registered households on the main attendance form and compare it to the list of households below. If a farmer from the list below is PRESENT on the MAIN ATTENDANCE FORM follow the steps below, otherwise proceed to the next household.

a. ENTER A CROSS (X) in the first column "Farmer identified".

b. CHECK AND CORRECT FARMER INFORMATION: Check the spelling of the farmer's name, and gender for each FARMER that is PRESENT on the MAIN ATTENDANCE FORM. If shown incorrectly, please make clear corrections in the respective columns.

c. ENTER THE TNS HH ID: Enter the HH ID provided by TNS in the TNS HH ID, as shown in the 'HH ID' column on the MAIN ATTENDANCE FORM. This is a number between 1 and 50. Please write it down clearly.

5. CALL UNMATCHED FARMERS: Look at the list of remaining unmatched households from the list below who have NOT been identified (no "X" in the column "Farmer identified"). START CALLING ALL the farmers' names from unmatched households from the list below and ASK farmers present at the training if they know the farmers from the unmatched household. If an unmatched farmer from the list below is KNOWN, by either you (FT), the Focal Farmer, or any farmer present at the training, ENTER "Y" in the last column "Farmer known". If the farmer isn't known, leave the space blank.

6. SUBMISSION OF SHEET: Once you have performed all the steps above to identify the farmers in the list below, check over the form one more time for correctness of information, sign your name, and then submit the form to your supervisor.

Kebele Name	Kecho Anderacha
Zone Name	Anderacha
Development Group (DG) Name	XYZ

Date of training	
Name of Farmer Trainer (FT)	
Name of Farmer Focal Group (FFG)	
Signature of FT	

Household Identifier (C4ED)	HH Member name	HH member sex	Farmer Identified (X)	TNS HH ID (Main Attendance form)	Farmer Known (Y)
220001009	XYZ	F			
220001006	XYZ	M			
220001020	XYZ	M			
220001002	XYZ	M			
220001007	XYZ	F			
220001008	XYZ	M			
220001011	XYZ	M			
220001012	XYZ	M			
220001013	XYZ	M			
220001015	XYZ	F			
220001016	XYZ	F			
220001017	XYZ	M			
220001019	XYZ	F			
220001021	XYZ	M			
220001022	XYZ	F			
220001023	XYZ	F			
220001024	XYZ	F			
220001025	XYZ	F			
220001026	XYZ	F			
220001027	XYZ	M			

A.5. ADDITIONAL STATISTICS

We provide balance tables comparing the treatment and control groups for the main outcome variables.

Table A.5.1 Balance Tests I

	(1) Treatment	(2) Control	(3) (1)-(2) (p-value)	(4) N
Share of male-headed households (%)	90.1	91.8	-1.7	2,160
	(29.8)	(27.4)	(0.17)	
Age of household head (in completed years)	45.8	46.6	-0.8	2,160
	(13.1)	(13.8)	(0.17)	
Share of households with married head (%)	85.1	88.8	-3.8***	2,160
	(35.7)	(31.5)	(0.01)	
Share of household heads with no formal education (%)	43.9	45.1	-1.2	2,160
	(49.7)	(49.8)	(0.59)	
Share of household heads with elementary education (1-6 grade) (%)	37.7	36.6	1.1	2,160
	(48.5)	(48.2)	(0.59)	
Share of household heads with middle education (7-10 grade) (%)	16.7	15.9	0.8	2,160
	(37.3)	(36.6)	(0.61)	
Share of household heads with secondary education (11-12 grade) (%)	0.9	2.0	-1.0**	2,160
	(9.6)	(13.8)	(0.04)	
Share of household head with higher education (degree or above) (%)	0.3	0.1	0.2	2,160
	(5.3)	(3.0)	(0.32)	
Share of household heads with other education (vocational) (%)	0.5	0.4	0.1	2,160
	(6.8)	(6.1)	(0.75)	
Household size	5.4	5.9	-0.4***	2,160
	(2.2)	(2.4)	(0.00)	

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Table A.5.2 Balance tests II

	(1) Treatment	(2) Control	(3) (2)-(3) (p-value)	(4) N
Total land owned by household (ha)	1.5 (2.0)	1.4 (1.5)	0.1 (0.10)	2,160
Total land for coffee (ha)	1.1 (3.5)	0.8 (1.0)	0.2** (0.03)	2,160
Number of agronomic practices adopted by the household	1.5 (1.0)	1.4 (1.0)	0.0 (0.40)	1,773
Share of households that adopted business skills (%)	0.1 (3.0)	0.2 (4.3)	-0.1 (0.56)	2,160
Share of households that adopted compost or manure during a year (%)	9.2 (28.9)	8.9 (28.5)	0.3 (0.82)	2,160
Share of households that adopted good nutrition practices (%)	9.3 (29.1)	8.2 (27.4)	1.1 (0.36)	2,160
Share of households that adopted erosion management practices (%)	48.2 (50.0)	50.1 (50.0)	-1.9 (0.37)	2,160
Share of households that adopted weeding (%)	13.4 (34.0)	13.4 (34.1)	-0.0 (0.98)	2,160
Share of households that adopted integrated pest management methods (%)	1.5 (12.0)	2.6 (15.9)	-1.1* (0.09)	1,773
Share of households that shaded main coffee farm: 20% and above (%)	62.2 (48.5)	56.4 (49.6)	5.8*** (0.01)	2,160
Share of households that adopted stumping (plot) (%)	3.2 (17.7)	2.7 (16.2)	0.5 (0.47)	2,160
Harvest of red cherries per hectare (kg)	865.1 (818.0)	970.3 (952.8)	-105.2*** (0.01)	2,160
Harvest of red cherries per productive tree (kg)	0.4 (0.5)	0.5 (0.5)	-0.1*** (0.01)	2,146
Total red cherries sold (kg)	515.1 (553.0)	555.6 (579.5)	-40.5* (0.10)	2,160
Total dried/jenfel cherries sold (kg)	33.4 (57.3)	27.2 (52.9)	6.2*** (0.01)	2,160
Share of farmers that sold red cherries at CWS (%)	16.0 (36.7)	13.8 (34.5)	2.2 (0.16)	2,061
Price of red cherries at CWS (Birr/kg)	49.0 (8.4)	50.3 (6.8)	-1.3 (0.13)	308
Total labor cost in the last main season (Birr/ha) (Extended questionnaire)	1,487.9 (3,872.5)	1,774.7 (4,019.8)	-286.8 (0.47)	388
Total coffee input cost in the last main season - excluding labor (Birr/ha)	611.6 (1,746.8)	750.0 (1,951.5)	-138.4* (0.08)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Table A.5.3 Balance tests III

	(1) Treatment	(2) Control	(3) (2)-(3) (p-value)	(4) N
Share of households that have some bee-keeping experience (%)	42.7 (49.5)	37.3 (48.4)	5.4** (0.01)	2,159
Share of beekeeping households that received training (%)	7.4 (26.1)	4.7 (21.3)	2.6** (0.02)	1,830
Share of households that harvested any honey (%)	26.6 (44.2)	20.5 (40.4)	6.1*** (0.00)	2,159
Total honey production in last main season (kg)	54.8 (106.9)	40.8 (78.9)	13.9* (0.07)	627
Average number of hives owned by the household (12 months)	11.1 (17.4)	9.8 (14.1)	1.3 (0.31)	627
Average number of traditional hives owned by the household (12 months)	11.3 (18.6)	8.9 (14.2)	2.4 (0.11)	492
Average number of transitional hives owned by the household (12 months)	4.8 (11.9)	1.0 (0.7)	3.8 (0.35)	33
Average number of modern hives owned by the household (12 months)	3.7 (3.3)	3.8 (4.8)	-0.1 (0.81)	225
Total beekeeping cost (Birr)	2,583.9 (2,975.8)	2,327.5 (2,967.8)	256.4 (0.41)	370
Share of households with access to pruning saws (%)	25.2 (43.4)	31.3 (46.4)	-6.2*** (0.00)	2,160
Share of households with access to pruning scissors (%)	2.9 (16.9)	6.6 (24.8)	-3.7*** (0.00)	2,160
Share of households with access to wheelbarrow (%)	1.2 (10.9)	1.3 (11.3)	-0.1 (0.83)	2,160
Margalef diversity index - Agricultural assets	0.2 (0.2)	0.3 (0.2)	-0.0*** (0.00)	2,160
Agricultural and household asset index	0.3 (0.2)	0.3 (0.2)	-0.0*** (0.00)	2,160
Total livestock owned (TLU)	2.0 (2.4)	2.1 (2.3)	-0.1 (0.28)	2,160

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

Table A.5.4 Balance tests IV

	(1) Treatment	(2) Control	(3) (2)-(3) (p-value)	(4) N
Extension source: Radio (%)	16.0 (36.7)	19.0 (39.2)	-2.9* (0.07)	2,160
Extension source: Development Agents (%)	40.1 (49.0)	44.0 (49.7)	-3.9* (0.07)	2,160
Extension source: Friends and neighbors (%)	41.8 (49.3)	48.5 (50.0)	-6.7*** (0.00)	2,160
Extension source: TNS (%)	33.1 (47.1)	3.2 (17.5)	29.9*** (0.00)	2,160
Total annual income (Birr)[51]	56,664.8 (53,735.4)	55,555.9 (51,615.1)	1,108.9 (0.62)	2,160
Total income from coffee (Birr)	46,155.0 (43,905.0)	46,483.9 (45,456.0)	-328.9 (0.86)	2,160
Total income from beekeeping (Birr): full sample	1,847.3 (,8049.9)	1,121.1 (5,651.0)	726.2** (0.02)	2,159
Total income from crop sales and other land uses, other than coffee (Birr)	2,179.2 (6,260.1)	2,382.7 (10,766.3)	-203.6 (0.59)	2,160
Total non-farm income in the last 12 months (Birr)	6,485.0 (20,991.6)	5,568.2 (12,714.3)	916.9 (0.22)	2,160
Total income from livestock, excluding own consumption (Birr) (Extended)	3,923.8 (8,786.8)	2,618.0 (6,911.0)	1,305.8 (0.11)	388

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

[51]This excludes income from livestock, as this indicator was collected only in the extended questionnaire.

Table A.5.5 Balance tests V

	(1) Treatment	(2) Control	(3) (2)-(3) (p-value)	(4) N
Number of coffee plots	2.3	2.3	0.0	2,160
	(1.2)	(1.1)	(0.76)	
Plot size (ha)	0.4	0.4	0.0**	4,920
	(0.5)	(0.4)	(0.03)	
Number of coffee trees	1,143.8	1,070.0	73.8**	4,889
	(1,362.9)	(1,188.8)	(0.04)	
Number of productive coffee trees	859.8	787.0	72.8**	4,889
	(1,070.0)	(918.9)	(0.01)	
Number of newly planted coffee trees	147.4	165.5	-18.1**	4,889
	(299.8)	(306.3)	(0.04)	
Number of stumped coffee trees	22.5	8.7	13.7***	4,889
	(66.9)	(44.4)	(0.00)	

Note: Columns (1) and (2) present the sample means (proportions when % is shown in the variable name or in the table) of selected variables for the Gomma and Gera Woreda, respectively. Standard deviations in parentheses. Column (3) presents the mean difference between the Gomma and Gera Woreda. P-value of the corresponding t-test in parentheses.
Significance stars: * p ≤ 0.1, ** p ≤ 0.05, *** p ≤ 0.01.
Source: Baseline data collected by C4ED.

A.6. BASELINE QUESTIONNAIRE

See the Excel document attached to this report.

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